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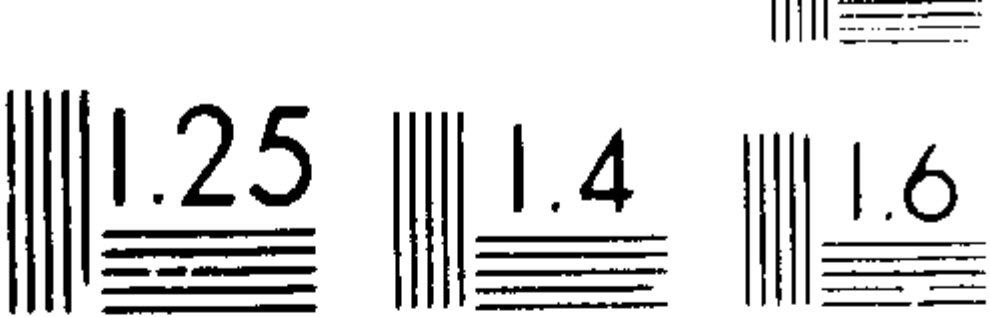
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org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FORESTRY AND FOREST PRODUCTS DEVELOPMENT, PHASE II

DP/INS/78/054

INDONESIA

Technical report: Secondary wood-based industries report*

Prepared for the Government of Indonesia by the
United Nations Industrial Development Organization,
in association with
the Food and Agriculture Organization of the United Nations
acting as executing agency for the United Nations Development Programme

Based on the work of Desmond P. Cody,
expert in secondary wood processing

United Nations Industrial Development Organization
Vienna

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ABSTRACT

This report contains a brief description of the secondary wood based industries of Indonesia together with an assessment of their potential. It also sets out the criteria by which they should be developed in the future.

Problem areas and shortcomings are identified which, unless they are dealt with as a matter of urgency,will continue to inhibit the rational and ordered growth and development of the industry in relation to both domestic and export markets. These refer, in particular, to marketing and production management expertise, appropriate raw material availability, production technology, manufacturing facilities, productivity, standards specification and quality control.

Reference is also made to the need for formal industrial training and research and development.

The recommendations arrived at in respect of the foregoing are incorporated in the text and are also summarized in the chapter dealing with conclusions and recommendations.

Some additional comments are made in respect of the Indonesian Wood Handicrafts Industry (see annex XIII).

INTRODUCTION

The secondary wood based or wood processing industry in Indonesia is characterised by a very large number of small workshops producing mainly hand-made products (between 80 and 90 percent) and medium-sized units or factories. Some of the latter are integrated with sawmilling and plywood production, but the vast majority are single units.

They are engaged in the manufacture of the following wood or wood-based products:

- Furniture (solid wood, panel, rattan);
- Joinery (doors, windows, staircases);
- Builders Woodwork (mouldings, parquet and strip flooring, wall panelling);
- Wood-framed housing;
- Boxes and pallets;
- Domestic woodware;
- Handicrafts (especially wood carving);
- Tool, brush and broom handles;
- Sewing machine and T.V. cabinets;
- Machined components and elements (doors and drawer fronts for cabinets);
- Rattan pole processing.

To date, there is no official data available on the number and location of production units, levels of employment or output, although it is evident that in all these respects the industry has quite a substantial base.

The industry is widely dispersed throughout the country, but by far the greatest concentration is in the Java region and particularly Jakarta, where most of the larger firms and those currently concerned with exports are located.

Ownership of the vast majority of enterprises is by Indonesians who adopt any of the common types of business organizations namely, single proprietorships, which are mostly family owned and managed; partnerships and limited companies. Where ownership is shared with non-nationals, the majority holding (at least 51 percent) must be in the name of the Indonesian national. It is usually on the basis of an arrangement which permits the transfer of design, product specification and technology, with the emphasis on exporting. Where such arrangements exist, these in most cases have been with Dutch, Japanese and Singaporean partners. It is evident that single proprietorships as a percentage of the total of registered, and un-registered businesses is very high,possibly at the expense of limited companies. This is in marked contrast to that in most other countries where the trend is towards a steady reduction in the total number of firms and a steady growth in the average size of the remaining firms.

The explanation for this lies in the fact that most firms operate on a job-order, custom-built basis with the furniture and other wood products being largely, if not altogether, hand-crafted. Machines, where they do exist, are used mainly as an extension of hand-production and not as a primary means of producing machine-made products. Thus the industry as a whole may be regarded as largely a hand-operated craft-based one with relatively little mechanization. Even where machines are used more extensively they tend to be old-fashioned, to have low capacities and are often difficult to maintain.

There are many organizations representing the various manufacturing sectors of primary and secondary wood based industries. In the case of the latter, the most appropriate is the Indonesian Woodwork Manufacturers Association with its headquarters in Jakarta. It is a relatively new association, but with 90 accredited members and others about to join can be said to fairly represent the interests of this sector. It is now accepted by various government agencies as the official negotiating body for the secondary wood industries.

The National Agency for Export Development (NAFED) is part of the Ministry of Trade and is responsible for promoting Indonesian export product groups and to diversify Indonesian export markets. Its main functions are marketing and market research, product development, trade promotion, advisory functions and training.

Annex I, Table I gives data on the export performance of rattan and secondary wood based industry.

The project Forestry and Forest Products Development Indonesia Phase II was approved by the United Nations Development Programme (UNDP) in January 1979, and the Directorate General of Forestry of the Government of Indonesia was designated as government co-operating agency with the Food and Agriculture Organization of the United Nations (FAO) as executing agency for primary wood based industries and the United Nations Industrial Development Organization (UNIDO) for secondary wood based industries.

The mission of the expert was from 27 July to 11 November 1981, and during that period he carried out an assessment of the industry with the objective of obtaining detailed information on its current level of development and potential for growth in respect of domestic and export markets. The expert's job description is given in Annex II.

Accordingly he visited about forty enterprises, some of which were integrated woodworking plants incorporating sawmilling, plywood production and general woodworking. Most, however, were single type woodworking plants and were located in the Jakarta area and throughout the regions of Indonesia. He also visited goverrment organisations and in particular worked closely with the Indonesian Woodwork Manufacturers Association.

The subdirectorate of Forest Product Processing, Directorate of Forest Production was assigned to be the counterpart to the expert and one of its Senior Forestry Engineers, Mr. Harnohadi, arranged

all visits to organizations and enterprises and accompanied the expert.

The factories and government organizations that co-operated with the expert in his field of work or participated in the project are listed in Annex III.

FINDINGS

A. General observations

The secondary wood processing industry in Indonesia, despite its long history, abundance of natural raw materials and current levels of employment, is still in structure a largely backyard or cottage type industry. It is highly labour intensive and shares little of the technology and design developments which characterise it in most other parts of the world. Even in enterprises employing numbers in excess of one hundred, with few exceptions, the level of mechanized production is little above that of an extension of the use of traditional handtools. Furthermore, the industry seems largely unaware of, or remains unmoved by technical trends and developments which have taken place elsewhere. Consequently, the items produced, or certainly a high proportion of them, are hand-made, custom built, and therefore rely heavily on individual levels of skill and judgement for their execution. These skills vary widely in terms of quality and experience almost from one enterprise to another to the extent that it is almost impossible to identify common standards of visual appeal, quality, function and performance in the end products.

The problem is further exacerbated by the absence in most firms visited of a product policy or any degree or rationalization or specialization. Thus it was not unusual to find a range of products which had little in common, such as sewing machine cabinets and framed and panelled doors, being manufactured under the same roof. Other enterprises attempt to produce goods for which they have neither the depth of skills nor the appropriate manufacturing facilities so that the end result is both disappointing and generally very expensive.

A very high percentage of the furniture made, for example, derives from classic designs of the past and traditional styles which, among other things, are noted for their proportion, elegant lines and delicate decorative features such as wood carving, mother-

of-pearl and shell inlay, and over-all attention to detail. They are therefore difficult to reproduce successfully and require an intimate knowledge of the working characteristics of the wood allied to skills which are highly developed and artistic. Of the many pieces of such furniture examined by the expert only relatively few could be rated highly enough to warrant acceptance in world markets. Most are crudely executed, lack proportion in detail, are poorly finished and clearly demonstrate that their producers have little knowledge or experience of either the design or detail of such period pieces and have even less appreciation of the importance of fine craftsmanship in their execution.

An outstanding exception to this, however, is the wood carving and wood sculpture handicraft industry in Bali which, because of its distinctive traditional and cultural designs motifs and artistic craftsmanship, has established a world-wide reputation which is fully justified.

Other wood products which often tend to fare somewhat better in terms of execution and finish are **joinery**, especially framed and panelled doors and builders woodwork i.e. flooring, panelling, and mouldings and this can be explained, rather significantly, by the use of woodworking machinery in their manufacture. These, too, are the products which make up the bulk of current exports and are therefore usually manufactured in accordance with the importers strict specifications regarding materials, manufacture and finish.

Factors which have contributed to the generally unsatisfactory state of the industry include its relative isolation from continued outside influences, a lack of detailed knowledge of design (especially for furniture) and technology, a low level of investment, or re-investment in the industry and, as a result poor manufacturing facilities, inadequate or no management training, no supporting services in product design, research and development difficulties in obtaining essential materials and hardly any worthwhile marketing activities.

Even in the field of basic raw materials the industry is virtually deprived, or perhaps it would be truer to say, has deprived itself of the use of particle board, and, as a consequence mechanized or even semi-mechanized production of veneered particle board panels is hardly known. When it is considered that this is now the basic raw material for all storage unit construction and that without it the Indonesian industry is obliged, or perhaps chooses, to substitute expensive, scarce and, not very stable solid wood, its difficulties may be further appreciated. Despite considerably reduced exports of sawn wood, the supply situation for local users and especially those engaged in exports is not much better. Quite serious shortcomings in quality, dimensional specifications and often availability are experienced because sawmillers are reluctant to supply home demands or at best will supply only second grade materials at inflated prices. This in turn increases manufacturing costs, reduces quality and ultimately interferes with the manufacturers ability to remain competitive.

Rattan processing is largely confined to pole and sika dressing. The material is then exported in vast quantities (see Table 1) to be made into rattan furniture in Holland, Germany, France, Italy and elsewhere. Notwithstanding abundant supplies of excellent raw rattan and a worldwide demand for rattan furniture, surprisingly few worthwhile factories exist. In neighboring Philippines for example, the island of Cebu alone will export in excess of 50 million US Dollars worth of rattan furniture in 1981. This is roughly half of the total projected value of rattan raw material to be exported by Indonesia in the same period. Yet the level of technology required for successful rattan furniture production is low, its relative labour intensivity is ideally suited to the Indonesian economy, and the required investment in buildings, machinery and equipment quite modest for what could be an adequate return in addition to being a valuable export earner.

Very few firms in the industry appear to be financially strong; there is a chronic shortage of working capital for development and expansion. This situation appears to have two main

causes: the ease of entry to the industry, which encourages employees and others with little capital to set up on their own and the intensive competition in the industry (itself partly caused by this ease of entry) which reduce profits below a level that would provide funds for re-investment.

The stage is now being reached where the industry, especially in the wood sector, is experiencing local market saturation and must therefore look to markets outside Indonesia. The development of any worthwhile export trade is, however, dependent on an awareness of what specific markets require, coupled with an ability to supply them competitively and in accordance with acceptable standards of design and quality. This should begin with a realistic assessment of every sector of the industry's administrative, marketing and production strategy so that on the one hand, the best possible use is made of all existing resources, and on the other, the industry gears itself properly for the difficult task which lies ahead.

A major difficulty facing the expert throughout the entire mission, which was never really overcome, was the lack of detailed information available concerning the structure of the industry i.e. the number, size and location of various enterprises and their level of employment and output. Officially published information deals only with a selected number of factories and their consumption of raw wood and proved of little value in attempting to build an industry profile. This is a serious ommission and while it remains it will gravely inhibit progress and development on a national scale. The expert therefore urges those government agencies particularly the appropriate Directorates of the Ministries of Agriculture, Industry and Trade, as well as the Bureau of Statistics to immediately collaborate in getting such a comprehensive national survey under way and to publish its findings without undue dealy.

B. Product Design

Design is the process of planning the development of each new product to its ultimate shape and usefulness.

Good design is the skillful achievement of relating a product's usefulness (through a series of economic, material and production techniques) to its visual beauty.

Since furniture plays an essential role in people's lives - creating their immediate environment, comfort and well-being - it is important that it should be well designed. Social, educational and economic conditions are rapidly changing in all parts of the world and awareness of the value of "good design" has become apparent to an ever-increasing number of consumers both domestic and industrial life.

The demand for well-designed furniture will increase and it is therefore both logical and desirable that the Indonesian furniture industry, with its inherent qualities of skill and an abundance of raw materials, should make a sustained effort to satisfy this demand now and in the future.

The question of design therefore is so fundamental to the furniture industry that it would be difficult to exagerate its importance. Yet, with a handful of exceptions, the industry as a whole lacks any understanding of the place and function of design in relation to its products. Design, where it is given any attention, is thought of exclusively in visual terms as something to be added to or subtracted from the final appearance of the product in order to distinguish it. Even in the case of traditional furniture design a product sector of the industry with which a large proportion of Indonesian manufacturers is preoccupied, it is clear that the reproduction of these old forms is without any understanding of the original work.

If, therefore, well designed furniture is to be made here in quantity, the manufacturers must first know what good design is, and there must be a critical and appreciative public.

At present the industry is immune to competition both in price - this is ensured by the tariff - and design. After many years of very high protection of the domestic market, the bulk of consumers are quite unfamiliar with well designed furniture. Not only have most of them never seen it, but in this country purchases of furniture are made so infrequently by the average household that there is no opportunity to acquire a background of expertise and appreciation in these matters. The public is therefore largely uncritical of current designs.

It is necessary to define what is meant by design in relation to furniture. Design must take account of the production facilities of the firm, the skills of its workforce, an understanding of the nature and characteristics of the materials used, the form and colour of the article, its tactile beauty, its fitness for the purpose, its decoration and its acceptability to the consuming public. It is no exageration to say that only the last two appear to have ever received more than passing attention in the industry. It is worth studying these characteristics in turn.

The results of ignoring the firm's production facilities and the skills of its workers are obvious. Pre-occupation with imitation of a competitor's product has forced a number of manufacturers into producing types of furniture for which neither their premises, their machinery, nor their workers are suited. Inevitably, they have made inferior imitations of an already imitated product with further degradation of quality as the result. Moreover, persistence in this process has created needless production difficulties for the firms themselves - in matters such as quality control, materials wastage, rate of output, finishing, upholstery and, frequently, even storage.

Throughout the industry there is a widespread lack of understanding of the nature and characteristics of the material used.

If we examine furntiure of the past which was made from solid timbers by the designer/craftsman himself, we find that he was necessarily made aware, by the endless differences and variations between each piece, of the nature of the material and the different problems of form, manufacture and design which it posed. This is equally true from present-day production, as design essentially rests on knowledge of materials and the ways in which they are used as the basis of furniture production. These have been largely neglected in Indonesia.

As far as fitness for purpose is concerned, the bulk of the industry's products cannot be rated very highly. This is hardly surprising since neither individually nor collectively have the firms in the industry ever undertaken any research or inquiry to discover exactly what consumer's needs are in furniture.

What is the cause of this situation? A principal reason is one which has already been discussed: conditions of competition in the industry are such that much of the enterprise and ingenuity of the industry has been concentrated on how to survive rather than exploring new possibilities. There are other causes. Chief among them is the industry's virtual isolation from, and lack of knowledge of, developments and, indeed, competition from the industry abroad. Thrown back solely on its own historic design resources there have thrown up both the good, but mostly the bad versions of the originals which clearly demonstrate the long-ingrained habits of plagiarism and the adoption of solutions to a set of problems quite different from their own. Plagiarism in furniture degrades the original because there is very little confidence in the joinery and Indonesian plagiarism lacks all the advantages of the originals.

While making due allowance for the special difficulties of what is largely a workshop industry, the expert cannot refrain from saying that most of the industry's present troubles can be

laid at its own doorstep. There is no doubt that the present situation stems fundamentally from the general lack of suitably trained management in the industry. Most of the industry's management lack the aesthetic training, management techniques and technical knowledge needed if the industry is ever to succeed in effectively penetrating export markets. Hardly anybody in management has been recruited for his managerial capacity or as a management trainee, nor is it the practice of firms to recruit any talent from outside the immediate family circle of the owners. The results of this are exacerbated by the excessive secrecy common in the industry: only a handful of management has ever set foot inside a competitor's factory, while relatively few have ever visited a factory outside the country.

It is necessary to say that the primary responsibility for improving the situation rests with the industry itself. It is not sufficient to say that the industry is simply producing what the public wants. What the public sees is what the industry produces and when its choice lies between, in the main, indifferent products, then their decision cannot be regarded as meaningful. An industry that enjoys a captive market, free of all foreign competition, has a public duty to offer the best product it can, and there is no reason why the legitimate fostering of Indonesian industry should necessarily mean inflicting badly designed and poorly made products on the consuming public.

The expert strongly recommends that a Development or Adaptation Council be set up by the industry in collaboration with appropriate state agencies and that one of its first preoccupations should be to devise ways and means of raising the general standard of design in the industry. The only lasting solution is to bring about the development of a native school of design with its own principles firmly rooted in Indonesian traditions. This is, however, a long-term solution and, even if applied now could hardly produce positive results in less than a decade.

This makes it all the more urgent that the problem be tackled immediately and the Development Council for the industry should, in conjunction with those who are charged with responsibility for industrial design, devote early attention to this problem.

In the meantime, there exists a basis for improving the situation in the short and medium term. A top flight international design consultant should be commissioned, possibly with international co-operation and assistance, to advise the industry on the development of its product design. One of his tasks would be to encourage several Indonesian firms to co-operate with individual designers to design competing lines. The Development Council could play a useful role here both in impressing on the industry the urgency of the problem, in co-ordinating the efforts of individual firms and in giving the design consultant every support and assistance.

1. Classical design

The adviser considers that the greatest potential for export success for the Indonesian furntiure industry lies in the "classical" type of furntiure. There is an increasing world demand for objects of value which will stand the test of time. Because even well-designed, well-made modern furniture (furniture of our age) has not yet passed this test, the great majority of the buying public prefer to invest in items from the past or which reflect the past.

This is a most important aspect of demand and with an eye to marketing success in the major markets in the world, the Indonesian industry must develop in this area of design throughout the whole spectrum of furniture. This would envisage the development of the "classical look" achieved by careful and detailed research into European and early American periods. In choosing a period, consideration must be given to the wood species of Indonesia, especially those which lend themselves to fine detailing, and colour by staining.

Styles from the late 17th to mid-18th century could be adopted and appropriately adapted by clever design to produce an entirely fresh Indonesian image with a distinct "classical" feeling. Once this theme has been developed, a whole series of ranges could be based upon it providing both continuity in design and manufacture. This identifiable theme could also be adapted if necessary for both home and Middle East markets.

In the case of upholstery, the classical look is not so vital - its first priority is to be comfortable and restful. However, the theme should not be lost. One significant method of retaining it is by the **patterns/texture and colours of fabrics. These fabrics** can even be specially designed to relate to the design features and scale of the furniture.

The exception to this is "show-wood" frame upholstery where the design motifs can identify with other furniture by using similar mouldings, leg details, etc.

2. Modern design

In general the expert does not feel that the export market for modern or contemporary furniture would be as easy for the industry to penetrate as that for classical furniture. This is because of long-established competition especially from Scandinavia, as well as a flourishing domestic manufacturing scene in developed countries generally.

Annex IV provides some additional design recommendations.

C. Manufacturing facilities

1. Buildings

Although any general purpose factory would be suitable for the manufacture of furniture and other wood products, the bulky

nature of the product itself and its susceptibility to damage in handling require that factory premises should be relatively spacious, free from obstructions and have flat floors. Since the output of any Indonesian factory could scarcely justify the installation of lifts or hoists, single-storey buildings are highly desirable. Because the quality of the finish often greatly affects the saleability of the product, separate enclosed finsihing areas with extractor fans are of considerable importance. Only a small minority of factories have any of those desiderata.

Individual factories are not only small in output, but also small in size. The largest firms are in excess of 5,000 m^2, but the majority are within the range 500/3,000 m^2 unless they are simply workshops and are then considerably smaller.

A large percentage of the industry operates in old buildings not designed for the production of furniture. They include converted dwelling-houses, warehouses and dilapidated sheds. Many of those have broken floors at different levels and little or no means of intercommunication between various parts of the buildings. The premises of a number of firms appear to have been acquired without regard to their suitability for production, convenience to transport or capacity for extension. A feature which most of these premises have in common is a low rental or purchase price, and the extent of their use among manufacturers is a manifestation of the marked reluctance found in the industry to think of any investment whether in buildings, plant or machinery, otherwise than in terms of initial cost. Very few have reasonably suitable premises and even most of those could be greatly improved in standard and layout. It was the exception rather than the rule to find firms with spacious modern single-storey premises designed and laid out with some kind of production flow in mind and with comprehensive dust-extraction and thorough ventilation systems. The better buildings were almost invariably to be found in the joinery sector of the industry, but again poor layout and

generally overcrowded working conditions were evident almost everywhere.

Observations of furniture factories for both wood and rattan furniture and discussions with management have led to the conclusion that manufacturers are not sufficiently aware of the deficiencies of their present buildings and the often unnecessary handicaps they impose in terms of costs, both overt and hidden, impediments to production and unsuitability of location - to say nothing of the effect of this environment on the morale and productivity of the workers. Perhaps one of the most effective ways of creating a balanced sense of cost-consciousness and of improving standards of factory management would be to induce a proportion of the industry to transfer to modern well designed buildings that would allow management to think in proper production terms and at the same time make their task easier.

Very few firms appear to have access to the capital needed to construct new buildings, but many could afford the rent of a modern factory if they organized their production to take advantage of the economies thus offered. Even if some element of state or international assistance were necessary to bring about a transfer to modern buildings, it could be far more beneficial than attempting to modernize many of their existing buildings.

The siting of machines, **wherever** they exist appears to be decided by the order of purchase rather than by production demands: in very few factories was there apparent any systematic organization of the processes in logical order or the setting up of what might be regarded as a production line. Work Study was not practiced by any firm visited. It is quite common to find material in course of production being brought up or down or across the factory for succeeding processes without any regard for the logical and efficient use of the space available. The result is often a prodigal waste of space in factories where space is at a premium. In most factories more than half the floor area was taken up with shavings, sawdust and waste-wood - many of them discarded rejects - while the management complained of lack of room for expansion.

Annex V provides further details on factory planning and the organization of production.

2. Materials handling

A notable feature of all the factories visited was the almost total absence of devices to aid materials handling. It does not seem to be generally appreciated in the industry that the physical handling of materials adds nothing to their value but adds considerably to their cost. Men paid at skilled wage rates spend much of their time simply lifting, stooping or carrying pieces of wood about while their machines remain idle. Even firms which employ unskilled labour to move materials about the factory rarely supply them with labour-saving devices such as castorized pallets or small hand-lift pallet trucks.

3. Working conditions

A feature of practically all the firms visited was that working conditions in the factory left much to be desired. In only a few plants was there a comprehensive dust-extraction plant with extensions to every machine. Some had partial dust extraction. The simple expedient of painting white lines on the floor to indicate passageways to be left clear for the transport of material was seen in only three factories. Very few had paid worthwhile attention to the need for thorough ventilation or the provision of cooling fans so that workers could carry out their tasks in some degree of comfort. Lighting in most factories was very poor despite the fact that Indonesia in day-time enjoys a very high level of natural daylight which is there for the taking. From the general lack of attention paid to those factors, it seems evident that management do not appreciate that they can considerably affect not only the comfort of the workers but also output and profits. The conditions described in the production areas in the factories are in sharp contrast to those prevailing in adjoining offices where almost invariably the atmosphere was cool, restful and conducive to work. Since visits have on the whole been

to the more **progressive** and better-run factories, it is hard to resist the conclusion that factory standards over the industry as a whole are no better and would likely be worse than those visited.

