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for Collection and Processing of Oil Palm Fronds (OPF)
for Feed Production
- 3 . General Circular No.1 of 1979

1. プラント概念図

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In compliance with the MARDI's request in the R/D mission, shown here are the two proposed layout plan of the feedmill plant based on the Hiruta's report. Further details would be discussed when the reports from consultants submitted which is expected in July.

P.S It will be necessary to controll about 14,000m² (200m*70m).

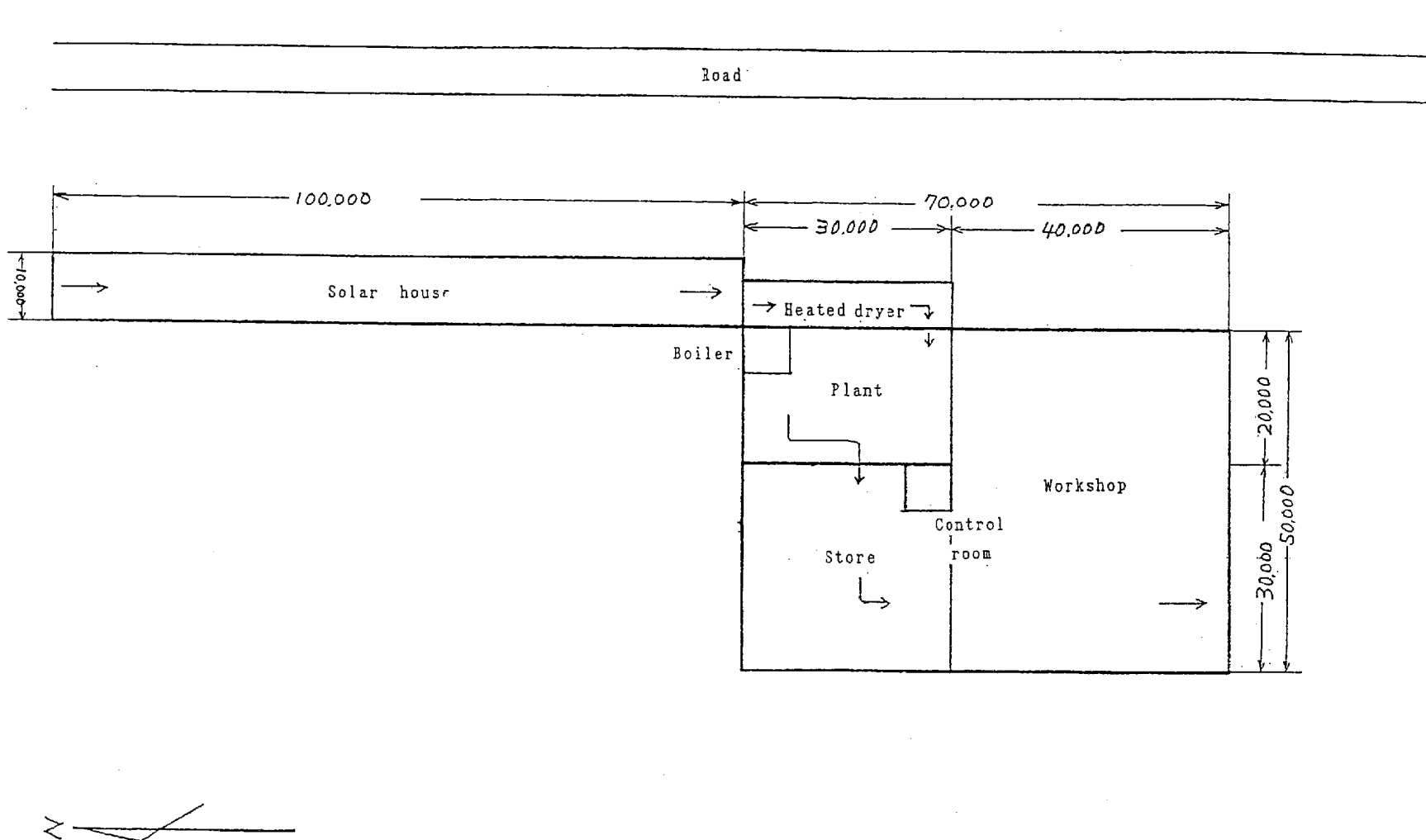


Fig.0 Building Layout Plan (draft)

(Example of reference: from K. TANAKA)

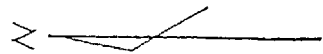
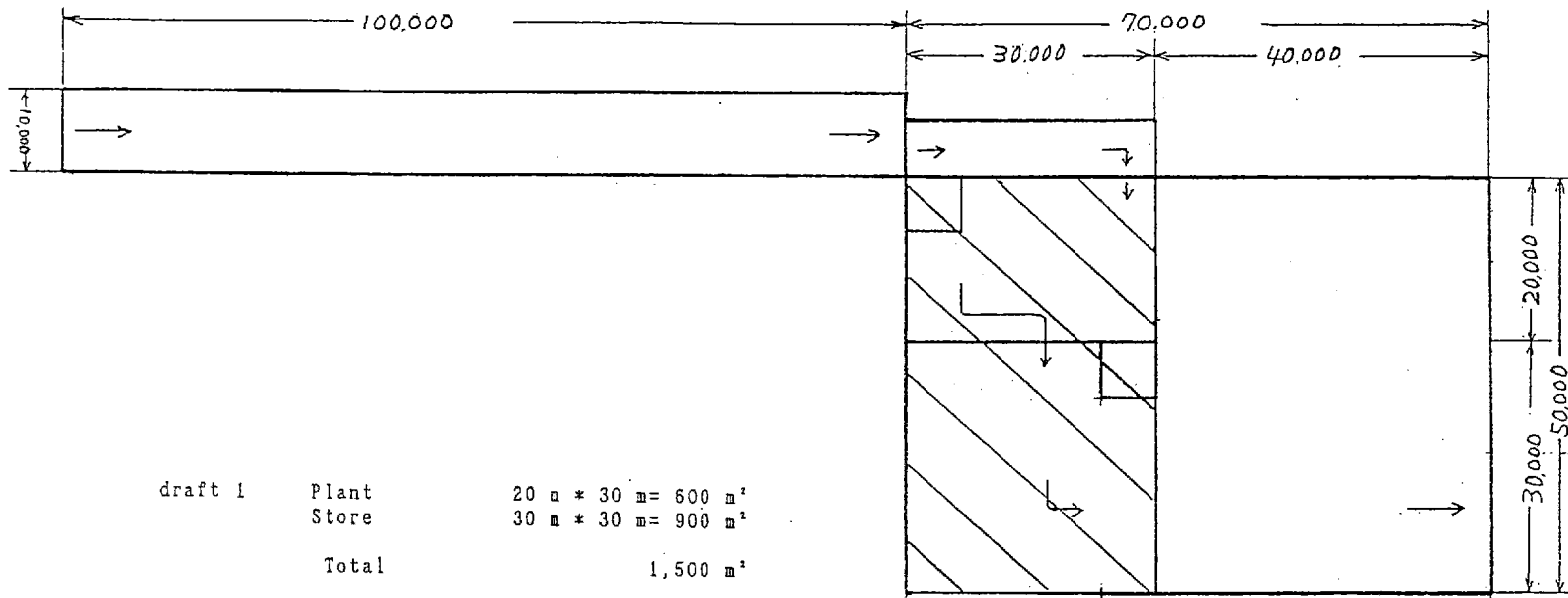


Fig.1 Building Layout Plan (draft 1)

(Example of reference: from K. TANAKA)

