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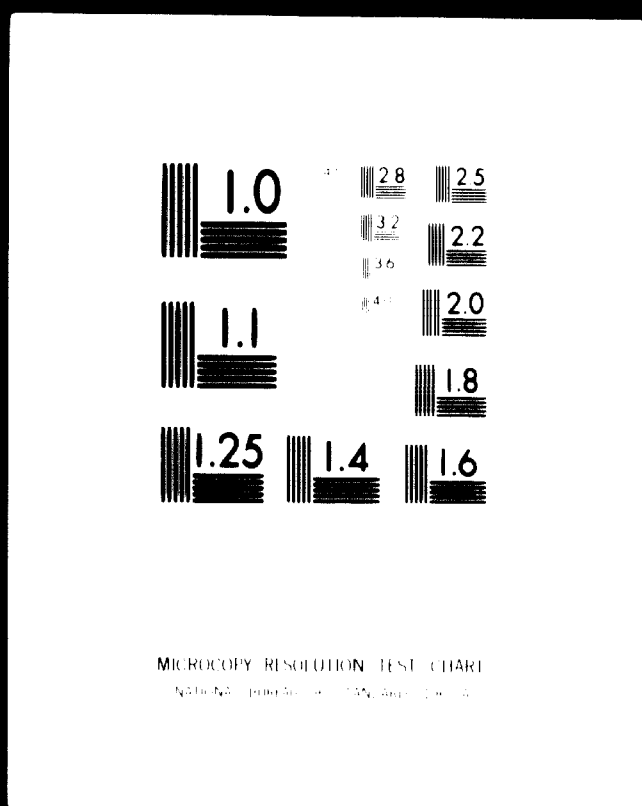
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DRAFT FINAL REPORT

(R) A STUDY OF MANUFACTURE OF
FARM AND ARTISAN HAND TOOLS
IN THAILAND

UNIDO CONTRACT NO. 71/85
PROJECT NO. SIS 71/1162 THAI-26

P.A. International Management Consultants Ltd.
London.

April 1972

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1. INTRODUCTION

The purpose of this report is to submit the findings and recommendations of the study of manufacture of farm and artisan hand tools in Thailand, carried out by P.A. International Management Consultants in the first quarter of 1972. In this report we describe the market for imported hand tools in Thailand; select a suitable range of forged tools for local manufacture; appraise the capability of each sector of existing industry to manufacture the recommended range; recommend steps for their improvement; specify in detail the technical requirements of the proposed plant; and forecast the financial return and other benefits which can be expected from the proposed plant. The study has thus followed the terms of reference of the UNIDO enquiry of 30th April, 1971 and the subsequent contract of 13 January, 1972.

We should like to express our gratitude to the many people who helped us considerably in the preparation of this report, and who are listed in Appendix 1. In particular, we should like to thank Nils Ramm-Ericson, UNIDO Industrial Development Field Adviser; and at the Applied Scientific Research Corporation of Thailand, Dr. C. Lewis Wrenshall and Dr. Kasem Balajiva of the Technological Research Institute, and Norman L. Wake, Suvanna Vibhatakarasa and Nipon Panomkarn of the Economic Evaluation Group. Their friendly assistance throughout the study has been very much appreciated.

2. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Following our study of the feasibility of manufacturing farm and artisan hand tools in Thailand, we recommend that a forging plant should be established in the Bangkok area, either as a new factory or as an extension to existing facilities. The plant should manufacture an initially narrow range of spanners, hammers and pliers, subsequently expanding its production to cover a wider range of hand tools. The proposed plant is intended to form a nucleus for the Thai forging industry, capable of producing in its later stages of development forged components for agricultural equipment and automobile assemblies.

Recommended initial production comprises 50,000 sets of spanners, 55,000 hammers and 83,500 pliers, equivalent to an estimated 10% share of the relevant market sector in the first year of operation. The factory should appoint distributors known amongst the well established hand tool distributors in Bangkok, and sell the tools to them at delivered godown prices.

Recommended prices are:

	<u>Baht</u>	<u>US \$</u>
Set of six open ended spanners	18	0.90
Set of eight ring spanners	54	2.70
Claw hammer	30	1.50
Ball pein hammer	20	1.00
No. 7 Combination pliers	8	0.40

Anticipated Sales Revenue rises from Baht 3,830,000 (US\$191,500) in the first year of operation to Baht 10,910,000 (US\$545,500) in the sixth, giving the following Return in Total Capital.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
	%	%	%	%	%	%
New plant	(12.6)	7.5	13.2	17.9	23.0	22.8
Extension	10.7	20.4	23.4	25.5	30.7	27.4

(No forecast of Return on Equity has been made as the level of equity depends on the financial policies of individual investors).

More general benefits include a reduction in foreign currency payments of Baht 32,400,000 (US\$1,620,000) over the six-year period under review, and the employment of 45 Thai personnel, rising to 129 in the sixth year of operation. The proposed forging plant could be an important source of foreign earnings, depending on the investor's links with overseas distribution networks. Moreover it would form a solid base for the development of the Thai forging industry.

To ensure that a suitable investor is found, capable of setting up and operating the proposed plant satisfactorily, we recommend that the ASRCT should be made responsible for the investment promotion stage of the project. The ASRCT should make this report freely available to all interested parties, and work closely with the Board of Investment in helping to select the most suitable investor.

Other recommendations for the improvement of existing industries, based on our observations of the family workshops, rural factories and city factories, are given in section 5.2.

3. MARKET BACKGROUND

With the exception of changkols, a widely used type of hoe produced in large volume by The Chillington Tool (Thailand) Company Limited, and various simple agricultural tools produced by small family workshops, imports satisfy almost all the demand for most product groups of farm and artisan hand tools in Thailand. Between 1966 and 1969 imports of the most commonly used tools grew at the rate of some 7% per annum, culminating in a total CIF value of Baht 194,121,900 (US\$9,706,000).

Since 1969 the world economic recession, poor rice prices and the reduction of American military spending in Thailand have combined to depress the Thai economy, and with it the sales of hand tools. No figures are available for local production, but the following table of import statistics provides an indication of overall trends. More details are given in Appendix 2.

Table 1: Imports of most common tools (CIF Value)

	1966	1967	1968	1969	1970
Baht (million)	151.32	190.36	181.82	194.12	143.19
US \$ (million)	7.56	9.52	9.09	9.70	7.02

However, there are already signs that the Thai economy is recovering, and it is confidently expected that the demand for hand tools will resume an upward trend of 3% to 5%, aided by population growth and programmes for agriculture and housing.

3.1 User location and preferences

With 83% of the Thai population of 36 million living outside the Bangkok-Thonburi conurbation, and dependent largely for their livelihood on agriculture, forestry and fishing, user demand for agricultural tools comes almost wholly from the upcountry areas.

The metropolitan area provides a much greater proportion of the demand for artisan hand tools, which comes both from commercial users (e.g. carpenters, mechanics, tinsmiths) and the general public for household use.

The low purchasing power of the Thai farmer ensures that the simple tools made by family workshops are correspondingly low in price and finish. Nevertheless the farmer is prepared to pay for durability where circumstances demand, as the success of locally-made high quality changkols readily proves. Price remains an important consideration in the market for artisan tools in the urban areas, but here again consumer recognition of the advantages of durability - particularly amongst commercial users - enables some higher priced lines to retain surprisingly high market shares in certain product groups. Nicholson (files) and Eclipse (hacksaw blades) are good examples of market leaders who enjoy strong brand loyalty despite higher prices.

Brands of agricultural and artisan hand tools are rarely demanded by name. Instead visual symbols serve to identify the manufacturer or brand. The lack of effective legislation to protect brand-names and trade-marks has led to frequent pirating of successful brands by manufacturers or wholesalers seeking to pass off an inferior product as the genuine article. "G-man" saws, "Crocodile" changkols, Stanley hammers, and "Eclipse" hacksaw blades are all copied closely in appearance and packaging by competing brands of lesser quality. The apparent preference of Thai hand tool users for foreign products ensures that the country of origin is frequently stressed in packaging design. Locally-made products often feature such phrases as "Swedish steel quality" or "U.S. pattern" to attract the customer.

3.2 Distribution

There are well-established channels of distribution. Several large, long-established European owned trading houses distribute imported and locally made tools with associated hardware lines through a network of hardware wholesalers and retailers in Bangkok and upcountry. The extent to which individual trading companies make use of wholesalers varies, some preferring to deal directly with retailers, on the grounds that selling expenses are reduced and dangerous dependence on a few large buyers eliminated. Locally-owned hardware importers and wholesalers distribute imported tools through similar networks of hardware dealers, generally spreading the costs of selling and distribution over a range of hardware lines. Changkols, being a farm and construction tool in high demand, are distributed upcountry through general stores.

3.3 Selling methods

Typical distributors' sales forces range in size from five men (two working upcountry, three in Bangkok) to eleven men (six upcountry, five in Bangkok). The numbers of dealers covered by these sales forces range from 500 upcountry and 200 in the Bangkok area to 600 upcountry and 400 in the Bangkok area. Generally upcountry dealers are visited monthly; Bangkok dealers receive closer attention because of their greater purchasing power and stock turnover, with weekly or fortnightly

visits the general norm. One major distributor, however, claims that its salesmen call daily on dealers in the Vorachak hardware quarter of Bangkok. Upcountry salesmen are required to act as bill-collectors; in the Bangkok area most companies employ specialist bill-collectors, leaving the salesmen to concentrate on their primary tasks of selling-in and merchandising.

Distributors vary in their policies on hardware salesmen's transport. Some salesmen travel upcountry at their company's expense by various forms of public transport (aircraft, boat, train, bus, taxi) whilst others are provided with company cars. In the Bangkok area salesmen are generally provided with an expense allowance for travel purposes, varying according to the type of vehicle they own or use.

3.4 Sales promotion

The two major brands of changkol, "Crocodile" and "Buffalo Head", are given promotional support typical of fast-moving consumer goods, including radio advertising in selected areas, banded offers, and dealer incentive schemes. Other hand tools, selling in much smaller quantities, are more dependent for their distribution on the acceptability of their distributors to hardware dealers in such matters as reliability of delivery, credit, and personal relations with the distributors' salesmen. Once distributed to hardware dealers, hand tools become dependent on the dealers' confidence in the product, and on their inherent value for money in the eyes of the user, for gaining initial and repeat sales. Promotion of imported hand tools is thus limited to the quality ranges distributed by European owned trading companies, who make use of such point-of-purchase material as counter stickers, shelf and small merchandising units. Company salesmen also participate in sales contests and other motivational schemes.

4. PRODUCT RANGE

The Thai hand tool market is made up of a large number of different tools in a very wide variety of sizes, shapes, finishes, qualities and makes. Sales of any one particular tool can therefore be extremely small in relation to the overall demand.

In examining this highly diversified market, the project team and the ASRCT together selected a product range for preliminary economic and technical evaluation, based on the outline list of tools provided in Appendix No. 1 (Selection A2) of the UNIDO Terms of Reference of April 1971. The products were grouped into the following categories for screening purposes:

i) Agricultural hand tools

Spades, shovels, picks, forks, rakes, crow bars, sickles, paddy knives, weed cutters, harpoons, plantation knives, changkols.

ii) Forged artisan tools

Pliers, pincers, tinman's snips, bolt croppers, spanners, wrenches, hammers, axes and bill hooks.

iii) Saws

Hand saws and hand saw blades; hack saws and hack saw blades; toothless saw blades; machine saw blades.

iv) Files and rasps

v) Components for agricultural equipment

Tips for the blades of buffalo-drawn ploughs; plough discs for tractor-drawn equipment.

The above product groups were then evaluated according to the following criteria:

- i) the estimated market size, growth and share available.
- ii) the estimated production costs.
- iii) the plant investment required.
- iv) the degree of technical expertise required.
- v) the opportunity given by import substitution for lessening the drain on foreign exchange reserves.
- vi) the labour content in their manufacture, and hence the employment which their manufacture could provide for Thai workers.

- vii) the desirability of using hand tools to build up a forging industry, capable of subsequently producing forged components for agricultural equipment and automobile assemblies.

The application of the above criteria to the selected product groups (detailed in Appendix 5) led to the following conclusions:

- i) simple tools should continue to be made by the cottage industry.
- ii) further local investment in changkols cannot be justified.
- iii) additional local production of finished saws should not be attempted until the raw material is available locally, and production quantities can be proved to be economic.
- iv) file manufacture should not be given further consideration until a viable forging industry is well established.
- v) plough blade tips should continue to be made by existing resources.
- vi) plough discs could be an attractive proposition to any local manufacturer with idle capacity on existing heavy presses, and with fixed costs already covered. Market size does not justify investment on new plant.
- vii) three types of tools should be given further evaluation:
 - spanners (open-ended and ring)
 - hammers (claw and ball pein)
 - pliers

The markets for these tools are discussed below.

Spanners and wrenches are supplied by 25 countries, of which five (India, Japan, West Germany, Sweden and the United States) accounted for 92% of total volume in 1970. With the possible exception of Gedore, whose Indian products have made an appreciable impact on the market in recent months, no one brand can be said to be very significant. Retail prices range from Baht 20 (US\$1.00) to Baht 130 (US\$6.50) for a six-piece set of open-ended spanners, and from Baht 55 (US\$2.75) to Baht 225 (US\$11.25) for a set of eight ring spanners, dependent on quality. The most popular sizes of open-ended spanner retail at around Baht 24 (US\$1.20) per set of six; for ring spanners a popular set of eight retails at about Baht 60 (US\$3.00).

Hammers, the next most important product group, are imported from a large number of suppliers in 11 countries. The market is dominated by cheap imports from Japan and Taiwan, accounting for 78% of total volume. Nevertheless the much more expensive products of Western Germany (13.8%) and the United States (4.2%) maintain respectable market shares. Most common are 1½ lb. claw hammers, retailing at an average price of Baht 50 (US\$2.50) and 1½ lb. ball pein type at Baht 30 (US\$1.50).

Pliers form the third product group of importance in forged hand tools. Manufacturers from Japan and Taiwan dominate the cheap end of the market, with a number of West German suppliers maintaining a 40% share of the market (by volume) with medium quality products. Typical medium-quality combination pliers retail at Baht 10 (US\$0.50), Baht 12 (US\$0.60) and Baht 14 (US\$0.70) for the 6", 7" and 8" sizes respectively.

