資料4－2 The Philippine Tool and Die Making Industry

The Philippine Tool & Die Making Industry

MIRDCにて
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Chapter I Introduction

Background

The Tool and Die Making Industry is a strategic sector of the metals and engineering industries. As categorized by the International Special Toolings Association (ISTA), this industry produces the molds, dies, jigs and fixtures that form the heart of the mass production system of our manufacturing industry. This enables our manufacturing industries to raise productivity with consistent product quality standard. Thus, the development of the tool and die making industry is imperative for the attainment of the country's goal of becoming a newly-industrialized country.

A multi-sectoral action towards this goal has been initiated with the formulation and implementation of the Metals and Engineering Industries National Action Plan 1990-2000. One of the leading-edge foci of the Plan is the Development Program for the Tool and Die Making Industry, stressing its importance to industrialization. This study is among the first actions of the Program.

Objective

The main objective of the study is to highlight the importance of the tool and die industry and to serve as an effective planning tool for industry and government decision-makers by presenting an overview of the tool and die making industry.

Scope and Limitations of the Study

The study is basically a profile of the industry. A brief description of the tool and die making process is included with consolidated data on equipment, manpower, and raw materials.

Indicative 1990 production data and commercial information is provided. In-depth analysis of the industry's problems and prospects and the corresponding development program for the industry are also presented.

Data were mainly gathered from existing shops in and around Metro Manila. Primary data were based on interviews and plant visits to firms with die making facilities. Secondary data were gathered from metal handbooks, technical journals, the National Statistics Office, the Securities and Exchange Commission, brochures and other relevant industry studies.

Nature and Uses

Tool and die making is a highly engineered metalworking technology for producing molds, tools and dies. Molds, tools and dies are precision metal components installed in a forming machine as a master to form the shape of a variety of end products which can be made of metal, glass, rubber, ceramics, or any of the newly-developed composite materials. The processes employed in forming these end-products are forging, pressworking, stamping, die-casting, extruding, drawing, spinning, rolling and other specialized processes, all of which are characteristically for mass production with consistent product quality.

The usage of molds and dies is invisibly evident in constantly everything we use such as in appliances, electronics, automobiles, toys, office equipment, agricultural and industrial machineries, communication equipment, etc.

Firms in the Industry

The Metals Industry Research and Development Center (MIRDC) has identified sixty two (62) tool and die making shops in the country specifically located in and around of Metro Manila. A total of fourty four (44) shops responded to the industry survey. Of these respondents twenty nine (29) are classified as independent shops and fifteen (15) are in-house shops. The latter are facilities owned by large manufacturing companies to exclusively service their requirements for molds and dies, while independent shops offer tool and die making services to other manufacturing companies. Annex 1 lists these companies according to their classification.

Year Established

The Philippine tool and die making industry is practically in its initial phase of development after evolving from general machining operations as compared to our industrialized neighbors. Chronologically, seven (7) facilities started machining services with limited die-making operations from 1960 to 1970. Then in the 70s, twenty (20) more facilities were opened while seventeen (17) shops were founded in the 80s. Table 1 shows the chronological establishment of tool and die shops.

Table 1
Chronological Establishment of Existing Tool and Die Shops

Years in Business	No. of Shops	% Share
1960 - 1969	7	16
1970 - 1979	20	45
1980 - 1990	17	39
TOTAL	44	100

Organizational and Ownership Structure

Twenty-six (26) of these facilities are organized under corporations, of which fifteen (15) are as in-house die-making shops of manufacturing firms. Sixteen (16) are organized as single proprietorships. One (1) shop is registered as a partnership while another shop, at MIRDC, is owned and controlled by government.

A total of thirty-nine (39) shops are owned by Filipinos almost half of which are of Chinese descent while five (5) shops are owned by multinationals. Tables 2 and 3 show the Organizational and Nationality Ownership Structure of the respondent shops.

Profile of Capitalization

The profile of capitalization of these respondent companies is presented in Table 4.

Seventeen (17) of the shops have Ps.1M to under Ps.5M in capitalization while eight (8) are capitalized between Ps.5M to under Ps.10M. Twelve (12) shops have below Ps.1M in capital investment and seven (7) shops belonging to the in-house groups have Ps.10M and above capitalization. This profile indicates that the tool and die making industry is inherently categorized as medium-scale.

