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**ASSISTANCE TO THE FURNITURE TECHNOLOGY CENTRE (FITEC)**

DP/MAL/92/006

MALAYSIA

**Terminal report\***

SECTION 1: ESTABLISHMENT OF FITEC  
SECTION 2: WOODWORKING MACHINERY  
SECTION 3: PUTTING INTO OPERATION A  
FURNITURE FINISHING STUDIO  
SECTION 4: MANAGING FURNITURE MANUFACTURING

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

*Based on the work of Mr. Donald Lubeck, senior furniture expert  
and furniture finishing specialist (Sections 1 and 3)  
of Mr. Dennison Brown, woodworking machinery specialist (Section 2)  
and of Messrs. Nicolas C. Widhaas and Stephen J. Hanover,  
wood products consultants (Section 4)*

Backstopping Officer: Robert M. Hallett, Agro-based Industries Branch

United Nations Industrial Development Organization  
Vienna

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\* This document has not been edited.

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# SECTION 1: ESTABLISHMENT OF FITEC

## 1.1 INTRODUCTION

The most difficult aspect of this project was the time taken to make decisions and then the time it took to act. For example in October 1992, it was recommended that the concrete floor be sealed to facilitate maintenance. It took until July 1993 (10 months) to get action. This is not an exception but the rule for action at MARA.

This is brought up not to embarrass, but to make a point that if the Centre is to be effective, it must be able to react quickly. If the manufacturers have a problem, they cannot wait 10 months for help.

### 1.11 SCOPE OF THE PROJECT

It is felt that those who are involved in this project may not realize what a gigantic undertaking this is. Far too many areas are being attempted to be covered at one time. The major obstacles facing FITEC will be the lack of qualified trained instructors. At the end of the project, there were none. Filling a factory with machines is one thing, providing training in their use is another. It is the expressed feeling of the management at MARA that practically any person with some training in woodworking can become a qualified instructor. This is not the case.

The original plan included a large area for product testing. Fortunately, at the insistence of the consultant, this idea has been dropped. The reasons for this are as follows.

- a. This is a Productivity Centre and all energies must be directed toward this purpose.
- b. The activities of product testing are already handled by the Forest Research Institute of Malaysia (FRIM), who have the equipment and most important, have people trained in its use.
- c. The area proposed to place the testing equipment is needed for more important training such as instruction on assembly and preparation for finishing.

The subject of purchasing equipment for teaching upholstery is to be held in abeyance until the equipment already purchased is operational.

### 1.12 ORIGINAL CONCEPT

It is felt that the basic problem with this project is that there has been no clear cut definition as to what exactly FITEC is to accomplish. "To upgrade the Bumiputra furniture industry" does not provide enough direction as to what action should be taken.

No one encountered by the UNIDO Senior Furniture Expert in MARA knew specifically what the problems of the Bumiputra furniture industry were, and what specifically was required

to correct them. Filling the Bumiputra factories with expensive equipment is not the answer. The answer lies in solving their present problems and providing guidance toward the direction of their future development.

### 1.13 PURCHASE OF MACHINERY

It is unfortunate that more consultation was not received on the purchase of the machinery.

*NOTE: A distinction must be made between identifying the need of a machine and the selection of the particular machine for purchase. This is to say that the person recommending a machine had one thing in mind, but the purchaser had something else in mind. The people responsible for the purchase of the equipment were vocational training instructors with virtually no experience in producing furniture.*

The machines and equipment outlined in UNIDO report (DP/ID/SER.A/1422), based on the work of Mr. Desmond Cody (UNIDO Furniture Consultant), and dated 13/12/90 are basically correct. It is the selection of machines purchased that poses a problem. The equipment installed in FITEC is not designed, for the most part, to assist the Bumiputra furniture industry.

### 1.14 LAYOUT

Fortunately, time was available to revise the original layout. Had an attempt been made to follow the original layout plan, very serious problems would have occurred at the start-up and in the future operation of the Centre.

### 1.15 INSTRUCTORS

One of the first assignments given was to provide training for two vocational school instructors. MARA felt that by providing these men with three month courses, they would become competent teachers. This of course is not possible under the best of conditions. The instructors selected for training openly opposed all efforts to be trained by anyone.

In April 1993, three more instructors were added to the staff. Two of the men graduated from the MARA Institute of Technology (MIT) in Wood Technology - Furniture Studies. They have had limited factory experience. People with so little background cannot be expected to upgrade the skills of workers who will come to FITEC with three (3) or more years' hands-on production experience without the guidance of an experienced Technical Director.

## **1.2 THE PROCESS OF MACHINERY SELECTION**

### 1.21 INTRODUCTION

The subject of the selection of machinery to be placed in a furniture training centre can be a complicated process. Some feel that a training centre should have the most sophisticated equipment pointing to the future. Others believe a training centre should be equipped with the machines that are found in everyday use in the factories.

A determining factor is who is going to use the Centre. If the industry is already highly advanced, such as in North Carolina, USA, sophistication is probably the answer. In a developing country situation, there is no question that the basic equipment approach must be taken.

Another determining factor in selecting machines for training is their flexibility. It is foolish to invest in highly specialized machinery that is fit for only one purpose. What is needed is machinery that can be used for multiple purposes and would be used in 80% or 90% of the Bumiputra factories.

Machine size or capacity is very important and should match TRAINING needs. People should be trained on machines that they would buy for their factories' immediate use, not something they might buy years from now.

When a person is trained on equipment of the proper size, it is not difficult to visualize the work that a large machine of the same type would do. One key to success in the manufacturing sector is to keep your capital expenses to a minimum, and not to buy more than is needed. This is especially true for machinery.

There is a prevailing feeling of "don't worry about costs," MARA will provide. This is a poor attitude. Even if the manufacturers end up not paying for the equipment, using grossly over-sized or too- sophisticated machine at a fraction of its capacity is not progressive.

It should be added that agencies other than MARA are also involved in supplying equipment. This is the first developing country seen by the consultant where many of the manufacturers have more equipment (possibly not even the right equipment) than they need.

Factory visits revealed that machines, such as shapers or routers, were on hand and when asked what the machine were used for, it was stated that they were not used, the Government gave it to them, but that they do not know how to use them.

### 1.22 SELECTION PROCESS

This process should have started with:

- 1) a careful identification and evaluation of what are the problems of the industry,
- 2) what was required to solve these problems, and
- 3) a careful evaluation of where the industry should be heading.

This was not done, and as a result, the following has occurred:

- 1) A major portion of the machinery received does not (as a major portion) reflect the needs of the industry.
- 2) Some machines were purchased that are rarely used in furniture or joinery manufacturing.
- 3) Machines were purchased that are oversized and do not represent the machines that the

manufacturers should use to upgrade their factories.

- 4) Machines were bought that are not multipurpose – too specialized and can perform only limited operations.
- 5) Machines that have too high capacities, way beyond the needs of the manufacturers.
- 6) Wrong machine purchased to do the job.
- 7) The absence of basic machinery required in all furniture factories, and which are required to upgrade the Bumiputra industry.
- 8) Specialized equipment that is required to meet the specific needs of the industry such as those found in Rough Mills and in the process of Veneering were not purchased.

The consultant prepared a rating system for the relative value of all of the machines purchased. Included is a listing of machines recommended for purchase. (Please see the Annex I.)

### **1.3 FACTORY LAYOUT**

FITEC consists of two equal size buildings of approximately 18,000 sq. ft. each. Building one (1) is the major production area. Building two (2) is approximately one half (1/2) production and one half (1/2) administration.

In the original plan, building one (1) was to be the production area, building two (2) was to be for finishing, upholstery and furniture testing.

In the building, in the original plan, there were three separate lines. Line One was for joinery (doors and windows). Line Two was for furniture and Line Three for panel products (from 4' x 8' sheet stock using plywood, particle board, MDF, etc.).

The original plan would have produced serious problems. There were two separate rough mill operations where one is more than enough. Machines were not grouped as to function. The machines were squeezed together allowing no room for work in process, storage or material handling.

Most important was the fact that a large number of the machines necessary for training were missing, and that no provision was allowed for their addition. This would mean that when these machines were added, either the layout would need to be changed, or the machines would have to be installed out of proper position.

In the layout, space has been provided for a proper rough mill including a rip saw and clamp carrier. Space has also been allowed for the necessary sanding, boring and panel processing equipment.

In building two (2), the finishing area will need to be expanded from the original concept, and the upholstery section will be held in abeyance. It has been agreed that air-conditioned rooms will be constructed for veneer processing and tool grinding



## 1.4 CONCLUSION

The present situation at FITEC is complicated. The question is what direction should be taken? The correction of the existing problems may be difficult to accept.

### 1.41 FIRST CONSIDERATION - FITEC MANAGEMENT

In order of importance, it is suggested that the first considerations are as follows:

- a. In order for FITEC to be able to function and do its job, it must be either separated from MARA or be so organized as to be completely independent in its action and decision making ability. It is felt that it cannot function efficiently under the present conditions.<sup>1</sup>
- b. A full time Senior Furniture Expert or Technical Director is required to manage the "technical" aspects of FITEC. A Malaysian manager is required to direct the overall non technical operations. This Technical Manager would most likely need to be a foreigner with extensive furniture making experience, as well as experience in training. His stay would need to be a minimum of two (2) years.

### 1.42 SECOND CONSIDERATION - OBJECTIVES OF FITEC

The next consideration suggested is to clarify precisely, what the objectives of FITEC are, and how will they be carried out.

#### a. Middle Manager Training

The most critical factor for the development of the furniture industry is not machines but MIDDLE MANAGERS. The greatest contribution that FITEC could possibly make for the furniture industry would be to train people to fulfill the role of Middle Managers - foremen (and women) and supervisors.

Most of the necessary elements of a good nationwide comprehensive programme are already in place. There are good vocational schools in operation. The furniture curriculum, however, needs to be updated and linked with the training offered at FITEC.

The MARA Institute of Technology (MIT) is the seat of higher learning. They have in operation a Wood Technology and Furniture Programme that should also be linked with the vocational school programmes and FITEC, and hopefully twinned with a British or American college or university.

What needs to be done is to tie all of the programmes together so that for example, the students from the vocational school, upon graduation, would move on to MIT or FITEC. There should be a continuity of subject matter.

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<sup>1</sup>N.B. This has subsequently been done but the degree of real independence still remains to be seen.

