V　プロジェクト実施上の留意点

今回の調査により，昨年１０月に署名・交換された討議議事録（R/D）により定められたプロジェクトの骨子に，技術協力のスケジュール・内容（専門家派遣・研修員受入れ・機材供与）ならびに建屋の最終的な建築計画・施設計画といった具体的な肉付けが出来たといえる。

今後は，建屋増改築において「日」側の宿題となっている部分を可能な限り早く「マ」側に回答し、プロジェクトの受け皿ともいえるサイトを至急完成させることに、「日」「マ」双方とも力を注いでいくべきであろう。

Ⅵ　資　　料

6－1　4月1日現在のカウンターパート一覧表

カウンターパート名簿

氏　　名	役　　職　　名	最終学歴	配属時期	専属又は兼務の別	担当分野	ＪＩＣＡ研修経験の有無（ある場合には研修期間を記載）
HELME HASHIM	HEAD FTU	M.Eng. Sci, B.Sc.(Hons)	1.9.1979		FTU	Cast Iron Foundry-MIDC, Bandung Indonesia
		Production Engineering				
MUHAMMAD FAUZI ISMAIL	RESEARCH OFFICER	B.Sc.(Mech. Engineering)	12.9.1985		PATTERN MAKING	–
LEE LAY KUAN	R & D RESEARCH OFFICER	B.Sc.(Hons.) Nuclear Chem.	1.1.1989		FOUNDRY MATERIALS	–
BAKRI BAKAR	INDUSTRIAL DESIGNER	Dip. in Ind.Design	1.7.1988		PRODUCT DEVELOPMENT	–
JAMIL SULEIMAN	ASST. RESEARCH OFFICER	B.sc.Mech. Engineering	2.7.1979		MOULDING	Special Extension Workshop - Bangkok - 3 1/2 weeks
MOHAMAD SABRI ABDULLAH	ASST. RESEARCH OFFICER	Dip. in Mech. Engineering	17.2.1986			Investment Casting Technigue - CIAST
ZAIN AZLAN UJANG	TECHNICIAN	Cert. in Mech. Eng.(General)	1.2.1982		PATTERN MAKING	Inplant Training in Japan - Look-East Policy
MOHD. YUSOFF SAPIAN	TECHNICIAN	SPVM	2.5.1980		MOULDING	Inplant Training in Japan - Look - East Policy
ROSLI HUSSAIN	DRAUGHTMAN	SPVM	15.5.1980			Design of Jigs & Fixtures MADRAS - India
ROSLINDA SHAMSUDIN	STENOGRAPHER	Diploma in Stenography	10.4.1989		FTU	–
MOHD. FAIZ B. EYUB	TECHNICIAN				MELTING	–
MOHD. ASRI	TECHNICIAN		1.4.1989		MELTING	–
AHMAD KAMAL	TECHNICIAN		1.4.1989		MELTING	–
MOHD RADZI	TECHNICIAN		1.4.1989		PATTERN MAKING	–
KAMARULLAIL	TECHNICIAN		1.4.1989		MOULDING	–
HISHAM	TECHNICIAN		1.4.1989		MOULDING	–
AZHAR	TECHNICIAN		1.4.1989		FOUNDRY MATERIALS	–
MOHD. AKHIR YEOP KAMARUDIN	RESEARCH OFFICER	B. Sc. (Mech. Fngineering)	15.4.1989		MELTING	Test & Inspection of Metal 6 months - Japan
		Dip. in Manag. & Prod. Tech.				
MUHAMMAD AKHIR	DRIVER	SRP	17.4.1989			

6－2　Towards Strategic Planning and Development of Foundry Technology Unit

UNIT TEKNOLOGI FAUNDRI

FOUNDRY TECHNOLOGY UNIT

TOWARDS STRATEGIC PLANNING AND DEVELOPMENT

OF

FOUNDRY TECHNOLOGY UNIT

TOWARDS STRATEGIC PLANNING AND DEVELOPMENT

OF

FOUNDRY TECHNOLOGY UNIT

Prepared by :

HELME HASHIM
Head
Foundry Technology Unit
SIRIM

AUGUST 1988

CONTENTS

TOWARDS STRATEGIC PLANNING AND DEVELOPMENT

OF

FOUNDRY TECHNOLOGY UNIT

1 INTRODUCTION

The proposed M$18 million Foundry Technology Centre to be set up in Ipoh, Perak, could not be implemented as scheduled due to the present financial constraint. Institute is currently looking for various alternatives to provide the services needed by the foundry industry both in Perak and the country as a whole. As a first step approval has been obtained for the establishment of a scaled down foundry workshop to be located in Shan Alam. With the assistance from the Japanese Government (through JICA) the foundry workshop is now in its implementation stage and is expected to be fully operational by 1993. This workshop is known as FOUNDRY TECHNOLOGY UNIT (FTU) and will be one of the six units in MIDEC.