Table 2
Organizational Structure

Category	No. of Shops	% Share
Corporation	26	59
Proprietorship	16	35
Partnership	1	3
Government Institution	1	3
TOTAL	44	100

Table 3
Nationality Ownership Structure

Type	No. of Shops	% Share
Filipino-owned	39	87
Multinationals	5	11
TOTAL	44	100

Table 4
Profile of Capitalization

Capitalization	No. of Shops	% Share
Under P1 M	12	27
P1 M to under P5 M	17	39
P5 M to under P10 M	8	18
P10 M and above	7	16
TOTAL	44	100

Geographical Location of the Firms

All of the facilities, except for three in-house shops are located in Metro Manila, where industrial manufacturing activity is heaviest. Not even Metro Cebu, which has a considerable machine shop sector supporting its industrial firms, has a shop which produces dies and molds. Table 5 shows the geographical breakdown of these facilities.

Caloocan City has the most number of tool and die shops at fourteen (14), followed by Mandaluyong with six (6), the other Metro Manila cities and municipalities have from one (1) to four (4) shops. Batangas, Laguna and Bulacan have one tool and die facility each as in-house shops.

Table 5
Geographical Distribution of Shop Locations

Location	No. of Shops
Metro Manila	
Caloocan City	14
Makati	2
Malabon	1
Mandaluyong	6
Manila	3
Muntinlupa	2
Navotas	1
Parañaque	1
Pasay City	2
Pasig	4
Quezon City	2
Taguig	2
Valenzuela	1
Batangas	1
Laguna	1
Bulacan	1
TOTAL	44

Employment

The employment profile for tool and die making classified accordingly to type of personnel is shown in Table 6.

The consolidated employment records of respondent tool and die shops is about one thousand one hundred sixty-seven (1167) with nine hundred ninety (990) technical personnel and one hundred seventy seven (177) administrative employees.

Analyzing further, Table 7 classifies personnel according to type of shop where seven hudred eighty-six (786) personnel were engaged by independent shops while in-house shops employed three hundred eighty one (381) tool and die making related personnel.

Table 6
Employment Profile Classified According to Type of Personnel

Type of Personnel	No. of Persons	% Share
Technical	990	85
Administrative	177	15
TOTAL	1167	100

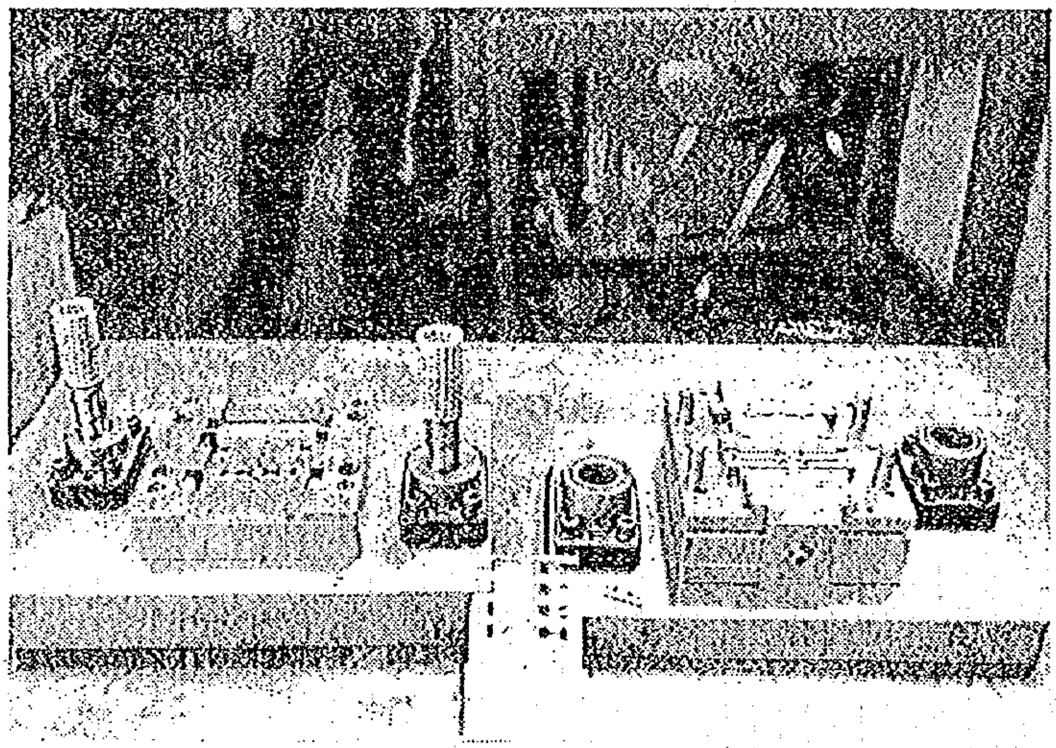
Table 7
Employment Profile Classified According to Type of Shop