It is also worth noting that, properly marketed, the selected tools have considerable export potential. Opportunities exist in two forms:

- i) in the nearby markets of East and West Malaysia: in 1970, for example, West Malaysia imported pliers and pincers to the CIF value of Malay \$2,375,000 (US\$840,000), of which over 31% came from West Germany and over 23% from China.
- ii) in industrialised, high labour-cost countries. The opportunities offered by this export could well attract investment in a joint venture from a major tool company currently manufacturing in high labour-cost areas. Thus a manufacturer based in an industrialised country could devote his investment in a Thai production unit to expanding his share of the Thai market, exporting to neighbouring markets, and importing into his own home market the range of tools made in Thailand, thus reducing the erosion of profits in his home market caused by rising costs on high labour-content products.

In the following section we appraise the status of the present industry in Thailand, and evaluate the capability of each sector to produce the recommended range of hand tools as a basis for future expansion into the production of forged parts for agricultural equipment and automobile assemblies.

5. APPRAISAL OF EXISTING AND POTENTIAL TOOL MANUFACTURERS

Hand tools and agricultural implements are currently manufactured in Thailand by family or cottage industry workshops, rural factories, and more capital intensive urban factories. In the following pages we discuss their present status, some suggestions for their improvement, and our conclusions on establishing a forging industry.

5.1 Present status

In the rural areas many family workshops are producing, as separate production units, a wide variety of simple hand tools. Tours were undertaken by members of the project team to study a variety of centres. Manufacture of such items as axes, seams (a type of shovel) and knives were observed.

One of the larger centres in Thailand where families manufacture tools is the village of Aranyig (near Ayutthaya). A day was spent in this typical centre studying the various methods of manufacturing knives. Production is continued all year round and the reputation of their good quality products is well known in Thailand. According to a survey carried out by the Industries Services Institute in 1971, family workshops produce approximately 480,000 units per annum from 170 metric tons of steel. Total nett income is Baht 1,500,000 (US\$75,000). 93 families are employed on full-time production, and 134 on part-time.

Production methods vary amongst the families from entirely manual operations (hand cutting, hand scraping, hand polishing etc.) to operations on simple machine tools, both manually and electrically operated. The types of equipment in use include oxy-acetylene and electric welding sets, hand fly presses, hand guillotines, two-wheel grinders and polishers, power saws, and electric air blowers for the forges.

Individual skills in various manufacturing processes are well developed. The strength and cutting edge of the Knives produced at Aranyig is quite good. However, little effort is put into finishing operations so that the appearance of the tools by international standards is low. At present the farmers are not prepared to pay extra for appearance, and there is thus little incentive for the cottage industry to produce better finished products. It is worth noting, however, that better finish is well within the skills of the family workshops, as proved by the excellent appearance of the 3,000 swords produced each month at Aranyig.

A number of rural factories produce much larger items than the cottage industry workshops; but manufacturing methods are still simple, with relatively small investment in capital equipment. Their products are manufactured entirely for local or rural consumption.

A typical example is Lim Chiang Seng Industries who employ 59 people in a small well equipped factory at Nakhon Sawan. Equipment includes machine presses, turning and drilling machines, oxy-acetylene and electric welding sets, a small tube bending machine, and a large hydraulic press for bending 9" diameter pipe, designed and built by the factory.

In addition to distributing John Deere tractors, Lim Chiang Seng manufacture tractor-drawn plough and narrow frames, buffalo-drawn single-blade ploughs, single seeders (similar to the single-bladed plough), maize millers, and items to special order (e.g. a large tractor drawn seeder selling for about Baht 15,000 (US\$750).

The work is seasonal and to balance capacity production is split roughly in the following way:

- 400 (approximately) tractor plough and harrow frames - 4 months
- 3,000 (approximately) single ploughs for maize growing centres - 4 months
- 400 (approximately) maize millers - 4 months

Production has just commenced of the single seeder.

Although production of the tractor plough and harrow frame is the largest item worth some Baht 2,400,000 per year (US\$120,000), the small, buffalo-drawn plough is an excellent example of the type of product suitable for manufacture in rural areas. This plough, made of tubular steel formed and welded, weighs 13 Kgs and sells to the farmer for Baht 100 (US\$5). It is simply constructed and quite durable. Ploughs were first made four years ago and these are still in use. The wearing components - blade tip and blade assembly - are easily replaced at a cost of Baht 2 (US\$0.10) and Baht 10 (US\$0.50) respectively.

The project team visited a number of Urban factories in the Bangkok area whose manufacturing skills could support the planned manufacture of small tools (see Appendix 4). The project team examined in particular their capabilities in machining, metal pressing, forging, heat treatment and plating; their supplies of raw material; and their machine tools and die manufacture.

Although the standard of performance and productivity in general can still be improved, many examples were seen of outstanding innovation by individuals to overcome technical manufacturing problems. In some plants management have even designed and built machines themselves to reach a solution. These measures are to be admired in a situation where industry has had many problems with finance, competition from imports and lack of available technical knowledge.

Whilst this entrepreneurial approach must be encouraged and supported if Thailand's industries are to be further developed, laissez-faire attitudes to standards and quality must change. As competition increases so must quality and product reliability.

Many of the firms visited have a wide range of equipment and facilities. However three factories with suitable equipment and facilities are known to be seeking new products, and are therefore of particular significance. These are:

The Chillington Tool (Thailand) Co. Ltd.,
Samutprakarn,
Bangkok.

Pressure Container Industry Corporation Ltd.,
79 Chongnonsee Road,
Bangkok.

Asia Equipment Industry,
5 Superhighway,
Dindaeng,
Bangkok.

The Chillington factory is basically a forging plant, set up to produce between 700,000 and 800,000 changkols per year. Over 2,000 metric tons of steel are processed annually. The productivity of the workers is excellent.

Pressure Container Industry Corporation has a well laid out plant producing a range of liquid and gas pressure containers. Standards of workmanship and quality are high satisfying rigid boiler pressure inspection tests and regulations. More than 50% of the products are exported.

Asia Equipment Industry is currently making parts for tractors, cars and truck chain for tractors. The present staff of 200 is largely engaged on machining, welding, heat treatment and assembly. There is a wide range of heat treatment facilities for normalising, annealing and hardening. Electroplating equipment capable of hard chrome plating has been installed recently.

It is interesting to note that both Pressure Container and Asia Equipment are using the services of the ASRCT and the Industries Services Institute to ensure that quality standards are met.

5.2 Recommendations for improvement

The major factors limiting the more rapid development of manufacturing industry in Thailand is the lack of sufficient knowledge of products, processes and equipment and the lack of sufficient training in technical skills.

In seeking to overcome the problems posed by these factors, the aims and programmes of the National Council for Skill Development are of particular interest and deserve support and encouragement. The objectives of the Council are to:

- i) co-ordinate the efforts of all vocational institutions to avoid duplication;
- ii) encourage in-plant training, e.g. of apprentices in industry;
- iii) make people more aware of what skills training is available;
- iv) upgrade training staff; and
- v) continually broaden and expand vocational training courses.

Some lines of action required to improve existing hand tool manufacture in the three sectors of the industry are now briefly outlined.

We recommend encouragement of the continued manufacture of simple farm and artisan hand tools by the family workshops rather than by rural or urban factories.

To help improve the manufacturing standards of hand tools in the cottage industry, we recommend that the courses programmed to be conducted on-site by such institutions as the Industries Services Institute and the Community Development Department should concentrate on the following subjects:

- i) Simple manufacturing equipment available and how it is best used;
- ii) Properties of materials (e.g. heat treatment);
- iii) Simple and economic product design;
- iv) safety in production operations.

It is recommended that in developing training programmes initial planning be left fairly flexible so that the detailed courses can be designed on site for the specific problems encountered.

Two factors need to be considered in developing the rural factories for the manufacture of hand tools and agricultural implements:

- i) improvement of skills
- ii) expansion in the number of factories.

Skills improvement can be achieved through training programmes similar to those recommended for the cottage industry.

The expansion in the number of rural factories is a more long-term development. Rural factories will not develop in numbers until the demand for agricultural implements has grown. In turn increased demand depends on the increased awareness of the farmers of means of improving the yield from the land. One method of achieving this awareness is through the intensified application of research results to agricultural methods, using full-time field level education programmes. In their report "Rural Manpower, Rural Institutions and Rural Employment in Thailand" (July 1971), Dr. F.W. Fuhs and Dr. Ian Vingerhoets point out that the present ratio of field level officers communicating research results is one to every 8,000 families. In their view, effective implementation of research results will not be achieved until the ratio is reduced to the order of 1 : 1,000. To improve and expand the number of rural factories, this move would thus seem to be just as essential as the present programme of technical training.

Urban factories can develop strongly. Labour is extremely cheap by world standards, and when properly organised and managed, is capable of productivity equal to that of labour in developed countries. In the manufacture of labour-intensive tools, such as well-finished good quality spanners, there are excellent opportunities to produce these more cheaply than imported goods and plan for eventual export.

Discussions with various factory owners and managers have shown ample evidence of good business knowledge. Technical help is readily available, but there is much work still to be done in developing the technical skills of employees and management in such areas as heat treatment, tool setting and the maximum utilisation of equipment. Whilst existing seminars and training programmes are good, on-the-job training, such as that conducted by the field officers of the Industries Services Institute, should be extended.

At present scholarships are available for technical training staff to travel overseas and complete further training. It is highly desirable that means should be found for awarding more scholarships for managerial and technical staff of manufacturing companies to undertake study-tours in industrialised countries and see what is happening at first hand. A model that could be used is the "Entrepreneur Group Study Tour" provided in the programme of the Industries Services Institute.

5.3 Conclusions on establishing the forging industry

From our examination of the three sectors of the Thai hand tool industry - the cottage industry, the rural factories and the urban factories - we believe that only the last-named can provide a nucleus for a forging industry. In our view, only the Bangkok area has the necessary infrastructure to support this industry, notably in its location for the supply of raw materials and the distribution of the finished products, the availability of skilled labour and technical support, and its location for future markets such as the automobile assembly industry.

In the next section of this report we summarise the technical requirements needed by a forging plant to manufacture hand tools.

6. PROPOSED MANUFACTURING PLANT

To determine the technical requirements of the proposed manufacturing plant the following steps were taken:

- i) Specifying the products
- ii) Detailing the manufacturing procedures
- iii) Deciding sources of components, raw materials and tooling
- iv) Determining machinery requirements
- v) Developing the plant layout
- vi) Specifying the organisation structure.

These aspects together with the consequent findings and recommendations, are described below. Detailed calculations in support of our findings are given in appendices. Set-up costs (plant, equipment, buildings) have been established in two ways:

- i) What a complete new plant would cost to establish;
- ii) What an existing plant with available land and buildings would need to set up the proposed plant as an extension.

6.1 Product Specification

Initial production is planned around the following products, equal in finish and quality to world standards:

- i) A set of 6 open ended spanners ranging in size from 6mm x 7 mm to 17mm x 19mm. Quality of the finished article is in line with British Standard BS 192.
- ii) A set of 8 ring spanners ranging in size from 6mm x 7mm to 22mm x 24mm. Quality of the finished article is in line with British Standard BS 3555.
- iii) A 1½ lb. claw hammer with 27mm diameter striking face, quality and finish as specified in British Standard BS 3197.
- iv) A 1½ lb. ball pein hammer with 35mm diameter striking face, quality and finish as specified in British Standard BS 876.
- v) A No. 7 or ½ lb. set of combination pliers, quality and finish as specified in British Standard BS 3087.

The recommended selling price of each product - the price of the article delivered to the distributor's godown - is shown in the following table.

Table 2: Recommended selling prices

Description	Size	Factory Price to Distributor delivered into godown	
Open ended hammer (Set of 6)	6 x 7 to 17 x 19	Bt. 18	US\$0.90
Ring spanner (Set of 8)	6 x 7 to 22 x 24	Bt. 54	US\$2.70
Claw hammer	1 $\frac{1}{2}$ lb.	Bt. 30	US\$1.50
Ball pein hammer	1 $\frac{1}{2}$ lb.	Bt. 20	US\$1.00
No. 7 combination pliers	$\frac{1}{2}$ lb.	Bt. 8	US\$0.40

6.2 Manufacturing operations

Each product was broken into its components and the detailed sequence of operations defined to manufacture the product.

Table 3 illustrates:

- a set of spanners
- a typical 1 $\frac{1}{2}$ lb. hammer
- a pair of pliers

Appendix 5 shows the detailed build up of operation times for a set of open ended and ring spanners.

Table 3: Manufacturing operations

	Ring Spanner (Set of 8)	Typical 1½lb. Hammer	Pliers
1. Cut bar	.60 mins	1.10 mins	.20 mins
2. Load Furnace	1.50 mins	.20 mins	.20 mins
3. Heat	2.90 mins	.60 mins	.40 mins
4. Forge	2.90 mins	.60 mins	.40 mins
5. Trim	4.80 mins	.60 mins	1.00 mins
6. Punch	4.20 mins	.60 mins	.40 mins
7. Drill	10.70 mins	-	-
8. Broach	6.50 mins	-	.30 mins
9. Stamp	4.70 mins	.50 mins	.30 mins
10. Harden-Temper *			
11. Grind	7.80 mins	1.00 min	.30 mins
12. Polish	11.30 mins	2.50 mins	1.20 mins
13. Rumble *			
14. Straighten	4.60 mins	-	1.20 mins
15. Shot Blast	1.40 mins		.30 mins
16. Polish	8.70 mins	2.00 mins	1.00 mins
17. Oil	.20 mins	.10 mins	.10 mins
18. Clean	1.60 mins	.60 mins	.40 mins
19. Test	2.70 mins	1.40 mins	1.00 min
20. Chrome	5.90 mins	-	1.00 min
21. Lacquer		1.00 min	
22. Assemble		1.40 mins**	2.80 mins
23. Pack	2.00 mins	.50 mins	.50 mins
	<hr/>	<hr/>	<hr/>
	85.00 mins	15.00 mins	15.00 mins
	(1.42 Hrs)	(.25 Hrs)	(.22 Hrs)

* Included in Shop Overhead Charges

** Includes final grind after handle assembled

6.3 Components, raw materials and tooling

All components required in the products such as rivets for pliers and wedges for hammer handles would be manufactured locally. As far as possible, subcontracting has been avoided, since the high demand for special skills and good quality in such specialised fields as plating enables subcontractors to charge premium prices. The proposed factory has thus been designed to be as self-sufficient as possible, and at a later stage to possibly act as a sub-contractor itself. Only one item needs to be obtained from sub-contractors - the hammer handles, which would be supplied by a Bangkok wood turner.

