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HIGH LEVEL ADVICE IN ESTABLISHMENT OF FURNITURE RESOURCE
AND TECHNOLOGY CENTRE AT MARA

SI/MAL/89/801

MALAYSIA

Technical report: Furniture industry training*

Prepared for the Government of Malaysia
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

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* This document has not been edited.

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Abstract

This report is concerned with the establishment and future role of the Furniture Resource and Technology Centre currently being set up by MARA for the technical and managerial development of the Bumiputra sector of the Malaysian Furniture and Woodworking Industry and the industrial training of its personnel.

It provides an analysis of the needs of the industry in these respects and makes detailed recommendations as to how they should be responded to by MARA and the Centre itself.

(ii)

Notes

Reference to dollars is to United States dollars unless otherwise stated.

The monetary unit in Malaysia is the Malaysian Dollar (M\$) or Ringgit. During the period covered by this report, the value of the Malaysian Dollar in relation to the United States Dollar was \$1 = M\$2.70

The following abbreviations and symbols are used in this report:

D.I.Y.	Do it yourself.
FIRA	Furniture Industry Research Association (U.K).
FAS	Industrial Training Authority of Ireland.
FPRL	Forest Products Research Laboratory (U.K).
FRDC	Furniture Resource and Development Centre.
KD	Knock Down.
MARA	Majlis Amanah Rakyat.
MTIB	Malaysian Timber Industry Board.
NRC	Numerically Controlled Routers
TRADA	Timber Research and Development Association (U.K)

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INTRODUCTION

Majlis Amanah Rakyat (The Council of Trust For the Indigenous People) or MARA, as it is more commonly referred to, is a statutory body entrusted with the responsibility "to promote, stimulate, facilitate and undertake economic and social development in the Malaysian Federation and more particularly, in the rural areas thereof" (MARA Act 1966). The indigenous people to which the Act refers originally lived in the rural, agricultural and coastal lands and villages.

In pursuance of these policies, MARA has over the years, become actively involved, among other activities, in promoting the development of small and medium-sized enterprises in a variety of industries through its programmes of education and entrepreneurship which embrace all aspects of industrial activities and the provision of supportive ancillary services.

The Bumiputra sector of the furniture industry, because of its size, growth potential and physical distribution throughout the peninsula, continues to absorb and benefit from the considerable direct assistance, both administrative and technical, provided by the MARA organisation. This has culminated in the decision to establish a permanent Furniture Technology Centre, the building for which is rapidly nearing completion on a five acre site in Kampung Batu some 5 kilometres from Kuala Lumpur.

The mission of the consultant was to assist the personnel involved in the establishment of the Centre in determining appropriate training programmes and their implementation in respect of suitable personnel and facilities. The project lasted three weeks from 10 to 31 October, 1990 during which time he visited some Bumiputra owned furniture plants and held discussions with various MARA executives at management and technical levels. The consultant's job description is given in Annex 1.

The Entrepreneur Division of the MARA programme, which is responsible for the establishment and future direction of the Centre was assigned to be the counterpart of the consultant and its Chief Development Officer (Industry I) Mr. Kamaruddin Hassan together with Senior Assistant Development Officer Mr. Ismail Jidin assisted in carrying out the limited field work, arranged plant and other visits and provided the consultant with detailed information on the industry and work to date on the establishment of the Centre.

Towards the end of this mission, the consultant presented his findings to one of the Deputy Director Generals of MARA, Mr. Bakar Yaacob who is also Executive Chairman of Kayu Sedia SDN. BHD a large Bumiputra Woodworking Complex on the outskirts of Kuala Lumpur.

FINDINGS

A. Current Status of the Bumiputera Furniture Sector

While no official statistics concerning this sector of the industry were readily available, it is evident that it has a fairly broad base and is characterised by a multiplicity of small and medium-sized workshops, some 400 in number, scattered throughout the country and surviving mainly on publicly financed contract work for government offices, schools and like institutions as well as sales to the local community. The number of employees in individual workshops ranges from a low of 5 persons (in over 50% of enterprises) to a high of about 30 persons in the more mechanised enterprises (about 15%).

The better made products are those destined for government offices etc., the designs for which are supplied by the agency concerned. The remainder, which are sold directly to the public, is made up of domestic ranges for bedroom, living room, dining room and kitchen and incorporate storage furniture, seating, upholstery and occasional items. Most are custom built and are copyist in nature. They are poorly executed and tend to be sold mainly on price.

Factors that have contributed to the generally under-developed state of this sector of the industry include its relevant ignorance of and isolation from up-to-date technological developments, a lack of detailed knowledge of or expertise in furniture design and quality standards; a continuing low level of investment; untrained and inexperienced management, particularly on the technical side, no supporting services in product design and development; low levels of productivity and little or no understanding of marketing or its functions in relation to their products. A further exacerbating factor, especially in relation to enterprises which are fulfilling

government contracts, is often the undue delay in receiving payment for such contracts because of delays in building completion etc. which in turn obliges the manufacturer to delay his delivery and thus at his expense, carry large stocks of fully and semi finished goods. In a business already suffering from a shortage of working capital such a situation can often be catastrophic and does little to encourage further investment in machinery and equipment.

B. Identification of Training Needs

Based on the above assessment, which is already well known to the MARA organisation charged with the responsibility of developing this sector, it is evident that a radical overhaul of the industry's technological base is necessary with a view to modernising it and adapting it for up-to-date production. A major step in this direction is the decision by MARA to establish a Furniture Resource and Technology Centre (FRTC) which shall be appropriately staffed and equipped to respond to the industry's training needs and to effectively assist in bridging the gap between the low levels of technology and production management currently practised by the industry and their replacement with those more appropriate to present day as well as future market and productivity demands.

In this connection an immediate objective by MARA is to obtain a larger slice of the home market for the Bumiputra sector which, at present is almost the total preserve of the better equipped Non- Bumiputra sector. A further and longer term objective would be to develop successful export-oriented enterprises since it is recognised that the domestic Malaysian furniture market is rapidly reaching saturation point.

In this connection MARA would do well not be content simply to emulate what is regarded as the more developed sector of the Malaysian furniture industry. The most recent statistics

provided by the Malaysian Timber Industry Board indicate that the furniture industry's exports of wood furniture to the United States amount to only US\$18.9 M. and this makes up only one percent of the total furniture imported into the U.S., ranking it 15th among exporters from Asia, Latin America and Europe. This indicates that both sectors of the industry have still some catching up to do and, therefore, to set out to achieve standards of competency which are appropriate to the domestic situation only, would at best retain the status quo and at worst be self-defeating.

MARA must, therefore, look further afield for its development guidelines and in particular at those countries namely, for example, Italy, Denmark and the United Kingdom and nearer home, Thailand, whose furniture industries, although based mainly on small and medium sized enterprises, have attained world wide recognition for the design and quality of their products. It is also worth noting that these industries depend on such as Malaysia for their tropical hardwood supplies.

In these and other countries with a well established furniture industry, the personnel structure at individual plant level is that of management, supervision and labour. It is therefore necessary to analyse their functions in order to respond effectively in terms of their training needs as follows:-

1. Management

In order to attain the efficiency required for the development and continued viability of the furniture and other wood-based industries, it will be necessary to improve the technology and the branch knowledge of the industry. A high level of technology and professional knowledge is required at all levels of the industry if it is to operate successfully and produce products of the kind and quality demanded by the market, within the country as well as abroad and at a cost which allows for an acceptable

profit. In this connection it would be wrong to assume that a high level of academic qualifications is necessary. It is rather the scope and depth of knowledge and the ability to put that knowledge into practice which constitute competence.

