

Table IV-1-22 Evaluation of Production Technology

Questionnaire		MTB	MTK	MTP	MTH	MTA	Praga
(1) Production Control	a. Computer Utilization	0	0	0	0	0	0
	b. Lead Time	40	45	45	45	45	45
(2) Quality Control	a. TQC	5	10	10	10	10	5
	b. Inspection and Measuring Instruments	95	100	100	95	95	95
	c. Accuracy Control	95	100	100	95	95	95
(3) Maintenance Control	a. Maintenance	60	95	100	95	90	90
	b. L.O. Control	70	95	100	90	85	80
(4) Working Environment	a. 4S Activity	40	100	95	70	70	60
	b. Machine Cleaning	40	100	100	80	75	70
	c. Component inventory control status	40	100	100	80	75	70
	d. Safety precaution, uniform	0	0	0	0	0	0
(5) Storage Control	a. Automatic Storage System	0	0	0	0	0	0
	b. Inventory Months	30	30	30	30	30	30
	c. Space	50	50	50	50	50	50
	d. Finished Products Storage	50	50	50	50	50	50
(6) Production Technology	a. CNC Machine	5	5	5	5	5	5
	b. Automation Functions (Accessory Equipment)	0	5	10	0	0	10
	c. FMC & FMS	0	0	0	0	0	0
	d. Clean Shop	0	0	0	0	0	30
(7) Design Dept.	a. CAM, CAD	0	0	0	90	0	0
	b. Drawing Control	0	0	0	0	0	0

Note: For Praga Tools, it should be considered that the score is the result of overall evaluation of two factories, the level of production technology of which are quite different.

## D. Input Factor Analysis

### 1. General Purpose Machines

Input factor analysis of general purpose machines are conducted for 8 models manufactured at MTB.

Cost structure of these 8 models are shown in Table IV-1-23. Their specifications of them are as follows.

#### B32 2M Gap Bed: Supercut lathe

Center Height	320 mm
Center Distance	2,000 mm
with Gap Bed	

#### L45 3M: Heavy Duty Lathe

Center Height	450 mm
Center Distance	3,000 mm

#### RM: Radial Drill

Drilling Capacity	50 mm in Steel
	60 mm in Cast Iron

#### Drilling Radius

(RM 61)	1,190 mm
(RM 62)	1,500 mm
(RM 63)	1,790 mm
(RM 65)	2,350 mm

#### SEW-II: Hydraulic Surface Grinder

Table Surface	250 x 1,000 mm
Max. Height of Job	400 mm

#### GH-H400: Gear Hobber

Max. Dia. of Job	400 mm
Max. Travel of Job	400 mm

### (a) Material and Conversion Cost

According to Table IV-1-24, the conversion cost is equal to or more than the material cost, in particular, 1.5 times for the lathe and 1.9 times for the grinding machine.

This indicates that RMT products are still labor-intensive.

Table IV-1-23 Cost Structure of GPMs (1991-92) (Est.)

SI N.	Particulars	B32 2M Gap Bed	L45 3 Mtr	RM 61	RM 62	RM 63	RM 65	SFW-11	GH-H400
1	MATERIAL COST								
	Steels	84450	97618	25425	20659	20767	25088	28849	77060
	Castings	78999	180353	71790	83323	89933	124421	166303	206544
	Bought-Indigenous Bought-Imported	95471 25534	83290 131364	21802 22348	21794 22348	21663 22348	27707 17827	37518 40438	200434 274842
	Total	284454	492625	141365	148124	154711	195043	273108	758880
2	CONVERSION COST								
	Manufacture Cost	316824	541150	131081	132594	134081	151706	401292	476998
	Assembly Cost	105743	172452	40543	40683	40768	41952	118252	265261
	Total	422567	713602	171624	173277	174849	193658	519544	742259
3	Spl tool/Pattern Cost	4220	4662	488	488	488	488	2878	5189
4	DIRECT COST (1+2+3)	711241	1210889	313477	321889	330048	389189	795530	1506328
5	OVERHEADS								
	Materials	19912	34484	9896	10369	10830	13653	19118	53122
	Administration	70702	120623	81299	32140	32956	38870	79265	150114
	Total	90614	155107	41195	42509	43786	52523	98383	203236
6	COST OF PRODUCTION	801855	1285004	354672	364399	373835	441711	893912	1709563
7	SALES COMMISSION	50472	81462	16368	17208	21168	26550	44142	103020
8	SELLING PRICE Rs.L	9.00	13.62	3.18	3.32	3.99	4.93	7.38	16.04

(b) Manufacturing Cost and Assembly Cost

Table IV-1-24 indicates the ratio of the manufacturing cost to the assembly cost. For most models, the manufacturing cost exceeds by 3 times or more the assembly cost.

This is quite high compared with the world standard and shows that machining operations are extremely inefficient at MTB.

(c) Use of Imported Parts and Components

Table IV-1-25 shows the ratio of the cost of boughtout-imported and that of boughtout-indigenous and the ratio of boughtout-imported to material cost.

Imported boughtouts occupy about 10-15 % and, in some cases, about 30% of material cost.

Major imported parts and components are critical parts including main bearings. They seem to be imported because domestic parts and components do not satisfy the required accuracy and performance.

(d) Special Tools/Patterns

The costs of jigs & fixtures, tooling, cutters and patterns consist of only 0.3 - 1.3% of the manufacturing cost.

It is necessary to reduce manufacturing cost by about 10% and at the same time it is necessary to increase cost of special tools and patterns five-fold by investing in this area.

(e) Overheads

About 10% of the direct cost is designated as the overhead-administration cost, which includes the maintenance cost for schools and hospitals.

Table IV-1-24 Ratio of Conversion Cost to Material Cost and Ratio of Manufacturing Cost to Assembly Cost

Particulars	(a) Conversion Cost/Material Cost (%)	(b) Manufac. Cost/Assembly Cost (%)
B32 2M	149	300
L45 3M	145	313
RM 61	121	323
RM 62	116	325
RM 63	113	328
RM 65	99	362
FW-11	190	392
GH-H400	98	180

Table IV-1-25 Ratio of Imported Boughtout to Indigenous Boughtout and Ratio of Imported Boughtout to Total Material Cost

Particulars	Imported/Indigenous (%)	Imported/Material Cost (%)
B32 2M	26	9
L45 3M	157	27
RM 61	103	15
RM 62	103	15
RM 63	103	14
RM 65	64	9
SFW-11	108	15
GH-H400	137	36

Social overheads seem to be too high in HMT units considering the size of production. From the viewpoint of cost reduction, the necessity of re-examining these social overheads is pointed out.

## 2. CNC Machines

Table IV-1-26 shows the cost estimation of the MTK CNC Lathes (1991-92).

According to the table, the boughtout cost is 13.7 times the raw material cost for the STC-15 and 11 times for the STC-25 and this represents 69% of total production cost and 66% of total production cost respectively.

The large part of boughtout cost is for the CNC components including ball screws.

Increased manufacture of CNC components for use within the company is required.

Table IV-1-26 Cost Estimate of CNC Lathes of MTK (1991-92)

Unit: Rs.

Cost Structure	STC 15	STC 25
Raw Material cost	91,547	1,53,183
Boughtouts	12,57,419	16,88,518
Manpower cost	49,594	81,116
Subcontracted work cost	13,850	27,800
Special cost	15,000	10,000
Technical overhead	1,07,812	1,76,338
Other conversion costs	58,218	95,223
Material overhead	53,959	73,668
Admn. overhead	1,81,214	2,53,643
Total cost of production	18,28,613	25,59,489
Selling expenses at units	49,422	69,175
Financing charges on cash credit	1,48,266	2,07,526
Sales commission	93,800	1,31,880
Cost of packing and forwarding	11,880	28,600
Cost of sales	21,31,981	29,96,670

E. Identification of Prospective Product Groups and Product Mix

1. CNC Ratio of the Products

The CNC ratio (the ratio of CNC machine sales to the total sales of the machine tools by value) of major countries are as follows,

Table IV-1-27 CNC Ratios of Major Countries

Country	CNC Ratio
Japan (1990)	
Japan Machine Tool Manufacturers Ass.	83 %
MITI Statistics (including outsiders)	76
Korea (1988 Statistics)	34.9 %
France (1988)	77.8
UK (1990, Jan-Jun)	53.7
Germany (1988)	63.2
USA (1989)	42.3

On the other hand, the CNC ratio of HMT is as follows:

Table IV-1-28 CNC Ratio of HMT

Year	CNC Ratio
1990 - 91 (Actual)	%
1991 - 92 (Projected)	%
	(including JWA-FMS)

Considering the above data, it is proposed that the target of CNC ratio of HMT for 1996/97 be set at 60-80%.



2. Product Rationalization Plan for the Elimination and Integration of Products and for the Transition to CNC

The basic concept of the product rationalization plan are as follows:

- (1) To review the prospects of all the products including GPM, SPM and CNC and decide the direction of product integration.

Based on the data of production and profit by model during the last 3 years, promising products and non-promising products are to be identified.

- (2) To cut down the variety of GPMs and to promote the R&D of CNC machines.

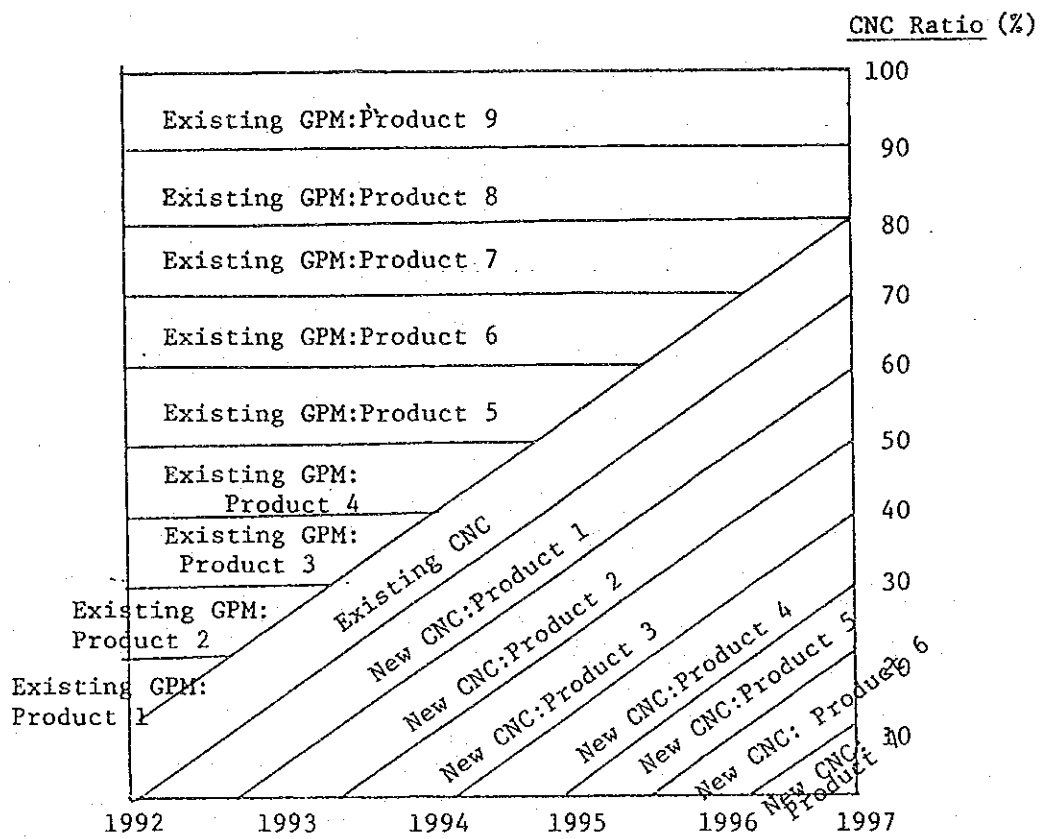
Small volume and unprofitable products should be eliminated.

Technological collaboration with foreign manufacturers in the field of CNC is recommended. R&D should be given priority because the technological lag in CNC designing, leads to an immediate loss of market.

Fig. IV-1-8 shows the schematic concept for the CNC development. In the figure, G-1 to G-9 denote existing GPM models. CNC-1 to CNC-7 denote CNC models to be newly developed. According to this concept, the following restructuring of product mix is suggested.

- (1) GPM G-1 group will phase-out in 1992 - 93.  
GPM G-4 group will phase-out in 1994 - 95.  
Only G-8 & G-9 groups will remain in 1997.
- (2) CNC-1 will be developed in 1992 - 93.  
CNC-4 will be developed in 1994 - 95.

Fig. IV-1-8 Concept of the Development of CNC Ratio



- (3) Accordingly, CNC Ratio will be 20% in 1992 - 93.  
CNC Ratio will be 50% in 1994 - 95.

### 3. Models to Be Developed

Considering technological resources in HMT, the following products are recommended to be developed.

- (1) CNC Lathe
- (2) CNC Machining Center
- (3) CNC Milling Machine
- (4) CNC Plano-Milling Machine with Table Change
- (5) CNC Cylindrical Grinding Machine

### 4. GPMs Which Will Remain in 1997

GPMs which will remain in the last year of schematic plan are as follows.

- (1) High Speed Precision Lathe, NH-series (MTK)
- (2) Milling Machine, FN-series (MTP)
- (3) Radial Drill, RM-series (MTB)
- (4) Grinding Machine (MTA)
- (5) Heavy Duty Machine (MTH) (to be transferred from MTB)

The results of evaluation of HMT machine tools, which provide a basis for the identification of future product-mix, are shown in Table IV-1-29.

Table IV-1-29 Product Evaluation of HMT Machine Tools

Unit	Type	Economic Scale		Technical				Cost of Production		
		Domestic	Export	Spec.	Features	Level	Material	Processing	Others	
MTB	L22TP	C	D	B	C	B	C	D	C	
MTB	B32	D	D	B	B	B	C	D	C	
MTB	L45	D	D	B	C	C	C	D	C	
MTB	RM63	A	B	B	C	B	C	B	C	
MTB	G17/1200U	C	D	B	C	B	C	C	C	
MTB	M250	E	E	B	C	B	C	D	C	
MTP	FN1H	A FN1 series	B	B	B	B	C	B	C	
MTP	FN2VE	A	B	B	B	B	C	B	C	
MTP	EM3H	E	E	B	B	B	C	C	C	
MTP	RW5	E	E	B	C	C	C	C	C	
MTK	NH22	A	B	B	B	B	C	B	C	
MTK	NH26	A	B	B	B	B	C	B	C	
MTK	NL22	E	E	B	C	B	C	B	C	
MTK	NL26	E	E	B	C	B	C	C	C	
MTK	S-Pilote	E	E	B	C	B	C	C	C	
MTH	AZ9	D	E	B	C	B	C	C	C	
MTH	AZ11	E	E	B	C	B	C	C	C	
MTH	UAT130	D	E	B	C	B	C	D	C	
MTH	UAT160	D	E	B	C	C	C	C	C	
MTA	GTC28	A	B	B	C	C	C	B	C	
MTA	K130/500P	A K130 series	B	B	B	B	C	B	C	
MTA	GIF80/125	E	E	B	B	B	C	C	C	
MTA	GCL60	D	D	B	C	C	C	C	C	

A: Very good B: Good C: Fair D: Bad E: Very bad

## 5. Product Line by Unit

Preferable Product lines by unit are as follows.

- (1) MTB: Large Machining Centers, FMS, FMC, GPM
- (2) MTP: Machining Center, CNC Milling Machine, (GPM)
- (3) MTK: CNC Turning Lathe, (GPM)
- (4) MTH: CNC Plano-milling Machine, SPM, GPM
- (5) MTA: CNC Grinding Machine, GPM

MTP and MTK should be specialized in CNC machine tools only. The existing GPM FN-series and NH-series should be diverted to other units. They are indicate as (GPM) in the above list because the units which will undertake the production of these series can not be identified at this point.

## F. Direction of Marketing Strategy

### 1. Basic Strategy

As a leading machine tool supplier in India, HMT should pursue the marketing strategy to maintain the market leadership in all aspects such as market coverage, product competitiveness, service network, etc.

In the basic strategy, the following two points should be kept in mind.

#### (1) Increase in demand for CNC machines

Although it is anticipated that the future user-sector distribution will remain almost unchanged as in the past, there may be stronger demands for CNC machines in the industrial machinery, industrial intermediates and other general industries including electrical and electronics, as the Indian economy is upgraded.

#### (2) Increasing importance of small-scale users

Sales activities are going to be geared to meet the demands from small-scale firms because these firms have started considering the joint purchase of expensive CNC machines in order to improve their own productivity.

Over dependence on the large-scale business, such as "projects" or the public sector's big investments, the new purchasing behavior of the small scale firms may be overlooked.

## 2. Strategy for GPMs

Recommended strategy for general purpose machines (GPMs) consists of the following.

- (1) Cost reduction must be the first priority. Being technologically saturated, price is the most important factor for the buyer.
- (2) Quicker and more firm delivery has to be assured.
- (3) Those with higher value added higher profit have to be selected and given priority for sales activities.
- (4) At negotiations, price flexibility must be allowed to sales personnel.
- (5) Authorized dealers may be considered for more economical sales activities.

## 3. Strategy for CNC machines

Recommended strategy for CNC machines are as follows.

- (1) For strategic products like the CNC machines, it is most important to capture as high a market share as possible.
- (2) Sales personnel are to be encouraged to contact the prospective buyers as frequently as possible in order to obtain full vision of users' thoughts and to actively compete with other manufacturers.

(3) Flexible pricing is necessary when encountering fierce competition.

(4) Quicker and more firm deliveries have to be attained.



## G. Necessary Measures Concerning Cost Reduction

### 1. Strategic Actions Necessary for Cost Reduction

There are three urgent issues concerning cost reduction which HMT should tackle immediately as follows.