Type of Shop	No. of Persons	% Share
Independent	786	67
In-house	381	33
TOTAL	1167	100

Table 8 presents the employment profile classified according to the number of employees per firm. Ten (10) shops employ less than 10 persons, twenty three (23) shops engage from 10 to below 25 persons, eight (8) shops maintain from 25 to below 50 personnel and three (3) shops have more than 50 workers. In Japan, US and Europe, the average employees of die shops range from nine to fifteen.

Table 8
Employment Profile Classified According to Number of Employees Per Firm

Employment	No. of Shops	% Share
1 to below 10	10	23
10 to below 25	23	52
25 to below 50	8	18
50 and above	3	7
TOTAL	44	100



Die assembly used to produce alligator clips
(Courtesy of Maximetals Ind., Inc.)

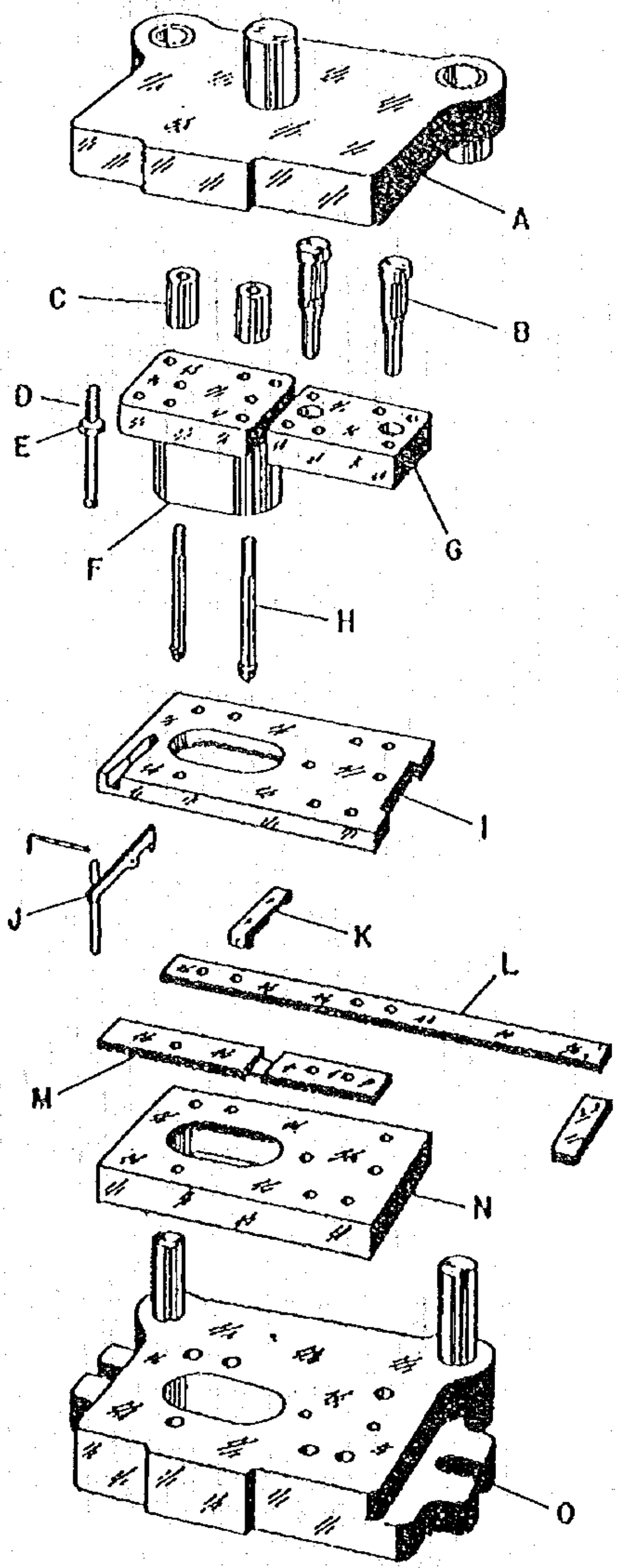


Figure 1

An Exploded View of a Pressworking Die

A — Punch holder of die set
B — Piercing punch
C — Pilot nut
D — Square head set screw
E — Jam nut
F — Blanking punch
G — Punch plate
H — Pilot
I — Stripper plate
J — Automatic stop
K — Finger stop
L — Back gage
M — Front spacer
N — Die block
O — Die holder of die set

Mold/Die Assembly

A mold/die assembly can be described as consisting of a mating upper and lower shoe containing all the mold/die elements for doing the desired work. The mold assembly and the tool and die assembly are fundamentally different due to the forming operation they perform.

Due to the diversity of mold/die designs according to their functions, this section has opted to focus its description of a die assembly on a pressworking die and a mold assembly for plastic molding which are among the first and widest applications of molds, tools and dies.

Die Assembly

A tool and die assembly is used for operations of forming materials in the cold or even hot state such as in pressworking, stamping, forging, and drawing of metals, plastic and rubber. In these operations, the blank material is placed between the assembly and then the tool is mated with the die to form the end product.