The major raw material used is steel. Initial consumption is estimated at 100 tons per year, and growing to 300 tons by the sixth year of operation.

Steel costs are based on current import prices supplied by local importers and manufacturers. Discounts have been taken into account on the basis of order quantities being a minimum of 10 tons and the factory will be granted a promotion certificate from the Board of Investment enabling imported raw material to be procured at reduced duty rates. In the forging operations an average of 25% metal loss has been allowed in trimming and rejects. There is a good market for scrap steel.

Locally produced steel was considered as a potential source of supply. Alloy steels are available but only as castings, not rolled bar. As soon as domestic production commences a raw material cost saving should be possible, in addition to the national benefit of reducing the outflow of foreign exchange for imported raw material.

Steel prices used in establishing material costs are given below:

- i) Light alloy steel (BS En 18D, 1S1. 50 Cr IV23 or J.I.S. SCM3) used in manufacturing spanners is Baht 7 (US\$0.35) per Kilogram. This steel can be produced in Thailand at Baht 7/Kg. but only as cast steel, not rolled bar.
- ii) Medium carbon steel is available in Bangkok for prices between Baht 3.50 (US\$0.17) per Kilogram and Baht 4 (US\$0.20). An average price of Baht 4 (US\$0.20) has been taken for the BS En 9 "55" carbon steel used for hammers and the BS En 42 carbon spring steel used for pliers.

With regard to tooling, the forging and press die budget is more than Baht 200,000 per annum (US\$10,000), rising proportionally each year as volume increases. This is well in excess of what is required as each die with repairs during its life should produce in excess of 100,000 pieces. For the first year of production of spanners each die is only required to produce 25,000 pieces.

In this way allowance is made for:

- i) Possible teething problems during initial local manufacture of the dies.
- ii) Possible problems in initial production.
- iii) Expenditure on the manufacture of new dies and plant trials for the manufacture of new products.

6.4 Machinery requirements

From the sales forecast, and the anticipated growth of some 300% in the first six years, it was decided to establish a plant capable of producing on a single shift basis nearly double the units of production anticipated in the first year. Based on single-shift operation (equivalent to 2352 hours per man / per machine per year : Appendix 6), machinery and equipment requirements have been established to meet the following volume of production:

Spanners - 100,000 sets
Hammers - 100,000 units
Pliers - 100,000 units

Details of machinery and equipment requirements are shown in Appendix 8. Estimated set-up costs are:

- i) For a new factory Bt.4,356,900 (US\$217,845)
- ii) For additions to an existing factory Bt.3,782,900 (US\$189,145)

The latter sum is estimated to be the maximum outlay required in machinery and equipment by a company with already established manufacturing facilities. Depending on the type of equipment already installed, available spare capacity, and the amount of integration possible, the estimated amount allocated for additional equipment could be reduced.

6.5 Plant costs and layout - Land

In the case of an existing company expanding into the production of forged hand tools, it has been assumed that suitable land is readily available for the necessary extensions.

For a completely new factory, discussions with different factory managers and the Industrial Finance Corporation of Thailand (IFCT) have led us to the conclusion that an allocation of Baht 360,000 (US\$18,000) per rai* would be enough to cover the costs of land and filling in an area where electricity and water are available. In this study we have used Baht 1,080,000 (US\$54,000) as the estimated cost of land (three rais) and filling. It is worth noting however that land prices in the Bangkok area fluctuate considerably, from Baht 50,000 (US\$2,500) per rai at Bang Pa In to Baht 1,000,000 (US\$50,000) per rai at West Thonburi. North of Don Muang airport land costs per rai vary between Baht 100,000 (US\$5,000) and Baht 400,000 (US\$20,000).

Leasing was considered as a possibility but dismissed as little leasehold land is available on the new estates.

* 1 rai = 0.16 hectares or 0.40 acres approximately.

6.6 Factory building

Factory building prices in the Bangkok area range from Baht 600/M² (US\$30/M²) for simple construction to Baht 1000/M² (US\$50/M²) for a stronger construction, concrete floor, cane columns etc. factory. Foundations are extra.

In this study, construction costs have been estimated at Baht 1,200/M² (US\$60/M²) allowing for both the factory building and reinforcement in the areas where heavy equipment will be installed. The floor area allowed is 1000 M² to cover the factory area, godown, workshop, office and power house. Investment in buildings has thus been calculated at Baht 1,200,000 (US\$60,000).

In addition the costs of ancillary buildings and fittings have been estimated at Baht 250,000 (US\$12,500). These include:

- Water well
- Pump house
- Water storage tank
- Piping
- Managers house
- Workman's quarters
- Canteen
- Boiler
- Road
- Fence and gates

In the case of an existing company it has been assumed that there would be no expenditure required by an existing manufacture setting up to produce forged tools.

Although in reality there may be some necessary extension of factory building to set up a project of this size, it has been assumed that any capital required would be available from the allocation of Baht 3,782,900 (US\$189,145) for new machinery and equipment.

6.7 Factory layout

A proposed factory layout is shown overleaf (Chart 1).

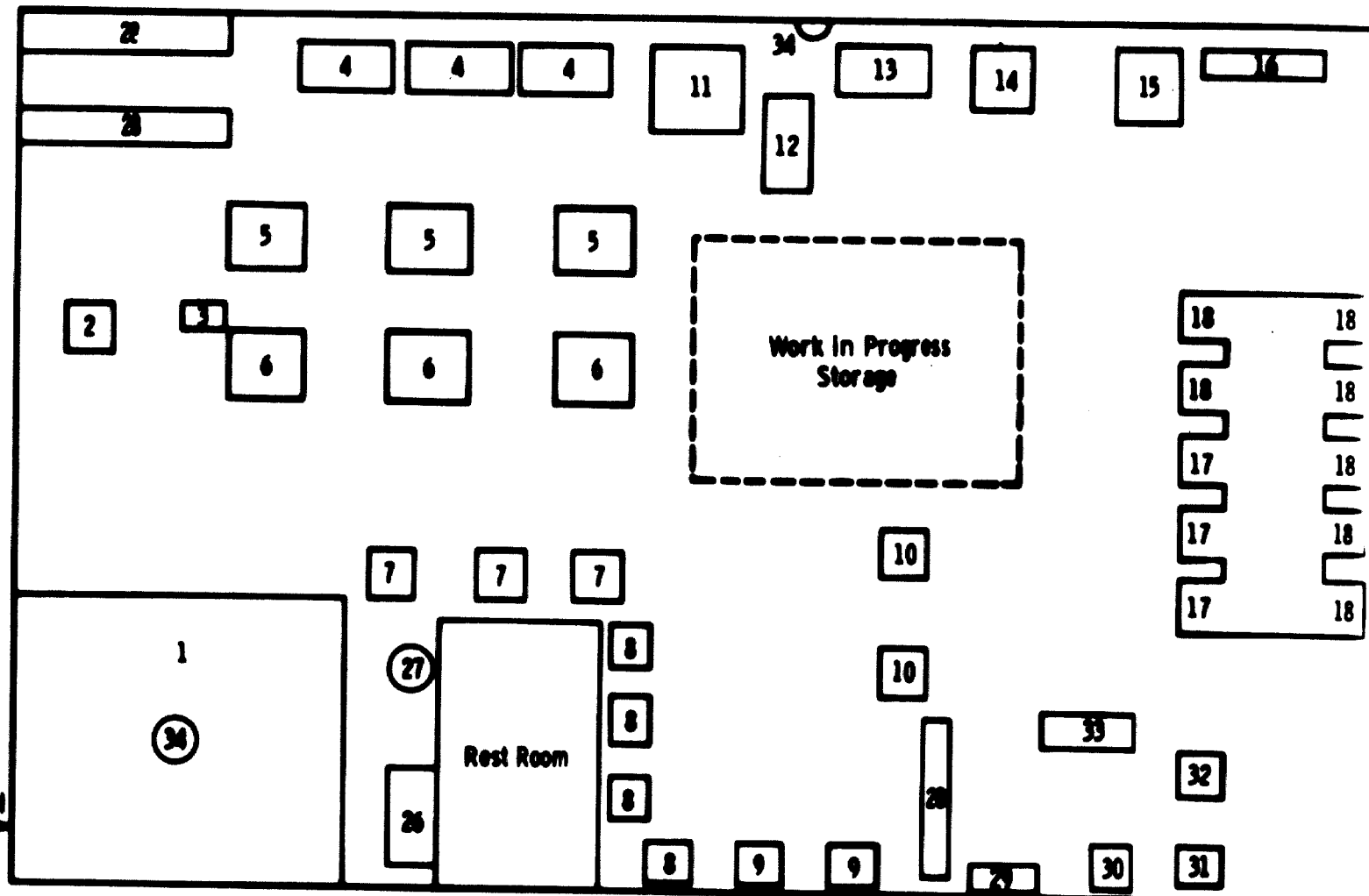
In Table 4, also overleaf, items of equipment have been given code numbers to identify them on the plan. The numbers in the right-hand columns indicate the sequence of operations for each product, and hence the material flow.

Some of the features incorporated in the proposed layout are:

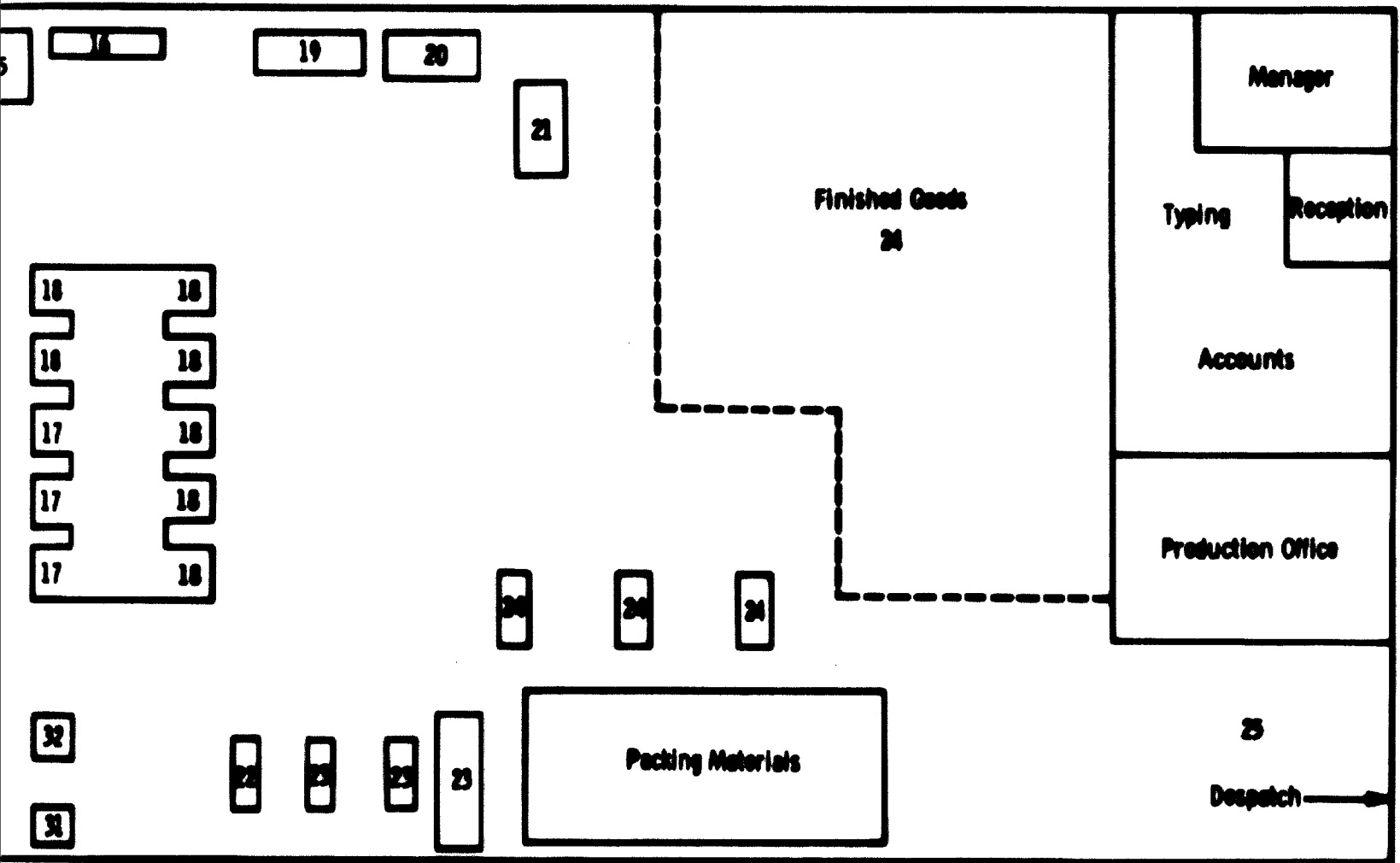
1. Flow is simple but allows for flexibility as demands for products fluctuate. A work in progress centre has been allocated to allow a small buffer stock of components to be established to help balance the loads on work stations.
2. Oil furnaces for forging and heat treatment are grouped to facilitate oil feeding from a central location just outside the factory wall.
3. Planned factory expansion should be simplified by the present direction of flow, new products in new plant will be able to run parallel to existing product lines.
4. The production office has been located to make communication with the general office easy and at the same time ensure plant security can be maintained (at the despatch dock).