The FITEC programmes for vocational school graduates would be a hands-on reinforcement of basic knowledge to which they have already been exposed. The FITEC programmes for MIT would be on a higher productive oriented management program. These programmes would involve making production runs of products in FITEC. The consultant's version of the organizational plan for FITEC (at the time of preparation it was called FRTC) demonstrates that machines are only a small part of what is required for furniture training (See Annex 4.)

The most important element as previously stated, is that all of the programmes are tied in together - vocational, MIT and FITEC, and not operated separately, as is presently being done.

b. Direct Assistance to the Industry

The emphasis of the FITEC programmes should be on training, however, industry must be served. The best way to serve industry is to help them be more productive in what they are presently doing, i.e., to help them solve today's problems today.

Most Bumiputra factories are involved with the Umbrella Concept. It is a subsidized operation not open to competition from outsiders. The concept of the Umbrella is very good, and if properly administered, would do much to improve the position of the Bumiputra furniture manufacturers.

The Malaysian government has a large demand for furniture to supply to its schools, police and military. It was determined that only the Bumiputra would make this furniture. The ordering and purchasing of this furniture would be under a system that is called the Umbrella.

This is an attempt to get the Bumiputra into the furniture making business. The manufacturers, who were mostly farmers, were given machines and asked to make furniture. With little or no experience, they started. Needless to say, the majority of these manufacturers have problems. These problems can easily be solved by FITEC.

The suggested plan is for FITEC to solve the most pressing problems by duplicating the operations in FITEC. Manufacturers would be invited to see the solution to the problems, and hopefully, they would copy the solutions. Examples of the suggested projects are as follows:

Vertical Boring - Twenty factories, who have the same vertical borer and do not know how to use it properly. Buy a vertical borer, mechanize it properly and have the manufacturers attend classes at FITEC to learn how to use the machine properly.

Horizontal Boring - More than thirty factories have horizontal borers, producing millions of holes. All these machines should be mechanized with automatic feeding mechanisms. Same as above, buy a machine, mechanize it and hold classes.

Cold Pressing - More than fifty factories are involved in laminating 3mm plywood to core frames. They brush the glue on the frame, apply the plywood and build a pile to which they eventually use a car jack and a pole against the roof rafter to apply pressure.

The answer lies in building a cold press and using a glue spreader, then demonstrating how to laminate panels properly. The point here is that to attempt to solve the problems in each factory on an individual basis cannot work. Solve the problem under controlled conditions and demonstrate the results. In this way several factories can be effectively served with a minimum of effort.

This procedure has far reaching effects. As the manufacturers move into new products, they will need assistance in construction, the building of jigs and will need to learn how to use the machine properly. This can all be done at FITEC.

#### 1.43 THIRD CONSIDERATION - UPGRADING FITEC

When the objectives of step II are firmly established, then an evaluation needs to be made of the equipment required to fulfill the objectives of upgrading the Bumiputra industry. Much of the equipment already purchased will need to be moved out, to be replaced by more functional machines. Rather than attempt to address all of the problems involving the machines and equipment used in the industry, it is suggested that efforts be directed to the following key areas:

Rough Mill - As the industry develops, the conversion of raw lumber into dimensioned parts will become more critical. It is a fundamental process in the manufacture of furniture throughout the world, but is not understood in Malaysia except by the large companies. All of the larger companies use the process. A programme should be directed toward the principles and practices of the rough mill. This will require machinery investment.

Veneering - The development of the furniture industry will rely on the use of veneered panels. This is an area very little attention has been given to in the past, the reason being that solid lumber is used. For higher production, lower costs and a product more acceptable in the market, veneer must be used. Some veneering equipment has been purchased, however, more will be required.

Finishing - Finishing is no doubt the greatest weakness in furniture manufacturing. A great deal of effort must be devoted to raising the standards of finishing furniture. It is always the finish that sells the product. This area, with the addition of the Finishing Studio is ready for instruction.

#### 1.44 FOURTH CONSIDERATION - TRAINING OF INSTRUCTORS

Presently at FITEC, there are two grades of potential instructors. The first grade are those who have graduated from the MARA Institute of Technology (MIT) and majored in Wood Technology. These men have a foundation of the wood industry, but as has been previously mentioned, very little practical experience in the furniture industry. They need more overseas exposure to the industry.

The second grade are those with a more limited education who spent their time teaching in basic vocational schools. These men have no experience in manufacturing furniture. They have demonstrated a lack of cooperation and willingness to improve themselves.

FITEC will require two levels of trainers. One level would be that of hands-on people who are responsible for the instructional operation of the machines. This would include tooling, the use of jigs and fixtures, set ups and operation of the machines. These men would have to be recruited, as no one of the present staff has these abilities.

The second level is that of the instructor, the person who will provide the classroom and lecture programs. This is the more critical aspect in understanding how to produce furniture, and should be directed toward middle managers.

The minimum requirement for instructors must be a graduate from the MARA Institute of Technology (MIT) or equal, and preferably five (5) years of industrial experience.

With regard to overseas training, this should be used to upgrade skills already learned. To attempt to send a person with little or no background or experience for overseas training is a waste of time, effort, money and opportunity.

The fact that recruitment of instructors for FITEC is limited to Bumiputra, is a severe limitation. The Bumiputra industry is in a very basic state of development, and there are not enough trained people available. Low pay is also a limitation. If you want good people, you must pay them.

It is felt that there is a frantic attempt being made to fill all of the positions on the organization chart and that quite possibly, the best people may not be selected.

#### 1.45 DESIGN

A separate technical report was prepared, based on the work of Ms. Selma Arnautovic (DP/ID/SER.A/1737) which covers this important aspect.

## **SECTION 2:** **WOODWORKING MACHINERY**

### **2.1 INTRODUCTION**

On arrival of the Woodworking Machinery Specialist, Mr. Dennison Brown, at the FITEC Training Centre, there was no power connected to any of the machines. But following a great amount of pressure and perseverance, by the end of his assignment, it was reported that most of the machines had been connected to compressed air, electricity and dust extraction, and were commissioned, ready for use.

There was still a shortage of tooling in most cases but this problem was expected to be solved in the very near future.

### **2.2 NEW COMPANY STRUCTURE**

It was decided to follow the recommendation of the UNIDO Senior Furniture Expert, Mr. Donald Lubeck, to separate the day to day operation of the centre from MARA. To this end, a new company F.I.T. Centre Sdn. Bhd. has been set up. This company has its own Board of Directors with its own cost centre and budgets. The new company was expected to be operational within the next one to two months. An immediate advantage would be that decisions can be made and implemented without delay, which in the past have been a major headache.

### **2.3 PRODUCTION**

It has been suggested that FITEC should be a production centre as well as a training centre. Training will be greatly affected if production targets have to be met. Also in training, many mistakes will happen and people learn most by making their own mistakes.

The consultant felt strongly that training would suffer if production becomes a reality. There is still a large amount of work to be done to get the centre into a position of being a full fledged training institution.

### **2.4 INSTRUCTORS**

The training of potential instructors except furniture finishing, has so far only been possible in a theoretical manner. This has been accomplished through discussions, written papers and lectures.

In the training of instructors it was noticed that the senior people showed little or no interest at all in learning new skills. This had a negative effect on the junior staff. This should be kept in mind when selecting instructors and technicians in the future.

## **2.5 MACHINERY FOR TRAINING**

Training, to a large extent, will be limited. The cause of this limitation is that many of the necessary basic machines has not been purchased, i.e.:

- Vertical spindle moulder,
- Boring machine,
- Sanding machine
- Case clamps.

It must also be realized that some equipment is better suited to a high volume factory, rather than a training institute. Long setting times of a complicated nature are unsuitable for training situations, especially when short training courses are envisaged.

N.B. It must be pointed out that the responsibility of the consultant was to commission the machines that were purchased and to provide training on the use of these machines. His views supported those of the Senior Furniture Expert that often the wrong machines were bought.

## **2.6 TRAINING MODULE: DEVELOPING PRODUCTS FOR PRODUCTION**

The consultant produced a system to be used in developing products for production as a training module. This system will be used to train people in product development for the industry. (See Annex 6)

## **2.7 RECOMMENDATIONS**

The consultant recommended that a wood machine and production expert be stationed with the Centre for a minimum of two years. This person should have at least 10 years in-depth experience working with woodworking machines in the furniture industry.

A system of preventive maintenance was suggested for all machines. If this is followed correctly, most of the future maintenance problems can be avoided. See annexes 2 and 3.

## **SECTION 3**

### **PUTTING INTO OPERATION A FURNITURE FINISHING STUDIO**

#### **3.1 INTRODUCTION**

The finishing of furniture is one of the most critical aspects of the furniture manufacturing process. One of the major problems encountered by manufacturers wanting to export is that of producing acceptable finishing. FITEC recognized this problem and requested assistance in placing into operation a Furniture Finishing Studio. It is to be noted that the word "Studio" is used and not laboratory, as the studio is to be used to train people on the use of materials and equipment and not for chemical formulation.

In the FITEC facility, a room was designated for instruction in Furniture Finishing. The room is ideal as there is good natural light and is situated next to a major furniture finishing production area that has a large spray booth and an oven for forced air drying.

The selection of the equipment required for the Finishing Studio was made by FITEC personnel and the consultant during a previous assignment. This contract was a two months assignment which started in December 1993.

#### **3.2 PROCEDURE**

During the early phases of this project, visits were made to several major suppliers of finishing materials. During these visits, materials were tested at their facilities. The reasons for this was to assist Mr. Zahari, the engineer selected to take the instruction, to get the feel of the disciplines of lab work, to become familiar with the products on the market, and to let the suppliers become aware of what FITEC was doing. Experience had shown the consultant, that if the suppliers are involved in the programme at the beginning, they are more willing to cooperate.

During this early period, tests were run at FITEC on the various materials that would be used at the seminars.

A programme of color styling was given to provide the candidates with an idea of how to use the materials to match colors and achieve special finishes.

Two courses of six (6) days each were given to the FITEC engineers not directly involved with finishing. This gave Mr. Zahari the opportunity to go over the subject material in seminar form. This also provided the FITEC staff with the necessary training in furniture finishing.

Visits were made to several furniture factories, to become familiar with the problems being encountered by the industry. Discussions were held concerning solving these problems, and which subjects should be emphasized in the training courses.