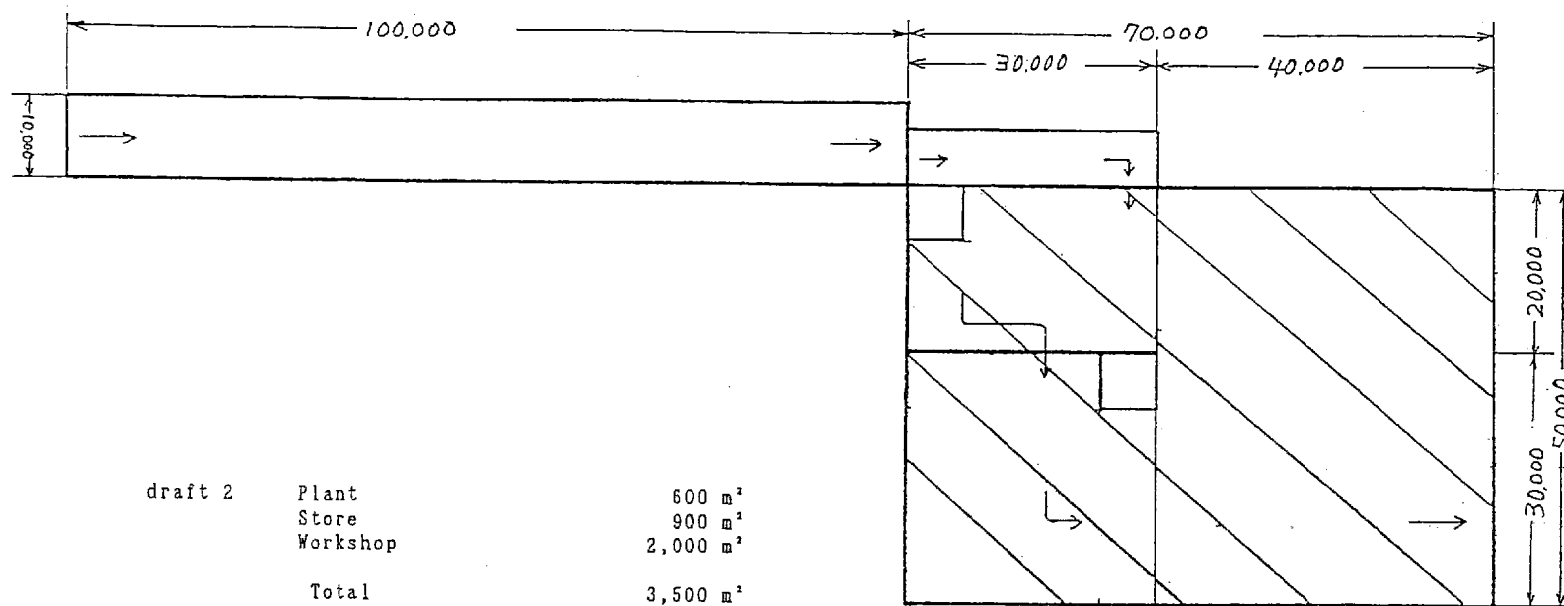


Fig.2 Building Layout Plan (draft 2)

(Example of reference: from K.TANAKA)

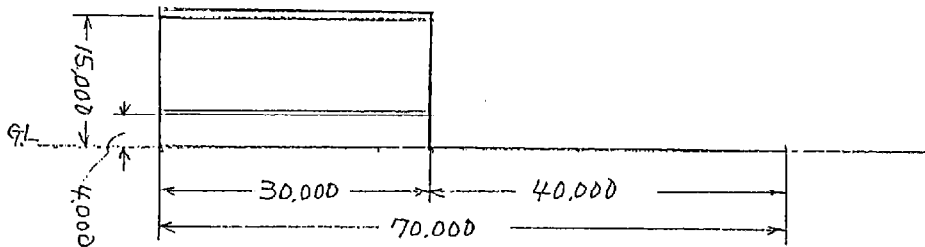
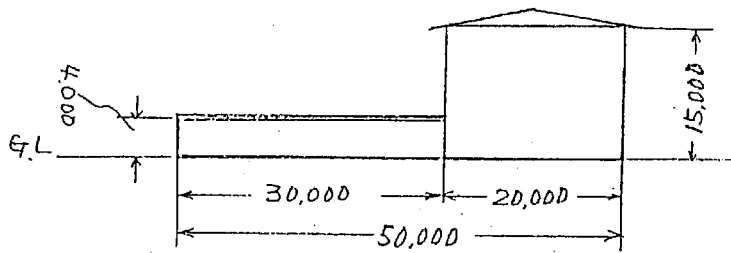


Fig.3 Section chart (draft 1)

(Example of reference:from K.TANAKA)

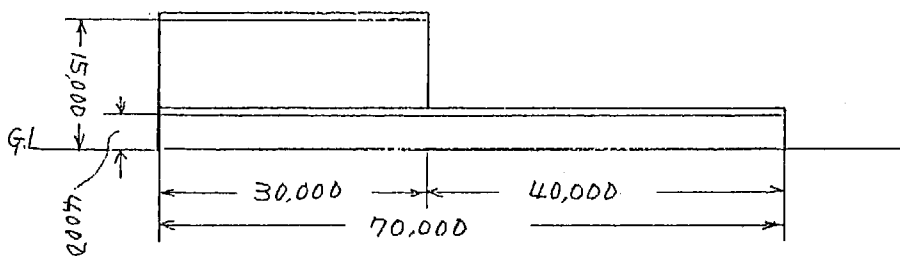
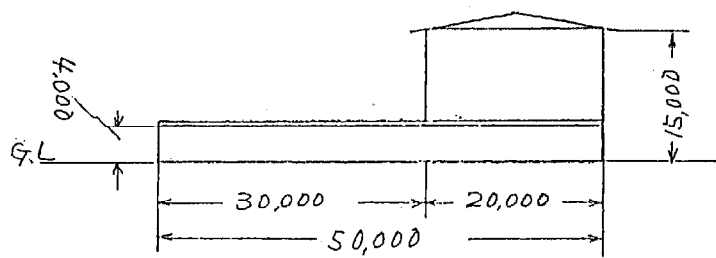


Fig.4 Section chart (draft 2)

(Example of reference:from K.TANAKA)

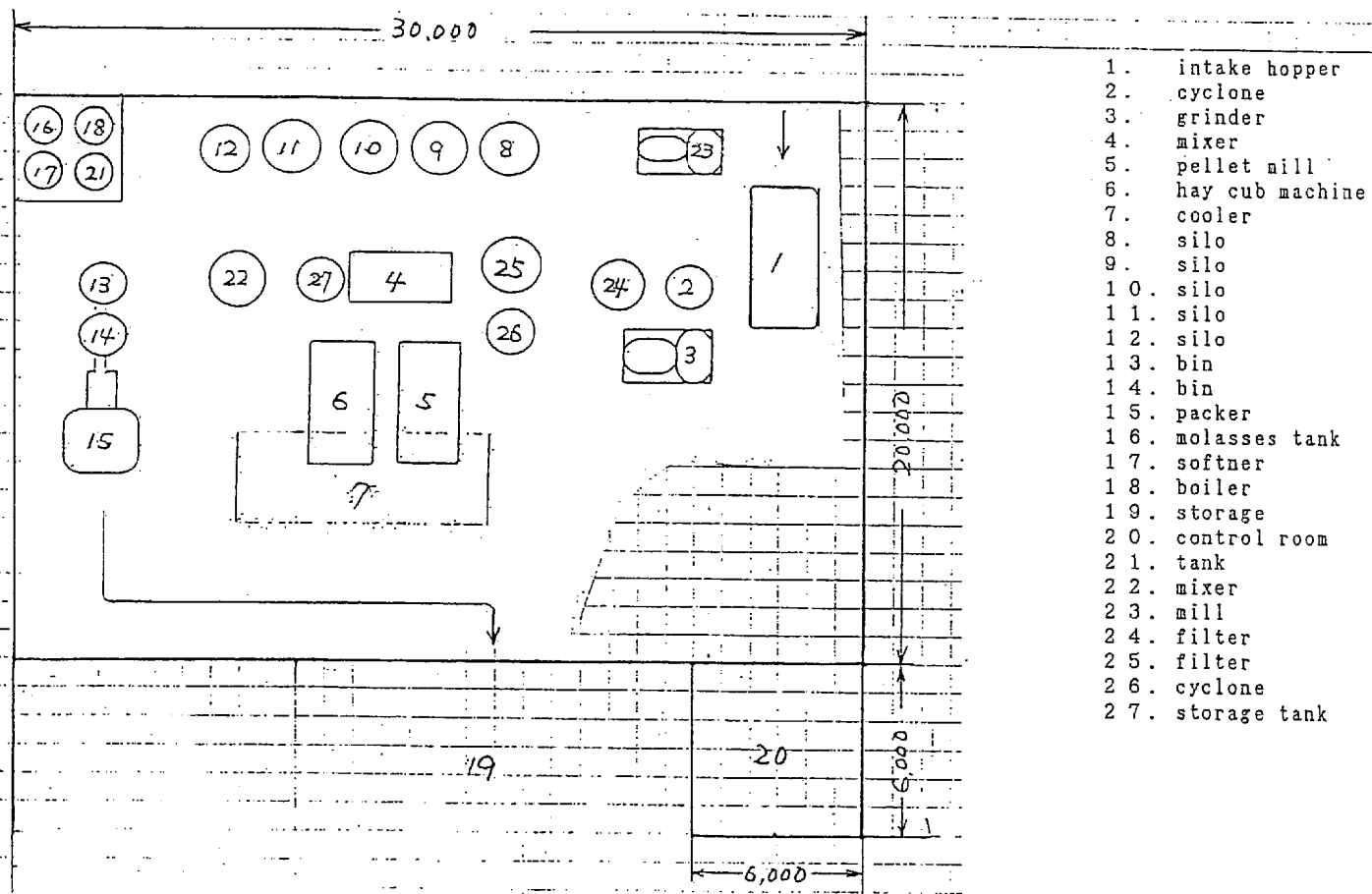


Fig.5 Plane charte

(Example of reference:from K.TANAKA)