CHART 1 PROPOSED FACTORY LAYOUT

Scale 1 cm. = 1 metre



SECTION 1



95m

SECTION 2

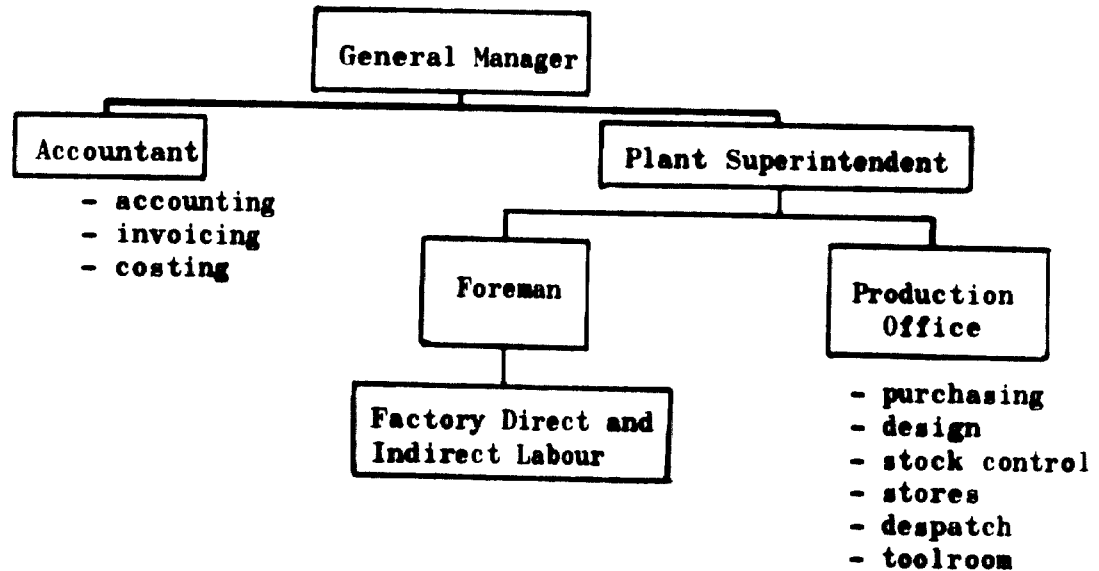
Table 4: Machinery Layout and Material Flow

Code No.	Material Flow Sequence				
	Spanners		Hammers	Pliers	
1 Raw material storage	1		1		1
2 Clearing press	2		-		2
3 Cut off saw	-		3		-
4 Forge furnace	4		4		4
5 Drop forge hammer	5		5		5
6 Trim press	6		6		6
7 Punch press	7		7		7
8 Drill	8		-		
9 Broach	9		-		8
10 Stamp press	10		8		10
11 Heat treatment furnace	11		9		11
12 Oil quench	12		10		12
13 Salt Bath	13		11		13
14 Electric Furnace	14		12		14
15 Rumble (shot blast)	17	19	-		18
16 Straighten	18		-		17
17 Grind	15		13		15
18 Polish	16	20	14		16
19 Oil	21		15		20
20 Degrease	22		16		21
21 Plate	23				22
22 Assemble (Paint)	-		18		24
23 Inspect Test	24		17		23
24 Pack Store	25		19		25
25 Despatch	26		20		26
26 Air Compressor					
27 Air Receiver					
28 Tool storage					
29 Lathe					
30 Vertical Mill					
31 Grinder					
32 Bandsaw					
33 Toolmakers Bench					
34 Crane					

6.8 Organisation Structure

A recommended initial organisation structure is shown below:

Chart 2: Proposed organisation structure



For the first year of operation factory staff would be deployed as follows:

- Plant Superintendent : Foreign forging engineer with management experience.
- Foreman : Thai toolmaker or equivalent with experience of managing employees.
- Technical Personnel : 2 toolmakers) to assist in
2 die setters) operator training
- Semi Skilled : 34 semi skilled, through previous experience or training
- Unskilled : 2 material handlers
2 cleaners (factory)
1 packer
1 cleaner (degreasing)

The foreman would be a deputy to the Forging Engineer and after one year would move to the position of Plant Superintendent. The Forging Engineer would move to a more advisory and training role particularly in design and developing tooling for an expanded range of products.

Costs of maintaining a Tooling Engineer have been built into the cost structure each year. Whilst there is a definite need for this position to be filled the length of his stay would depend on the design and development workload imposed by company growth, and as such is a management decision.

No sales personnel have been incorporated into the proposed organisation structure as we recommend that all sales and distribution should be carried out by established Bangkok-based distributors.

7. FINANCIAL ANALYSIS

The following steps were taken to carry out the financial analysis:

- (i) Determining Direct Material Cost, Direct Labour and Miscellaneous Direct Material Costs.
- (ii) Determining Factory Overhead Operating Costs.
- (iii) Estimating Administration Costs.
- (iv) Calculating depreciation and payback on start-up costs.
- (v) Calculating capital requirements.
- (vi) Forecasting Sales Revenue.
- (vii) Relating estimated costs to Revenue.
- (viii) Calculating financial indices.

7.1. Direct Material and Labour Costs

These have been calculated on weight of tools produced - allowing for 25% metal loss, the estimated manufacturing times shown earlier.

Investigations of current labour rates being paid in Bangkok showed conclusively that using a direct labour rate of Baht 4 (US\$ 0.20) per hour has a large margin to cover such items as Sick Pay, Holiday Pay, etc., and also cover any normal overtime that may be worked (e.g. 10 hours per week).

Direct costs have been forecast for the first six years of operation, and are given in Table 5 overleaf.

TABLE 5 : FORECAST DIRECT COSTS

	Year 1 (1974)	Year 2 (1975)	Year 3 (1976)	Year 4 (1977)	Year 5 (1978)	Year 6 (1979)
<u>Direct Material</u>						
- Spanners (Steel & Plating 11.58)	575,000	875,000	1,034,000	1,200,000	1,370,000	1,545,000
- Hammers (Steel & Handle 4.53)	249,000	382,000	457,000	534,000	620,000	700,000
- Pliers (Steel & Rivet & Plating 3.20)	267,000	429,000	527,000	646,000	760,000	894,000
	1,091,000	1,686,000	2,018,000	2,380,000	2,750,000	3,139,000
<u>Direct Labour</u>						
- Spanners 4.34	215,000	328,000	388,000	450,000	514,000	580,000
- Hammers 1.00	55,000	84,500	101,000	118,500	137,000	155,000
- Pliers 0.88	73,500	118,000	145,000	178,000	210,000	246,000
	343,500 (36)	530,500 (57)	634,000 (67)	746,500 (79)	861,000 (91)	981,000 (104)
<u>Direct Overhead</u>						
- Spanners	302,000	460,000	545,000	633,000	723,000	815,000
- Hammers	153,000	236,000	282,000	330,000	382,000	432,000
- Pliers	158,000	254,000	312,000	383,000	452,000	529,000
	613,000	950,000	1,139,000	1,346,000	1,557,000	1,776,000
<u>Forecast Volume (Units)</u>						
- Spanners	49,600	75,600	89,425	103,800	118,400	133,500
- Hammers	55,000	84,500	101,000	118,500	137,000	155,000
- Pliers	83,500	134,000	165,000	202,000	238,000	279,000

All values are 1972 values.

7.2. Factory Overhead Costs

The figures in Table 6 are summarised from the analysis given in Appendix 9. They have been established on the basis of producing the three types of tools that have been analysed in detail, with spanners as the first line to be produced. Hammers and pliers are added products.

Table 6 : Summary of Factory Overhead Costs

<u>Fixed costs per annum:</u> Baht 276,500 (US\$ 13,825)		
<u>Variable costs per annum:</u>		
Spanners	: 100,000 sets	: Baht 600,000 (US\$ 29,000)
Hammers	: 100,000 sets	: Baht 280,000 (US\$ 13,000)
Pliers	: 100,000 sets	: Baht 190,000 (US\$ 9,500)

7.3. Administration Costs

The summary of Administration Costs is based on estimates, developed in discussions with the management of various manufacturing companies in the Bangkok area.

Table 7 : Summary of Administration Costs

	New Factory		Additional Products to existing factory	
Item	Annual Cost		Annual Cost	
	Baht	US \$	Baht	US \$
<u>Administration Staff</u>				
General Manager (1)	200,000	(10,000)		
Accountant (1)	150,000	(7,500)		
Accounts/Typists (2)	40,000	(2,000)	(2) 40,000	(2,000)
Pays & Bookkeeping (1)	32,000	(1,600)	(1) 32,000	(1,600)
	422,000	(21,100)	72,000	(3,600)
<u>Administration Expenses</u>				
Office Equipment	40,000	(2,000)	5,000	(250)
Automobiles	80,000	(4,000)	-	
Truck	120,000	(6,000)	80,000	(4,000)
Office Supplies and expenses, e.g. stationery, phones, cables, etc.	160,000	(8,000)	100,000	(5,000)
Insurance, Medical provision, etc.	250,000	(12,500)	150,000	(7,500)
	650,000	(32,500)	335,000	(16,750)

7.4. Depreciation

Estimated annual depreciation rates are shown below:

Table 8 : Estimated Depreciation Rates

Item	Value	Period	Rate p.a.
Buildings	1,450,000	15 yrs.	97,000
Plant equipment	4,357,000	10 yrs.	435,000
Office equipment	40,000	10 yrs.	4,000
Automobiles	200,000	5 yrs.	40,000
			576,700

In the case of a plant already in existence but taking on additional products, depreciation is in the order of Bt. 370,000 per annum.

7.5. Capital Requirements

Capital requirements for establishing a new plant are shown in the table below.

Table 9 : Capital requirements - new plant

<u>Fixed Assets</u>		
Land	Bt. 1,080,000	(US\$ 54,000)
Building and fittings	Bt. 1,450,000	(US\$ 72,500)
Machinery and equipment	Bt. 3,754,000	(US\$ 187,700)
(including installation)	Bt. 603,000	(US\$ 30,150)
<u>Working Capital</u>		
Raw Material		
(e.g. 50 ton Steel)	Bt. 500,000	(US\$ 25,000)
Running expenses	Bt. 500,000	(US\$ 25,000)
Administration and		
factory overheads (6 mnths)	306,000	(US\$ 15,300)
Direct labour (6 months)	Bt. 200,000	(US\$ 10,000)
Start up expenses (e.g.	Bt. 300,000	(US\$ 15,000)
foreign technical assist-		
ance on installing and	Bt. 200,000	(US\$ 10,000)
"running in" plant.		
<u>Total:</u>	Bt. 8,893,000	(US\$ 444,650)

Capital requirements for extending an existing plant with available land and buildings are given below:

Table 10 : Capital requirements - extension to existing plant

<u>Fixed Assets</u>		
Machinery and equipment. (including installation)	Bt. 3,384,000 Bt. 400,000	(US\$ 169,200)* (US\$ 20,000)
<u>Working Capital</u>		
Raw Material	Bt. 500,000	(US\$ 25,000)
Running Expenses:		
Administration and Factory Shop O'heads	Bt. 200,000 Bt. 306,000	(US\$ 10,000) (US\$ 15,300)
Direct Labour for 6 months	Bt. 200,000	(US\$ 10,000)
Start up expenses	Bt. 200,000	(US\$ 10,000)
<u>Total:</u>	Bt. 5,190,000	(US\$ 259,500)*

* Depending on the amount of integration possible with existing equipment, this figure could be substantially reduced.

7.6. Sales Revenue

Sales revenue has been estimated by extrapolating recent trends in demand for imported spanners, hammers and pliers, and assuming that the proposed plant would capture a home market share rising from 10% at the end of the first year to 25% at the end of the sixth. The capture of these market shares has been based on the assumption that the factory would appoint at least two distributors from leading Bangkok companies in this field, and that the markets for spanners, hammers and pliers would remain highly fragmented. It has been further assumed that, whilst the market is open to free competition, Government action would prevent the dumping of low-priced, low-quality tools from abroad.

TABLE 11 : FORECAST SALES REVENUE

	Year 1 (1974)	Year 2 (1975)	Year 3 (1976)	Year 4 (1977)	Year 5 (1978)	Year 6 (1979)
<u>Forecast Volume</u> (Appendix B.3)						
<u>Spanners (sets)</u>	49,600	75,600	89,425	103,800	118,400	133,500
<u>Hammers</u>	55,000	84,500	101,000	118,500	137,000	155,000
<u>Pliers</u>	83,500	134,000	165,000	202,000	238,000	279,000
	<u>Baht</u>	<u>Baht</u>	<u>Baht</u>	<u>Baht</u>	<u>Baht</u>	<u>Baht</u>
<u>Forecast Sales Revenue</u>	1,790,000	2,720,000	3,220,000	3,740,000	4,250,000	4,800,000
<u>Spanners @ Bt. 36 ave/set</u>	1,370,000	2,110,000	2,520,000	2,960,000	3,420,000	3,880,000
<u>Hammers @ Bt. 25 ave/unit</u>	670,000	1,070,000	1,320,000	1,610,000	1,900,000	2,230,000
<u>Pliers @ Bt. 8 each.</u>	3,830,000	5,900,000	7,060,000	8,310,000	9,570,000	10,910,000
	<u>US \$</u>	<u>US \$</u>	<u>US \$</u>	<u>US \$</u>	<u>US \$</u>	<u>US \$</u>
<u>Gross Revenue</u>	191,500	245,000	353,000	415,500	478,500	545,500

Prices shown in the above table are 1972 factory to distributor prices, delivered to distributors' godowns.

7.7. Gross Annual Profit

Table 12 compares the differing levels of estimated gross profit available from a completely new plant, and from extending an existing factory. Not surprisingly, the return on total capital available from an existing factory is markedly superior to that available from a new plant because of the lower capital expenditure required. Because of promotion privileges, business tax is not imposed until the sixth year of operation: gross and net profit figures are thus identical for the first five years.

Table 12 ; Gross Annual Profit ; indices

Year	1 (1974)	2 (1975)	3 (1976)	4 (1977)	5 (1978)	6 (1979)
<u>New Factory</u>						
Gross Profit (Baht 000's)	(113)	680	1,119	1,602	2,071	2,580
Return on Total Capital (%)	(12.6)	7.5	13.2	17.9	23.0	22.8
Percentage of Gross Sales (%)	(2.9)	11.5	15.8	19.3	21.0	23.6
<u>Extension</u>						
Gross Profit (Baht 000's)	409	1,202	1,651	2,124	2,593	3,105
Return on Total Capital (%)	7.8	23.0	31.8	41.0	49.8	46.5
Percentage of Gross Sales (%)	10.7	20.4	23.4	25.5	30.7	27.4

No figures have been calculated for an estimated return on equity, as the equity level would depend very much on the individual financial resources and policies of each investor.