2 ROLE OF FOUNDRY INDUSTRIES IN THE MANUFACTURING SECTOR

Malaysia is now objectively developing itself to become a new industrialised country (NIC). Plans have been formulated (such as the IMP) to develop the manufacturing sector. In order to uplift the manufacturing capabilties of our industries it is inevitable that technological development through planned R & D activities and technological services from related Government Institutions is one of the crucial inputs. In this respect FTU will have a major role to play in achieving the national objectives.

2.1 The Manufacturing Sector

Fig. 1 demonstrates the various industrial grouping linking together that make up the manufacturing sector. FIVE main groups of industries can be identified, namely as follows ;

1 the manufacturing group
2 the supportive group
3 the intermediate supportive group
4 the primary industry group
5 the resource based group

2.1.1 The manufacturing group

The manufacturing group of industries consists of the components manufacturers, the sub-assemblers, and the major assemblers. The main role of this group of industries is to manufacture component parts which are then sub-assembled and fully assembled as finish products to be distributed to the consumers both for domestic and export purposes. The manufacturers may also manufacture fully finish products to be delivered directly to the consumers.

2.1.2 The supportive group

The manufacturing group of industries depends on the supportive industries for the supply of tools (moulds, dies, jigs, and fixtures) needed for the manufacture of products. Replanishment of machineries and the expansion of the manufacturing activities calls for the machine makers to design and fabricate new machines and equipment needed by the manufacturers. Engineering Designers plays their role in designing more sophisticated machines so as to enhance the production capabilities of the manufacturers, while the Industrial Designers strive their effort to develop new products in order to capture the market needs.

Designers, toolmakers and equipment makers make up the group of the supportive industries which consists of highly skilled technocrats performing the core activities needed in the industrialisation movement.

2.1.3 The intermediate group

Hi-tech and capital intensiveness characterise the intermediate group of industries namely the large scale foundries and forgers. The machines manufacturers in the supportive group