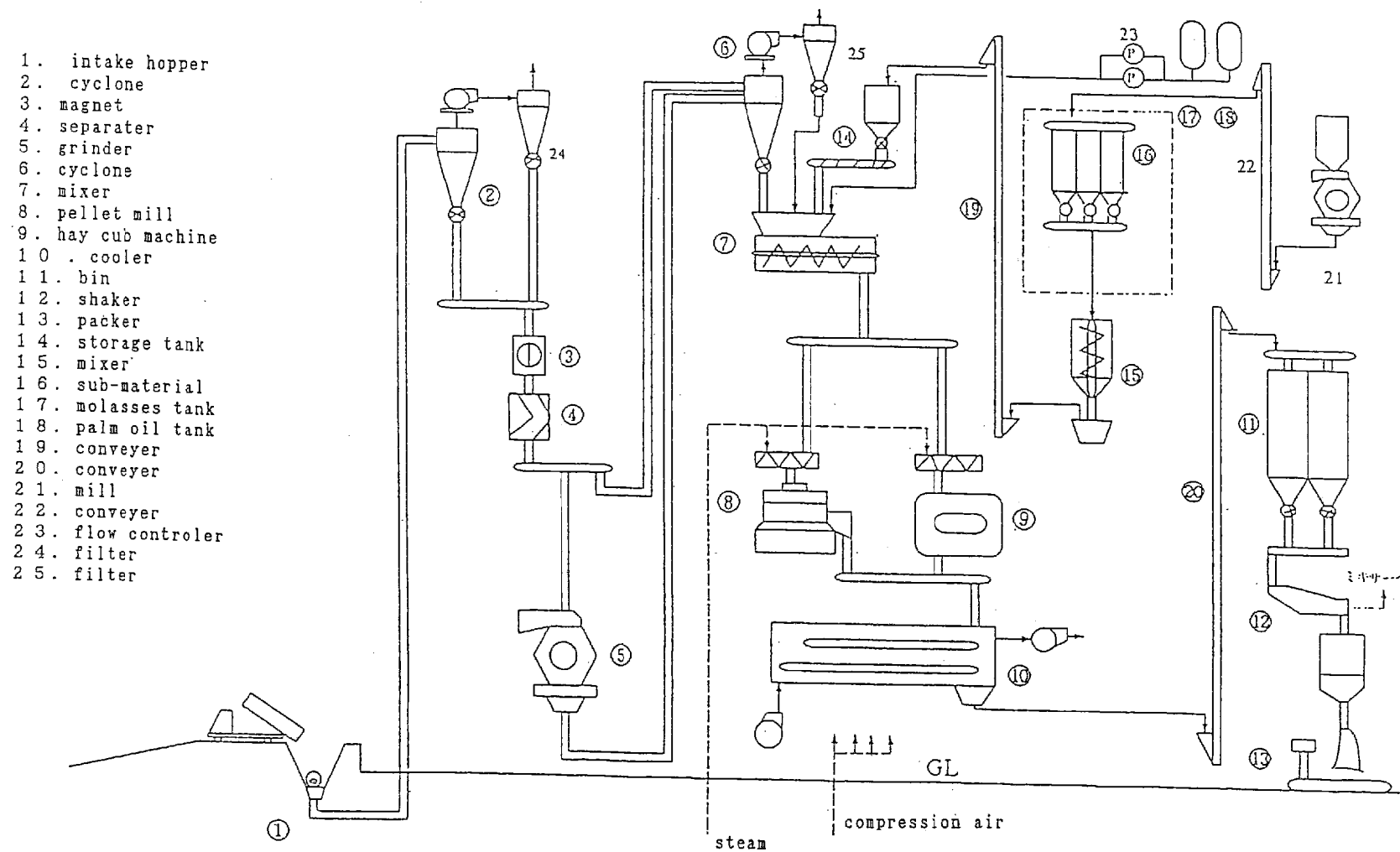


Fig.6 Process chart

(Example of reference: from K.TANAKA)

2. 機械化体系概要報告書 : Conceptual Design of Machinery System for Collection and Processing of Oil Palm Fronds (OPF) for Feed Production

*Conceptual Design of Machinery system
for Collection and Processing
of Oil Palm Fronds (OPF)
for Feed Production*

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Conceptual Design of Machinery System for Collection and Processing of Oil Palm Fronds (OPF) for Feed Production

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1. Introduction

The Malaysian livestock industry can be generally classified into the ruminant and the non-ruminant subsectors. The non-ruminant production of poultry meat, eggs and pork has kept pace with the national requirement with some excess for export. However, the ruminant subsector comprised of cattle, buffalo, goat and sheep is not well developed in spite of the priority given by the government for its development. Commercial large scale cattle production has met with little success due to the long gestation interval, high capital and low return (Mahyuddin, 1993). On the other hand, the smallholders are still the main sluggish player of the ruminant subsector using their limited land, capital and diminishing communal grazing reserve due to the rapid housing and industrial zones development in the country (Abu Hassan *et al.*, 1995a). Although Malaysia is able to export some pork, poultry meat and eggs, overall she is a net importer of animal products, namely milk, beef and mutton (Table 1). About RM720 million worth of animal products were imported in 1990 compared to only RM320 million worth exported in the same year (DVS, 1992).

One of the major constraints to the development of ruminant subsector in Malaysia is the inability to produce sustainable feed resources which in turn perpetuated the production pattern of low input-output traditional production systems. Even though a number of fibrous agriculture products and by-products have been proven to be suitable for incorporation into ruminant feed, their usage is still limited to *in-situ* or areas specific (Abu Hassan *et al.*, 1995b). Therefore, the greatest challenge is to develop appropriate technology for processing available fibrous agro-biomass for use beyond *in-situ*. In this respect, oil-palm industry generates most of the agro-biomass, both in quantity and quality, that can be utilized as resources for commercial manufacturing of animal feed.

Table 1. Production and consumption of animal products in Malaysia (1990)

Animal Products	Local Production	Total Consumption	Percapita Consumption (kg)	% Self sufficiency
Beef, t	12,245	50,874	3.49	24.07
Mutton, t	657	7,283	0.50	9.03
Pork, t	176,014	150,093	10.29	131.45
Poultry, t	366,000	297,000	20.40	117.27
Eggs, mil. nos.	5,029	4,085	280.01	1123.11
Milk, mil. l.	26.2	561.06	28.47	4.67

Source: DVS Livestock Statistics (1992)

2. An overview of biomass production in oil palm industry

The oil palm, *Elaeis guineensis*, was first introduced into Malaysia in 1870 and later commercially cultivated in large plantations since 1917. In 1993, about 2.3 million hectares of land had been cultivated with oil palm producing about 7.4 million tonnes (mil. t) of crude palm oil (CPO) (Singh, 1994). In the process, the oil palm industry generates a number of by-products and residues both in the field and at the palm oil mills, which are either recycled or converted into value-added products. The types of by-products and residues produced by the oil palm industry are shown in Scheme 1.

2.1 Field residues

The main residues produced in the field are the pruned oil-palm fronds (OPF), removed during regular harvesting and pruning rounds, and the oil-palm trunks (OPT) and OPF of the old trees during replanting when the palms reach their economic life of about 25 years. A total of about 76,000 hectares comprising approximately 10.3 million oil palms are expected to be replanted every year (Kamarudin *et al.*, 1994).

In a fully mature palm, about 24 fronds are pruned annually (Singh, 1994) with the average planting density of about 136 palms per hectare ((Kamarudin *et al.*, 1994). The amount of OPT and OPF available in 1993 is given in Table 2. The quantity of OPT and OPF generated in the field are expected to increase to 7 mil. t and 26.2 mil. t, respectively, by year 2000 (Salleh, 1994).