Forecast Trading Results for the first six years of operation are detailed for both a new plant and an extension to an existing factory in Appendices 10 and 11 respectively.

7.8. Financial Assistance

Financial assistance is available to the investors from a number of sources, notably:

- (i) The Loans Office for Small Industries Development of the Department of Industrial Promotion (Ministry of Industry). This office caters essentially for the small manufacturer, with a loan ceiling of Baht 2 m. (US\$ 100,000).
- (ii) Commercial banks, who reduced their prime interest rate to 10.5% at the end of March 1972.
- (iii) The Industrial Finance Corporation of Thailand (IFCT), formed by the Government in 1962 to assist local industry in raising capital for its development.

Of the various sources available, the IFCT is probably the most relevant to the hand tool project, depending of course on the financial resources and policies of the investor concerned. The IFCT provides loans of up to Baht 30 million (US\$ 1.5 million) for periods of up to ten years. It is prepared to make loans up to a maximum equivalent to 70% of the value of land, machinery and buildings.

Potential investors in the proposed project who are unfamiliar with the steps involved in establishing a factory in Thailand and obtaining finance should consult the Board of Investment and the IFCT, from whom several helpful publications can be obtained.

8. CONCLUSIONS AND RECOMMENDATIONS

We believe that four major benefits would result from establishing a forging plant in Thailand to manufacture an initially narrow range of spanners, hammers and pliers.

- i) Following a once-off purchase of foreign plant, it is estimated that import substitution would reduce foreign currency payments by a total of Baht 32,400,000 (US\$1,620,000) over the six year period under review.
- ii) 45 Thai personnel, rising to 129 in the sixth year of operation, would find employment. Earnings would amount initially to Baht 350,000 (US\$17,500), rising to Baht 1,000,000 (US\$50,000) in the sixth year (1972 rates).
- iii) The proposed forging plant could be an important source of foreign earnings, dependent on the type of investor involved and the strength of his links with overseas distribution networks.
- iv) The nucleus of a viable forging industry would be established, capable of expansion at a suitable stage into the production of forged components for agricultural equipment and automobile assemblies.

These benefits would ensue whether the proposed plant is developed from an existing factory, or whether a completely new factory is set up. To obtain them, we strongly recommend the following two-stage action programme.

Stage 1 : Investment promotion

- i) The ASRCT should be made responsible for the investment promotion stage of the hand tool project, liaising closely with other Thai Government agencies, notably the Board of Investment and the Ministry of Industry.
- ii) The immediate task of the ASRCT should be to ensure that the findings and recommendations of this report are brought to the attention of all likely investors in the proposed plant. Copies of the report should be made freely available to all interested parties. These are likely to include The Chillington Tool (Thailand) Company Limited, The Asia Equipment Industry Company, and The Pressure Container Industry Corporation Limited, as well as prominent importers and distributors of hand tools, whose foreign principals could well be interested in participating in a joint venture.

- iii) Interested parties should be invited to apply to the Board of Investment for a Promotion Certificate for the proposed plant, either as an extension of existing facilities or as a completely new factory.
- iv) The ASRCT should work closely with the Board of Investment in helping to select the investor(s) best suited to setting up and operating the proposed plant. Applicants should be screened according to the criteria listed in (v) below. A deadline of seven months after this report has been made available to potential investors should be set for the acceptance of promotion applications. This should ensure that the selection of a suitable investor or investors is not unnecessarily protracted. Promotion privileges should be granted to only one applicant.
- v) To ensure success, the project should have the backing of investors possessing:
 - adequate financial resources
 - immediate access to a strong national distribution organisation backed by well-developed skills in all aspects of marketing
 - excellent know-how in production management and methods
 - experienced financial management.
- vi) If, following the screening process, an otherwise acceptable candidate for promotion privileges is thought to be deficient in one of the above areas, the ASRCT should provide assistance to overcome the problem. Other possible sources of assistance include the Industries Services Institute, the Thailand Management Development and Productivity Centre, and the Thailand Management Association.

The recommended timetables for investment promotion, and plant execution by the promoted company, are given in graphic form overleaf (Charts 3 and 4).

CHART 3: RECOMMENDED INVESTMENT

APRIL					
					MON
1	2	3	4	5	6

PROGRAMME ITEM

1. Complete Report (draft, comments, final draft)
2. Distribute Report to interested parties
3. Decide action in Thailand e.g. ASBCT become co-ordinating body for advising promotion.

ASBCT compile programme for communicating proposal and selecting potential investors.

Communicate Proposal to:

- a) Potential companies
- b) Potential overseas assistance e.g. Joint venture prospect

Select best alternatives from submissions made by potential manufacturers.

Review companies with best submissions and review in best interests of Thailand, both Development prospects and Financial prospects.

Recommend to BOI and MOI a course of action

4. Help investor prepare programme for setting up proposal
5. Highlight problem areas that will need assistance and decide course of action.
6. Company/ies execute programme.
7. ASBCT supply/organise backup help.

SECTION 1

RECOMMENDED INVESTMENT PROMOTION - PROGRAMME

MONTHS FROM COMPLETION OF FEASIBILITY STUDY																	
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		

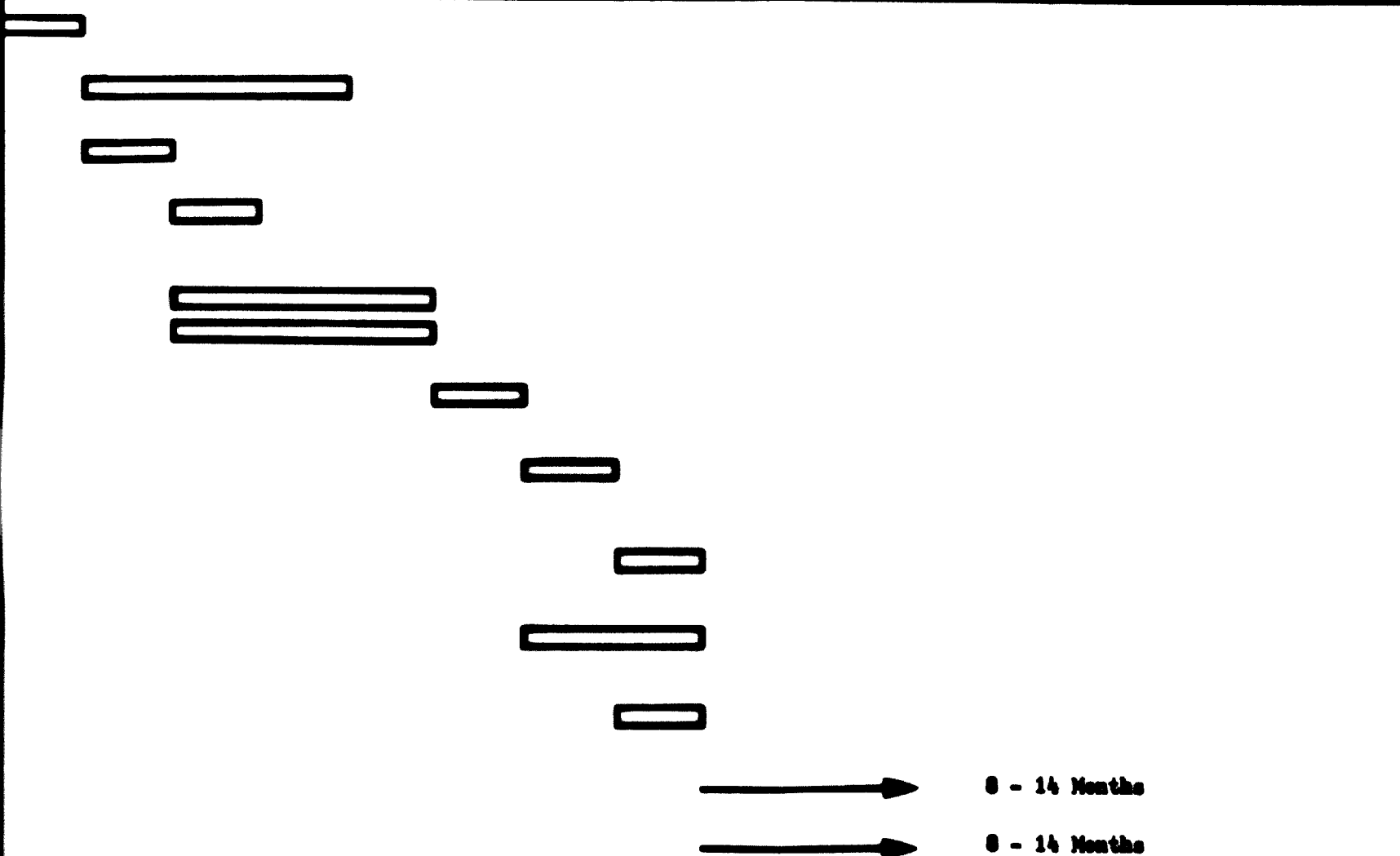
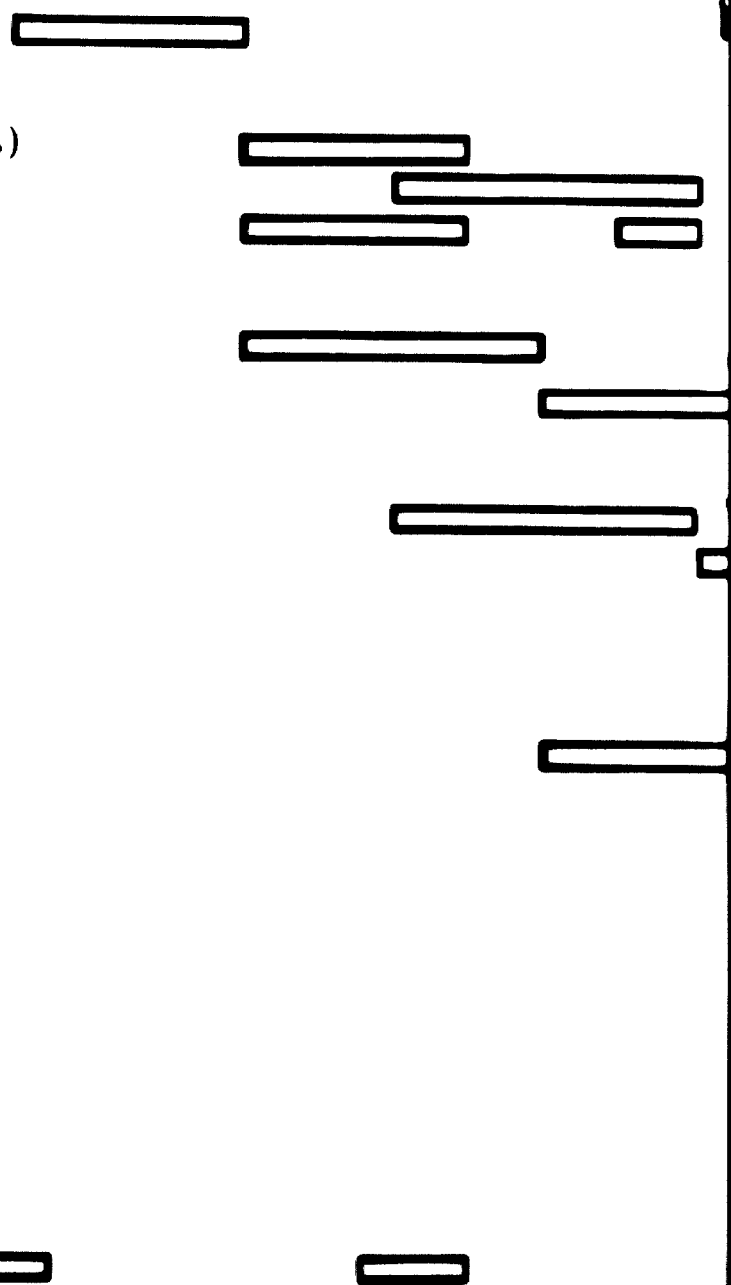


CHART 4: SUGGESTED EXECUTION PROGRAM

PROGRAMME ITEM

MONTHS FROM					
9	10	11	12	13	14

1. Prepare Company Plan
 - Draft
 - Detailed
 - Recruit foreign manufacturing expert (joint venture co.)
 - Compile detailed specification on plant and equipment
 - Prepare finding and cash flow plan
2. Find Land
 - Conduct search, review availability
 - Buy land
3. Prepare Factory Design
 - Layout machinery
 - Building specification
4. Get Quotations
 - Factory
 - Machinery
5. Place Orders
 - Factory construction
 - Machinery delivery
 - Material
 - Tooling
6. Recruit Labour
 - Technical
 - Skilled
 - Unskilled
7. Arrange Distribution
 - Accept orders
8. Commission Plant
 - Start production
 - Build up to initial production plans

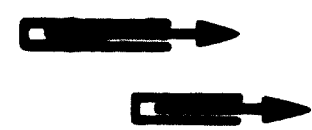


	From Completion of Feasibility Study	
Complete Promotion Programme	10	Months
Complete Execution Programme	14	Months
	<u>24</u>	Months
Time Saved if using Existing Factory	6	Months
	<u>18</u>	Months

ED EXECUTION PROGRAMME FOR PROMOTED COMPANY

MONTHS FROM COMPLETION OF FEASIBILITY STUDY

12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----



Completion of Feasibility Study

Time	10 Months	
Time	14 Months	(8 Months if no New Factory Required)
	24 Months	
ing Factory	6	
	18 Months	

SECTION 2

APPENDICES

APPENDIX 1. LIST OF ACKNOWLEDGMENTS

We are very grateful to the following:

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UNIDO (Vienna)	Jordan C. Smith (TEPCO) S. Jonsson (TEPCO) B. Jamilla (Technical Co-operation Division) A.A. Swamy-Rao (Industrial Technology Division)
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National Economic Development Board	Krit Sombatsiri
Ministry of Industry	Siravong Changkasiri
Industrial Finance Corporation of Thailand	Tos Pantumasen Chalerm Niyomthai
Thailand Management Development and Productivity Centre	Vira Boonyanurak

Other Agencies

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Association of Thai Industries	Pramam Adireksam
Thailand Management Association	Yuthasar na Nagara
Thai-German Institute of Agricultural Training	Banyat Vimokesant

Trading Companies and Importers

Ekman & Co. Ltd.	Prasong Srithornratkul Pramouth Sivaruk
F.E. Zvellig (Bangkok) Ltd.	Marcel G. Leu Lim Siew Hong
Borneo Engineering Co. Ltd.	D.J.N. Fisher
Diethelm & Co. Ltd.	Ernst Brunner Roger Wuetrich Hans Piaz Walter Bremeis Pichai Pinaikul
East Asiatic Company Ltd.	Hans Erik Larsen
Anglo-Thai (Bangkok) Ltd.	T.J.P. Hughes
Louis T. Leonowens	Denis Imray T.J. Delaney
Anglo-Thai Motors Ltd.	R.V. Taylor G. Cole
John Deere Thailand Ltd.	John H. Ruth Fred F. Fairman
United Motor Works (Siam) Ltd.	Charoen Varnichkorn

Hand Tool Wholesalers and Retailers

Chiew Hua Huat, Wern Nakorn Kasem.
Chin Seng (Thai Pattanasin) Nakorn Kasem.