4. Safety

Other equally important factors which in the view of the expert receive little or no attention are safety and fire hazard. Many high speed woodworking machines are not provided with protective guards which would ensure their safe usage. Many materials used by the industry, especially lacquers and upholstery cushioning, are highly flammable, and the danger and obstruction to physical movement caused by the accumulation of **sawdust** shavings, and timber on factory floors need careful and continued attention.

Much of the industry's indifferent performance can be traced to cut-throat competition from small units operating all over the country. There is no doubt that the removal of this kind of competition would immeasurably benefit the **industry** as a whole, but the expert has considerable difficulty in framing a recommendation aimed at achieving this object. To provide statutorily for higher standards of factory and workshop buildings would certainly solve the problem but apart from possibly causing undue hardship, it might be inappropriate to the conditions of other industries not familiar to the expert. He recommends that the appropriate authorities, including the financial institutions, give early consideration to this problem and to its general implications. It cannot be stressed too much - and this is a theme to which the expert returns throughout this report - that if the industry is to grow and prosper, particularly in relation to exports, attention and encouragement will have to be focused on the more progressive firms at the expense, if necessary of the backward unit. This would also enable the better firms to concentrate on the high quality product of which they are capable and which is essential if they are to break into

export markets, without having constantly to look over their shoulders to meet competition on their home market conducted exclusively in terms of price.

5. Plant and equipment

Most factories and workshops in both the rattan and solid wood sectors of the industry are poorly equipped for mechanized production processing, and the equipment is generally in keeping with the dilapidated appearance and conditions of the factories in which it is housed. Much of it is very old and is past its usefulness and many of the factories have built their own equipment, but not very successfully. Thus the industry is excessively labour-intensive possibly because of lack of capital and undoubtedly because manual labour is relatively cheap, and as a result, there has grown up the almost invariable practice of producing, especially furniture on a custom-built basis only. Its successful production is therefore dependent almost solely on the workers' skills in the handling and processing of the raw materials. However, it must be realised that cheap labour, no matter how skilled, is no substitute for the mechanised-craft context which characterises the industry the world over today and reference need only be made to such countries as the United States, Italy, France, the United Kingdom and, much closer to home, Japan, the Taiwan province of China and Singapore where such an approach has achieved a highly successful outcome and should be the headline for the successful development of the Indonesian industry.

If the industry's equipment needs are related to its current and potential markets, not excluding the production of custom-built furniture and joinery it will be seen that selection should be on the basis of a very large range of models and timber species, limited volume production, manufacture exclusively by order, with competition based on quality of products and service. This means that the major role is still played by fairly straight-forward machinery where the human element is of great importance and which

can be easily adapted for the number of different operations required.

Annex VI gives an outline of plant equipment required for (a) a solid wood processing factory; (b) a rattan furniture factory: (c) a panel **furniture** factory and; (d) a multi-purpose joinery factory employing in each case approximately 100 persons. The machines chosen are particularly suitable for a very diversified production, and are simple to operate. The investment for technical assets could be around US$ 300,000 and therefore the investment per employee is approximately US$ 3,000.

Annex VII provides general criteria for the supply of wood-working machines.

6. Timber drying

Many previous reports concerned with the development of the industry have rightly emphasized the importance of the proper drying of timber. This is a field in which co-operation by the industry would pay immense dividends. Kilns are expensive items of equipment, **require** considerable skill to operate and do not readily fit in to the day-to-day management of **furniture** factories in Indonesia. A central drying station run in co-operation by the trade could reach the maximum economies of continuous operation, guarantee a steady supply of properly-dried timber and relieve the producers of the physical and financial burden of carrying large stocks of timber for "natural" air drying.

The expert would like to caution against an over-**dependence** on the emergence of a so-called low cost drying kiln at some future stage. There is little likelihood that those being currently developed will prove to be an adequate substitute for the established proprietary types and since suitably dried timber, especially for solid wood production of furniture for export is essential, anything less than an efficient drying system should not be considered. Any solution to this problem

still requires considerable initial capital investment, and the industry would do well to consider all the alternatives. One which should receive serious consideration is drying through de-humidification or refrigeration. This is the least expensive of all drying systems to buy and install. It can be installed in an existing storage room since it is totally self-contained and, in general, its efficiency compares favourably with a conventional kiln.

Annex VIII gives some information on drying methods and equipment.

D. Raw materials

In the woodworking industry, raw materials can account for as much as 50 to 60 percent of the total cost of production, and are therefore of paramount importance in both design and production considerations. Time did not permit an examination of all the materials used by the industry and attention is focused on those which cause the industry most concern, namely solid wood, sheet material, rattan, fittings and accessories, adhesives and lacquers.

1. Solid wood

Despite large forest reserves and a complete ban by the Indonesian Government on the export of logs, supplies of suitable timber, such as teak, meranti and ramin, for secondary wood processing are both erratic and expensive. This is because sawmillers are reluctant to supply local users with prime material preferring to sell it to export markets. In addition they do not wish to supply cut sizes in accordance with domestic users' specifications so that often there is considerable waste and high costs. Many manfuacturers also complained of the quality of the material claiming that invariably it was second or third grade.

This is a serious matter especially for existing or potential exporters and the expert urges the proposed Development Council 1/ in collaboration with the Directorate of Forestry to give immediate and urgent attention to the establishment and maintenance of a satisfactory supply situation.

Attention should also be given by the Forest Products Research Institute to the important matter of finding, and introducing to the trade alternative species which could be used commercially. When eventually these have been identified and tested assistance will also be required in promoting them at consumer level both at home and abroad.

2. Sheet material

This is largely confined to plywood of which **Indonesia** is now a major producer. There is one particle board plant with a capacity of approximately 20,000 sheets per month. However, at the time of the visit of the expert to the plant, roughly 12,000 sheets were being produced per month because "there was no demand". Much of the material was being used in the Company's own woodworking department for the **production of very indifferent** school furniture and the remainder was supplied to the furniture plants. According to the management, the board is a three-layer one manufactured to DIN standards and the company is constantly in touch with its Belgian colleagues, who were responsible for the design and erection of the plant, in order to maintain quality. Time did not permit a detailed examination of the board but from a purely visual inspection, it appeared to be satisfactory.

1/ This Council should, tentatively, be composed of representatives from the industry (the Indonesian **Woodworking** Manufacturers' Association) and the Ministries of Agriculture (Forestry Section) and Industry.

Up to recently, it was used almost exclusively in the production of wooden houses. On the face of it, this is surprising since the material is not particularly noted for its use for external purpose because of its propensity to absorb moisture. However, the expert did examine houses erected some five or six years ago which were made largely from the material and so far, have stood the test very well. Some deterioration was noted on the lower edges of external panels but this, as was pointed out to management, could easily be rectified by improved weathering of this area. External panels were coated with a cement based water-proof paint and the considerable over-hang of the eaves provided further protection. The company, however, intends to introduce cement-bonded boards for all external cladding in an effort to reduce the consumption of exterior type phenol and tannin formaldehyde adhesive which is very expensive in Indonesia. At the same time it wishes to promote considerably increased use of particle board for furniture, panelling and flooring.

The expert agrees with this, but cautions against so doing without ensuring that all concerned, manufacturer and end user, understand and apply the specific technology relating to particle board as a basic raw material. This is, initially, at any rate, the responsibility of the particle board producer who obviously has a vested interest in the correct use of this material. The technology is too well known to require further elaboration in this report but for those in any doubt, the expert recommends a careful reading of the many UNIDO reports and documents on the subject as well as other publications.

One major user of particle board was asked why he did not use the Indonesian product instead of importing large quantities from Australia. He replied that despite having to pay freight and import duties, it still costs less than the local product. Secondly, in his opinion, since the latter is manufactured largely from rubber-wood it remains suspect to insect and fungal attack, and therefore is of poorer quality. Whatever the accuracy of

of those observations, it is clear that the particle board manufacturer must respond by demonstrating, as has been the case wherever the material is used elsewhere, that it is an excellent material in its own right and one which if used properly will enhance the industry and its end products.

The expert visited one plant producing blockboard. This is manufactured in accordance with the appropriate British standard and the entire output is exported to the United Kingdom.

Neither hardboard nor medium density fibreboard is produced although, both are under active consideration by the industry at present. The relatively low price especially of hardboard and its particular suitability in the domestic market would indicate that demand would fully justify the investment.

3. Rattan

Availability and quality of Indonesian rattan intended for the reproduction of furniture throughout the world is very satisfactory. This sector of the industry accounts for a very high proportion of total exports of secondary wood based products (see Annex I) and demand will undoubtedly increase as the material becomes scarcer in other parts of South East Asia.

Producers are, however, experiencing problems in respect of fungus attack and subsequent discolouration which if not dealt with could have serious consequences for this most promising sector. Accordingly, the expert has included in Annex IX suggestions for controlling this problem.

4. Adhesives and lacquers

Manufacturers in general expressed satisfaction with the quality of both materials but claimed that prices were excessive.

They quoted prices (including tax) for comparative imported products which were competitive with the home produced versions, the only problem being the insistence of the manufacturer on minimum order levels which, in many cases, were beyond the resources of the user.

The finishing of furniture and other products requiring surface coating is of vital importance as a point of sale especially for exports. Of the many items examined by the expert only a small proportion could be regarded as having reached this standard. He is aware that finishing technology also needs to be upgraded but not all the fault lies with the operators even though, for example, sanding is a critical pre-requisite for any successful finishing system. The material itself must therefore remain open to question. Since international standards for wood finishings exist, he recommends that the lacquer manufacturers in collaboration with the Institute of Technology in Bandung subject their materials to the appropriate tests in relation to their use for wood finishing.

This will not only set the minds of the manufacturers at rest but will also prove to be a useful promotional aid in respect of the prospective customer.

5. Fittings and accessories

By this is meant handles, hinges, locks, movements, shelf-supports etc. made from metal or plastic. Some of the more traditional fittings, especially handles, hinges and locks, are manufactured locally, but in the main they must be imported. These materials form the basis for most sophisticated industries and traditionally have become associated with such countries as the Federal Republic of Germany, Italy and Scandinavia. Even the woodworking industry in the United States imports a large proportion of its fitting needs from these sources recognizing that this particular technology is highly specialized and would be difficult to emulate.

In the circumstances, therefore, it would be unreasonable to expect Indonesia, with its low manufacturing base, to seriously contemplate home production of such materials. Yet, they are as essential as any of the industry's other materials and without them the end product would not be complete. **Meanwhile,** the importation imposes enormous and sometimes insuperable problems for both importer and user alike. There are duties and tariffs to be paid adding considerably to the already over-strained working capital situation.

If the industry is to grow and prosper both on home and export markets, and this is, without doubt, the avowed purpose of the Government, then it must **remove** all such anomalies and artificial **obstacles** standing in the way of progress. It should begin by immediately **liberalizing the importation of these** materials and in so doing would make a more practical contribution to the industry's development than all its other endeavours, not excluding the activities of state agencies who are attempting to provide assistance in such areas as finance, design, marketing, research and development, and exports.

The expert recommends that this matter should be among those to be given prior consideration by the proposed Furniture and Wood Industry Development Council.

E. Production

1. Output

The output of the wood furniture sector of the industry may be divided into seven classes, cabinets, tables, dining-room chairs, upholstered goods, occasional furniture, bedding and metal **furniture.** Rattan production is almost entirely devoted to dining-room chairs, easy chairs (some with loose cushions), tables and occasional **furniture** such as shelving,

screens, bedheads, etc. Some wood manufacturers use rattan for decorative purposes.

All this may suggest that specialization is a feature of the industry. This is true in only a very limited sense. Within each class of goods there is an extremely wide range of articles and most firms produce an almost endless variety of models. The vast majority of firms do not specialize to any particular extent: most of them are prepared to undertake the manufacture of any piece of furniture within their competence or request.

A very few firms have been notably successful in reducing the number and variety of articles produced. Two firms, specializing in panel door production, and a few furniture firms, have highly rationalized product ranges with a large proportion of common parts and it is significant that they are among the few who have succeeded in effectively penetrating export markets. This, however, is quite exceptional. The majority of firms in the wood sector are not in a position to emulate them. There may be a number of subsidiary reasons for this - lack of financial resources, anxiety to make maximum possible use of idle capacity, versatility of workers and machinery - but the principle causes are lack of a distinctive product and the dominating influence of the practice of custom-building furniture. These interact on each other, for firms without a distinctive product are susceptible to demands to produce a competitor's product more cheaply while the knowledge that its features would be pirated, possibly in inferior materials, discourages a firm from producing a distinctive product. The result has been largely a case of the bad driving out the good, exacerbated by the almost total insulation of the home market from outside influence. Even the rattan sector of the industry, despite its apparent success in export markets, seems to have benefited little from this experience especially if judged by the low level of technology and antiquated methods of production still practiced by the manufacturers. The expert shall return to this theme in the chapter on marketing.

Meanwhile he has no hesitation in stating that the poverty of design, itself due to a combination of factors, has been in large measure the cause of the **industry's** production problems.

2. Fluctuations in production

Flow production is unknown in the furniture industry. Even batch production is the exception rather than the rule even in the largest factories. Where it does exist the batch sizes quoted range from 6 to 500 but a more representative range of sizes commonly used in the industry would be from 12 to 50 units. This is little removed from the four or five man workshop. The largest factories will also fulfil special orders.

The size of orders varies considerably, but large orders are virtually confined to contract jobs for hotels, institutions or government agencies. Since there are very few retailers, their orders are rarely large and manufacturers are regularly called upon to supply single articles or single sets or suites of articles. The result is that manufacturers, if they do produce for stock, are forced to carry the finished goods; whole-saling in furniture is virtually unknown in Indonesia. Practically no manufacturer whether wood or rattan, considers he is in a position to insist on minimum order sizes. The necessity for manufacturers to stock the finished goods, together with their chronic shortage of working capital alluded to earlier, puts them under constant pressure to keep manufacturing batch sizes down to the minimum consistent with quick turnover. The smaller batch sizes in turn push up costs.

3. Costs

It is difficult enough to get **reliable** costing of production in any industry, especially for the purposes of inter-firm or international comparison. It is doubly so in the woodworking industry, where any form of costing other than the crudest job costing is the exception rather than the rule. The costing systems that exist in many firms were devised by the owners and can hardly be said to have any scientific basis.

A "straw poll" conducted by the expert during the course of his investigation of the industry indicated that productivity i.e. output value per worker per year, ranged from alow of 5,000 to a high of 9,000 US Dollars. This is low by any standards and contains a strong suggestion that labour costs per unit of production are high despite the fact that wage rates are approximately ten times or more for the same category of worker in, say, Europe.

He considers it important to make this point for many Indonesian manufacturers regard **labour** productivity as merely a matter of the workers producing more, without realizing that good factory buildings, efficient plant layout and informed management are necessary to make it possible.

4. Production technology .

Production of wood products derives from a set sequence of operations which is invariably followed from factory to factory, and **alters** only in detail in accordance with specific design considerations. The technology is well-known and highly developed **and relates specifically to the nature and quality of the materials** used, the methods of construction, finishing (i.e. polishing) and where appropriate, upholstering.

5. Solid wood processing

In the case of wood products production, the equipment to be used as a means of achieving this technology, although constantly being refined and its capacity increased, has altered hardly at all over the years. As has been emphasized already, much of it is no more than a mechancial extension of otherwise manual processes, but it provides the opportunity, at a relatively low cost, of achieving a desired level of accuracy as well as productivity. Thus it may be regarded as an essential ingredient of production even in the most primitive of workshops and naturally

be of a more sophisticated and productive nature in a factory situation. To this must be added the manipulative and machining skills of the operatives, neither of which can be achieved without training and knowledge.

These are minimum requirements and it was clear to the expert that in many of the workshops and factories he visited their absence was reflected in the poor design and poor quality of the end products. Many factory owners aspire to export their products but they must realize that without radical change in their whole approach to manufacturing and without a drametic improvement in standards of construction and finish such hopes must remain stillborn.

6. Rattan processing

While the sequence of operations for rattan production is roughly similar to that for wood production, there are, nevertheless, important technological differences between the two. For example, the raw material when it arrives in the factory is, apart from minor surface treatment, ready made (i.e. shaped in section for production). It then requires to be straightened, dimensioned, sanded steam bent, sub-assembled sanded again, finally assembled, bound at the joints and, as is the practice in present circumstances, rescraped, re-sanded and finally polished.

These techniques have evolved particularly over the past ten years almost exclusively on the basis of purely manual operations. Recently some factories have installed mechanical scrapers, contour belt sanders, simple boring devices, pneumatic staplers and paint sprayers but essentially the industry remains highly labour intensive. It was not surprising therefore to find the rattan factories heavily manned, indeed, in the opinion of the

expert, over manned. One factory visited employs over 200 workers and it appears that the rattan producers' answer to the need for increased output is simply to employ more people. To this may be added a wide variety of models to be produced, few of which were designed with production considerations in mind.

The picture then emerges of an industry which is little more than a collection of cottage-type activities gathered for convenience under one roof. A brief check on productivity revealed that there was little change in the level of output from one factory to the other and that it averaged roughly half a unit per person per day, which by any standards is decidedly low.

The reasons for this are no different from those which are inhibiting the development of the wood sector, namely poor technical management, lack of capital for investment, inappropriate machinery and equipment, almost no marketing activities by the industry and, as a result, no worthwhile design information. In fairness it should be added that despite these shortcomings some individual manufacturers produce a product with good potential, but this is reflected in neither good technical facilities nor a reasonable level of productivity.

7. Particle board processing

Particle board as a raw material in the Indonesian Woodworking Industry is hardly known despite the fact that throughout the world it is accepted as a welcome alternative to traditional materials, being easy to work, is favourably priced, makes possible labour and materials savings as well as good construction methods.

Taking cabinet **furniture** and kitchen cupboard industries as examples design and construction must be the first considerations.

Using particle board, the principles of flat panel construction may be fully exploited. In this concept:

a) All horizontal members, that is top bottom and shelves, are cut to a common length

b) All horizontal members, including the top, fit between the vertical members.

c) The ends are edge veneered to match the facing material and finishes flush or allowed to stand proud of the top.

d) Doors and drawer fronts fit over the face of the cupboard. This avoids time consuming and costly fitting to achieve fine clearance margins.

e) Doors and drawer fronts are edge veneered, low shelves and bottoms are veneered on the leading edge.

f) Vertical and horizontal members are dowelled together or dowelled in conjunction with knock-down (KD) fittings. The dowel joint is simple, gives positive location and is most effective.

g) A well secured back gives additional strength and stability to the assembled units.

Using this technique, panels may be finished prior to assembly or processed from pre-finished particle board.

Other uses for particle board which illustrate the versatility of this material include moulded components, sheet flooring, exterior cladding, building fitments, demountable partitions and concrete formwork.

8. Production reorganization

The expert therefore recommends a radical overhaul of the industry's current technological base with a view to **modernizing** and adapting it for up-to-date production. The deceptive simplicity of the various processes should provide a challenge for the work study **engineer** which, when overcome will undoubtedly pay handsome dividends for the industry. This should begin with an assessment of the product itself, its overall design, its raw

material input, the methods of processing each component, the means used for joining those components, their individual and collective rigidity procedures for sub- and final assembly and finishing systems. Other aspects which also require attention are the extent to which each product, especially seating is dimensionally accurate and performs satisfactorily.

9. Prototyping

In this connection each factory should set aside a small section for prototyping and product development where this essential activity can be carried out without interfering with normal production. It should be staffed with the most skilled workers available and no model should be manufactured in series until all production difficulties have been ironed out and all production aids have been perfected. This would also pre-suppose a high degree of standardization of parts for each range of models and, it is worth noting, that this is the function of the skilled furniture designer who as well as being the expert judge of shape, character and colour,and the fount of inspiration for new creative ideas, has also a sound knowledge of materials, economics and production techniques.

Only when this essential "homework" is satisfactorily completed can effective production be planned for. There is, of course, little standard equipment available for the rattan industries which can be bought "off the shelf". But, there is an almost infinite variety of small and medium sized and priced machines suitable for most purposes which could be adapted effectively for any of the processes mentioned above. Reference in particular is made to profile strippers and sanders, adjustable dowelborers,spindle scribers for accurate jointing, pneumatic contour handsanders and the universal use of compressed air-operated hand tools for stapling,screwing and for assembly fitting. There is a particular need to redesign assemply stations in conjunction with compressed air assembly procedures so that most the of present product-damaging methods can be eliminated.

Another chapter in this report deals with industrial training and as a result the emergence of the technician for both rattan and wood production. This level of management does not at present exist in the industry but is urgently needed if the advantages of increased efficiency and, as a consequence, improved output are to be won. At this stage, it would be difficult to quantify the latter accurately, but a conservative estimate would certainly be not less than a 100 percent increase in productivity. This is the minimum target at which all sectors of the industry should aim.

F. Management and labour

1. Management

The quality of management must be viewed against the tasks with which it is concerned in making individual enterprises productive and profitable. In ordinary circumstances efficient management requires many qualities. "The small owner manager must like change, be good at recognizing opportunities, be willing to take moderate risk and have plenty of drive. He needs a very good knowledge of business trends in the market and the relevant technology. He must be a generalist. He needs to know the key points in financing a business, planning, finance, marketing, production and personnel without having the time to be expert in any one field. He can and must react quickly and has little time for anything he perceives as irrelevant".[1/]

Times of rapid change, such as we have now, require that where these qualities are not present in the industry they must be acquired speedily. The impressions gained from interviews left occasional feelings of hope but also of disappointement that many managements fail to appreciate either the problems of the industry or the functions of management in dealing with them. For example,

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1/ Bolton Report on Small Industries, United Kingdom

firms described salesmen as sales managers, the technicians as designers, foremen as production managers and the owner/manager especially of the smaller concern, more often than not, as a combination of all three.

Almost all managers are too heavily production oriented. Too often there is a pre-occupation with the present and very few had any philosophy for the long-term. There is no doubt that such attitudes were born and fostered through the continued isolation and protection of a small home market. It manifests itself in a lack of management skills, particularly of analysis and decision-making and a kind of complacency with regard to the need to make improvements in performance. Part of the reason for this problem is the lack of formal training in woodworking production on the part of many managers in the industry at present. Unless this matter is tackled urgently, the expert sees little worthwhile future for the industry, especially in relation to exports.

Accordingly, he strongly recommends, as an immediate follow-up to the current project or as part of it, that in conjunction with international co-operation a special course of two months' duration be organized in production technology and woodworking industry management. This should be attended only by owners, managers, and other supervisory levels of management in each factory. The course should be run on the basis of lecture sessions and the practical application of the principles of production and administrative management in each of the participating factories.

The syllabus for this course should have appropriate emphasis placed on the following:

(a) Plant layout and design: Problems in industrial plant design as applied to furniture and joinery manufacturing; building structures; equipment location; space utilization; power utilization; light, heat ventilation and safety; materials handling; maintenance.

(b) Woodworking equipment: Study of production woodworking equipment for cutting, shaping, sanding, veneering and assembly operations; capabilities and limitations of machines, theory and practice of cutting and sanding wood, low cost mechanization, pneumatics, electrics and hydraulics.

(c) Wood processes: Processes of drying, glueing and finishing wood; reconstituting wood as hardboard and particle board.

(d) Engineering economy: Study of criteria and techniques for management decisions in relation to economy of design, selection, and operation; effects of depreciation policies and machine replacement.

(e) Furniture design and construction: Detailed drawings and bills of materials from samples and designers' sketches. In construction, emphasis should be placed upon good performance under varying atmospheric moisture conditions, adequate strength and rigidity, and low cost.

(f) Furniture and joinery manufacturing and processing: Study of production methods in the woodworking industry, including production procedures from the timber yard, through all operations, packaging and dispatch.

(g) Manufacturing controls: Development of principal procedures and documentation for control of materials, manpower and costs with special attention to production and inventory control, equipment utilization, work study, wage classification and cost reduction programmes.

(h) Quality control: Economic balance between cost of quality and value of quality. Statistical theory and analysis as applied to sampling, control charts, tolerance determination, acceptance procedures and control of production.