Figure 1 shows the exploded view of a pressworking die (which is classified as a compound die) performing a piercing and blanking operation on a strip of metal. Figure 2 shows the die as assembled.

Among the major components of this die assembly are:

1. Die set — is a mating pair of plates on which all parts comprising the die assembly may be mounted. This is usually made by several manufacturers and may be purchased in a variety of shapes and sizes.

2. Die shoe — is the upper plate or block upon which a die holder and in which guide posts are mounted.

3. Die holder — is the lower plate or block of the die set upon which the die block is mounted.

4. Die block — a block or plate of hardened tool steel out of which the die is cut and to which sections or parts of the die are secured.

5. Guide posts — pins usually fixed in the lower shoe and accurately fitted to bushings in the upper shoe to ensure precise alignment of the two members of a die set.

6. Punch holder — the plate or part of the die which holds the punch.

7. Punch — the male die part, usually the upper member and mounted on the slide, which performs the operation of producing holes which may be for piercing small holes or blanking large areas of mate...

8. Pilot — a pin or projection provided for locating work in subsequent operation from a previously punched or drilled hole.

9. Stripper plate — a plate used to remove the workpiece or material strip from the punches.

10. Back gage — is a thin steel member against which the material strip is held by the press operator in its travel through the die.

11. Front spacer — is the opposite steel member of the back gage which supports in grinding the material strip through the die.

12. Finger stops — sometimes called the primary stop for dies with two or more stations, is a small strip of steel that positions the strip raw material for each operation. The number of finger stops depends upon the number of die stations.