- (1) To minimize work in process inventory
- (2) To maximize inventory turnover
- (3) To minimize manufacturing costs

The background for the above HMT problems are:

#### (1) Extremely superannuated facilities

The layout of the machine shop consists of an enormous amount of the conventional GPMs, which results in lower efficiency. This makes it difficult to grasp the instantaneous flow of materials and complicates the transporting of components in the shop.

#### (2) Lack of consistent policy for parts management

The integral tactics to program the component production is lacking. There is no distinct principle for the subcontracting of production.

Components are staying too long in the working area. It seems unclear as to who should and how to control the overall flow of production.

#### (3) Too many stagnant materials (materials which remain on the shelves) at all levels

This is particularly serious at warehouses for intermediates and finished products although material warehouses also exhibit this tendency.

At the same time, assembly work cannot stay on schedule due to the non-availability of necessary components.

These are the problems which major enterprises in not only advanced countries but also such Asian countries as Korea, Taiwan and Singapore have been trying to solve with the continuous company-wide efforts.

Even HMT's major competitors in India, such as Mysore Kirlosker and TELCO, have noticed the importance of production efficiency and they have already started to improve their cost performance.

Upon the opening-up of the Indian market in the near future, the HMT's market share in India might be easily eroded up by incoming foreign products without drastic efforts for the improvement of cost performance. HMT might lose cost competitiveness against domestic competitors who are making efforts at cost reduction.

It is proposed that against the above three issues, the following two actions should be implemented immediately.

(1) To establish tight production systems

A production control system in which the flow of parts and components can be monitored at any time and the production progresses with the concept of "Just-In-Time", is required. An organization which will manage this production control system should be established.

The production control organization should operate with the philosophy that any matter is to be examined and checked from the viewpoint of "4Ws and 1H" ( who, what, when, where and how). After the establishment of the production control system and the organization for this system, the computerisation of production control system should be promoted as the next step.

- (2) To make investments for modernization and renovation

Conventional GPMs should be gradually replaced by CNC machines. The production system should be transformed from the divided stage control system to the integrated stage control system.

Also, with the introduction of FMC and FMS, labor-saving operations should be promoted.

These systems enable the production to be changed from the conventional batch system to flexible manufacturing system, which will contribute greatly to the reduction of inventory.

Investments should be aimed at not only the man-hour saving but also the restructuring of the factory as a whole with the purpose of improving the total cost performance.

## 2. Operational Measures Necessary for Cost Reduction

### (a) Activities for the Improvement of Cost Performance

Cost performance is one of the important factors in enterprise management for any company, including HMT. Cost performance should be achieved with endless effort in the daily activity by all personnel concerned.

The following principles should be carried out for the improvement of cost performance.

#### (1) Reduction of defects

According to the officially listed data, the defect ratios seem to be unrealistically low. However, there must be many latent defects such as defects due to materials, defects at processing, defects at transportation, defects at assembly, and loss.

Scheduled actions for the reduction of defects should be carried out with targets given monthly, semi-yearly and yearly.

#### (2) Elimination of the unnecessary

Cost of the unnecessary is difficult to identify but it seems to be considerably huge in HMT.

A campaign for the elimination of the unnecessary (machines, methods, material) should be organized which encompasses all of HMT's activities. This should cover auxiliary materials, tools, L.O. and also stationary items.

(3) Review of the administrative overhead

The cost for administrative staff should be constantly reviewed and efforts should be made to reduce it. The optimum size and efficient management systems for administrative offices should be examined.

The size of welfare facilities such as hospitals and schools seems large considering the size of company. The optimum size and services should be reviewed.

(b) VE activity

The technologies of GPMs have matured and the performance of existing GPMs have reached the top level. Therefore, for GPMs, there is quite small room to add the improvement in terms of designing.

Under these circumstances, the VE (Value Engineering) method should be applied company-wide because it will contribute largely to cost reduction.

## H. Necessary Measures Concerning R&D

The current trend in machine tool production is definitely in CNC machines. Technologies in CNC machines have progressed for the actualization of systematized production and FA and have arrived in FMC and FMS configurations. At the same time, the relevant accessory equipment has also been developed.

The progress of production systems still continues with the construction of Computer Integrated Manufacturing (CIM), which is being introduced by leading machine tool manufacturers. As the information/communication system for CIM, Local Area Network (LAN) and Manufacturing Automatic Protocol (MAP) have been proposed.

The Indian machine tool industry has to follow this world trend but it is far behind in the top level of CNC technology. R&D activities should be propagated to catch up soon to the advanced technology.

HMT should therefore direct its efforts to the following two areas of R&D activities.

### (1) R&D for basic CNC control technology

The technological development in CNC control is rapidly progressing. Unless the latest CNC controller is offered, a CNC machine tool will be left behind the market trend.

HMT has two problems concerning the development of CNC controller. Under the current collaboration with Siemens, HMT always advances one step behind the latest technologies. At the same time, the in-house R&D capabilities in HMT are insufficient for HMT to develop these technologies by itself.

HMT should strengthen the collaboration with the licensor, Siemens, to acquire much higher technical assistance. By involving Siemens into the joint development, HMT should acquire the up-to-date CNC controller, of the same level as the licensor's technology in its products.

(2) Design development of CNC machine tools

HMT should review the current CNC machine lines in all the units and implement the integrated program of design development of CNC machines.

The program will consist of the following steps.

Step 1

To develop basic designs of CNC lathe and machining center and to establish new HMT product lines.

Step2

To consolidate the ideas of FMC and FMS, to develop the simulation designs, and to develop essential accessory equipment as follows.

- Cutting monitoring device
- Auto-detection device of tool breakout
- Auto gauging and compensation device
- Tool life calculation-Cumulative device
- Robots
- Auto loading and unloading system
- Auto chip removal

Step 3

To develop the Flexible Transfer Line (FTL) simulation design and to develop the modular machine and the head indexer.

Step 4

To prepare for the development of the Computer Integrated Manufacturing (CIM) with a host computer.



## IV-2. DIE-CASTING MACHINES AND PLASTIC MOULDING MACHINES

### A. Market and Competition Analysis

#### A-1. Die-Casting Machines

##### 1. Market Situation

Aluminum consumption in India has recently reached to about 400,000 tons per year. Approximately 100,000 tons are presently used for die-casting processes and 40 - 50 % is consumed by 2- or 3-wheel automobile manufacturers.

Japanese 2-wheel manufacturers such as Honda, Suzuki and Yamaha decided to establish their manufacturing plants around 1981/82 and consequently the die-casting machine market remained strong until 1986/87, hitting its peak in 1984/85.

Table IV-2-1 HMT's Turnover and Number of Die-Casting Machines Delivered

Unit: Turnover Million Rupees  
Quantity-set of machine

Year	81/2	82/3	83/4	84/5	85/6	86/7	87/8	88/9	89/90	90/1
Turnover	15.3	25.2	43.9	79.7	47.4	71.5	52.9	57.7	34.5	35.3
Quantity	16	18	34	61	39	38	27	26	20	12

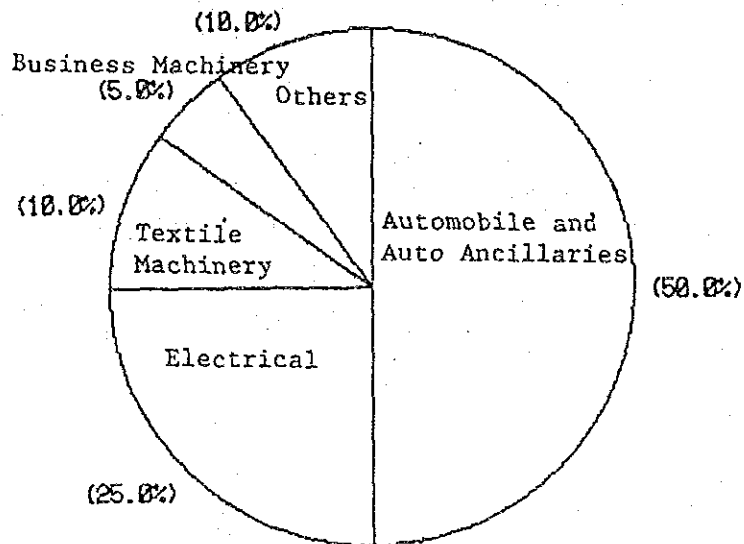
Although demand from the electrical industry has remained steady, demand from the automobile industry has stayed rather weak.

Due to the recent development of engineering plastics, demand for die-casting machines is not likely to pickup again until 2-wheel manufacturers or industry machinery manufacturers make another big investment.

## 2. Customer Analysis

Two-wheeler manufacturers, their sub-contractors and ancillaries are the main users, followed by the electrical appliance manufacturers.

Fig. IV-2-1 Customers of HMT Die-Casting Machines by Sector



In the last ten years, about 60 different companies placed orders for HMT Die-casting machines and one third of the orders were repeat orders.

## 3. Competitor Analysis

HMT holds a 90-95% share of the die-casting machine market in India but has some competition in the area of lower tonnage machines of 60T & 120T.

There are three competitors, namely DYNACAST, PTC (Delhi) and PTC (West Bengal). Among them, DYNACAST is the strongest but has only a limited product range up to 120T. Their technology level is low, but lower pricing sometimes appeals to customers.

## A-2. Plastic Moulding Machines

### 1. Market analysis

Total plastic consumption in India is estimated to be around 750,000 tons in 1990-91, which will grow to 1.8 million tons in 1994-95, and then to 2.5 million tons by the year 2,000.

Demand for plastic processing machinery is also expected to increase quickly and reach 30 billion rupees in 1994-95.

Due to the recent devaluation of the Indian currency, the plastics industry may stagnate for some time. But taking into consideration the fast spreading use of engineering plastics, plastic processing machinery has a bright future.

### 2. Customer analysis

HMT has never seriously tried to enter into the domestic plastic injection moulding machine (PIM) market because Klockner & Windsor (India) Limited (KWL) has dominated the market since 1964.

Therefore, HMT has only a limited number of customers in the domestic market. For the last eight years, the USSR has been the biggest customer, purchasing about 250 sets of PIM from HMT.

Table IV-2-2 Sales of Plastic Injection Moulding Machines by HMT

	83/84	84/85	85/86	86/87	87/88	88/89	89/90	90/91
Domestic Market	4	3	4	9	8	7	3	6
Exports to the USSR	1	1	3	12	42	58	23	112

### 3. Competitor analysis

KWL holds a 75 - 80% share of the domestic market whereas HMT has only 2%. KWL's turnover in 1987/90 was 743 million rupees, compared with 2.8 million rupees for HMT.

KWL has always been a leader in the domestic manufacturing of plastic processing machinery such as PIM, extruder, blow moulding, thermoforming, rubber moulding, and CNC.

KWL is a subsidiary company of Klockner - Werke, and receives good technological support from the parent company.

Besides KWL there are ENGEL INDIA which is a subsidiary of ENGEL, Austria and SLM MANEKLAL which has a collaboration agreement with TOSHIBA, Japan for PIM.

As India goes into the development era for the plastics industry, various established companies are going to enter into the plastic processing machinery industry from next year on.

They are all reputed private companies and their collaborators also have high technology. In order to cope with the competition from KWL, they all plan to manufacture CNC plastic processing machines.

Under these circumstances, only HMT has no source of updated technology and has to try to face the fierce competition in the market with little experience to rely on.

Table IV-2-3 Technical Collaborations in the Plastic Processing Industry

Company	Collaboration
Larsen & Toubro	Mannesman Demag, Germany
Godrej & Boyce	Cincinatti Milakron, USA
Nuchem Plastics	Japan Steel Works, Japan
NTB	Sergher, Germany
Chem India	John Brown, USA

## B. Product Competitiveness Analysis

### B-1. Die-Casting Machines

HMT now dominates the market by holding a 95% share. The product range covers the six series of DC-60 to H-660D. HMT has overwhelming competitiveness in the domestic market.

Furthermore, HMT established a joint working arrangement in 1990 with Buhler Ltd. for engineering and manufacturing CNC-controlled B-series die-casting machines. HMT established the arrangement in order to implement automatization and manpower savings in the products. The arrangement will cover the range of seven series of H-160 to 2000.

### B-2. Plastic Moulding Machines

Klockner-Windsor now dominates the market by holding an 80% share. HMT's share is less than 2%, which prevents HMT's products from gaining competitiveness in all aspects.

Household articles occupy the majority of the plastic product market. Klockner dominates the machines in this field. HMT manufactures machines for industrial use.

The enrichment of the product line is an important subject of HMT's PIM business for competition with powerful competitors.

The present product range covers the four series of PI-130--R-400, and HMT also plans to manufacture the 25, 50, 80, and 1000 series.

In 1982, HMT collaborated with Reifenhauer for the production of extrusion machines for pipes, cable coating and pelletising plants, and so far only one machine has been delivered.

Now HMT plans to manufacture CNC-controlled PIMs, extrusion machines for plastic film, and blow moulding machines.

## C. Production Facility and Product Technology Assessment

### 1. Production Facility

In the beginning, the present plant was designed to have a capacity for manufacturing 30-35 machines a year, however recently 40-45 machines a year have been manufactured.

The production facilities were installed in or after 1975 and are still operable with no problems due to age. Because of the installation of large-sized machine tools, there is no particular problem in the machine shop. However, there is a problem of limited machining capacity.

Because of scheduled preventive maintenance not being carried out, maintenance of facilities is not sufficient, and thus frequent breakdowns of the facilities are one of the problems in the plant's operations.

Rough machining of large steel cast materials are contracted out to maintain the effective machining capacity of the plant.

### 2. Product Technology

#### i. Die-Casting Machines

The technology was introduced through a license agreement with Bühler Ltd. during 1970-71, and HMT started to manufacture the four standard series (H-160D, 250D, 400D, 660D). After that, HMT developed DC-60 and 120 using their own technology.

Furthermore, HMT established a joint working arrangement in 1990 with Buhler for engineering and manufacturing CNC-controlled B-series die-casting machines.

The number of engineers in the Engineering Department is now twelve including for PIM. This may not be sufficient for the job of issuing drawings for production, developing the designs of mechanical, electrical, in-

strumentation and CNC-systems, and for the job of basic engineering for proposals.

Because of the low quality of drawings and their insufficient follow-up, frequent revisions of the drawings have caused confusion in production.

#### ii. Plastic Moulding Machines

With the introduction of technology through a license agreement with Buhler Ltd. in 1970, HMT started to manufacture the five standard series (PI-100, 160, 250, 400, 630). After that, HMT modified PI-100, 160, 250, by their own technology to meet the domestic conditions.

In 1982 HMT collaborated with Reifenhäuser to manufacture extrusion machines.

There are now twelve design engineers, including for DCM. This is not sufficient for the independent engineering activities.

### 3. Production Technology

The capacity of the machining shop does not cover the manufacturing of all parts.

This is quite usual in this kind of machine production. The assembly and trial test should be carried out in the HMT shop. But the machining shop should be limited to the production of key parts only as essential elements to keep the quality of the products. The other parts should be manufactured outside of the plant. The present HMT plant is arranged in line with this concept.

However a consistent policy for purchasing may not have been established.

The non-existence of a consistent purchasing policy has given rise to the following problems.

- (1) The delay of materials and bought-outs delivery causes the disruption of total production control.
- (2) Materials of poor quality or out of specification are sometimes delivered. This causes confusion in the production process.

In addition, insufficient quality control management necessitates repairs or corrections after processing.



## D. Input Factor Analysis

### 1. Labor

The Manpower Committee's Report issued in 1988 shows a shortage of manpower of eight personnel since 1988 in this division.

The number of employees does not seem too much compared with other units in the present stage. Judging from the total of 225 personnel, some surplus will arise about after improving the attitude and productivity of the workers.

The discipline and diligence of the workers are now problems at the plant.

Twelve engineers in the Engineering Department do not seem to be sufficient. Engineers should be reinforced to achieve aggressive development of mechanisms, systems and sales activities.

### 2. Materials

Stabilized purchasing of materials is difficult.

Especially the price of imported materials is twice that in the country of origin, and furthermore, the delivery terms are long. Consequently, much of the inventory has to be kept in stock.

Indigenous cast steel materials are not obtained at a consistent quality level as specified.

## E. Identification of Prospective Product Groups and Product Mix

### E-1. Die-Casting Machines

HMT keeps the dominant position in the domestic market, enjoying overwhelming market share.

On the other hand, the market prospects for die-casting machines do not seem bright. Die-cast parts tend to be replaced gradually by plastic molded parts. The demand for die-casting machines is not expected to pick up unless big investments in the automobile industry and the like take place.

To maintain the present position in the market, it is necessary to introduce the CNC-controlled B series to the main product line with the acquisition of relevant technology.

### E-2. Plastic Moulding Machines

HMT holds only a small share in this market which is dominated by Klockner & Windsor. Major competitors are introducing CNC-type models onto the market.

In terms of technology and marketing capabilities, HMT has fallen far behind the competitors.

It is indispensable to place an equivalent CNC-type model on the market to survive the competition in the market. Considering HMT's R&D capabilities, technical collaboration with a foreign manufacturer is essential.

## F. Direction of Marketing Strategy

### F-1. Die-Casting Machines

The Basic course of action for marketing is as follows.

- (1) Since there are not many prospective users in this field, direct selling has to be continued. Direct contact with the users has proved to be effective in securing repeat orders.
- (2) More autonomous price determination by the sales division shall be allowed to win contracts in the lower tonnage areas.
- (3) Efforts should be made to make the price of lower tonnage machines competitive.

### F-2. Plastic Moulding Machines

The basic technology of HMT's PIM was transferred from Buhler Ltd. of Switzerland in 1970. To compete with competitors who are equipped with modern technology, the upgradation of technology is a must.

An active advertising campaign and sales promotion have to be considered.

Manpower in marketing has to be increased.

Machinery has to be made available on short notice and with reliable deliveries (Planned manufacturing).

Taking the present situation in the USSR into consideration HMT cannot rely too much on the export market. With the domestic market about to grow quickly, a serious trial entrance into it has to be made.