(i) Upholstery production:

(1) Upholstery equipment and technology: Equipment for fabric inspection, laying up, marking and cutting, sewing, buttoning and quilting, foam cutting, jointing and profiling, cushion filling and closing, springing up, assembling, packaging; capabilities and limitations of machines; theory and practice of cutting and sewing; low-cost mechanization, pneumatics, electrics and hydraulics;

(2) Upholstery processes: Processes for cutting fabrics, matching, sewing, springing, finishing, reconstituting foam and other filling materials;

(3) Raw materials technology: Basic raw materials, including textiles, natural and imitation leathers and polyvinyl chlorides; cushioning materials, including latex and polyurethane foams; resilient webbing and other seating support materials; quilting and buttoning materials; needles and threads for various sewing techniques; spring materials; stapling, nailing and fixing. Annex X gives a job breakdown checklist for management.

2. Supervision

Many references have already been made to the need for informed and sustained supervision of the work force. This is a particular requisite for good productivity and there is no substitute for it. Again it requires training in human relations, work allocation and quality control. Above all, it calls for personal qualities of

leadership which will win and sustain the loyalty and respect of the workers, and encourage them to learn and to give of their best. It should be manifest in fair-mindedness and a careful observance of individual plant regulations whether concerned with discipline, punctuality or productivity.

3. Labour

The expert has formed a good impression of the work force in the industry. Whatever it lacks in skill is more than compensated for in a friendly willingness to learn, which promises well for the future. Despite the general inexperience and lack of technical know-how, there is much evidence of latent talent which the industry would do well to foster and nourish. This can best be brought to the surface by ensuring, first of all, on the part of management, that a system of work is established to which everyone adheres, rather than at present when decisions are left to individual skills and judgement with, as has been seen, often very bad results.

While taking into account the traditions and practices which have been established over the years, the understandable absence of industrial mindedness of the people, and the prevailing climatic conditions which inhibit a good production tempo, it must still be said that many improvements can and should be made. This will best be done by the continued and consistent application of the principles of good management. Allied to this should be the adoption of a policy of upgrading staff skills through proper supervision and training.

G. Marketing

1. Present situation

Marketing as it is practiced by the furniture and wood industry in most developed countries is still relatively unknown

in the Indonesian industry. Most local manufacturers sell directly to the public on the basis of job orders. The exceptions are when they are supplying to hotels and similar institutions or, as in the case of a few enterprises, have a partnership arrangement with overseas organizations.

There is some retail-selling. The larger manufacturers have their own show-rooms and often carry other complementary lines. Some manufacturers offer a design service which could include the complete furnishing of a dwelling, office or bank etc.

There is very little exporting of solid wood furniture. In the case of rattan this is mainly through importers who take responsibility for design, promotion and distribution, the manufacturers themselves being little more than production units. In general, exporters seldom participate in international trade fairs, but rely on personal contacts or trade missions abroad.

2. Future prospects

The growth rate of the Indonesian furniture market may well quicken in the next decase due to higher incomes and improved living standards. Contributory growth factors will also probably include a higher standard of education and consequently a greater appreciation of the living environment. New promotional techniques with greater emphasis, for example, on fitted kitchens and built-in furniture generally will also help to extend the market. In this way people will be influenced to discard their old furniture and replace it by pieces bought on a more selective basis.

On the foreign markets, total export sales, especially for rattan furniture, are increasing and there is no reason to assume it will be otherwise for the foreseeable future. Even in the case of solid wood furniture, woodware and joinery the indications

of continuing demand especially for high quality, well designed goods can best be gauged by the export success of such wood products exporting countries as the United Kingdom, Italy, Scandinavia the Taiwan province of China, Singapore and the Philippines.

Indonesian manufacturers should therefore direct their efforts to meet the increased and more design-conscious local and foreign markets which will undoubtedly develop in the next decade.

3. Marketing management

The expert's comments on general management expertise in the furniture industry are contained elsewhere in this report. These suggest that professional management is largely absent from the industry as a whole and the resultant lack of qualified management is the single most important problem which can be recognized in the industry at present. Until this problem is tackled seriously and urgently, the solutions to other problems, other programmes of assistance to the industry and other measures taken to create a viable, export oriented industry cannot be fully effective.

The lack of expertise is particularly noticeable in the area of marketing management. Apart from some firms that have direct overseas connections, there are few marketing managers in the industry and little attention is given to the formulation of marketing policy. Sales managers are in fact sales representatives or agents and the background of the chief executive more often than not is in production rather than in marketing, finance or others. Nor does there seem to be any real awareness of what marketing is or of the need for marketing management in the industry.

4. What is marketing?

Marketing is the strategy of the offer: it is the industrial function that translates the potential demand of a market into

goods and services in order to satisfy and fulfil socio-economic needs and expectations.[1/]

The chain of marketing includes four stages: research, production, delivery and consumption. A marketer considers all these stages and divides them as follows:

Stage I: Basic research (statistics, research in the field, internal statistics)
Product research (technical research, development, design, styling, etc.)
Consumption research (what the consumers need, who they are and where, how they make decisions, purchases and why)
Forecasts
Stage I gives an existing model to which are added targets and activities, resulting in a "required" model.

Stage II: Production (includes purchasing of raw materials, use of power, labour, machinery, etc.)
Transportation (production is mostly done in places other than selling and consuming)
Selection (production is mostly done in different quantities and qualities rather than selling and consuming)
Stock-keeping (there is a time difference between production and selling/consuming, which must be overcome)
On this basis a price is set: based on the product itself, on time and place; also the price itself has an effect (certain items will be bought only if they are cheap or if they are expensive)

1/ Definition of the European Marketing Association.

Stage III: Sales promotion
Production presentation
Product information (advertising and other knowledge)
Selling
The aim is to get the right product at the right time to the right place in the right quantities and combinations and at the right price!

Stage IV: Purchasing
Consumption
Satisfaction
Re-purchasing
Faithfulness

A final objective of marketing is achieved when the selected consumers continue to buy those products offered so that there is a commercial gain.

It is clear from the foregoing that direct involvement by the industry in marketing its own products is essential. Indeed many of the current difficulties highlighted in this report may be traced directly to its absence. The range of products on an individual enterprise basis, in the main, lacks the integrated characteristics of good design, namely form, appearance, function, specialization and standardization. These are normally associated with output at this level. Individual manufacturers have little or no idea to whom their product is sold, why it is bought, what the consumer reaction to it is, and how it compares with competitors' products. **Importers,** whether deliberately or otherwise, leave no impression on the mind of the consumer that this product comes from Indonesia. Thus the producers and major contributors to the total marketable product are reduced to the state of anonymous production units, with a minimum return for **their** activities since they sell only to importers at what appear to be excessively low prices compared to the ultimate **retail** selling price. As a consequence, the industry remains impoverished. There is not sufficient finance generated

for re-investment;for research and development: the commissioning of good designers: or the development of new products and market outlets.

The picture is no better at local level. In effect, every customer, and there are many, has a say in what the individual manufacturers must produce, since each product is custom-built and thus we have the classic example of the "tail wagging the dog". As long as this method of operation exists, the industry has little hope of emerging from its current workshop orientation, and there is even less chance of its developing a worthwhile export base.

Basically then, each individual manufacturer must pay serious attention to the market and to the factors which determine real and profitable success in the market-place before he can effectively plan to meet future competition and ensure his own survival.

H. Major marketing recommendations: furniture

1. Aesthetic considerations

The marketing approach required for wooden household furniture exports must focus attention on qulaity and design, and thus place particular emphasis on product planning and product adaptation. It is essential to bear in mind that in the case of furniture, unlike many other durables, aesthetic considerations play a major role in buyers' motivation and that furniture is also subject to frequent changes in fashion affecting styles, design, materials, etc.

2. Types of furniture

While wooden chairs were traditionally the main type of furniture imported from developing countries into France and the Federal Republic of Germany, imports are now - like in the United

States and Japan - fairly diversified and include sizeable quantities of living and dining-room furniture, including upholstered furniture, and also furniture of rattan. Mass-produced cheap furniture, in cheap wood-based materials, is also in demand especially by the low and medium income groups: however, because of the high cost of transport, manufacturers in Indonesia would probably not be able to compete in price in these markets.

3. Furniture styles

Furniture manufacturers in Indonesia should develop their own native style or create special designs suited to the customers' requirements. Such furniture should be sent for testing in the target markets. In the absence of native furniture styles, they should attempt to gain a foothold on the target market by offering furniture reproductions in the following styles:

United States: Early American or period furniture, particularly reproductions of cabinet work and marquetry in English and French styles (Georgian, Chippendale, Regency, Louis XV and Louis XVI). Garden furniture of wood or rattan in casual styles is also popular.

Japan: Furniture in Early American and English period styles as well as functional modern furniture in Scandinavian, German or Italian styles seem to offer the best prospects.

Federal Republic of Germany: Rustic furniture in "high German" and Bavarian styles would offer good opportunities as well as comfortable modern furniture.

France: Rustic style furniture, particularly in Louis XIII style, probably has the best market potential, although modern furniture tends to gain in popularity.

4. Wood species and seasoning

The tropical wood species most in demand are: rosewood (particularly palisander), mahogany, teak, dark meranti or lauan, and bete.[1/]

Rosewood veneers should be used in manufacturing period style furniture, whereas mahogany and oak[1/] are best suited for rustic furniture. In manufacturing early American style furniture, light coloured woods such as maple[1/], birch[1/] or ramin should be used, whereas dark coloured species suit rustic style furniture best. Whenever possible, the wood used should first be sent for testing and approval to a wood research institute in the target country.

Correct seasoning of the wood to be used is of paramount importance. The moisture content should normally be in the range of 8 to 12 percent, but must always conform to the prevailing climatic conditions in the target country. This is particularly important in the case of exports to the United States.

5. Joinery requirements

The requirements of the bulk market for doors are met by hollow core flush doors for interior use. The market is dominated by large producers using mainly automated processes. Newcomers therefore to this sector would have to face stiff competition both in price and quality from established producers from Europe, the United States, the Taiwan province of China, Japan and the Republic of Korea.

The market for solid wood framed and panelled doors with and without carving is slowly expanding. So far it has been dominated by machine carved doors from Korea and the Taiwan province of China, but lately discriminating buyers are insisting

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1/ Not native to Indonesia

on the more delicately hand-carved doors. Other similar items include louvered doors, framed cabinet doors and drawer fronts, various types of flooring, turnery and mouldings. A recent trend is for such products to be supplied already sanded and lacquered.

Tropical wood species most in demand are teak, red and dark red meranti, mahogany and ramin.

Design, construction, materials should be in accordance with local standard specifications or architect's specifications if the former do not exist.

6. Distribution channels

In the early stages of an export drive distribution should be arranged through an importer dealing exclusively with a particular product sector eg. furniture, joinery, moulding,etc. Depending upon the type of furniture to be exported, for example, a general furniture importer or a specialized importer/decorator should be selected. In either case, the importer must receive a sufficient number of samples, and should have adequate showroom facilities for exhibiting the imported furniture and testing the reaction of the specialized trade. Once a product has met with reasonable success, exporters might seriously envisage appointing an exclusive importer who can ensure after-sales service and handle complaints.

Importers should be selected in the major centres of the furniture trade namely, Paris, Cologne, Tokyo, New York and, for manufacturers in Indonesia exporting to the United States, San Fransisco or Los Angeles.

Except in the case of occasional furniture,exporters must be prepared to offer substantial supplies. For the United States market, in particular, exporters are expected to ship a minimum

of 1,000 items per month.

7. Contractual arrangements

Quotations should normally be made f.o.b. for the United States and c.i.f. for Europe and Japan. They should preferably be expressed in the currency of the target market. Payment is usually by letter of credit or cash against documents. The exporter is often requested to grant terms of 30 to 60 days to allow for checking of the furniture for possible defects. Delivery from overseas must be made within at most three months from the time of the order. Regular deliveries are essential, failing which customers might be lost.

8. Packaging and transport

Whenever possible, furniture should be exported in containers to avoid unnecessary packing and to prevent damage. Indonesian exporters should avoid shipping furniture as general cargo, and instead obtain a cheaper "commodity" rate. Special regulations concerning packaging, which are applied in several countries must be observed.

9. Promotional materials

The importer must be provided with catalogues and photographs, in colour, indicating the characteristics and technical specifications of the furniture and joinery. The metric system should be used for technical specifications of furniture exported to Japan, France and the Federal Republic of Germany, and the English equivalent for the United States market. Layout and presentation of publicity material must be of good standard.

10. Participation in fairs and exhibitions

Indonesian exporters should actively envisage participation in furniture exhibitions. The principal specialized trade fairs are

the "Salon international du meuble" and the "Internationale Moebelmesse", held alternatively every other year in Paris and Cologne. The various Annual Building **Materials** Exhibitions are the most appropriate trade fairs for Joinery and Mouldings. Since participation in trade fairs is costly, manufacturers should endeavour to organize joint participation on a country basis.

11. Quality control and after-sales service

Testing of materials used and quality control of the final product are of crucial importance for the reputation of an export firm and for the development of sound business relations. Appropriate after-sales service, including repair in case of damage during transport, must also be organized in an efficient manner.

12. Co-operation in the industry

Many of the problems which this report highlights in the Indonesian industry ar· characteristic of the industry in many countries. The structure of the industry is similar in many ways, but on other countries there has been a definite trend for a the number of manufacturers to be reduced over the last 20 years. As a consequence, the remaining firms have grown larger, nearer to their "optimum" size, or maximum efficiency. Among the smaller manufacturers in other countries, particularly in Scandinavia and Italy, there has been a willingness to realize the disadvantages under which they operate due to their size, such as marketing expertise and lack of finance. Their answer to this problem has been establishment of a number of co-operative marketing groups.

13. Degree of co-operation

The co-operative marketing group can take various forms and supp· fferent services to its members. In some cases the marke·ing companies themselves are fully owned by the supplier

manufacturers while in a few cases, the arrangements between the marketing company and the suppliers is purely a contractual one. There are advantages and disadvantages in both types. But it is important that the participating manufacturers recognize that they have mutual interests, that they must operate successfully as a group or possibly not at all, and that they enter into a group effort with a full committment to its principles and objectives.

A typical marketing group will be financed out of commission on sales of its members' products ranging from 5 percent to 15 percent depending on the services which the group provides to the manufacturer. The basic service is a slaes and marketing one, and the group will employ sales representatives to sell on behalf of all the members. It will usually employ a qualified marketing manager and all sales will be through the group. Typically the marketing will be on a franchised basis through selected outlets. The group may also attempt to build up a brand identity for its products and establish a reputation for quality and service. In some cases it may provide other services such as financial service to its members, through which the members receive regular two-weekly or monthly payments for products, and the group will provide credit to customers.

I. Standard specifications and quality control

1. Quality control

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 woodworking industry there are very many sources of quality variations including the following:

- Properties and conditions of timber, rattan and other materials;
- Dimensional accuracy of machined or hand-made components;

- Dimensional accuracy of assembled products;
- Quality of surface finishing;
- Durability 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 **management's ability to delegate,** i.e. to define what quality is required and 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 plant and equipment used must be capable of achieving the required quality;
- The worker must possess the necessary skills and ability;
- The worker 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 operator is a machinist, assembler, polisher, upholsterer, packer, buyer, etc. 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 roles of managers, supervisors and craftsmen. This approach spans all functions in the enterprise and in particular the following main areas:

Quality standards - how they are defined and understood.

Supplier relations - control of incoming materials through reliable inspection.

Process capability - including plant **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 relations - through effective monitoring of customer reaction and customer needs. Quality is not absolute. It is comparative and part of the value judgement made by the consumer. Knowing where quality standard and performance stands relative to competitors is necessary in order to improve quality of design and to adopt the manufacturing process to achieve it consistently.

3. Standard specifications

There are no national **Indonesian** standard specifications for furniture or other wood-based products, nor is it likely that these will be introduced in the near future. Consequently, it is up to the Industry itself to establish its own standards since they are the surest way of improving the low level of technology currently practised by the majority of firms in the industry.

This is no easy task and certainly not one which the Industry could attempt to tackle alone. The expert therefore recommends that this be included among the priority tasks for the proposed

Development Council, working in close collaboration with the Research Institute in Bogor and the Institute of Technology in Bandung.

Many similar specifications are already in use in other countries, are readily available, and could be used as a general guideline for the Indonesian industry. Naturally they would require to be adapted to local needs and circumstances. Annex XI gives one such example from Yugoslavia, a country which is also a major producer of wood and wood products. This standard specification applies only to furniture, and joinery manufacturers who should, therefore, familiarize themselves with and apply in particular the British Standards Institute Specifications since these are adopted by many countries throughout the world.

J. Research and Development

Total expenditure, either direct or indirect by the industry on product research is negligible. The prevailing view is that this is the responsibility of the Government alone and until such time as the latter sees fit or is pressured into providing it, nothing will be done. This situation is unfortunately symptomatic of the industry's general lack of dynamism, but is not in itself a serious impediment to its progress. There are many effective research organizations throughout the world providing wide-ranging programmes of research directly geared to the requirements of the furniture and other wood-using industries. Two in particular, membership of which are open to Indonesian firms, are the **Furniture** Industry Research Association of the United Kingdom (FIRA), and the Timber Research and Development Association (TRADA) also of the United Kingdom. These organizations give

free access to their findings and provide comprehensive technical information service to their members on all aspects of the industry including marketing, design, technology, standard specifications, quality control and management systems and procedures. The expert therefore recommends that in order to keep abreast of technical developments in the year ahead as many firms as possible should join FIRA, if they are furniture manufacturers and TRADA if they produce joinery. The proposed Furniture and Wood Industry Development Council could usefully bring to the notice of the industry the benefits to be gained from membership and could possibly negotiate with both organizations' block membership arrangements similar to those existing for other countries.

The expert is familiar with the services provided by the Forest Products Research Institute in Bogor. These services, which include Research and Development of wood species technology and training,meet to some extent the needs of these industries, but would need to be expanded considerably in order to bridge the gap between the industries' present level of expertise and its ultimate aim of becoming a major export earner and adequate replacement for exports lost since the imposition of the government ban on raw timber exports. In this context the expert had many discussions especially with sawmillers who now wish to change over to secondary processing, or the production of finished wood products. They are quite prepared to invest in manufacturing facilities, but lacking both the experience and practical knowledge, are reluctant to make such a venture without adequate advice and training. Together with the existing industry they form a sizeable sector of the industrial economy of Indonesia and provide every justification for an expansion of this nature. Indeed just as in most other major timber producing countries, inlcuding those which are still developing, there should be a government-

supported organization providing a comprehensive service in all aspects of wood processing. This organization would in effect be a Research and Development Centre. The Forest Products Research Institute with its existing skills and facilities is the obvious spring board for such a development. Considerably and detailed investigation into the precise needs of the industry would be an essential prerequisite to the development of such an organization and this should include visits by representatives of the industry and appropriate government organizations to established institutes abroad including FIRA and TRADA where this research work is already being carried out effectively. This would have the added advantage of avoiding the costly exercise of re-inventing the wheel while ensuring that the nature of the service envisaged is tailored precisely to the needs of Indonesian industry.

Based on the expert's discussions with personnel in the industry and on his observations during many plant visits made during the course of the project he recommends the inclusion of the following activities in any research and development project envisaged for the furniture and other woodworking industries:

(a) Design and product development (in collaboration with School of Arts, Institute of Technology, Bandung)

This will include the design of new products and redesigning of existing ones in accordance with the requirements of individual factories; make prototypes of new products: assist in product development to the stage when batch production is reached: assist in the solution of all technical production problems; co-operate with other designers not attached to the centre; provide advice and assistance in graphics and sales literature generally.

(b) Research into materials and production technology

Including solid wood, rattan, sheet materials, adhesives, lacquers, upholstery materials; machining problems including

setting up and maintenance, low cost mechanization, quality control, exporting furniture and components; finishing problems and the selection of appropriate finishing systems; particular upholstery requirements for rattan and solid wood furniture;

(c) Furniture and joinery performance standards and specifications

The drafting, in conjunction with the Indonesian Standards Institute, of a comprehensive 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 and joints (mechanical and integral); foams; fillings; chair suspensions; fabrics such as upholstery covering materials.

(e) Analytical services

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 evaluation, factory planning and re-organizing, plant selection and utilization aids, work study, work programming, production planning and control, costing, pneumatics and electrics, machine adaptation, compressed air and waste extraction systems, exhaust systems and internal transport systems.

(g) Technical information

This is the combined knowledge of the technical staff of the research organization allied to a comprehensive and up-to-date bank of technical information derived from books, journals, magazines and special reports all of which are concerned with the many facets of the furniture and joinery industries. It is made available as a technical inquiry service, publication of manuals on selected topics and periodicals (in Indonesian).

(h) Training

This is concerned with demonstrations to managers and technical staff from the industry of the practical and commercial application of the work carried out by the research organization. Each course would be set out to meet a particular need in either a relevant management or technical area, and through a modified seminar/workshop approach would encourage active participation by those attending such courses. Topics would therefore include design, materials and production technology, management systems and procedures, health and safety, quality control, production supervision, work planning and allocation, finance and marketing. Training would also include the organizing of technical study tours to overseas trade fairs, woodworking plants, training institutions, and research institutes concerned with the industry.

(i) Rattan production

A separate department should be included to deal specifically with the problems of development of the rattan sector of the industry. In addition to the foregoing in respect of wood furniture, aspects which require immediate attention include: the harvesting and transport of rattan poles, the establishment of a suitable replacement cycle, preproduction treatment including drying and protection from staining; mechanization of particular aspects of production, especially at the stages of bending, jointing, sanding, assembly and surface coating: design; and marketing.

(j) Marketing

This would include the maintenance and publication of industrial statistics; the production of market research surveys and forecasts on materials availability and usage, Indonesian and overseas markets, retailer and consumer attitudes and buying motivations.

A feature of the marketing department would be the organization of new marketing planning workshops in order to improve an awareness of marketing and its importance within the industry.

High priority would be given at all times to direct liaison with individual enterprises and the latter would be encouraged through publicity, special "open" days and in-plant technical consultancy and training programme to make full use of the services offered.

Meanwhile the expert would urge the Directorate of Forestry Planning to speed up its research programme in respect of the supply situation for rattan poles and the availability of suitable alternative hardwoods of immediate and commercial application to the industry.

(k) Staffing

It is evident from the foregoing that only personnel who have been trained in the furniture and other wood-using industry can carry out these functions effectively. They will therefore, in the main, be drawn from industry and will require additional training preferably abroad and in conjunction with an internationally established research organization.

Annex X provides a list of appropriate literature which is easily obtainable and should be made available to the industry.

K. Follow-up Action

International co-operation

The expert recommends that further international assistance for the Indonesian wood-using inudstries should be provided along the lines recommended in this report.

Naturally, some manufacturers, and especially those already engaged in export, will progress at a faster rate than others so there should be sufficient flexibility in any future programme to accomodate this eventuality. There are, however, only marginal

differences between enterprises in this respect and all manufacturing concerns would benefit considerably from professional advice and assistance in the fields of product design and adaptation, production technology, management systems and procedures and marketing.

Accordingly the expert recommends that the following activities should be commenced without undue delay with the assistance of the United Nations Industrial Development Organization (UNIDO).

(a) Industrial training - production management

Intensive course for owners and managers covering every aspect of the syllabus described in the chapter dealing with management and labour. During the course each participant, under the direction of the course leader,would plan and implement a re-organization and development programme for his own factory.

Period: Two months (including course materials' preparation for the actual course which itself would form part of six-month comprehensive consultancy programme for the industry.)

Course leader: Industrial engineer or wood technologist with considerable experience in production management and marketing.

(b) Design and product adaptation

Commissioning of internationally established furniture and wood products designer to assess the current state of product design in the industry and to advise on the introduction of new designs and/or the adaptation of existing ones. The designer will also give services in the field of design of sales materials and graphics.

Period: Three one-month periods to be extended over at least one year.

(c) Management and technical consultancy

To provide in-plant service and assistance on all aspects of the industry based on a pilot scheme project for the 10 most suitable enterprises (rattan and wood) and incorporating the

following:

- Preparation and implementation of detailed plans for re-organization and development of participating enterprises in relation to raw materials procurement and utilization, manufacturing facilities, product design and development, productivity, quality standards, production for export.

- Formation of one or two marketing groups capable of promoting and handling integrated ranges of wood products for export;

- Identification of market opportunities and selection of suitable market sectors. Preparation of marketing plan;

- Implementation of marketing plan in respect of promotion, sales and repeat pruchases;

- Participation in trade fairs and establishment of marketing channels.