13. Automatic stop — a device for positioning stock in a die or to initiate

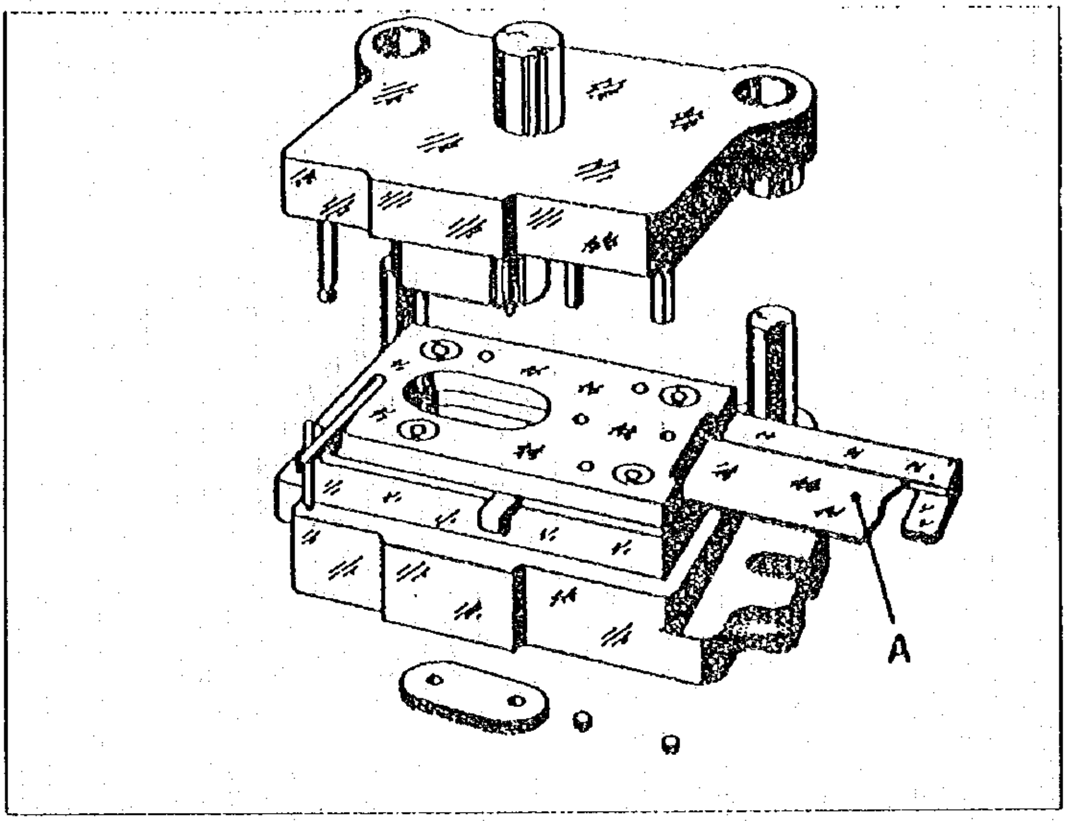


Figure 2
A pictorial view of an entire die

the stopping action of a press after a complete cycle or upon operating trouble.

Traditionally, dies have been classified according to the number of operations or stages it can perform:

a. Simple Dies are those intended to perform one operation. The operation may be either cutting type or forming type. This type of die is usually of the simplest possible arrangement and construction consistent with the intended quality of product and life of the die.

b. Compound Dies are single stage dies for performing two or more operations of the same general type. The several operations may be performed simultaneously or in sequence. The most important characteristic of this die is that all operations are performed on the part in one location.

c. Progressive Dies are multi-stage dies in which two or more operations are performed during the same stroke of the press but at several work stations. The work is fed progressively through several stages, and one or more operations may be performed at each stage. A progressive die actually may consist of several simple dies mounted on common supporting elements. Some progressive dies incorporate combination and compound as well as simple stages.

d. Special Dies are those whose design and functions are so radical that they possess none of the dominant characteristics of the more general classes of dies. Typical dies which can be classified in this category are lateral trimming dies, hydraulic dies, universal dies, and rubber dies.

Recent classifications as adopted in Japan now take into consideration the degree of precision as an important factor. These are the following:

a. Block-type simple single process die/mold

b. York-type division die/mold

A relatively high precision die/mold manufactured using surface grinding. This usually consists of several stages.

c. Insert-type high precision die/mold

This consists of two variants. The first design variant involve the placing of a part (or an insert), which may or may not be of the same raw material into the die before the forming operation into the end-product. This part is embedded into the die and becomes a part of the end product. The second variant involves interchangeable die/mold parts which permit variation in sizes and configuration of the end product.

Mold Assembly

A mold assembly is used for operations for forming materials in the liquid or semi-liquid state such as metalcasting, die casting, plastic injection molding, glass moulding, rubber molding, and ceramic extrusion. In these operations, the molten material is poured into the mold assembly and allowed to cool into the shape of the mold to form the end product.

Basically, a mold consists of a plunger and a cavity which form the actual molded part. Supplementing these are the frame components which provide support and guidance and also the operating members which simplify removal of parts from the mold. A typical mold for plastic cup shown in Figure 3 illustrates the fundamental components normally required in a semi-automatic compression mold.