There are three aspects of competence which are important to the furniture and wood industry and each one must complement the other in degree of proficiency. They are:

Managerial and Executive
Technical and
Vocational.

At the executive level, the basic skill required is the ability to organize, control and make decisions. This involves matters of product policy, finance and marketing as they are to be applied to daily routine matters of administration and production. Technical knowledge is also essential at this level to ensure that such problems are thoroughly understood and dealt with in a practical manner.

At this juncture, it is necessary to emphasize the importance of understanding the financial implications of activities at factory floor level. While managers need not be experienced accountants they, nevertheless, should have a working knowledge of costing and cost control and be able to read cost accounts so that they can correctly judge efficiency and economy of choice of methods and products.

Trained and qualified junior levels of management, namely supervisors, technicians and foremen, are almost completely lacking in the Bumiputra sector of the furniture and woodworking industry. This is because there is a reluctance at all levels of management to delegate responsibility and authority to lower levels and there may well be a reluctance among production personnel to accept such responsibility.

Neither of these reasons, however, are acceptable for allowing a vacuum in the management structure of any reasonable-sized enterprise. As it is now, problems which are encountered in production are often left to employees to overcome and top management is seldom aware that they even exist.

Furthermore, it is necessary to continuously see that orders and instructions are being implemented, that problems and bottlenecks are anticipated and action taken to ensure an even flow of acceptable quality products; this can best and sometimes only be done by competent factory floor supervisors and technicians.

This section of management must have the technical expertise of machine setting up and operation, detailed knowledge of production standards and an ability to obtain, from a group of employees, a work effort which will produce desired results.

Almost all managers in the industry are too heavily production oriented. Too often there is a preoccupation with the present and very few have a philosophy for the long-term. There is no doubt that such attitudes were born and fastened through the continuing isolation and protection of a small home market. They manifest themselves in a lack of management skills, particularly of analysis and decision-making and a complacency with regard to the need to make improvements in performance. Part of the reason for these problems is the lack of formal training on the part of many managers in the industry at present.

2. Supervision

It is hardly necessary to emphasise the need for informed and sustained supervision of the work force. It is a particular requisite for good productivity and there is no substitute for it. Again it requires, in addition to technical competence, training for supervisors in human relations, work allocation and the achievement of quality standards, above all, it calls for personal qualities of leadership which will win and sustain the loyalty and respect of the workforce and encourage them to give of their best. It should be manifest in fair-mindedness and careful maintenance of individual plant regulations whether concerned with discipline, punctuality or productivity.

3. Labour

There is no reason to assume that the Bumiputra labour force cannot be productive nor that it can perform most operations to satisfactory standards of quality, provided that it is properly trained, instructed and supervised and that the technical management is competent to do so. However in practice it has been shown that there is often a conflict between, on the one hand, the requirement of production and on the other, the need to train production personnel in their particular crafts with the former, not surprisingly, winning out. That is why MARA is also providing a programme of vocational training which to some extent prepares pre-entrants to the industry but is in no way a substitute for either in-company or off-the-job training which should now be a function of the FRIC.

C. Industrial Training In The Furniture Industry

1. Management Level

The number of management personnel varies with the size of the operation, the diversity of the production and also with the number of employees. Sometimes one and the same person may be called upon to perform several functions. However three distinct categories of management can be distinguished:

- (a) Administration - Sedentary in nature, requiring knowledge of business practices.
- (b) Production - Manual, requiring knowledge of processing techniques.
- (c) Marketing - Sedentary, requiring marketing and market knowledge.
- (d) Design - Manual/sedentary, requiring expertise in design, serial production technology and marketing knowledge.
- (e) Machine setting up - Manual, requiring knowledge of mechanics, pneumatics and electrics.

For categories (a), (b), (c), business management, company law, industrial engineering, quality control and basic accounting constitute the field in which knowledge is required. The initial training could be obtained at Universities or in specially arranged courses. At present, few such specialised courses are available in Malaysia and no University or Technical College offers training in these fields with special emphasis on furniture and wood-based

industries. However, general training as offered by Universities, combined with practical experience and complementary training could serve the same purpose until specialized courses become regularly available. The complementary training could be in the form of seminars and workshops and it is likely that in the initial stage instructors have to be trained abroad. Industrial design training is carried out both by the Universities and MARA but its impact on the furniture industry has yet to be felt.

2. Technical Level

The technical or operative category in the furniture industry can be described as belonging to three major groups:

- (a) Production technicians, whose task is to develop products from the design stage to the stage when they can be manufactured in series production and in accordance with quality specifications and projected costs.
- (b) Machine maintenance technicians, who set-up machines design and maintain cutting tools.
- (c) Operatives, who carry out the tasks of machining, sanding, finishing and, where appropriate, upholstering a wide range of wood-based products.

The basic skills required for categories (a) and (b) are complete understanding of why and how the equipment and other facilities they are concerned with perform in a given manner, an awareness of their limitations, an ability to detect faults and flaws and to take corrective action and an ability to adapt machines and devise additional production aids for particular purposes.

The need for trained and experienced technicians in all branches of the Malaysian furniture industry is great and any planned expansion of the industry and its diversification of manufacturing and market emphasis will escalate this need. In this situation it is imperative that MARA, as a matter of urgency initiates the establishment of technician training courses in the FRIC as soon as is practicable. This category more than any other effects the smooth transition from the concept of the designer to its efficient and profitable production on the workshop or factory floor.

Finally, in order to provide for further advancement within the industry for technical personnel leading, for example, to production management, advanced training courses for technicians who have completed their technical training and gained experience in the trade should also be provided.

3. Vocational Training

All production personnel in the woodworking industry are described as requiring skill. Often the following subdivision of functions by grade or level of skill is used:

	<u>Furniture Plant</u>	<u>Joinery Plant</u>
Skilled 1	Cabinet/Chairmaker Machine Operator *	Joiner Machine Operator *
Skilled 2	Assembler Veneering Worker Wood Finisher Upholsterer	Assembler
Skilled 3	Sander	Sander

* With ability to set up and operate a wide variety of woodworking machines.

The above listing is brief and does not include every type of operator. It is intended to show that there are degrees of skill; for example a spindle moulding machine operator requires more skill than a routing machine operator.

4. Instructors

The training requirements which have been identified in the foregoing are to a great extent new in Malaysia. The most difficult problem in implementing them will be the availability of suitable instructors. There is, therefore, an urgent need, in anticipation of the commencement of training at the FRIC, to commence instructor training with particular emphasis on some or all of the following:

- Organisation of special instructor training courses with the assistance of international training agencies.
- Provision of overseas training courses in well established training centres.
- Recruitment of qualified and experienced managers and supervisors as part-time instructors and whole-time after retirement.
- Operatives with high skill and ability to instruct should be identified with a view to their being trained as permanent instructors in the FRIC.
- Trainee instructors should be sent abroad to work in efficiently-operated plants.
- Manufacturers of equipment should be encouraged to provide special training in respect of the efficient operation of the equipment they supply.

5. Summary Of Existing Categories Of
Furniture Industry Personnel

(a) Management

- (1) General Manager.
- (2) Finance and Administration Manager.
- (3) Production Manager; Asst. Production Manager.
- (4) Marketing and Design Manager.