Period: Six months

Expert: Senior marketing and production consultant in the wood-using industries.

(d) Assistance by internationally recruited associate experts and volunteers, supervised by an expert, should be provided to the Indonesian Furniture villages. This should cover such fields as furniture construction, tool maintenance, surface finishing, etc.

(e) Technical and marketing study tours

Two study tours, one for personnel in the furniture industry and the other for personnel in the joinery industry to one of the following countries: United Kingdom, Italy or Denmark. The purpose of these study tours would be to see at first hand the developments, both technical and marketing, which have taken place in these sectors of the wood industry and to relate them to the specific needs of the Indonesian industry. All factories and market organizations to be visited would approximate in size and scope to the developing needs of the Indonesian industry.

Period: Two weeks, including travelling, for each study tour.

Tour leader: Senior marketing and **production** consultant.

Additional short-term inputs shall be provided during the course of the project by specialist advisers in woodcutting machining, wood finishing and packaging.

Periods: Approximately one month each.

(f) Counterpart agencies

This responsibility should be jointly shared by the Forest Products Research Institute Bogor and the Institute of Technology Bandung.

The total period for the project should be approximately one and a half years.

II. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

1. The industry is for the most part housed in unsuitable buildings. Plant layout is an important factor in the industry, but few firms have made any systematic approach to this problem. Very little thought seems to have been given to cheap and simple methods of reducing handling costs. A feature of practically all the firms visited was that working conditions left much to be desired.

2. Most factories and workshops are poorly equipped and there is a lack of modern machinery for woodworking production. Few factories have proper **timber-drying** facilities. There are many impediments to the importation of such equipment.

3. Production techniques are poor over much of the industry and there is a low level of production technology. In matters such as product development, production planning, work study and cost control there is little evidence of an awareness of modern developments.

4. Production fluctuates throughout the year in step with demand. A principal cause of this pattern is, on the home market, the practice of custom-building and direct selling of furniture, and on export markets the dominance of the importers and distributors.

5. Very few firms are financially strong: there is a chronic shortage of capital for development and expansion. This situation has two main causes: the ease of entry to the trade which encourages employees with little capital to set up on their own, and the intensive competition in the industry (itself partly caused by this ease of entry which reduces profits below a level which would provide funds for re-investment.

6. The industry is experiencing shortage of raw materials despite assurances of abundant supplies. There is a lack of an organized supply system for both sectors. Other essential materials which have to be imported are in short supply because of import restrictions.

7. Worthwhile exports are confined almost exclusively to the handicraft and joinery sectors. The export prospects for the wood sector of the industry are not good, mainly because of the lack of well-designed products. Even with an exportable product, many years of pre-occupation with the completely protected home market have left the industry unprepared to embark on such a venture.

8. The industry's deficiencies are most apparent in management, design and marketing, the meaning and function of which are largely misunderstood. If the industry does not improve the general standard of its products, it cannot hope to expand exports.

9. The industry seems to be largely unaware of and isolated from the developments which have taken place in the woodworking industry in most parts of the world.

10. The firms in the industry must learn to see themselves as competing with other consumer durables (such as TV sets, hi-fi equipment, refrigerators, etc.) rather than simply between themselves. This calls for agreement between firms to specialize in broadly defined areas of production which in turn should enable agreement to be reached on the narrower specialization that is necessary if economic production runs are to be achieved.

11. The future of the Indonesian industry does not appear to lie in large series production by methods common in the United States and Europe but rather in the production of classical and modern furniture of above average quality.

12. Few tangible benefits appear to have accrued to the industry in the fields of marketing, technology, design and industrial training as a result of the activities of state institutions offering such services.

13. If the industry accepts and acts without delay on the recommendations contained in this report, there is little doubt that a strong and healthy industry can be developed within the next decade, capable of winning a large export trade, of becoming a prestige industry at home and of at best maintaining the present levels of employment.

14. At the time of writing this report there was no statistical information available concerning the industry in relation to its size, location studies, levels of employment and output.

B. Recommendations

1. Development Council

A Development Council for the industry under the joint aegis of the industry itself, the Indoneisan Woodworking Manufacturers Association and the Ministries of Agriculture (Forestry section) and Industry should be established. This would be drawn from various sectors of the industry and the state agencies which offer support services. The problems to which the Development Council should immediately devote its energies are:

(a) The low level of production efficiency;

(b) The poor standard of design:

(c) The need for a rational production policy for individual firms and for the industry as a whole;

(d) The need to develop export consciousness in the industry;

(e) The need for joint effort, particularly in ensuring the supply, purchase, handling and preparation of materials and processing equipment;

(f) The urgent need for management education and training;

(g) The need to raise the standard of labour productivity.

Administrative activities of the Council should be carried out jointly by the staff of organizations referred to above.

2. Buildings and working conditions

(a) Early attention should be given to the matter of the improvement of factory and workshop buildings, and of bad working conditions;

(b) The industry would benefit greatly by transfer to modern buildings. State assistance should be sought in this matter.

3. Machinery and equipment

(a) The industry urgently requires basic wood-working machinery and ancillary equipment. The state should permit its importation duty free even if it is used for the production of merchandise destined for the home market only.

(b) Most firms require to have their plants relaid out and dust extraction and compressed air line systems installed.

(c) The industry should make use of work study and low-cost mechanization in both wood and rattan sectors.

4. Design

(a) The Development Council should collaborate with the Institute of Technology in Bandung and the National Agency for Export Development (NAFED) in seeking to raise the general standard of design.

(b) The work of the Institute of Technology Bandung should be considerably strengthened and extended in the field of furniture design.

(c) Firms should co-operate to engage international furniture and wood products designers to design non-competing lines.

(d) State bodies should insist on high standards of design in the furniture they buy or the purchase of which they finance.

5. Production technology

(a) The industry's technical base should be strengthened by greater awareness of established production techniques and current developments. This can best be achieved by attendance at technical seminars, the availability of appropriate technical information literature and participation in fact-finding trade missions abroad.

(b) Greater attention should be paid to quality standards in the industry especially in machining, sanding and finishing operations.

6. Industrial training

(a) Industrial training for all levels of personnel should be carried out on a national basis as a matter of policy. This should include in-plant training as well as ancillary training in technical colleges.

(b) There should be a Woodworking Industry Training Board established which should be largely made up of representatives of the Industry and those responsible for training in industry.

Industrial training is an integral part of the policy of any industry and should be regarded as such by both the Indonesian Government and the industry itself. The practical implications of this are that there will be established procedures for all aspects of industrial training and that responsibility for carrying them out will be delegated to those qualified to do so.

Training should be regarded as one of the best means of increasing the profitable use of manpower. It should therefore be based on a careful assessment of training needs, which in turn is directly related to the insufficiency of personnel with adequate skills, or to the ineffective use of the knowledge and skill of existing personnel.

Industrial training should be established on a nation-wide basis and should be concerned specifically with training in the woodworking industry. Hence there should be a Woodworking Industry Training Board which should be concerned with preparing and monitoring training programmes for all levels of personnel in all aspects of secondary wood processing. The Board should be representative of all sectors of the industry, the various training institutes and the Ministries of Education, Industry and Agriculture (Forestry Section). There should also be special training committees for the sectors of sawmilling, joinery, wood furniture, rattan furniture, plywood, particle **board,** etc. The industry in particular, should have adequate representation on these committees.

Training institutes should be staffed with personnel who are fully experienced in all aspects of production and production technology and in preparing and supervising **in-plant** and other types of training programmes.

(c) Special scholarships should be provided to enable promising personnel from the industry to train overseas in production management and design.

7. Research and development

(a) The furniture and Woodware Sectors in the industry should join the Furniture Industry Research Association (FIRA), and the Joinery sector should join the Timber Research and Development Association (TRADA).

(b) A Research and Development Institute for the furniture and other wood processing industries should be established as an expansion of the current services being provided by the Forest Products Research Institute. It should cater specifically for the needs of those industries and should therefore be directed and staffed only by personnel who are themselves qualified and have direct industrial experience in the furniture and wood industries.

(c) The proposed Furniture and Wood Industry Council should, with the Directorate General of Forestry, examine the possibilities of the latter doing some immediate short-term investigation into lesser known timber species suitable and available for furniture and other wood products production.

8. Marketing

(a) Manufacturers should update their marketing, selling and promotional techniques, at least to the level being used by their existing or potential export competitors.

(b) There should be market planning, the definition of the market segment in which individual manufacturer's products are being aimed at, the establishment of sales targets, co-operative marketing where appropriate, more investment in qualit. sales literature, sales representation, point of sale display material and if appropriate, brand advertising.

(c) Special training courses for appropriate industry personnel on all aspects of marketing and tailored to the specific needs of the furniture and other wood-using industries should be organized immediately.

(d) The industry as a whole should promote an image of quality Indonesian wood products in both the home and export markets.

9. State assistance and encouragement

(a) As the industry becomes an outward looking export earner, a reappraisal of protection policy towards its suppliers will have to be made.

(b) Arrangements should be made to ensure that the policies of all state and semi-state bodies complement each other in preparing the industry for exports. They should be co-ordinated and tailored to the specific needs of the industry.

(c) A detailed statistical survey of the industry should be undertaken without delay in order to ascertain its structure in relation to number of firms, their size and location, products manufactured, raw material utilized, levels of employment and output existing and planned output, domestic and export performance, etc.

10. Addressed to the Indonesian Woodworking Manufacturers Association

The membership of the organization should be strengthened so that it is totally representative of the industry throughout the entire country. A full-time executive, preferably with a marketing background to implement the governing board's decisions and to actively pursue the Association's interests with state and other agencies should be appointed. The Association should participate fully in the activities of the proposed Furniture Development Council and the Woodworking Industry Training Board and ensure

that the interests and needs of the industry are fully catered for. It should also ensure that all state-sponsored activities generated on behalf of the industry are done so on the basis of prior consultation and agreement.

Annex I

Table 1

EXPORT OF SECONDARY WOODBASED PRODUCTS, RATTAN AND RATTAN PRODUCTS FROM INDONESIA

FOB in US Dollars

C.C.C.N	Commodity	1978	1979	1980	Jan/Apr 1981
4420000	Wooden picture frames photograph/mirror	113 617	134 252	229 424	115 983
4424000	Household utensils of wood	-	74 549	313 430	34 278
4427000	Standard lamp, table lamp	140 043	239 885	327 490	88 766
4428990	Other articles of wood	636 779	1 261 950	1 073 501	188 726
9401110	Chairs and other seats of wood	133 394	701 714	1 885 435	194 133
9401910	Parts of chairs and seats of wood	-	-	-	7 872
9403290	Other furniture of wood	682 745	968 022	1 186 410	84 168
	Total furniture	1 706 578	3 380 372	5 015 690	713 926
4419000	Wood beadings and moundings	5 652 828	2 072 000	2 704 710	268 948
4423100	Prefab buildings of wood	-	-	-	358 476
4423900	Other builders joinery of wood	1 420 494	2 623 273	991 021	725 204
	Total mouldings & joineries	7 073 322	4 695 273	3 695 731	1 352 628
	Total sedondary woodbased products	8 779 900	8 075 645	8 711 421	2 066 554
1401311	Rattan & cane, whole unwashed	22 412 019	58 172 973	57 424 434	846 694
1401312	Rattan & cane, whole washed and sulphured	-	-	-	9 440 498
1401313	Rattan & cane, whole, short/ small in 50 cm	-	-	-	13 805
1401319	Other whole rattans & canes	-	-	-	6 404 070
1401320	Rattan split	-	-	-	42 700
1401330	Rattan cane	2 829 163	11 382 973	13 297 221	4 030 829
1401340	Rattan bark	1 184 215	2 866 750	4 476 835	1 363 496
1401900	Other vegetable mat for platting	839 144	2 396 617	1 107 885	-
9403390	Other furniture of other mat.	-	-	1 186 410	65 609
460220	Matting of rattan	2 184 928	6 724 132	7 608 304	-
	Total rattan and rattan products	29 449 469	81 543 445	85 101 089	22 207 701

Source : Central Bureau of Statistics

Annex II

EXPERT'S JOB DESCRIPTION

Post title	Expert in secondary forest industries
Duration	Three months
Date required	As soon as possible
Duty station	Bogor, with travel throughout Indonesia.
Purpose of project	To develop forestry, forest based industries, and forest products utilization in Indonesia.
Duties	The expert will be attached to the UNDP/FAO Forestry and Forest Products Development Project in Indonesia. Under the general supervision of the Chief Technical Adviser, and in close collaboration with the expert in Forest Industries (appointed by FAO) and their Indonesian counterparts, the expert shall determine the ability and scope of the existing wood processing industry in Indonesia and indicate and define the opportunities that may exist for expansion into secondary processing.

In particular he will be expected to :

a) Advise the existing primary forest industries on feasible lines of diversification and markets

b) Assist the industry in the choice of machinery and techniques suitable for secondary wood processing under the economic and social conditions of Indonesia

c) Assist the Directorate General of Forestry in formulating a set of implementable policies for secondary wood based industry development and design suitable incentives and disincentives for guiding this development

d) Assist the Directorate General in establishing standard requirements for imported second hand wood working machinery

e) In collaboration with the Expert in Forest Industries prepare a report outlining the findings and recommendations.

Qualifications	Wood technologist of engineer with considerable experience at policy making level in the production of manufactured wooden products. Experience in developing countries desirable. He is also expected to have a knowledge in world markets for semi-manufactured and manufactured wood products and in making economic evaluations. Experience with a wide range of equipment for secondary wood processing industries also desirable.
Language	English
Background information	Forest land occupies approximately 120 million hectares (65 percent of total land area) of Indonesia. These forests are being depleted due to shifting cultivation. Although 4000 species grow in these forests less than 60 are commercially exploited. Over the last decade forestry export production has increased some 20 fold in volume and 50 fold in FOB value to represent in 1976 some 7 percent of the nation's export. UNDP/FAO have provided assistance to develop Indonesia's forestry and forest products since November 1974 through the strengthening of the planning capability of the Directorate General of Forestry. In 1978, it was decided to continue this assistance for a further four years, along the same lines but carrying out a more intensive analysis of the sub-sectors. As part of this assistance, FAO have requested UNIDO's participation in the implementation of the UNDP/FAO project through the provision of the services of an expert in secondary forest industries for six months.

Annex III

FIRMS AND AGENCIES CO-OPERATING WITH THE EXPERT

1.	PT Sri Tokai Indonesia	Furniture
2.	PT Sri Buwana Draft	Furniture
3.	Macrowood	Furniture Flush and louvered doors
4.	Kamal Furniture	Rattan furniture
5.	Elka Furniture	Fibre glass furniture Upholstery
6.	PT Harfit International (Woodworking complex)	Sawmill, furniture Framed Doors Builders Woodwork
7.	PT Jaya Interior Indonesia	Sawmill, Furniture, Joinery, Panelling Builders Woodwork
8.	Ligna Furniture	Furniture
9.	Tixo Furniture	Panel furniture
10.	Units I + II Perum Perhutani Forest State Corporation (Teak Woodworking complex)	Sawmill, Veneer, Moulding, Joinery Parquet and Strip Flooring
11.	Woodworking Village, Jepara	Cooperative for Furniture, Wood Carving, Handicrafts
12.	Woodworking Village, Serenan	Cooperative for Furniture, Wood Carving, Wood Turning
13.	PT Indo Veneer (Woodworking complex)	Sawmill, Veneer, Plywood, Furniture
14.	PT Wing On	Furniture, Joinery, Framed and Carved Doors, Mouldings
15.	PT Ardi Indah (Woodworking complex)	Furniture, louvered doors, containers Floors, Pallets, Tool Handles
16.	PT Golden Pharos Ltd.	Sewing machine cabinets Framed & Panelled Doors
17.	Woodworking Village, Bukir	Hand-made teak furniture

18.	Bumi Raya Utama Group (Woodworking complex)	Sawmill. Veneer. Plywood. Mouldings, Handles furniture components
19.	H.K.U. Group (Woodworking complex)	Sawmilling, Veneer, Plywood (mainly) Mouldings, louvered doors.
20.	PT Mantan Mas Rattan Factory	Mainly pole, sika and rattan splits processing, Brush and brown handles
21.	PT Pirok Indonesia	Chopsticks for Japanese market
22.	Parbutaran	Sawmilling, Furniture
23.	PT Raja Garuda Mas (Woodworking complex)	Sawmilling, Veneer, Plywood, Blockboard, General Woodworking
24.	CV Lariza	Rattan Pole Processing Rattan Furniture
25.	Garuda Bali	Traditional Balinese Wood Carvings
26.	Sanggar Kriya Coasta (Handicraft Centre)	Wood Carvings, Wood Sculpture, Wood Relief
27.	Wood Carving Village	Wood sculpture, Wood marks, Wood relief
28.	Perum Perumnas	Particle Board Plant, School Furniture, Wood framed housing
29.	Furniture Fair '82, Jakarta	Wood furniture, Panel furniture, Rattan furniture, Upholstery, Wood carving, Panel doors

30. Indonesian Sawmillers Association

31. Indonesian Plywood Producers Association

32. Indonesian Woodwork Manufactures Association

33. Directorate General of Forestry, Directorate of Forest Planning and Utilization

34. Directorate General for Multifarious Industries

35. Directorate General for Small Scale Industries

36. National Agency for Export Development (NAFED)

37. Pendidikan Industri Kayu Atas (PIKA) Semarang (Technical Institute for Woodworking Training)

38. Forest Products Research Institute, Bogor

39. Institute of Technology, Bandung
Departments of Art and Design and Industrial Engineering

40. Bank Bumi Daya, Jakarta

Annex IV

ADDITIONAL DESIGN RECOMMENDATIONS

1. To use the best available timber species in cabinet furniture in conjunction with veneered panels.
2. To exploit the use of the solid wood content by expressing its character in more detailed mouldings around frames, and on lipped panels.
3. To soften all exposed edges by using a good radius (something which is difficult to achieve with man-made materials).
4. To improve sanding and finishing techniques and to achieve a smoother feel, and richer look in both the veneered and solid wood areas, in keeping with the fine nature of such materials.
5. To introduce warmer colours in the selection of all fabrics for chairs and upholstery items for export. Conversely to introduce cooler fabric colours for the domestic market.
6. To improve the comfort of all chairs and upholstered units, as mentioned earlier (care will be needed, however, in choosing foams and fabrics for export, so as to comply with any relevant fire regulations and other specifications).
7. To provide a wider choice of chairs to complement bedroom, living room and dining room furniture. Each chair frame should be capable of having three different backs, thereby effectively altering its appearance e.g. upholstered panel, vertical rails or horizontal rails.
8. To provide a selection of tables to suit varying needs such as gate-leg, drop leaf, extension flip-over, draw-leaf extension, etc.
9. To design wherever possible for greater versatility in usage.
10. To increase the number of occasional items : e.g. wine tables, lamp tables, stools, writing units, corner cupboards, connecting elements etc.
11. To establish two maindesign objectives "CLASSICAL" and "MODERN".

Annex V

FACTORY PLANNING AND THE ORGANIZATION OF PRODUCTION

Production

Productivity in the woodworking industry in the developed economics of the world such as the Federal Republic of Germany and Sweden has reached an upper limit of 75 000 US Dollars per worker per annum. This is the standard by which the Indonesian industry must measure its performance, since it wishes to compete successfully in those markets. This inevitably means increasing pressure on the manufacturer to produce more efficiently, and to this may be added higher demands for quality and finish from the consumer, and continually increasing wages and salaries.

Fortunately the industry has at its disposal a plentiful supply of the basic hardwoods and softwoods required for production and even **though** it must exercise the greatest vigilance in **their** economic use, the area in which the industry will find the greatest opportunity for achieving higher levels of productivity is in the optimum use of the manufacturing facilities available to it. These facilities may be summarized as the buildings, machinery and equipment; and the skills of both management and workers.

Manufacturing facilities

It is sometimes forgotten that buildings, as part of the total capital investment, have to be costed into the product not only in relation to their erection costs but also in relation to their use and maintenance. They must therefore be suited to the manufacturing activity planned to be carried on in them, and yet be sufficiently flexible in their design to easily absorb any changes which may occur in the future.

Many factories visited were found to be unsatisfactory in those respects, a fact which was clearly evidenced by the following:

(a) Badly organized processing and assembly lines:

(b) Excessive capital tied up in stocks:

(c) Buildings unsuitable for modern processing machinery and internal transport:

(d) Poor space utilization and work flow:

(e) Poor quality standards.

(f) Excessive waste:

(g) Low productivity with resultant high unit costs.

This means that at the initial planning stage of the enterprise, not all the factors concerned with growth and development were taken into account, and the factory subsequently pays the penalty for this lack of foresight. In the case of a particle board or sawmilling plant such long-term planning is simple, but in the case of furniture and joinery plants it is quite complex because of:

(a) The multiplicity of the work processes:

(b) The unlimited number of designs and design combinations:

(c) The speed with which technological changes occur.

It is therefore relevant to the immediate needs of the industry to consider the factors which go into the planning of not only new furniture and joinery plants, but also the re-organization and future development of existing ones, so that the mistakes of the past may be corrected. Once the building has commenced, the future possibility for flexibility has gone, which may result in high maintenance and personnel costs, poor utilization of machine capacity and space, high manufacturing costs, and unnecessarily high working capital costs.

The factors which will allow for built-in flexibility for future requirements may be summarized as follows:

(a) Results of a careful analysis of the market potential of the product:

(b) Structure and materials utilization of the product:

(c) High rates of production through optimum use of modern machinery and equipment;

(d) High levels of productivity per worker through better factory organization, and production planning and control systems.

Among the most significant changes which have occured in the woodworking industries especially during the past 20 years has been the growth in space required for manufacturing purposes. In many instances this has as much as trebled, and while production space has increased at the rate of 20 percent, storage areas both for work-in-progress and finished goods have increased fourfold. This is because the partly - or fully - automated equipment currently in use sets much higher limits on the necessary space for storage of processed components and raw materials. This in turn, has made demands on the provision of additional space for production planning and control, internal transport, organization and administration.

With regard to building disposal and layout for the achievement of optimum production efficiency, it has been found in practice that a building module of 7.5 metres produces a good planning base.

Many types of building layouts have been tried in the past, including E-, F- and H-type buildings, but have in the main proved unsuitable. Experience has shown that the U-type building with two long parallel halls connected to one another at one end is the ideal shape, making the whole production line in the factory a complete circuit.

Figure 1 shows the layout of a typical factory using a "U" layout and Figure II shows the intermediate and final stages of growth to the full utilization of the factory site.

The production flow is only interrupted where the material is fed in and at the point of dispatch. This layout has the following advantages:

(a) Extension is possible on three sides;

(b) Each production, storage or control area, while independent, is organically expandable:

(c) Raw material supply and dispatch can be located on one side:

(d) The inner yard is a fire lane;

(e) All expensive equipment is located in one area;

(f) Lower building costs;

(g) Centrally-located main and auxiliary services.

The main building which determines the future of the building, should therefore be considered as having at least a 20-year life. Once this has been determined, department layout and work-flow are produced in block form according to a logical sequence of operations. The criteria which apply in respect of the various areas of storage and manufacturing activities are as follows:

Raw material storage

This should be located beside or close to the break-down mill, and have the same environmental conditions as the production areas.