Chiew Mow Seng, Wern Nakorn Kasem.
Ha Huat, Wern Nakorn Kasem.
Si Sophon Phanit, Jawarath.
Sing Heng, Wern Nakorn Kasem.
Nguan Hong, Wern Nakorn Kasem.
Saeng Thaivorn, Wern Nakorn Kasem.
Sin Charoen, Wern Nakorn Kasem.
Sahai Kolkorn, Wern Nakorn Kasem.
Sahai Chongsearit) Victorious Co. Ltd.,
Boon It Teer) Chakrphet.

Manufacturers

Yarnapund Co. Ltd.	Kee Phanpanit Smuck Kiriwong
Wong Wai Vit	Bjern P. Sandstro
Somboon Spring Manufacturing Ltd. Partnership	Somboon Kitaphanich
Siam Iron and Steel Co. Ltd.	Genek Bhonghibhat
The Chillington Tool (Thailand) Co. Ltd.	Denis Imray
Lim Chien Saeng, Nakorn Sawan	Cher Sunreongthai
Sakcharoen Engineering Ltd. Partnership, Thunburi	Charoen Sukboon
Lim Ea Kuang Screw Factory	Veravit
Duang Keo Industries, Bang Pa In	Avudh Charit
Pressure Container Industry Corp. Ltd.	Tony V. Kevaloe
Asia Equipment Industry	Tongsa.

APPENDIX 2 : HAND TOOL IMPORTS 1966 - 1970

	1966 CIF Value	1967 CIF Value	1968 CIF Value	1969 CIF Value	1970 CIF Value
Spades, shovels	1,119,438	1,466,071	1,265,699	1,381,244	1,952,725
Changkols, hoes	23,061,335	26,917,575	8,962,418	9,336,982	4,383,439
Picks, forks and rakes	662,336	1,115,461	406,201	527,779	457,005
Axes, bill hooks	2,756,616	2,730,631	3,118,602	2,494,973	2,345,253
Saws, non-mechanical	4,580,624	6,950,344	9,153,557	11,244,211	11,608,133
Hand saw blades	8,378,729	10,893,079	12,584,725	11,134,397	10,405,791
Toothless saw blades	1,764,499	2,565,599	2,458,656	2,986,935	1,803,880
Machine saw blades	9,514,220	11,361,567	10,921,146	14,105,920	11,628,205
Pliers, pincers	3,307,412	5,011,471	4,889,672	10,338,068	6,241,500
Tinmen's snips, bolt croppers	1,250,578	1,379,785	2,057,998	1,753,398	1,809,871
Spanners, wrenches	15,394,632	20,942,122	18,977,116	20,209,349	18,033,551
Files, rasps	11,587,390	19,513,275	15,148,412	17,008,520	19,638,953
Vices, clamps	2,499,759	4,606,115	5,341,264	3,871,066	2,918,414
Hammers	3,554,692	4,825,056	5,521,025	7,301,562	6,822,849
Tools for masons, plasterers	670,815	1,298,135	1,156,170	1,387,596	4,907,423
Tools for carpenters	5,576,227	6,192,193	5,300,612	5,398,599	4,086,827
Drilling, threading, tapping tools	5,645,182	4,694,860	3,628,154	6,232,282	
Interchangeable tools for hand tools	30,814,313	38,973,534	47,172,577	43,645,698	3,372,605
Knives and cutting blades for machines	4,230,421	5,083,552	5,852,172	6,075,667	9,914,920
Screwdrivers	-	-	-	-	3,656,213
Hand tools (not elsewhere specified)	14,953,496	13,842,083	17,929,031	17,687,654	17,207,492
TOTAL	151,323,654 7.56	190,362,508 9.52	181,825,201 9.09	194,121,900 9.70	143,195,019 7.02

(Baht)
(US\$ millions)

APPENDIX 5. SUMMARY OF PRODUCT SCREENING

<u>Product Group</u>	<u>Source</u>	<u>Observations</u>	<u>Conclusions</u>
1. <u>Agricultural hand tools</u>			
(a) Simple tools - spades, shovels, picks, forks, rakes, crowbars, sickles, paddy knives, weed cutters, harpoons, plantation knives.	Thai cottage industry (family workshops).	No production statistics are available. No manufacturing plant could compete with the costs of the part-time or full-time family workshop, producing low-priced goods to match the low purchasing power of the Thai farmer. Any attempt to do so through price competition would be unprofitable for the plant, and could result in severe loss of earnings for the family workshops.	Simple tools should continue to be made by the cottage industry (see also Section 5 of the text).
(b) <u>Changkols</u>	Chillington Tool (Thailand) Company Ltd.	Strong national distribution through competing networks - Diethelm and Company ("Crocodile" brand), The East Asiatic Company ("Buffalo Head" brand) and local wholesalers - combined with strong brand loyalty ensure that Chillington enjoys a dominant share of the changkol market.	Further local investment in Changkol manufacture cannot be justified.
	Imports	1970 CIF Value: US\$ 219,000. Imports are largely from West Germany, Austria and Hungary.	

Conclusions

Project team should appraise capability of local industry to manufacture limited range of spanners, hammers and pliers, and should provide detailed recommendations for their production in Thailand.
(See Section 6).

Observations

A most important product group, accounting in 1970 for 99% of total CIF value of hand tool imports. Most important are spanners and wrenches, hammers, and pliers and pincers. Current demand for these tools, coupled with their technical suitability as nucleus for forging industry, make them desirable propositions for local manufacture. Fragmented demand for other products does not justify local production initially: they could be added to the product range later.

Additional local production of the complete finished article should not be attempted until the raw material is available locally, and production quantities can be proved to be economic.

Source

Largely imports.

Product Group

2. Forged artisan hand tools

Pliers, pincers, tinman's snips, bolt croppers, spanners, wrenches, hammers, axes and bill hooks.

3. Saws

Hand saws and hand saw blades; hack saws and hack saw blades; toothless saw blades; machine saw blades.

There is a wide variety of types, sizes and qualities within this product group, (worth US\$ 17.72 in CIF value in 1970). Economic production of finished products would be difficult. Moreover the raw material would still have to be imported in the event of local production, reducing the labour content to teeth-cutting and assembly. Additional local production is not an attractive proposition until raw material is also produced locally.

Imported finished products, and local conversion of imported saw steel into finished article.

<u>Product Group</u>	<u>Source</u>	<u>Observations</u>	<u>Conclusions</u>
4. <u>Files and rasps</u>	Imported	<p>Whilst the overall market is sizeable (1970 CIF value : US\$9.82 million) two major factors preclude local production at this stage:</p> <p>i) the very wide range of shapes and sizes required to meet local needs making production quantities uneconomic.</p> <p>ii) the highly technical nature of the equipment and know-how required to manufacture products of acceptable quality.</p>	<p>A viable forging industry should be well established before further consideration is given to local file manufacture. Because of (ii) a future feasibility study would be best undertaken jointly with a world file manufacturer enjoying a sizeable share of the Thai market.</p>

5. Components for agricultural equipment

a) Tips for the blades of buffalo-drawn ploughs	<p>Thai cottage industry, rural factories.</p> <p>Plough blade tips are made in large quantities from scrap materials by family workshops, rural factories and small foundries. There are no published statistics. However, a 1967 estimate of 100,000 buffalo-drawn ploughs would seem to indicate an annual usage of one million tips. These commonly retail at Baht 2 (US\$0.10) per piece. There is thus no attraction for an investor to enter this area.</p>	<p>Blade tips should continue to be manufactured by existing resources.</p>
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Conclusions

Sales on this scale do not justify the heavy investment in plant required. However, their production in Thailand could be an attractive proposition to any manufacturer with idle capacity on existing heavy presses, and with fixed costs already covered.

Observations

The annual consumption of plough discs for attachment to tractor drawn ploughs is estimated at 60,000 discs. Sales, largely tied to the slowly growing four-wheeled tractor market, are not expected to exceed 100,000 by 1960.

Source

Imports

Product Group

5. b) Plough discs for tractor-drawn equipment.

APPENDIX 4 : APPRAISAL OF EXISTING AND POTENTIAL

<u>Company</u>	<u>Contact</u>	<u>Major Products</u>	<u>No. of Employ- ees</u>	<u>St</u>
ARNAFUND CO. LTD., No. 42 Soi 81 Sukumvit Rd., Prakanong, Bangkok.	Khun Keo Phanpanit, Managing Director; Khun Smuck Kiriwong, Factory Manager.	A wide range (approx 950) of spare parts for automobiles, trucks and buses.	130 (approx)	Large plant, producing a automobile co to order. I design and to
WONG WAI VIT., Sukumvit Rd., Bangkok.	Mr. Bjorn P. Sandstro, Managing Director, Wee Thai Engineering Co. Ltd., 448 Suriwongse Rd., Bangkok (Thorfsen Bldg) Khun Sumeth, Assistant Manager.	Building Construction Contracts, Overhaul of engines for Airforce, Contract repairs of equipment for manufacturing plants.	Factory 60 Construc- tion 500	This is a re with a well shop. Howev concentrated tracts over There is lit machine shop
SAHAI CHONG SARIT, 22-628 Chuck-Pet-Road, Bangkok.	Khun Sahai Chongarisdi, Managing Director.	This group is not manufacturing at present but importing and distributing a wide range of hand tools.		It is plann a plant of Thonburi. P to start in
SOM SOMBOON SPRING MFG. LTD. PARTNERSHIP, 48/1 Bang-Na Sukumvit Rd., Bangkok.	Khun Sembeen Kitaphanich,	Spare parts for cars, trucks & tractors, Springs, mainly leaf springs, Brake linings, Yokes.	300 (approx) in Factory	This is a la company with outlets. It stores employ people for products.
THE SIAM IRON AND STEEL CO. LTD., 814 Techavanich Road, P.O. Box 1474, Bangkok. Factory - Ta Luang Sara Buri	Khun Ganok Ehongbhibhat, Assistant Manager.	Iron castings, Steel castings, Rolled steel bar, flats.	1400 - 1500	A large Comp to produce Equipment fo excellent.

EXISTING AND POTENTIAL TOOL MANUFACTURERS

<u>of</u> <u>employ-</u>	<u>Size</u>	<u>Type of Work</u>	<u>Special Strengths/Conclusion</u>
100 (approx)	Large plant, well established, producing a wide range of automobile components in batches to order. It does all its own design and tooling.	The factory is equipped to produce: - hot work pressing - drop forgings - machined components - fabrication (welding etc) - assemblies	Well experienced well established manufacturing plant, capable of producing products requiring detailed tooling.
Factory	This is a reasonably large plant with a well equipped machine shop. However, it has concentrated on building contracts over the past few years. There is little work for the machine shop.	The factory is equipped for: - casting - machining - heat treatment	It has a very good machine shop equipped for producing a wide range of work, mainly precision work e.g. Engine components, rather than a general range of "simpler" machined components. To undertake a new range of products would require considerable rebuilding of technical skills.
	It is planning the building of a plant of 3 rai of land in Thonburi. Production is planned to start in February 1974.	It currently holds a Promotion Certificate from the Board of Investment to set up and manufacture: - chisels, 200,000/year - handsaws, 200,000/year, - cut plane iron, 400,000/yr. - hammers (claw, ball pein, smith), 200,000/year. - axes, 200,000/year.	The Company has the facilities for distributing products through its existing organisation. Strong technical support and back up will be required to successfully produce the tools it is planning. This should be arranged before it begins to implement production plans.
100 (approx) in factory	This is a large manufacturing company with own distribution outlets. It has two large stores employing 100 (approx) people for selling its products.	Producing a wide range of products from: - pressing - forging - machinery - heat treatment	A large expanding Company (currently setting up a Foundry Plant) with a strong entrepreneur managing it. With its strong management it would make a success of any worthwhile new venture. Good potential for undertaking a new line of products with the right support and technical assistance.
100 - 100	A large Company well equipped to produce iron and steel. Equipment facilities are excellent.	Producing a wide range of iron and steel castings also steel collets for rolling mills.	Has capability of producing quality steels to an exact specification. A plant with good potential to supply steel specified for tool production at competitive prices. Using raw material from this plant instead of imported material would save an estimated Bt.32,000,000 (US\$1,600,000) in imported steel over the first 6 years planned production of small tools.