(b) Supervision/Technician

- (1) General Supervisor.
- (2) Production Supervisor:
 - (i) Timber Drying
 - (ii) General Machining - solid wood products
 - (iii) General Machining - panel products
 - (iv) Veneering
 - (v) Sanding
 - (vi) Surface finishing
 - (vii) Upholstery
- (3) Draughtsman Technician.
- (4) Prototyping and Product Development Technician.
- (5) Machine Set-up and Maintenance Technician.
- (6) Work Study/Costing Technician.
- (7) Checker.

(c) Skilled Workers or Furniture Operatives

- (1) Timber drying and storage.
- (2) Woodcutting machinists - general.
- (3) Wood Turners.
- (4) Cabinet/Chairmakers.
- (5) Surface finishers.
- (6) Upholsterers.

(d) Special Skilled Workers*

Operators of:-

- (i) Routers - High Speed and NCR.
- (ii) Spindle Moulders.
- (iii) Planers and Moulders.
- (iv) Automatic Shaping Machines.
- (v) Double End Tenoners.
- (vi) Edge Banding Machines.
- (vii) Veneering.

* Usually in highly mechanised and large turnover plants.

6. Quality Considerations And Training

Since considerations of quality play a vital role in the training of wood processing personnel, the consultant considers it important to draw attention in the following paragraphs to what exactly constitutes quality in the furniture industry. In particular, he would like to emphasise that quality is an integral function of production and cannot be superimposed on it.

The ability of a product to compete on a market is directly related to its overall quality and to a lack of variation in that quality. In the furniture and joinery industry there are very many sources of quality variations including the following:

- properties and conditions of timber and other materials;
- dimensional accuracy of machined components;

- dimensional accuracy of partly of fully assembled products;
- quality of surface finishing;
- durability and performance of finished products.

Control of quality implies comparing what is achieved with what is required, seeking the causes of any disparity and taking action. There are two main aspects of control of quality:

- (a) regulating the process to maintain quality;
- (b) adapting the process to achieve new and often higher levels of quality.

The most effective and economical approach is for the skilled craftsmen to control their own quality and to inspect their own work. This is an expression of the management's ability to delegate, i.e. to define what quality is required and to provide the conditions necessary for the worker to achieve this standard consistently.

The conditions are:

- the worker needs a clear definition of the quality to be achieved;
- the materials must be to the required specifications;
- the tools and equipment used must be capable of achieving the required quality;

- the worker must possess the necessary skills and ability;
- he must know whether or not he is achieving quality and, if not, be able to adjust the operation or process to achieve it;
- he must be motivated to achieve quality.

It is important to note that these conditions need to be satisfied at each stage of operation in the process whether the worker is machining, assembling, or polishing. Consistent failure to satisfy any one of these will mean that a chronic problem is present.

2. A Strategy For Quality Improvement

The principles and concepts outlined are basic and practical. Together they can form the basis for reviewing and upgrading quality in manufacture by considering the main areas of quality and testing the level of performance, the level of control, identifying the obstacles and defining the role of supervisors and craftsmen. This approach spans all functions and in particular, the following areas:

Quality Standards - how they are defined and understood.

Supplier Relations- control of incoming materials through reliable inspection.

Process Capability- including factory capability, worker skills, control and motivation.

Management Control- through product design and development, provision of appropriate equipment and skills, careful production planning, supervision, and communication.

Customer Relation - Through effective monitoring of customer reaction and customer needs. Quality is not absolute. It is comparative and part of the value judgement is made by the customer. Knowing where quality standards and performance stand relative to competitors is also necessary in order to improve quality of design and to adapt the manufacturing process to achieve it.

D. Role Of Furniture Resource and Technology Centre

1. Nature And Extent Of Services

The role of the FRIC has already been defined by MARA as one of providing appropriate support services related to the upgrading and development of all aspects of the sector of the furniture industry including industrial training; management techniques, systems and procedures; product design; production technology of materials and processes; quality standards and marketing.

These support services, which are both technical and managerial in content, will be effected by the Centre through the establishment of a series of well-organised and well planned practical and theoretical training programmes which relate specifically to the immediate and longer term needs of the industry. Further support will be provided by the Centre through its involvement with individual enterprises on their particular requirements and through the already well established counselling work carried out by the relevant MARA technical and managerial specialists.

Accordingly the work content associated with these activities may be further elaborated on as follows:

(a) Design and Product Development

This will include the design of new products and the re-designing of existing products in accordance with the requirements of individual plants; making prototypes of such products; assisting in product development to the stage when series production is reached; assisting in the solution of all technical production problems.

(b) Applied Research Into Materials
and Production Technology

Including solid wood (species selection and conditioning) sheet materials including plywood, medium density fibreboard, particle board, veneer, adhesives, surface coatings, fittings and accessories, upholstery materials; machining, including machine selection, utilisation, setting up and tool maintenance, low cost mechanization, quality and waste control, technical problems associated with the processing of wood-based items and components; finishing problems and the selection of appropriate finishing materials and systems; particular upholstery problems for rattan and solid wood furniture.

(c) Furniture and Joinery Performance
Standard and Specifications

The drafting and/or adoption of standards specification and test document for domestic (residential) and contract (hotels and similar institutions) furniture and joinery.

(d) Structure And Performance Testing

For components, elements and complete items of furniture and joinery; board materials; adhesives; finishes (surface coating); jointing systems (mechanical and integral) foams, fillings and seat suspensions; fabrics for upholstery covering.

(e) Analytical Service

Including fault finding and trouble shooting in respect of materials, machines and processing problems which arise at individual plant level.

(f) Technical And Productivity Services

Including plant/workshop evaluation, factory planning and re-organising, plant selection and utilization, work study, work programming, product costing, production planning and control, pneumatics and electrics, machine adaptation, design of work stations, compressed a.r and wood waste extraction systems, materials handling and internal transport systems.

(g) Technical Information

This would be based on the combined knowledge of the technical staff allied to a comprehensive and up-to-date library of technical information derived from books, journals, magazines and special reports, all of which are concerned with the many facets of secondary and tertiary wood processing. It should be made available as a technical enquiry service and the publication from time-to-time of papers on selected wood industry topics. A list of relevant literature is given in Annex 2.

(h) Training

This is concerned with lectures and demonstrations to managers and technical staff from the industry of the practical and commercial applications of the work carried out by the FRTC. Each course would set out to meet a particular need in a relevant management or technical area and through a modified seminar/workshop approach would encourage active participation by participants. Topics would therefore include product design and procedures, production and productivity, quality control, supervision, work planning and allocation, health and safety, finance and marketing. Entrepreneurs would be encouraged to use the centre's facilities as an adjunct to their acquisition of similar equipment.

(i) Cane Production

At a later date, the FRTC should also include attention to the development of the cane sector of the industry, namely the processing of rattan for furniture production. In addition to the foregoing in respect of wood products, aspects which require immediate attention include a supply survey of the raw materials, harvesting and transport, the establishment of a suitable replacement cycle, pre-production treatment including drying and protection from insect and fungal attack, mechanization of particular aspects of production especially for bending, jointing, sanding, and surface coating, product design and marketing.

(j) Marketing

This will include the commissioning of outside and/or MARA marketing specialists to carry out market

research surveys and prepare forecasts on marketing opportunities in domestic and overseas markets, retailer and consumer attitudes and buying motivations.