Machining areas

Since initial installation costs are high , particularly those for the foundations, these should be planned so that when expansion or re-organization, is required a complete removal is not necessary. The main power and service lines should be of flexible design and located mainly at roof-truss height or under

Figure I. Typical furniture factory plan using a "U" layout

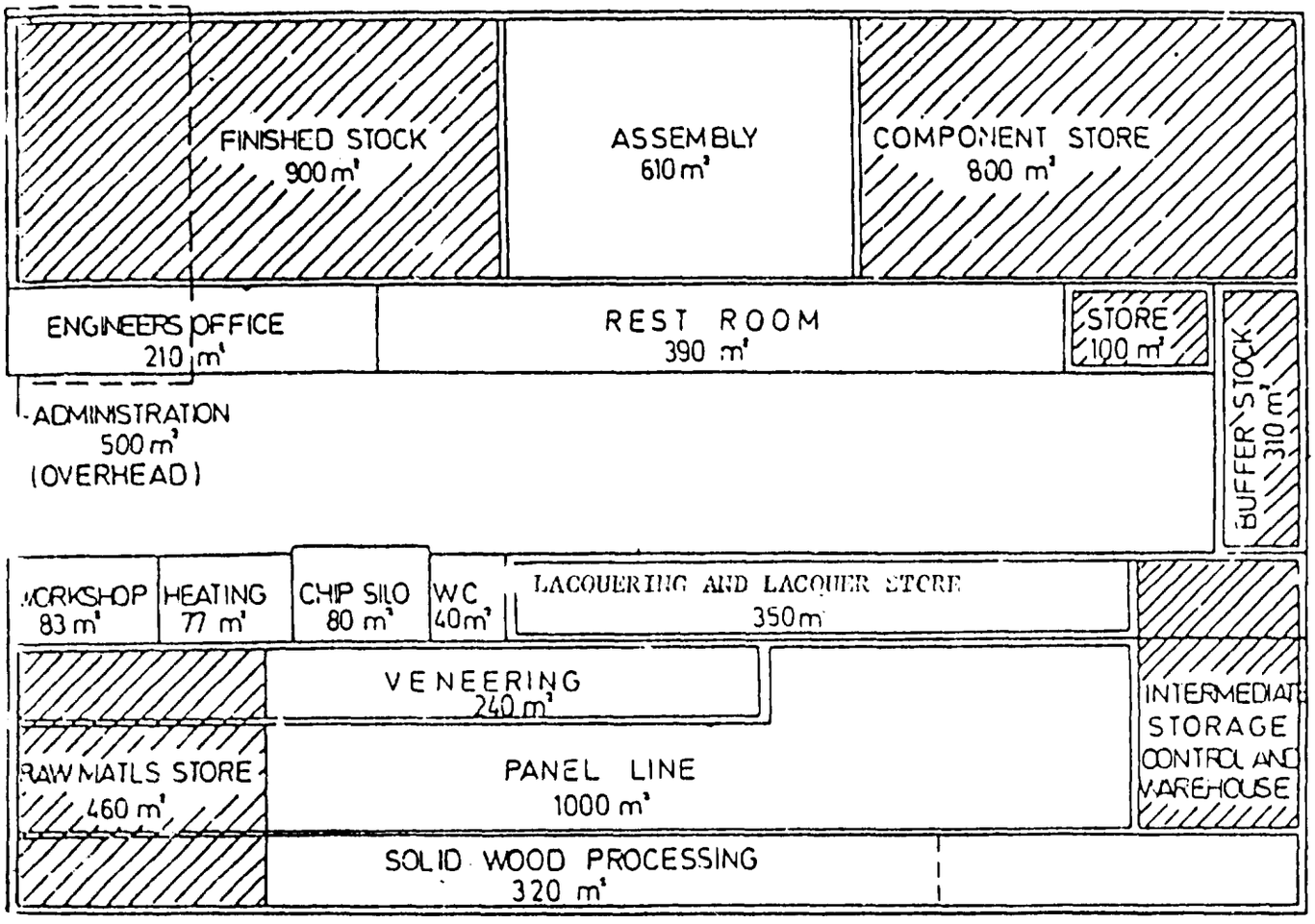
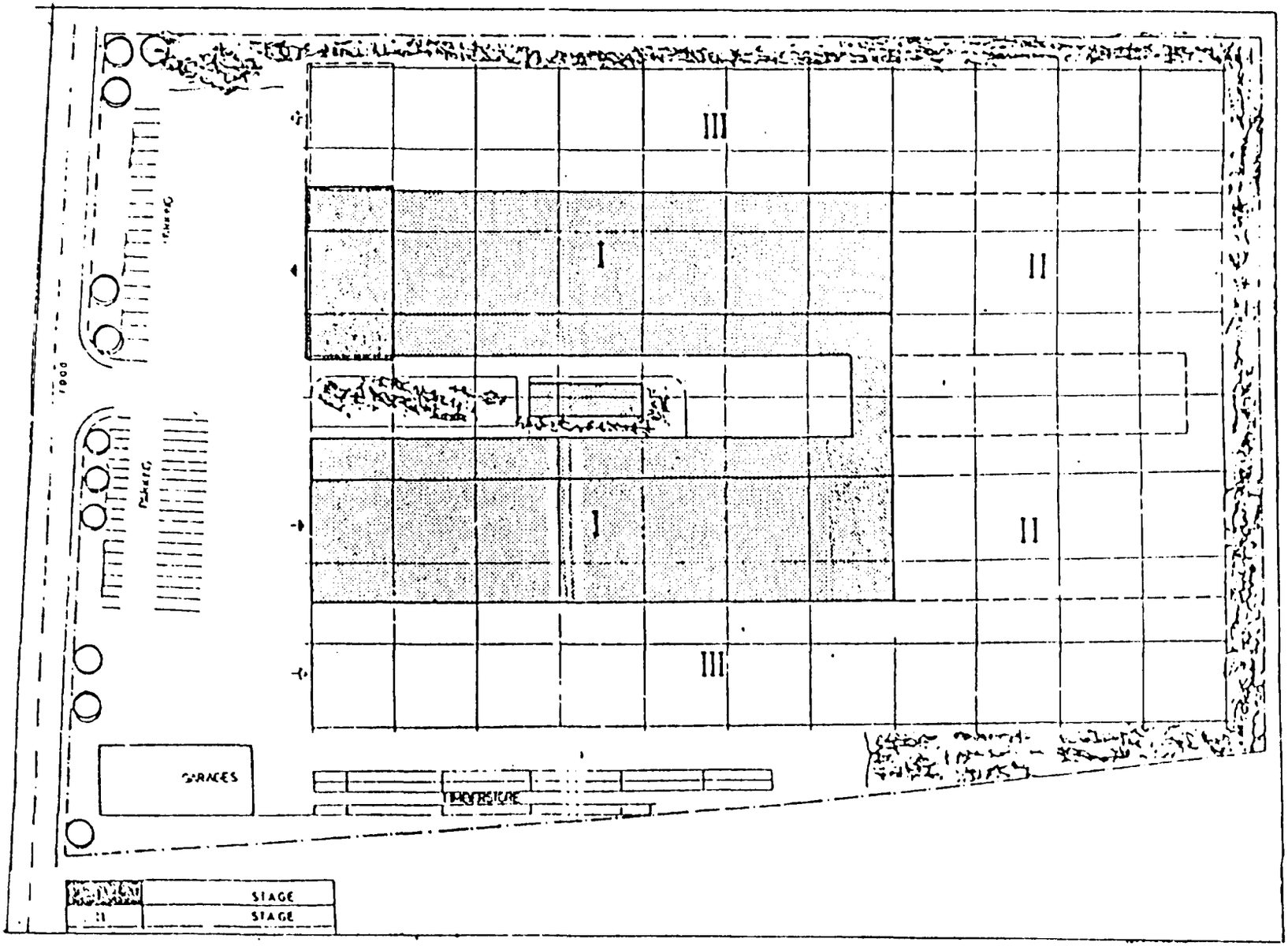


Figure II. Various stages in the development of a furniture factory



the ceiling. Compressed air lines must be on a ring system with reserve connections in each section. **The electric wiring system** must be carefully suited to the production areas, and the lighting system must provide general shadow-free illumination.

Intermediate storage

This area should be regarded as unwanted and should be kept as small as possible. In the case of completely knock-down (CKD) furniture it may even be eliminated. For storage, long, narrow, fire-proof buildings with a minimum width of 7.5 metres should be used which should be capable of housing both rough and machined parts. Lacquer rooms should be on the outside of the building because of the fire hazard.

Assembly

The investment in this area is the smallest, but it still repays to plan according to the principles of method and work study. Work stations for various stages of assembly should be carefully organized so that the operator is enabled to work quickly and efficiently. His assembly bench, fully serviced, pneumatically and electrically, should be designed specifically to suit the assembly processes in which he is involved and he should be provided with the appropriate assembly aids, location jigs and adequate supplies of other required tools and fittings. Work delivery and disposal should also be planned so that the maximum amount of the assembler's time is engaged directly in production.

Machinery and equipment planning

The basic arrangements of the operation pattern in a machining department is as follows: rough storage, break-down (rough dimensioning), pressing, intermediate storage, sawing and cutting to shape, planing, milling, drilling, edge veneering, glueing, sanding,

parts storage, lacquering, finishing, final assembly, packing and despatch.

The planning should be based on the installation of the best up-to-date equipment of maximum dimensions, even though this may initially mean that, due to cost or work load factors, existing old equipment will have to be used initially. Identical operations should be carried out in the same work area. The following principles apply in this connection to the machining department:

(a) The rough stores (veneer, panels or solid wood) must be located parallel with each other;

(b) The press area must contain all presses including hot, cold and moulding press;

(c) All production lines must be planned so as to give a minimum distance between individual machines of twice the length of the longest workpiece;

(d) For machines which are not lines, particular attention should be given to the provision of a suitable working area around the machine, and waiting areas for components awaiting processing or transport to the next work station.

There should be adequate facilities for transport to and from each machine without interfering with other work places. The choice of a particular transport system will be influenced by the size and shape of the components being processed. In general, however, it may be said that for panel production roller conveyors are the most suitable and for solid-wood processing live and dead pallets or bins in conjunction with hand-lift and fork-lift trolleys and trucks. Whatever system is used, it should be standardized throughout the factory. Longitudinal and transverse passages should split up the entire production line into areas which can be easily controlled.

Annex VI

OUTLINE OF PLANT EQUIPMENT

I Solid wood processing

a) Production of straight tenoned components

1. pneumatic circular swing-saw for cross cutting
2. multi-blade circular saw, 300 mm working width for rip sawing
3. moulding machine, 170 mm working width, with seven cutterheads
4. automatic double-head tenoner with rounding off unit

b) Production of non-contoured components and other operations

5. 2 bandsaws, 900 mm diameter wheel
6. surface planer, 520 mm working width
7. thicknessing machine, 630 mm working width
8. 2 spindle moulders, 5 speeds, 10 000 rpm
9. double end sawing machine
10. automatic sawing, boring, shaping machine
11. automatic double-head mortising machine
12. automatic gang mortising machine with three independent units
13. high speed router with floating head
14. semi-automatic lathe with centering device
15. sanding machine with wide belts above feed table, 1100 mm working width
16. 2 horizontal sanders with a 4900 mm belt
17. brush sander with abrasive holder
18. bench sander
19. dust exhaust system for twelve sanders
20. automatic dowel-making machine
21. automatic shaper for corner blocks and panels

c) Assembly and finishing

22. pneumatic cramps for pre-assembly
23. cramp for assembly
24. electrically heated hydraulic two-platen press size 2500 x 1300 mm
25. 4 dip tanks

26. spray booths, 4000 x 2200 x 2000 mm
27. de-nibbing benches
28. 4 airspray guns
29. final fitting benches

d) Product development

30. universal woodworking machine
31. single table mortising machine
32. automatic single table tenoning machine with rounding off unit
33. bandsaw
34. assembly benches

e) Maintenance room

35. grinding machine
36. 3 kw portable welders
37. drill press
38. knife sharpener
39. universal tool sharpener
40. bandsaw sharpener with setting attachment
41. bandsaw butt welding machine

f) Power plants

42. chip and dust exhaust system with 2 collectors, 1 silo (capacity 315 m^3), 2 electric exhausters, filter system
43. compressor station consisting of a rotary compressor (capacity 1000 l), air maintenance and cooling system
44. transformer unit and distribution station
45. compressed air-line system

g) Tools and accessories

46. various tools for the setting up of machines, tool maintenance, assembly and sanding tables, benches and bench supports for components.

II Rattan furniture processing

h) Cross-cutting, straightening, sanding

47. 2 overhead cross-cut saws
48. locally made working tables with adjustable length stops
49. 2 hydraulic straightening machines
50. 2 profile sanding machines

i) Splitting

51. 1 fine splitting and planing saw

j) Moulding

52. variety of locally-made moulds to suit all required beads (metal and plywood)

53. 4 steaming ovens. Locally-made (2 x 1.75 m; 2 x 1.5 m) diameter 0.75 m

54. 1 steam boiler, 5 HP, 60 PSI maximum working pressure with water level gauge, pressure gauge, safety valve, pipes release valve (oil or wood).

k) Curve and profile sanding

55. 1 buffer sander fitted with cylinder and brush heads

56. 1 bobbin, brush and disc sander

l) Shaped cutting

57. 1 band saw, saw-wheel diameter 630 mm

m) Boring and scribing (sometimes called coping)

58. 5 electric pneumatic self feed drills with multiple set-up frame and foot pedal control. Locally-made benches

59. 6 electrically-powered, hand operated drills on stands

60. variety of boring and scribing bits

61. variety of boring jigs, locally made

n) Assembly and sanding

62. 2 pneumatic jig and assembly tables assembly benches

63. variety of power-operated hand tools
6 hand torches
6 hand drills

III Panel furniture processing

o) Board break-down and calibration

64. Panel saw or vertical wall saw

65. Calibrating machine

p) Veneer preparation

66. Veneer jointer or guillotine

67. Veneer splicer

q) Veneer pressing

68. glue spreader

69. single or multiple daylight press

r) Panel completion

70. double cut-off squaring saw with scoring heads

71. single-sided edge-banding machine capable of applying veneer, imitation veneer and solid edge lipping

72. multiple boring machine capable of boring vertically and horizontally

73. wide-belt speed sander

74. hinges and other fittings recessing machine

s) Moulding and grooving of solid edge-lipped panels

75. spindle moulder and/or

76. router

t) Assembly

77. carcase assembly press

78. drawer assembly press

IV Joinery production

u) Timber drying

79. kiln with four-chamber battery 20/25 m^3 capacity per chamber

v) Break-down mill

80. cross-out saw with roller tables

81. circular saw/straight-line edger

82. bandsaw

83. band Re-saw

84. surface planer

85. thicknesser planer

86. planer and moulder

w) General machining

87. spindle moulder

88. router

89. single-end tenoner

90. single morticer

91. boring machine for dowelling door frames
92. belt sander
93. drum sander
94. hinge recessor
95. powered cramping table
96. woodwaste extraction system
97. compressed air-line system

Annex VII

GENERAL CRITERIA FOR THE SELECTION OF MACHINES[1/]
UNIDO DOCUMENT ID/WG.277/3 Rev.1

1. Introduction

In all industrial concerns, whatever their size, purchasing capital goods is becoming increasingly important due to its incidence on turnover, but an extremely delicate task is entrusted to those who have to consider the purchase of machines or systems.

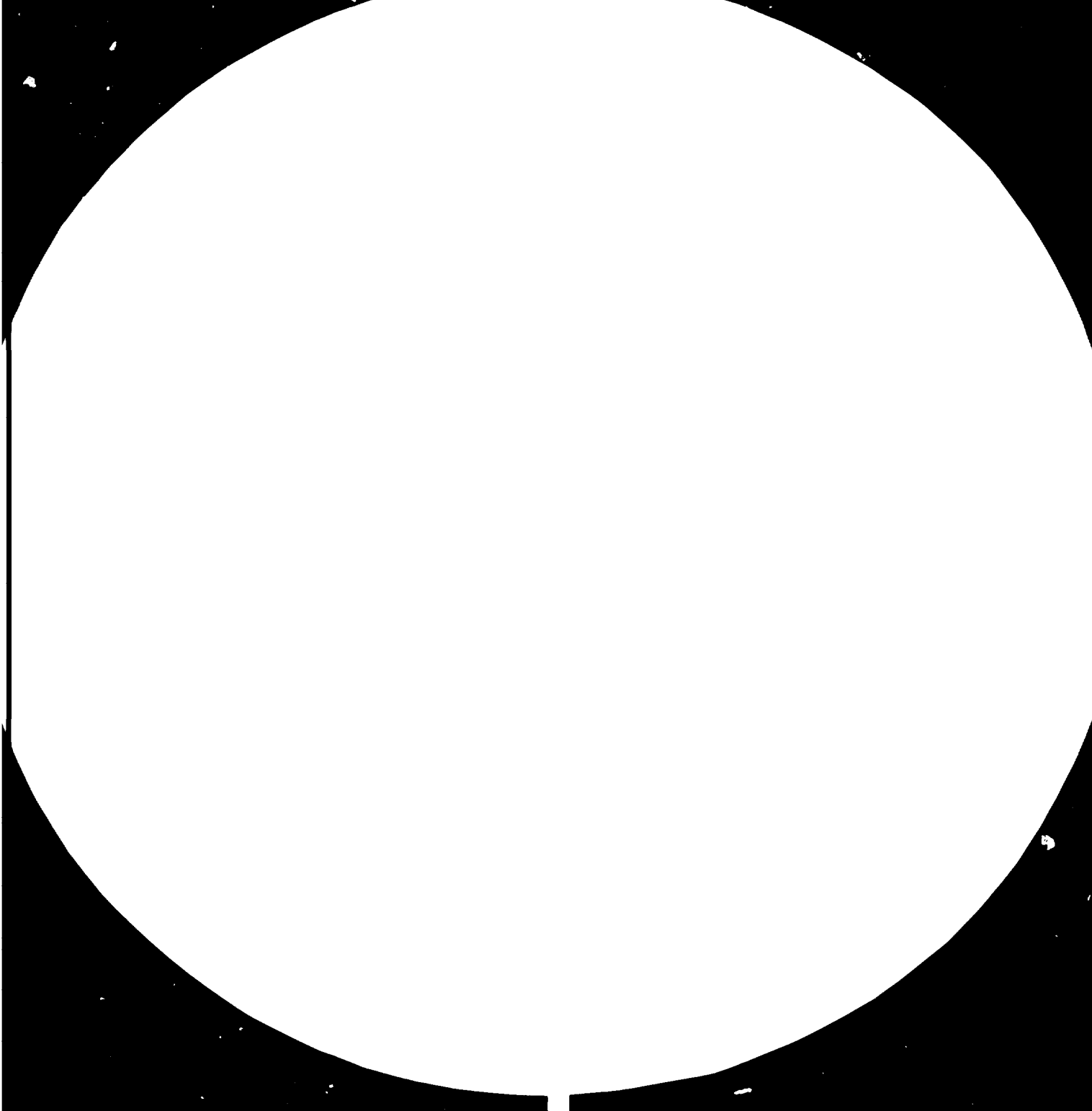
Sophistication of these items has led to increased investment costs and therefore, constant efficiency, especially in mechanized production, as well as the need for the finished product to meet required quality standards, are only some of the main elements determining economic results. Careful choice is, therefore, of prime importance.

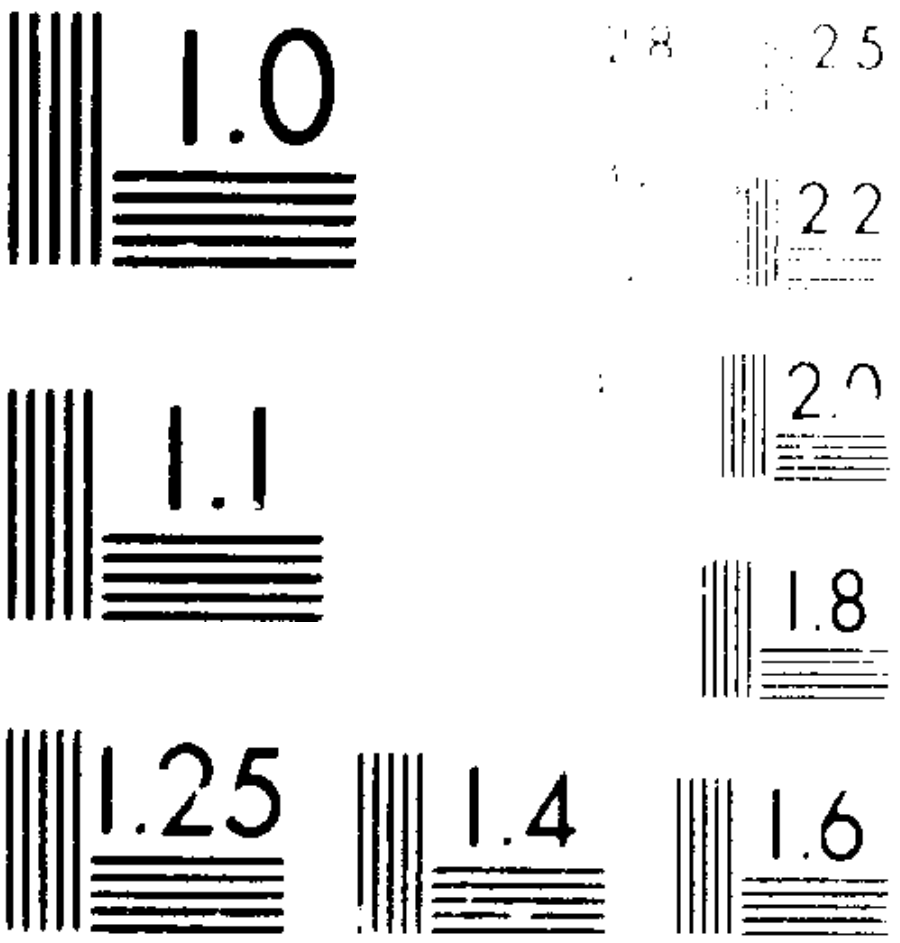
The object of this report is to emphasize, in a general survey, the principles for the choice of machines or systems to be purchased.

Whenever the purchase of a machine is contemplated (machine being intended in its widest sense: machinery, systems, servomechanisms, etc.) at least the following questions instinctively arise:

- why purchase
- what to purchase

1/ by G. L. della Torre

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- when to purchase
- how to purchase

Answers to these questions involve treating them as natural consequences of three fundamental purchasing components:

a) technical-productive

b) **economic**

c) **commercial.**

In order to reach these conclusions machinery must be considered in two of its qualifying aspects:

Machinery in the productive context (Productive entity - dynamic)

Machinery in its intrinsic make-up - (Physical and technical entity - static)

2. The manufacturing process

Considering machinery in its productive context signifies examining a large number of strictly interdependent parametres, difficult to **classify** in order of priority but all of them important for the optimisation of man-machine-ambience system.

Some are referred to below:

The productive process in general

Many wood products may be considered "finished" in those industries making only one product (eg. plywood) or "semi-finished" if they go to make up more complex products (eg. furniture).

This schematic representation calls our attention to the considerable variety in production parts which, while often having something in common among their various applications, should be considered from different points of view according to whether they go to make up a product with a manufacturing cycle having few of many **operations** and even more if **production** is an integral cycle (eg. from log to finished furniture.

3. The product

We referred above to the production processes required to transform the wood into saleable products, but the product finds a reason for its existence in the need of the end user, a need which stimulates the market in mutual action and feedback with all the relative problems concentrated in marketing.

For consumer products this means the reality of industrial design (a premise to technical drawing) which, in the light of production facilities and object function (value analysis), appears in the various manufacturing phases detailed in "production cycles". These cycles specify methods as well as the machinery required which, among other things, must be consistent with:

a) the quantity of parts to be made in the unit of time taken as a reference;
b) assortment of semi-finished parts in production simultaneously;
c) type of supply: if a work order or for stock;
d) quality level of the product stipulated for its sale.

4. Size and siting of the factory

4.1 Economic resources (finance available, turnover, development programme, etc.)
4.2 Personnel (qualifications, remuneration, cost, availability, etc.)
4.3 Geo-economic area (climate, availability of mechanical energy, infrastructures, availability of raw and auxiliary materials, state of communications and transport, access to purchasing sources, etc.)
4.4 Organizational structure and its reaction on technical-economic management of resources such as production planning.

5. Production planning

High production costs (direct labour and social charges, material, wear and tear, depreciation, etc.) make it necessary to avoid hold ups due to lack of supplies, bottlenecks, accumulation of materials, insufficient equipment, etc., which become liabilities due to space wasting, useless handling, material in stock with interest on capital; all to the detriment of productivity, and, therefore, adding to the finished product costs.

It is,therefore, vital to foresee the problems and plan accordingly, as far as humanly possible, to eliminate delays, co-ordinate the various sequences and balance machine utilization to achieve the final objective of optimizing the resources available.