Table 2: Availability of oil palm trunks and fronds in 1993

Residues	Dry weight	
	t/ha	mil. t
Oil palm trunks (OPT)	75.5	3.65
Oil palm fronds (OPF):		
At replanting	14.5	0.70
During pruning	10.4	23.70

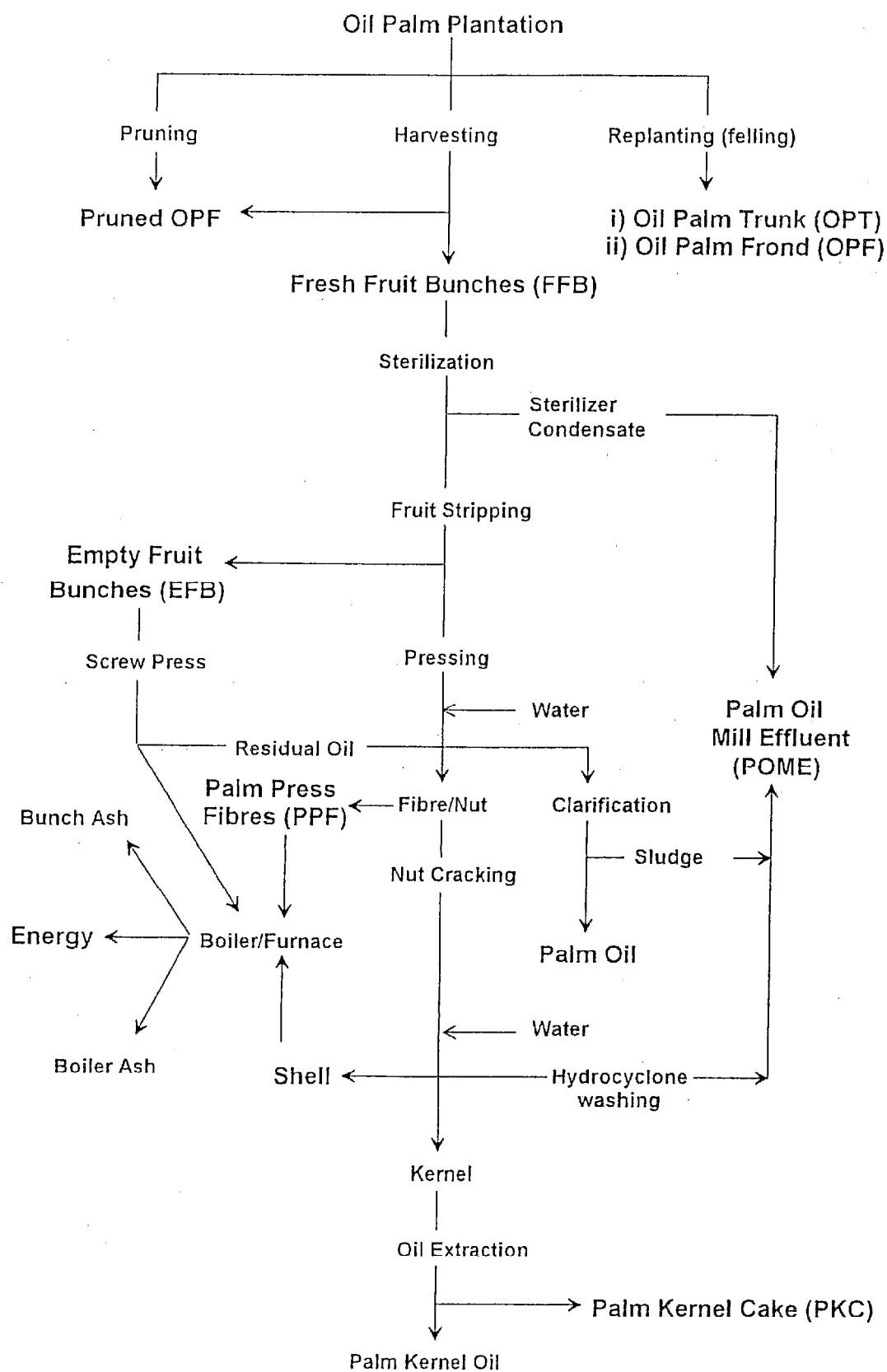
2.2 Mill residues

In the mill, the main residues produced during the milling of the fresh fruit bunches (FFB) for the extraction of oil and kernel are the mesocarp fibre or also known as palm pressed fibre (PPF), shell, palm kernel cake (PKC), empty fruit bunches (EFB), palm oil mill effluent (POME), boiler ash and bunch ash.

On the average, for every tonne of FFB processed, about 220 kg of EFB, 670 kg of POME, 120 kg of PPF, 70 kg of shell and 30 kg of PKC are generated. The amount of each residue produced in 1993 is given in Table 3 (Singh, 1994).

Table 3: Available palm oil mill residues in Malaysia (1993)

Residues	Fresh weight (mil. t)	Dry weight (mil. t)
Palm Pressed Fibre (PPF)	4.74	1.68
Shell	2.77	2.54
Empty Fruit Bunches (EFB)	8.70	3.05
Palm Oil Mill Effluent (POME)	26.47	1.32
Palm Kernel Cake (PKC)	1.19	1.15



Scheme-1: Types of by-products generated by the oil palm industry

3. Prospect of using oil palm fronds (OPF) as animal feed

Among the oil palm residues suitable to be used as animal feed, OPF is the most abundantly available throughout the year either as a result of pruning or replanting operations in the plantations (Table 2). Whole OPF, comprised of petiole and leaflets (Figure 1), can be chipped to about 2-3 cm particle size by mechanical chippers and utilized as cattle feed either as green chops or as silage, in combination with other ingredients or concentrates as total mixed rations (TMR).

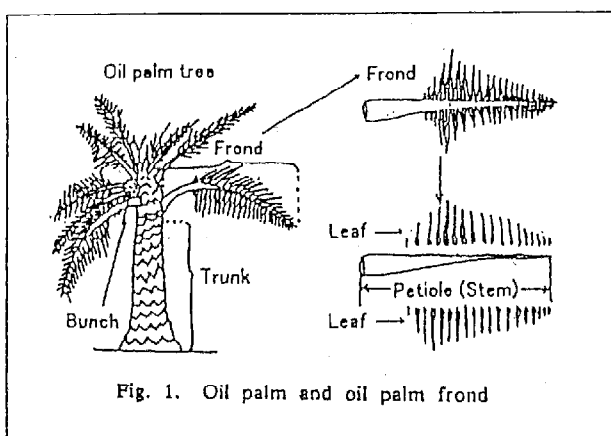


Fig. 1. Oil palm and oil palm frond

3.1 Nutritive value of OPF

Long term experiments on beef cattle and dairy cows show that animals fed with OPF based diet were able to perform comparably to those given cut grass based feed without any sign of negative effects. The optimal levels of OPF inclusion in the TMR on the dry matter basis were proposed to be 30 to 40% and 30% for beef and dairy cattle, respectively (Ishida & Abu Hassan, 1997) and 30% for goat and sheep (Abu Hassan *et al.*, 1995b).

The chemical composition of OPF compared to other oil palm by-products is as shown in Table 4.

Table 4. Chemical composition of OPF & other oil palm by-products

Items	Composition (% of dry matter)					
	OPF	PKC	POME	PPF	OPT	EFB
Crude protein (CP)	4.2	17.2	12.5	5.4	2.8	3.7
Ether extract (EE)	2.0	1.5	11.7	3.5	1.1	3.2
Crude ash	4.7	4.3	19.5	5.3	2.8	-
Crude fibre (CF)	38.5	17.1	20.1	41.2	37.6	48.8
Neutral detergent fibre (NDF)	69.5	74.3	63.0	84.5	79.8	81.8
Acid detergent fibre (ADF)	50.9	52.9	51.8	69.3	52.4	61.6
Metabolisable energy (ME), MJ/kg	5.65	11.13	8.37	4.21	5.95	-
Total digestible nutrient (TDN), %	45.0	79.4	-	-	-	-

Source: Abu Hassan (1996)

The analysis done by Ishida and Abu Hassan (1992) found that OPF composed of about 70% fibre and 22% soluble carbohydrates on a dry matter basis. Based on the measured *in vitro* dry matter digestibility (IVDMD) of 35.6%, *in vivo* dry matter digestibility of OPF was estimated to be 45% (Ishida & Abu Hassan, 1997). These results showed that OPF could be utilised as roughage for ruminants with nutritive value equivalent to that of rice straw.

OPF silage as roughage source for dairy cows: One of the critical components of a dairy diet is the amount and type of fibre consumed by the animal. Higher fibre diets are broken down more slowly by rumen microorganism and induced more acetic acid (C_2) production compared to propionic acid (C_3). Within limits this favour milk synthesis and improved milk fat levels (Owen, 1987).

In a feeding trial conducted by Abu Hassan and co-workers, they found that Sahiwal- Friesian cows fed with 30% OPF silage based diet show excellent dry matter intake (DMI) and produced more milk at higher milk production efficiency compared to other treatments in the trial (Abu Hassan *et al.*, 1993).