A feature of the marketing activities would be the organization of new planning workshops in order to improve an awareness of marketing and its importance to the industry. High priority should be given to direct liaison with individual enterprises and the latter should be encouraged to participate in all consultancy and training programmes and to make full use of the services offered.

2. Product Types

The following is a comprehensive list of wood-based components and end products normally associated with the furniture and joinery industries and with which the Centre should be capable of dealing as the need arises:

Dimensioned Stock

- (i) Accurately sawn and correctly dimensioned kiln-dried hardwood species, scantlings (i.e. random lengths) and cut to length boards and blanks which are prepared strictly in accordance with a wide variety of end-user requirements in the construction, joinery, furniture, D.I.Y and general woodworking industries.
- (ii) Dimensioned and preservative treated stock for paling fences etc.
- (iii) Dimensioned stock for boxes and crates.
- (iv) Re-dimensioning and squaring of offcuts from above which could be used as blocks for parquet flooring,

chair, drawer, turned parts and parts including handles and knobs for occasional furniture components and for the production of a wide variety of domestic and general woodware and marine internal trim.

Moulded Products

- (i) Kiln-dried hardwood which is planed, tongued, rebated, chamfered, V-jointed, centre V-jointed, beaded centre-beaded.
- (ii) Wide variety of beadings and mouldings, surface coated and unfinished, which are used in builders woodwork, furniture, joinery and D.I.Y stores.
- (iii) Decorative mouldings which are used for picture and frame production.
- (iv) Moulded components for door and window frame production. Stair treads, hand rails, bannisters, plinths, architraves, curtain rods and rings.
- (v) Broomsticks and dowels.
- (vi) Container flooring.
- (vii) Wall panelling in a variety of moulded finishes.

Joinery Products

- (i) Range of standard builders joinery including framed and panelled interior and exterior doors and door jambs, windows and window frames, staircases, louvre doors and panelling.
- (ii) Purpose designed architectural joinery.

- (iii) Roof trusses.
- (iv) System housing components.
- (v) Garden sheds and patios.

Furniture Products

- (i) Dimensioned stock or sized blanks which are straight sawn for square edged components e.g. shaped chair legs, arms and backs.
- (ii) Fully machined and sanded components which are manufactured to the customer's specification and are ready for assembly. Further value may be added by introducing turnery, in-lay work and wood carving where appropriate.
- (iii) A wide variety of mouldings, both large and small section, which are used by the furniture industry, e.g. astragal, cyma recta (ogee), cyma reversa, beading and scotia.
- (iv) Fully assembled framed and panelled and louvred doors and drawer fronts which are used in the production of a wide variety of storage units for kitchen, living-room and bedroom furniture.
- (v) Panel-based (i.e. particle board and M.D.F) furniture which is veneered and edge treated (solid wood and veneer) and incorporates both knock-down (K.D) and fixed forms of construction.

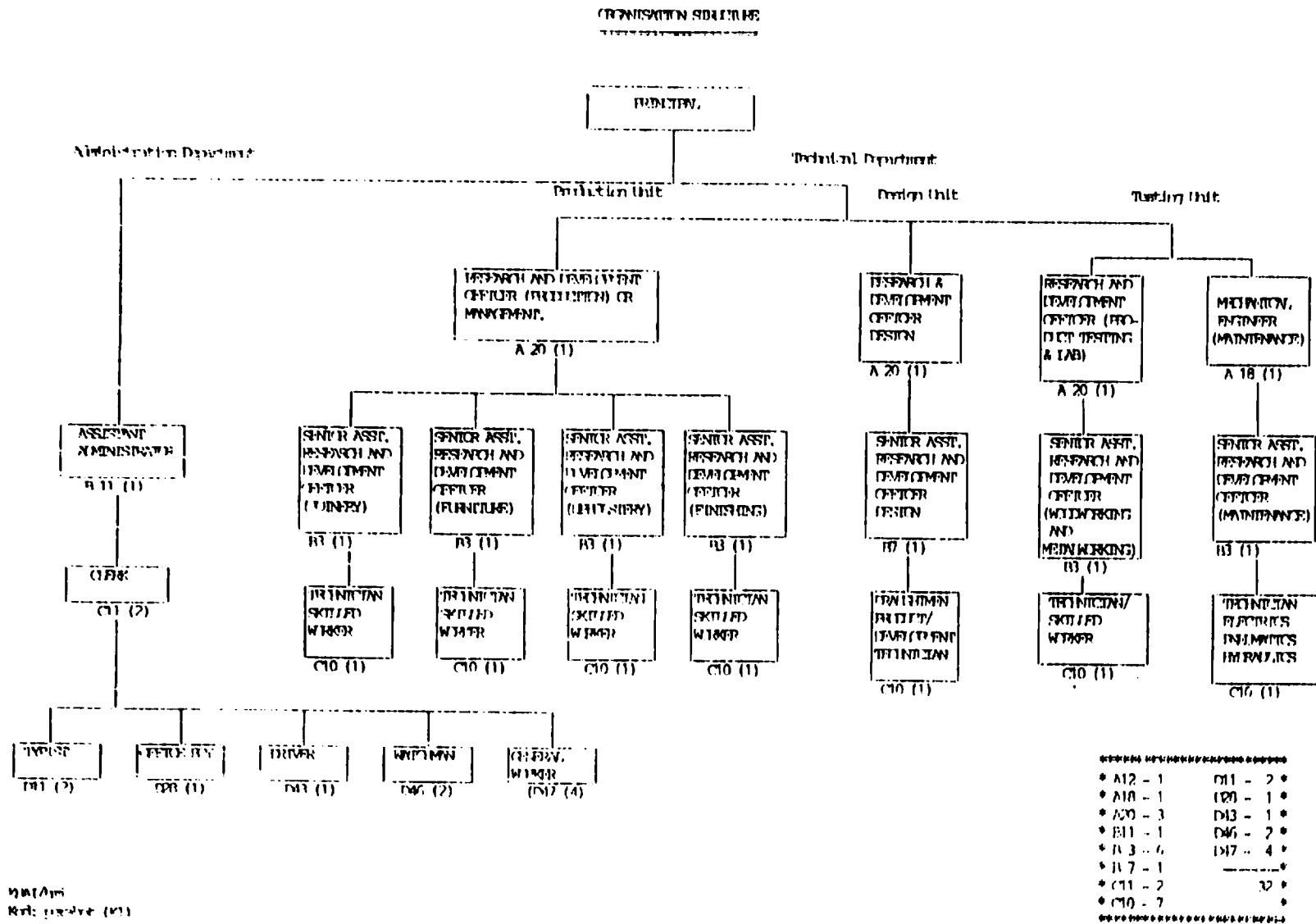
- (vi) Completely or partly knocked-down (K.D) furniture especially dining-room chairs, show-wood seating and table frames which are lacquered and ready for assembly.
- (vii) Fully knock-down garden furniture and fireplace surrounds:
- (viii) Fully assembled occasional furniture which is well designed and packs economically.

3. Staffing Requirements For Centre

Attention has already been drawn to the various categories of personnel within the structure of the furniture industry and the extent to which each requires training of a specific nature. In addition, there are also the other functions of the Centre relating to the upgrading and development of the industry which must be taken into account in establishing its staff requirements.

MARA has already prepared its own organisation structure with which, with some amendments, the consultant is in complete agreement. (See Figure 1.) This structure calls for particular capabilities, skills and other attributes which are normally exercised in leading and directing such as the furniture industry. The consultant is not familiar with what might be termed comparable qualifications in Malaysia to those normally applying in Europe or the United States in the furniture industry. Nevertheless, what should be common to either, especially in the context of industrial training and development, is sharing considerable experience in and a deep knowledge of the industry, which will be best reflected in an ability to analyse and find solutions to its problems.