6. Layout

In drawing up a processing layout, consideration must be given to the breakdown of the product into assemblies, subassemblies, and piece parts, to co-ordinate them into the various manufacturing cycles, making them into a common flow diagram which produces the layout with its relative infrastructures. It is at this stage that much can be done to obtain optimization in the use of the machines available. Therefore, the drawing up of a layout is of the utmost importance and must take into consideration the points (a-b-c-d) mentioned under item 2. It is on these points, above all, that the choice depends as to the establishment of:

- fixed layout;
- processing layout (areas with homogeneous machines):
- product layout (machines arranged sequentially according to the manufacturing cycle);
- mixed layout(in which the requirements of the processing and product layouts are taken into account simultaneously).

A hypothetical situation worth considering, where applicable, is to build up the layout flexibly by shifting the production equipment from time to time in the sequence most suitable for production flow. Both horizontal and vertical handling outside the machine must always be carefully considered, as well as the direction of flow which should always be positive.

In addition to the correct location of machines, the subject of layout involves the suitable location of the various production departments, stores, buffer stock areas, auxiliary facilities and therefore of installations which are concerned with the layout and availability of machines.

7. Machine features

After having mentioned the context in which the machine will be inserted, we now examine the machine's specific evaluations which imply judgement of its merits as to essential content and competition with similar types or substitutes offered on the market.

Considering machines in a general schematic way, they can be subdivided as follows according to the number of tools and also the number of operations:

- single purpose (for single operation);
- multi-purpose (for multiple operations with movement of tools or of parts being machined in transfer.

According to the intervention of an operator they can be:

- manual;
- semi-automatic;
- automatic;
- numerically controlled.

Although there is a variety of machines available which offer many interesting features some are more distinguished than others mainly because of their sophistication which consists of:

- reduction of direct labour costs;
- reduction of tooling costs;
- increase in production;
- improvement in product quality;
- reduction of rejects;
- certainty of achieving planned machining times;
- possibility of entrusting to one or more persons the task of attending more than one machine simultaneously;
- reduction of required floor space.

The desire to acquire machines having these features must not cause the following considerations to be overlooked:

- high investment cost;
- possibility of increased utilization;
- technical up-dating with reflection of premature obsolescence;
- complexity with its influence on maintenance and servicing;
- tooling up times;
- times, costs and practical possibilities for programme preparation for NC machines;
- possibility of obtaining special tools and essential mechanical and electronic spare parts, even after a reasonable lapse of time.

It must be emphasized that the economic values involved make these machines convenient when they are used on a continuous basis (even on three shifts). Therefore, the purchase of a machine which is not fully exploited, or left inactive, is most unwise.

To explain the "fundamental purchasing components" mentioned in the foreword i.e.:

1) Technical productive
2) Economic
3) Commercial

an attempt is made hereunder to group the most significant points contributing to the formation of these components.

Some of the points are given placings, either multiple or apparently inappropriate, according to the classification adopted. But, rather than a sterile perfectionism, the preference has been for pragmatic description of the main concepts to which the attention may be directed for the required judgement of their merits before deciding to purchase; stress being laid on any which are worthy of attention.

7.1 Technical-productive component

7.1.1 Hygiene and safety

7.1.2 Accident prevention:

Accident source statistics, while including some collateral causes and incidental factors (2 percent), consist almost entirely of two main factors of which the human element is 88 percent and technical 10 percent.

Without doubt woodworking machines may be considered among the most dangerous, for the distracted or unskilled operator, especially if not provided with all the technically feasible safety measures. All machine producing countries have strict and precise safety regulations and machines must be sold in conformity with them.

7.1.3 Noise:

Unfortunately nearly all woodworking machines have a high noise level.

Noise assumes an important role in factory life due to its social and economic implications. It is a considerable burden and much is done to reduce it at source (on the machine itself) and to reduce its transmission

by insulating the machine and the environment with sound deadening material. Its effect on operators is also limited by means of suitable personal protective measures, with labour turnover, etc.

It is, therefore, very important to take this factor into account in the choice of machinery.

7.1.4 Vibration:

This is dangerous to human beings, makes accurate work difficult to achieve and leads to many failures in machines and environmental structures. Machines must be provided with suitable damping where necessary.

7.1.5 Protection against dust, chips, smoke, vapours, humidity and their automatic extraction. All machines should be provided with a means for connecting up to a general exhaust system.

7.1.6 Viability and illumination of the working zone and practicability.

7.1.7 Machine body designed to eliminate or minimize dangerous projecting parts and sharp edges.

7.1.8 Ergonomics of man-machine combination and physiological and functional chromatism, as regards main colour and that of individual parts, for easy and instinctive access to functions (controls, electrical and hydraulic equipment, working zone, etc.).

7.2 Toolings

7.2.1 Incidence of cost for special tools

7.2.2 Incidence of down time for tooling

7.3 Maintenance

7.3.1 Maintenance aptitude

Ease of maintenance, such as access to parts liable to failure, and possibility of easy handling of tools for rapid repairs

7.3.2 Standardization of components and spare parts and their long term availability.

The high cost of machinery does not permit the installation of stand bys and therefore the coefficient mentioned below must be kept high

$$\frac{\text{available hours}}{\text{actual hours}}$$

A failure does not only involve the burden resulting from the repair and/or maintenance operation, but also costs involved in production losses during the failure, of re-starting the machine, and of any defective production before settling down again to normal running. If it is also considered that, in some cases, annual maintenance costs are over 8 percent of the capital invested, the importance of this parameter can immediately be appreciated.

7.4 Reliability and efficiency

When it is considered that breakdown can derive from:

a) Design or be inherent (responsibility of the designer)
b) manufacture (responsibility of the manufacturer)
c) operation (responsibility of the user and influenced by operating conditions and preventive maintenance)

it is necessary to make sure, as far as possible, of long term reliability and efficiency in addition to the testing by which the performance is judged on delivery. The reliability of a machine defines the probability of its being able to function without breakdown for a certain number of hours under certain pre-established operative conditions.

The ratio between the average interval between two breakdowns (T), and T plus the average duration of a breakdown (F), represents efficiency (or availability) i.e. the percentage of time during which the machine should function without

breakdown

$$(E\% = \frac{T}{T + F})$$

Unfortunately these values and the relative technical-commercial guarantees, very important for the evaluation of costly and complex machines, are still difficult to obtain from manufacturers who have only recently commenced collecting the necessary statistical data.

7.5 Automation

- Use of reliable automatic devices for loading, clamping;
- Application of automatic loading and unloading (robot or transfer);
- Applicability of unit heads permitting a more universal use.

Due to the important function of certain automatism which could interrupt an entire production process when becoming defective, it is advisable to be generous in their application to avoid damage from hold-ups in production which could prove far more burdensome than the cost of stand by devices.

7.6 Technological features

- Overall dimensions of the machine;
- Machine weight, useful for judging stability and fatigue resistance;
- Quality of materials used and their metallurgical treatment;
- Characteristics of electric motors relative to available power supply and loads foreseen. Their intrinsic quality also regarding hermetic sealing, cooling, etc.
- Dimensioning of moving parts or those more subject to stress (shafts, bearings, bushes, gears etc.) and their accurate lubrication and cooling;

- Adequate supply of control instruments both for production and correct working of the various machine members;
- For NC machines, programmes and their management.

7.7 Technological capacity

This is specific for the operations involved. It defines operative capability (quantity and quality) of the machine for the material being used, the involvement being: forming (presses), stock removal (sawing machines, planers, etc.), coating (spreaders, automatic roller painters, sprayers, etc.) or in other words any modification to the state of the workpiece between input and output.

Among particular characteristics, operational speed and working tolerances should be underlined.

8. Economic component

8.1 Investment

- Machine purchase price plus charges for transport, customs, insurance, etc.;
- Obsolescence prospects (residual value);
- Problems concerning machine base, foundations, environmental conditions, etc.;
- Floor space and height;
- Cost of NC unit;
- Optionals;
- Cost of connections and/or alternatives or expansion of infrastructures, such as electric, hydraulic, pneumatic systems, etc.;
- Expenses involved in any modification to existing systems and moving of other machines and equipment;
- Testing and commissioning costs;
- Costs for training of personnel;
- Depreciation indexes (real and fiscal).

8.2 Management

- Operational or running costs (direct and indirect labour, breakdown costs etc.);
- Qualifications of personnel and pertinent remuneration;
- Consumption of energy for a given production;
- Facility of loading and unloading workpieces;
- Operational flexibility; maximum and minimum dimensions of workpiece;
- Reject coefficient;
- Characteristics of waste and losses due to scrap;
- Cost of floor space occupied.

9. Commercial component

Elements for commercial negotiations are fully dealt with in "General Conditions for the Supply and Erection of Plant and Machinery for Import and Export" established by the United Nations Economic Commission for Europe.

The following, however, may be considered as complementary to these conditions:

9.1 Quotation request

It is always advisable to ask for the characteristics of the supply and its price by means of a formal "Quotation request" which, attached to the "Quotation", the "Purchase Order", the "Order acknowledgement" and the illustrations (leaflets, drawings, etc.) referred to constitute the technical, economic and legal documentation of the supply. In periods of price increase, like the present, quotations should include validity and indicate formulae for possible price escalation.

9.2 Customs tariff number

It is advisable to give a precise description also for customs purposes of the machine required. In this regard several countries are working on the standardization of the

terminology defining all woodworking machines. Standardization work which is already in a fairly advanced state of development is being carried out by EUMABOIS.

9.3 Specifications

The quotation request should include the technical specifications to which the machines intended to be purchased should conform. These specifications should be drawn up by the purchaser and should refer to well known specifications (eg. SCHLESINGER, STANIMUC, NAS for NC machines).

9.4 Documentation

According to the complexity of the supply, adequate documentation should be included in the appropriate language and comprise:

- installation layouts;
- wiring diagrams;
- operating manuals;
- maintenance manuals;
- programming manuals for NC
- illustrated list of spare parts;
- stock cards.

9.5 Delivery scheduling of machinery or equipment

It is essential that careful programmingas to delivery of various items of equipment be the subject of advanced programming so that a mistake does not occur whereby an item may arrive on the scene far ahead of one which must first be installed to allow that particular piece to become operative or effective. If such a programme is not properly adhered to it can very well be that certain pieces of

equipment or machinery may arrive well in advance of its scheduled time for installation and consequently may be subject to damage due to having to remain in either a crated or uncrated condition for a long period of time unprotected from local weather conditions at the plant site. In such cases damage could result due to rusting, dust particles, or even pilferage.

Annex VIII

TIMBER DRYING METHODS AND EQUIPMENT

Extract from paper read by F.J. Christensen
UNIDO Expert in Wood Drying and Preservation

8th World Forestry Congress, October 1978

A variety of drying methods, ranging from simple to sophisticated to suit divergent needs, can be applied to those building members that need to be dried to a greater or lesser extent before installation in service. The size of the drying operation, the capital investment and drying costs involved, and the extent and rapidity of drying required are the principal criteria to be considered in the selection of a particular system or combination of system. For Indonesia's hot humid climate, the best possibilities are:

- Air drying;
- Forced air drying;
- Pre-drying;
- Kiln drying.

Air drying

This is the simplest, but frequently not the cheapest method of drying timber, although it is the usual starting point in the development of commercial drying facilities.

In its basic form, capital investment for facilities is low but comparatively high for stock, particularly for slow drying species and thick material. Air drying rates are retarded by unfavourable weather conditions, eg. during the wet monsoon when relative humidities are generally high and timber stacked in the open is repeatedly rain wetted. The latter can be largely counter-

acted at the expense of placing stacks under cover. During periods of high relative humidity, fungal attack can commence in timber even in stickered stacks unless the timber is protected by dipping or spraying it with fungicides after sawing, prior to stacking.

With air drying, the minimum moisture content attainable is the EMC value determined by prevailing meteorological conditions. Rate of drying especially from about 30 percent moisture content downwards, becomes progressively slower as wood moisture content decreases. Also, there is a potential economic loss from drying degrade, predominantly in the top layers and outermost boards along both faces of the stack.

In spite of these disadvantages, air drying is widely practiced in most countries and gives a generally satisfactory result.

Forced air drying

This method differs from conventional air dying in that ambient or heated air is forced through timber stacks either by mobile fan units placed between two or more covered stacks in an air drying yard (yard dryers) or by fixed fans installed in one wall of a simple enclosed shed in which the timber is placed. In both cases, air flow is across the width of the stack. A velocity of about 0.5 - 1.0 m/s through the stack is adequate.

For the shed type units, more even circulation is obtained by sucking not blowing air through the stacks. This is usually a single pass operation but, if required, air can be recirculated by somewhat modifying the basic design. In this case, the unit can be designed to accelerate drying at virtually no extra cost by utilizing the good potentialities for solar heating in tropical countries. Operation of fans can be monitored by a hygrostat control system designed to stop them whenever the relative

humidity rises above 90-95 percent when drying rate diminishes markedly, or falls below 35 - 40 percent to avoid the risk of checking.

In general, forced air drying tends to be faster than conventional air drying and minimizes variations in drying rates throughout the year caused by seasonal fluctuations in climate. This results in more uniform production rates and reduces timber stock holdings. Drying degrade is also reduced. Capital equipment costs are minimal in terms of the advantages to be gained. The principal direct operating cost is powering of the fans; maintenance costs are generally low.

Thus, in tropical countries, there are manifold advantages in exploiting the use of relatively simple and inexpensive forced air dryers, which is a logical development in the process of providing suitable drying facilities for building timbers, particularly since mixed species and thickness of timber can be dried together in the same unit without reservation.

Predrying

This is a method of further accelerating rate and quality of drying at about half the capital investment cost and two-thirds of the operating costs of kiln drying for both green and partly air dried timbers, taking into account the longer drying times and greate holding capacities required for predrying than for kiln drying. It is frequently used as a preliminary to kiln drying.

Timber is dried under controlled and generally fixed psychrometric conditions, usually at comparatively low dry bulb temperatures to lower moisture contents, if necessary, than is attainable with either air drying or forced air drying without heating. In general, predrying is faster than either of these methods but depends on schedules used. Design air velocity is about 1.5 m/s through the stack.

A predryer is a multi-line unit having but a single air circulation, heating and humidification system, wherein the savings in equipment and operating costs are principally made (Wright, 1954). A steam is not essential for heating and humidification, high capital and operating costs for steam plant can be avoided. Heating can be effected indirectly by exhaust gases from oil or waste wood burners, and humidification by atomized water sprays. Again, different thicknesses of timber can be dried simultaneously. Timber holding capacities of up to 500 m^3 can be provided.

Generally, predrying is of greatest interest to the larger processor concerned with minimizing capital investment for equipment and stock, maintaining constant production rates at all times, and having the facility of drying to lower moisture contents to capture ... ial markets for his products.

Kiln drying

The principles are similar to predrying but with the following essential differences: drying conditions are continually changed in a set pattern according to species and stage of drying reached; a wider range of drying temperatures and relative humidities are used; faster drying rates are attainable, particularly during the latter stages of drying; different thicknesses of timber cannot be dried satisfactorily in the one kiln charge; different species can only be dried at the same time if their drying characteristics are similar or schedules are chosen to suit the most difficult to dry material.

The comparatively slow drying times of many broad-leaved species generally make it uneconomic to kiln dry them from the green conditions, since drying costs are directly related to kiln residence times. This is particularly relevant to 40 mm or thicker timber. Therefore, the usual practice is to dry such species

to about 30 percent moisture content by one or other of the methods already described before kiln drying is commenced.

Kiln drying schedules have been published for an estimated 10 percent of the commercially important species in Indonesia, principally by the Forest Products Research Institute at Bogor and the Forest Products Research Laboratory at Princes Risborough. England (Pratt, 1974). Although it is considered to be important to continue research on the determination of schedules for other economically important groups of species, optimization of schedules for other conditions will depend to a very great extent on how well mixed sawn timbers can be identified, either into individual species or groups of species with similar drying characteristics. Unless this can be done the only alternative is to use a (slow drying) universal schedule that will limit the development of drying degrade to acceptable levels in the most susceptible species. Invariably, such an approach will increase drying costs by maximizing drying times and minimizing kiln throughput.

There are many different types of prefabricated and custom built kilns with basic and important differences in design. The two board classes are compartment and progressive kilns. Briefly, in compartment kilns static stacks of timber are subjected to drying conditions that are regularly changed in a set pattern according to species and stage of drying achieved, whereas in progressive kilns stacks of timber on wheeled trucks are placed in the green end and progressively moved on a stack for stack basis to the dry end, during the course of which the drying conditions are gradually increased in severity. In contrast to compartment kilns, which have an inherently high degree of flexibility for handling a wide variety of drying of long runs of timbers of one thickness and with similar drying characteristics

and initial moisture contents. Thus, both classes of kilns merit consideration for the drying of sawn building timbers in Indonesia.

Uniformity of drying is greatly influenced by the rate and eveness of air flow through all of the stacks in a kiln charge. In respect of compartment kilns, cross-shaft kilns are generally better in this regard than longitudinal-shaft kilns, assuming both are competently designed. Means should be provided for periodically changing the direction of air circulation during the drying process, so that variations in the final moisture content of individual pieces of timber are minimized. For broad-leaved species, a velocity of 1.0 - 2.0 m/s through the stack is recommended compared with 2.5 - 5.0 m/s for conifers (depending on the drying temperature used). In progressive kilns, air circulation is unidirectional and should have a velocity of 0.75 - 1.0 m/s.

There are a number of other factors important to the proper functioning of kilns, but it is not appropriate to do other than list them here: heating systems and media; humidification and venting; structural and sheathing materials; doors and seals; control and handling systems; maintenance requirements and facilities.

Timber drying kilns are applicable to the needs of small to large processors. But as investment and operating costs are relatively high, there is need to give careful consideration to whether kiln drying is really the best method or whether one of the less sophisticated methods is right for a particular application.

Annex IX

SUGGESTIONS FOR CONTROLLING FUNGAL DISCOLORATION IN RATTAN

Rattan includes some species of climbing palm (calamus spp.) which are usually found growing in the low and medium altitudes of Indonesian forests. A typical rattan stem, cut into poles, has a diameter which ranges from 1 to 1-3/4 inches. Ordinarily, it is cut into poles of 5 metres long for commercial use. Because of its remarkable pasticity when heated, the stem can be bent into different desired forms for chair or table frames. When split, the skin or rind may well serve as wrapping cord and tying material for rafting purposes. Strips from the stem of certain varieties may also be used for baskets, woven seats of chairs and various other uses.

However, like other industries, the rattan industry too has its own problems. One of these is fungal discoloration of rattan poles. Although it is generally conceded that Indonesian rattan is as good if not better than those obtained elsewhere in South-east Asia in quality, poor methods of gathering and processing it from the forest, coupled with a lack of proper care and handling in seasoning and storage, often reduce the quality of the poles. Unless properly handled and treated immediately after cutting, rattan is always subject to attack by staining fungi which cause blue and dark spots or streaks on the surfaces of the poles.

Blemishes in rattan are caused by certain fungi (Ceratocystis sp. and Diplodia sp.) which heavily infect the rattan tissue with colored vegetative structures, known as hyphae. Most of these discolorations are caused by soluble pigments which are given off by the fungi and taken up by the cell walls of the substrate.

In some instances, however, the pigmentation of the fungus filaments may contribute to the discolorations. The pigmented hyphae penetrate deeply the rattan tissue and produce subsequent blemishes which cannot be removed even by scraping.

The staining fungi produce spores which float in the surrounding air. Once the spores get in contact with the cut ends and bruises of green rattan poles, they germinate so fast that hyphal penetration may go as deep as 50 mm in 24 hours. The spread of the hyphae continues as long as the moisture in the poles remains favourable for the growth of the fungi. However, fungal growth is inhibited when the moisture content of the rattan is below 20 percent.

Points in preventing staining of rattan poles

1. If possible, harvesting of rattan should be done during the dry season when weather conditions are favourable for the cutters to treat the poles with fungicides. Many rattan cutters leave their poles in the woods for as long as three weeks without treatment, which causes heavy loss due to degradation occasioned by staining.

2. Rattan canes that are cut in the forests should be transported to the treating depot before the canes are dried and processed either for local use or for export.

3. Transportation of rattan poles from the forest to the treating depot should be done on the same day when the poles are harvested for dipping in anti-stain chemical solution. This should be done in order to protect rattan poles from initial infection. If the dipping is made within 24 hours, after cutting, the effectiveness of the anti-stain chemical solution is high.

But it is preferable to effect that treatment at least within 12 hours after cutting so as to ensure complete protection from staining fungi. Further delay in dipping will reduce the effectiveness of the chemical treatment against stain infection.

The anti-stain chemical solution, consisting of Dowicide G[1/] with a concentration of approximately 0.84 percent by weight (0.63 percent pentachlorophenate) or 3,18 kgs of the chemical per 378,53 litres of water, has been found to be effective. When applied properly it is effective in controlling rattan stain provided, of course, that the poles are properly handled before and after chemical treatments. To maintain a relatively consistent concentration, the solution should always be stirred thoroughly before rattan poles are dipped into it. The tank which contains the solution should be covered to protect it from the rain.

4. If it is not possible to bring the harvested poles to the treating depot on the day when they are cut, preliminary dipping in the chemical solution should be done in the cutting area soon after cutting to minimize the risk of infection.

5. The poles to be treated should be hauled to the treating depot,scraped, then dipped for one to two minutes in the Dowicide G solution.

6. Clean and sanitary conditions in the treating depot should be observed strictly. No rattan trimmings or scrapings should be scattered in the area. A good practice is to gather this waste and burn it; otherwise, it provides an excellent place for harbouring and propagating the staining fungi.

7. The treated poles should be air-dried by end-racking. While being air-dried, the poles should be protected from the rains

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1/ Dowicide G is said to consist of 75 % sodium pentachlorophenate, 13% sodium salts of other chlorophenols and 12% inerts. There are other chemicals in the market which are being used for the control of stain in logs and lumber. Some of these chemicals have been tried on rattan but data accumulated regarding their performance are still too limited to warrant their effective use.

to prevent washing away of the anti-stain-chemical solution. When the poles are thoroughly dry, they should be sanded for smoothening and subsequently subjected to another and final anti-stain-chemical treatment. It may be suggested that, during this last treatment, an insecticide be added to the anti-stain-chemical solution to protect the pole from both stain and insect attack. These poles should be air-dried in a well ventilated and sheltered storage place by the end-racking method for about a month until the moisture content is below 20 percent. Once the poles are dried continuous efforts should be exerted to keep them dry, especially when they are in transit.

Before shipment for export to foreign countries, the poles should be wrapped in thick-water-repellent paper or other materials that will protect and minimize moisture pick-up of the poles while aboard the ship.

It should be borne in mind that once the staining fungi have penetrated rattan poles beyond the reach of the chemical solution recommended, cure and prevention of fungal staining becomes impossible.

All poles should be treated with pentachlorophenol or saline solution to safeguard against insect borers.

Annex X

JOB BREAKDOWN CHECKLIST FOR MANAGEMENT

1. Marketing and sales

- Plan and maintain sales of the company's products to its home and export markets;
- Design and maintain a suitable and profitable price structure for the company's products;
- Budget and control advertising expenditure;
- Plan and control special promotions: in particular show-room displays (permanent or otherwise);
- Plan and control selling costs budget;
- Set targets for domestic and export sales and maintain or adjust them;
- Review the popularity and profitability of each product and plan suitable times for discontinuing lines;
- Advise on the introduction of new products, prepare marketing specifications;
- Negotiate terms for bulk purchases and prepare a list of incentives for bulk purchasers (eg. contract sales);
- Maintain good customer relations: design and maintain a system for after-sales service;
- Design and maintain a method for the internal administration of the sales function;
- Maintain close liaison and good relations with the other main functions of the company especially product design and development, purchasing and production.

2. Design and development

- Prepare designs for new models;
- Prepare detail and assembly drawings;
- Provide information for estimating costs for new designs;

- Prepare material specifications;
- Make prototypes and develop each new design to the manufacturing stage;
- Design appropriate jigs, fixtures and other production aids;
- Prepare manufacturing instructions;
- Integrate activities with other departments;

3. Purchasing and raw material stock control

- Prepare purchasing budget;
- Order materials;
- Check contracts and improve sources of supply;
- Store materials and record issues and receipts;
- Establish and maintain a stock control system;
- Control stock;
- Check incoming materials and reject those below standard;
- Dispose of scrap, surplus materials and plant.