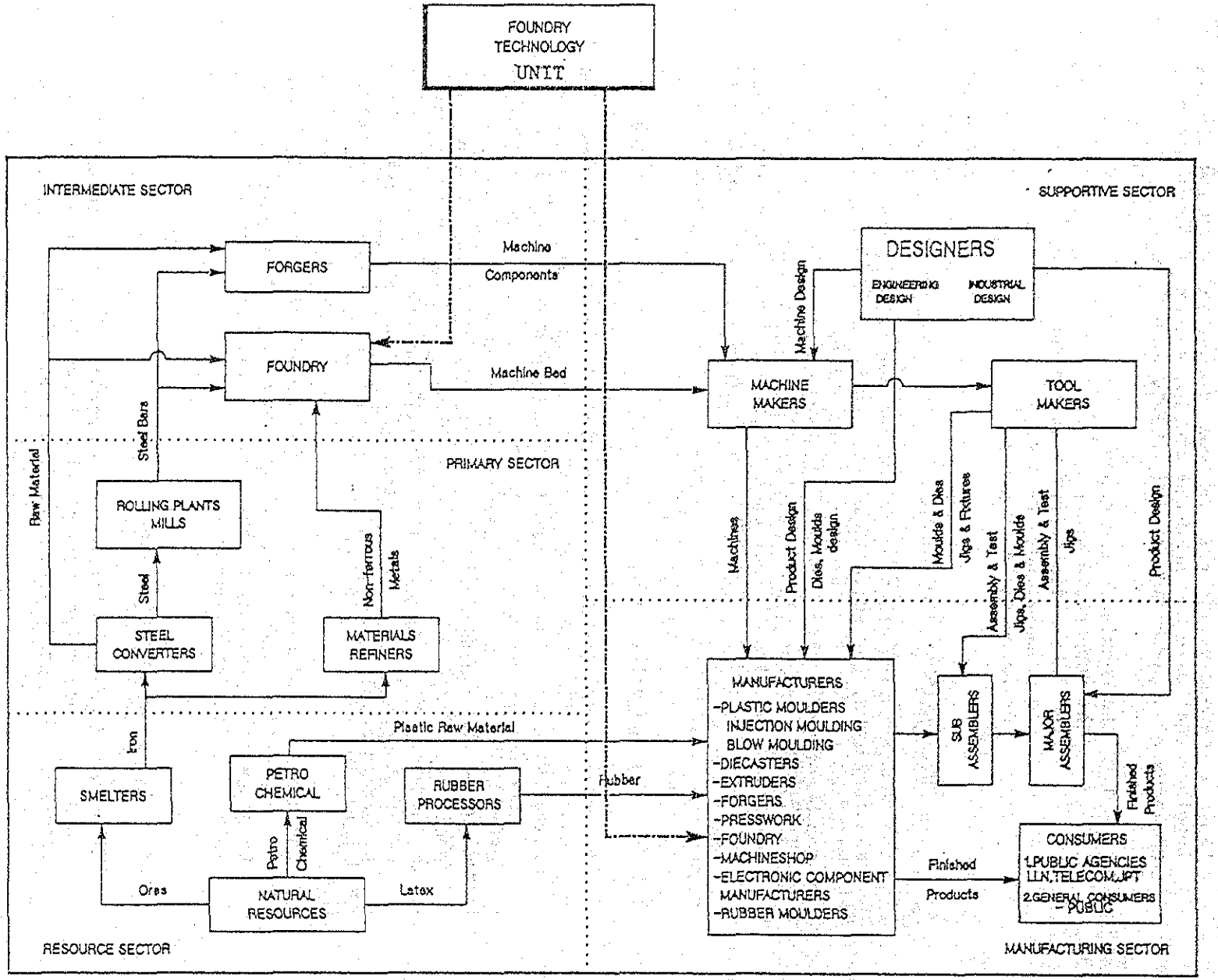


FIG 1 : THE ROLE OF FOUNDRY TECHNOLOGY UNIT IN THE INDUSTRIAL STRUCTURE

requires sophisticated and high quality cast and forged items to produce the equipments and machineries needed by the manufacturing industries. Parts such as machine-beds can only be produce by foundries capable of melting large volume of molten iron and having the knowhow in the moulding techniques so as to produce these parts. As such heavy capital investment is needed in order to equip these foundries with modern and sophisticated furnaces, laboratory and testing facilities.

2.1.4 The primary industries

The primary industries with its rolling mills, steel convertion plants and metal refiners provides the semi-finish raw materials (such as ingots, rolled plates and bars) to the other groups of industries.

2.1.5 The resource based industries

The resource based industries translates the natural resources such as iron-ore into basic raw materials (e.g pig iron, cast iron etc) for further consumption of the other industries.

2.2 The Role of The Foundry Industry

The Malaysian foundry industry produces casting components of both ferrous and non-ferrous metals for consumption by the domestic markets (Government, other industries and public consumers) as well as for export. The industrial structure, fig. 1, identifies two levels of foundry industries in the manufacturing sector. One which lies in the manufacturing group of industries supplying small castings required by the sub-assemblers, major assemblers and the public sector. While bigger foundries in the intermediate group of industries supply larger castings needed by the machine manufacturers.

Existing Malaysian foundries exclusively belong to the manufacturing group while bigger intermediate group of foundries are virtually non-existance. The vital contribution of the foundry industries at both levels should be recognised as they are the backbone of the industrialsation movement.

The need for upgrading the technological competency of the local foundries to the level expected in the intermediate group calls for the establishment of Foundry Technology Unit.

3 THE LOCATION OF FOUNDRY TECHNOLOGY UNIT

Fig. 2 shows the location of the building to be renovated for the foundry workshop.