### **3.3 PROGRAMME OUTLINE**

The outline of the material covered during this period is as follows:

- Why finish furniture?
- Different systems to finish wood,
- Materials and operations required for high quality furniture finishing
- Solvents used in finishing
- Rubbing of furniture finishes
- Characteristics of wood that affect the finish
- Sanding - the key to good finishing
- Finishing equipment requirements
- How to spray finishes
- Drying and curing of finishes
- Economics in finishing
- Tests conducted on finishing materials
- Problems encountered in finishing

### **3.4 CONCLUSION**

The Furniture Finishing Studio is fully operational. There is a stock of materials needed for the seminars. Mr. Zahari has received instruction on their use. Mr. Zahari has been introduced to and has some working experience with several technicians in industry that he can call upon for assistance. Considering that furniture finishing is a complicated art of which very few have knowledge and that two months is too short for one to gain expertise, the consultant felt, however, that Mr. Zahari received sufficient exposure to do considerable practicing.

It is recommended that after a period of six or eight months, a finishing consultant should again be brought in to upgrade Mr. Zahari's skills.



## SECTION 4

### MANAGING FURNITURE MANUFACTURING

#### 4.1 EXECUTIVE SUMMARY

During the period December 2 - 29, 1993, UNIDO Wood Products Consultants, Messrs Nicholas C. Weidhaas and Stephen J. Hanover, Department of Wood and Paper Science, North Carolina State University, Raleigh, NC, USA visited Malaysia under contract with UNIDO. The major objective was to assist the newly formed MARA Furniture Industry Technology Centre (FITEC) effectively assist the Bumiputra furniture industry by training and guiding managers and technical staff. Specific duties included: (1) survey level of knowledge of technical and managerial staff of selected Bumiputra factories and assess their major problems; (2) determine training needs of the Bumiputra factories; (3) provide ad hoc assistance to the Bumiputra plants visited; (4) prepare and/or adapt visual aids and existing technical and/or managerial documentation; (5) present a Development Programme for Managers in the Woodworking Industry to MARA/FITEC employees and other invited guests from Industry, Education and Associations; and (6) assist FITEC in planning and development of their training programmes.

During this assignment, on site investigation and assistance was done at six Bumiputra furniture plants. All firms were relatively small and shared numerous common problems including lack of managerial and technical skills, limited machinery and maintenance, limited wood raw material sources and poor quality, poor design and/or product engineering, poor finishing and little understanding of marketing. Only one firm could even begin to think seriously about export. All firms manufactured items for the Malaysian government and included simple chairs, tables and plywood -on-frame construction case goods.

The newly formed FITEC was definitely in the very infantile stage. Most machines had been received for this training centre, but still needed completion of installation and commissioning. Many of the machines were either the wrong size to realistically represent what the Bumiputra factories need or they were of the wrong type. More machines were recommended. Only two furniture experts were on the staff. They were funded by UNIDO. The remaining staff consisted of local, educated employees, but their level of knowledge of wood and industrial furniture manufacturing concepts was seriously limited. Considerably more effort and trained personnel will have to be implemented at FITEC if the immediate objective of bringing the Bumiputra furniture manufacturers at par with the much better run non-Bumiputra plants is to be realized.

A one week seminar entitled "Development Programme for Managers in The Woodworking Industry" was presented to 39 MARA employees and other invited guests.

As part of the North Carolina State University's contract with UNIDO all videos developed by NCSU, Department of Wood and Paper Science were given to FITEC. There were some 75 tapes which included short course sets, individual subject matter tapes and update series sets.

## **4.2 FINDINGS**

### **4.21 BUMIPUTRA PLANT VISITS - GENERAL**

Individual plant reports are included in Annex 13 of this report. This section of the report examines findings which were common to most of the Bumiputra factories.

### **4.22 MANAGERIAL**

In most of the plants visited, inadequate product and process engineering systems were found. These included:

- a. Lack of detailed route sheets which should include such things as:
  - detailed part drawings
  - machine operations involved to process the part
  - rough and finished sizes of parts
  - product quality specifications
  - time standards
- b. Lack of detailed bills of materials. Since bills of material and route sheets with estimates of materials and labor costs and process times are necessary for the establishment of product costs, and adequate production control systems, these functions were also found to be inadequate.
- c. Lack of measured work (time study) also limited the potential for the establishment production incentive systems as a means of worker motivation and productivity improvement.
- d. A major problem cited by a number of factory managers which deserves further investigation was financial in nature. Reportedly, it is common for companies operating under the Payong to finish processing an order for an extended time period. This "delayed payment" reportedly puts a severe financial burden on the company. Also, the need for the company to hold the order in inventory, creates other factory inefficiencies and ties up much needed factory floor space.

### **4.23 MATERIALS HANDLING AND GENERAL WORK METHODS**

The relatively small plants visited suffer from the same process inefficiencies that many small plants suffer which do not have engineering staff personnel. Machinery layout and production methods were generally inefficient. A tremendous amount of time was usually spent handling parts-in-process, often one arm-load at a time, from machine to machine. In many of the plants this was due to the condition of the floors in the factory which were often dirt or broken concrete, and minimal use of conveyors. Many of the other basic techniques of methods of economy and work efficiency were not employed.

### **4.24 TECHNICAL**

Major technical problems observed in most plants were:

- a. Inadequate procedures in lumber cut-up operations which leads to excessive waste. This is particularly important because lumber represents in order of 30-40 percent of the sales of dollar for some of the companies investigated.

- b. Lack of efficient gluing methods contributed to joint quality problems and production inefficiencies.
- c. Lack of jigs and fixtures which could speed , roduction, increase safety for the worker, allow single machines to often perform a variety of operations and promote production of a quality product.
- d. Improper tooling which caused excessive production times, quality problems in wood machining, and safety concerns. Examples of tooling problems viewed include: boring bits which burned when used, and use of improper saws for the cutting applications undertaken and sharper cutters.
- e. Inadequate sanding methods and sanding equipment which contributes to poor finish quality. Often finishing was done in close proximity to the sanding area so that sanding dust contaminated the finish.
- f. Lack of good, fully enclosed lumber dry storage sheds.

#### 4.25 WORK ENVIRONMENT

Production methods, machine guarding, and dust extraction systems generally were not conducive to sage working environment for production employees in plants visited. Also, personal protection equipment for workers such as safety glasses and ear plugs were not seen to be employed.

### 4.3 FITEC

#### 4.31 CONCEPT

The concept of providing technical assistance to the Bumiputra wood products industry through the establishment of FITEC we believe is correct and worthwhile. FITEC can perform many needed services for the industry and be a tremendous aid to the industry. However, even though it has been in existence for a number of years, FITEC is really still in the beginning stage of developing an effective programme for the industry.

#### 4.32 PERSONNEL

The UNIDO Furniture Finishing Specialist and the Woodworking Machine Expert were assigned to FITEC and were the only persons at FITEC with in-depth knowledge of industrial furniture production techniques. They were judged to be critical ingredients in FITEC's efforts to develop a meaningful programme. Others of FITEC's staff have some woodworking experience, primarily gained as students or teachers at other educational institution, but they do not have significant industrial experience.

#### 4.33 EQUIPMENT

Most of the woodworking machines purchased by FITEC had been received and installed. Many of them, however, were not yet commissioned and FITEC personnel trained in their use, maintenance, etc. Commissioning machines and training personnel was a main purpose of the Woodworking Machines Expert, Mr Brown's assignment at FITEC. Many of the machines purchased, however, are not really the most desirable for use in furniture manufacturing

instruction. Further, many of the basic machines needed for instruction on furniture manufacturing technology were not purchased. Annex 12 includes a listing of additional machines which FITEC needs to adequately train people for the furniture manufacturing profession.

#### **4.4 FURNITURE VILLAGES**

The establishment of furniture villages seems to be a goal of MARA and the Government of Malaysia. We believe that the Village concept has a great merit. The Village would allow:

- a. Purchasing efficiencies to be achieved through joint buying by groups of companies which would make up the village.
- b. Materials utilization efficiencies to be achieved through the employment of a common rough mill, parts production facility. It is currently very difficult for small companies to independently cut lumber, glue and efficiently produce rough dimension parts. The Village would also provide the opportunity for the production of veneer and veneered furniture which would improve the utilization of the timber resource, as well as enhance furniture product design possibilities.
- c. Finishing quality and efficiency to be achieved through the establishment of a common finishing plant through which the products of the individual Village companies could flow.
- d. Manufacturing efficiency and costing accuracy in general to be improved since an engineering and costing service department could be established to serve the member companies in the Village.
- e. Cooperative design and marketing programmes to be established.

A number of the companies which were visited were planning to move to a Village. In general however, these companies did not have a firm picture or organizational plan as how the Village would be structured, function, its division of products, and how their company would fit into the overall operation of the Village.

#### **4.5 RECOMMENDATIONS**

Most of the problems observed during our plant visits and listed previously in this report could be greatly alleviated through the assistance of FITEC. Recommendations which follow suggest using FITEC as a major educational entity for the improvement of the Bumiputra furniture industry. Certainly other organizations can and should interface with FITEC in this effort. The problems observed are common problems for small plants throughout the world. Education and hands-on technical assistance from FITEC can certainly play a major role in helping the industry develop. The establishment of Furniture Villages should allow the relatively small Bumiputra factories to enjoy many of the benefits often reserved for only larger companies, including the availability of engineering, product design, and marketing assistance as well as the benefits of common rough mill, veneer, and finishing facilities. Recommended steps to take in order to enhance development of the Bumiputra industry through programmes at FITEC and the Furniture Villages in conjunction with other agencies (such as Institut Teknologi Mara, vocational schools, and the Malaysian Timber Industry Board) are

#### 4.51 FITEC RELATED RECOMMENDATIONS

1. Conduct educational programmes at and through FITEC for the Bumiputra industry. These should include workshop programmes at FITEC and hands-on level in a broad range of woodworking technologies. Specific training should be done particularly in the following areas:
  - Preparation of jigs and fixtures
  - Tooling technology and sharpening procedures
  - Lumber cutting and rough mill procedures
  - Machining, including machine set-up, operation and maintenance.
  - Gluing procedures
  - Sanding
  - Assembly
  - Finishing
  - Product engineering
  - Sample or model building

These workshops will be most effective if they involve demonstrations of how to apply the above technologies to solving problems that factories are now experiencing in the production of their current products. Since many of the Payong factories produce the same products, this technique should be particular effective. Also, this will provide the learning experience which will allow companies to learn how to produce other products.