<u>Company</u>	<u>Contact</u>	<u>Major Products</u>	<u>No. of Employ- ees</u>	<u>Si</u>
THE CHILLINGTON TOOL (THAILAND) CO. LTD., Old Railway Road, Samutprakarn, Bangkok.	Mr. Denis Imray, Resident Director.	Changkols, a digging hoe ranging from 1 - 3 Kgs. approximately.	160 (approx) 2 shifts	It has by far percentage market and producing so 900,000 char
LIM M CHIEN SAENG, 92-94 Sawanvithi Rd., Nakorn Sawan.	Khun Chor Bumreongthai, Manager.	Plough frames for discs, Harrow frames for discs, Single ploughs, Single seeders, Maize millers.	58	Large factory town. Looking opportunities expansion.
SAKCHAROEN ENGINEERING LTD. PART., 53/3 Soi Sakcharden, Anaransanitwongse Road, Thapra, Thonburi.	Khun Charoen Sukbeon, Manager.	Large cutting blades (weight 9-10 Kg.) for sugar milling equipment, Small gears including spur gears up to 10 Kgs., Dies for presses, Jobbing work including fabrication.	20 (approx)	This is only factory produc orders.
LIM M EA KUANG SCREW FACTORY, 81 Sukumvit Road, Pomriri Lane, Bangkok.	Khun Veravit, Manager.	A wide range of nuts, bolts and screw threads, Special orders of simple tools for car and trucks e.g. Combination tyre lever and spanner.	95	Well establish specialising threads for of uses.
DU DUANG KEO INDUSTRIES, 38 Donkanong Road, Wikanong Bridge-Jomtong, Muckdee Lane, Thonburi.	Khun Buntint, Proprietor.	Dies for die casting, Die casting machines.	9	A very small producing to

of loy-	<u>Size</u>	<u>Type of Work</u>	<u>Special Strengths/Conclusion</u>
20 prox) shifts	It has by far the largest percentage of the changkol market and is currently producing some 700,000 - 900,000 changkols per year.	Work done in the plant covers: - shearing - forging - heat treatment - grinding and polishing - paint and pack.	This Company has an extremely high level of labour productivity. A factory with good potential for future development in new products, particularly those aligned with forging. They have the necessary base skills with both material and technical know how to undertake such a programme.
3	Large factory for a rural town. Looking for opportunities for expansion.	Mostly steel fabrication - press work - welding Also machining	The factory is well developed considering the problems encountered in starting up in this area. It is capable of designing and making special machines for its own use. It produces its own discs for its presses. Quality is quite acceptable. A factory with good potential for further development in agricultural implements.
1 prox)	This is only a small factory producing to orders.	Main work is machining. Heat treatment is done on site using salt baths built by themselves with technical help from the Industries Services Institute.	This plant has potential to supply press dies required in small tool manufacture.
9	Well established company specialising in screw threads for a wide variety of uses.	Work done mostly involves: - "hot" press work (components heated similar to forging before pressing) - screw threading - machining its own screw threading dies and press dies.	Although equipment is fairly old they are competent to produce a wide range of products requiring a reasonable level of innovation. A factory capable of producing some hand tools. They are receptive to help and advise. With the assistance of I.S.I. heat treatment facilities they are now producing their own screw threading dies more cheaply than Japanese imports and of quality giving longer tool life than the Japanese product.
6	A very small family factory producing to orders.	Work done is largely machining and assembly of dies and die casting machines. Some die casting of plastic products is also undertaken. Heat treatment of dies is also done on site in an oil fired furnace with thermo couple measurement and controls. Technical assistance is given by the Industries Services Institute.	This factory has potential to manufacture forging and press dies required in small tool manufacture. The owner-manager of the factory is an innovator.

<u>Company</u>	<u>Contact</u>	<u>Major Products</u>	<u>No. of Employees</u>	<u>Size</u>
<p>MAI AI MACHINERY INDUSTRIES, Bang Pa Tn. Bang</p>	<p>Khun Avudh, Deputy General, Manager; Khun Charit, Factory Manager.</p>	<p>Agent for Steyr tractors (Austria) Assemble or import complete a range of tractors of: 48 HP, 50 HP, 57 HP, 78 HP. Currently have 200 tractors which are overhauled and leased to farmers. Have assembled small "Southern Cross" diesel motors of 3, 6, 9, 12 HP using mostly imported components with some minor parts e.g. fuel tank manufact- ured at Bang Pa Tn. Have assembled some 1,600 Wisconsin Gasoline Engines again from imported components with fuel tanks made at Bang Pa Tn.</p>	60	<p>Present opera small scale w 10 tractors b week. No eng assembled at</p>
<p>PR PRESSURE CONTAINER INDUSTRY CORP. LTD., 79 Chongnonsee Road, Bangkok.</p>	<p>Mr. Tony V. Kevalae, Marketing Manager.</p>	<p>Assorted pressure containers for petroleum products, liquified gases, some chemicals viz ammonia. Special order air receivers.</p>	193	<p>Present opera rapidly. Sa anticipated (US\$1,850,00 Bt.22,000,00 be export. are cylindric ers ranging 2' to 5' by</p>
<p>ASIA A IA EQUIPMENT INDUSTRY, 5 Superhighway, Dindang, B Bangkok.</p>	<p>Khun Tongma, Manager.</p>	<p>Machine components for tractors and cars using many imported forgings e.g. cylinder pins, Track chain for tractors.</p>	200 (approx)	<p>This company It is lookin to diversify</p>

of
ploy-

Size

Type of Work

Present operations are only on a small scale with approximately 10 tractors being overhauled each week. No engines are being assembled at the moment.

All work is currently overhaul or fitting type work.

The factory consists of four shops of approximately 5,400 sq. metres each (total 21,600 m²) as well as additional buildings for stores and offices. There are excellent (but specialised) machines installed which have not been used e.g. Presses, cranes, small lathes, turret lathes, millers, grinders etc. There is also extensive foundry equipment still in packing cases. Land consists of approximately 100 rai with good road and river access. Excellent resources for future development, but will need extensive investment to rebuild management and technical skills required.

Present operations are expanding rapidly. Sales for 1972 are anticipated to reach Bt. 37,000,000 (US\$1,850,000) of which Bt. 22,000,000 (US\$1,100,000) will be export. The export products are cylindrical pressure containers ranging from approximately 2' to 5' by 1' diameter.

Work done in the plant is mostly press work (up to 500T press),

- welding (boiler standard)
- assembly
- painting
- heat treatment
- pressure testing

High standard of workmanship, with thorough testing procedures covering pressure, tensile strength, hardness and X ray inspection of welded joints. Reasonable level of productivity. A factory with excellent potential for further development. They are looking for new products and already have some equipment with available capacity that could be used in small tool manufacture e.g. discs for ploughs and harrows up to 3/16" thick.

This company is growing rapidly. It is looking for opportunities to diversify in its products.

Work done in the plant is mostly:

- machining
- welding
- assembly
- heat treatment using:
 - induction heating,
 - electric furnaces,
 - oil fired,
 - salt baths.
- hard chrome plating.

The variety of equipment in operation and the skills available to use it. Reasonable level of productivity. A factory with good potential for further development. They are interested in investing in and developing new products. Has room to expand.

Appendix 5 : Operation Times for Spanners

Open Ended Spanner

Most common set.

Refer. BS.192

m x m

Operation	7 x 8	8 x 10	10 x 11	11 x 13	13 x 17	17 x 19	
1. Cut steel	.050	.050	.050	.050	.055	.060	.315
2. Pack Table	.113	.113	.113	.113	.125	.129	.706
3. Operate Furnace	.225	.225	.225	.225	.250	.258	1.408
4. Forge	.225	.225	.225	.225	.250	.258	1.408
5. Trim	.420	.420	.420	.420	.420	.423	2.523
6. Broach small end	.217	.219	.221	.221	.300	.318	1.496
7. Broach big end	.217	.219	.221	.221	.300	.318	1.496
8. Stamp small end	.190	.190	.195	.195	.200	.210	1.180
9. Stamp big end	.190	.190	.195	.195	.200	.210	1.180
10. Harden and temp							
11. Grind	.370	.370	.370	.445	.520	.587	2.662
12. Polish heads	.487	.487	.527	.623	.717	.767	3.608
13. Polish handle	.208	.208	.208	.232	.255	.273	1.384
14. Straighten	.286	.286	.286	.286	.286	.360	1.790
15. Shot blast	.040	.040	.055	.055	.060	.172	.422
16. Polish flats 1	.298	.298	.325	.353	.417	.445	2.136
17. Polish flats 2	.285	.285	.310	.340	.400	.423	2.043
18. Buff flats	.337	.337	.367	.402	.437	.503	2.383
19. Oil	.042	.042	.042	.050	.062	.070	.308
20. Degrease	.083	.083	.100	.100	.125	.183	.674
21. Chrome plate	.267	.267	.267	.267	.523	.850	2.441
							31.563

31.6 minutes per set @ 100% efficiency.

Allowing a shop performance of 70%, time/set = 45 minutes of .75 hrs/set.

Ring Spanner

Most common set.

m x m

Refer. BS. 3555

Operation	6 x 7	8 x 10	10 x 13	11 x 14	14 x 17	17 x 19	19 x 22	22 x 24	
Cut	.050	.050	.050	.050	.055	.055	.060	.060	.430
Pack	.113	.125	.125	.129	.129	.129	.129	.157	1.036
Op. Furnace	.225	.250	.250	.258	.258	.258	.258	.313	2.070
Forge	.225	.250	.250	.258	.258	.258	.258	.313	2.070
Trim	.420	.420	.420	.423	.423	.423	.423	.427	3.379
Punch S.	.164	.164	.168	.168	.177	.192	.223	.223	1.479
Punch L.	.164	.164	.168	.168	.177	.192	.223	.223	1.479
Drill S.	.400	.400	.450	.450	.510	.510	.510	.530	3.760
Drill L.	.400	.400	.450	.450	.510	.510	.530	.550	3.800
Broach S.	.217	.219	.221	.221	.300	.318	.358	.445	2.299
Broach L.	.217	.219	.221	.221	.300	.318	.358	.445	2.299
Stamp S.	.190	.190	.195	.195	.210	.210	.230	.250	1.670
Stamp L.	.190	.190	.195	.195	.210	.210	.230	.250	1.670
H & T									
Straighten	.360	.360	.360	.360	.446	.446	.446	.446	3.224
Grind	.252	.402	.533	.596	.790	.925	.973	1.052	5.523
Polish Heads	.447	.447	.447	.507	.675	.810	.895	1.025	5.253
Polish Handle	.255	.273	.297	.320	.366	.388	.400	.406	2.705
Rumble									
Shot Blast	.040	.040	.055	.060	.112	.172	.222	.285	.986
Polish Ring	.218	.238	.312	.360	.487	.487	.487	.497	3.086
Polish Ring	.218	.218	.312	.360	.487	.487	.487	.497	3.066
Buff Ring	.232	.252	.326	.374	.501	.501	.501	.501	3.188
Oil	.012	.012	.012	.012	.018	.025	.028	.040	.159
Degrease	.087	.087	.100	.100	.142	.183	.183	.250	1.124
Chrome	.267	.267	.267	.267	.533	.850	.850	.850	4.151
									59.906

60.0 minutes/set @ 100% efficiency.

Allowing a shop performance of 70%. time/set of 8 = 85 minutes or 1.42 hours.

APPENDIX 6 : AVAILABLE CAPACITY ON SINGLE-SHIFT OPERATION

FACTORY WORKING YEAR

Ref. "Thailand Business - Legal Handbook" by Kirkland

Normal

48 hour week (8 hour day)	Overtime	x 1½
	Public holiday	x 2
	Annual leave	x 2

Public holidays	13*
Annual leave	6*

* Not compulsory. Above conditions for pay rates apply if worked. May 1st is the only compulsory holiday.

Maximum capacity 365 - 1 = 364 days.

"Normal"	365
less 52 (Sundays)	
13 (Public holidays)	
6 (Annual leave)	
	<hr/>
	71
	<hr/>
	= <u>294 days</u>

Available Hours

	1 shift (8)	2 shifts (16)	3 shifts (21)
Normal	2,352	4,704	7,056
Maximum	2,912	5,824	8,736

APPENDIX 7 :

MANUFACTURING QUANTITIES AND REQUIRED MANHOOR CAPACITY

	Spanners 100,000 sets 96 tons	Hammers 100,000 68 tons	Pliers 100,000 23 tons	Total 187 tons
	(2)	(3)	(3)	
1. Cut bar	1,000	170	330	1,500
2. Load furnace	2,500	330	330	3,160
3. Heat	4,800 - 2	1,000 - 1	670	6,470 (1)
4. Forge	4,800 - 2	1,000 - 1	670	6,470 (1)
5. Trim (2 men)	8,000 - 2	1,000 - 1	1,670	10,670 (1)
6. Punch	7,000 - 3	1,000 - 1	670	8,670 (1)
7. Drill	9,000 - 4	-	-	9,000 (1)
8. Broach (2 men)	10,800 - 2	-	500	11,300 (1)
9. Stamp	7,800 - 3	500	500	8,800 (1)
10. Harden & Temp.				
11. Grind	13,000 - 6	1,670 - 1	500	15,170 (1)
12. Polish 2/machine	19,000 - 8	4,200 - 2	2,000 - 1	25,200 (1)
13. Rumble				
14. Straighten	7,600 - 3		2,000 - 1	9,600 (1)
15. Shot Blast	2,300		500	2,800
16. Polish	14,500 - 6	3,300 - 2	1,670	19,470 (1)
17. Oil	330	170	170	670
18. Clean	2,600	2,600	670	5,870
19. Test	4,500 - 2	2,300	1,670	8,470 (1)
20. Chrome	9,800 - 4		1,670	9,800
21. Lacquer (Paint)		1,670		1,670
22. Assemble		2,300	4,800	7,100
23. Pack	3,300	830	830	4,960

(1) Operations requiring duplicated equipment and/or more than 1 shift (based on a normal yearly shift of 2352 hrs)

(2) Number of machines required on 1 shift basis.

(3) Additional machines required.