3.2 *Processing OPF as animal feed for usage beyond in situ*

Since the release of the OPF technology in 1992, the early adopters of OPF technology generally use it *in situ* as fresh green chops on day-to-day basis. At most, the OPF was conserved in the form of silages. But, in order to expand the ruminant production in the country (*ie.* increases the rate of self-sufficiency cum food security), it is pertinent to develop processing technology capable of producing OPF based feed for use beyond *in situ*, either in cube or pellet forms, to ensure sustainable feed supply to meet the animals requirement.

In a study conducted by Asada and co-workers, the total digestible nutrients (TDN) of pelletised OPF was estimated to be 33% which showed that nutritive value of OPF based feed was preserved even after being dried and pelletised. It was also found that pelletised OPF based feed shows good *preservability* (*ie.* no deterioration due to moulds etc.) during long term experiment (Asada *et al.*, 1991) which is a very important factor to enable it to be used beyond *in situ*.

As at the moment, researchs in producing complete feed based on OPF in a pellet form as well as the animal trial on a small scale basis are still going on in MARDI. Preliminary results show positive findings in terms of dry matter intake and improvement of the production potential of the animals.

4. Conceptual design of machinery system for collecting, chipping and transporting OPF from oil palm plantation to processing plant

At present, collection of OPF along row is carried out manually and transportation is usually by 1-tonne lorry in its whole form from farm to processing centre where it is mechanically chipped. Chipped OPF is then fed to the animals either as fresh green chops or after being ensiled. Such operation is generally carried out by individual animal producer in small scale basis and proven to be technically and economically viable. However, collection and transportation of fresh OPF to supply enough raw materials for large scale production of OPF pellets and cubes require a rethinking from the usual practice of collecting OPF. For instance, the bulk density of whole OPF is very low (about 100 kg/m³) which will incur high transportation cost in large scale basis. On the other hand, the bulk density of chipped OPF was estimated four times higher (Hamdan, 1996). Therefore, transporting chipped instead of whole OPF can reduce transportation cost (*ie.* for the same haulage volume, 4 times more amount in weight of chipped OPF can be transported compared to whole OPF). A new process flow need to be designed.

4.1 *Process flow-chart*

Based on observations and communications with farm operators (Hamdan, 1996), collecting OPF from farm to feedmill comprised a sequence of activities as follows:

- a) *Pruning of OPF during harvesting of FFB:* It is a common practice to prune on the average two OPF for every FFB harvested. This is to enable the harvester access to cut the FFB to be harvested.
- b) *Collecting whole OPF to roadside collection points:* After every round of FFB harvesting which is carried out commonly every two weeks for each area, the pruned OPF would be collected and brought to predetermined roadside collection points, either manually or mechanized using tracked infield transporter.
- c) *Chipping OPF in the farm:* Gathered OPF at the farm roadside collection points were chipped by transportable mechanical chipper, either engine-driven or tractor PTO-driven, and loaded directly into a waiting empty container.
- d) *Transporting chipped OPF to processing plant:* In order to minimise handling and save time, chipping OPF in the farm and transporting chipped OPF to the processing plant can be done simultaneously by employing *Roll on-Roll off container system*. In this system, a lorry - fitted with hydraulic locking device and equipped with two container - first put to the ground (*ie. roll-off*) an empty container at the farm roadside OPF collection point to be filled with chipped OPF by the chipper and then hoisting up (*ie. roll-on*) an already filled container and transported it to the processing plant in a continuous repeated cycle. In this case, the idle time of both lorry and chipper was kept to the minimum and thus, less number of machines are required to meet the target production since more operating hours per machine are utilised. Summary of the process flow-chart is as shown in Figure 2.

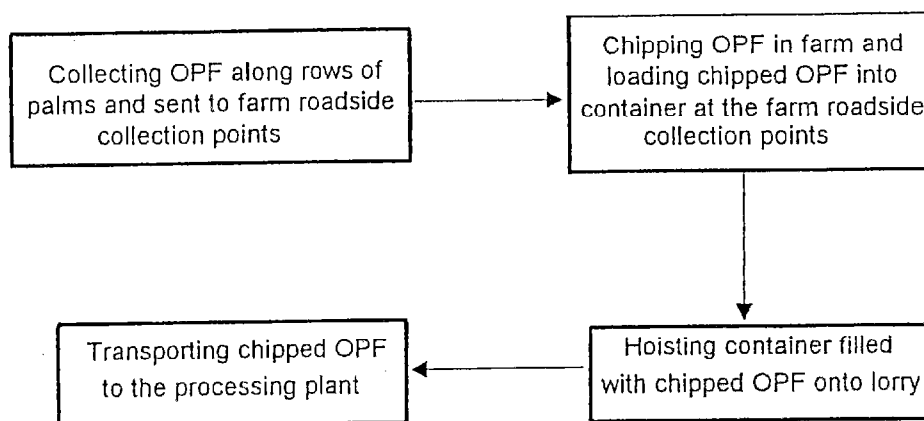


Figure 2: Process flowchart of OPF collection and transportation from farm to processing plant

4.2 *Estimation of machine components of the proposed machinery system*

Analysis for estimation of machines acquisition and maintenance, labour and fuel consumption of the conceptually designed machinery system is as shown in Appendix A. The analysis was based on the projected processing plant production of about 2 t/hr OPF cubes comprised of 100% OPF (dried, 15% m.c.) and 2 t/hr OPF pellet comprised of 30% OPF mixed with other ingredients in the TMR at daily operating hours of 5 hrs/day.

The summary of the analysis in case of mechanised versus manual OPF row collection is given in Table 5. From the analysis, it is clear that mechanized row collection of OPF can save about 117% of labour cost per day as well as alleviating associated working drudgery. In view of labour shortage of farm workers now acutely experienced by Malaysia due to stiff competition by industrial sector, the fully mechanised system is considered the better option. The increased capital cost due to machines acquisition does not increase the unit cost (*ie.* ex-plant delivered cost, RM/t fresh OPF). In fact, the unit cost reduced about 2% by going fully mechanised but the reduction is considered insignificant.

Table 5. Estimated no. of machines and labour required and its cost to deliver 26 t/day fresh OPF within 10 km radius travel distance: Mechanised vs. manual row OPF collection

Operation	Machine Components	Mechanized row collection				Manual row collection			
		Machine		Labour		Machine		Labour	
		No	Cost (RM)	Man-day	Cost (RM/day)	No	Cost (RM)	Man-day	Cost (RM/day)
OPF row collection	Crawler truck	2	100,000	6	180	-	-	13	390
On-farm OPF chipping	9 in. dia. Chipper	1	61,000	1	30	1	61,000	1	30
Transportation of Chipped OPF to feedmill	Roll on-Roll off 3t Lorry	1	112,000	1	50	1	112,000	1	50
	Container	2	15,000	-	-	2	15,000	-	-
TOTAL		RM288,000		8	RM260	RM188,000		15	RM470
Ex-plant delivered cost, RM/t		26.11				26.65			

4.3 Cost analysis of the proposed machinery system

Also shown in Appendix A is the detail cost analysis with the result of the analysis given in term of cost (in RM) per tonne of fresh chipped OPF delivered to the processing plant (*ie.* ex-plant delivered cost, RM/t) which is calculated at about RM26.11 and RM26.65 for mechanised and manual row OPF collection, respectively. This value can be used as a basis for decision by the feedmill operator whether to acquire machines and labours to carry out the OPF collection himself or opted for outside contractor to do the job if the quoted price is lower than this value. However, at the present transportation charge of *whole* OPF at an average RM50 per trip of 1-tonne lorry within 10 km travelling distance, it seemed owning and operating machines by operator himself can bring about more than 100% overall saving considering the OPF is already *chipped*.

5. Conclusion

It has to be clarified here that the above analysis had been done at a conceptual level based on preliminary field experiments, observations and personal communications with persons experienced in oil palm plantation management. The main purpose is to study the technical and economical feasibility of embarking upon large scale collection and handling of OPF for commercial manufacturing of OPF based feed in the form suitable for use beyond *in situ*, either as roughage or complete feed. In this context, the following conclusions can be made from above analysis:

- 5.1 Mechanised collection of whole OPF along the row to the farm roadside collection points using tracked infield transporter and two workers (*ie.* for loading OPF) for each transporter can bring a projected 117% of labour saving compared to fully manual operation without affecting the unit cost (*ie.* ex-plant delivered cost). Tracked transporter, preferably using rubber, is recommended to ensure vehicle mobility (*ie.* no slippage or sinkage) in most ground and weather conditions.
- 5.2 In-farm chipping of whole OPF before transportation to processing plant can increase the bulk density of OPF by four times, thus, can bring about four-fold saving in transportation cost. However, the chipped OPF has to be dried as soon as possible to prevent deterioration due to fermentation or moulds infection.
- 5.3 Transportation of chipped OPF using *Roll on-Roll off container system* can bring about a projected significant increase in percentage of effective operating hours of both chipper and lorry compared to *fixed container system*. The increased effective utilisation meant less number of machines are required to accomplished the task, thus, bring about a saving in machine acquisition cost.
- 5.4 The projected ex-plant delivered cost of fresh OPF employing the proposed mechanised collection and transportation system (*ca.* RM26/tonne) constituted at least 92% saving compared to the present average transportation charge offered by the transport contractors.