2. Use FITEC as a base for an outreach programme which would bring to the factory locations technical assistance in a manner similar to operation of the Cooperative Extension Service from the Land Grant Universities in the United States. Furniture specialists housed at FITEC would be available to assist companies at their plant locations with technical problems. These specialists would be supported by other specialists at FITEC.
3. Coordinate the activities and programmes of FITEC, vocational schools, Institut Teknologi Mara (ITM), and Malaysian Timber Industry Board (MTIB). Evaluate the opportunity to provide follow-up courses of one to two years duration at FITEC for graduates of vocational schools. Consider also programmes which would allow some of these students to continue their education at ITM. The establishment of these types of programmes should be a longer range programme than the workshop and outreach programmes indicated above and should be undertaken only once the above programmes (1 and 2 ) are functional.
4. Install at FITEC veneer processing equipment to develop the capability of producing veneered furniture.
5. Acquire machines listed in Annex 12.

6. In cooperation with ITM and perhaps with the MTIB or other government agencies, participate in applied research projects directed at developing timber production systems (sawmill) which increase utilization of the timber resource, and the development of veneer production systems from rubberwood. FITEC should minimize its participation in research type projects since its major focus should be to serve the industry through presentation of workshop programmes and technical service activities designed to solve industries current problems. Too often, "grand" research programmes are developed at the expense of hands-on assistance which is the immediate need of industry. However, there is little doubt that the hands-on knowledge which should be available at FITEC can add to the quality of the research. The prime responsibility for the research, however, should be a organizations such as ITM with FITEC's role as an advisor or support entity. North Carolina State University would also be interested in participating in research programmes designed to evaluate methods of increasing utilization of the timber supply in Malaysia.
7. Establish and maintain a well stocked library to include:
- books on furniture manufacturing
  - furniture and secondary wood products periodicals, trade magazines, etc.
  - company literature on machines, tooling, adhesives, abrasives, finishing material, hardware and fasteners, etc.
  - all MTIB and ITM relevant publications

The above programmes of FITEC all require an adequate staff. Maximum effort should be directed at developing and retaining, when already in place, the expertise necessary to perform particularly the hands-on and technical service outreach programme. The expertise of consultants such as Messrs. Lubeck and Brown are considered critical to the success of FITEC and every effort should be exerted to retain such people, and add other personnel with similar expertise to provide the quality of operating management which will be necessary to direct successful programmes at FITEC.

#### 4.52 FURNITURE VILLAGE RELATED RECOMMENDATIONS

As mentioned previously, the concept of the Furniture Village is judged to be sound. The concept however needs to be strategically evaluated. A feasibility study needs to be conducted to investigate such factors as:

- Products which offer a competitive advantage to Bumiputra industries
- Characteristics of markets for alternative products
- Products prices
- Design alternatives
- Product market demand
- Interest in alternative products by potential customers
- Distribution methods
- Optimum machine and facilities layout for the Village

North Carolina State University would consider participating in a study of this type if this would be of interest to MARA

## **ANNEX 1:**

### **RATING OF MACHINERY SELECTED FOR FITEC**

A rating system has been prepared to allow the reader, who may not have in-depth background on the machinery required to produce furniture, to have an idea as to:

- i. How necessary is the machine to furniture (and joinery) production?
- ii. Suitability of the machine selected for training
- iii. Listing of necessary machines not purchased

The system that rates the value or necessity of a machine is as follows:

- A. **Excellent:** A very necessary and basic woodworking machine, a machine that a factory should not be without.
- B. **Good:** A machine that complements the above machines and are found in many furniture factories.
- C. **Fair:** A machine used in making certain types of furniture. Industry-wide, it has limited application.
- D. **Poor:** A machine that is so specialized that it has very limited use, or just is not used in industry.

The system that rates the correctness or the suitability of the particular machine selected for use in FITEC is as follows:

1. Ideal machine to demonstrate the process.
2. Good machine for training, but with some objections.
3. Has drawbacks, can do the work, but a different machine should have been selected.
4. Not satisfactory.

Examples of using the system are as follows:

- A. The machine is necessary and the best machine was selected. **NOTE:** There can be several machines from different manufacturers that are of equal quality and therefore could also be good or best selection.
4. The machine is necessary, but a wrong selection was made. Not satisfactory.

When reading the results of the following evaluations, the factor to keep in mind is the suitability of the machine for training in FITEC.

	MACHINES PURCHASED		MACHINES NEEDED	
	MACH NEED	SEL. ECT		
R1 CUT-OFF SAW	A	4		Saw useless as is. Needs in-feed and out-feed tables with gages.
R2 SURFACE PLANER	A	3		Table too wide, smaller table more suitable.
R3 THICKNESS PLANER	A	1		
R4 RIP SAW	D	1	A	Wrong saw purchased. Need rip saw not a table saw. Even as a table saw, this is a panel saw, not a lumber saw.
R5 EDGE JOINTER			B	Used in addition to the surface planer to insure good glue joints
R6 CLAMP CARRIER			A	Not purchased but is needed for the Rough Mill.
R7 RADIO FREQ CLAMP	C	2		Good clamp for lumber paneling but "clamp" gluing is preferred, with less problems.
R8 SURFACE PLANER			A	All factories need two planers, one for rough, the other for finish planing.
R9 MOULDER	A	1		
R11 FINGER JOINTER	A	3		Finger jointing has limited application, but should be available for training. The machine selected is too large. A smaller machine would demonstrate the process and be easier to train on.
M14 SPINDEL MOULDER	D			Too specialized for a training centre and has very limited application. Table is too small for large work. Poor purchase.
M16 SPINDEL MOULDER LINEAR	D			Too specialized and has very limited application. Not at all a good purchase.
M18 OVERHEAD ROUTER LINEAR	A	3		This machine should have been purchased with the automatic feed, which is usually purchased with this model. A small router is far better for training.
M22 DOVETAIL MACHINE	B	2		
M23 CORNER LOCK MACHINE	D			Used for different field of woodworking, not used in making furniture.



M24 DOWEL MAKING MACHINE	A	1	
M27 DOUBLE END ROUND TENONER	C	2	This is a high production machine. A single round tenoner would be more practical.
M30 TWIN TABLE SLOT MORTISER	B	2	Single table is sufficient. Single table with two, three or four heads more instructive.
M32 TWIN TABLE EIGHT (8) HEAD SLOT MORTISER	B	2	A single sided machine is required. This machine too complicated for this level of training.
M34 CHISEL MORTISER 4 HEAD	D	4	The poorest machine that could be selected. Tooling set-up and poor quality work will make this machine difficult to use. Not suitable for learning.
M35 LOUVER SLOTTING	A		
M36 LOUVER SWAGGING 4 HEAD	A	1	
<u>BORING MACHINES</u>			
B1 DRILL PRESS			A An absolute must.
B2 32MM HORIZONTAL AND VERTICAL BORER	A	2	Machine acceptable but too large for normal industrial use or training.
B4 VERTICAL MULTIPLE BORER			A Widely used in the Bumiputra industry.
B5 HORIZONTAL BORE - SINGLE & MULTIPLE HEAD			A Widely used in the Bumiputra industry.
B5 HORIZONTAL END AND SIDE MULTIPLE BORE			A Widely used in the Bumiputra industry.
B7 END CUT-OFF MOULD AND BORER	D		High production machine with single use and no little flexibility, little value for training.
B8 HINGE BORER			B Needed wherever there are cabinet doors.
<u>SANDING DEPT</u>			
S1 WIDE BELT	A	3	Machine is too large for average manufacturer and training.
S2 STROKE SANDER			A Basic Sanding Machine, used with S1 or replaces it.

S3 EDGE SANDER

A

Basic Sanding Machine, required in all factories.

S4 BOBBIN SANDER

B 1

S5 BRUSH BACK SANDER

A

Basic machine for sanding curved or rounded pieces.

S6 PNEUMATIC SANDER

A

Basic machine for sanding curved ed or rounded pieces.

S7 PROFILE SANDER WHEEL

B

Basic for sanding profiles

S8 PROFILE SANDER BELT

C 2

Too high a production machine. Little value for training.

S9 DISK-BELT SANDER

C 3

A toy was purchased, not a production machine. This machine is used for assembly fitting.

S10 SPONGE SANDER

B

ASSEMBLY DEPT

A1 FRAME CLAMP

A 3

A simpler less expensive machine would do much better and provide a better example for training.

A2 CASE CLAMP

A

Case clamp purchased and paid for, but not delivered. Another machine was delivered in its place.

A3 DRAWER CLAMP

B

A4 CHAIR CLAMP

B 1

A5 DOOR CLAMP

A 1

A6 LOUVER ASSEMBLY

B

Ordered but not received.

A7 AUTO GLUE AND DOWEL INSERTER

A 1

TURNING DEPT

T1 COPY LATHE W SANDER

A 1

T2 COPY LATHE LINEAR

A 1

T3 TURNING SANDER

D

Too high a production machine. Used only with high volume lathe programme. Will not be used at FITEC.

PANEL DEPT

P2 SLIDING BED PANEL SAW

A	3	
		A
B	2	
		B
		B
		B
		B
		B
		B

Sliding carriage too short, need to be able to cut an 8' panel; this will only cut 4'.

P3 VERTICAL PANEL SAW

Best investment for the small manufacturer.

P5 EDGE TRIMMER

P8 CONTACT SPRAY BOOTH

The ability to laminate high pressure laminates to particle board or MDF, or to laminate boards together is important for training.

P9 CONTACT SPRAY

Spraying is the best way to apply contact cement.

P10 PINCH ROLLER

Absolutely necessary to secure a good contact band.

P11 EDGE STRIP CUTTER

Cuts strips of various widths for edge banding.

VENEER DEPT

V1 CROSS CUTTING SAW

Used to cut veneer to length.

V2 GUILLOTINE

Purchased but not delivered.

V3 TAPELESS SPLICER

A better way to splice than the zig zag for long pieces.

V4 TAPE SLICER HAND TOOL

Alternative way to splice veneer.

V9 GLUE SPREADER

The construction of the machine indicates that there could be problems in maintaining accurate glue spread.

V11 COLD PRESS

Cold pressing is an absolute necessity for the Bumiputra industry.

V12 HOT PRESS

Poor selection of hot press. Poorly made and is questionable on how well it will function. In place of one, there should have been three smaller plattens.