4. Production planning

- Construct a production programme;
- Prepare production budgets;
- Revise production programme where necessary;
- Balance production staff to meet programme;
- Requisition material from stores or yard;
- Provide technical estimates;
- Investigate and introduce new production techniques.

5. Production

- Produce according to specification and agreed production levels;
- Establish and maintain work standards;
- Determine and maintain machines, equipment and handling systems;
- Keep methods and layout under review and simplify operations where possible;
- Ensure that the factory's capacity is being effectively used;

- Record production and the issue of production materials;
- Liaise with product development and sales on the introduction of new models;
- Maintain quality control;
- Inspect products;
- Advise on machinery and equipmen needing overhaul;
- Devise ways to improve quality and reduce waste within cost and performance standards;
- Control costs by effective utilization of manpower and materials.

6. Maintenance

- Organize and maintain plant register;
- Prepare preventive maintenance check-sheets for all machinery, equipment and buildings;
- Maintain register of checks on dust extraction systems, handling equipment and transport system ;
- Carry out repairs to plant and machinery.

7. Rattan and wood storage yards

- Plan storage layout;
- Determine and implement yard procedures;
- Arrange staffing and recommend any capital investments needed;
- Establish and implement a system for checking and reporting faulty material;
- Arrange appropriate transport system

8. Administration

Accounting

- Prepare annual financial plans reflecting the company's policy;
- Co-ordinate departmental budgets;
- Provide financial information required by the management;

- Maintain an administrative system to monitor actual performance against budgeted forecast;
- Pay salaries, wages and other emoluments;
- Arrange collection and payment of debts;
- Keep accounts in accordance with the company's requirements;
- Carry out internal check system to safeguard company's assets.

Office

- Establish and maintain office procedures;
- Investigate and implement improved systems;
- Authorize/recommend purchases of new equipment.

9. Personnel

- Engage new personnel;
- Assign personnel to jobs so that the best use is made of them;
- Arrange transfer between jobs;
- Review pay and authorize changes in rates of pay;
- Review performance;
- Ensure all workers receive adequate training for their existing jobs;
- Develop the potential of workers with the ability to do more senior jobs;
- Inform workers regarding department or work area rules including security and safety arrangements;
- Take disciplinary action within area of responsibility;
- Deal with problems raised by individual workers;
- Give leave of absence;

10. Safety, fire and health:

- Establish and administer safety rules and ensure that they are complied with;
- Prepare and submit reports on accidents;
- Establish and administer fire precautions and ensure that they are complied with;
- Maintain standards of working conditions.

Annex XI

STANDARD SPECIFICATIONS FOR FURNITURE PRODUCTION

The Yugoslav example

The quality of a product may be defined as the sum total of its most essential characteristics which determine its degree of suitability for a particular purpose. The role of those responsible for the establishment and maintenance of quality control is to provide and co-ordinate a system which ensures that the operation will produce an optimum quality product at minimum product cost. Their actual responsibilities are to define, plan, coordinate and measure the quality efforts of the enterprise, as well as to perform those activities normally associated with the quality control function. Quality cannot be inspected into the product but must be designed and built into it. It is essential therefore that the organization responsible for quality control should have the organizational freedom to identify and evaluate quality problems and to initiate, recommend and provide solutions.

It has been proved in practice that quality and standard specifications are becoming more and more interdependent and complementary. The most important tendencies in this respect are as follows: standards containing quality requirements and test methods are increasing; the level of quality requirements stipulated in standard specifications is rising; quality improvement increasingly necessitates that quality requirements regarding materials and final products should be stated; quality requirements presented in standard form are playing an ever-increasing role in the exchange of goods and technical processes.

Countries are not interested in quality to a very significant extent. This can be regarded as the result of a connection between balance of trade and exports on the one hand, and, on the other, the fact that the most decisive pre-requisite for successful export is product quality. Investment alone will not ensure a speedy development of exports unless it is accompanied by appropriate technical know-how, skilled workers and management to operate the enterprise, and above all the existence of effective quality control based in established standard specifications.

In the case of the furniture industry in Yugoslavia the responsibility for evolving such standards rests with the Institute of Technology in Sarajevo. It has recently outfitted, with international assistance, a standards and testing department which has the function of testing the quality and performance aspects of furniture and its various materials and accessories and will advise on the elaboration of standards for furniture, joinery and their components including textile materials, upholstery materials, adhesives, surface coatings and plastics. This department also assists in the establishment of quality control procedures among the many furniture and joinery plants primarily in Bosnia and Herzegovina and will train others in their application.

The definition of an acceptable level of quality in relation to furniture production is based on a number of existing standards, including those prepared by the Yugoslavia Standards Institute (JUS). These standards have been adopted, and in some instances elaborated upon for use by the industry in form of a standards handbook. The work done by the expert and the select committee set up to prepare the handbook should be regarded as only a beginning. the committee itself should be given permanent status and the task of further developing the handbook on the basis of industry reaction and support. The committee should also be further streng-

thened by the inclusion of representatives of every sector of the industry, particularly at policy-making level, and it should be given the full support and encouragement of top management.

A. Furniture quality

Furniture is classified into three quality groups. In the first group is furniture that complies with the requirements for fundamental quality. Furniture in the second group complies with requirements for higher quality. The third group is for furniture that complies with requirements for particularly high quality.

Quality wooden components used for furniture production are classified at four levels;
Level A: the component must not have any defect or imperfection which could influence the use and appearance of the furniture;
Level B: the component must not have any defect or imperfection which could influence the use of the furniture, but it may have a small number of defects provided it affects appearance only;
Level C: the component must not have any defect or imperfection which could affect usage, but it may have additional defects or imperfection provided they affect appearance only;
Level D: the component must comply with hygiene requirements and must not have any sharp projections which could cause damage or hurt. This requirement applies to parts of furniture that are hidden or covered with another material.

Changes in the given quality levels may be introduced only for special aesthetic reasons. Certain levels may include: requirements defined for the levels. For example, level A covers all special requirements defined for levels B, C and D. Requirements for materials and quality of performance for one product may be different for different parts.

B. Materials for furniture production

Table 1

POSSIBLE DEFECTS AND IMPERFECTIONS FOR DIFFERENT QUALITY
QUALITY LEVELS OF SAWN TIMBER

Possible defects and imperfections	Quality group			
	A	B	C	D
Bark	1	1	1	1
Bast	1	1	1	1
Damages caused by insects	1	1	1	1
Decay	1	1	1	1
Dead knots	1	1	1	1
Pitch pocket	1	1	1	1
Live knots	1	1	1	2
Scar	1	1	1	2
Fustiness	1	1	1	2
Sapwood 1/	1	1	1	2
End check	1	1	4	2
Surface check	1	1	4	2
Inner check	1	1	3	3
Cluster knots	1	6	2	2
Wild grain	1	6	2	2
Wood in compression and tension	1	6	2	2
Water-saturated wood	1	6	2	2
Variations in colour of wood	1	6	2	2
Knots	8	7	5	2
Repaired [illegible] and holes	1	1	2	2
Honeycombing	1	1	2	2

Note : (1) no; (2) Yes; (3) permitted only if they do not effect chemical characteristics; (4) only small or filled checks are permitted; (5) permitted for surfaces on projecting parts with non-transparent coverings; it must not have knots that are visible after treatment; holes must be repaired and sanded including intergrown knots of less than 20 mm.; (6) permitted at one place only; (7) only knots of less than 20 mm in diameter are permitted; (8) projecting parts must not have knots, while other parts may have only intergrown knots of less than 7 mm.

1/ Broad-leaved species with evident sapwood and medulla (oak, poplar, mahogony, palisander, but not walnut).

Face veneers must comply with the following requirements:
Level A: same requirements as for timber and furniture parts;
Level B: same requirements as for timber and furniture parts, differences in colour and texture not permitted;
Level C: same requirements as for timber and furniture parts, darker and lighter shades also permitted, different textures, holes or open checks not permitted but may be repaired;
Level D: same requirements as for timber and furniture parts.

Laminated wood must comply at all levels with the same requirements as for timber and veneer.

Veneered boards must comply with following requirements:
Level A: same requirements as for timber and face veneer, sheets of veneer must be joined in such a way that differences in colour and texture are not visible;
Level B: same requirements as for timber and face veneer;
Level C and D: must comply with JUS D.C5.041 requirements.

Particle board and fibreboard must comply with the following requirements:
Level A and B: rough or other spots are not permitted;
Level C and D: must comply with JUS D.C5.031, grade I requirements.

Laminated plastics and upholstery materials must comply with the manufacturers' requirements. Webbing should be made from flax, hemp or jute. Alternatively, polyester fibre webbing of 50 mm in width may be used. If rubberized webbing is used, it should have a breaking strength of not less than 14 N per mm of width. Rubber webbing should have a breaking strength of not less than 20 N per mm of width. Webbings should be used in accordance with the manufacturers' instructions.

All the foams are tested according to the following standards: JUS G.S2.410-1967, JUS G.S2.421-1966, DIN 53420, DIN 53577, DIN 53572 and DIN 53571. Polyurethane foam trade marks should be tested in accordance with the above-mentioned standards. Crumbled foam should be well bonded and free from skin. Latex foams should be tested in accordance with the above mentioned standards and conform to the requirements of British standard 3129:1595 concerning latex foam rubber components for furniture. Flock for upholstery filling shall not contain more than 1.8 percent soluble extractable matter when tested by British Standard 1425:1960 concerning cleanlines of filling for bedding, upholstery, toys and other domestic articles.

Sewing thread for upholstery should have a breaking strength of at least 20 N and be suitable for the upholstery fabric with which it is used. Other upholstery materials such as webbing, cotton, textiles, various regenerated materials etc. should be used in accordance with manufacturers' instructions. All springs should be manufactured from hard-drawn carbon-steel wire and given a heat treatment at approximately 250°C in order to relieve the stresses set up during cooling.

Adhesives consist of dry matter, solvent, filling, hardener as well as some other elements that make them resistent in various conditions of utiliztion.

Phenolic glue, urea-formaldehyde, polyvinyl acetate should be used for the gluing of wood. Phenolic glue is a mixture of phenol-formaldehyde resin in water or organic solvent (acetone, ethanol) with or without hardener and eventually with other additives. It is primarily used in the production of water resistant plywood and wood in layers. The glue should comply with the requirements of JUS H.K.2.024-1964. Urea-formaldehyde is a mixture of water solvent of ureaformaldehyde resin with hardener and eventually with other additives. It is used for glueing of assemblies and in board manufacturing. Adhesive should comply with standard JUS H.K2.023-1954. Polyvinyl acetate dispersional glue is a colloidal dispersion

of PVC synthetic resin in water with chemical additives. It is primarily used for the glueing of assemblies. The adhesive must comply with the requirements of JUS G.K2.031-1964.

C. Quality Standards

Performance

Timber for furniture production must have a moisture content of 8 ± 2% with regard to shrinkage, and should be somewhat longer than planned in the finished product. Permitted tolerances are ± 1 mm for level A and ± 1.5 mm for levels B, C and D. The following deviations from the right angle are allowed: level A: - 0.4 mm for 400 mm or 1 mm for whole length between two angles; levels B, C and D: -0.6 mm for 400 mm or 1.5 mm for whole length between two angles. Imitation of wood is permitted (if pre-determined in the technical description).

With regard to elements, the following requirements must be fulfilled:

Level A: joints must be strong and close-fitting, discoloration caused by glue is not allowed: joining fixtures - nails, screws, tenons, etc. - must not cause bad joining, and must be accessible and visible in half-hidden places.

Level B: joints must be strong, even poorly fitted joints are permissible to a reasonable extent; materials for joining must be treated like those for level A, except when used as decoration, in which case they must have rounded edges and be well protected: lesser discoloration and, to a small extent, the appearance of glue on the joints are allowed.

Level C: small clearances are allowed; materials for joining must not be visible on the surface.

Level D: clearances caused by tensions during construction or by shrinkage are allowed under special conditions. Furniture intended for use in the open air must be made of materials that can withstand such conditions.

With regard to veneering, the following requirements must be fulfilled:

Level B: veneering must be strong,glue must not be visible except to a small extent; texture, structure and colour of veneer must be approximately the same as other wood components; changes in colour of veneer because of penetration of glue are permissible to a small extent; sanding-through of veneer is not permissible; it may occur only on hidden places and even then must be carefully corrected.

Level C: veneering must be well done so that veneer is glued to the total surface; broken parts of veneer, splits and blisters are not permissible.

Edges must comply with the following requirements:

Level A: edge veneer must be of the same species of wood and, if possible, the same colour as the surface; glue must be applied evenly on the whole surface; it is best to protect edges by using the same species as the surface.

Level B: painting of edges is permissible only if the surface is painted or if an aesthetic effect is needed; particle board and fibreboards must not have damaged edges.

Level C: edges that can be broken must be protected with edge veneer.

Outside surfaces are subject to various requirements. Bow specifications are indicated below:

Level A: 0.2 percent space between two angles,up to 2 mm

Level B: 0.2 percent space between two angles, up to 3 mm

Level D: no part of furniture should have honeycombing so insufficient as to cause it to be unusable.

Allowed deviation from the surface is measured by ruler. At level A, visible traces of sanding and rough surfaces caused by distortion of the fibres are not allowed.

Twist specifications are as follows:

Level A: 0.2 percent from longer outer edge to 2 mm.

Level B: 0.3 percent spacing between two angles to 3 mm.

Level D: no part of furniture should have honeycombing so insufficient as to cause it to be unusable.

Allowed deviation from surface measured with ruler: at level A, 0.4 mm for 200 mm ruler, or 0.2 mm for 50 mm ruler; at level B, 1.0 mm for 200 mm ruler, or 0.2 mm ruler.

With regard to evidence of processing, the following points should be noted:

Level A: visible traces of sanding and rough surfaces caused by distortion of the fibres are not allowed.

Level B: marks of tools and materials for sanding are not allowed; wooden arm rests must have rounded edges.

Level C: surfaces must be smooth; tool marks and material for sanding are allowed only to a very small extent.

Controls

Before testing and measuring, products must be kept in the air at a temperature of 20°C (± 2°C), and at a humidity of 60 percent (± 5 percent). For control measurement, various measuring instruments and calibrators are used. The accuracy of measuring instruments must be greater than 1/5 of the permitted tolerances where the object is measured, When the width of the joints is measured, the object is put on a horizontal base whose deviation from the surface must not be greater than 0.05 percent of the distance between two angles. Given measures are recorded in the report on testing with all limit values.

Measuring of straight lines is controlled by calibration or steel metres. The smallest and largest width of a joint is measured with an auxiliary measuring instrument such as comparator, calibrator and similar devices; the difference between these two measurements gives the measured deviation.

Clearances of the same kind are measured in the above manner; the middle value of these two measurements is used for comparison purposes and gives the degree of accuracy. The biggest difference in width is recorded in the report as the difference between joints of the same kind.

For angle control, a protractor of 90° is used with a side of 400 mm. Angles are not controlled if edges are shorter than 400 mm.

For bow control, a ruler with two feet and a comparator are used. The ruler is placed in a position so that one foot is at an angle to the board and the other is moved so that distances between two adjacent edges are measured. Measuring is done at all outside edges as well as on the diagonal. On surfaces without angles, four defined points are selected. One straight line of less than 200 mm, a ruler of 50 mm is used.

For twist control a straight edge with two feet and a comparator are used. The surface is measured so that lines of edges are in the horizontal or vertical face. Deviations from horizontal or vertical faces of particular edge line are measured with a straight edge and a comparator and given as a measure of outside twist. For surfaces without angles, four defined points are selected.

For outside rough points, a straight edge of 50 mm and 200 mm, a comparator and similar instruments are used. The straight edge must be parallel to surfaces at different places and in different directions as long as the largest deviation is shown.

Other applicable standards are indicated below:

JUS D.C5.031: particle board, boards for general use;

JUS D.C5.041: veneered block boards - structure, characteristics and classification;

JUS D.E2.042: sample for testing furniture quality;

JUS D.E2.042: furniture quality requirements;

JUS D.E2.060: furniture for storage - durability of drawers;

JUS D.E2.061: furniture for storage - stability.

FURNITURE MANUFACTURE

The manufacturer ensures that all the production materials comply with specification standards, and, for inspection purposes, maintains documentary evidence of such compliance. He must have adequate facilities for the storage of materials and furniture production, and satisfy himself by regular periodical tests that the furniture conforms to specification requirements.

If requested by the purchaser, the manufacturer should make good or replace without charge any article in which defects appear within a period defined from the date of delivery, provided that in the meantime the article has been subjected only to fair wear and tear and reasonable storage conditions. Official regulation 38/77 defines the guarantee period and conditions and requirements for testing.

A. Cabinet furniture

The carcass of cabinet furniture shall generally be constructed using one of the following three methods of construction or a combination of these: frame, stool and box. The measurements given in this chapter are minimum finished dimensions unless otherwise stated.

Framed Construction

A framed construction consists of components which are joined together. The components are made from frames to which facings are glued or to which panels are set in.

The frames are of solid hardwood 45 mm x 18 mm in cross-section. The joints of the frame are mortised and tenoned or dowelled: for double-faced frames, corrugated fasteners of galvanized steel may be used. Cross rails of 38 mm x 16 mm hardwood are used if the area within the frame members is over 0.75 m^2 and 3 mm plywood is used as facing. Alternatively, if a 5 mm plywood facing is used, the area may be up to 1.1 m^2 without a cross rail.

The facings are of plywood or faced hardwood of 3 mm thickness. Where frames are double-faced, the closed spaces are ventilated. Where glass is used in panelling, the frame is made of show wood. The glass is held in place by slips pinned or screwed to the frames. The adhesive used to attach the facings to the frames is of polyvinyl acetate or urea formaldehyde type.

The components are joined together by one of the following methods: knock-down fittings, not more than 300 mm apart; slips of 18 mm x 18 mm glued and screwed to both stiles; pocket screws, not more than 300 mm apart; dowelling and glueing.

The length of screw used is such that, when inserted, about half the length is located in each component joined; the point of the screw must not come closer to the face than 6 mm.

The corners formed by the components are finished in such a way that the framing, if not made of show wood, is covered by a lipping or edge veneer. When facings meet at a corner, they are mitred to show a clean arris. Components forming projecting tops, unless made of show wood, have lipped or veneered edges. The edges of all plywood apron pieces, mouldings, shaped tops or bottoms are supported all around.

Stool construction

A stool construction consists usually of four main corner posts to which rails are attached, thus giving a rectangular framework. The joints of the legs to the frame or top are of one of the following types: mortice and tenon, bridle joint, halving joint, mitre joint, dowelled joint, housing joint, combed joint or knock-down fitting.

For stool supports for carcases the legs are joined securely to a base frame or form an integral part of the carcases or, alternatively, are securely attached to a specially-strengthened part of the carcase. The size and cross-section of the legs and rails are related to the type of furniture and to its end use. The stool bases are fixed to the carcases by pocket screws, dowels or glue blocks.

Box construction

Usually a box construction is used for carcases. It consists of wide boards joined at the ends to form a rectangular box-like structure. Board of one of the following types is used: 20 mm solid timber, 16 mm particle board, 16 mm blockboard or 12 mm plywood. Nails are used for fixing the structural components together. Fixed divisions are not housed into the face of particle board but may be dowelled or glued into it. Internal divisions are fixed to the outer shell in such a way that the strength of the sides of the carcase is not adversely affected. Backs are grooved in, rebated and screwed or pinned and glued. Unsupported backs of up to 0.75 m^2 are of 3 mm plywood or hardboard, and unsupported backs of up to 1.1 m^2 are of 5 mm plywood. Backs of greater area are supported by muntins (hardwood reinforcing members) or by extruded metal H-sections.

Lipping of edges with wood is done in one of the following ways: veneered or edged using at least 0.5 mm veneer; hardwood lip glued to the edge; edge foils.

Bedsteads

Head-boards of bedsteads are of solid timber of 18 mm thickness or consist of single - or double-faced frames of 40 mm solid timber glued to 5 mm plywood. Where the frame is shaped, the rail must not be less than 40 mm at any place. Cross rails are spaced at not more than 45 mm from centre to centre. The frames are mortised and tenoned, dowelled or tongued and grooved. Legs measure 38 mm x 38 mm and are attached to the head boards by dowels or screwed with at least three countersunk screws.

The rails, if made out of solid timber, measure 100 mm x 25 mm and are attached to the legs by knock-down fittings. Rails for spring or upholstered bases will have timber of 38 mm x 25 mm screwed and glued to the inside to serve as a support for the spring or upholstered

Webbed fr.. s will be made of rails of 75 mm x 50 mm. Two steel u-bars or two 50 mm x 50 mm hardwood rails, reduced in section to allow for depression of the mattress, will be provided to hold the side rails apart.

Tables

The cross-section of legs for tables having no under-frame is as follows: 45 mm x 45 mm for table tops of less than 1 m^2;

50 mm x 50 mm for table tops of up to 1.5 m^2, 60 mm x 60 mm for table tops of more than 1.5 m^2. The cross-section of the frame rails for tables having no under-frame is 90 mm x 22 mm.

Extendable tables will have a locking device to lock the extension into place. Frames for extendable tables and frames of tables with solid timber tops will be fitted with corner blocks. Tables fitted with drawers will have rails of 115 mm depth.

Table tops

Table tops of solid timber are connected to the frame by a method which permits lateral movement (expansion or contraction).

The thickness of table tops is 18 mm for solid timber tops, 12 mm for plywood tops, and 18 mm for unveneered particle board tops. Cross rails are used to support the top when the unsupported area of the top is over 0.75 m^2. Tops are secured to the rails by screws.

Edges of plywood or particle board table tops will be edge-veneered with solid hardwood lips of 3 mm thickness.

Components

Shelves

All loose shelves will be reversible. Solid timber shelves of up to 900 mm in length will be 25 mm thick. Shelves will be provided with an intermediate support. The thickness and maximum lengths of shelves of plywood or particle board will be as recommended by the manufacturers.

Drawers

Front: The front will be of solid hardwood or plywood of 12 mm thickness, or of 16 mm-thick particle board.

Sides and back: For an internal drawer area of less than 5 dm^2, 6 mm thick solid wood is used, for an area of 5 dm^2 to 16 dm^2, 9 mm thick solid wood or plywood, and for over 16 dm^2, 12 mm-thick solid wood or plywood. If the side of the drawer is grooved to take a runner, the side is 12 mm thick and the depth of the groove is not greater than half the thickness of the side.

Bottom: For internal drawer area of less than 5 dm^2, 3 mm plywood or hardboard is used, for an area of 5 dm^2 to 16 dm^2, 4 mm plywood or hardboard, and for over 16 dm^2, 5 mm plywood or hardboard. The bottom of drawers wider than 600 mm are reinforced with a central muntin (hardwood member) of 45 mm x 16 mm solid hardwood. Grooves will be provided in the sides and front to retain the bottom in place. The depth of the groove will be not more than half the thickness of the sides. Alternatively, drawers may have the bottom grooved half-way into a 9 mm fillet (hardwood strip) glued to the sides.

Joints: Front-to-side joints are dovetailed, lock-jointed, comb-jointed or dowel-jointed, back-to-side joints are dovetailed, lock-jointed or comb-jointed;the back may also be held in grooves of a depth which is half the thickness of the sides; the grooves are 12 mm from the end of the sides.

Kickers and runners: Kickers and runners will be of hardwood to resist wear. Runners underneath the drawer will be at least of such thickness as well as support fully the drawer sides. Inserted-type runners are to project into the grooves to not more than half the thickness of the sides. They will be pointed and glued to the carcase and extend the full length of the drawer. The depth of runners, whether below or grooved into drawer sides, will be 6 mm drawers of an area of less than 5 dm^2, 12 mm for drawers of an area of 5 dm^2 to 16 dm^2, and 18 mm for drawers of an area greater than 16 dm^2.

The wearing surfaces of runners, kickers and drawer sides will be treated with wax or some other suitable material to improve the sliding properties.

Pulls or handles: Pulls or handles must be of adequate strength and may be of either the sunken or plant-on type. Drawers of over 600 mm width will be provided with two-handed-grip plant-on handles.

Stops: One stop will be fitted at each side of the drawer within 50 mm from the corner at the front or at the back of the drawer.

Clearance: The clearance between the back of the drawer and the carcase will be not more than 25 mm, unless the overall depth of the drawer is more than 400 mm.