FIG. 1: MVA FURNITURE REPAIR & TRIMMING CENTER



The following are some additional observations in respect of the various levels of responsibility referred to in the organisation structure chart:

(i) Research and Development Officer - Production

Ideally, he should have a background in industrial engineering with specific reference to the furniture and other wood-based industries. He, therefore, would be familiar with all management and technical considerations and would be capable of planning and directing the work of the Centre and ensuring that it is carried out in accordance with the high standards normally expected from the industry itself. In particular, he should be experienced in the preparation and implementation of technical and managerial training programmes for all categories of personnel in the furniture industry. It should be appreciated from the outset that his is a key role in the effective operation of the Centre.

(ii) Research and Development Officer - Design

Product design is probably the greatest single need of the industry in Malaysia today and the individual chosen to undertake this task in the Centre should reflect in this background and experience the importance of his function. Normally an industrial designer of furniture requires a preliminary training period of four years at a university or similar institution after which he would practice as a designer in a furniture plant and later, perhaps, become a free-lance designer. In this way he would familiarise himself with, not only the market implications of design, but also the technical ones concerned with raw material usage and production. In the case of the Centre, he should also

be capable of transmitting design expertise by means of training through draughtsmanship and product development with the assistance of his design technicians.

(iii) Senior Assistant Research and Development Officer
Furniture, Joinery, Upholstery, Surface Finishing,
Design, Product Testing and Machine Set-up and
Maintenance

Since these categories will take responsibility for the implementation of the Centre's individual training and applied research programmes and the carrying out of field-work counselling, it follows that they should each have undergone a period of apprenticeship or craft training in respect of each of their crafts, followed by at least five years as journeymen, foremen and supervisors, practising their trade in an industrial environment. It would, of course, be preferable if they had undergone additional post-apprentice training in production technology and supervisory management leading to, for example, the full technological certificate of the City and Guilds of London in Furniture Production, or its equivalent. In any event, they would be furniture industry technologists of the highest calibre with both the technical and analytical skills.

(iv) Technician/Skilled Workers

This category would have similar backgrounds to those of the furniture technologists and could well become the latter in due course. Again, broadly-based experience in the industry is essential with, in this instance, highly developed manual/mechanised skills coupled with a deep knowledge of modern furniture

production techniques and a full appreciation of the quality standards required.

4. Further Training For Technical Staff of Centre

Since it is likely that the prospective staff of the Centre will be drawn from the Malaysian furniture and joinery industry, it is evident that the provision of further training will be necessary before taking up full-time work in the Centre. This should be of two distinct types, namely, for the Research and Development (Technologist) category and for the Technician category as follows:-

(a) Research and Development (Technologists)

- (1) Study-tour to selected European Countries where the industry, though fully developed, is similar in size and scope to that in Malaysia. Included would be organised visits to training and research institutes relating to the furniture industry; trade fairs concerned with products, materials and processing equipment (e.g. Interzum and Ligna in Germany in May 1991); furniture design centres and furniture plants.

Such a programme would require three weeks duration, including travel time and would have as its main objectives the exposure of the participants to the industry at its best and the extent to which it relies on support services concerned with training, research and development.

- (2) The study-tour should be followed by special in-house training and induction programme at the Centre concerned with the day-today operation of

the Centre and in particular, the preparation of training modules, course organisation and implementation and the implementation of the counselling or consultancy services.

It should also be noted that a special training programme for the technologist who would take charge of furniture and materials testing would also have to be arranged for in a suitable furniture testing laboratory.

(b) Technician/Skilled Worker

These, in effect, will be the Centre's training instructors who will be responsible for the transfer of furniture technology at craft level and the development of skills relevant to all types of production. They must therefore, as we have seen, be themselves craftsmen and then have the ability to teach or instruct the trainees in the practice of their craft. This calls for additional skills in pedagogics as well as the structuring of course material accordingly. There are many appropriate and relevant organisations in Europe willing to provide specialist courses of this nature, which are specifically tailored to the needs of the participants. Two, of which the consultant has direct experience, are the Furniture and Timber Industry Training Board in the United Kingdom and FAS, the Industrial Training Authority in Ireland. Either would provide the training required.

The instructors would also require a further period of in-house training and induction similar to that for the technologists.

It is, finally, not inappropriate to refer briefly to the terms and conditions of employment of the various staff levels of the Centre. After training, they will be well equipped to deal with all aspects of the industry and in the nature of things, may well be sought after by the private sector. It is therefore important that this be taken into consideration in arriving at decisions of this nature.

5. Training and Research Facilities For The Centre

(a) Building

As already indicated the FRTC is located on a 5 acre site within Kampung Batu, and the building is expected to be completed by March 1991. The total area under-cover is 2,500m² made up of the following centres of activity:-

Department

1. Timber Storage.
2. Timber Drying Kiln.
3. Materials Storage.
4. Machining area for furniture and joinery production.
5. Machine Maintenance.
6. Assembly Area workshop.
7. Surface finishing workshop.
8. Upholstery production workshop.
9. Furniture testing laboratory.
10. Design Studio.
11. Materials laboratory.
12. Classroom.
13. Library.
14. Staff Room.
15. Display Area.
16. Administration Offices.

(b) Machinery and Equipment

Equipment for all departments within the centre had been budgeted for and a preliminary selection of all machines including detailed specifications had been prepared by the staff of MARA prior to the arrival of the consultant. Purchase would be made in two phases in accordance with the following schedule:

Phase 1 : Kiln-drying equipment.

Machines for solid wood and panel processing.

Machines for veneering.

Machine maintenance equipment.

Assembly equipment.

Upholstery equipment.

Surface finishing equipment.

Power-operated tools.

Hand tools.

Drawing-office equipment.

Compressors.

Phase 2: Dust exhaust system.

Compressed air-line system.

Materials handling equipment.

Furniture and materials testing equipment.

Library and technical information.

Phase 1 would be immediately and Phase 2 would occur when the machinery and equipment had been installed and commissioned and in the case of testing equipment when the initial training programme had been completed by the technologist.

Meanwhile, the brief to the consultant was to assist in the selection of up-to-date machinery and equipment

which might normally be found in a well planned medium-sized furniture and joinery plant. It would subsequently be laid out in accordance with established work flow and would also serve as a headline and guide to the remainder of the industry.

The consultant wishes to emphasize that the equipment listed hereunder is the result of the collective wisdom of the MARA personnel, who have been working for many months on the project, his own input in respect of the original selection and its further amendment in the light of subsequent discussion and analysis.

At first sight it may seem over-elaborate and that, indeed, was his immediate reaction. He demonstrated that many of the processes relating to the acquisition of some individual machines on the list could be achieved by adapting other more flexible machines for that purpose. To give one of many examples, special attachments fitted to a spindle moulder would render it capable of making tenons, finger joints, inter locking drawer joints etc. and thus would obviate the need for those machines. This was accepted fully by the technical staff of MARA who, however, pointed out that in the particular circumstances of the Bumiputra sector, where little or no opportunity is afforded to personnel to study up-to-date mechanisation in the industry, the justification for such additional investment would, in the long term, prove its worth. In any event, where two possibilities such as those referred to, exist, it is the intention to demonstrate both as a matter of course.