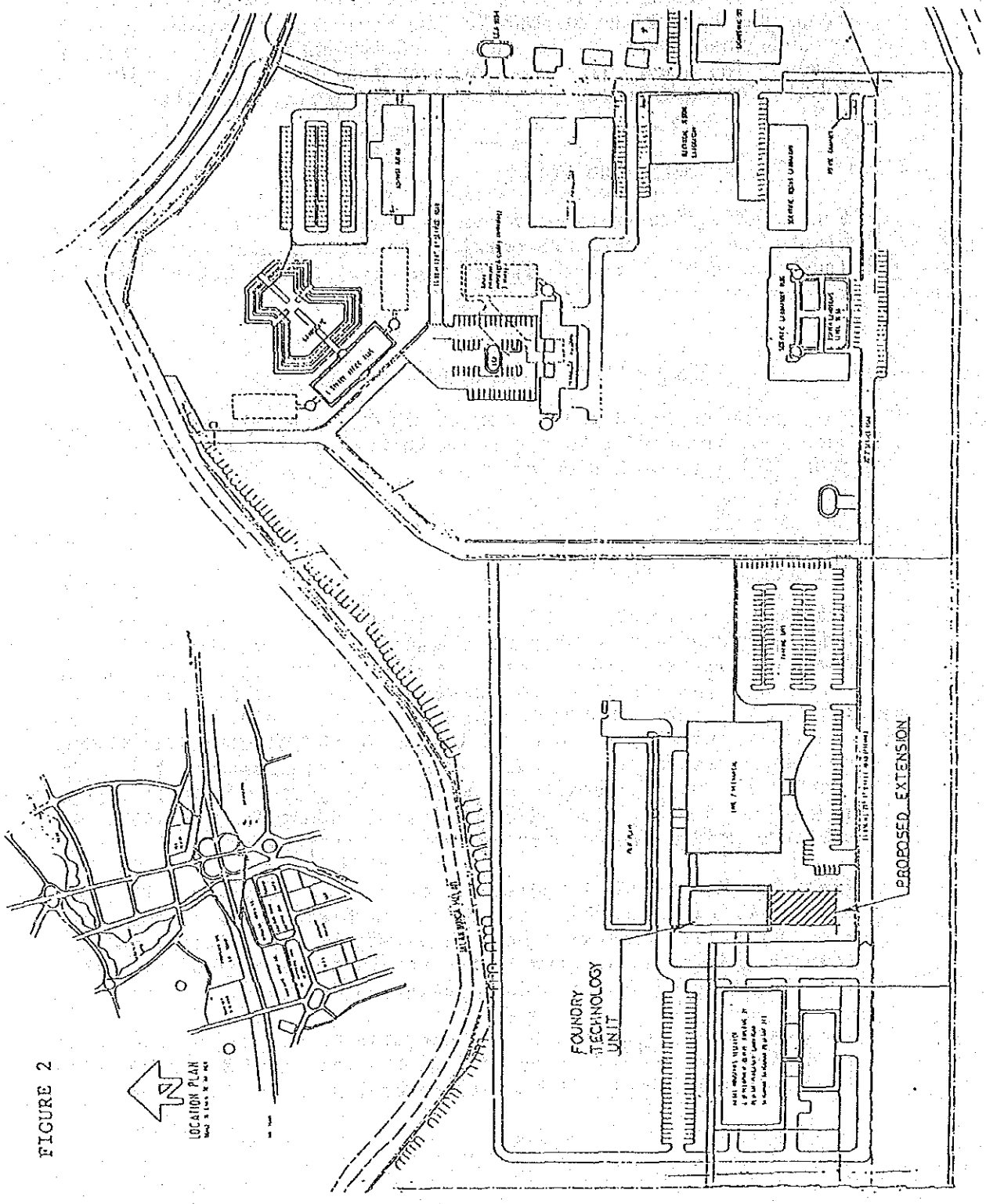


FIGURE 2

4 OPERATIONAL OBJECTIVE

The objective of the Foundry Technolgy Unit is to provide a continuous support for the development of the Malaysian foundry industry through the following programmes :

RESEARCH

1 To undertake research activities in relation to the utilisation of industrial by-products and the locally available materials with the view of upgrading indegeneous foundry technology, improving product quality and reducing the production cost of the local foundries.

DEVELOPMENT

2 To carry out development programmes in order to expand the market horizon of the local foundries through product deversification while complying with the need for localization and import substitute.

3 To pursue technological development activities so as to acquire the capabilities of producing heavy and sophisticated castings by the process of absorption, adaptation and improvement.

SERVICES

4 To render consultancy and advisory services and to offer facilities in the pursue of upgrading the quality of castings manufactured by the local foundrymen.

5 To support and to formulate programmes so as to encourage Bumiputra participation in foundry industry in line with the NEP.

6 To disseminate information related to foundry activities through programmes of seminars, workshops, trainings and dialogues with the view of upgrading foundry technology.

7 To assist the Standard Division of SIRIM in formulating Malaysian Standards related to foundry activities.

5 OPERATIONAL STRATEGIES

5.1 Target Areas and Their Needs

In order to understand the roles of the FTU in its endevour to develop the foundry industry, it is essential to first identify the target areas and their needs.

5.1.1 Target areas

Fig. 3 shows schematic relationship between the FTU and the identified target areas.In order for FTU to assist in the development of our local foundry industries products identification followed by in house development of these products for localisation appears to be the key activity. Other important needs are R & D, technology acquirement, information dissemination, quality control guidance, testing assistance, and consultantcy.