Door and falls

The thickness of doors to falls will be the following: 15 mm for particle board and an area of up to 36 dm^2, 18 mm for particle board and an area of over 36 dm^2, 12 mm for plywood and an area of up to 36 dm^2, 16 mm for plywood and an area of over 36 dm^2, 20 mm (finished thickness) for double or single flush doors; and 18 mm for solid timber framed panelled doors. Particle board, if hinged on the edge, will be fitted with a 12 mm lipping. Three hinges will be provided for doors with a height of over 900 mm; alternatively, a single piano hinge may be used for all doors, in which case particle board need not be lipped.

Closure: Doors over 1200 mm high will be fitted with one closure at the top and one at the bottom, or one at or near the centre. Falls will be similarly fitted with closures.

Sliding doors: If possible, sliding doors should have a height to width ratio of 9 to 5. The sliding mechanism should operate smoothly. The bottom of the doors will be fitted with wear-resistant smooth-running fitments and the upper surface of the bottom frame is to be similarly equipped.

All unframed glass, such as that for shelves, sliding doors or table tops, will be of 6 mm plate of float glass.

Dimensions of cabinet furniture

Wardrobes will have a clear internal depth of 480 mm for face hanging of garments and 530 mm for side hanging. They will have a hanging height of 1500 mm for men's wardrobes, the hanging height will be 1350 mm.

Chests of drawers and dressing tables of at least 900 mm in width will have an internal depth of 430 mm, and those less than 900 mm wide will have a depth of 400 mm.

The length provided for sleeping will be 1930 mm for all types of bedsteads, and the width of the sleeping space will be 900 mm.

B. Chairs

Construction

Dining chairs

In the construction of dining chairs, mortice and tenon joints or combed joints should be used wherever possible; in joining the side rail to the back leg, however, only mortice and tenon joints should be used. Dowel joints may be used to connect the side rail to the front leg and for front and back rails, provided that a joint using three dowels can be achieved.

If the chair legs are of less than 625 mm^2 in cross-section, an underframe should be used, preferably all around, but at least joining the back to the front legs. For chairs with arms, however, no underframe is needed. If the chair leg is attached to one rail only it should be joined by a mortice and tenon joint which is pinned by a dowel perpendicular to the joint.

The underframing connecting the back and front legs should be mortised and tenoned at both joints and have a cross-section of 560 mm^2.

Drop-in and covered seats should be constructed of 6 mm-thick laminated timber or of a dowelled frame having a cross-section of 48 mm x 16 mm. The gap between the seat and the chair frame should not exceed 1.5 mm when the seat is in place. If a laminated seat is stuffed over it should be vented.

All dining chairs, except those with solid seats, should have corner blocks fixed by rebating or glueing and screwing, or have gussets glued into grooves.

If an unupholstered seat forms part of the fixed structure of the chair, it should be made of 6 mm-thick laminate supported by rails. If edge-jointed solid timber is used, it should form part of the structure and the legs should be fixed to it directly by dowelling or tenoning.

Easy chairs

Dowel joints may be used for all joints provided the height of the seat rails of the chair does not exceed 350 mm. Where the seat rails are higher than this, the side rail will be connected to the back by mortice and tenon joint.

All rails carrying springing or webbing should be constructed from close grain hardwood with good tack-holding properties, at least comparable to beech or birch, and should be 35 mm x 22 mm in cross-section.

Settes

Timber for rails must be 47 mm x 47 mm x 32 mm.

Dowel joints, preferably with three dowels, may be used; where two dowels are applied they should be situated at the top and the bottom of the rail. All joints must be braced, preferably by corner blocks which should be glued and nailed, or by metal braces.

For settees of a width of 900 mm to 1 350 mm, a cross rail of 75 mm x 32 mm or 48 mm x 48 mm cross-section must be inserted at the centre of the base. The cross rail should be dipped to allow for depression of the springing or webbing. Settees that are wider than 1350 mm should be fitted with at least two dipped cross rails and an extra pair of legs forming an integral part of the frame structure.

All load-bearing rails should be made of close-grained hardwood similar to beech. Arms on fully-upholstered settees should be planed and all arises rounded to prevent wear of the filling and cover. Backs should form an integral part of the structure and be fixed at least at three points. Dowel joints should be used throughout. The rail should be 44 mm x 44 mm and the section of bearing members at ground level 38 mm x 38 mm.

Dimensions and joining

For dining chairs the height of un-upholstered or fully-depressed upholstered seats should be 430 mm to 460 mm. Easy chairs should have a width of 460 mm and a depth of 495 mm. With regard to settees, the width of seat at the front, excluding the arms, should be 900 mm for two-seater settees and 1350 mm for three-seater settees. The depth of the seating area should be 460 mm.

For chair joints, a gap-filling urea formaldehyde adhesive should be used in accordance with the manufacturer's instruction. Other adhesive may be used, provided they have equivalent properties of strength and durability.

Upholstering

The edges of the front, arm and back frame should be covered with 25 mm foam, with paper or wadding to prevent wear of the covering. Where loose cushions are used over serpentine or tension springs which might damage the cushion or covers, a layer of felt with quilted-on upholstery fabric should be attached to the webbing.

Arms should be padded inside and on top. The covering material on the inside arms of fully upholstered settees should be supported by webbing.

The fabric used to upholster all parts of chairs and settees, with the exception of the bottoms, should conform to the requirements of Irish Standard 169 :1969 concerning upholstery fabric.

The jute, hemp of flax webbing should be attached to the frame with five 12 mm-long tacks, and at least two of the tacks should be driven through a double layer of the webbing. By means of a web strainer, the webbing should be stretched to the full limit.

The number of webbings used for a settee or chair seat is as follows: For settees - not less than twelve lengths of webbing from back to front and five from side to side; for easy chairs - not less than five lengths of webbing each way; for spring-seated dining chairs - slip-in type (not less than two lengths of webbing each way), and stuff-over type (not less than three lengths of webbing each way).

Springs

Serpentine (no-sag) springs

Springs are attached to the front and back rails, i.e. transversely. All steel fixing clips are wrapped with fabric to avoid metal-to-metal contact and to prevent squeaks. Brass clips may be used without fabric insulation.

The number of springs to be used will depend on the product, its dimensions and diameter, and the quality of the wire used for the production of springs.

At present, the central distance between springs is 10-12 cm, which is in accordance with fundamental furniture quality.

The following number and size of strands will be used in serpentine springing for any chair or settee:

(a) For dining chairs, there will be a minimum of three stands 11 SWG (2.95 mm); the strands need not be cross-clipped;

(b) Easy chairs will require a minimum of five strands 9 SWG (3.66 mm) for seats and a minimum of four strands 12 SWG (2.64 mm) for the back. Only the strands of the seats need be counter - or cross-clipped.

(c) For seats of settees measuring 1 400 mm between the arms a minimum of twelve strands 10 SWG (3.25 mm) are used. For each 125 mm of length below or above 1400 mm, the number of stands are reduced or increased by one. All strands should be counter or cross-clipped. For the backs of settees measuring 1400 mm between the arms, a minimum of eleven strands 12 SWG (2.64 mm) are used. For each 125 mm of length below or above 1400 mm, the number of stands are reduced or increased by one. These strands need not be counter - or cross-clipped.

Tension springs

Tension springs should be fixed securely to ensure adequate strength and to avoid damage to the upholstery. They should be continuous between the points of fixing to the frame and no metal extensions should be substituted for any portion of the spring. The amount of stretch in spring, when fixed, is between 38 and 50 mm.

The wire used in tension springs is at least _ SWG (1.63 mm) for seats and at least 20 SWG (0.91 mm) for backs. The coil diameter of tension springs are given in table 3.

Table 3

DIMENSIONS OF TENSION SPRINGS

Furniture element	Coil diameter (mm)	Wire dimensions (SWG) a/
Seats	12	14 (2.03)
	9	16 (1.63)
Backs	9	18 (1.22)
	6	20 (0.91)

a/ Figures within parantheses indicate corresponding values in millimeters.

The following number of tension springs should be used for chairs or settees:

(a) Easy chairs: For seats, at least nine tension springs should be used. If the springs are attached to a steel frame, the number of springs may be reduced to six for seats of 500 mm x 500 mm and under, and to eight for seats of a size up to 580 mm x 580 mm. For backs, at least eight tension springs should be used. If the springs are attached to steel frame the number of springs may be reduced to five.

(b) Settees: For seats of settees measuring 1200 mm between the arms at least 21 tension springs should be used. For each 150 mm of length below or above 1200 mm, the number of springs should be reduced or increased by three. For backs of settees measuring 1200 mm between the arms, at least 16 tension springs should be used. For each 150 mm of length below or above 1200 mm, the number of springs should be reduced or increased by two.

Spring cushion units

The minimum number of compression springs for open-type spring cushion units should be 24 srrings of 100 mm x 13 SWG (2.34 mm), for bagged or pocketted units a mimimum of 30 springs of 125 mm x 14 SWG (2.03 mm) should be used, either clipped or sewn.

Latex or polyurethane foam cushions should be not less than 12mm from the edges of the sewn cushion material, and the thickness of the foam units should be the same as that of the sewn cushion borders. Where rubberized hair is used in conjunction with latex or polyurethane foam, it should be firmly attached with adhesive solution to each surface of the foam unit.

C. Workmanship and finishing

The factory should be clean and well lighted, and provision should be made for the removal of dust and chips and for measuring the moisture content of the air.

The machining of woods and construction of joints should be done precisely and carefully.

All joints should be close, without gaps, and free from visible splittings, cracks or other defects as a result of joining. They should also be handtight and well glued using the required adhesive and following any instructions provided by the manufacturer. All surplus adhesive should be wiped off.

It is important that the room where veneering is done should have dry air and be free from dirt, dust and draught. All veneered man-made boards should have a balancing backing veneer of similar weight, with the grain running in the same direction. Joints in veneers should be free from filler.

The finishing area should be kept free from dust and dirt. All furniture should be free from direct saw marks or rough wood, even in places not nomrally visible. All surfaces are planed, except the

the carcase of upholstered furniture, and all interior surfaces sanded and coated with sealer, lacquer, or an equally suitable finish to ensure cleanliness and ease of cleaning. Upholstered frames should have clean surfaces and all edges must be rounded.

D. Foam thickness

In accordance with Irish Standard 159 : 1967, the Institute for Industrial Research and Standards gives proposals for thicknesses of foam with regard to their indentation hardness. For seating, the most suitable thickness of foam of given indentation hardness will depend on a number of factors, eg. nature of use (cinema seating, private use, etc.), nature of support (rigid base, sprung base, etc.), which must be assessed by the furniture manufacturer.

The following are suggested minimum cushioning requirements for private use on a reasonably rigid base.

CUSHIONING REQUIREMENTS

Type of foam	Slab thickness (mm)
UF 15	125
UF 18	100
UF 22	75
UF 27	50
UF 33	25

Annex XII

Literature on furntiure

I. Journals:

1. Furniture manufacturer (monthly)

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

2. Cabinetmaker (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, Leenesdale 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 WIP 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. 1 + Corr.1)

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)

4. Wood Processing for Developing Countries. Report of a Workshop Vienna, 3-7 November 1975 (ID/180).

5. Adhesives in the Wood Processing Industries, Report of a Workshop, Vienna, Austria, 31 October - 4 November 1977 (ID/223)

6. 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 Rev.1)

   IV. Methodology for the Purchase of Woodworking Machines (ID/WG.256/26)

   XVI. Industrial Production of Doors, Windows and Frames, (ID/WG.277/9 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.277/8 Rev.1)

   XIX. Selection of Equipment for Parquetry Production (ID/WG.277/15)

7. Manual on Jigs for the Production of Furniture (ID/265)

8. Manual on Upholstery (ID/275)

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 Industrial 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)

3. Timber drying (ID/WG.226/11)

4. Production of Solid Wood Furniture in Developing Countries: An Analysis of Alternatives (ID/WG.200/9)

5. Joinery Production in Developing Countries: An Analysis of Alternatives (ID/WG.200/6)

6. Fibreboard Production in Developing Countries: An Analysis of Alternatives (ID/WG.200/5)

7. Particle Board Production for Developing Countries (ID/WG.200/13)

8. A basis for Establishing Criteria for the Choice of Processes and Equipment in the Saw Milling Sector (ID/WG.200/2)

9. Adhesives for Wood (ID/WG.200/3)

10. Production of Veneer, Plywood in Developing Countries: An Analysis of Alternatives (ID/WG.200/4 Rev.1)

11. Furniture Upholstering for Developing Countries (ID/WG.200/11)

III. Pamphlets Published by Timber Research and Development Association (TRADA), Hughenden Valley, High Wycombe, Buckinghamshire HP14 4ND, Great Britain.

1. Visual Stress Grading of Timber
2. Courses Available to the Timber Trade
3. Consumption of Selected Forest Products 1972 and 1980
4. Care and Treatment of Timber
   Timber Yard Operating Manual Information Bulletin No. 2
5. Modern Timber Yard Practices
   Timber Yard Operating Manual Survey Report No. 1

6. Mechanical Handling Equipment
   Timber Yard Operating Manual Information Bulletin No. 1
7. TRADA Publications 1980

IV. Books and pamphlets published by the Furniture Industries Research Association(FIRA), Maxwell Road, Stevenage, Hertfordshire SG1 2EW, Great Britain

FIRA Bulletins

FIRA Research Notes

FIRA Technical Reports

Furniture Literature

Management Accounting

Methods Engineering

The Furniture Standards Handbook

V. Irish Standard Specification - Furniture

Published by Institute for Industrial Research and Standards,
The Industrial Research Centre, Ballymun Road,
Dublin 9, Ireland

VI. Furniture and Timber Industry Training Board, 31 Octagon Parade, High Wycombe, Bucks, Great Britain.

A. Recommendations on Management Training and Development

1. Supplement No. 1:
   Job description and performance standards.

2. Supplement No. 2:
   Management techniques

3. Supplement No. 3:
   Selection and appraising managers.

4 Training Note No. 4
   Compiling a training programme

5. Training Note No. 7:
   Identifying company training needs

6. Design Management

B. Training Recommendation for Woodworking Machinist Apprentice:

First Stage:	WMTG	1	Circular Rip Saw
	WMTG	2	Cross-cutting Saw
	WMTG	3	Narrow Band Saw
	WMTG	4	Surface Planer
	WMTG	5	Thicknessing Planer
	WMTG	6	Mortising Machine
	WMTG	7	Band Woodworking Lathe
	WMTG	8	Wood Boring Machine
Second Stage:	WMTG	11	Dimension Saw
	WMTG	21	Log Sawmill
	WMTG	22	Band Saw
	WMTG	31	Surface Planer (Second Stage)
	WMTG	32	Vertical Spindle Moulder
	WMTG	33	Four-sided Planer and Moulder
	WMTG	34	Double-end Tenoner
	WMTG	41	Router
	WMTG	51	Drum and Wide-belt Sander

C. Kiln Operator's Handbook
   Published by Her Majesty's Stationery Office
   49 High Holborn, London WC1, Great Britain

VII Sawn Hardwood Grading System

Ministry of Technology
Forest Products Research Laboratory
Princes Risborough, Aylesbury, Bucks. Great Britain

VIII. Timber Selection by Properties (quarterly)

The Species for the Job

Constance Webster

Distribution Unit
Application Services Division
Building Research Station
Garston, Watford WD2 7SR
Great Britain

IX Work Study (Fourth Edition)

R. M. Currie

Pitman Publishing Limited
39, Parker Street, London WC2B 5PB
Great Britain

Annex XIII

INDONESIAN HANDICRAFTS IN WOOD

1. Woodworking villages

The workshop tradition is very strong in Indonesia and no matter where one travels, artisans are to be seen plying their trade either as single workshops or as is more often the case, grouped together in villages and doing more or less the same kind of work.

There are many such villages scattered throughout the country and during the course of his survey of the woodworking industry, the expert visited three in Central and East Java, namely Jepara, probably the largest and best-known, Serenan and Bukir. In all three cases, the total income of the village is derived from the manufacture and sale of a variety of furniture and other similar wood products manufactured mainly from teak and usually sold in the local market. Occasionally items are shipped abroad but this is the exception rather than the rule.

In the case of Bukir, for example, there are 2,000 workshops employing about 10,000 workers. Bukir Co-operative, which is state directed, accounts for about 1,000 workers and consumes about 750 m^3 of teak per month supplied by Perum Perhutani, the state enterprise responsible for the commercial exploitation of teak in the Java region. Others are supplied by local timber merchants who accept the finished or partly finished product as payment for the raw material and provide the balance of the selling price in the form of income to the entrepreneur. The average earnings per worker per week is reckoned to be in the region of 10,000 Rupiahs.

The workshops produce a variety of totally hand-made furniture and other wood products often incorporating ornate and intricate wood carving

with traditional Indonesian motifs. In the main they are crudely executed, almost always from undried wood and despite the evident manipulative skills of the workers, it is evident that they lack familiarity with basic forms of furniture design and construction. In particular the dimensional and functional aspects are not sufficiently taken into account and established constructional details for door, drawer and carcase construction are often replaced with crude and unsightly nailing. It is not unusual in the circumstances to find the whole piece fully assembled before any attempt is made to smoothen the rough exteriors and prepare it for polishing.

In the case of woodcarving, often executed by young children, some no more than 10 years old, while again there is evidence of high levels of skill and craftsmanship, the net result is often disappointing because despite long and arduous hours of work in often dimly lit houses and huts, the finished piece is no more than a copy of an original which has been reproduced over and over again.

The problems of these and the other woodworking villages mentioned, clearly begin with the supply of suitable raw material, Perum Perhutani recognizes the importance of this local industry by attempting to cater for its timber requirements but its efforts are evidently so far not sufficient to make any worthwhile impact on the income and living standards of the people. Certainly these are at odds with the long hours of effort put by them into their small businesses. Much of that effort is wasted because the material, to begin with, is not right for the end product. There is no virtue, for example, in ripping a wet log into planks by hand when it could be done more quickly and efficiently by a machine and despite the plea that this activity provides additional employment, it is really a matter of gainful employment which the latter certainly is not.

Secondly there is the question of the supply of suitably dried wood. It is almost impossible to make an acceptable piece of furniture from wood which is not properly dried. Perum Perhutani recognizes this need in its own joinery and furniture-making plants and has installed elaborate kiln-drying facilities for this purpose. It must do no less for its many small customers by supplying them with dimensioned material which is properly seasoned. An immediate consequence would be an increase in consumption of timber as well as a considerable improvement in the quality of the end product.

The design and technical aspects of production as well as marketing at this level should be the responsibility of the state or more practically of the state through the co-operative. Given the strong tradition in woodworking and the innate craft ability of the people there is no doubt that if the opportunity were provided they would quickly learn the fundamental technology of furniture-making. There are many ways to do this, but probably the quickest and cheapest is to bring into the villages skilled technicians who would move around from workshop to workshop imparting the desired knowledge and techniques.

It is unlikely that such individuals are readily available in Indonesia and therefore organizations such as UNIDO should be requested to provide assistance in this regard. Many young highly qualified and experienced technicians in Europe would be prepared to work for a limited period in Indonesia and in a very short time could make a considerable impact on this sector of the industry which urgently needs help. These associate experts, as they are usually called, would be attached to the co-operatives who would provide appropriate counterpart services.

Of even more fundamental importance is the question of design and elsewhere in this report the subject has been dealt with at some length. However, it has a particular significance in respect of wood carving and wood relief panels. Indonesia undoubtedly enjoys a worldwide reputation for her wood handicrafts especially those emanating from the island of Bali. But wood carving is also practised in many other parts of the country without having achieved the deserved reputation of Bali. The fundamental difference is that in the case of Bali,

the designs are original and peculiar to that area. Furthermore, they are allied to exceptionally high levels of skill so that in most instances the end result is a piece of wood sculpture of rare beauty.

There is no reason why the wood carvers and woodworkers in the woodworking villages referred to could not emulate the Bali success. To do this they must, however, incorporate more originality into their designs and refrain from copying pieces which by now have lost their appeal to the discerning buyer. Again, outside advice and assistance are needed and the expert recommends that this activity be included in the job description of the proposed design input recommended in this report. This, however is only a short term measure and the international designer or designers should also be requested to prepare detailed proposals for the establishment of an Indonesian School of Design for the handicrafts industry.

The co-operatives should also endeavour to improve marketing arrangements for each woodworking village. The suggested improvements in quality and design will undoubtedly enhance the saleability and value of the merchandise. It is therefore essential that it be presented and packaged attractively. Each village should have its own handicraft centre which should become a focal point for all craft activities including training of craftsmen not only in their specific skills but also in design, materials technology particularly wood drying, and workshop accounts.

2. Balinese wood carving

Reference has already been made to the exceptional design and quality characteristics of Balinese woodcrafts which are rooted in its culture and traditions going back over centuries. It finds expression in a wide range of art forms which reflect not only the innate craft ability of the people, but also their religious and profane way of life, which in many instances has changed little since its inception.

This, in particular, maintains the freshness and vitality of their products and not surprisingly, accounts for the sustained and increasing demand for them in world markets. Indeed this interest, coupled with the advent of tourism, has further stimulated the production of works of art-craft and thereby created more work opportunities for the Balinese people.

Fortunately, there are few signs, so far, that this heightened interest from abroad has adversely affected the unique nature of the Balinese craft. Nevertheless there is some tendency, especially on the part of exporters to encourage the development of more mechanized forms of production which would enable the possibly greater volume which might well be at the expense of other and more attractive characteristics such as the uniqueness attached to being executed by a specific and named craftsman and, as a result, its scarcity value. Such a development should therefore be resisted especially by the woodcarvers themselves.

On the other hand, new and creative art forms and designs should be encouraged especially of a more abstract nature. The wealth of skill and talent in Bali needs further stimulation and this can be obtained particularly by exposure to positive outside influences. Accordingly, the expert recommends that the proposed design input should also include a more detailed assessment of the Balinese art-craft industry with a view to its further stimulation.

The expert, during his visit to Bali encountered a serious problem which affects not only the industry there, but is also of particular interest to woodcarvers wherever the craft is practised throughout Indonesia. This concerns the dimensional stabilization of the tropical hardwoods used in the production of woodcarvings. The species concerned are:

1.	Ebony (Diospyros celebica)	Timor, Sulawesi
2.	Panggal Buaya (Tagara rhetza)	Bali
3.	Bentawas (Wrightia calysina)	Bali

4.	Kepelan (Manglita glauca)	Bali
5.	Waru (Hibiscus tilinaus)	Bali
6.	Pale (Alstonia scholaris)	Bali
7.	Cendana (Santalum album)	Bali
8.	Nangka (Artocarpus integra)	Bali
9.	Batang kelapa (Cocos lucifera)	Bali
10.	Suar (Samania saman)	Bali

Various treatments have been recommended particularly aimed at anti-shrink efficiency, control of warping, surface and end checking and reduction of staining or discolouration. The most effective method appears to be that of soaking the carvings in a solution of polyethylene glycol with a molecular weight of 1000 (PEG-1000) having particular regard for the proper choice of solution concentration, soaking time and soaking temperature. This can result in an ASE (anti-shrink efficiency) as high as 90 percent.

Experiments with wood carvings carried out by the local Forestry Office in Bali on the species referred to above indicate the effectiveness of this treatment. However a side-effect is the resultant de-grade of the carvings quality. The grain tends to "lift" and subsequent attempts to sand off this defect have not proved successful. In addition because the relative humidity, particularly in Bali, is commonly over 80 percent PEG-1000 treated wood will become damp or dripping wet.

This can largely be avoided by treating rough blanks, drying and then carving rather than carving in the green condition and then soaking in the chemical. This procedure will also minimize staining.

In some cases this surface dampness can be avoided by use of a wax-based finishing material.

The drying equipment used by the Forestry Office is, to say the least, rather primitive even for work of an experimental nature. However, since it affects the well-being of a unique export-oriented industry, the expert recommends that a fully equipped wood research laboratory be installed and manned with trained wood research technicians. He further recommends that this laboratory should liaise closely with the Research Institute in Bogor and should also seek the assistance of the Timber Research and Development Association (TRADA) of the United Kingdom and the Centre Technique du Bois in Paris in finding a long-term solution to this problem.