Accordingly the following list of equipment was agreed to, to which are added some additional specifications not included in the original MARA list. It is confined to the major items of purchase since all other tools and equipment had already been adequately dealt with.

PANEL PROCESSING - MINIMUM REQUIREMENTS

Process	Machine	Add. Specification
1. <u>Veneer Preparation</u>	<ul style="list-style-type: none"> . Veneer Cross-cutting saw . Veneer Guillotine/jointer . Veneer Stitching/ splicing machine 	<p>Cutting length: 3100 mm Double-cutting device Cutting Length 3,100mm</p> <p>Table mounted Outreach: 750 mm</p>
2. <u>Veneering</u>	<ul style="list-style-type: none"> . Glue spreading machine. . Single Daylight Veneer Press 	<p>Fitted with doctor rollers Capacity: 2200 mm</p> <p>Hydraulic Electrically heated.</p>
3. <u>Laminating</u>	<ul style="list-style-type: none"> . Cold Laminating Press Contact Adhesive spray booth. 	<p>Exhaust for ducting and spraying equipment.</p>
4. <u>Panel Processing</u>	<ul style="list-style-type: none"> . Panel sizing saw . Double cut-off squaring saw . R.F Press for wide solid edge lipping. . Single-sided edge banding machine. . Small multiple boring machine . Hinge recessing machine 	<p>Single-sided, Tilt Blade with scoring unit.</p> <p>With scoring unit Cutting Width 1800 mm</p> <p>End trimming, edge Trimming and edge sanding attachments.</p> <p>32 mm centres adjust- able for horizontal/ vertical boring</p> <p>For hinges and locks.</p>

Process	Machine	Add. Specification
<p>5. <u>Solid Wood/MDF Processing</u></p>	. De-Humidifier Drier	Capacity 6 m ³
	. Cross-cut saw	Pneumatic, Under-table roller conveyor table with length stops.
	. Power-feed saw bench	With feeder
	. Surface Planing Machine	With feeder Capacity 510 mm.
	. Thickness Planing machine.	Capacity 510 mm.
	. Morticing machine	Oscillating type
	. Tenoning machine	Producing round tenon for chair work.
	. Four-sided moulding machine	With five spindles Pre-straightening table.
	. Band saw	Saw wheel- 800 mm.
	. Vertical spindle moulder	With tilting head and power feed.
	. Automatic shaping machine	Fitted with two spindles.
	. High-speed router	Floating head and frequency changer
	. Single-end tenoning machine.	For joinery work.
. Slot morticing machine	For joinery work.	
. Horizontal boring machine	For chair work Straight-line and cluster boring.	

Process	Machine	Add. Specification
<p>5. <u>Solid Wood/MDF Processing</u></p>	<ul style="list-style-type: none"> . Louvre slotting machine . Dovetailing machine . Lormer locking machine . R.F. Laminating Press . Dowel-making and milling machine . Dowel cross-cutting, trimming and chamfering machine. Semi-automatic wood-turning lathe 	<p>2 Auto milling heads. Workpieces 800 mm length 45 mm thick 160 mm width</p> <p>Max. width: 140 mm.</p> <p>Max. Width 450 mm.</p> <p>Suitable for wide board laminating.</p> <p>Dowel length 6 - 18mm</p> <p>Fitted with sanding heads and centering device.</p>
<p>6. Sanding</p>	<ul style="list-style-type: none"> . Wide-belt sanding machine . Open belt sander Vertical finisher . Buffer or profile sander. . Narrow-belt (dolly) sander . Disc sander 	<p>Course and fine belts pressure cushion and roller.</p> <p>With sliding table 2500 x 800 mm. Belt width: 150 mm Belt length: 7,200mm</p> <p>For shaped components.</p> <p>- do -</p> <p>- do -</p>

Process	Machine	Add. Specification
7. <u>Machine Maintenance</u>	. Automatic knife grinder	Knife length: up to 600mm. Wet grinding. Simultaneous sharpening.
	. Universal tool grinder	With attachments for: 1. HSS and TCT cutters. 2. Grinding of boring drilling, routing bits. 3. Moulding cutters. 4. Routing cutters. 5. Boring and slotting cutters, plain/threaded. 6. Straight knives. 7. Standard and diamond grinding wheels.
	. Automatic grinder for HSS and CTC Circular Saws.	For grinding of tooth front and back. Additional grinding wheels.
	. Bandsaw shears	For blade width up to 200 mm.
	. Butt welding machine	Blade width up to 50 mm
	. Bandsaw setting machine	Blade width up to 50 mm Tooth pitch 3 to 24 mm Centering adjustment for blade thickness.
	. Device for setting and Balancing cutter blocks.	
	. Knife Balancing stand.	
	. General purpose bench grinder.	Attachment for hand tool blades.
	. Power drill for wood/metal boring.	Two speeds.

Process	Machine	Add. Specification
7. <u>Machine Maintenance</u>	<ul style="list-style-type: none"> . Light weight oxy-acetylene welding equipment. . Various power and hand-operated tools 	All relevant accessories
8. <u>Surface Finishing Equipment</u>	<ul style="list-style-type: none"> . Waterwash spray booth . Airmix spray system . Mobile shelving for lacquered panels. . Dipping tank. 	<p>Width : 3500 mm Length: 2000 mm Exhaust Fan: 1.5 KW Cir. Flow : 210 m3/min. Water plate: Stainless steel. Water tank filter net.</p> <p>Kremlin or Similar 2 air guns Pump Assembly Fluid hose Air hose</p>
9. <u>Upholstery Equipment</u>	<ul style="list-style-type: none"> . Cutting table. . Industrial sewing machine . Button-making machine . Buttoning maching . Rotary knife - cutting machine. . Air tackers. 	<p>Width 1500 mm. Length 6000 mm. Fitted with cover roller brackets.</p> <p>Single needle. Heavy duty lockstich. Compound and reverse feed. Presser foot Built-in bobbin winder.</p>

E. Nature And Outline Content Of Training Courses

As has been emphasized throughout this report, the main objective in the establishment of the FRTC is to provide direct technical and managerial assistance to the Bumiputra furniture industry sector so that its products will reach a much wider market than heretofore and that this will be evident in both its increased capacity and in the means used to produce it. The training programmes, therefore, to be undertaken by the Centre must themselves reflect this objective but must also be in line with the most up-to-date technological developments in the industry itself.

The Centre is largely technically oriented and if outfitted in accordance with the details in preceding chapters in this report, will be ready to meet this responsibility. However, the industry is not only run on technical lines and to be successful, must also depend on the development of effective management expertise, an aspect which, sooner or later, must also be tackled by the Centre. In the meantime, its immediate aim must be to upgrade the production and supervisory skills of the workforce generally as well as providing direct assistance to individual enterprises by means of counselling and trouble shooting.

With regard to standard woodworking and furniture industry training programmes, these are already well established throughout the world and while certain aspects may be adjusted to fit in with the Malaysian situation, by and large they apply here equally well. They may be summarised as follows:

- (1) Operative or craft training.
- (2) Technician and supervisory training.
- (3) Training in special techniques and/or equipment

(1) Operative or Craft Training

The furniture industry has four basic crafts, namely, wood-machining, cabinet/chairmaking, surface finishing and upholstery. The essential skill requirements and initial outline training course content for each is as follows:

Wood Machining (Theory and Practice)

- Basic handtools.
- Working from cutting lists.
- Sawing and planing machines.
- Joint forming machines.
- Moulding and shaping machines.
- Jig fixture and former making.
- Reading drawings, draughtsmanship and setting out.
- Machining and assembly work for furniture and joinery.
- Production and quality control.
- Surface sanding.
- Surface finishing.
- Cutter Making.
- Basic Maintenance.
- Wood turning.
- Wood and composite materials technology.
- Safety and good housekeeping.
- Waste control.
- Layout of machining department.
- Dust exhaust and compressed air-line systems.