**ANNEX 2:**  
**MACHINE MAINTENANCE INFORMATION SHEET**

**MACHINE MAINTANANCE INFORMATION**  
-----

<u>MACHINE NO.</u>	<u>DISCRIPTION</u>	_____
BELT SIZE	NO. REQD	WERE FITTED
BEARING NO.	NO. REQD	WERE FITTED

	<u>TYPE</u>	<u>FREQUENCY USED</u>
GREASE		
OIL		
HYDRAULIC FLUID		

OTHER NECESSARY INFORMATION

# ANNEX 3: MAINTENANCE CHECK LIST

## PUSAT INDUSTRI TEKNOLOGI PERABOT MAINTENANCE CHECK LIST

M/C	CLEAN			OIL			GREASE			CHECK BELTS & PEED			CHECK OIL WAYS			CHECK OIL LEVEL		
	D	W	M	D	W	M	D	W	M	W	M		W	M		W	M	

CODE:

- D = DAILY
- W = WEEKLY
- M = MONTHLY

CHECK BY:

DATE:

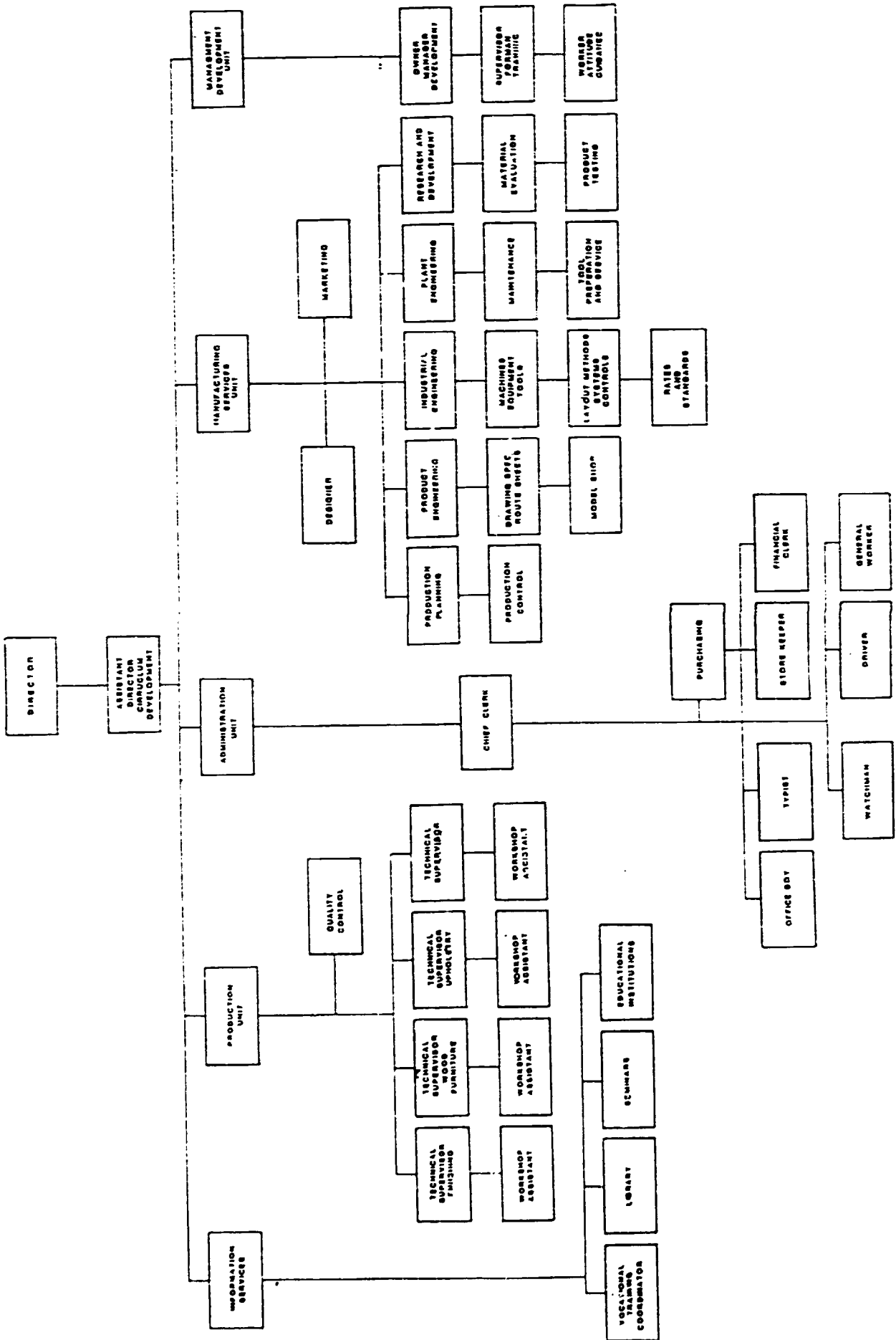
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PUSAT TEKNOLOGI INDUSTRI PERABOT (PITEC)  
 26/01/1994  
 DB/myba  
 KOD: 9TP94

# ANNEX 4: ORGANIZATION PLAN FOR FITEC



**ANNEX 5:**

**SCHEDULE OF TRAINING PROGRAMMES AT FTTEC IN 1994**



**JADUAL PROGRAM KURSUS F.I.T. CENTER SDN. BHD. TAHUN 1994**

No.	TAJUK	CIRI-CIRI	TEMPON PROGRAM	BILANGAN PROGRAM	TARIKH PROGRAM	No. PESERTA		KATEGORI PESERTA	KELOMPOK
						SAHAJIAH	Jumlah		
1.	Pengantar kepada Perancangan Program Industri Peringkat Produk (Production Engineering in Furniture Industry)	1. Sesi Aliran Kerja (Layout) 2. Egan Chart (Market Study) 3. Analisis Riba (Riba Analysis) 4. Inventori 5. Sistem Aliran dan Struktur Perancangan (Product Construction and Hardware) 6. Quality Control	4 hari	1	APRIL (2-5)	20	20	Supervisor	Pending FTTC
2.	Salah satu dari Sektor Industri Peringkat Produk (Salah satu dari Sektor Industri Peringkat Produk)	1. Konsep ME 2. Perancangan dan Perancangan 3. Perancangan dan Perancangan 4. Perancangan	3 hari	1	MEI (23-25)	20	20	Supervisor	Pending FTTC
3.	Metode Amalgamasi Produk	1. Rancangan Amalgamasi 2. Proses, Penyediaan dan Teknik Amalgamasi 3. Reka bentuk dan Perancangan 4. Teknik Penyediaan dan Penyediaan 5. Pengiraan Riba	3 hari	2	APRIL (15-16) MAY (15-16)	15	30	Supervisor	Pending FTTC
4.	Reka bentuk dan Industri Peringkat Produk	1. Proses 2. Cost reduction (berkaitan dengan Perancangan dan Perancangan) 3. Reka bentuk dan Perancangan 4. Konsep CAD dalam Industri 5. Perancangan Produk	4 hari	1	APRIL (12-15)	20	20	Supervisor	Pending
5.	Product Development in Cabinet Making	1. Pengantar Merancang 2. Perancangan 3. Pengiraan Bahan 4. Langkah-Langkah Kerja Yang Sesuai 5. Keseluruhan	4 hari	2	APRIL (18-21) MAY (18-21)	15	30	Supervisor	Pending FTTC
6.	Kemahiran dalam Reka bentuk dan Industri Peringkat Produk (Kemahiran dalam Reka bentuk dan Industri Peringkat Produk)	1. Pengantar Reka bentuk 2. Sesi Aliran Kerja 3. Sesi Aliran Kerja 4. Keseluruhan	3 hari	2	MEI (2-7) JULAI (11-15)	10	20	Supervisor	Pending
7.	Product Development Capabilities	1. Pengantar Merancang 2. Perancangan 3. Pengiraan Bahan 4. Langkah-Langkah Kerja Yang Sesuai 5. Keseluruhan	6 hari	2	MEI (5-14) JUNE (1-4)	15	30	Supervisor	FTTC Pending
8.	Pengantar ke (ME) dan Keseluruhan Perancangan Industri Peringkat Produk (ME) dan Keseluruhan Perancangan Industri Peringkat Produk)	1. Pengantar Reka bentuk dan Merancang 2. Perancangan dan Merancang 3. Pengiraan Bahan 4. Langkah-Langkah Kerja Yang Sesuai 5. Keseluruhan	3 hari	1	MEI (25-28)	20	20	Supervisor	Pending
9.	Reka bentuk dan Industri Peringkat Produk	1. Keseluruhan Reka bentuk dan Industri Peringkat Produk 2. Keseluruhan Reka bentuk dan Industri Peringkat Produk 3. Keseluruhan Reka bentuk dan Industri Peringkat Produk 4. Keseluruhan Reka bentuk dan Industri Peringkat Produk 5. Keseluruhan Reka bentuk dan Industri Peringkat Produk	4 hari	2	JUNE (4-8) JULAI (14-17)	15	30	Supervisor	Pending FTTC
10.	Reka bentuk dan Industri Peringkat Produk	1. Pengantar kepada Reka bentuk dan Industri Peringkat Produk 2. Reka bentuk dan Industri Peringkat Produk 3. Reka bentuk dan Industri Peringkat Produk 4. Keseluruhan	4 hari	2	JULAI (13-16) SEP (21-24)	15	30	Supervisor	Pending FTTC
11.	Kejuruteraan Perancangan dan Industri Peringkat Produk	1. Pengantar kepada Reka bentuk dan Industri Peringkat Produk 2. Reka bentuk dan Industri Peringkat Produk 3. Reka bentuk dan Industri Peringkat Produk 4. Keseluruhan	3 hari	1	JULAI (18-21)	20	20	Supervisor	Pending