**G. Necessary Measures Concerning Cost Reduction**

For cost reduction, the following measures should be taken:

- (1) Training of workers for multi-applications aimed at manpower savings and high machine utilization;
- (2) Intensive management of purchasing, and quality control of materials and boughtouts;
- (3) Eradication of design errors.

## H. Necessary Measures Concerning R&D

### H-1. Die-Casting Machines

It is necessary to develop new models and relevant technology by grasping the needs in the market and the future trends through active contact with customers.

### H-2. Plastic Moulding Machines

As HMT is far behind Klockner & Windsor, it would be very difficult to get into the market.

With respect to this, HMT should make every effort to collaborate with an outside supplier of technology, otherwise entry into this market will probably be in vain.

Hence, aggressive sales activities in conjunction with the licensor is vital.

### IV-3. Press Machines

#### A. Market and Competition Analysis

##### 1. Market situation

HMT's inland turnover in recent years is as shown in Table IV-3-1.

Table IV-3-1 HMT's Turnover (Inland) of Press Machines  
Unit: Amount - Rs. Lakhs  
Quantity - Set

	1986/87	87/88	88/89	89/90
Amount	614.7	169.1	957.1	750.2
Quantity	31	7	28	13

In 1990 HMT produced press machines worth Rs. 17.8 crores, including the export portion. HMT's production share was 44.3%.

According to HMT's estimates, the future market will be as follows.

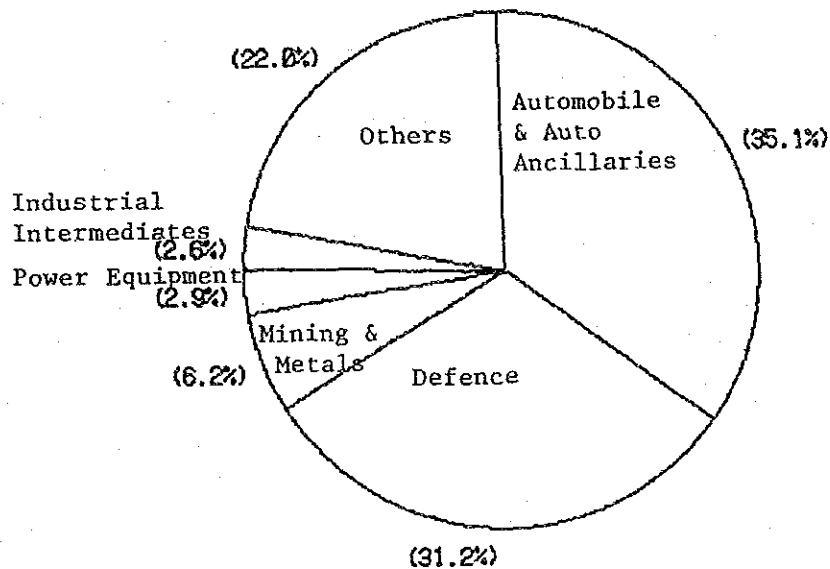
Table IV-3-2 Future Market for Press Machines in India  
Unit: Rs. Crores

	1991/92	95/96	99/2000
Market Size	39	62	100
HMT Sales	17	29	50
HMT Share (%)	42	46	50

## 2. Customer analysis

Sector-wise inland turnover of HMT press machines in the last 5 years is shown in Figure IV-3-1.

Fig. IV-3-1 HMT Customers by Sector



Orders from automobile manufacturers and automobile ancillaries were at a peak in 1985/86 and 1986/87 but there were no orders in 1989/90.

Defence demands were strong in 1988/89 and 1989/90 but are usually not steady.

In 1989/90 and 1990/91, there were considerable exports to Ethiopia and Bulgaria but again these cannot be considered to be steady.

### 3. Competition analysis

There are several competitors of smaller size who have the technology required by the present market. Some of them are as follows:

- M/s. Godrej & Boyce :  
Started manufacture of Metal Forming Equipment basically to meet their own needs. Beginning from reverse engineering of imported machines available with their own manufacturing division, they developed designs for a wider range. By virtue of their engineering background, they have emphasis on quality even though their design base is not strong. Although in the lower capacity range (up to 250 ton) their prices are lower, their prices are equally high as HMT's as evident from their quotation to OF, Medak. They have built and supplied maximum capacity units of 1,000 ton to M/s. Hindustan Ferode, Bombay.
  
- M/s. Ameteeep Machine Tools Limited :  
They began their press building activity with a Japanese collaboration (M/s. Yodogawa) which was augmented with their own internal strength. Presently they do not have a tie-up with any foreign manufacturers. By virtue of their lean organization they are able to offer prices 40% - 60% lower than HMT. They have been highly successful with a few customers such as ITI, Bajaj Auto, or government organizations. They do not enjoy a reputation for quality but have built up excellent relations with a few organizations such as Bajaj Auto, Kelvinator, or Escorts by virtue of their prompt service.
  
- M/s. Indian Sugar & General Engg. Co. is a relatively new entrant in the field of mechanical presses. They have been able to achieve success mainly by virtue of their tie-up with Howetta, Italy. They have supplied a 650 ton link drive mechanical double action press to M/s. Bajaj Auto and are also building a 260 ton hydraulic double action press for OF, Medak. This order was finalized in their favor on the basis of their low price even though there were technically superior offers from M/s. SPS, Kumimoto & HMT-Versor.



- M/s. Electro Pneumatics :

They have basically started with pneumatic system components. Subsequently they have entered the small press range (up to 100 ton capacity) for molding plastics. Encouraged by their success, they have built and supplied presses up to 1,200 ton capacity to M/s. Standard Motors, Madras. Other customers are RCF, Kapurthala (1,000 ton press) and Escorts Motorcycle and Scooter Division (630 ton press).

HMT's prices are said to be higher by 20-40% in the mechanical press category and by 40-60% in the hydraulic press category.

Consequently, there was no order book in the middle of 1991. Unless serious effort is made for technological upgradation and cost reduction, it will not be possible to obtain the future market share shown in Table IV-3-2.

#### B. Product Competitiveness Analysis

HMT products, as the leading brand in the domestic market, have a technological advantage against competitors although there is room for technological improvements.

HMT has little price competitiveness for non-standardized press machines. Those companies whose standard designs are more similar to the customer's specification requirements tend to have more cost advantage.

In terms of quality, on account of the assembly inspection, there is no problem for HMT products.

## C. Production Facilities and Product Technology Assessment

### 1. Production Facilities

The facilities required for a heavy machinery shop are installed, however the facilities are generally aged and of low productivity. The large facilities are now a bottle neck for production in the plant.

The steel fabrication shop occupies one area in the press factory. The welding shop is narrow due to heavy plates being stocked in the welding section. Welding work has not been mechanized.

Max. capacity of the E.O.T. Cranes is 50 Tons of which the hook height is 7.5m above the floor level. They are rather small and low for this kind of heavy machinery shop.

Three assembly pits are provided in the assembly shop, however the assembly area is not sufficiently wide for sub-assembly works.

### 2. Product engineering

The technology had been introduced through a license agreement with Verson Allsteel Press Co. (USA) during 1969-79 for engineering and manufacturing of various presses. After that, during 1982-89, HMT collaborated with Verson International (UK) for presses with a capacity below 500 tons.

Now, HMT has no effective technology collaboration with any leading overseas company. Thus HMT must cope with the various requirements of clients using their own technology.

Since they do not have a technology collaboration agreement with any foreign company, they are not able to meet all of the technology requirements of their clients.

The present HMT technology is limited to sheet metal forming. Thus, HMT cannot cover the market demands in a wide range of metal forming machinery.

Engineers have not been given sufficient chance to acquire the recent technology in the international market, so they have been behind in new technology.

HMT has developed partial mechanisms to meet the requirements of clients, though they are limited by their own technology. This has sometimes caused problems of revision in the course of production.

### 3. Production Technology

#### (a) Steel fabrication shop

Welding processes have not been mechanized/automated and quality is not good in general.

Large capacity annealing furnace has not been introduced so that large pieces have been sub-contracted outside for annealing, and thus costs become higher.

The steel fabrication shop in Hyderabad is split into two sections, one for machine tools and the other for the press division. Consistent management for improvement of productivity and quality has not been implemented.

#### (b) Machine shop, Assembly shop

The plant's facilities are almost sufficient to cover the current production.

However, the material handling capacity is limited by the max. capacity (50tons) of the crane. By this limitation, weight of sub-assembled units is limited, so that assembling productivity cannot be improved, and the assembling period cannot be shortened.

## D. Input Factor Analysis

### 1. Labour

There are many large machines in the heavy machinery shop, on which more than one worker must work.

In this respect, good team work by the workers is vital in the shop. Professional management is also vital in this area.

At present, HMT's common incentive system has been applied and it has resulted in poor productivity of workers due to lowered morale because all workers are equated, regardless of individual qualities.

Management systems designed to motivate workers to participate in the plant's operation have not been formulated.

### 2. Materials

Purchasing of heavy steel plates has been a most difficult issue.

Heavy steel plates above 60 mm thick must be imported and it takes about 10 months. Therefore, some surplus materials must be purchased to avoid a shortage of materials, and it has caused an increase in the amount of stock. In 1991, stocks of the heavy plates amount to one year's production.

The price of indigenous steel plates is approximately twice that in Japan, and the price of imports is approximately 3 times as high as that in Japan.

## E. Identification of Prospective Products Groups and Product Mix

Under the limited product range, it is difficult to identify prospective product among existing products.

It is advisable to diversify the product line so that HMT can respond to varied needs from various types of users.

The wide product line can lessen the influence of possible market fluctuation due to the narrow market in India.

The following products are pointed out as candidates for diversification.

- Bending rollers
- Beam/pipe benders
- Shearing machines
- Punch/braking presses
- Forging press
- U/O presses
- Straightening machines
- Auxiliary equipment for rolling mill plants like roller tables, pushers/pullers, various beds, transfer machines, etc.

In addition, to increasing the operational efficiency of the factory, the processing of large-sized parts from outside should also be examined.

The following areas can be considered as potential fabrication and machining jobs.

- Large steel structures
- Round products (for example, reactor vessels, heat exchanger, pressure vessels)
- Furnace shells
- Transfer cars and buggies
- General industrial machinery

Sub-contracting/joint working with other companies for large projects will be one of strategic activities to obtain the manufacturing jobs of large parts.

This opportunity would greatly be increased in the condition of HMT to be competitive manufacturing base for the international market under long term technology collaboration with overseas leading companies.

#### F. Direction of Marketing Strategy

HMT, at present, manufacture press machines of narrow range. Sales activities are passive.

First of all, it is necessary to diversify the product line through a long-term technological collaboration, followed by the efforts to exploit market potential and energetic sales promotion activities.

#### G. Necessary Measures Concerning Cost Reduction

The following measures should be taken for the reduction of Cost.

- (1) Improvement of facility utilization, NC-revamping
- (2) Improvement of labor productivity
- (3) Strengthening of procurement and quality controls
- (4) Eradication of design errors
- (5) Microfilm processing of drawing, provision of OA facilities

#### H. Necessary Measures Concerning R&D

Effective and long-term technology collaboration with overseas leading company is essential, through which products could be diversified, and new technology in the international market could be acquired.

In this respect, the reinforcement of engineering department is necessary to realize quick response to customers' and provide basic and proposal engineering to them.

A department for new machines and new technologies and a sales engineering department should be established as well as a department which will engage in designing for production.

## I. Concept of Factory Renovation

The high productive capacity of engineering fabricating, machining and assembling of products is necessary in order to manufacture presses competitive in terms of engineering level, price, quality and delivery time.

The following two points are proposed as the direction of factory renovation.

### (1) Integration and modernization of fabrication shop

The present fabrication shop of the press division should be integrated to the fabrication plant of the machine tool division.

The renovation of facilities and introduction of new facilities should be implemented aiming at high productivity and quality with low cost, and further aiming at diversification of fabricated products.

### (2) Reinforcement of machining/assembly shops

The reinforcement of machining/assembly shops is required. Because existing large machine tools are even now the bottleneck of the production and the present assembly shop area is not wide enough.

Existing machine tools should be revamped to convert to NC machines. New high efficient machine tools should be also introduced there. Small machine tools should be released to sub-contractors, thus, the machining shop will be reinforced.

In future steps, cranes should be updated with the reinforcement of building structures, and assembly shop should be expanded.

Along with the plant renovation, the technology collaboration with overseas leading companies and the reinforcement of engineering department should be promoted.

After the completion of plant renovation, to secure high operation ratio of high productive capacity of the plant will be an important issue. Diversification of products and sub-contract manufacture of heavy parts should be pursuit.

The renovation of the press factory should be examined carefully in order to keep good balance of engineering power and plant facilities.



#### IV-4. Printing Machinery

##### A. Market and Competition Analysis

##### A-1. Inland Market Analysis

##### 1. Market size and growth

The government aims a rapid improvement of literacy rate of Indian people. The literacy rate in 1981 was 36% and is estimated to be around 40% by the end of 7th Five Year Plan (March 1990). This increase in literacy rate brings the need for more reading and writing materials.

The overall industrial growth in India was an annual rate of 5.6% during the 6th Five Year Plan and was targeted to grow at the rate of 7% annually during the 7th Five Year Plan. Continuous growth of Indian industries has supported the steady increase of the printing industry and consequently, of the printing machine industry.

Table IV-4-1 Market Size of Printing Machinery  
Unit: Rs. Million

	1980/81	85/86	89/90
Domestic Production	84	150	320
Import	66	80	140
Total Demand	150	230	460
HMT Sales	13	50	91

Thus the total demand for printing machines has grown 3 times in the last decade and the indigenous production covered 70% of the total market in 1989/90 comparing with only 56% a decade ago.

During the next five years, advertisement expenditure is estimated to grow at 20-25% p.a., education expenditure at 12% and accordingly the demand for printing machines, especially offset printing machines, is expected to grow at around 10% p.a.

Table IV-4-2 Demand Projection of Printing Machinery in India  
Unit: Set of machine

	1991/92		1995/96		1999/2000	
	Market size	Growth rate	Market size	Growth rate	Market size	Growth rate
One-color offset						
Domestic	290	-	375	29.3%	470	25.3%
Export	-	-	20	-	70	250.0%
(S-total)	(290)	(-)	(395)	(36.2%)	(540)	(36.7%)
Two-color offset						
Domestic	100	-	150	50.0%	300	100.0%
Export	-	-	-	-	15	-
(S-total)	(100)	(-)	(150)	(50.0%)	(315)	(110.0%)
Four-color offset	40	-	70	75.0%	105	50.0%
Letterpress	50	-	50	-	50	-
TOTAL	480	-	665	38.5%	1,010	51.9%

(b) Customer analysis

The Indian printing industry comprises of an estimated 62,130 printers, of which 73% are in small scale, according to government statistics.

Table IV-4-3 Number of Printers by Scale

	1987	1991
Large	1,445	N.A.
Medium	18,665	N.A.
Small	52,620	N.A.
Total	72,730	95,300(estimate)

Note: N.A. denotes "Not Available."

Small scale printers mostly use letter press with an investment level of below Rs. 5 Lakhs.

Out of 1,445 large scale printers, 300 are government presses, railways, universities and public corporations.

Approximately half of the printing machines manufactured by HMT in 1990/91 were sold to the consumer industries. This tendency will not change largely. Customers in this sector tend to demand more and more accuracy and speed of printing. These demands require HMT to improve the performance of products and services. Requirement for after-sale service is also very high.

For the printing industry, HMT machines do not satisfy customers in printing speed as well.

Improvement in durability, price reduction and upgradation of services are also required by customers in all sectors.

(c) Competition analysis

i. HMT's share

In 1990/91, HMT sold 74 sets of one-color offset, 10 sets of two-color offset and 8 sets of letterpress, totalling the turnover of Rs. 91.2 million. HMT's market share was 19.8% in the total market and 28.5% in indigenous supply.

HMT aims to take the share of 34-35% in one-color machine field where there are more competitors, and more than 40% in two-color machine field.

In the next five years, demand for letterpress is going to be substituted by one-color offset. One-color offset will remain as the best-selling model in terms of the number of machines, although two-/four-color machine sales will rapidly increase. After the next five years, as the Indian economy advances, two-color offset will be the main product in the market. In order to realize the target of market share mentioned above, HMT has to introduce a new model of two-color offset as soon as possible and then a new four-color offset machine by 1995/96.

ii. Competitor analysis

Maschinenfabrik Polygraph (MPI) and Dominant Offset (DOPL) are the strongest competitors. Both of them have good foreign partners for technical collaboration, are equipped with more modern technology and provide wider range of products than HMT.

MPI has the widest product range including web-offset. To upgrade their products, they entered into technical collaboration with a Swedish Company and are now preparing to put new models of two-/four-color machines into the market soon.

MPI's printing machine business, achieving a turnover of Rs. 300 million with 1,200 employees, is about three times as big as HMT. Their main product range is the machine 25-inch wide, which HMT has not developed so far

Table IV-4-4 Projection of HMT Market Share  
Unit: set of machine

	1991/92		1995/96		1999/2000				
	Market size	HMT sale	HMT share	Market size	HMT sale	HMT share	Market size	HMT sale	HMT share
One-color offset	290	115	40%	395	141	34%	540	184	34%
Two-color offset	100	20	20%	150	62	41%	315	129	41%
Four-color offset	40	-	-	70	14	20%	105	43	41%
Letterpress	50	-	-	50	-	-	50	-	-
Total	480	135	28%	665	217	33%	1,010	356	35%

and is expected to grow fastest. Their prices are said to be cheaper by 25-30% than HMT.

DOPL also concentrates on the 25-inch wide machine market with one-/two-color offset machine being manufactured under the license of a Czech company. Regarding 4-color machine, DOPL imports from the Czech collaborator. DOPL has two advantages: This Czech collaborator is well known in India as more than 2,000 sets of their products have been installed in India; and DOPL uses imported components for about 50% of their machine, which makes users believe that their machines more reliable.