5.1.2 Needs identification

Direct problems related to foundry operators

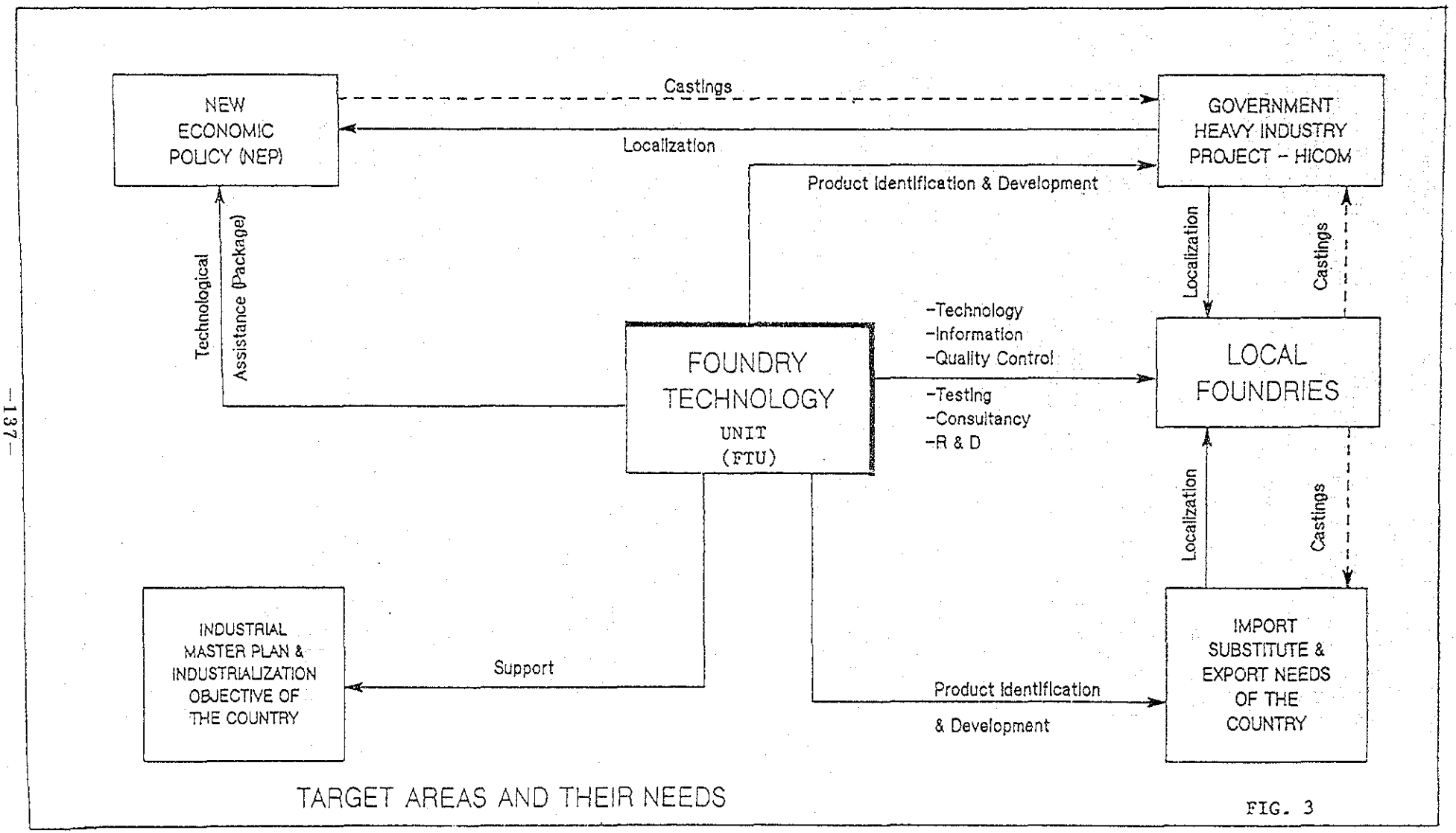
Survey on the existing local foundries (1) has unveiled a number of crucial problems currently faced by the local foundrymen which need immediate remedial attention. These problems can be summarised as follows :

Small and competitive market

Inherent attitude to rely on castings required by the resourse-based industries (tin, rubber and oil palm) for their manufacturing activities has resulted in stiff competition among foundry operators. Lately, the shrinkage in tin mining activity has led to a complete shutdown of a number of foundries. The need for market expansion through product diversification activity is therefore crucial.

Low level of technology

Low quality castings were acceptable during the boom days of the tin mining and rubber industries. The business was good then and both parties, the buyers



TARGET AREAS AND THEIR NEEDS

FIG. 3

and the suppliers, were contented with the castings so long as they serve the purposes that they were made for irrespective of the quality. Very little was done to upgrade the quality of castings and this has resulted in most of the local foundries to be very backward in their technology. At present many of the foundries are limited to producing simple components and their operation are mostly jobbing in nature.

Low product quality

Lacking in knowledge, expertise and facilities among the local foundry operators has resulted in low quality of castings being produced. This means that the products being produced are less competitive in the local market let alone for export market.

Rising cost of production

Although most foundries strive their best to use local materials for the production of castings but those materials needed that are not available locally, such as coke, liquid fuel, moulding resins, are imported. Continuous rising in the prise of these materials will inevitably increases the cost of production.

Finance

In order to upgrade their technology the foundries requires financial assistance. Little is known to our local banking institutions as to the importance of foundry industry to the nation and as such very few banks are willing to provide large amount of financial assistance for the foundry to upgrade their facilities.

R & D activity

The local foundry at present are incapable of conducting any form of R & D work. This can be due to lack of finance, unavailability of research equipment or simply that they do not have the qualified and capable personnel to carry out research activities.

Information

In order for the foundries to upgrade their capabilities, information as to how and where to source for the technology is important. At present there is no specific information centre made available to serve this need.

Other related problems/needs in general

Present Government projects such as the Industrialisation programme and the NEP programme in some way relate to the development of our foundry industry. This can be argued in the following manner :

a) Heavy Industrial Projects

Localisation of components

HICOM downstream projects such as PROTON, HICOM-YAMAHA and HICOM-HONDA require numerous casting components in their assembly operation. The present arrangement calls for the importation of almost all of these casting components. This highly unfavourable situation must not be allowed to go on forever, and as such the need to localise these components is of undisputable urgency.

Utilisation of industrial by-products

Industrialisation will result in the production of tremendous amount of by-products. Waste from one industry can be input materials to the other. Here it is apparent that research in the utilisation of various industrial by-product may benefit the local foundrymen.