The mold plunger and cavity may be made from alloy steels or tool steels. Table 9 summarises suitable materials for a given type of mold and die.

Molds are available in several types of cavity designs to produce a given molded part. Such types are the following:

1. Flash type — usually are of the simplest plunger and cavity relationships. The cavity is machined only as deep as the desired molded part and the excess molding compound overflows only in a horizontal plane. While this construction may be the most economical from the standpoint of original tooling, overall advantages and disadvantages should be considered before manufacture of this or any other plunger and cavity design. Generally the flash type design is used for compression-type molding.

2. Positive type — The action of the truly positive design may be likened to that of a piston trapping the molding compound and forcing it into the cavity. Inasmuch as there is no land surrounding the cavity, the full molding pressure is exerted against the compound, and the resultant density of the molded part is uniformly good. Uniformity of flash burr is another characteristic of this type of mold since the only flash escape occurs as a vertical burr between the fit of the plunger and cavity.

One of the critical features of this type of mold is the necessity of accurate weighing of the molding compound. Any excess material simply tends to increase the thickness of the part, and it is therefore difficult to maintain close tolerances on vertical dimensions.

3. Semi-positive type — The semi-positive design is a variation of the basic truly positive type. This design behaves somewhat as a flash type mold until the last fraction of an inch of closure, when the short positive portion of the plunger enters the cavity depression. This design permits overflow of slight excess of compound charge while retaining good alignment between plunger and cavity. The uniform burr characteristic is especially beneficial for finishing operations, particularly if belt sanding can be utilized.

4. Landed plunger type — This design incorporates many of the desirable features of other types previously described. Loading space is attained by allowing necessary space in cavity block above cavity cut-off line. The entering plunger provides excellent alignment between elements molded above and below the parting line. Wear which may occur between plunger and cavity walls ordinarily does not affect the molded part since these lines of friction are outside the outline of the molded part. Reasonable control of compound weights is required although the situation is far less critical than in the truly positive design.