To compete with MPL and DOPL, HMT has to keep trying to improve the specifications of existing machines such as printing speed, durability and on reducing the manufacturing cost. At the same time, it is urgently required to develop an entirely new model of two-/four-color sheetfed offset machine of 25-inch width.

For this purpose, taking into account the present level of HMT's technology and the capacity for developing designs, HMT needs to seek technical collaboration with a leading manufacturer from industrially advanced countries.

#### A-2. International Market Analysis

In developed countries, the main product is 4-color machine with much faster speed about which Indian manufacturers are not conversant.

In the area of one-/two-color machines, Taiwan and China are exporting mainly to developing countries. Taiwan also exports web-offset machines. Their products are said to be about half the price of those from developed countries.

In India, MPI has been exporting web-offset units worth Rs. 10 crores each in last three consecutive years. HMT exported one set each of one-/two-color machines to Tanzania and USSR.

If HMT is able to improve the product quality such as printing speed, durability, affixation of optional components to main machine, etc., and succeed in reducing the manufacturing cost to the competitive level with East Asian countries, there will be a possibility of export of the existing one-/two-color machines to the Middle East, Africa and some European countries during the next five years.

## B. Product Competitiveness Analysis

### 1. Product Quality Competitiveness

The governmental protection policy unfortunately resulted in a technology lag and a lack of eagerness to catch up with the rapidly advancing world trend.

However, major competitors are introducing up-to-date technologies through technical collaborations with foreign manufacturers and are expected to place higher quality products on the domestic market in the near future.

To secure the HMT market against competitors and imported machine, HMT has to make continuous efforts to improve product quality.

The typical HMT printing machine - SOM 125 is compared with competing products in terms of product technology in Table IV-4-5.

According to the comparison, the following are observed as the areas requiring immediate improvements.

Mechanism	Remark
Feeder:	
Pre-piling system	To be developed as optional item.
Cross sheet detector	To be developed
Rapid pile board lift	Preferably to be prepared
Printing System:	
Coating of cylinder	Important on account of the Indian climate
Quick paper clamp	Important for the efficient operation
Plate registering	Vital for future multi-color products



Dampening:	
Reciprocation control	Preferably to be prepared
Form roller control	Preferably to be prepared
Delivery:	
Grippers coating	Coating of cylinder gripper is necessary
Blower	To be improved
Lubrication:	To develop outside gear system
Printing Speed:	To be improved

## 2. Price Competitiveness

The price of SOM 125 is compared with competing products in Table IV-4-6.

The price of HMT SOM 125 is higher by 11% than that of Polygraph P025. However, HMT SOM 125 maintains the competitiveness against P025 because P025 has trouble because it does not suit the quality of Indian paper.

Dominant 715 quoted almost the same price, but it has superior specifications when compared with HMT SOM 125. But it does not bring about a critical disadvantage to HMT on account of the lower quality of Indian paper and printers with low efficiency consciousness.

HMT SOM 125 has a strong cost competitiveness against imported Japan-made product due to the protective import tariff and devaluation of the Rupee.

Table IV-4-5 Product Technology Comparison with Competing Products

	Indian Manufacture				Foreign Manufacture	
	HMT SOM 125	Dominant 715	Polygraph		Japanese Standard- type Machine	German High-quality Machine
			P025	SOLNA TYPE		
[FEEDER]	X	O	O	X	X	O
1. PRE-PILING	O	O	O	O	O	O
2. PILE BOARD LIFT DURING RUN RAPID	O	O	O	O	O	O
3. NO SHEET DETECTOR	O	O	O	O	O	O
4. TWO SHEET DETECTOR	O	O	O	O	O	O
5. CROSS SHEET DETECTOR	X	O	O	O	O	O
6. REGISTRATION SIDE LAY TYPE	O	O	O	O	O	O
7. INFEED SYSTEM	O	O	O	O	O	O
[PRINTING SYSTEM]	X	O	X	X	X	O
1. COATING OF CYLINDER	X	O	O	O	O	O
2. QUICK PLATE CLAMP	X	O	O	O	O	O
3. PLATE REGISTERING	O	O	O	O	O	O
[DAMPENING]	X	O	X	X	X	O
1. RECIPROICATION CONTROL	X	O	O	O	O	O
2. FORM ROLLER CONTROL	X	O	O	O	O	O
[DELIVERY]	X	O	X	X	X	O
1. GRIPPERS COATING	O	O	O	O	O	O
2. SLOW DOWN SYSTEM	O	O	O	O	O	O
3. GRIPPER OPENING CAM ADJUSTABLE	O	O	O	O	O	O
4. BLOWER	X	O	O	O	O	O
[DRIVE & LUBRICATION]	O	O	O	O	O	O
1. MOTOR & SPEED CONTROL	O	O	O	O	O	O
2. LUBRICATION	O	O	O	O	O	O
[PRINTING SPEED] (RPM)	X 7,500	O 10,000	O 10,000	O 10,000	O 11,000	O 10,000

Note: O: Strong Δ: Medium X: Weak

Table IV-4-6 Product Price Comparison with Competing Products

	HMT SOM 125	DONIMANT 715	POLYGRAPH P025	Japanese Standard-type Machine
Price of Basic M/C	Rs. 680,000	Rs. 680,000	Rs. 610,000	¥8,610,000 **
Price of Optional Equipment	Rs. 530,000	N.A. *	N.A. *	
Total	Rs. 1,210,000	-	-	Rs. 1,435,000 (CIF, India)
Excise Tax (15%)	Rs. 181,500	-	-	-
Import Tariff (85%)	-	-	-	Rs. 1,219,750
Selling Price	Rs. 1,391,500	-	-	Rs. 2,654,750

Note: Rs.1 = ¥6.00

"N.A." denotes "Not Available"

\* The cost of optional equipment similar to that of HMT SOM 125 was not available.

\*\* Total Price was estimated based on the specifications of HMT SOM 125 basic M/C and optional equipment.

## C. Production Facility and Product Technology Assessment

### 1. Production Facility

#### (a) Environmental Factors

- (1) The climate of high temperature and high humidity causes trouble at the printing test and the coating process.
- (2) Geographically away from users, who are usually located in urban areas, reinforcement of service system and communication network is required.
- (3) Supporting industries have not developed around the factory.

#### (b) Factory Structure

- (1) Administration and design divisions are separated about 150 metres away from the factory.
- (2) The assembly area is very small.
- (3) Supporting facilities such as repair room, tool room, and oil tank, occupy the centre of the factory, which hampers the production efficiency.
- (4) There is room for improving efficient use of space.

#### (c) Production Facility

- (1) Although the production equipment is ageing, investments in production equipment have not been made since 1985.
- (2) The introduction of CNC machines and the development of automated production have not advanced compared to other factories in HMT.

- (3) The number of machines compared with the production volume is large due to the delay of the modernisation and rationalisation of machinery and equipment.

## 2. Product Technology

To establish product superiority over the competitor's products, additional features should be provided to the current specifications, such as the reversing mechanism.

Also the multi-color printing machines and the rotary printing machines should be developed as soon as possible to meet the challenge from the competitors.

In the sheet printing machines, two product lines should be developed in the future, one for the standard series for the domestic market and exportable to the neighboring developing countries, and the other, the higher grade series for the domestic market and for export to the advanced countries.

The medium-priced standard model should carry the following features.

- Reversing mechanism
- Numbering
- Slitter
- Thicker paper applications
- Sheet de-curler
- De-electrostatic device
- Application of international standard, especially for electric parts.

For higher-grade series, the following features should be developed.

- Coater and dryer
- Press roller cleaning
- Ink roller cleaning
- Blanket washer
- Continuous water feeder
- Print adjuster remote-control

- Print cocking remote-control
- Ink adjust remote-control
- Automatic print changer

### 3. Production Technology

- (1) Material control to be more of the just-in-time concept throughout the production.
- (2) Currently in HMT, the materials are supplied for production in a manner of batch control, with some percentage of safety margins added to the determined amount for production. Then the component control is left to the shop floor level, which exaggerates the confusion of control and decreases the effective use of production space in the shop.
- (3) This could be prevented by introducing more stringent schedule control, integral for the shop as a whole.
- (4) The modular design should be pursued to minimize the number of components while expanding the product mix in future.
- (5) The introduction of CNC machines and automatic transfer systems should be studied in the future plan for more efficient production.

## D. Input Factor Analysis

### 1. Labour

- (1) Average age of the workers is high.

The average age of WG class is 41.18 years and that of PS class 42.17. Among 525 employees, only 4 are below 28 years old. There is possibility that this will distort the future personnel structure.

- (2) Low attendance rate

The attendance rate is 70%. The measures for raising employee morale should be taken, because low attendance rate hinders the improvement of efficient operation and cost reduction.

- (3) Insufficient training

Consistent in-house education and training system is not established. Systematic on-the-job training schedule as well as off-the-job training is required to be formulated. Job rotation should be recognized as a useful measure for training.

### 2. Materials and Parts

- (1) The proportion of steel among materials is high.

The use of domestic steel should be promoted by examining the rigidity and heat treatment of steel from various domestic sources.

- (2) The proportion of in-house production is very high.

As the number of parts processed internally is large, more small-sized parts and parts of small order quantity (which account for 82% of total number of parts, and for 9% of total value,) should be contracted out.

(3) The proportion of imported parts is high.

Imported parts account for 40% of total boughtouts. Joint development with domestic makers should be examined for such parts as oil-seal, bronze, nylon, and bearing. Centralized purchase of materials required by all the HMT units and change of suppliers should be also examined.



**E. Identification of Prospective Product Groups and Product Mix**

The product line of HMT is compared with competitors in Table IV-4-7. The evaluation of market potential by type of product is illustrated in Table IV-4-8.

The following are pointed out as urgent subjects.

- The limited product line
- The necessity of developing 2-color ulor machine and reversing mechanism to cope with the trend of domestic market
- The necessity of developing multi-color machine for the future demand
- The necessity of developing large-sized machine responding to the growth of the advertising industry and the packaging industry
- The necessity of reinforcing the R&D system to catch up with the technology of rotary press in future

Based upon the market potential and HMT's capability, the following product-mix is proposed for the next ten year.

Table IV-4-9 Proposed Future Product-Mix

	5 years later	10 years later
For Indian Domestic Market	SOM 225	SOM 225P
	SOM 225P	SOM236P
	SOM 236	SOM 240P
	SOM 236P	SOM 425
		SOM 436
		Rotary (WEB)
		(Newspaper, letter print)
For International Market	SOM 125	SOM 225P
	SOM 225	SOM 236P
	OMIR 136	SOM 240P
	SOM 236	SOM 425
		SOM 436
		SOM 440
		Rotary (WEB)
		(For commercial printing)

Table IV-4-7 Product Line Comparison

Type	Size (Inch)	Colour	HMT	Domestic Manufacturers		Overseas Manufacturers
				Dominant	Polygraph	
Printer House	Printer House					
	Printer House					
Offset Printing Machinery	20	1 2 4	No intension to develop			
	25	1	◎	◎	☆ SOLNA	◎
		2		◎	☆ SOLNA	○
		4			☆ SOLNA	◎
	28	1			★ Adast	◎
		2		Ceased in 1988		◎
	31	4				◎
		1		◎		◎
		2				◎
	36	4				◎
		1		◎		◎
		2		◎		◎
	40	4				◎
		1				◎
		2				◎
		4				◎
44	1				◎	
	2				◎	
	4				◎	
50	1				◎	
	2				◎	
	4				◎	
	1				◎	
56	2				◎	
	4				◎	
Rotary Press	Newspaper				★ From Polygraph	◎
	Commercial Use				★ From Polygraph	◎
Remark			Collaboration with Nebiolo (Italy).	Collaboration with Adnst (Czech). Half of Parts are imported from Adnst.	Ceased the collaboration with OMCSA (Italy) for existing product (◎). New Collaboration with Solna (Sweden) for new products (☆).	Aiming at the lower market. Exporting to France, Australia, etc.

Note: ◎: Existing ○: Developing ☆: Planning to produce through collaboration ★: Importing

Table IV-4-8 Evaluation of Market Potential by Type of Product

Type	Remark
Offset	
20 inches	Low priority considering the situation of the domestic market.
25 inches	Demand is increasing in India. High-class machines are going to be introduced by a competitor. Development of 2-color/4-color machines are urgent subject.
28 inches	HMT stopped the production because of mismatch to Indian paper size. Demand in the EC is expected to grow because it fits the EC paper size.
31 inches	Demand is increasing in India, but decreasing in the international market. HMT is shifting to 36-inch machine.
36 inches	Demand is increasing in India. To cope with Dominant, the development of reversing mechanism is an urgent subject. The development of 4-color machine is also an urgent subject.
40 inches	Popular size in the international market. Demand is expected to grow in India. The development is necessary.
44 inches	Compared with 40-inch machine, the expected demand is small. The development of 40-inch machine is more urgent.
50 inches	Demand is relatively small in the international market. The technological requirement is high. Low priority of development.
56 inches	Demand is relatively small in the international market. The technological requirement is high. Low priority of development.
Rotary Press	
Newspaper	The demand for newspapers and magazines is expected High building is necessary for the production.
Commercial Use	The demand is expected to grow because of the growth of the advertising industry and the increase in multi-color printing.

## F. Direction of Marketing Strategy

Capability to develop a new product which will satisfy the customer needs is identified as an important critical factor for success.

Under the circumstances that major competitors are introducing higher quality products on the market, new product development should be a driving force of HMT's printing machinery business in order to realise a competitive edge.

The marketing and design groups currently assess the customer needs by averaging and direct their R&D efforts to the targets set by the average customers, which results in the product level sufficient for the requirements of small and medium scale printers but not large-scale printers.

But judging from the Indian imports of multi-color sheet printing machines and rotary printing machines, top-class printers tend to demand higher quality, higher performance machines. R&D efforts should aim, at least, to meet the requirements of top users in India.

The next ten years will be divided into two phases, i.e., Phase I: Period of establishing a base in the domestic market, and Phase II: Period of entering the international market. The following basic policies should be adopted for these phases.

### Phase I: Period of Establishing a base in the domestic market

To expand the market share in the domestic market and surviving the competition with domestic competitors

To market higher quality products for the domestic market through a technical collaboration with leading printing machinery makers in the world

To export products to neighbouring countries and developing countries

To expand the production capacity and realise the cost reduction through factory expansion and modernisation of the facility

Phase II: Period of Entering the International Market

To market internationally competitive products through a technical collaboration with leading makers in the world

To reinforce the R&D capability and promote in-house R&D activities

To develop new products with the co-operation of top domestic users

To establish overseas sales and after-sales networks

## G. Necessary Measures Concerning Cost Reduction

### 1. Foundry

The proof cutting and necessary heat treatment process should be incorporated in the production of castings within the foundry.

It is important to establish the quality responsibility of the foundry and also to avoid the intricate handling procedure between the machine and the foundry shop, as currently practised in the division.

### 2. Response to Mechatronics

Mechatronics component will account for about 10 - 20% of production cost for the future product. Mechatronics equipment and component require the production technologies quite different from the existing technologies.

By establishing the system that facilitates the rationalization of production facility relating to mechatronics, cost reduction and stable quality should be pursued.

### 3. Domestic Procurement

It is necessary to increase domestic procurement.

About 15 items of parts and components, which account for about 10% of the production cost, are still imported. Joint purchase with other units of HMT and purchase from other sources should be examined.

### 4. Ancillary Development

In-house production is still high, when compared to the Japanese manufacturers, which can be improved with extensive commitment of HMT to support the development of the ancillaries.

## H. Necessary Measures Concerning R&D

- (1) Only 10 people are assigned as design staff in the Printing Machine Division.

Design staff should be about 20% of total workers.

- (2) Such information as development needs and market survey is heavily dependent on the marketing staff.

Design staff does not have any direct channel for the transfer of information on claims or evaluations of competitors products from the customers.

The design department should be a technical centre, where the information from international exhibitions, DRUPA, IGA, IPEX is accumulated, and it should combine all the information in order to develop the future R&D strategies.

- (3) Domestic competitors would actively attempt to acquire new technology from earlier foreign collaborators and aggressively enter into the expanding market.
- (4) R&D and QA are the sole responsibility of the design dept., which causes delays in development.

Comprehensive co-operation is essential to establish an efficient production program - shortening of the delivery time, and quality creation in the entire production stage.

- (5) Basic technology research is also necessary, along with the new development of products.
- (6) The development target has been placed in the mean requirements from the customers; hence the top ranking customers are not satisfied by HMT product lines.

R&D should always correspond to the requirements of the top class customers and the future targets should be placed definitely in exports.

## IV-5. Tractors

### A. Market and Competition Analysis

#### 1. Inland Market Analysis

##### (a) Demand for tractors in India

The demand for tractors in India in the past 10 years is shown in Fig. IV-5-1. The number of tractors produced in India surpassed 100,000 in fiscal year 88/89 and reached a record high of 139,411 in 90/91 after long stagnated sales between 1982 and '87, which was believed to be a result of a credit squeeze from NABARD. In terms of selling price, it reached approximately 17 billion Rupees in 90/91.