No.	TAJUK	CIRI-CIRI	TEMPON PROGRAM	BILANGAN PROGRAM	TARIKH PROGRAM	No. PESERTA		KATEGORI PESERTA	KELOMPOK
						SAHAJIAH	Jumlah		
12.	Product Development in Chair Making	1. Pengantar Merancang 2. Perancangan 3. Pengiraan Bahan 4. Langkah-Langkah Kerja Yang Sesuai 5. Keseluruhan	4 hari	2	JULAI (14-18) SEP (5-9)	15	30	Supervisor	Pending FTTC
13.	Perancangan dan Perancangan Industri Peringkat Produk (Perancangan dan Perancangan Industri Peringkat Produk)	1. Merancang dan Perancangan Industri Peringkat Produk 2. Merancang dan Perancangan Industri Peringkat Produk 3. Merancang dan Perancangan Industri Peringkat Produk 4. Merancang dan Perancangan Industri Peringkat Produk	3 hari	2	JULAI (18-20) OCT (9-11)	10	20	Supervisor	Pending FTTC
14.	Pengantar ke Industri Peringkat Produk	1. Jani-Jani Reka bentuk dan Industri Peringkat Produk 2. Reka bentuk dan Industri Peringkat Produk 3. Reka bentuk dan Industri Peringkat Produk 4. Keseluruhan	3 hari	1	OCT (22-24)	20	20	Supervisor	FTTC
15.	Kemahiran dalam Reka bentuk dan Industri Peringkat Produk (Kemahiran dalam Reka bentuk dan Industri Peringkat Produk)	1. Development of Product 2. Rancangan dan Perancangan 3. Riba dan Industri Peringkat Produk 4. Keseluruhan	4 hari	1	SEP (13-16)	20	20	Supervisor	Pending
16.	Reka bentuk dan Industri Peringkat Produk	1. Pengantar kepada Reka bentuk dan Industri Peringkat Produk 2. Reka bentuk dan Industri Peringkat Produk 3. Reka bentuk dan Industri Peringkat Produk	4 hari	2	OCT (2-6) NOV (8-11)	15	30	Supervisor	FTTC Pending

**JADUAL PROGRAM SEMINAR F.I.T. CENTER SDN. BHD. TAHUN 1994**

No.	TAJUK	SAMBUNGAN	TEMPON PROGRAM	TARIKH PROGRAM
1.	Seminar Pengantar dan Perancangan dan Industri Peringkat Produk	1. Pengantar kepada Reka bentuk dan Industri Peringkat Produk dan Perancangan dan Industri Peringkat Produk 2. Reka bentuk dan Industri Peringkat Produk dan Perancangan dan Industri Peringkat Produk 3. Keseluruhan	2 hari	MEI 30-31
2.	Seminar Perancangan dan Industri Peringkat Produk	1. Fungsi Perancangan dan Industri Peringkat Produk 2. Perancangan dan Industri Peringkat Produk yang Berkesan 3. Memahami Perancangan dan Industri Peringkat Produk 4. Jabat dan Teknik Industri 5. Pengantar Perancangan dan Industri Peringkat Produk 6. Keseluruhan	2 hari	JULAI 25-26
3.	Seminar Perancangan dan Industri Peringkat Produk	1. Pengantar kepada Reka bentuk dan Industri Peringkat Produk 2. Reka bentuk dan Industri Peringkat Produk dan Perancangan dan Industri Peringkat Produk 3. Reka bentuk dan Industri Peringkat Produk dan Perancangan dan Industri Peringkat Produk 4. Keseluruhan	2 hari	SEPT 27-28

\* Jadual ini akan tertitik kepada pindaan dan kesesuaian dengan keadaan semasa.  
**KETERANGAN LANJUT:**

**Pengurus**  
**F.I.T. CENTER SDN. BHD.**  
011 KM 13, Jalan Batu Caves, 68100 Batu Caves, Kuala Lumpur

## ANNEX 6: DEVELOPING A PRODUCT FOR PRODUCTION

The following steps are the procedures followed by successful manufacturers in bringing a product to the market. Each step contributes toward producing a product with the correct design, maximum efficiency in production and at the lowest cost.

**STEP 1:** Identify the product to be produced

A discussion is held to decide the form, size, shape, function, etc., of the new product to be produced. It may be a new cabinet, table and/or chair to interest the market.

**STEP 2:** From the ideas produced in step 1, free hand sketches are produced. These sketches are usually 3-dimensional with several possible variations. These sketches are in rough form, that is, attention is not paid to detail, only to illustrate the idea. These sketches will have overall dimensions.

**STEP 3:** When the sketches have produced the idea of the product, then a detailed drawing in three dimensions is prepared. The drawing or drawings are produced in their (a) visual state (how they will appear to a customer) and (b) an exploded form, which provides information on the function.

**STEP 4:** When the detailed sketch has been approved, the next step is to produce working drawings. The working drawing has a front, side and top view, with all dimensions showed.

The working drawing is usually prepared in small scale ( $1/4" = 1"$  or  $1\text{mm} = 5\text{mm}$ ). Full sized drawings are made of construction details, which may not be clear on the working drawing.

**STEP 5:** From the working drawings, a Bill of Materials is prepared. The Bill of Materials is a complete listing of every item, and quantity required to produce the product.

**STEP 6:** With the working drawing and the bill of materials completed, the next step is Product Analysis.

In Product Analysis, a review is made of the product to ensure that the product is fulfilling the intended function. This is the time to see if any changes should be made to improve the product, eliminated production problems, or reduce costs.

**STEP 7:** When all the questions about how the product will be produced and what materials will be used have been answered, a Costing is made.

The Bill of Materials list all the items are required. These costs can be calculated along with waste factors.

The labor factors can be estimated by using the route sheets or the process route sheet. To these costs are added standard indirect costs to arrive at the selling costs.

**STEP 8:** a) At this step, if the product is for a full scale production factory, the working drawings and the bill of materials are sent to the sample shop. In the sample shop, highly skilled workers will produce two models. One model is finished and shown at furniture markets. If the model is "sold," then the steps in 8b take place.



The second model is assembled without glue and stored. If the model is put into production, the parts will be painted (so they will not be confused with production) and be used in production, along with the route sheet.

b) For a training program, Step 8 starts at this point. Route sheets are prepared for each part listed on the bill of materials.

The route sheet consists of a drawing of the "part", fully dimensioned. The route sheet also has a step by step listing of every operation required to produce the part.

The route sheet also lists all supplies such as dowels, screws, abrasive paper, etc., required by that part.

STEP 9 When all the route sheets have been completed, a Process Route Sheet is prepared. The Process Route Sheet is used to control the movement of the part through the factory.

STEP 10 Once the Route Sheets have been prepared, the product is ready to be made. The manufacturing process includes the following:

- a) Rough Mill - converting of rough lumber into dimensioned pieces ready for machining
- b) Machining - giving parts their shape, final dimension and joints for assembly
- c) Sanding - removal of machining marks and smoothing of the surface for finishing. Note: Sanding before assembly.
- d) Assembly - joining of sanded parts into assembled unit
- e) Finishing - applying beauty and protection of the furniture.

STEP 11 Value Analysis - Once the product has been completed, all the departments that have been involved can discuss ways in which the product can be improved. This includes small design changes that facilitate production, different methods of construction or assembly, changes in the use of materials, etc.

STEP 12 Jigs, Fixtures and Tooling - Once the decision to produce the product has been made, the type of jigs, fixtures and the selection of tooling need to be made.

**ANNEX 7:**  
**PHOTOS**

1. Seminar participants at briefing at FITEC
2. Nick Weidhaas presenting seminar session to participants
3. Seminar participants watching a machine demonstration by Dennis Brown, UNIDO Wood Machine and Production Expert at FITEC
4. Same as 3
5. Same as 3
6. Same as 3
7. Same as 3
8. Same as 3
9. Same as 3
10. Donald Lubeck, UNIDO Senior Furniture Expert at FITEC illustrating finishing spray booth to MARA Seminar Participants
11. Mara Seminar participants observing door clamp at FITEC

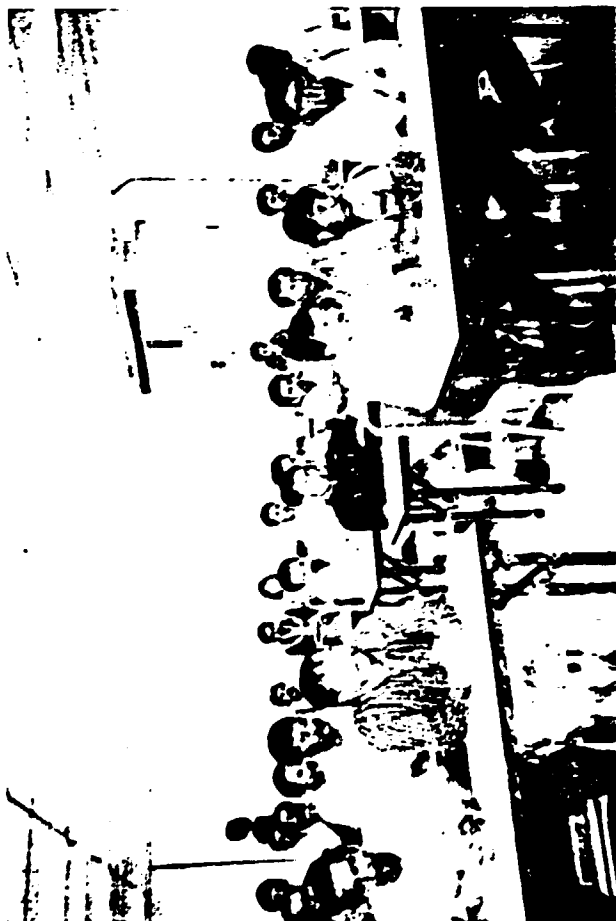


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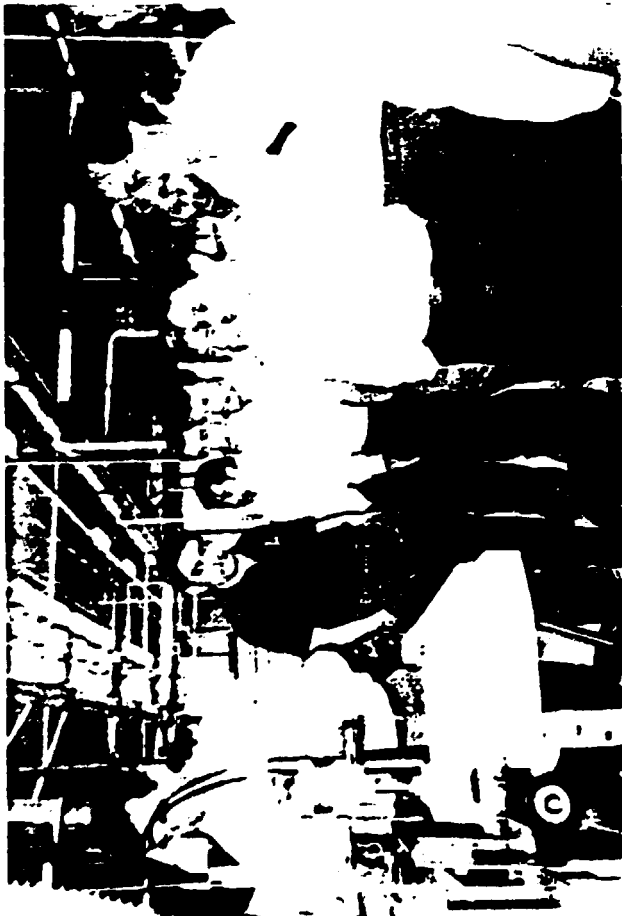