Import substitute and export

Industrialisation too will lead to continuous importation of parts and manufactured products into the country. This leads to tremendous loss of the country's valuable foreign exchange. The country's annual import of capital good and casting parts is estimated to be about M$3.1 billion. Therefore

identification and development of these imported products for manufacture by the local foundries can be of tremendous benefit. Assistance to overcome the technological problems coupled with the introduction of these products will help the local foundrymen to supply the local demand and may even be exported at a latter stage.

b) New Economic Policy (NEP)

Bumiputra participation

The NEP outlined by the Government calls for a substantial involvement of Bumiputra in the manufacturing sector. To date, the Bumiputra involvement in the foundry work has been limited to the brassware industry in the East Coast. This very minimal participation of the Bumiputra demands a concerted and major effort from the Government agencies to rectify the problem.

c) The Medium and Long Term Industrial Master Plan (IMP)

Heavy and sophisticated products

The ultimate goal of our industrialisation program is to achieve a state of independence as an industrialised nation. In this pursuit, foundry industry will be the backbone to support the various sectors as addressed by the IMP, particularly the Machinery and engineering industry.

In this context, the foundry industry is in need of an assistance for the development of capability to produce sophisticated and heavy components (such as machine-bed) as required by the machinery and engineering industry.

Utilisation of ferrous and non-ferrous metals

The IMP also stressed the important of both the ferrous and non-ferrous metal industry. This calls for a coordinated programme of research in order to exploit the potential usage of these metals in the foundry industry.

5.2 Needs Analysis

Table 1 summarises the present needs of the various identified target areas, while table 2 presents the analysis of the needs in order to identify our roles and to formulate the research strategies and programmes.

5.3 Operational Strategies

It can be deduced from the needs analysis, table 2, that the operational strategy to be undertaken in meeting the objective of the Unit is as follows :

5.3.1 Research Strategy

To address the research needs the FTU will identify the industrial by-products of our local industries (particularly that of the heavy industries) and the locally available materials (clay, sand, limestone, etc) that may be useful for the foundry processes. In-house research will be carried out to explore the potential use of these materials for our local foundrymen.

5.3.2 Development Strategy

Table 2 identifies TWO major developmental roles of the FTU, nemely :

i) To expand the market horizon of our local foundries.

ii) To develop technical capability to produce heavy and sophisticated castings.

To complement the first role, FTU will identify and develop four main areas of products :

a) Products needed for localization by the Government heavy industrial projects such as PROTON.

b) Cast products that are imported for the development of areas such as telecommunication, electrical supply, etc which needs for localization, i.e import substitution.

c) Products that may have immediate export potential such as light machineries (rubber and woodworking machineries).

SUMMARY OF THE NEEDS

TARGET AREAS	NEEDS
Local foundries	- market expansion - upgrading of technology - upgarding product quality - reducing cost of production
Heavy industry	- localizing heavy industries casting components - utilization of heavy industries by-product
Import substitute & export	- localization of imported casting products - exploration of export potential of casting product
New Economic Policy (NEP)	- increase Bumiputra participation in foundry industry
Industrial Master Plan (IMP)	- development of sophisticated and heavy components required by machinery and engineering sector - utilization of ferrous and non-ferrous materials

TABLE 1

ANALYSIS OF NEEDS

IDENTIFIED NEEDS	OPERATIONAL STEPS TO SATISFY NEEDS				ROLE
-market expansion	PRODUCT IDENTIFICATION	IN-HOUSE DEVELOPMENT	TRANSFER		DEVELOPMENT
-localization of heavy industries castings	PRODUCT IDENTIFICATION	IN-HOUSE DEVELOPMENT	TRANSFER		DEVELOPMENT
-localization of imported casting products	PRODUCT IDENTIFICATION	IN-HOUSE DEVELOPMENT	TRANSFER		DEVELOPMENT
-exploration of export potential of cast products	PRODUCT IDENTIFICATION	IN-HOUSE DEVELOPMENT	TRANSFER		DEVELOPMENT
-utilization of ferrous and non ferrous materials	PRODUCT IDENTIFICATION	IN-HOUSE DEVELOPMENT	TRANSFER		DEVELOPMENT
-technological upgrading	TECHNOLOGY IDENTIFICATION	TECHNOLOGY ABSORPTION	TECHNOLOGY ADAPTATION	TRANSFER	DEVELOPMENT
-sophisticated & heavy casting	HEAVY PRODUCT IDENTIFICATION	TECHNOLOGY DEVELOPMENT	PROTOTYPE DEVELOPMENT	TRANSFER	DEVELOPMENT
-production cost reduction	IDENTIFICATION OF PROBLEM AREAS	IN-HOUSE RESEARCH	TRANSFER		RESEARCH
-by-product utilization	IDENTIFICATION OF INDUSTRIAL BY-PRODUCT	IN-HOUSE RESEARCH	TRANSFER		RESEARCH
-product quality upgrading	FACILITIES IDENTIFICATION & COMPENSATION	KNOWLEDGE AND EXPERTISE DEVELOPMENT	CONSULTANCY ADVISORY TRAINING		SERVICES
-Bumiputra participation	PACKAGE DEVELOPMENT OF BUMIPUTRA THROUGH FORMULATED PROGRAMME	CONTINUOUS TECHNICAL CONSULTANCY, ADVISORY & TRAINING			SERVICES

TABLE 2

d) Those products needed by the general public, tourist industry etc. In general these products are made of non-ferrous metals. This may assist in encouraging the utilization of non-ferrous materials as called upon by the IMP.