Table IV-5-1 Demand for Tractors in India (Sets)

<u>81/82</u>	<u>82/83</u>	<u>83/84</u>	<u>84/85</u>	<u>85/86</u>	<u>86/87</u>	<u>87/88</u>	<u>88/89</u>	<u>89/90</u>	<u>90/91</u>
81,742	61,848	72,974	85,464	73,456	78,292	90,900	108,000	120,729	139,411

Some of the important factors which determine the size of the demand for tractors in the country are as follows:

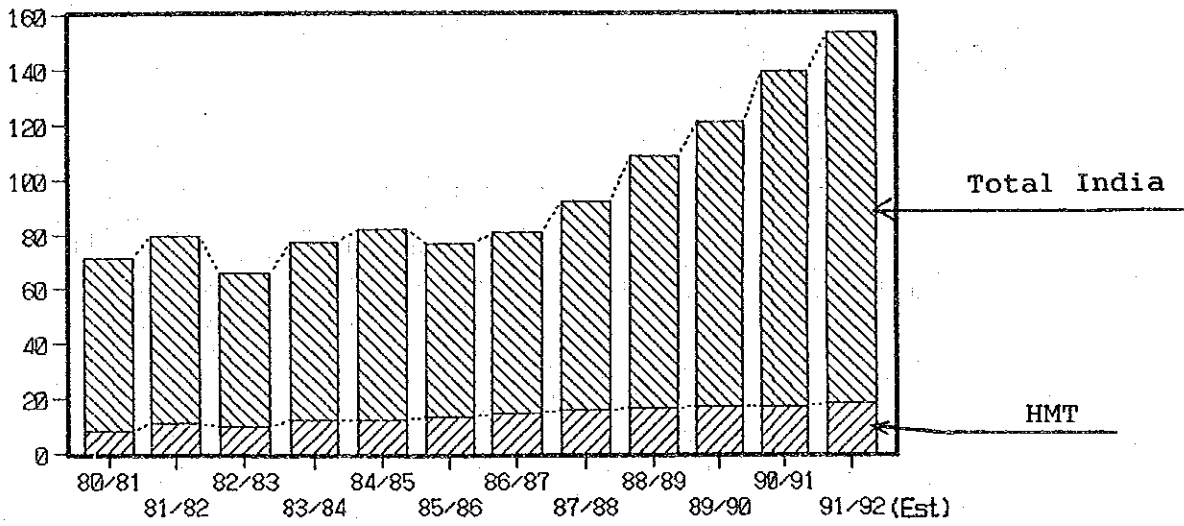
- Income level of farmers, which is principally subject to governmental subsidies
- NABARD's policy on bank loans for farm mechanization
- Gross area of farm land
- Climate, in particular, the condition of monsoon

Since no substantial changes or declines in these factors are foreseen, the demand for tractors is expected to grow at approximately five percent through the nineties. The possible strong demand is supported by the fact that the Indian government has emphasized the development of agriculture as one of the most important policy matters in its Eighth five year development plan. Taking all the above into consideration, it is reasonable to expect that the demand for tractors will continue upward through the rest of the 20th century.



Fig. IV-5-1 Demand for Tractors in India

Unit: 1,000



The number of tractors currently operating on farms in India is estimated to be approximately 1.2 million, while the potential demand, which is based on the area of farm land and the number of farmers who are able to purchase tractors in the country, is said to be 2.4 million. It indicates that there exists approximately 1.2 million tractors of potential demand, and it is foreseen that the market will be saturated early in the next century.

Table IV-5-2 Flow of HMT's Production of Tractors and Market Share

	<u>85/86</u>	<u>86/87</u>	<u>87/88</u>	<u>88/89</u>	<u>89/90</u>	<u>90/91</u>
HMT's Production	13,563	14,659	15,697	16,314	17,171	17,414
Market Share	17.7%	18.2%	17.1%	15.0%	14.2%	12.5%

(b) Demand for tractors by state

State-wise, Uttar Pradesh is the largest in number of tractors sold in 90/91, where 39,363 units were sold. This state alone accounts for 28.2 percent of the total tractors sold in India in the year. The second is Punjab, followed by Haryana. These three states jointly occupy 56.4 percent of the total Indian market. Adding Rajasthan and Madhya Pradesh, the top five states jointly occupy 71.3% of the entire market. As stated above, the sales of tractors varies widely state by state.

Table IV-5-3 Demand for Tractors by State

State	Number of Tractors(1990/91)	Ratio(%)
Uttar Pradesh	39,363	28.2
Punjab	22,037	15.8
Haryana	17,278	12.4
Rajasthan	10,398	7.5
Madhya Pradesh	10,273	7.4
Other States	40,062	28.7
<b>Total:</b>	<b>139,411</b>	<b>100.0%</b>

There is little relationship between the number of tractors sold and the area/size of the states; the top selling three states, and the five states, occupy no more than 17.6% and 42.5% of the total land area of India, respectively. Considering that these states are located in the middle and north of the country, where the land is fertile and is equipped with an efficient irrigation system, it is said that the demand for tractors in the southern states will be realized if an agricultural infrastructure such as an irrigation system is developed.

The land of India is grouped into five zones, and the demand trend and market potentiality are compared with each other. A summary of the comparison is shown in Table IV-5-4. Zone 5, where Madhya Pradesh is located, shows the highest annual increase ratio, followed by zone 3 and zone 2. In terms of the size of market, however, zone 3 is the largest, then zone 1 follows. HMT occupies the biggest market shares in zones 2 and 5, but 4th in zone 2 and 6th in zone 3. It may be said that HMT is strong in lower potential areas, but weak in higher potential ones.

Fig. IV-5-2 is a matrix of market growth vs. HMT's market share. The vertical axis indicates the rate of annual increase in the market by percentage, and this axis is divided into two by the average annual increase of the manufacturing sector in India between 85/86 and 89/90, which is 7.4 percent. The upper part over the line shows that the areas are growing faster than the country average, while the lower part shows that the areas are lower in growth. The horizontal line represents HMT's relative market shares. The relative market shares are obtained by dividing HMT's market shares by the shares of the top selling companies, whereas in cases where HMT occupies the largest shares, they are obtained by dividing HMT's shares by the shares of the second selling companies. Each circle represents each zone, and the size of a circle indicates the market size of each zone. The shaded areas show HMT's market shares.

Table IV-5-4 Demand for Tractors by State

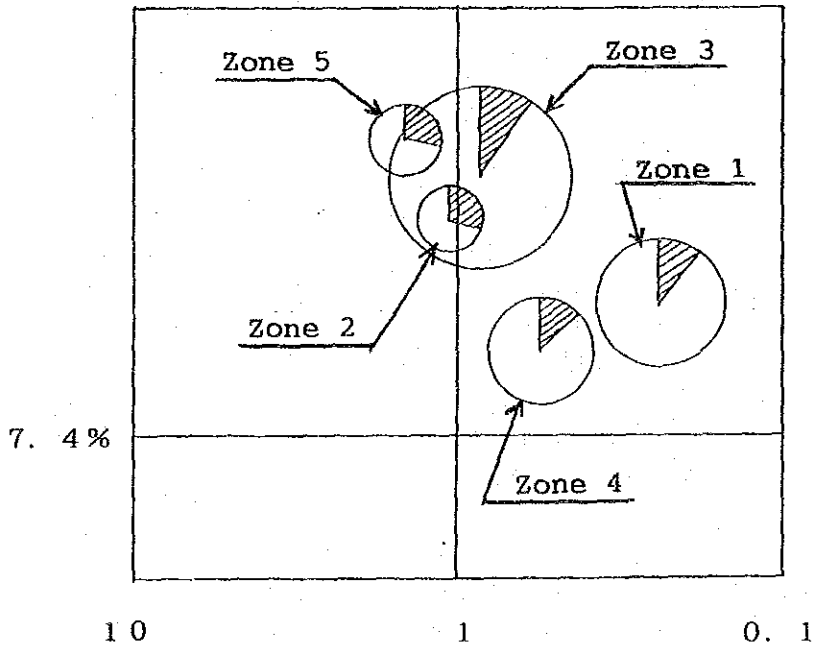
State	NET SOWN AREA (1000ha)	MARKET SIZE (90/91)		ANN. INCR. (85-90)	HMT MKT SHARE (%)	MARKET POTENTIALITY	COMPETITORS	
		NUMBER OF TRACTORS	SHARE BY STATE				NAME OF FIRMS	MARKET SHARE (%)
Andhra Pradesh	11,486	6,399	4.6	8.8	7.9	LOW	(1) M & M	32.0
Gujarat	9,583	7,435	5.3	12.6	10.5	MED	(2) TAFE	31.6
Karnataka	10,605	3,406	2.4	9.6	24.2	MED	(3) FORD	10.2
Kerala	2,180	366	0.3	-0.5	6.6	LOW	(4) HMT	9.1
Maharashtra	18,302	7,343	5.3	15.6	6.6	HIGH	(5) ESCORTS	6.9
Tamil Nadu	5,875	5,033	3.6	12.4	2.4	MED		
(ZONE 1 SUB TOTAL)	58,031	29,982	21.5	11.8	9.1	LOW-HIGH		
Assam & N.E.S.	3,752	373	0.3	-0.9	0.8	LOW	(1) HMT	27.9
Bihar	7,580	6,785	4.9	13.5	32.1	MED	(2) M & M	27.8
Orissa	5,990	735	0.5	27.3	26.0	MED	(3) ESCORTS	17.7
West Bengal	5,341	1,368	1.0	11.3	15.4	MED	(4) TAFE	11.7
(ZONE 2 SUB TOTAL)	22,663	9,261	6.6	13.1	27.9	LOW-MED	(5) PTL	8.0
Haryana	3,663	17,278	12.4	12.8	8.6	HIGH	(1) EICHER	22.5
Rajasthan	16,234	10,398	7.5	10.7	5.8	MED	(2) ESCORTS	22.1
Uttar Pradesh	17,273	39,363	28.2	16.4	10.9	HIGH	(3) M & M	13.6
(ZONE 3 SUB TOTAL)	37,170	67,039	48.1	14.5	9.5	MED-HIGH	(4) PTL(10.1), (5) TAFE(10.4)	
Himachal Pradesh	593	238	0.2	11.2	60.9	LOW	(1) EICHER	18.0
Jammu & Kashmir	729	263	0.2	11.2	12.2	LOW	(2) M & M	17.9
Punjab	4,215	22,037	15.8	9.6	12.3	MED	(3) PTL	15.9
(ZONE 4 SUB TOTAL)	5,537	22,538	16.2	9.6	12.8	LOW-MED	(4) FORD(14.0), (5) HMT(12.8)	
Madhya Pradesh	19,223	10,273	7.4	14.8	27.1	HIGH	HMT(27.1), ESCORTS(19.0)	
(ZONE 5 SUB TOTAL)	19,223	10,273	7.4	14.8	27.1	HIGH	M&M(14.4), PTL(13.3), TAFE(12.8)	
Others/Misc.	142,624	318	0.2	-22.7	11.6	-	M&M(19.3), TAFE(25.2), PTL(16.4)	
TOTAL		139,411	100.0	12.7	12.5			

All the five zones show relatively high growth rates, for all the circles are beyond the 7.4 percent line. In particular, zones 3 and 5, which are both located in the middle and northern parts of India, show substantial market growth. On the other hand, by far the largest area in market size is zone 3, followed by zone 1, the percentage market shares of which are 48.1 percent and 21.5 percent, respectively. In any of these zones, HMT does not occupy more than 10 percent of the market share. HMT maintains high market shares in zones 2 and 5, the market sizes of which are as small as 6.6 percent and 7.4 percent, respectively. It is imperative for HMT to increase market share in high potential areas such as zones 1, 3 and 4.

The matrix illustrated in Fig. IV-5-2 gives some insight which HMT should consider, that is to say HMT should continuously work to maintain their present market shares in zones 2 and 5, while in zones 1, 3 and 4, HMT should selectively strengthen their sales force through strategic use of their internal resources. In the latter case, it is recommended that HMT expand their sales force in zone 1 in the states of Gujarat and Andhra Pradesh using Karnataka as a base, where HMT already maintains a substantial market share. By the same token, in zone 3, first priority should be put on Uttar Pradesh, then on Haryana. In zone 4, keeping the present market share in Himachal Pradesh, HMT should try to push into Punjab.

Fig. IV-5-2 Matrix of Market Growth vs. HMT's Market Share by State

Growth of Market



HMT'S Relative Market Share

(c) Demand for tractors by size of horsepower

Demand for tractors in the past five years is studied by dividing the market into three sections based on the size of the horsepower in the tractors. As summarized in Fig. IV-5-3, demand for tractors of less than 30 HP (smaller class) is 48,345 units or 34.7 percent of the total demand, 30 to 40 HP (medium class), 66,789 units or 47.9 percent, and more than 40 HP (larger class), 24,277 units or 17.4 percent. In value terms, the total Indian tractor market amounts to approximately 17 billion Rupees at the market price in 90/91, and about one half of the market is occupied by the medium class, 25 to 27 percent by the smaller class, and 23 to 25 percent by the larger class.

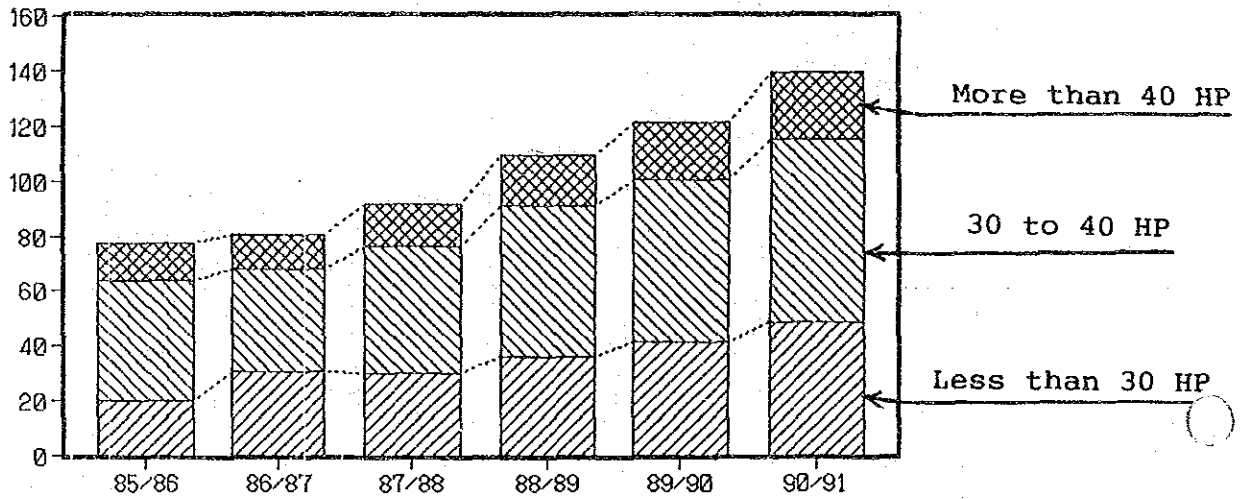
The compound annual rate of growth for the past five years in the smaller class is 19.4 percent, the highest among the three classes, followed by the larger class, 12.5 percent, and the medium class, 9.0 percent. In year 90/91, however, the larger class recorded the highest increase in volume, an 18.0 percent increase over the previous year, followed by the smaller class and the medium class, of which annual increases were 16.6 percent and 12.9 percent, respectively. Considering both the growth and the size of the market, the medium class is regarded to have the largest demand potentiality, and the smaller class and the larger class have nearly equal potential.

Table IV-5-5 Demand for Tractors by Size of Horsepower

	85/86	86/87	87/88	88/89	89/90	90/91
Less than 30HP	25.9	38.1	33.1	32.9	34.2	34.7
30 - 40HP	56.6	46.4	50.2	50.4	48.8	47.9
More than 40HP	17.5	15.6	16.8	16.7	17.0	17.4
Total:	100%	100%	100%	100%	100%	100%

Fig. IV-5-3 Demand for Tractors by Size of Horsepower

Unit: 1,000





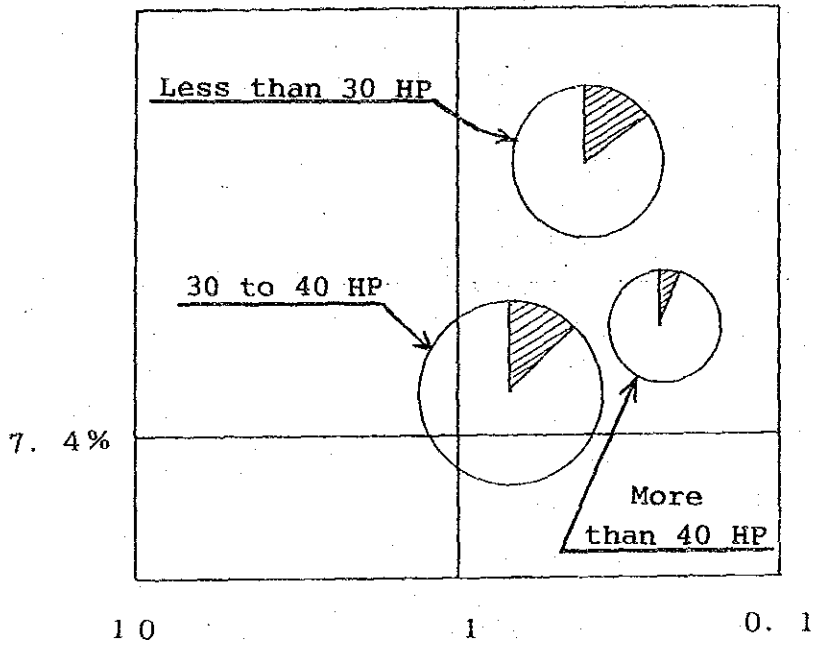
Considering the condition of the soil, it can be said that the smaller class tractors are better suited for the northern areas of India, while the medium and the large classes are suitable for the southern areas. On the other hand, in the northern areas the middle and the large classes sell well as replacements, and in the southern areas the small class sells well for those who purchase tractors for the first time. Thus, little difference is observed by region on the size of the tractors.

Fig. IV-5-4 is similar to Fig. IV-5-2, which shows a matrix of market growth vs. HMT's market share by size of tractors. The vertical axis indicates the annual increase of the market by percentage, and the axis is divided into two at 7.4 percent, the same as in Fig. IV-5-2. The horizontal line represents HMT's relative market shares. Each circle represents the market size for each horsepower category, where the size of the circle indicates the market size of each class. The shaded areas represent HMT's market shares.

According to Fig. IV-5-4, all three classes are in the first sphere. This indicates that all the classes enjoy high market growth. HMT's market share in any of the classes is low, and it implies that HMT is less competitive in the rapidly growing market. Considering horsepower, by the growth ratio, the smaller class comes first, then the larger class and the medium class follows. By the size of the market, the medium class is the largest, and the smaller class and the larger class follow. From the above, HMT's strategy should be to put first priority on the smaller class, then on the larger class, while at the same time keeping the present market share for the medium class.