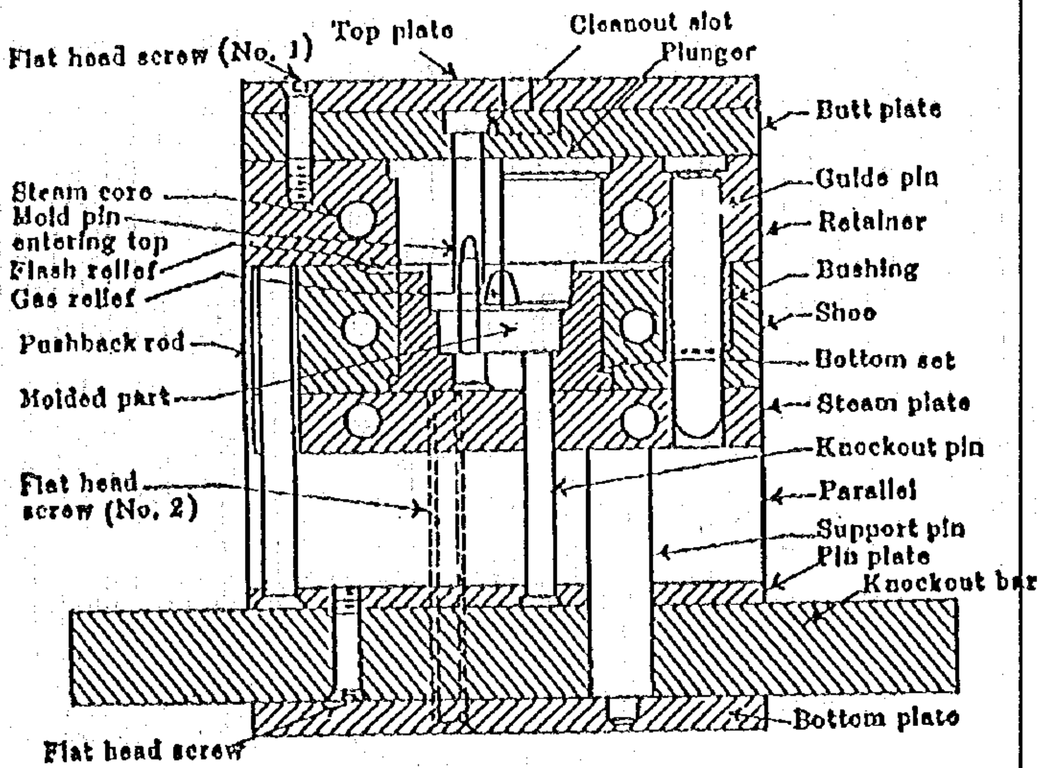


Figure 3
Conventional bottom-knockout compression mold

5. Subcavity type -- This is a hybrid capacity which may be adapted to high production multiple-cavity molds for relatively small simple parts. A horizontal line of flash will be noted between the various individual cavities.

Process and Technical Operations

The current technology level of mold and tool and die making is characterized as equipment intensive and skill intensive. In the Philippine setting, however, it is still regarded more as a craft rather than a technology. The main technologies for die making are design technology and fabrication technology.

Design Technology

Mold and die design technology consists of making several engineering decisions on the elements critical to the die and then drafting the engineering drawings according to its decided specifications.

Die design must satisfy two primary concerns that are interrelated. The first concern is functional. This concerns designing a die that will

Table 9

Type of Die and Mold Material Standard

Type of Die or Mold	Steel Material for Use
Press Die	Rolled steel for general construction (SS), carbon steel for mechanical construction (SC), carbon tool steel (SK), alloy tool steel (SKS.SKD), Preharden steel, high-speed tool steel (SKH), WC, P/M high speed steel, powder die steel, flame hardening steel, ceramics
Forging Die	Structural alloy steel (SC.SCM.SNCM), carbon tool steel (SK), alloy tool steel (SKT.SKD), precipitation hardening steel
Casting Mold	FC.BC.AC.CKA alloy tool steel (SKD), stainless steel (SCS), heat-resisting steel, heat-resisting alloy, copper alloy
Die-Casting Die	Structural alloy steel (SC.SCM.SNCM), carbon die tool steel (SK), alloy tool steel (SKS.SKD), high-speed tool steel(SKH), maraging steel, precipitation hardening steel, ceramics
Plastic Mold	Rolled steel for general construction (SS), Structural alloy steel (SC.SCM.SNCM.SACM), alloy tool steel (SKS.SKD), preharden steel, high-speed tool steel (SKH), mirror surface, wear-resisting, corrosion-resisting stainless steel, copper alloy, aluminum alloy, P/M high speed steel, high-hardness stainless steel
Rubber Mold	Rolled steel for general construction (SS), structural alloy steel (SC.SCM), alloy tool steel (SC.SCM), cast iron, aluminum castings, SKS, SKD, SKH
Mold for Glass	Ordinary cast iron, ductile cast iron, meehanite metal, alloy tool steel (SKD), stainless steel (SCS), SUS
Die for Powder Metallurgy	Structural alloy steel (SC.SCM.SNCM), carbon tool steel (SK), alloy tool steel (SKS.SKD), high-speed tool steel (SKH), P/M high speed steel, powder die steel, WC
Mold for Ceramics	Cast iron, structural alloy steel (SC.SDM.SNCM), SKD, P/M high speed steel, powder die steel
Other Molds	Rolled steel for general construction (SS), zinc alloy, structural alloy steel (SC.SCM.SNCM), carbon tool steel (SK), high-speed tool steel (SKH), ceramics, WC, P/M high speed steel, powder die steel, copper alloy, aluminum alloy

conform to the shape of material and dimensional tolerances of a product, and whose service life can produce the number of products required.

The second concern is economic. This concerns designing the most economically manufactured die which can be used. It is in this concern where the mastery of die design is fully employed.

Although this economical concern can be categorically secondary to that of the functional concern, the highly competitive nature of today's manufacturing industries dictates that economical consideration must always be satisfied.