The second role is to complement the proposal made by the IMP to develop the Machinery and Engineering Sector of our industry. Heavy and sophisticated quality castings will be required in order for this sector to develop. To produce such castings high technological capability and expertise is needed. In this respect FTU sees its major role as technology innivator in developing such capabilities. Developmental projects will be carried out to develop such capabilties through prosess of absorption and adaptation.

5.3.3 Service Strategy

Product quality up-grading - to meet this important need FTU will identify the common facilities already available in other institutions and to promate the usage of these facilities by the local foundrymen. Whatever facilities that are not available will be provided by FTU. Quality control programmes will be introduce to foundrymen through seminars, dialogs, consultancy and advisory.

Bumiputra participation - A carefully formulated package development programme will be conducted in order to introduce foundry business to Bumiputras. This will be followed by continuous technical consultancy and advisory support in order to sustain their participations in this industry.

Information dissemination - Seminars, dialogs, workshops will be conducted periodically in order to disseminate latest development and information to local foundrymen.

6 OPERATIONAL PROGRAMMES

Table 3 and 4 illustrate the tentative programmes of research, development and services to be undertaken by FTU. The programmes will be revised upon futher development of FTU and the needs of the foundry industry.

For the period of 1988 to 1989, prior to the establishment of the iron foundry, FTU will be involved in its R & D activity in the area of non-ferrous casting by investment

LONG TERM RESEARCH AND DEVELOPMENT PROGRAMME
FOR
FOUNDRY TECHNOLOGY UNIT IN SIRIM

Table 3

RESEARCH AREAS	RESEARCH OBJECTIVES	PROJECT AREAS	PROJECTS EXAMPLES	TIME FRAME										
				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
PRODUCTS DEVELOPMENT	TO CARRY OUT PRODUCTS DEVELOPMENT PROGRAMMES WITH THE OBJECTIVE OF EXPANDING THE MARKET HORIZON OF THE LOCAL FOUNDRY INDUSTRY THROUGH PRODUCT DIVERSIFICATION WHILE COMPLYING WITH THE NEEDS FOR LOCALIZATION AND IMPORT SUBSTITUTE	PRIMARY PRODUCTS	- Brake drum	X										
			- Motor casing and housing	X										
			- Automotive spare parts		X									
		SECONDARY PRODUCTS	- Pump, Motor, Generator casings			X								
			- Engine Block				X							
		TERTIARY PRODUCTS	- Lathe Bed					X						
			- Milling bed						X					
ADVANCED TECHNOLOGICAL DEVELOPMENT	TO PURSUE THE ADVANCED TECHNOLOGY SO AS TO ACQUIRE THE CAPABILITIES TO PRODUCE HEAVY AND SOPHISTICATED CASTINGS.	SOPHISTICATED AND PRECISION PRODUCTS	- Testing Machine bed and parts							X				
			- Precision Machine parts								X			
MATERIALS AND PROCESSES DEVELOPMENT	TO EXPLORE THE POSSIBILITY OF OF LOCAL MATERIALS AND THE INDUSTRIAL BY-PRODUCTS WITH THE VIEW OF UPGRADING INDEGENOUS TECHNOLOGY, IMPROVING PRODUCTS QUALITY AND REDUCING THE PRODUCTION COST OF THE LOCAL FOUNDRIES.	PATTERN	- Local wood	X										
			- Metallic pattern (eg. tin and lead)		X									
			- Resin and ceramic materials			X								
		MOULDING	- Local sand	X										
			- Local Binders (eg. clay)		X									
		MELTING	- Materials for melting (eg. ductile iron Ni-Hard iron)	X										
			- Furnace Insulating Materials		X									
			- Furnaces dev. (eg. gas and liquid fuel fired, electical)	X										
			- Induction Melting						X					
POLICY RESEARCH	TO EVALUATE THE CURRENT STATUS OF THE NEEDS AND TECHNOLOGICAL LEVEL OF THE FOUNDRY INDUSTRY AND TO POSTULATE RECOMMENDATION FOR ACTION BY THE RELEVENT AUTHORITIES	TECHNOLOGICAL STATUS	- survey	X			X			X			X	
		POLICIES IMPLICATIONS	- survey		X			X			X			X
		NEEDS REVIEW	- survey			X			X			X		