Fig. IV-5-4 Matrix of Market Growth vs. HMT's Market Share by Horsepower

Growth of Market



Relative Market Share

(d) Competitiveness

Every year since 1982/83, HMT has increased its sales, which reached a record high of 17,414 units in 90/91, but since the growth of the market has been faster than that of HMT's sales, HMT's market share has decreased. During the five years between 85/86 and 90/91, the market has recorded an average annual increase of 12.7 percent, while HMT increased its production by only 5.1 percent each year. As a result, HMT's market share declined from 18.2 percent in 86/87 to 12.5 percent in 90/91. According to HMT's production plan, it will produce 18,500 units of tractors in 91/92, which would result in 12.1 percent of the total tractor market in India of an estimated 153,500 units.

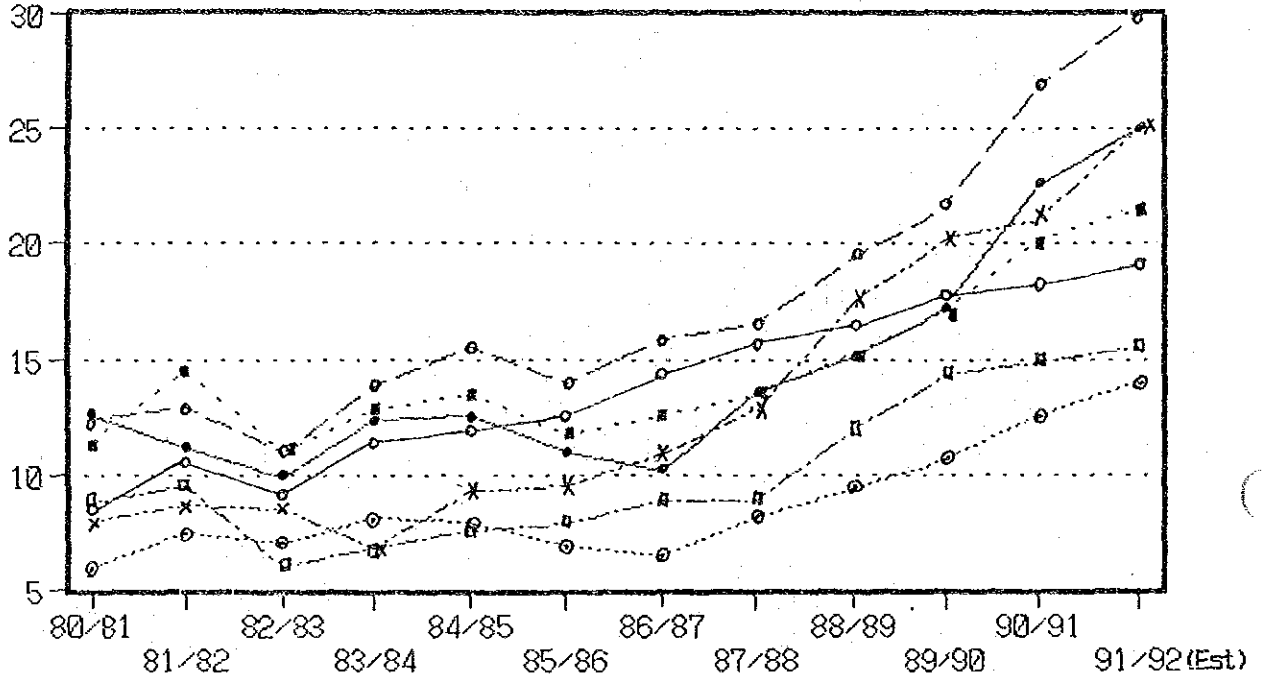
Fig. IV-5-5 summarizes production trends for the seven major tractor manufacturers. HMT had been the second largest next to Mahindra & Mahindra (M&M) between 85/86 and 87/88, but by 1990 it was the fifth largest, having been replaced by Escorts, TAFE, and Eicher. It is probable that HMT's market share will continue to decline unless drastic measures are taken.

HMT has 186 dealers throughout India, which is fifth among the major tractor manufacturers. As for HMT's competitors, M&M has 343 dealers, Escorts 252, PTL 245, and Escorts Tractors 188.

Although the number of dealers directly influences the sales of tractors, the number of dealers of HMT tractors is small, and they are geographically concentrated in the middle and northern states of India: 39 in Uttar Pradesh, 18 in Madhya Pradesh, 17 in Haryana, 16 each in Punjab and Rajasthan. It is therefore suggested that HMT strengthen their dealership network in the southern part of India.

Fig. IV-5-5 Production Flow of Major Tractor Manufacturers

Unit: 1,000



- — Escorts
- — M&M
- — Eicher
- — PTL
- X — TAFE
- ⊙ — Escorts Tractors
- — HMT

The market shares of each company in 90/91, ranked by the size of horsepower, are shown in Figures IV-5-6, IV-5-7, and IV-5-8. In the smaller class, Eicher is by far the largest company, accounting for 41.8 percent of the market, which is more than twice that of the second largest, Escorts. This class, which covers horsepower less than 30 HP, is said to be the most competitive market, where many companies compete with one another. Such companies as Escorts, M&M, and TAFE have entered into this segment since 86/87. HMT's market share has been cut in half in the last five years. Its market share was 29.9 percent in 85/86, but only 14.7 percent in 90/91. Eicher, too, dropped 15 percentage points in the same period. Escorts is a winner in this class, increasing production by 57 percent by 90/91, and is today the second largest manufacturer in this class.

In the medium class, no single large manufacturer exists. TAFE has the largest market share at 29.0 percent. HMT's share is 13.1 percent, and it is the fourth largest following TAFE, M&M, and Escorts. PTL, the fifth largest, accounting for 12.8 percent of the market, is going to catch up with HMT rapidly. Considering PTL's high annual increase in production, which is 11.8 percent per year for the past five years compared with HMT's 6.8 percent, there is a good possibility for PTL to surpass HMT in the near future.

The market of the larger class is regarded to be oligopolistic since Escorts Tractors, which has such famous brand as FORD, occupies more than half of the market. Although HMT accounted for 6.6 percent in 90/91, which is the fourth largest, it lost 1.4 percent from the previous year. M&M, the second largest, and Escorts, the third largest, both continue to increase their positions in the market, and HMT is being further left behind from the top group companies. This class segment is expanding so rapidly that it is imperative for HMT to take immediate actions for strong sales expansion.

Fig. IV-5-6 Market Share by Horsepower (Less than 30 HP)

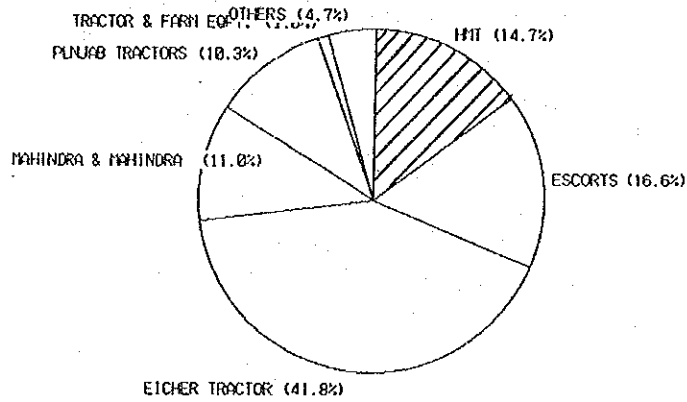


Fig. IV-5-7 Market Share by Horsepower (30 to 40 HP)

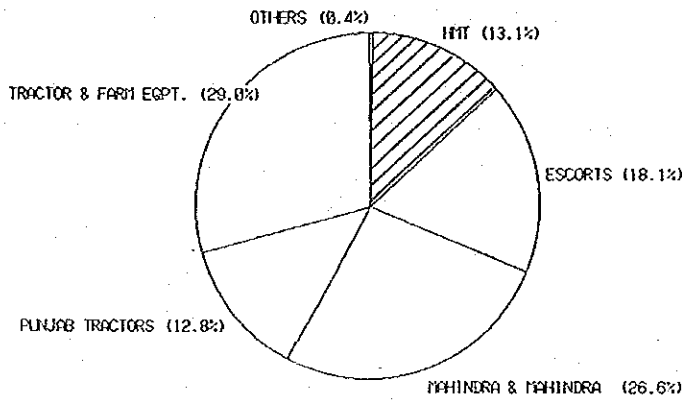
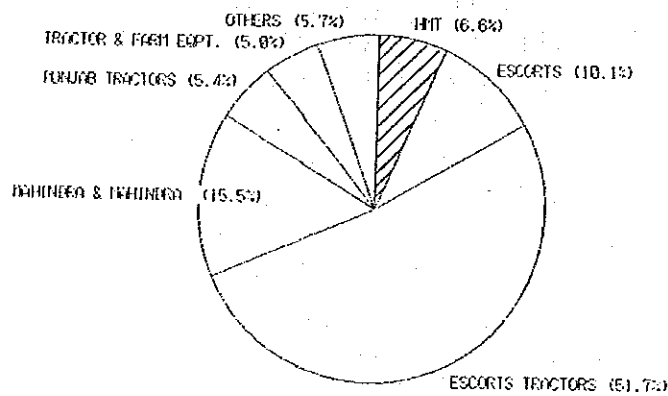


Fig. IV-5-8 Market Share by Horsepower (More than 40 HP)



## 2. International Market Analysis

Trends in world production of tractors in terms of volume is shown in Fig. IV-5-9. Since 1980 the production of tractors in the world has decreased, and it is forecast that the world production in 1991 will be approximately 1.06 million units. By country, the U.S., Europe, Eastern Europe, and Japan have decreased production. The world market is considered to be saturated, and the number of tractors tends to decrease significantly since larger tractors are substituted for smaller ones. In 1991, the size of demand for tractors by country group is: 370 thousand units or 35 percent of the total world demand in Eastern Europe, 190 thousand or 18 percent in Europe, 106 thousand or 10 percent in the U.S.; and 90 thousand or 8.5 percent in Japan.

India is one of the few countries where the demand for tractors is expanding. In 1984, the demand for tractors in India accounted for 5.4 percent of the world demand. India's demand is estimated to have reached 14.5 percent of the total world demand in 1991. In the early 21st century, it is forecast that Indian demand will be approximately 220 thousand units, and occupy 20 percent of the total world market.

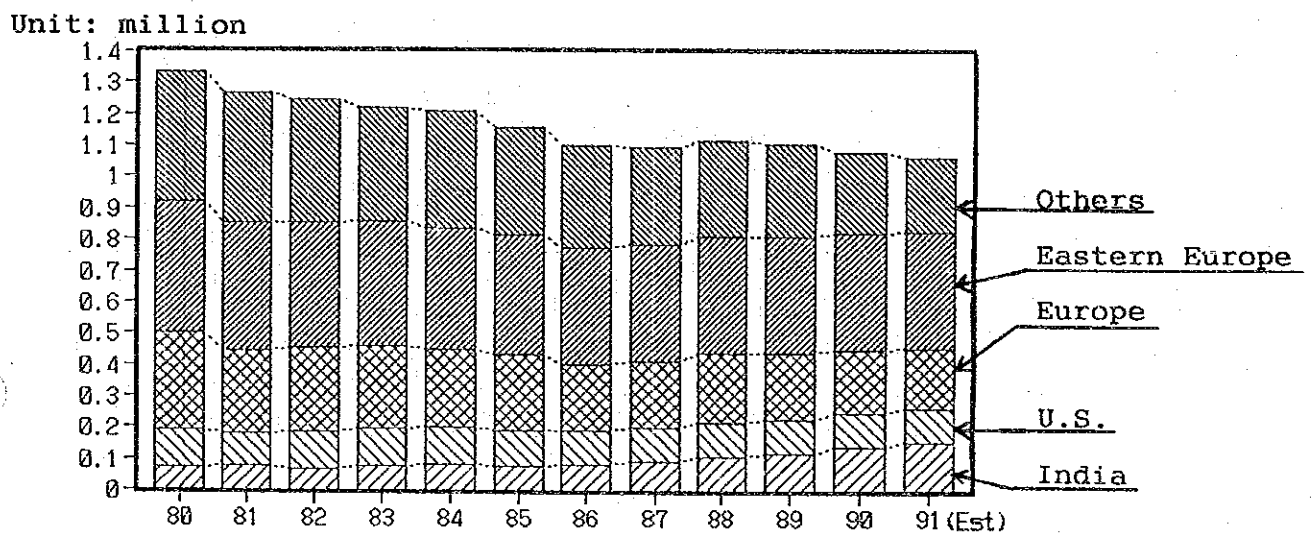
In order to see the characteristic differences of tractors by region, the world market is placed into three groups: industrialized countries, Japan, and developing countries. In the industrialized countries, large horsepower models which are usually over 50 HP are widely used. In Japan, medium horsepower models, which fall between 15 and 35 HP, are popular for the small scale farm land. Tractors used in the industrialized countries and Japan adopt various advanced technologies such as synchromesh gears and transmissions with much wider shift ranges than those of India. Four-wheel drive tractors are also widely used for good traction. In contrast, in developing countries like those found in Africa, market characteristics are similar to those of India, and smaller horsepower tractors, usually less than 50 HP, are widespread, and, technology wise, simple ones, which do not require frequent maintenance, have a large market share. From the above point of view, it can

be said that there is a good possibility for HMT to export tractors to developing countries such as those in Africa.

Aggressive export promotion efforts would be required in order to achieve targeted goals.



Fig. IV-5-9 Demand for Tractors in the World



## B. Product Competitiveness Analysis

### 1. Price Competitiveness

Table IV-5-6 Shows the tractor price comparison.

Table IV-5-6 Tractor Price Comparison

Unit: Yen					
HP	25	35	45	60	70
HMT(ex-works)	591,503	735,537	-	1,071,938	-
Japan	1,750,000	2,900,000	3,300,000	-	5,000,000
International					
US	1,520,000	1,619,000	2,059,000	2,963,000	3,085,000
Europe	1,568,000	1,830,000	2,308,000	2,757,000	3,342,000

Remarks: Exchange rates: 5.1 Yen/Rs. 130.7 Yen/US\$  
Japanese Spec. being economy types in 25, 35,  
45 HP with power Steering, synchronized Drive;  
70 HP of De-Lux Spec.

The HMT prices are well below the international level and indicates its competitiveness in up-grading the performance and the quality.

### 2. Competitiveness in Product Quality

According to the actual verification in HMT factories and the information gathered from customers and from dealers, there are quality problems which need improvement. This means HMT tractors do not stand out in terms of quality, compared with other Indian competitors.

The problems in gears, shafts and hydraulic lines are critical, necessitating complicated overhaul procedures. This must be eliminated. With respect to painting, their appearance is not satisfactory. Also there are questions of the tractor's durability. Integrated endeavors to upgrade the quality in design and production are urgently required.

### 3. Other Characteristics of Tractor

Basic factors used to determine the tractor characteristics are the weight, cylinder volume and the wheel base. To reduce the weight, which contributes to the fuel economy and a reduction in costs, requires sophisticated technology.

A larger cylinder volume induces higher horsepower even in low rpms, but the increase adds to the total weight and subsequently causes the cost to increase. A longer wheel base adds to the comfortability in rugged terrain, but it also increases the weight and causes the cost to increase. There is also a loss in maneuverability. HMT's tractor, originally coming from Zetor, Czechoslovakia, is heavier, and has a larger cylinder volume with low rpms.

Available data indicates that the Ford and Escort tractors are akin to the western specifications. Other tractors, licensed with other European originals, also sell well in India. In developing a world wide strategy, HMT may find it necessary to review the design of these competing products. The specification comparison between Ford, Escorts and Japan are compiled in Table IV-5-7.

Table IV-5-7 indicates the characteristics of the Japanese design: lighter, smaller cylinder volume, and higher rpms. Heavier construction, which might be suited for Indian agricultural conditions, but still the constraints remain in cost, fuel economy and maneuverability. The Escort strategy is worthy of review and it is certainly affected by the original Ford design.

For HMT, other characteristics such as reduction in weight, reduction in cylinder volume, reduction in wheel base, and increase in RPM will imply an altogether new design either in-house or as a collaboration.

As mentioned before, the Indian tractor price is favorable and internationally competitive. If the quality can be improved by establishing administrative controls and if it is comparable with international brands, the

licensors might try to produce the export brand tractor in Indian licensee, which will certainly contribute to add to international competitiveness in HMT's competitors. HMT, also must put the emphasis on this point to build up superior competitiveness in the near future.

Many domestic manufacturers currently collaborate with foreign firms. If one of these domestic manufacturers were able to improve the quality of their products, their collaborator may try to export the improved product under license from the domestic manufacturer. This would certainly add to the international competitiveness of the domestic manufacturer.

Table IV-5-7 Tractor Specification Comparison

HMT	HP	25	35	45	59	70-80
	cc	1,560	2,340	2,698	3,465	
	rpm	2,000	2,000	2,000	2,200	
	Kg	1,580	1,725	2,085	2,445	
Ford	HP			47	50	
	cc			2,868	3,149	
	rpm			2,000	2,000	
	Kg			1,800	1,800	
Escorts	HP	27	35	47		
	cc	1,795	1,960	3,420		
	rpm	2,200	2,200	2,200		
	Kg	1,680	1,565	1,820		
Kubota	HP	25	38	46	65	75
	cc	1,463	2,165	2,437	2,580	4,329
	rpm	2,600	2,600	2,600	2,400	2,400
	Kg	1,110(4W)	1,630(2W)	2,250(4W)	2,580(4W)	2,950(4W)
Shibaura	HP	25	38	45	55	75
	cc	1,330	1,995	2,269	2,269	3,989
	rpm	2,500	2,500	2,500	2,500	2,200
	Kg	980(2W)	1,270(2W)	1,595(4W)	1,750(4W)	2,935(4W)

Remarks: 4W: 4-wheel drive;  
2W: 2-wheel (ordinary) drive

## C. Production Facility and Product Technology Assessment

As the tractor industry is as classified in the automobile category, is closely connected to the automobile industry and uses mass-production technology. Unless production can be increased thereby, it is hard to survive. Should the market become saturated thereby decreasing the production, the manufacturers with lesser market shares, would be eliminated. Thus today, after integration through competition, there are relatively a small number of tractor suppliers in the world, and Japan is the major supplier.