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COST ANALYSISOIL PALM FROND (OPF) COLLECTION & TRANSPORTATION FROM FARM TO PROCESSING PLANT: ROLL ON-ROLL OFF CONTAINER SYSTEM

1. Gathering whole OPF to roadside collection points

Basic Information:

- Processing plant output: 2 t/hr pellets (30% OPF) + 2 t/hr cubes (100% OPF)
- Fresh OPF has moisture content about 65% (wet basis)
- Required OPF moisture content prior to pelleting/cubing: 15% (wet basis)
- Daily requirement of dried OPF = $(2 \times 0.3 + 2) \text{ t/hr} \times 5 \text{ hr/day} = 13 \text{ t/day}$
- Daily requirement of fresh OPF = $13 / [1 - (0.65 - 0.15)] = 26 \text{ t/day}$
- Average weight of fresh whole OPF = 13 kg
- Oil palm planting density = 136 palms/ha
- 2 rounds of FFB harvesting for a particular area per month (*ie.* every 2 weeks)
- Average oil palm tree bears 5 FFB per year

Assumptions:

- 2 OPF pruned for each fresh fruit bunch (FFB) harvested
- No. of FFB-bearing palm tree out of every 100 palms per round harvesting
 $= (5 \text{ FFB/palm}) / (12 \text{ mths/yr}) / (2 \text{ rounds/mth}) \times 100 = 21 \text{ out of every 100 or } 21\%$
- Max travelling distance from roadside = 200 m covering 20 palms in a row (*ie.* half of 400 m distance between adjacent parallel farm roads covering 40 palms each row)
- An average worker can collect whole OPF manually 3 rows per hour (20 palms/row) working at 6 operating hours per day (*ie.* due to drudgery, rest periods are required from time to time)
- A collector gang of 2 workers and a tracked infield transporter with a driver can collect whole OPF 16 rows per hour (20 palms per row) working at 7 operating hours per day (*ie.* due to less drudgery, workers can operate longer hours per day)

Cost Calculation:

- Required no. of OPF to be collected to get 26 t/day fresh OPF
 $= (26,000 \text{ kg/day}) / 13 \text{ kg/frond} = 2,000 \text{ OPF}$
- Required no. of palms to be harvested to get 26 t/day fresh OPF
 $= 2,000 \text{ OPF} / 2 \text{ OPF/palm} = 1,000 \text{ palms}$
- Area to be covered = $(1,000 \text{ palms}) / (136 \text{ palms/ha}) / (21\% \text{ fruiting palms}) = 35 \text{ ha}$

(a) *Manual collection:*

- Per hour, a worker can collect: $3 \text{ rows} \times 20 \text{ palms} \times 2 \text{ OPF} \times 21\% = 25 \text{ OPF}$
- Per day, a worker can collect: $25 \text{ OPF} \times 6 \text{ hrs/day} \times 13 \text{ kg/frond} = 1.95 \text{ tonnes}$
- Required man-day to collect 26 t/day fresh whole OPF = $26 / 1.95 = 13 \text{ man-days}$
- Labour cost per day to collect 26 t/day whole OPF = $13 \times \text{RM}30 = \text{RM}390.00$

(b) *Mechanized collection:*

- A tracked infield transporter (Yanmar):
 - Price : RM50,000.00 per unit
 - Fuel consumption (diesel): 10 litres/hr
 - Maximum payload: 2200 kg

- Per hour, a gang can collect: $16 \text{ rows} \times 20 \text{ palms} \times 2 \text{ OPF} \times 21\% = 135 \text{ OPF}$
- Per day, a gang can collect: $135 \text{ OPF} \times 7 \text{ hrs/day} \times 13 \text{ kg/frond} = 12.285 \text{ tonnes}$
- Required no. of collector gang = $(26 \text{ t/day}) / (12.285 \text{ t/gang/day}) = 2 \text{ gang each}$ comprised of one transporter and 3 workers (*ie.* 2 collectors + 1 driver)
- Total transporter acquisition cost = $2 \times \text{RM}50,000/\text{unit} = \text{RM}100,000.00$
- Labour cost per day = $3 \text{ man-day/gang} \times 2 \times \text{RM}30 = \text{RM}180.00$
- Fuel cost per day = $10 \text{ l/hr} \times 7 \text{ hrs/day} \times \text{RM}0.65/\text{l} \times 2 \text{ transporters} = \text{RM}91.00$

2. On-farm chipping of OPF

Basic Information:

- 9 in. knife dia., diesel-powered, transportable OPF chipper (Bandit):
 - Price: RM61,000.00 per unit
 - Throughput: 5 tonnes chipped OPF per operating hour
 - Max throughput per day = $5 \text{ t/day} \times 6 \text{ operating hrs} = 30 \text{ t/day}$
 - Fuel consumption: 12 litres/hr
 - Each chipper operated by one operator @ RM30/day

Cost Calculation:

- Required no. of chipper to chip 26 t/day OPF = $26/30 = 0.87$ say 1 chipper
- Actual operating hrs required per day to chip 26 t OPF = $26/5 = 5.2 \text{ hrs/day}$
- Total chipper acquisition cost = $1 \times \text{RM}61,000/\text{unit} = \text{RM}61,000.00$
- Labour cost per day = $1 \text{ man-day} \times \text{RM}30 = \text{RM}30.00$
- Fuel cost per day = $5.2 \text{ hrs/day} \times 12 \text{ l/hr} \times \text{RM}0.65/\text{l} \times 1 \text{ chipper} = \text{RM}40.56$

3. Transportation of chipped OPF to processing plant

Basic Information:

- Bulk density of chipped fresh OPF = 425 kg/m^3
- Roll on-Roll off container system: The system consisted of a 3-tonner lorry fitted with hydraulic locking capable of lifting 3 - 6 tonnes payload and equipped with 2 box container, 3 tonnes payload each. The container can be roll-off the lorry onto the ground and pick up back (roll-on) by the hydraulic system and also can be tipped to unload the payload. In the system, an empty container left behind in the farm would be filled with chipped OPF by the chipper while the lorry transporting the filled container to the processing plant in a continuous cycle.
- 3-tonner lorry fitted with hydraulic system (Isuzu):
 - Price: RM112,000.00 per unit
 - Fuel consumption: 15 km/litre
 - Price of container: RM7,500.00 per unit
 - Haulage capacity = 3 tonnes payload; 8 m^3 haulage volume

Assumptions:

- Travel distance between farm and processing plant: within 10 km radius
- Travel time (back and forth): 30 min. per trip
- Loading time in the farm *ie.* roll-off empty container onto ground & hoisting up filled container onto lorry by hydraulic: 10 min.
- Unloading time at processing plant by tipping = 5 min.

Cost Calculation:

- Time taken per trip (loading, travelling & unloading) = 45 min. = 0.75 hrs.
- Maximum no. of trips per day = (7 hrs/day)/0.75 hrs. = 9 trips
- Maximum payload per trip = (Haulage vol.)x(bulk density) = 8 x 0.425 = 3.4 say 3 t
- Maximum payload delivery per day = 9 trips x 3 tonnes/trip = 27 tonnes/day
- Required no. of lorry to deliver 26 t/day OPF = 26/27 = 0.96 say 1 lorry
- Total distance travelled per day = 9 trips x 20 km = 180 km
- Total acquisition cost = RM112,000 + 2 x RM7,500 = RM127,000.00
- Fuel cost per day = 180 km/(10 km/l) x RM0.65/l = RM11.70
- Lorry driver wage = RM50.00 per day

4. Cost analysis

Assumptions:

- Effective operating hours per day:
 - Infield transporter: 7 hrs
 - OPF chipper: 5.2 hrs
 - 3-tonner lorry: 7 hrs
- Working days per year = 290 days
- Annual interest rate for machine acquisition = 8% p.a.
- Trade-in value of machine at the wear-out life = 10% of new cost
- Annual charge for taxes, insurance & shelter = 2% of new cost
- Wear-out life: Transporter = 5 yr; Chipper = 5 yr; Lorry = 10 yr; Container = 5 yr
- Engine oil & filter cost = 15% of fuel cost
- Machine repair cost (RM per hour) = 0.01% of new cost

Cost Estimation (Manual OPF row collection):