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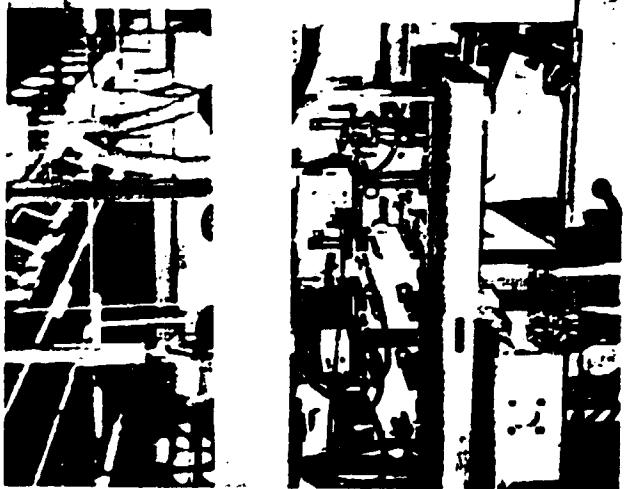
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7



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9



## **ANNEX 8:** **DAILY ACTIVITIES OF N.C. STATE TEAM**

**2-4 December 1993**

Travel, Raleigh, NC to Kuala Lumpur, Malaysia

**5 December 1993**

Meeting with UNIDO Senior Furniture Expert, Mr. Donald Lubeck

**6 December 1993**

Meeting at the MARA Furniture Industry Technology Centre (FITEC) for staff and facilities introductions and programme planning

**7-8 December 1993**

Visitation to six Bumiputra furniture factories

**9 December 1993**

Visitations to the Malaysian Timber Industry Board, Kuala Lumpur and to Institut Teknologi MARA, Selangor Darul Ehsan

**10 December 1993**

Seminar Planning and visual aids equipment preparation at FITEC and MARA; visitation to large industrial wooden door and furniture manufacture, Kuala Lumpur.

**11-12 December 1993**

Seminar planning and preparation

**13-16 December 1993**

Seminar presentation, MARA Building, Kuala Lumpur

**17 December 1993**

Seminar continuation, MARA Building and FITEC, Batu Caves, Kuala Lumpur

**18-19 December 1993**

Travel, Kuala Lumpur to United States

## ANNEX 9: PERSONS/OPERATIONS VISITED BY N.C. STATE TEAM

### The MARA Furniture Industry Technology Centre (FITEC)

Address Furniture Industries Technology Centre, Off km13, Jalan Batu Caves  
68100 Batu Caves, Kuala Lumpur

Telephone: 687-6195/6

Telefax: 687-6198

\*Donald Lubeck, UNIDO Senior Furniture Expert

\*\*Ismail Jidin, Technical Executive

\*Dennis Brown, UNIDO Woodmachine & Production Expert

\*Zahari md Yassin, Technical Executive

\*Mohd. Noor Sulong, Manager

\*Radim Abdullah, Technical Executive

### The Malaysian Timber Industry Board

Address Block A - E Anjung Felda, Janan Maktab, P.O.Box 10887, 50728 Kuala Lumpur

\*Mahpar Atan, Utilization Officer

\*Zaibi Yakin, Planning and Development

### Institut Teknologi Mara (ITM)

Address ITM, Pusat Daerah Sek 6, 4000 Shah Alam, Selangor

Telephone 03-5500755

Telefax: 03-5506488

Telex: TEKMA MA 38671

\*Ashari Abd Jalil, Head, Wood Technology Department

\*Zaibi Yakin, Planning and Development

\*Jamaludin Kasim, Lecturer, Wood Technology Department

-plus 5 other staff members

\*Suhaimi Muhammed, Wood Technology Department

### BUMIPUTRA FURNITURE INDUSTRIES

#### Probil Industries

Address Lot 4692, Jalan 57, Selayang Baru, 68100 Batu Caves, Selangor Darul Ehsan

Telephone 03-6189462

Telefax: 03-6187620

\*Ahmad Kamal Ghazali, Managing Director

#### Yamin Furniture Enterprise

Address No 104, Jalan Bungu Tanjung, Sg. Tua Bahru, 68100 Batu Caves, Selangor Darul Ehsan

Telephone 03-6885880

Telefax 03-6876413

\*Zamal Mohd Taib, Manager

#### Adnan Manufacturing and Industries

Address Not available

\*Anuar B Abd Hamid, Manager

#### Azams Maznun SMD BHD

Address No 32, Tingkat 1, Jalan Besar, Pekan Batu 14, 47100 Puchong, Selangor Darul Ehsan

Telephone 5711703/5711604

Telefax 5711140

#### Fajaa Enterprises

Address 22, Blok E, Keramat Jaya, Datok Keramat, 54000 Kuala Lumpur

Telephone 03-2922307

\*Abdul Gham Bin Hussin PJK

AKI Beranang Furniture

Address Sasapan Batu Rembau, 43700 Beranang Selangor Darul Ehsan  
 Telephone 03-8167658 Telefax 010-605764  
 \*Mohamad Fauzi Daud, Manager

**OTHERS**MWE Intersean Wood Industries SDN BHD (plant visit)

Address Not available

GI. Furniture (Pahang) SDN BHD (Attended seminar)

Address Songsang Industrial Estate, P.O Box 32, 28007 Termeluh, Pahang Darul Makmur  
 Telephone 09-271300/274373 Telefax 09-271630  
 \*Ibrahim Bin MD NOR, Manager

Privakin SDN BHD (Attended seminar)

Address Lot 2993, bendang Kerian, 16200 Tumpat, Kelantan  
 Telephone: 609-756135 Telefax: 609-757790  
 \*Hanafee Yusoff, Managing Director



**ANNEX 10:**  
**LIST OF MARA SEMINAR ATTENDEES**

**PERKARA** : SENARAI NAMA PESERTA  
**PROGRAM** : DEVELOPMENT OF MANAGERS IN WOOD WORKING INDUSTRY  
**TARIKH** : 13 DISEMBER HINGGA 17 DISEMBER 1993  
**TEMPAT** : PUSAT LATIHAN KAKITANGAN MARA  
BANGUNAN MARA LAMA, TKT.2, JLN. TUANKU ABD. RAHMAN  
KUALA LUMPUR.

BIL.	NAMA PENUH	NO. GAJI	JAWATAN	PUSAT
1.	ABDUL KARIM B. MOHD YUSOFF	75213	JURUTUNJUK	PEJ. MARA NEGERI PERAK
2.	HARUN BIN ISMAIL	069436	JURUTUNJUK	PEJ. MARA NEGERI PULAU PINANG
3.	KAMARUDIN BIN AWANG	050416	JURUTUNJUK	PEJ. MARA NEGERI KELANTAN
4.	LADIMAN BIN SIMIN	061052	JURUTUNJUK	PEJ. MARA NEGERI JOHOR
5.	MD. NOH B. AHMAD	023906	JURUTUNJUK	PEJ. MARA NEGERI PAHANG
6.	MOHAMAD ALIAS B. MANSOR	046624	JURUTUNJUK	PEJ. MARA NEGERI KEDAH
7.	MOHD SULAI B ABDULLAH	046543	JURUTUNJUK	PEJ. MARA NEGERI SELANGOR
8.	RAMLAM B. M. AMIN	050717	JURUTUNJUK	PEJ. MARA NEGERI TERENGGANU
9.	SAHARI B. ISMAIL	036760	JURUTUNJUK	PEJ. MARA NEGERI MELAKA
10.	ISMAIL B. JIDIN	18322	PENGAJAR KETUKANGAN GRED I (K) (PEYELIA TEKNIKAL)	FITEC
11.	RADIN ABDULAH B. HAMZAH	25535	PENGAJAR KETUKANGAN GRED I (K) (PENYELIA TEKNIKAL)	FITEC
12.	ABD. WAHID B. HARUN	32890	PENGAJAR KETUKANGAN GRED II (K)	FITEC
13.	ABD. MOIN B. SHAARI	82109	PENGAJAR KETUKANGAN J4	FITEC
14.	ZAHARI B. MD. YASIN	81906	PENGAJAR KETUKANGAN J4	FITEC
15.	HAMDAN B. SELAMAN	82002	PENGAJAR KETUKANGAN J4	FITEC

16. GOOPA @ DZULFAR B. HUSIN	24840	PENGAJAR KETUKANGAN GRED I (K)	BHG. KEMAHIRAN
17. TAJUDIN B. ZAKARIA	36171	PENGAJAR KETUKANGAN GRED I	IKM PEKAN
18. MOHD. MUFARADZI B. MAT SOM	36278	PENGAJAR KETUKANGAN GRED I	IKM LUMUT
19. ABDULLAH B. EJANG	35703	PENGAJAR KETUKANGAN GRED I	IKM LUMUT
20. UYOB @ AYOB B. ABDUL RANY	44493	PENGAJAR KETUKANGAN GRED I	IKM SG. PETANI
21. NOOR ZAINEE SHAH B. IBRAHIM		PEGAWAI	BHG. KEMAJUAN PROJEK
22. ROSMINAH BT. MOHD. HUSSIN		PEGAWAI	BHG. BIMBINGAN USAHAWAN
23. MOHD. FUAD B. ISHAK			MTIB
24. KAMARUDDIN B. OSMAN			MTIB
25. ZAWAWI B. KASSIM			FRIM
26. KAMARIZAN B. MUHAMAD IDRIS			SIRIM
27. IBRAHIM B. MD. NOOR			GENERAL LUMBER
28. RASILAH B. ABDULLAH			GENERAL LUMBER
29. MOHAMMAD NADZIRI B. SULAIMAN			GENERAL LUMBER
30. HANAFEE B. YUSOFF			USAHAWAN
31. ABDUL KADIR B. ABDUL WAHAB			USAHAWAN
32. DR. SUHAIMI B. MUHAMMED			ITM
33. ABD. JALIL B. AHMAD			ITM
34. SHAIFUL ANWAR B. ABU HASSAN			GUTHRIE
35. ZAINI ITHNIN B. HJ. RAJAK			ITM
36. ASMI B. ISMAIL			PROTEC
37. KASANI B. YUSOF			ITM
38. MANSUR B. AHMAD			ITM
39. ABDUL KARIM B. ISMAIL			FRIM

[D:JU/NAMA1].