Course duration : 12 weeks.

Cabinet/Chairmaking (theory and practice)

- Reading drawings, draughtsmanship and setting out.
- Furniture and joinery construction details.
- Door, drawer and carcass construction.
- Assembly procedures.

- Adhesives.
- Veneer preparation and veneering.
- Bonding procedures.
- Fittings and fitting up.
- Use of machines and machining.
- Preparation for surface finishing.
- Use and maintenance of hand and powered tools.
- Inlaying, crossbanding and wood carving.
- Safety procedures and good housekeeping.

Course duration : 12 weeks.

Surface Finishing (Theory and Practice)

- Assessment and preparation of surfaces.
- Selection and application of suitable finishing systems for staining, wood filling, and surface coatings.
- Shading and matching colours and their application.
- Pigmented finishes and their application.
- Surface finishing materials technology.
- Selection and use of coated abrasives.
- Defects, causes and remedies.
- Compressors and compressed air.
- Selection, use and maintenance of surface finishing equipment.
- Finishing materials preparation and testing.
- Safe storage of finishing materials.
- Layout and working environment of finishing department.
Fire prevention.
- Spray booths and exhaust fans.
- Repairing and touching up.
- Health and safety procedures.
- Good housekeeping.

Course duration : 12 weeks.

Upholstering (theory and practice)

- Upholstery design : Traditional and modern.
- Fixed and loose cushion upholstery.
- Identification and characteristics of cover materials including woven fabrics, coated fabrics PVCs and leather.
- Cushioning systems : Traditional and modern.
- Springing systems : Traditional and modern.
- Upholstery equipment, tools and their use.
- Planning for and cover cutting.
- Selection and use of upholstery sewing machines.
- Sewing system and various types of constructions and decorative stitching. Top and blind stitching.
- Piping, welting, zip insertion.
- Button-making and buttoning.
- Repairing and re-upholstering.
- Cushion filling and closing.
- Latex and urethane foams.
- Use and maintenance of air tackers.
- Health and safety precaution.
- Upholstery department layout.
- Good housekeeping.

Course Duration : 12 weeks

(2) Technician and Supervisory Training

Technicians are essentially highly experienced craftsmen, who, with this background, can now turn their attention to the planning, organising and supervising of each craft activity so that those under their direction achieve the productivity and quality objectives required. In order to be proficient in this work, they must be trained in leadership, the salient characteristics of which, are motivation, discipline, communication, consultation, decision-making, co-operation co-ordination and integration.

To the above may be added the development and training in other essential skills relevant to the furniture and wood industries and include work study (mainly methods and time measurement) prototyping and product development, machine adaptation and jig design, cutter and knife design and production, low-cost mechanisation, plant selection and layout, production planning and control and appropriate documentation, costing and documentation, quality specifications and their control. They should also have a working knowledge of pneumatics, hydraulics and electrics and should understand that modern production in the industry is the application of industrial engineering principles to what were originally craft techniques without in any way diminishing the latter.

(3) Training in Special Techniques and/or Equipment

These training courses are usually of an ad hoc nature and shall be undertaken from time-to-time by the Centre in response to industry demands or the emergence of a new material, machine or production techniques which would have wide industry appeal or interest. Often it shall require specialist lecturers, suppliers of equipment or materials to be invited to co-operate with the Centre in mounting the course and usually they are only too happy to oblige.

Training Courses Curricula and Work Content

These are the responsibility of the staff of the Centre and training in their preparation shall be included in the programmes referred to in the chapter dealing with further training for the technical staff of the Centre (page 28). Many may be obtained on request from well established technical training institutes or Furniture Technology Centres abroad.

In this connection, the consultant has provided MARA with the following documents from FAS, the Irish Industrial Training Authority and should be found to be suitable to the Malaysian situation:

- Furniture Maker:
- Course organisation and administration manual.
 - Practical and related knowledge.
 - Craft Practice.
 - Craft theory/science programme.
 - Craft drawing programme.

- Carpenter/Joinery:
- Course organisation and administration manual.

- Woodcutting Machinist:
- General principles.
 - Guide to stage 1, training.
 - Guide to stage 2 training.

- Training Guide for:
1. Circular Rip Saw
 2. Cross-cutting saw
 3. Narrow Band Saw
 4. Surface planer
 5. Thicknessing planer
 6. Mortising machine
 7. Woodturning lathe
 8. Wood Boring machine
 9. Dimension saw
 10. Log sawmill
 11. Band Resaw
 12. Vertical spindle moulder
 13. Four sided planer and moulder
 14. Double-end Tenoner
 15. Router
 16. Drum and wide belt sander

Some documentation regarding the following was also provided by the consultant:

1. Training needs analysis.
2. Compiling a training programme.
3. Job descriptions and performance standards.
4. Management techniques.

Copies of the UNIDO publication, Furniture and Joinery Industry in Developing Countries and the FAO/UNIDO Rattan Seminar proceedings were also provided.

F. Follow-up Action

The consultant recommends immediate follow-up action in respect of the establishment of the FRTC with particular reference to the placement of orders for the machinery and equipment as detailed and the recruitment and training of the permanent staff of the Centre. To all intents and purposes it will be at least six months from the date of this report until the Centre is fully operative and the intervening time could profitably be used for the above-mentioned activities.

He is aware that the project document concerned with the current project does not envisage any follow-up activity. Nevertheless, he recommends that bearing in mind the importance of the Centre to the future development of the Bumiputra sector and the not inconsiderable state investment in manpower and facilities, the services of a full-time furniture and wood industry specialist be sought to assist in guiding the Centre and its activities especially during the first year of operation. This will obviously be its most critical period and should therefore be subject to some "hand-holding" until it has found its feet.

Arrangements for the overseas training in respect of technologists, technicians and instructors should also be put in train and again international assistance should be sought in facilitating this objective.

Finally, in placing orders for machinery and equipment, an imperative condition should be that suppliers must provide installation and operating instructions in the English language, in respect of each machine supplied as well as providing training in its operation.

III. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

1. The Bumiputra sector of the Malaysian Furniture industry is still very much at the development stage.
2. Investment is low and the sector is characterised by a large number of small to medium-sized workshops which are only partly mechanised and as a result, unduly labour intensive.
3. Products are mainly inspired by government contracts or sales of indifferent quality and low-priced items at local community level.
4. Designs are copyist in origin and reflect a lack of understanding of the nature of design and its relevance to market and technical considerations.
5. The sector often has serious cash-flow problems due to delays in payment for contract work.
6. The industry's most serious defects stem from a lack of training in both management and production technology.
7. Industrial training, in so far as it exists, caters mainly for vocational level personnel mainly at pre-employment stages.
8. This has only a minor relevance to the needs of the furniture and other wood-based industries and could not be regarded as a substitute for its own special training requirements.