- *Annual fixed charges:*

• Depreciation	- Chipper: (61,000-6,100)/5	=	RM10,980.00
	- Lorry: (112,000-11,200)/10	=	RM10,080.00
	- Container: (15,000-1,500)/5	=	RM 2,700.00
• Interest	= 0.08 (188,000+18,800)/2	=	RM 8,272.00
• Taxes, insurance & shelter:	0.02 x RM188,000	=	<u>RM 3,760.00</u>
	TOTAL	=	RM35,792.00
- *Cost per day:*

• Fixed cost:	RM35,792/(290 working days/yr)	=	RM123.42
• Repairs:	0.0001[(5.2 x 61,000)+(7 x 112,000)]	=	RM 39.56
• Fuel cost		=	RM 52.26
• Oil & filter:	15% x RM52.26	=	RM 7.84
• Labour cost		=	<u>RM470.00</u>
	TOTAL COST PER DAY	=	<u><u>RM693.08</u></u>
- *Ex-processing plant delivered cost:*

• per tonne fresh OPF:	RM693.08/(26 t/day)	=	RM26.65
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Cost Estimation (Mechanized OPF row collection):

- *Annual fixed charges:*
 - Depreciation
 - Transporter (100,000-10,000)/5 = RM18,000.00
 - Chipper: (61,000-6,100)/5 = RM10,980.00
 - Lorry: (112,000-11,200)/10 = RM10,080.00
 - Container: (15,000-1,500)/5 = RM 2,700.00
 - Interest = $0.08 (288,000+28,800)/2$ = RM12,672.00
 - Taxes, insurance & shelter: $0.02 \times \text{RM}288,000$ = RM 5,760.00
 - TOTAL = RM60,192.00
- *Cost per day:*
 - Fixed cost: $\text{RM}60,192 / (290 \text{ working days/yr})$ = RM207.56
 - Repairs: $0.0001[(5.2 \times 61,000) + (7 \times 112,000) + (7 \times 100,000)]$ = RM 46.56
 - Fuel cost = RM143.26
 - Oil & filter: $15\% \times \text{RM}143.26$ = RM 21.49
 - Labour cost = RM260.00
 - TOTAL COST PER DAY = RM678.87
- *Ex-processing plant delivered cost:*
 - *per tonne fresh OPF:* $\text{RM}678.87 / (26 \text{ t/day})$ = **RM26.11**

(Sulit BPE 40/100/9 Vol. III.)

KERAJAAN SERI PADUKA BAGINDA
MALAYSIA

GENERAL CIRCULAR NO. 1 OF 1979

TERMS AND CONDITIONS FOR FOREIGN EXPERTS
SERVING IN MALAYSIA

I. Introduction

The purpose of this Circular is to revise the existing terms and conditions provided to foreign experts in Malaysia. This revision is necessary in the light of experience gained in the past years and to effect general improvements in the administration of technical assistance programmes as a whole. This Circular will thus supersede General Circular No. 1 of 1969.

2. The provisions of this Circular will come into effect as from 1st January, 1979 and will be applicable to experts recruited and assigned to Malaysia after this date. Experts assigned to State Governments, Public Authorities and other Agencies such as Malaysian Industrial Development Authority, Federal Agricultural Marketing Authority, Malaysian Industrial Development Finance Limited, University of Malaya etc. will be governed by the provisions of this Circular. The payment of allowances and other remuneration to experts so assigned will be the responsibility of the respective agencies.

II. Definition and Categories of Technical Assistance Experts or Projects

3. In general, the term 'expert' in this Circular refers to suitably qualified and experienced personnel provided under the Colombo Plan and other bilateral programmes to carry out specific assignments requested by the Malaysian Government. The terms of this Circular will not be applicable to those experts for which separate agreements between the Malaysian Government and other Countries/Agencies concerned have already been entered into e.g. the United Nations Development Programme and other United Nations Specialised Agencies, the Ford Foundation, the International Executive Service Corps, etc.

4. Three broad categories of technical assistance experts/projects are distinguished and covered by this Circular. These are:

- (a) provision of a long-term expert defined as an expert whose period of assignment in Malaysia is not less than six months;

- (b) provision of a short-term expert defined as an expert whose period of assignment is less than six months;
- (c) provision of consulting services and surveys involving a single or a team of experts with final responsibility resting on the chosen consulting firm or appropriate body.

III. Allowances and Other Privileges of Experts

A. LONG-TERM EXPERTS

5. The allowances and other privileges provided to long-term experts serving in Malaysia are as follows:

(1) *Installation Grant*

A lump sum installation grant will be paid to meet the initial settling-in cost of the expert for the first 14 days of his arrival in Malaysia. Thereafter the expert will be paid housing and subsistence allowances as specified in (2) below with payment for the month following the first 14 days being calculated on a *pro rata* basis. The rates of installation grant are as follows—

Single (or unaccompanied by wife) ...	\$ 780
Married and accompanied by wife ...	\$1,100
Married and accompanied by wife and one or two children not exceeding 18 years of age	\$1,500
Married and accompanied by wife and more than two children not exceeding 18 years of age	\$1,900

The installation grant is a once-for-all payment appropriate to the expert's circumstances at the time of arrival and no other claims can be made following the arrival of his family or when an expert returns from overseas leave on extension of his assignment.

(2) *Housing and Subsistence Allowances*

The Malaysian Government will not be responsible for providing the expert with accommodation. However, at the request of the expert, the Agency to which the expert is assigned will assist him in finding suitable private accommodation for rental. In lieu of housing the expert will be paid the appropriate rates of housing allowances as set out below.

An expert assigned to Sabah or Sarawak may be given accommodation provided there are available unoccupied Government quarters. In such a case no housing allowance will be paid to the expert nor will he be charged the normal government rental on the quarters. The expert will, however, be responsible for payment of water, electricity and other charges incurred while in occupation of such premises.

Subject to the above paragraphs the rates of housing and subsistence allowances payable to an expert depending on his family status are set out as follows—

	Allowances for		Total per month
	Housing	Subsistence	
Single (or unaccompanied by wife)	\$500	\$300	\$ 800
Married and accompanied by wife	550	500	1,050
Married and accompanied by wife and one or two children not exceeding 18 years of age	650	650	1,300
Married and accompanied by wife and more than two children not exceeding 18 years of age	650	750	1,400

NOTE:

- (i) At the request of the donor Government/Agency, the housing and subsistence allowances may be combined and considered as a single allowance.
- (ii) The housing allowance is viewed as a subsidy and payment will be effected through the donor Government/Agency.
- (iii) For the purpose of payment of subsistence allowance, an expert who is married without children and is not accompanied by his wife will be deemed as if he is single.
- (iv) Where both husband and wife are assigned as experts they will be paid housing and subsistence allowances as for an expert accompanied by wife plus an additional sum of \$300 per month.
- (v) Changes in the family circumstances of an expert should be reported immediately to the Head of Department concerned to permit adjustments to be made in respect of the expert's entitlement to allowances under this category. In cases of doubt the Department will refer the matter to the Economic Planning Unit (E.P.U.) for a decision which will be final.

(3) *Mileage and Other Allowances While on Duty*

Mileage allowances will be paid at the normal rates for journeys performed on official duties in accordance with the existing regulations governing transport and travelling claims in the State/Public Authority to which the expert is assigned. No claim is permitted for travelling between house and office. An expert who does not own or use a personal car for official duties will be reimbursed for the cost of actual transportation used and in conformity with existing rules applicable to Government officers. An expert on duty tour away from his Headquarters is eligible for a Day Allowance/Subsistence Allowance in the same way as Government Group A officers. The payment is governed by the relevant

regulations currently in force and at the rates applicable in Peninsular Malaysia, Sabah and Sarawak and of the Authority to which he is assigned.

For purposes of calculating an expert's claim for mileage and other allowances while on duty, an expert's salary will be deemed to be within the range of either \$1,006-\$1,804 or \$1,805-\$2,865 depending on the salary of his Malaysian counterpart in the State/Agency to which the expert is assigned.

(4) *Conveyance Advance*

An expert is eligible to apply for a loan for the purchase of a motor car. The terms for the granting of this loan are as follows—

- (i) the loan is granted only once in the whole tenure of the expert including all extensions of his assignment;
- (ii) the amount of loan applied for should not exceed the value of the vehicle to be purchased subject to a maximum amount of \$7,000. The terms of the loan will be in accordance with existing regulations enforced in each of the States of Malaysia or as amended from time to time. If a second hand car is purchased a valuation certificate on the car must be attached with the application;
- (iii) the loan is to be repaid in monthly instalments and to be settled in full before the expert departs from Malaysia. At the time of making the application for the loan the expert is requested to submit his proposal for the repayment of the loan;
- (iv) during the period of the loan the expert is requested to ensure that the car is adequately covered by insurance and he is not permitted to sell or transfer his motor car without the prior permission of the Government;
- (v) provision of sureties for the loan is not required but the Head of Department to which the expert is assigned should ensure that the Registration Card of the car is stamped with the words "Ownership Claimed by the Government" until the full loan has been repaid.