## ANNEX 11: SEMINAR PROGRAMME

### DEVELOPMENT PROGRAMME FOR MANAGERS IN WOODWORKING INDUSTRY

13-17 DECEMBER 1993

#### Monday

08.00 - 08.45	-	Registration	
09.00 - 09.30	-	Opening remarks	
09.30 - 10.00	-	Tea break	
10.00 - 12.30	-	Properties of wood	Hanover
12.30 - 14.00	-	Lunch	
14.00 - 15.00	-	Overview of furniture manufacturing	Weidhass
15.00 - 17.00	-	Economics of manufacture	Weidhass
17.00 -		Tea	

#### Tuesday

08.30 - 10.15	-	Operation Analysis	Weidhass
10.15 - 10.30	-	Break/Tea	
10.30 - 11.15	-	Wood and moisture	Hanover
11.15 - 12.45	-	Lumber drying	Hanover
12.45 - 14.00	-	Lunch	
14.00 - 15.00	-	Lumber cutting system	Weidhass
15.00 - 16.30	-	Techniques of lumber yield improvement	Weidhass
16.30 -		Tea	

#### Wednesday

08.30 - 09.15	-	Calculation lumber and rough mill processing costs	Weidhass
09.15 - 10.15	-	Break/Tea	
10.15 - 12.00	-	Work measurement and motion analysis	Weidhass
12.00 - 12.45	-	Wood machining, gluing and veneering	Hanover Brown
12.45 - 14.00	-	Lunch	
14.00 - 16.30	-	Wood machining, gluing and veneering (continued)	
16.30 -		Tea	

Thursday

08.30 - 10.00	-	Product costing	Hanover
10.00 - 10.15	-	Break/Tea	
10.15 - 12.00	-	Wood sanding and finishing	Lubeck
12.00 - 12.45	-	Production planning and control	Weidhass
12.45 - 14.00	-	Lunch	
14.00 - 15.15	-	Production planning and control (continued)	
15.15 - 16.30	-	Discussion of seminar	Weidhass
		Team plant visitation (continue)	Hanover
16.30 -		Tea	

Friday

08.30 - 09.15	-	Requirement for exporting	Hanover
09.15 - 10.00	-	Innovation in the plant	Weidhass
10.00 - 10.15	-	Break/Tea	
10.15 - 11.30	-	Course review and discussion	
11.30 - 12.00	-	Closing remarks	
12.00 - 14.30	-	Lunch	
14.30 - 17.00	-	Visit to Furniture Industry Technology Centre (FITEC) Batu Caves	

## ANNEX 12: MACHINERY NEEDS AT FITEC

1. Cut-off saw
2. Lumber bottom head planer (facer)
3. Straight line rip saw
4. Glue spreader for edge/face lumber gluing
5. Clamp carrier for edge/face lumber gluing
6. Shaper (single or double spindle) with tilting head and sliding table
7. Sanding machines including:
  - spool
  - edge with 8-inch belt, tilting table with oscillating head and minimum of 52-inch long table
  - stroke sander for flat panels, minimum 8-foot table
  - pneumatic/brush sander combination with several diameter heads.
8. Panel saw for cutting standard sheets of plywood (a vertical wall unit is suggested)
9. Drilling machines including:
  - horizontal with a minimum of 3 chuck cluster fixed at 35 mm and including one universal head
  - vertical drill press, 21 inch, with attachments and multi speed
  - vertical press, multi head
10. Frame clamp for case goods manufacture
11. Pod (or hydraulic) cold press for lamination work
12. Band re-saw for lumber or cants
13. Small jointer (8-inch)
14. Roughing top head lumber/panel planer
15. Veneering equipment to include clippers, splicers, jointers

## ANNEX 13: FINDINGS - BUMIPUTRA PLANT VISITS

### PLANT No. 1:

This plant has about 1.5 million RM sales per year and employed 35 people. The major species used are nyatoh and meranti and no rubberwood. They purchase lumber 6-foot and up in length and have it custom dried for 80-100 RM per ton (600 board feet). On the average the company cuts about 1000 board feet per day. The lumber is not stored in a weather proof building.

About 75% of their market is to the payong (Guthris), but more markets are needed as the company has excess capacity. Their main products are chairs and plywood-on-frame constructed case goods.

Some of the technical problems encountered were as follows:

- Machines were rusting due to poor maintenance and inadequate protection from the weather
- Use of wrong saw blades for ripping
- Using only one knife in a three knife head on the shaper
- Lack of set-up table to position frame stock during assembly of plywood-on frame panels
- The plywood quality was poor and required considerable filling prior to application of vinyl overlays.

From a managerial view point, the company had only 2 supervisors and 5 skilled workers. Use of parts route sheets and scheduling aids were all but non-existent. The most urgent problem according to the owner was adequate electrical energy supply. They could not run a lot of machines at one time. Plant layout needs to be studied and revised. The cut-off saw for cutting lumber to rough length was outside the main building. The plant had a dirt floor which did not allow use of factory carts to move stock in process from one machine operation to another.

The management was asked what FITEC could do for him. His answer was training both supervisors and management. Specific areas of needs were machine operation and maintenance and finishing assistance. The management indicated that he would send supervisors to a seminar at FITEC.

The company is planning to move to a "furniture village" that would include other Bumiputra companies.

PLANT No. 2

This plant projects sales of 2 million RM for 1993. Fifty percent of their production is sold to payong (Guthris) but outside markets generate some 70 percent of the company's revenue. The major item for the payong is chairs and for the outside market, some 34 different office furniture items are made. The management indicated that it has been difficult to make money through the payong. Better margins are made with outside sales if quality office furniture is produced. The company employed about 40 people.

The company purchases kiln dried lumber (mostly nyatoh and meranti) that is in short lengths mainly because shorts are less expensive per ton than long lengths. Most of the firm's products are well suited for the short lengths yet yield problems exist. The management suggested that a study be done to determine the feasibility of establishing a company that would collect short lumber offal (waste) from various Bumiputra plants and finger joint into reusable, longer lengths. The company has no moulder and needed moulded parts are sourced from other plants. Likewise they have no lumber edge gluing equipment which contributes to the poor lumber yield problem. Solid, edged glued chair seat blanks, for example are sourced from other manufacturers.

Some technical problems include:

- Poor machine performance
- Lack of certain jigs for machines
- No case or frame clamp; there were problems of fitting machined parts into frame assemblies for the office furniture
- Layout of machines and material flow among machines needed serious study for better productivity

The management appeared well educated and very serious about expanded productivity and quality. Detailed drawings, parts route sheets or production scheduling aids were lacking. Basically, a full scale model of a piece of furniture was erected and used on the shop floor for the supervisors to take measurements of parts. The management realized that this was not the proper way, but it needed help with drawings and routing plans for parts. The manager wanted to mass produce items instead of making only a few pieces of many different items. The problem was finding customers. An indication was given that finding capital was not a problem. When asked what FITEC could do, the response was to help on mass producing quality products. Management would attend FITEC seminars.

PLANT No. 3

This Bumiputra operation was a small shop employing 5 full time workers. They make tables, chairs, joinery and other specialty items for special order. Considerable hand carving was done, but the quality was very good. Special jigs had been made so that a machine could be used for multiple purposes, yet the management realized there was a lot of room for improvement. Some tooling was in severe need of replacement (example: a very dangerous square moulder head was being used). The management indicated that FITEC could help upgrade the skills of workers. Much time was devoted to training new workers on the production floor.

**PLANT No. 4**

This company has annual sales of about 3 million RM and 58 employees. It is planning to move its operation into a Furniture Village with nine other companies. The exact structure of this cooperative arrangement has not yet been established.

The workplace of the factory was judged to be average, for a "daywork" pay system. The company does have a few situations where pay is influenced by productivity level. Some of the problems of the company were:

- Poor material handling, influenced in-part by the poor floor conditions in a portion of the factory. Floor repair or the use of some simple conveyor systems to bridge the poor floor area would be worthwhile.
- Expensive materials. Lumber costs currently represent about 40% of the sales dollar for the company and have been increasing dramatically recently. The application of modern lumber cutting systems and rough mill technology which should be possible once the company moves to the Furniture Village should greatly improve materials yield. Even before the move, however, the company should be able to improve its utilization of timber by reducing its trim allowances on the length of its parts, and using such production aids as back gauges on its cut off saws.
- Need to upgrade finish quality if export is desired. Also, the target moisture content to which the lumber is dried would need to be adjusted and the use of plywood should be considered for certain parts rather than solid wood.

**PLANT No. 5**

This plant has annual sales of about 1.8 million RM and employs 41 people. The major problem cited by the manager was the cash flow problems caused because the company could not deliver completed goods and receive payment because the customer was not ready to accept delivery. Workplace in the factory was judged to be average but the manager was very interested in working with FITEC to upgrade the skills of his employees. Methods of production in general needed improvement. Problems observed included:

- Lack of an adequate rough mill operation caused wastage in materials.
- The system employed for gluing panels needed drastic improvement. The need for an adequate panel clamping systems was evident.
- Operator spray finishing techniques were also judged to be wasteful. Training in spray gun techniques which minimize overspray and maximize finish quality would be very worthwhile.
- Dust collection systems need severe upgrading.
- The use of correct saw blades for the task undertaken could reduce reject rates, and the tendency for the saw to tear out the wood during sawing.



PLANT No. 6

This firm is a small company which employs 11 people. IT suffers from the need to produce a product in a very small building. It is cramped, and raw materials storage is disorganized on the floor causing inefficiencies. The quality of the finish needs severe upgrading. Use of jigs and fixtures could be a great help for the company. Training at FITE in finishing, jigs and fixtures and production technology, in general, would be very helpful to the company.