APPENDIX 8 : MACHINERY AND EQUIPMENT INVESTMENT

Equipment description	Unit Price	Investment for spanners 100,000 sets/year			Additional investment for hammers 100,000/year			Additional investment for pliers 100,000/yr			
		Units	Value		Units	Value		Units	Value		
			Baht	US\$		Baht	US\$		Baht	US\$	
1. Crane for material	S 20,000	2	40,000	2,000	-	-	-	-	-	-	-
2. Stock racks	S 1,000	1	5,000	250	-	-	-	-	-	-	50
3. Cleaving press	S 100,000	1	100,000	5,000	-	-	-	-	-	-	-
4. Material transport bins	S 200	30	6,000	300	10	2,000	10	2,000	10	2,000	100
5. Furnace table	S 400	1	400	20	-	-	-	-	-	-	-
6. Furnace - oil fired	S 10,000	2	20,000	1,000	1	10,000	1	10,000	1	10,000	500
7. Forging hammer I.T. (drop)	S 300,000	2	600,000	30,000	1	300,000	1	300,000	1	300,000	15,000
8. Trim press 50T	S 240,000	2	480,000	24,000	1	240,000	1	240,000	1	240,000	12,000
9. Punch press 30T	S 120,000	2	240,000	12,000	1	120,000	1	120,000	1	120,000	6,000
10. Drill	S 6,000	4	24,000	1,200	-	-	-	-	-	-	-
11. Broach	S 260,000	2	520,000	26,000	1	260,000	1	260,000	1	260,000	6,000
12. Stamping press 30T	S 120,000	2	240,000	12,000	1	120,000	1	120,000	1	120,000	500
13. Heat treatment furnace/m	S 10,000	2	20,000	1,000	1	10,000	1	10,000	1	10,000	-
14. Hardening - oil quench	S 10,000	1	10,000	500	-	-	-	-	-	-	-
15. Tempering - electric furnace	S 20,000	1	20,000	1,000	-	-	-	-	-	-	-
16. Belt grinder - 2 belt (4 wheel)	S 20,000	3	60,000	3,000	1	20,000	1	20,000	1	20,000	1,000
17. Polisher - 2 wheel	S 10,000	4	40,000	2,000	2	20,000	2	20,000	1	10,000	500
18. Rambler (shot blast)	S 100,000	1	100,000	5,000	-	-	-	-	-	-	-
19. Straightening block	S 500	3	1,500	75	-	-	-	-	-	-	25
20. Buff polishers	S 10,000	3	30,000	1,500	1	10,000	1	10,000	1	10,000	500
21. Oil tank	S 500	1	500	25	-	-	-	-	-	-	-
22. Degreaser	S 10,000	1	10,000	500	-	-	-	-	-	-	-
23. Plating tank and equipment	S 30,000	1	30,000	1,500	-	-	-	-	-	-	-
24. Sawdust boxes	S 500	1	500	25	-	-	-	-	-	-	-
25. Stock racks	S 4,000	1	4,000	200	-	-	-	-	-	-	50
26. Pallets	S 60	30	1,800	90	10	1,000	10	600	10	600	30
27. Pallet truck	S 5,000	1	5,000	250	1	5,000	1	5,000	1	5,000	250
28. Air compressor	S 250,000	1	250,000	12,500	-	-	-	-	-	-	-
29. Air receiver	S 25,000	1	25,000	1,250	-	-	-	-	-	-	-
30. Hardness tester	S 10,000	1	10,000	500	-	-	-	-	-	-	-
31. Torque tester	S 1,000	1	1,000	50	-	-	-	-	-	-	-
32. Testing jigs	S 500	4	2,000	100	2	1,000	2	1,000	1	500	25
			2,896,700	144,835		860,600		43,030		25,600	1,280

Equipment Description	Unit Price Baht	Spanners			Hammers			Pliers					
		Units	Value		Units	Value		Units	Value				
			Baht	US\$		Baht	US\$		Baht	US\$			
1. Cut off saw													
2. Material handling equipment, e.g. rollers between opera- tions.	1000/m	30	24,000	1,200									
3. Vertical mill			30,000	10,000									
4. Small lathe			200,000	6,000									
5. Bandsaw			120,000	2,500									
6. Duct extraction or air exhaust system:			50,000	5,000									
- grinders & polishers			100,000										
- heat treat and plating													
6. Miscellaneous:													
- benches													
- small tools			50,000	2,500									
- hand tools, etc.													
- oxyacetylene													
			574,000	28,700									

Appendix 8 - Notes

1. Items marked "S" would be reduced if adding to an existing factory. No allowance has been made for benches, small lathe milling machine roller conveyors, etc. Assumed provision above is adequate to cover these items.
2. If starting a new factory, these items must be provided for as addition to that above.

MANUFACTURING COSTS, MAINTENANCE AND OPERATING COSTS PER YEAR

	Units req'd	To produce 100,000 sets/year		To produce 100,000 year		To produce 100,000 year		To produce 100,000 year	
		Units req'd	Value	Units req'd	Value	Units req'd	Value	Units req'd	Value
		Baht	US\$	Baht	US\$	Baht	US\$	Baht	US\$
1. Maintenance									
- Foreign technical assistance	1	140,000	7,000						
- Fuel	1	30,000	1,500						
2. Indirect Labor									
- Tool room staff (also machine setters)	2	40,000	2,000	1	20,000	1,000			
- Machine setters & heat treatment	2	48,000	2,400	1	8,000	400			
- Material handlers	1	16,000	800	1	1,500	750			
- Clerks	1	36,000	1,800	1	4,500	225			
- Cleaners	2	9,000	450						
3. Electric Power									
Based on existing plants consuming over 100,000 KWH/month, averaging 25 str/KWH.		200,000	10,000	15,000	100,000	5,000			
4. Fuel (120 litres/ton approx.)		20,000	600		9,000	450			
5. Press Dies									
- Cutting metal	14	42,000	2,100	4	12,000	600			
- Stamping (brand name etc.)	28	5,600	280	2	400	20			
6. Forging Die									
Average prices from two die manufacturers.	14	70,000	3,500	6	30,000	1,500			
7. Broaches	28	11,200	560	3	1,200	60			
8. Grinders									
- Wheels	50	10,000	500	20	6,000	300			
- Welts	500	50,000	2,500	300	30,000	1,500			

continued

	Unit Price Baht	To produce spanners 100,000 sets/year			To produce hammers 100,000/year			To produce pliers 100,000/year		
		Units req'd	Value		Units req'd	Value		Units req'd	Value	
			Baht	US\$		Baht	US\$		Baht	US\$
9. <u>Polishing Buffs</u>	40	500	12,000	600	200	8,000	400	50	2,000	100
10. <u>Miscellaneous</u>										
- Small tools	10,000		10,000	500		5,000	250		3,000	150
- Packing materials	20,000		20,000	1,000		10,000	500		10,000	500
- Maintenance supplies	40,000		40,000	2,000		20,000	1,000		10,000	500
- Miscellaneous materials:										
. Paint	10,000		-	-		10,000	500		2,000	100
. Grinding paste (polishing)	10,000		10,000	500		5,000	250		6,000	300
. Rivets - pliers	6,000		-	-		-	-		6,000	300
. Wedges hammers (handles)	10,000		-	-		10,000	500		6,000	300
11. <u>Contingencies</u>			24,000	1,200		21,000	1,050		6,000	300
			819,800	40,990		308,900	15,445		217,600	10,880

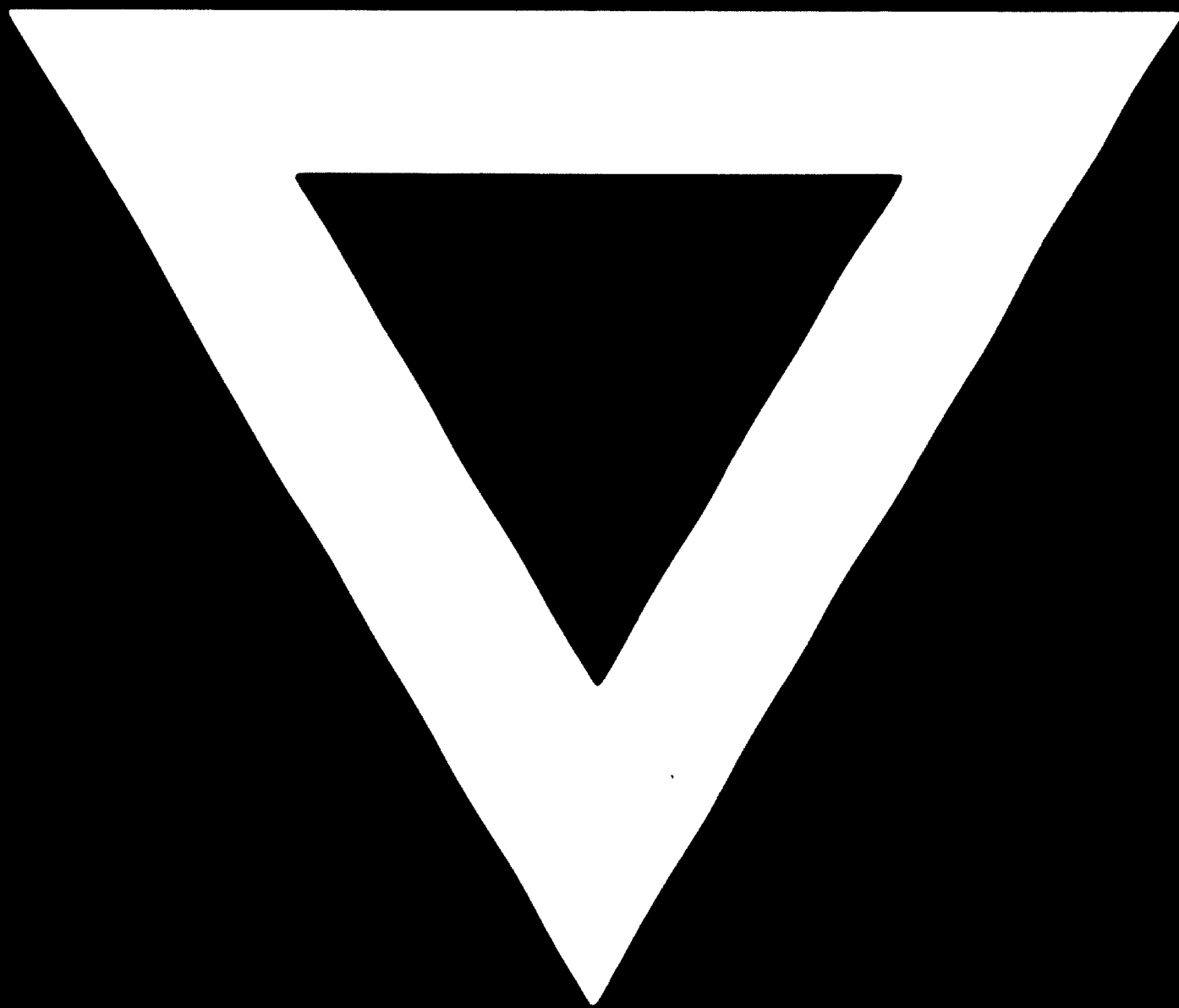
APPENDIX 10 : FORECAST TRADING RESULTS : NEW PLANT

	Year 1 (1974)	Year 2 (1975)	Year 3 (1976)	Year 4 (1977)	Year 5 (1978)	Year 6 (1979)
SALES REVENUE	Baht 3,830,000	Baht 5,900,000	Baht 7,060,000	Baht 8,310,000	Baht 9,570,000	Baht 10,910,000
DIRECT COSTS						
MATERIAL	1,091,000	1,686,000	2,018,000	2,380,000	2,750,000	3,139,000
LABOUR	344,000	531,000	634,000	746,000	861,000	981,000
OVERHEAD	613,000	959,000	1,139,000	1,346,000	1,557,000	1,776,000
TOTAL DIRECT COSTS	<u>2,048,000</u>	<u>3,167,000</u>	<u>3,791,000</u>	<u>4,472,000</u>	<u>5,168,000</u>	<u>5,896,000</u>
GROSS CONTRIBUTION	1,782,000	2,733,000	3,269,000	3,838,000	4,402,000	5,014,000
FACTORY FIXED COSTS	277,000)					
ADMINISTRATION	650,000)					
DEPRECIATION	577,000)					
START UP EXPENSES - PAY BACK	100,000)					
GROSS RECEIPTS TAX 7.6%	291,000	449,000	536,000	632,000	727,000	830,000
	<u>1,895,000</u>	<u>2,053,000</u>	<u>2,150,000</u>	<u>2,236,000</u>	<u>2,331,000</u>	<u>2,434,000</u>
GROSS PROFIT	(113,000)	680,000	1,119,000	1,602,000	2,071,000	2,580,000
BUSINESS TAX	-	-	-	-	-	535,000
NETT PROFIT	<u>(113,000)</u>	<u>680,000</u>	<u>1,119,000</u>	<u>1,602,000</u>	<u>2,071,000</u>	<u>2,045,000</u>

APPROXIMATE TIMELINE RESULTS : EXTENSION TO EXISTING PLANT

	Year 1 (1974)	Year 2 (1975)	Year 3 (1976)	Year 4 (1977)	Year 5 (1978)	Year 6 (1979)
SALES REVENUE	Baht 3,830,000	Baht 5,900,000	Baht 7,060,000	Baht 8,130,000	Baht 9,570,000	Baht 10,910,000
DIRECT COSTS						
MATERIAL	1,091,000	1,686,000	2,018,000	2,380,000	2,750,000	3,139,000
LABOUR	334,000	531,000	634,000	746,000	861,000	981,000
OVERHEAD	613,000	950,000	1,139,000	1,346,000	1,557,000	1,776,000
TOTAL DIRECT COSTS	2,048,000	3,167,000	3,791,000	4,472,000	5,168,000	5,896,000
GROSS CONTRIBUTION	1,782,000	2,733,000	3,269,000	3,838,000	4,402,000	5,014,000
FACTORY FIXED COSTS	277,000					
ADMINISTRATION	335,000	1,082,000	1,082,000	1,082,000	1,082,000	1,082,000
DEPRECIATION	370,000					
START UP EXPENSES - PAY BACK	100,000					
GROSS RECEIPTS TAX 76%	291,000	449,000	536,000	632,000	727,000	727,000
GROSS PROFIT	1,573,000	1,531,000	1,618,000	1,714,000	1,809,000	1,809,000
BUSINESS TAX	409,000	1,202,000	1,651,000	2,124,000	2,593,000	3,105,000
NETT PROFIT	-	-	-	-	-	675,000
	409,000	1,202,000	1,651,000	2,124,000	2,593,000	2,430,000

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