Application for motor car loan should be made in the usual forms and clearly identified with the words "EXPERT" for submission to and approval by the Secretary General to the Ministry/Head of Department/State/Public Authority concerned which will also ensure that the various conditions set out above have been and will be satisfactorily met.

(5) *Local Leave*

Local leave at the rate of 25 days a year will be granted to an expert. However, an expert assigned to an educational institution will not be eligible for leave other

than the normal school or college terminal holidays or with the prior permission of the authorities concerned. Such leave may be accumulated throughout the expert's tour of duty in Malaysia and may also be taken outside Malaysia. All local leave shall be taken within the period of the expert's assignment in Malaysia and an expert will not be permitted to accumulate his leave immediately prior to the completion of his assignment thereby in effect bringing forward his date of departure from Malaysia.

The Head of Department to which the expert is assigned or the officer designated by him is the approving authority for such leave and application for leave must be made in the usual form.

(6) *Medical Attention*

During his assignment in Malaysia, an expert and his family will be eligible for free medical and dental attention at Government hospitals. A letter of identity for this purpose will be issued to an expert seeking medical attention or dental attention.

No reimbursement will be made by the Government if the expert or his family elects to be treated by private practitioners. If admitted at a Government hospital the expert will be required to pay ward charges as laid down in Government regulations applicable to his Malaysian counterpart in the State/Department/Public Authority where the expert is assigned.

For purposes of determining class of ward, an expert's salary will be deemed to be within the range of either \$1,006—\$1,804 or \$1,805—\$2,865 depending on the salary of his Malaysian counterpart in the State/Department/Public Authority to which the expert is assigned. If an expert requests to be admitted to a higher class of ward than that to which he is eligible, he will be billed accordingly as is laid down in government regulations. Head of Departments must ensure that the appropriate hospital bills incurred by an expert are promptly settled.

(7) *Exemption from Income Tax*

An expert is exempted from Malaysian income tax on his official emoluments in respect of the period of assignment in Malaysia. An expert filling a cadre post will be required to pay taxes on the local portion of the salary paid to him.

(8) *Exemption from Customs Duty/Excise Duty and Sales Tax*

- (a) Subject to the conditions enumerated in sub-paragraph (d), an expert will be exempted from the payment of customs duty/excise duty and sales tax in respect of bona fide personal effects and essential basic household equipment brought into or purchased in Malaysia for his own use or the use of

his dependents provided that such personal effects and equipment are brought into Malaysia or purchased locally within the period of six months from the date of his arrival in Malaysia. For the purpose of facilitating customs clearance of the said personal effects and equipment a list thereof must be presented to the Head of Department to which the expert is assigned;

(b) In addition and also subject to the conditions in sub-paragraph (a), an expert is exempted from the payment of *ad valorem* registration fee and customs duty/excise duty and sales tax in respect of one motor car only brought into Malaysia or purchased locally in Malaysia, provided that—

(i) such imported motor car has been used by the expert concerned in his country of origin or the country of last posting, or

(ii) the motor car is purchased locally within the period of six months from the date of his arrival in Malaysia.

(c) Any expert desiring to make purchases of duty free locally manufactured/assembled items must in the first instances apply for the approval of the customs through the Head of Department. Such purchases are only permitted if orders are placed with the manufacturers and delivery made from bonded warehouses. These purchases are allowed only in the first six months of the expert's stay in the country;

(d) The exemptions in sub-paragraphs (a), (b) and (c) are given subject to the following conditions—

(i) the aforesaid exemptions are given only once irrespective of whether the expert's assignment in Malaysia is extended beyond the original period of his assignment;

(ii) each expert is confined to only one unit or set or a reasonable number of any bona fide personal effects to be imported or purchased locally;

(iii) the personal effects and household equipment for which the aforesaid exemptions are given, if imported, should be from the country of origin or the country of last posting or acquired from any other country while on transit to Malaysia;

(iv) the personal effects and household equipment or motor car in respect of which the aforesaid exemptions are given will be cleared by and delivered from the Customs upon presentation there to of a Certificate of Exemption prepared and duly signed by the Head of Department to which the expert is assigned;

- (v) the Head of Department to which the expert is assigned shall maintain a complete record of all the personal effects, household equipment and motor car so cleared and shall make such records available upon request for inspection by the Customs or other appropriate Government authority;
- (vi) any personal effects or household equipment or motor car in respect of which the aforesaid exemptions are given, if disposed of in Malaysia during or at the end of the period of an expert's assignment in Malaysia shall be subject to the normal customs duty or other charges at the rate in force on the date the exemption was given and on the value at the time of disposal.

B. SHORT-TERM EXPERT

6. A short-term expert will be paid an all-inclusive per diem allowance of \$70 per day. He is not entitled to the allowances and privileges stated in paragraph 5, items (1), (2) and (4). He is however eligible to the facilities provided under paragraph 5, items (3), (5), (6), (7) and (8).

7. The despatch of an expert or mission by the donor Country/Agency to evaluate any project or request will not be considered as falling within the scope of this Circular and therefore no payment of allowances or other privileges will be made to such expert besides the normal reception and other arrangements for his programme of visits, discussions, etc.

C. CONSULTING SERVICES AND SURVEYS

8. Consulting services normally involve the provision of a team of experts from the donor Government, other bodies and firms for the purpose of carrying out feasibility, management and specific projects. The fee for such services will be paid by the donor Government/Agency and that individual experts provided under this arrangement will not therefore be eligible to any other allowances from the Government.

9. The Government will, however, provide the Consultants with local facilities including reasonable transport, office accommodation which are necessary in carrying out the assignment. All reports and materials obtained in the course of their assignment remain the property of the Government which has absolute discretion as to their use or disposal.

IV. Equipment Associated with Provision of Experts and Services

10. All equipment brought into Malaysia associated with the assignment of the expert and consulting services will be exempted from customs and other duties. The Head of the Department/Authority concerned will ensure that such equipment is speedily cleared at the port of discharge. A Certificate for Exemption from

customs duty under this category, to facilitate customs clearance, is to be issued by the Head of Department/Public Authority concerned and copies of such Certificates are to be extended to the Treasury, Customs and E.P.U. A condition of this exemption is that the equipment is not to be resold in Malaysia but may be re-exported or left behind as a gift to the Government/Public Authority.

V. General

11. An expert is not immune from the laws and regulations prevailing in Malaysia including communication regarding classified matters/documents. In the exercise of his duties he is required to give due regard to these laws. In the event of any legal action arising from the performance of his official duties he will be entitled to legal assistance in the same manner as a Government officer.

12. The Government of Malaysia will have the right after due consultation with the donor Government/Agency to request the recall of any expert whose work or conduct is unsatisfactory.

13. The terms of this Circular are subject to review from time to time in accordance with policy and regulations and they may be modified, amended or terminated by the Government.

TAN SRI DATO' ABDULLAH BIN AYUB,
*Chief Secretary to the Government,
Malaysia*

ECONOMIC PLANNING UNIT,
PRIME MINISTER'S DEPARTMENT,
KUALA LUMPUR,
31st July, 1979

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KERAJAAN SERI PADUKA BAGINDA
MALAYSIA

AMENDMENT TO GENERAL CIRCULAR NO. 1 OF 1979

TERMS AND CONDITIONS FOR FOREIGN EXPERTS
SERVING IN MALAYSIA

The following amendments are to be incorporated in General Circular No. 1 of 1979 of 31st July, 1979 and effective from 1st January, 1979:

(i) Delete "ad valorem registration fee and" in paragraph 5 (8) (b).

(ii) Paragraph 5 (8) (d) (vi) now reads as follows—

"the goods of which the aforesaid exemptions are given cannot be sold or otherwise disposed of within a period of 3 months from the date of import or 6 months from the date of (local) purchase, provided that in the case of a motor vehicle if sold or otherwise disposed of shall be subject to the normal duties as the rate in force on the date the exemption was given and on the value at the time of disposal".

(iii) Last sentence of paragraph 6 now reads as follows—

"He is, however, eligible to the facilities provided under paragraph 5, items (3), (5), (6), (7), (8) (a) and (8) (b) (i) subject to item (8) (d)".

TAN SRI DATO' ABDULLAH BIN AYUB,
*Chief Secretary to the Government,
Malaysia*

ECONOMIC PLANNING UNIT,
PRIME MINISTER'S DEPARTMENT,
KUALA LUMPUR.

1st November, 1979

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