TABLE 4

LONG TERM SERVICES PROGRAMME
FOR
FOUNDRY TECHNOLOGY UNIT IN SIRIM

SERVICE AREAS	SERVICE OBJECTIVES	PROJECT AREAS	EXAMPLES	TIME FRAME										
				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CONSULTANCY AND ADVISORY	ON SPOT CONSULTANCY AND ADVISORY BY FACTORY VISITS	-SOLVING TECHNICAL PROBLEMS	- MOULDING	X										
			- MELTING	X										
			- PATTERN MAKING	X										
			- ETC	X										
		-REVIEW PROCESS LINE			X									
QUALITY ASSESSMENT	TO IMPROVE PRODUCTS QUALITY	-IDENTIFY SOURCE OF PROBLEMS ON SITE	- MOULD DESIGN	X										
			- PATTERN MAKING	X										
			- MOULDING TECHNIQUE	X										
			- ETC		X									
		-MATERIALS ANALYSIS ADVISORY AND TEST.	- CAST IRON	X										
			- DUCTILE IRON		X									
			- STEELS			X								
INFORMATION DISSEMINATION	TO EDUCATE LOCAL FOUNDRYMEN IN VARIOUS /LATEST FOUNDRY TECHNOLOGY	-PROCESS AND TECHNIQUES	- DESIGN AND MOULDING	X										
			- PATTERN MAKING		X									
			- MELTING											
			- FINISHING			X								
			(Seminars etc)											
		-QUALITY CONTROL SYSTEM	- All above mentioned areas	X										
			(Seminars etc)		X									
BUMIPUTRA PARTICIPATION	TO ENCOURAGE BUMIPUTRA PARTICIPATION IN FOUNDRY INDUSTRY	-SKILL AND ENTREPRENEUR DEVELOPMENT	- SEMINARS	X										
			- WORKSHOPS	X										
			- JOINT COOPERATION WITH OTHER GOVERNMENT AGENCIES		X									
			- PACKAGE PROGRAMME			X								

casting process. Through this exercise it is hopeful that FTU will soon be capabale of tranferring some basic investment casting techniques to the local foundry industry.

7 CONCLUSION

FTU is currently in is developmental stage which is expected to be partially operational by 1990 and fully operational by 1993. With the establishment of this Unit SIRIM will move one more step ahead in its endevour to support the development of the country's manufacturing sector.

REFERENCES

1 Engineering Survey - Part I The Malaysian Foundry Industry.
- Joint Survey by :
- Bank Kemajuan Perusahaan Malaysia Bhd.
- SIRIM
- NPC
May 1986

6－3　研修員受入れ計画（案）

研修計画(89,5,22～89,8,12)

1．基礎・・・研修生(4人)一緒に研修し、基礎知識，基礎技能を習得する。
但し、設計の研修生(1名)は、項目1,4,5の座学のみ研修を行う

項目	座学			実習		
	役職	担当者	時間	役職	担当者	時間
＊1．模型	主任	大平章永	15	班長	岡田英雄	6
2．溶解	課長	吉田敏樹	# 15	専任	渋谷正広	6
3．調砂	主任	深井伸之	# 6	類顕	梶原繁喜	3
＊4．中子	主任	深井伸之	# 3	主任	天野勝	3
＊5．造型	主任	深井伸之	# 6	類顕	風戸孝雄	3
6．鋳仕上	主任	野沢悦男	6	組長	野村直之	3
7．検査	類顕	稲永孝	9	主任	平井博明	6
計	(EL 30, L 30)		60			30

(EL #印 :英語での座学，L:主として日本語での座学)

2．実践・・・専門分野毎に分かれて、製造理論,製造技能を習得する。

分野	内容	座学時間	実習時間
模型製作 (P)	・模型製作 ・湯口方案 ・木工機械及び工具の使用法	42	192
造型 (素研) (P)	・鋳型造型（CO_2，フラン、生型） ・砂処理 ・中子製作 ・砂試験	# 42	192
溶解 (素研) (P)	・高周波誘導炉による溶解作業 ・成分分析、炉前試験 ・築炉技術	# 42	192
設計 (P)	・鋳物設計 [(L)藤井義正,(P)石垣忠夫] ・模型方案 [(L)大沢伸行,(P)石川和義]	# 12 # 12	129 129
	合計 (EL;108,L;30)	150	834

テキスト：日刊工業新聞社「鋳造の現場技術」（日本語版、インドネシア語版あり）
又は、各講師の作成資料による。

4．工場、研究所の紹介、及びまとめ # 12 H

3．見学・・・鋳物試験所、生産工場、鋳機メーカーなどを見学して知識を広める。

1．埼玉鋳物試験所　2．名古屋工業試験所　3．三重鋳物試験所
4．石川島鋳造　5．日立金属桑名工場　6．㈱日本可鍛鋳鉄所
7．スキタ鉄工所　8．日立金属九州工場

以上

[(EL);30+108+12=150 H　(L);30+42=72 H　(P);30+834=864 H]

研 修 日 程 計 画

(L) 座学
(P) 実習
(O) 見学

模型製作：YUSOFF　　溶解：ZAIN
造型　　：FAIZ　　設計：ROSLI