9. Training courses undertaken by MARA at present while undoubtedly helpful, require to be further restructured in accordance with standard training procedures.
10. The plans envisaged by MARA for a more organised and better structured approach to training in the shape of the establishment of a Furniture Resource and Technological Centre, are a realistic response to the current and future needs of the industry.
11. If MARA accepts the recommendations contained in this report and as a result, succeeds in establishing a centre for training and advisory services which responds to the current and future needs of the sector, it will contribute substantially to its future development and well-being.

B. Recommendations

1. MARA, in collaboration with other state agencies set up to assist in the development of the furniture industry, should establish an integrated programme of adaptation and modernisation of the Bumiputra sector of the industry.
2. Among the matters to which they should give immediate attention are:
 - (a) The unsatisfactory standard of design;
 - (b) The unsatisfactory level of production efficiency and quality standards;
 - (c) The need to raise the standard of worker productivity;
 - (d) The need for management, supervisory, technician and operative education and training and;
 - (e) The need to develop export awareness.

3. Since the establishment of a Furniture Resource and Technology Centre is a major plank in the MARA strategy for the upgrading and development of the industry, it is essential that in terms of personnel and facilities, it responds in a realistic and practical manner to the needs of the sector.
4. The Centre itself therefore from the point of view of its facilities, should offer the possibility for every type of technical and production management training required.
5. This should include operative or craft training, technician and supervisory training and special training courses related to materials technology, processing and product design.
6. It should also offer a technical information service and one of in-plant consultancy and trouble shooting.
7. It should also offer design and prototyping services and product performance testing for materials and whole items of furniture.
8. Only personnel who have at least five years experience in the furniture industry and are otherwise suitably qualified, should be employed in the Centre.
9. Prior to taking up duties in the Centre they should all undergo specially arranged overseas training related directly to their levels of responsibility.
10. They will be trained as instructors, technicians and technologists as well as course curricula preparation and teaching and demonstration techniques.

11. On their return to the Centre they should also be given a period of induction and a special training programme in consultancy and field work.
12. MARA should seek assistance from an international agency in providing a full-time furniture and wood industry consultant to provide additional direction and guidance during the first year of the Centre's activities.
13. Courses in craft training and development at operative level should be full-time and should extend over a period of not less than 12 weeks.
14. A maximum of 16 participants is the usual complement per practical class and it should be possible to run training courses in all four disciplines concurrently.

Annex I

CONSULTANT'S JOB DESCRIPTION

SI/MAL/89/801/11-01/J-12209

- Post title : Furniture production expert
- Duration : Three weeks
- Date required : As soon as possible
- Duty station : Kuala Lumpur (with travel in Peninsular Malaysia)
- Purpose of project: To advise MARA, the Government counterpart organization, in finalizing the list of equipment/ machinery and also the training programmes for the MARA Furniture Technology Centre to be established at Kampung Batu.
- Duties : An expert in furniture making will be fielded for two weeks in Malaysia. The expert is expected to undertake, in cooperation/consultation with the counterparts, the following activities:
- To assess technical specifications of equipment and machines, and review the existing list of equipment to be purchase and installed at the MARA Furniture Technology Centre.
 - To draw up the detailed technical specifications for the equipment/machinery for preparation of a proposal for tenders for this Centre.
 - To identify the level of training courses already available in several relevant schools in Malaysia, and to determine the contents of the training programmes.
 - To prepare programmes for trainees at the Furniture Technology Centre, on the basis of the above findings.
 - To suggest a programme for the training of the Center's trainers.
 - To prepare a terminal report which sets out several findings and recommendations on the above-mentioned subjects.
- Qualifications : Engineer or wood technologist with long experience in the serial production of furniture. Familiarity with production in developing countries and with planning human resource development desirable.
- Language : English.

Annex 2

FURNITURE AND WOOD INDUSTRY LITERATURE

I. JOURNALS:

1. Furniture Manufacturer (Monthly)

Magnum Publication. Ltd., 110/112 Station Road, East Oxted,
Surrey, Great Britain.

2. Cabinet maker (weekly) and
3. Woodworking Industry (monthly)

Benn Brothers Ltd., 25 New Street Square,
London EC4A 3JA, Great Britain.

4. Wood and Equipment News (monthly)

Westbourne Journals Ltd., Crown House, London Road,
Morden, Surrey SM4 5ER, Great Britain.

5. Furniture Design and Manufacturing (monthly)

Dun-Donnelley Publishing Corp., 222 S. Riverside Plaza,
Chicago, IL, 60606, U.S.A.

6. The International Journal of Wood Preservation

The Construction Press Limited, Lunesdale House,
Harby, Lancaster LA2 8NB, Great Britain.

7. Annual Report of the British Furniture Manufacturer's
Council

D.D. Mitchell, OBE, 17 Berners Street,
London W1P 4DY, Great Britain.

II. PUBLICATIONS ISSUED BY THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO), P.O. BOX 300, A-1400 VIENNA, AUSTRIA

A. Studies and Reports

1. Furniture and Joinery Industries for Developing Countries (Raw Material Inputs, pt.1: Processing Technology, pt. 2: Management Considerations, pt. 3) (ID/108 Rev.2)
2. Selection of Woodworking Machinery, Report of a Technical Meeting, Vienna, 18-23 November 1973 (ID/133).
3. Low-cost Automation for the Furniture and Joinery Industry (ID/154 Rev.1).
4. Wood Processing for Developing Countries. Report of a Workshop Vienna, 3-7 November 1975 (ID/180).
5. Value Analysis in the Furniture Industry (ID/298).
6. Manual on Jigs for Furniture Industry (ID/265).
7. Manual on Upholstery Technology (ID/275).
8. Manual on the Production of Rattan Furniture (ID/299).
9. Production Management in Furniture and Joinery Plants (ID/300)
10. Manual on Documentation and Information Systems for Furniture and Joinery Plants in Developing Countries (ID/315)

Technical Criteria for the Selection of Woodworking Machinery (ID/247) contains the following relevant chapters:

- I) Wood Characteristics Influencing the Selection of Equipment and Machining Operations (ID/WG.277/1 Rev.1)
- III) General Criteria for the Selection of Machines (ID/WG.277/3)
- IV) Methodology for the Purchase of Woodworking Machines (ID/WG.256/26)
- XVI) Industrial Production of Doors, Windows and Frames, (ID/WG.277 Rev. 1)
- XVII) Production of Chairs and other Wood Components (ID/WG.277/2 Rev. 1)
- XVIII) Technology and Machinery for the Production of Casegood Furniture (ID/WG.277/3 Rev.1)
- XIX) Selection of Equipment for Parquetry Production (ID/WG.277/15).

12. Proceedings of a workshop on the design and production of rattan and bamboo furniture (FAO/UNIDO/UNDP, RAS/86/048, Field report No.1).

B. Guides To Sources Of Information

1. Information Sources on the Furniture and Joinery Industry (UNIDO/LIB/SER.D/4 Rev. 1 + Corr. 1)
2. Information Sources on Industry Quality Control (UNIDO/LIB/SER. D/6)
3. Information Sources on the Paint and Varnish Industry (UNIDO/LIB/SER.D/18 - ID/150)
4. Information Sources on Woodworking Machinery (UNIDO/LIB/SER.D/31 - ID/214)
5. Information Sources on the Utilization of Agricultural Residues for the Production of Panels, Pulp and Paper (UNIDO/LIB/SER,D/35 - ID/234)

C. Documents Prepared For Workshops and Expert Group Meetings

1. Quality Control in the Furniture Industry (ID/WG.209/24)
2. Quality Control Procedures and Equipment for the Secondary Woodworking Industries (ID/WG.151/30).
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