### 1. Production Facility

The basic components of the tractor production facility consist of foundry, casting block machining, shaft/gear machining, heat treatment, press, painting, assembly and the bought fittings such as tires, injection pumps, and electrical parts. The important bought items are often produced in the specified enterprises in the automobile industry; the rest of the components are to be manufactured inhouse.

#### (a) Foundry Facility

The HMT foundry in TRP is poorly equipped; small and old, even a conveyor system has been partially introduced. Casting is the most important component of the diesel engine production, the quality of which affects the design, accuracy and also the efficiency of production. The machining facility for the casting blocks should keep pace with the development of the quality casting, so that the renovation of the foundry could be carried out in the future.

#### (b) Casting Block Machining

Decades-old conventional SPMs are still working; most of the time they have to be used for the setup of the work to interchange the production model. Therefore, tool changes have to be done once a month, which cause excessive inventory stock and makes it difficult to cope with customer's immediate demands.

Design modifications require substantial facility changes, thus changes in design are hard to make. A new FMS (Flexible Manufacturing System) concept should be introduced in the future modernization. The material handling facility also is poorly equipped, obstructing working efficiency and quality.

(c) Shaft and Gear Machining

Conventional obsolete machines are used, and there are few high performance/high efficiency machine tools in the shop. Material handling is also poorly equipped. Gears, prior to the heat treatment process, are piled up in the transfer case at random, which would be detrimental for the establishment of quality.

(d) Heat Treatment

The facility is small, as compared with the volume of the production in TRP; subcontracting might be partially necessary. Quality problems are found in the gear components. Comprehensive review is necessary including the heat treatment process, quality control and facility renovation.

It is worth considering for HMT to be equipped with facilities for continuous isothermal annealing of forgings for gears and shafts and continuous gas carburising and hardening furnaces in the long run.

(e) Press Work

Press work is subcontracted to small ancillary companies. The quality of the press work is represented by the appearance of the tractor body, which directly determines its image to the customers.

Body design of HMT tractor is intended to eliminate the complicated press work, whereas the simple press-fabricated configuration has been adopted. This however results in durability problems.

The monocoque body is under development. Design and manufacture should be studied at the same time. The press facility should be renovated with an effort at relevant accuracy up-grading.

A press shop to take care of design alternations in sheet metal components should be also considered.

(f) Painting

The painting process is primitive, combined with manual work. It is not acceptable by current Japanese standards. To be competitive both domestically and internationally, up-grading the painting process is vitally important. Electro-phoratic dip technology for primer/surface coating of sheet-metal should be studied to guarantee anti-corrosion, even in the unreachable corners of the pressed joints. The cleaning and painting of the engine block and the transmission case also need to be improved. Corrosion already takes place due to exposed storage of casting components.

(g) Assembly

i. Assembly line configuration

The railway track transfer system is used and the painting processes are on line but the engine trials are off-line, separated from the transfer system. An integrated transfer system from trials to packing and to dispatch should be studied.

Two conveyor systems are necessary; one for small and medium size models, the other for the larger models. Automated conveyor transfer is the most effective system for the future, with various innovations to ease the working strains in the assembly line.

ii. Component supply

It is necessary to designate the supply point clearly in

the transfer line; the place and the amount should be easily visible to everybody. Also, waste disposal should be systematically arranged.

### iii. Working procedure

The current assembly activity is irregular and wasteful in human movement. Working territory should be clearly determined and the standard work procedures should be noted. In the meantime, the track-time system should be adopted, precisely moving the trolley on schedule, and in the future plan, the automated conveyor system should be introduced in the assembly line.

### (h) Others

The storage is to be reinforced both for the raw materials and for the components. The amount of storage should be reduced to a minimum, although just-in-time supplying is quite difficult in current Indian conditions, but the effort should be pursued endlessly. Open-air exposed storage of the castings should be prohibited in the future plan.

### i. How to prepare the facility for renovation

Notwithstanding the low labor wage in India, labor-saving renovations should be pursued not only for the improvement of working conditions but also for the automated unattended operations for increases in quality and production, and finally to contribute to cost savings. New investments should be aimed at renovation, and will therefore be focussed on streamlining of the production lines and further introduction of automated production facilities aiming at labor-saving, quality improvement and production expansion.

Extensive facilities, with increased automation for material handling and swarf disposal should be considered. Replacement and modernization of old, obsolete and uneconomic machines of existing plant, cost reduction, productivity improvement and built in precision shall be major criteria during replacement and moderni-



zation.

Modernization of facilities are described in chapter VII-4-C. The comprehensive policy should be established with evaluations from finance, investment, depreciation and HRD (Human Resource Development) view points.

## 2. Product Technology

The product technology depends on the design capability, well supported by the production technology. Marketing information also affects development. Licensor's designs have a great effect in the Indian market today. Table IV-5-8 indicates the principle licensors of Indian tractor manufacturers.

Table IV-5-8 Principal Licensers

Maker	Licensor	Country
HMT	Motokov (Zetor)	Czechoslovakia
M & M	International Harvester	USA, Europe
Escorts	Ford	USA, Europe
TAFE	Massey Ferguson	Europe, USA,

Western countries are represented by their original design, except Zetor. The design quality of the HMT tractor is comparable to the other competitors but the maneuverability and comfort should be more intensively reviewed.

## 3. Production Technology

The systems, organization and standards are well established in TRP. But there are not so many small, effective facility renovations, coming from daily improvement activities. It is particularly important to accumulate the improvement actions on the shop floor and in management.

D. Input Factor Analysis

1. Labor

Man power in the tractor division is described in Table IV-5-9 and Table IV-5-10.

Table IV-5-9 Age Distribution

		below 21	21-30	31-40	41-50	51-58	Total
Manufact.	Workers	1	248	748	257	16	1,270
	Officers	1	5	124	164	19	313
	Total	2	253	872	421	35	1,583
Foundry	Workers	-	10	57	2	-	69
	Officers	-	5	3	6	1	15
	Total	-	15	60	8	1	84
Mohali	Workers	-	22	45	13	1	81
	Officers	-	1	4	8	5	18
	Total	-	23	49	21	6	99

Table IV-5-10 Classification of Employees

		TRP	TRP Foundry	Mohali
Workers	Low Skill	198	17	11
	Medium Skill	1,470	69	60
	High Skill	785	2	10
Supervisor/Foreman		385	8	11
Pay Scale of Managers				
	Grade PS IV	65	3	4
	V	62	2	1
	VI	27	1	-
	VII	20	-	2
	VIII	8	1	-
	IX	2	-	-

Age composition is generally acceptable, with the retirement age being 58 years. The skill classification and the managerial pay scale are well systematized. Work discipline seems to be superior to other HMT units, while the working procedures do have room to improvement.

## 2. Raw Material

Steel bars, plates and pipes are domestically produced and the quality is not in dispute. But forged material is not available for the gears, for which the inhouse heat treatment performs the important role of guaranteeing the durability in rigorous operations.

### 3. Components

There are two types of components; one for the boughtout items such as tires, fuel injection pumps and the electrical parts, which are procured from the automobile-related industries. The current quality is sufficient. The other components are manufactured by the ancillaries and no problem is apparent in quality, except in the hydraulic components.

Much attention should be paid to cleanliness control in the ancillaries in such items requiring precision and dust-free manufacturing. There are reports of trouble in the hydraulic lines and extreme care should be taken in the handling of the components.

E. Identification of Prospective Product Groups and Product Mix

The Tractor Division produces diesel engines, tractors and tractor implements, in which the prospects for the future can be analyzed as follows.

1. Diesel Engine

Diesel engines are widely used in several applications such as electric generators, fire pumps and other miscellaneous uses.

HMT's diesel engines are mainly produced for tractor production and the independent sales of the diesel engines are not stressed very much in the current sellers market condition for the tractors.

There are specialized diesel engine makers, who have comfortably dominated the market.

Table IV-5-11 Diesel Engine Makers  
(1985 - 86)

Maker	Amount of Sales(unit)	Share (%)
Kirloskar Oil (Cummins)	15,827	52.8
Simpson & Co.	4,593	15.3
Cooper Eng. Co.	3,400	11.3
Eicher	3,500	11.7
Ruston & Hornsby	2,678	8.9
Total	29,998 units	100.0%
HMT, 1989 - 90	99	
1990 - 91	65	

Should the diesel engine production shortage be solved by HMT in the future, it certainly should enter this market. The ruggedness and the durability of the tractor engine would be welcomed for usage in remote areas.

## 2. Tractor

The tractor market will exist as long as the agricultural sector continues to expand but the demand will change. As aforementioned, the trend is toward saturation and stagnation. If this occurs, production will then begin to decrease. Economic development and increases in personal earnings would direct the tractor production in two ways; one to the bigger size and the other to the smaller size.

The other part of the development would be the exploitation of new markets to expand the production volume. Such volume increase accelerates the market contraction; even though land fragmentation into smaller size farms works against the trend, the total market will definitely decrease. The Indian tractor market will follow exactly the world trend.

The expected counter-actions are,

- To enlarge the present share of the market
- Development of higher horsepower tractors (> 60 HP)
- Development of smaller size tractors (< 25 HP)
- Specification review to reduce costs  
(ex. lighter the weight, higher the rpm)
- Introduction of new products such as rice-planters
- Explore the usage in areas other than agriculture

The expansion of the present product mix could be achieved by increasing rpm by 200 - 300: upgrade the current 25 HP engine, increase 35 to 40 HP, and adding the smaller 15 - 20 HP product lines.

### 3. Tractor Implements

In Japan, there are successful small to medium scale industries who specialize in the manufacture of implements and are profitable. On the other hand, in India, manufacturing of implements is reserved for small scale industries. The implements are manufactured in more than 17,000 small scale industries, and the annual turnover reaches 3 billion rupees.

It is recommended that HMT help its vendors and ancillary manufacturers in the development of new implements, which would enhance the value of HMT tractors and thereby promote sales.

### 4. Others

There is some similarity in the facilities for the production of civil construction machinery such as small size back hoes, transport vehicles for industry use and mobile working stations. There are already established construction equipment manufacturers in the Indian market and severe competition can be expected, but this would be worth studying in the future flexible manufacturing system for the tractor production.

## F. Direction of Marketing Strategy

### i. Increase market share through expansion of production

The several reasons for HMT's loss of market share include poor quality of the products and a weak sales force. Among them, the biggest and the most direct problem is considered to be HMT's insufficient production capability to catch up with the increase in demand. HMT should try to expand present production by at least the same rate as the rate of market increase. Increase of market share does not only increase turnover but also decreases the production cost through economies of scale as well as the learning curve effect.

### ii. Establishment of better communication between production and marketing

HMT has recently encountered several technical problems relating to gear boxes and hydraulic systems. HMT-3511 is especially prone to problems in the gearbox. These problems are usually found first by dealers and the first line sales persons, but production people seem to be unaware of the problems or are ignoring them. These kind of problems brought by customers or found by dealers must be picked up by marketing people, and necessary actions must be quickly taken by production people. For this, establishment of better communication among dealers, marketing and production people is vital.

To improve communication among the three parties, establishment of better organization is to be determined. With better communication, information concerning both production and marketing is shared in common among all the parties concerned, which leads to the development of high quality tractors that farmers really want.

### iii. Expansion of dealer network

HMT has 186 dealers, excluding State Agro Coop., throughout India, placing it fifth among the major tractor manufacturers following M&M, Escorts, PTL, and Escorts Tractors. Since the sales of tractors is directly related to the number of dealers, HMT is urgently



required to expand the dealership network.

To catch up with the increasing demand, it is imperative to establish a more intensive sales network through by setting up new dealers throughout India.

Since HMT's dealers are geographically concentrated in the middle and northern parts of India, such as in the states of Uttar Pradesh, Madhya Pradesh, Haryana, Punjab, and Rajasthan, the areas to be emphasized might be the middle and southern areas where HMT's dealership network is weak. The reinforced dealership network is expected to shorten the delivery time of tractors as well as to give farmers better after-sales service.

Dealers basically have two functions: sales and after-sales service. HMT's after-sales service system is often criticized by its customers. One example is that HMT often takes longer to fix tractors than its competitors. For better after-sales service, it is necessary for HMT to support dealers intensively. Training and education of dealers as well as establishment of a quick delivery system of components and equipment are also important. To implement these dealer supports, HMT may need to expand its regional offices. In that case, it is recommended that a demonstration area in the same site be established so that potential customers can try HMT tractors.

#### iv. Flexible pricing policy

Although seven tractor manufacturers are competing with one another in the same market, all of them can still make a profit because the demand is bigger than the supply. This supply-demand relationship may not last long, and the expensive or low quality tractors will no longer sell. To prepare for this situation, cutting down of cost through the streamlining of the production process as well as quick and flexible pricing may be necessary. In case of pricing, the present system, where pricing is determined by the pricing committee, would not function properly. Wide range of authority including determination of prices should be delegated to the marketing department so that prompt action, in accord-

ance with the change of circumstances, can be taken.

#### v. New product development

One of the most important things to do before development of new products is the continuous improvement of existing products. It enables HMT to lower the production cost and increase profit with smaller effort.

Some examples of improvements in existing products include faster speeds of tractors and more fuel efficient engines. Development of fuel efficient engines is particularly important from the viewpoint of the national economy since most of the oil consumed in the country is imported. Synchromesh gear development should be hastened from an ergonomic viewpoint. Furthermore, tractors with higher horsepower are demanded in the southern part of India for the cultivation of stubborn land. As for new products, HMT should first consider the utilization of the existing technology. One example is earth moving equipment, which could be manufactured with minimal modification of the present tractors.

Priority may be put on development of a rice-planter, which is considered to have big demand in the future.

Application of engines to other usages such as generator sets and pump sets is worth considering.

#### vi. Export promotion through technology development

As implied by the number of Indian tractors exported, which was only 357 in 89/90, none of the tractors manufactured in India are very competitive in the international market. Some of the major problems are obsolete technology, insufficient horsepower and lack of an overseas after-sales service network.

India is behind in technology in fields such as development of synchromesh gears and four-wheel drive tractors. It is said that the development of such technology has not been pursued because Indian farmers do not necessarily need such features. These kinds of features, however, are popular among products overseas, and thus,

HMT needs to develop and accumulate technology to consider exports seriously. At the same time, it is foreseen that the present models sold in the country are going to shift to more sophisticated products with higher technology. HMT, therefore needs to continue R&D activities on advanced technology not only for promotion of exports but also in preparation for the next generation tractors in the Indian market.

### G. Necessary Measures Concerning Cost Reduction

Though there is competition in the domestic market today, the Indian market is basically a seller's market, which may continue for some time. Therefore, outside pressure for rigorous cost reduction is still weak as compared with in other countries.

There are several points to improve the cost performance.

Table IV-5-12 Tractor Cost Breakdown

Tractor	Material Cost	Labor Cost	Admin. Cost	Total
HMT-2511	66,800 (86%)	9,500 (12.2%)	1,526 (1.8%)	177,826
HMT-3511	73,000 (86%)	10,100 (12.0%)	1,662 (2.0%)	84,762
HMT-5911	115,800 (88%)	13,500 (10.0%)	2,586 (2.0%)	131,886

Note: Value in Rs. as of Apr. 1991

The material cost dominates, in which the prices of procured boughtouts determines the total cost; the price negotiation depends heavily on the amount of the production. Also mutual cooperation for the improvement in the cost performance is vitally important, where the quality-oriented activities, such as TQC and VE would be effective. It should be noted that the design department's cooperation is essential for these improvements.

## H. Necessary Measures Concerning R&D

### 1. Manpower

The current human resources for the R&D are:

R&D Staff	35
Design	41
<hr/>	
Total	76

Out of a total of 3,224 employees, in which there are 1,405 indirect employees, this total number of 76 R&D employees is too small. Reinforcement in R&D is urgently required. Inhouse development by R&D and improvement of already acquired outside technology could then be used to enhance competitiveness. R&D personnel should be closely attached to the outside information sources, contacting directly the operation sites of the tractors.

### 2. R&D Facilities

CAM/CAD applications, standardization, and modulization should be stressed in R&D, and the office environment should then be renovated accordingly.

The renovation of R&D facilities should be designed to expedite the development of additional features in the tractors for export and future inland needs such as four wheel drive, synchromesh gear drive, a greater number of forward and reverse speeds, and ease of operation.

## IV-6. Dairy Machinery

### A. Market and Competition Analysis

#### 1. Inland Market Analysis

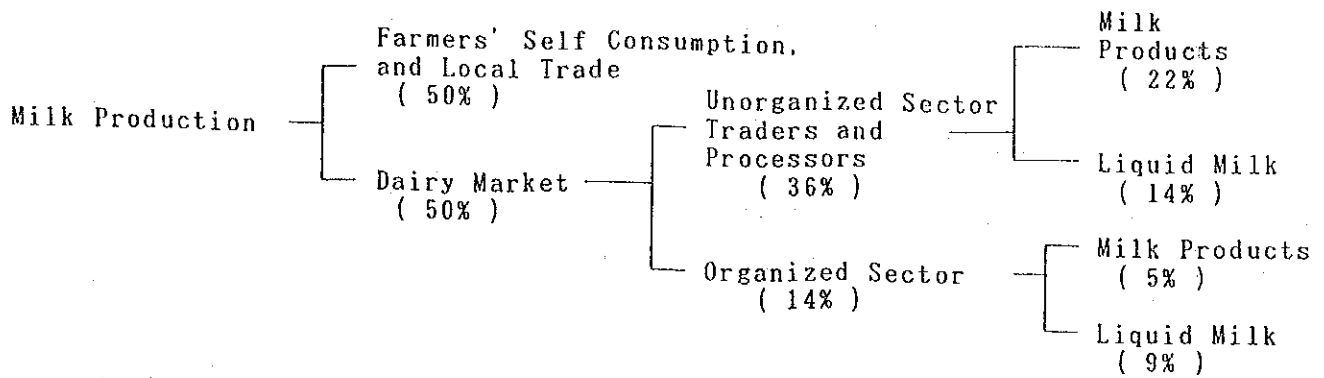
##### (a) Production of dairy products in India

Production of milk in India has been growing through the 1980's as illustrated in Fig. IV-6-1. In 80/81, the milk production was 31.6 million tons, and it has increased to 49.9 million tons in 89/90. During the period, it increased at an annual rate of 5.2 percent. Per capita consumption of milk also increased from 128 grams a day in 80/81 to 168 grams a day in 89/90, which was a 31 percent increase.

Table IV-6-1 Production of Milk in India (million tons)

80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90
31.6	33.5	35.0	36.3	37.8	42.3	44.1	45.9	47.9	49.9

It may be mentioned that dairying in India is essentially a cottage activity even today. Milk processing activities are, however, gradually being institutionalized although even now an estimated 50 percent of the milk production is processed and consumed locally. The next largest proportion of milk production is channeled through small semi-urban or urban trading/processing units, which are called dairies or 'halwais.' The following exhibit provides the current usage pattern of milk.



(b) Dairy Machinery in India

An estimate of milk processing patterns on an overall basis including both organized and unorganized sectors is shown below. Since 1951 no significant change has occurred in the dairy product mix although there have been some ups and downs by product. In 87/88, 46 percent of dairy products was taken by processed liquid milk, followed by ghee, and these two products jointly occupy 84 percent of the total market. On the other hand, popular dairy products in the western countries such as ice cream and cheese account for merely 2.2 percent.

Fig. IV-6-1 Milk Production in India in the 1980's

Unit: million tons

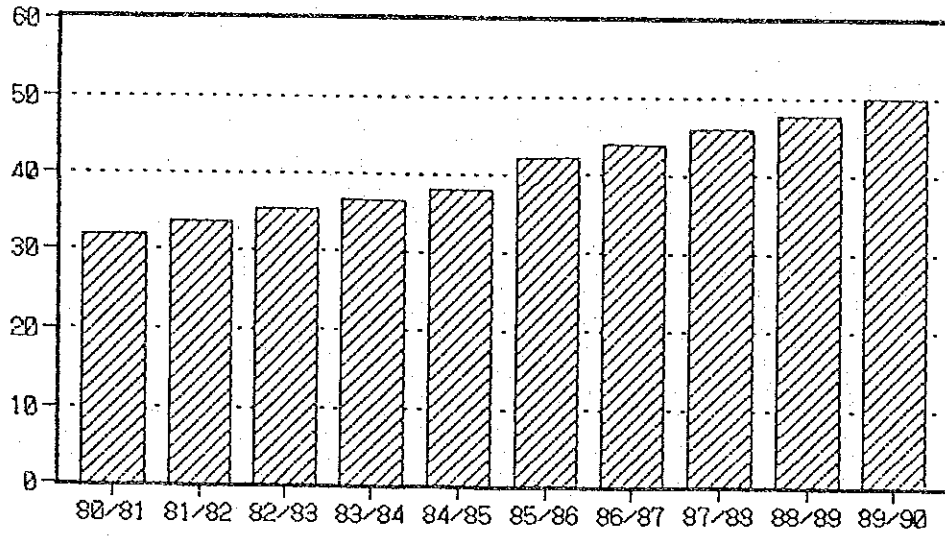




Table IV-6-2 Milk Processing Pattern in India

	1951	1961	1986/87	1987/88
Liquid Milk	39.3	45.1	46.0	46.0
Milk Powder	-	-	3.4	2.6
Ghee	39.3	31.8	28.0	28.0
Butter	6.0	6.4	6.5	6.5
Khoa	4.4	4.7	5.5	5.5
Cream	0.5	1.9	0.5	0.5
Curd	8.8	8.1	7.0	7.0
Ice cream	0.7	0.7	0.2	0.2
Cheese	-	-	2.0	2.0
Others	1.0	1.3	0.9	1.7
	100.0%	100.0%	100.0%	100.0%

In the Indian context, dairy machinery includes plant and equipment used to store, transport and process milk into liquid milk (pasteurized, sterilized, flavored etc.) and other products like butter, ghee (clarified butter), cheese, ice cream and various kinds of Indian sweets. The types of plant and equipment used are as follows:

- Storage : Bulk milk cooling tanks (including chillers based on plate heat exchangers)
- Transportation : Road/rail milk tankers
- Processing : Pasteurizing plants, Bottling/packing plants, Butter churns/cream separators, Evaporation plants, Spray drying plants

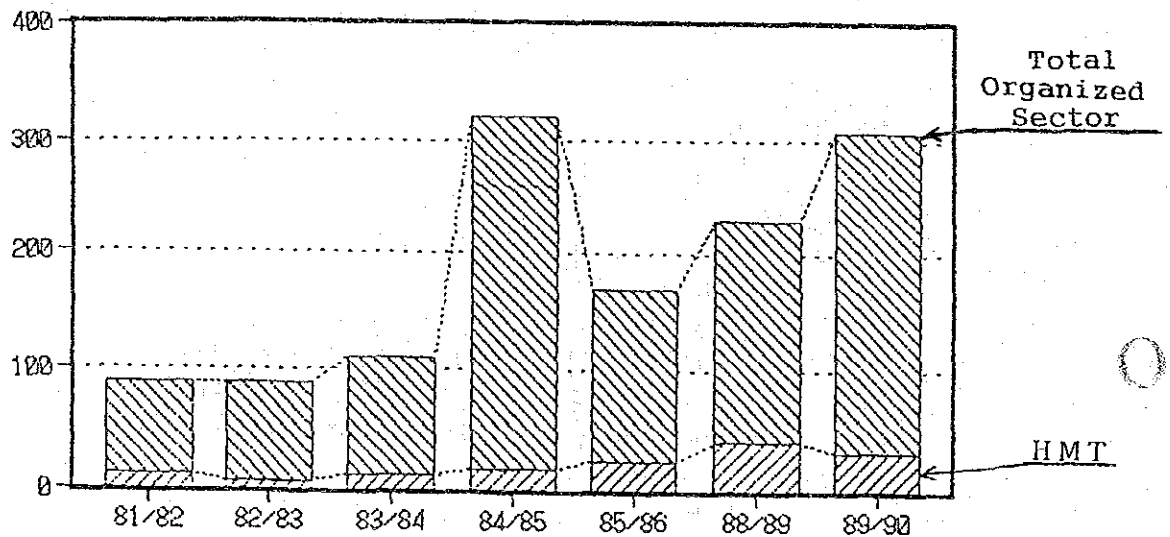
There is little standardization of equipment, most of it being tailor-made to specific customer requirements. Since most types of equipment are simply fabricated items of stainless steel and aluminium, a large proportion of the fabrication is done in the unorganized sector. The main customers are unorganized traders and processors, which are estimated to occupy approximately 70 percent of the market. For the balance, the market is primarily for turnkey installation of customized plants

rather than for discrete equipment as such, and the market is occupied by nearly 14 organized dairy machinery manufacturers.

Fig. IV-6-2 shows the turnover of the 14 large manufacturers of dairy machinery equipment since 81/82. As can be seen, the production in the organized sector has grown at an annual rate of 17 percent in nominal terms, or 8 percent in real terms, between '81 and '90, and the size of the market reached approximately 300 million rupees in 89/90. There have been wide fluctuations in the size of the market from year to year. These fluctuations are said to be on account of fluctuation in project funding approvals. The growth in processing capacity should be much higher in the future because the percentage of milk being processed in the organized sector is expected to increase at an annual rate of 6 to 8.5 percent through to the end of the decade.

Fig. IV-6-2 Production of Dairy Machinery in India

Unit: Rs. million



(c) Competitiveness

Alfa Laval is the largest manufacturer of dairy machinery in India in the organized sector which is comprised of 14 manufacturers and is said to occupy approximately 75 percent of the whole market, which amounts to as much as 300 million rupees. The company is a subsidiary of a Swedish company, who is a world leader in dairy machinery technology with a wide product range and a vast marketing network. According to industry sources, one of the reasons for Alfa Laval's success in India is that its principal supplies technology and provides design support on a regular basis.

Some of the other competitors are Filtron, Rifox, Kristam, Larsen & Toubro and West Falia, but they all are much smaller in production volume than Alfa Laval. For major dairy machinery, competitiveness of these companies is evaluated relative to HMT as illustrated below. " S " means the products are regarded to be superior to HMT's. By the same token, " M " is nearly the same as, and " I " is inferior to HMT's.

Table IV-6-3 Competitiveness of Major Dairy Machinery Companies

	Alfa Laval	Filtron	Rifox	Kristam	L&T
Milk Separator	S	-	-	-	-
Pl. Heat Exchanger	S	I	I	M	I
Ind. Pl. Heat Exchanger	S	M	M	M	I
Pumps	S	M	-	-	I

The production of dairy machinery is gradually being shifted to the organized sector, but a drastic shift may not occur since governmental subsidies on agriculture give priority to the unorganized sector over the organized sector.

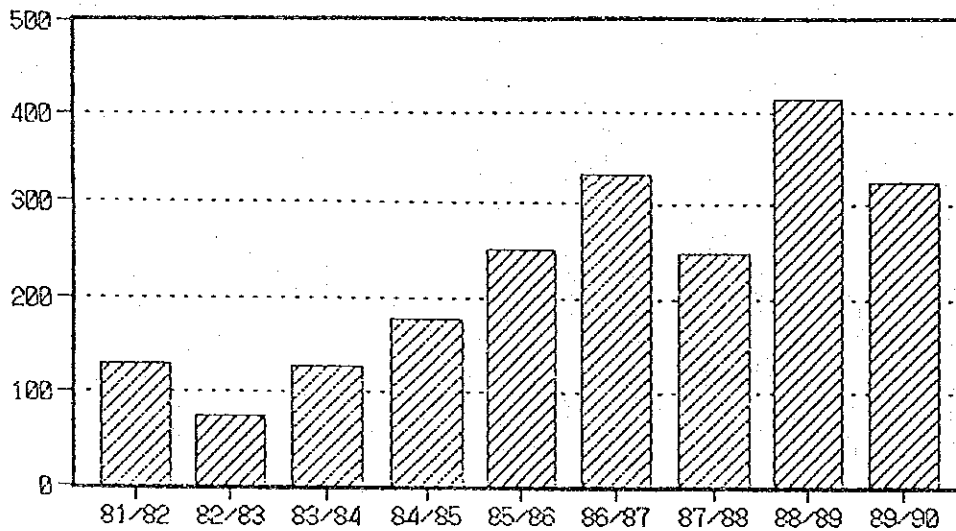
Governmental subsidies such as one conducted through the "Operation Flood" national plan take a substantial proportion of the total demand for dairy machinery in the country, and thus the competition is not always

determined by the simple bargaining power of competitors.

Fig. IV-6-3 illustrates HMT's production trend during the eighties in terms of value. The production fluctuated widely year to year, and achieved market shares between 5.5 percent and 18.2 percent. In recent years, it has occupied around eight percent of the market.

Fig. IV-6-3 Production Trend of HMT Dairy Machinery

Unit: Rs. 100 thousand



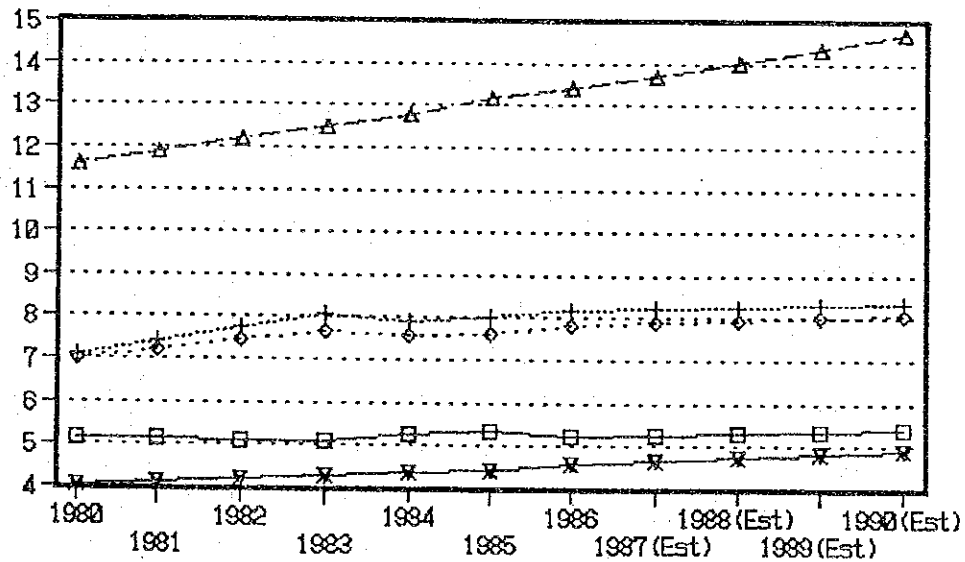
## 2. International Market Analysis

The production of major dairy products in the world between '77 and '86 is shown in Fig. IV-6-4. As can be seen, production of all the products grew during the period, but the rate of the growth was so small that even the production of cheese, which showed the highest growth, grew at an average annual rate of 2.8 percent only. Condensed milk showed the smallest growth at 0.17 percent. The international market for dairy machinery on the whole is considered to be saturated.

The market has been saturated in such areas as the U.S. and the European countries, however in most of the Asian countries, the market continues to grow. For example, in India, Pakistan and Japan, the production of butter has increased. The production of ice cream has shown high growth in Japan and Korea, too. It is foreseen that the African countries have the same trend as is seen in the Asian countries although no statistical data is available.

Fig. IV-6-4 Production Flow of Dairy Products in the World

Unit: thousand tons



□ Condensed Milk/Cream + Dried Milk/Cream    ◇ Butter    △ Cheese    × Ice Cream

## B. Product Competitiveness Analysis

Table IV-6-5 indicates the comparison of the competitiveness, in which Alfa Laval shows exceptional strength.

Table IV-6-5 Competitiveness - Price, Quality with Respect to HMT

Product Group	Major Competitor											
	Alfa Laval		West Falia		Filtron		L & T		Rifox		IDMC	
	Price	Qlty	P	Q	P	Q	P	Q	P	Q	P	Q
Separators	H	H	H	H	-	-	-	-	-	-	-	-
Plate Heat Exchangers (Chillers/Pasteurisers)	K	H	-	-	L	K	H	H	-	-	K	K
Indl. Plate Heat Exchangers	L	H	-	-	L	K	H	H	L	K	-	-
Pumps	K	K	-	-	L	K	H	K	-	-	-	-
Butter Making Machines	-	-	-	-	-	-	-	-	-	-	-	-
Butter Packing Machines	-	-	-	-	-	-	-	-	-	-	-	-
Ice Cream Freezer/Softy	-	-	-	-	-	-	-	-	-	-	-	-
Homogenisers	K	H	-	-	-	-	-	-	-	-	-	-

Note: Degree of Competitiveness: H = High  
 K = Medium  
 L = Low

## C. Production Facility and Production Technology Assessment

### 1. Production Facility

The configuration of production facilities is simple. Conventional single-purpose machines prevail with partial introduction of CNC lathes. The factory building is well designed with appropriate overhead cranes. The work floor is currently sub-divided, but in the future expansion plan, it should be opened to give easier production control.

### 2. Product Technology

HMT should be classified in the medium range in comparison with competitors in technology level and quality of products.

### 3. Production Technology

Development of production technology would be an important future issue for HMT to pursue its the expansion and diversification. The standardization of the components and units, and their combination in the modular configuration would determine the variety of the products, responding immediately to the demands of the market with competitive cost.

#### D. Input Factor Analysis

##### 1. Workers

Manpower at the Dairy Machinery Division is well balanced both qualification-wise and age-wise. The group of young workers is well motivated and the discipline is well maintained.

##### 2. Raw Materials and Components

The small volume of production makes procurement difficult, which should be improved through the process of VA, VE and TQC activities.



## E. Identification of Prospective Product Groups and Product Mix

The production of milk in India is projected to grow at 2.5 to 3 percent during the nineties. During the period, the production of dairy machinery in the organized sector is expected to increase at an annual rate of 6 to 8.5 percent. Considering the above, it may be said that all types of dairy machinery have some potential demands in the future.

Although the total demand for dairy machinery is increasing, the size and the growth for each type of machinery differs. Among HMT's present product range, industrial heat exchangers are considered to have the biggest market potential, then pumps, followed by oil expellers. All of these are expected to grow at average annual rates of more than 10 percent. On the other hand, as the eating habits of Indian people become westernized, it is expected that more western foods such as ice cream and cheese will be consumed. Thus, other potential machinery may include ice cream freezers and cheese processors as well as milk homogenizers. HMT should not limit its product range to dairy machinery but extend to food processing machinery.

Observing the present dairy activities in India from upstream to downstream, firstly, milking operations are manual in widely dispersed locations where the number of cattle may be as low as one and usually between two and ten. In the long run, however, milking is going to be concentrated into large-scale farms and cooperatives, and for labor saving, use of vacuum milking machines could pick up. Secondly, fresh milk is to be packed before distribution. In this stage, machinery for pasteurization, sterilization and aseptic packing is required. Thirdly, for distribution of dairy products to the final consumption locations from dairy processing plants, which tend to become bigger in size and farther from the final consuming places, development of cold chains is expected to grow in the country. The cold chains are made possible by development of new transportation means such as trucks equipped with refrigerated milk tanks and railroad cars equipped with refrigerated containers. It may be easy for HMT, in collaboration with transportation machinery companies, to enter into this field when the demand picks up by utilizing its production technology of plate heat exchangers.