Die design requires mastery of several elements, namely:

a. The shape and size of the product

The intricacy of the product's shape generally determines the type of die to be used whether it is a one process die, compound die, progressive die, or a transfer die.

b. The type and characteristic of the product's material

Different types of materials like metal, plastic, rubber, glass or ceramic have a wide range formability and this will also affect the types of die and the process to be used.

c. The quantity or batch size of the product

It is necessary that a designer knows this element so that the economic service life of the die design will match the service life for producing the required quantity or batch size. Generally, larger quantity or batch sizes require higher grades of die steel material. Likewise, additional metal finishing process may be required.

d. The required dimensions and tolerances

This factor generally dictates the type of machine tool to be used in fabricating a die. Strict dimensional tolerances, as required by most semi-conductor firms, usually entails using specialized machine tools such as EDMs, NCs and CNCs.

e. The forming operation to be used to manufacture the product (function of the die)

Each type of forming process such as forging, pressworking, stamping, die-casting, extruding or drawing have particular die design peculiarities. An example of this is that die-casting for either metals or plastic usually have to provide for design parameters for the flow of the material into the mold, which is not needed for forging or pressworking.

f. The type and specification of the forming equipment

This element is generally necessary to determine the dimension of the die set and its connection to the equipment. Likewise, this element dictates the service condition of the die.

g. Die cost

This economic concern is usually an inverse factor of product batch size, when the value of its production run can not offset or recover the cost of manufacturing the die. In this instance, the designer has the option of disregarding metal finishing processes, using a cheaper grade of die material to lower die cost or even recommending the manufacture of the product by other processes such as direct machining or casting.

h. Product cost

Also an economic concern, a die can be so designed to ensure least wastage of product raw material and to manufacture the most number of products over time and using lesser forming operations. These considerations lead to lower product unit costs.

Fabrication Technology

As functional and economic design considerations are met, die fabrication is then undertaken.

Manufacturing of tool and die parts and components involves several metalworking, metal finishing and quality control metrology processes. The basic process involved is machining of tool and die parts, after which they are heat treated as required. The parts may also undergo industrial (hard) chrome electroplating to further extend its service life. The parts are then subjected to quality control with measurement of dimensions and hardness.

As parts meet required quality parameters, they are then assembled, from which the die assembly is again dimensionally measured.

The die assembly is fitted into the forming equipment with several trial runs conducted and adjustments made as necessary.

Sequentially, Figure 4 shows the Process Flow for Die Making. Die design is initiated with the determination of product specification, namely shape, material, quantity, dimension and tolerance, and cost. From this point, the designer draws up conceptual drawings indicating the process design of the die. Then the designer determines the forming operation and the type of equipment to be used.

After gathering these design elements, the drafting of die engineering drawings is then undertaken. The designer then analyzes the fabrication process required for machining and metalfinishing and produces a cost estimate of die fabrication. This is then evaluated in terms of product cost and batch size to determine economic viability.

In today's advanced stage of die making, as practiced in Japan, the United States and European countries, the following characteristics can be observed.[1]

1. The ratio of machining to manual processing is 70:30%.

2. For precision machining, CAD/CAM (Computer-aided-design and computer-aided-manufacturing) are widely employed mainly based on CNC (computer numerically controlled) machines.

3. The most advanced stages uses FMS (flexible manufacturing system) and CIM (computer integrated manufacturing) where full automation is employed from material handling, processing, and even quality control.

4. New metal finishing technologies for heat treatment and surface treatment have led to the use of materials such as sintered and cast-alloyed tool steels.

Equipment

Tool and die making is an equipment-intensive process most often requiring specialized machine tools, metal finishing and quality control (measuring) equipment to achieve high precision dimensional tolerances. A new equipment slowly being introduced by the industry are computers for computer-aided design.

Machine Tools

The machine tools of the tool and die industry can be categorized under general purpose machining and various specialized machining processes. Table 10 shows the number of general purpose and specialized machine tools.

Classified under general purpose machining processes are conventional turning, milling, boring, grinding, and drilling operations. The respondent shops have a total of seven hundred sixty nine (769) units of general purpose machine tools. These consists of three hundred two (302) units of turning equipment which are basically different types of lathes such as bench, engine, turret and vertical, and one hundred ninety (190) units of milling machines such as universal, horizontal, and vertical. About ninety nine (99) units of drill press, fifty two (52) units of boring machines, and about one hundred twenty six (126) units of grinders were also recorded.

Specialized machining processes are worked on copy lathes, copy milling

1 *Excerpted from JICA 1990 Industrial Sub-Sector Study*

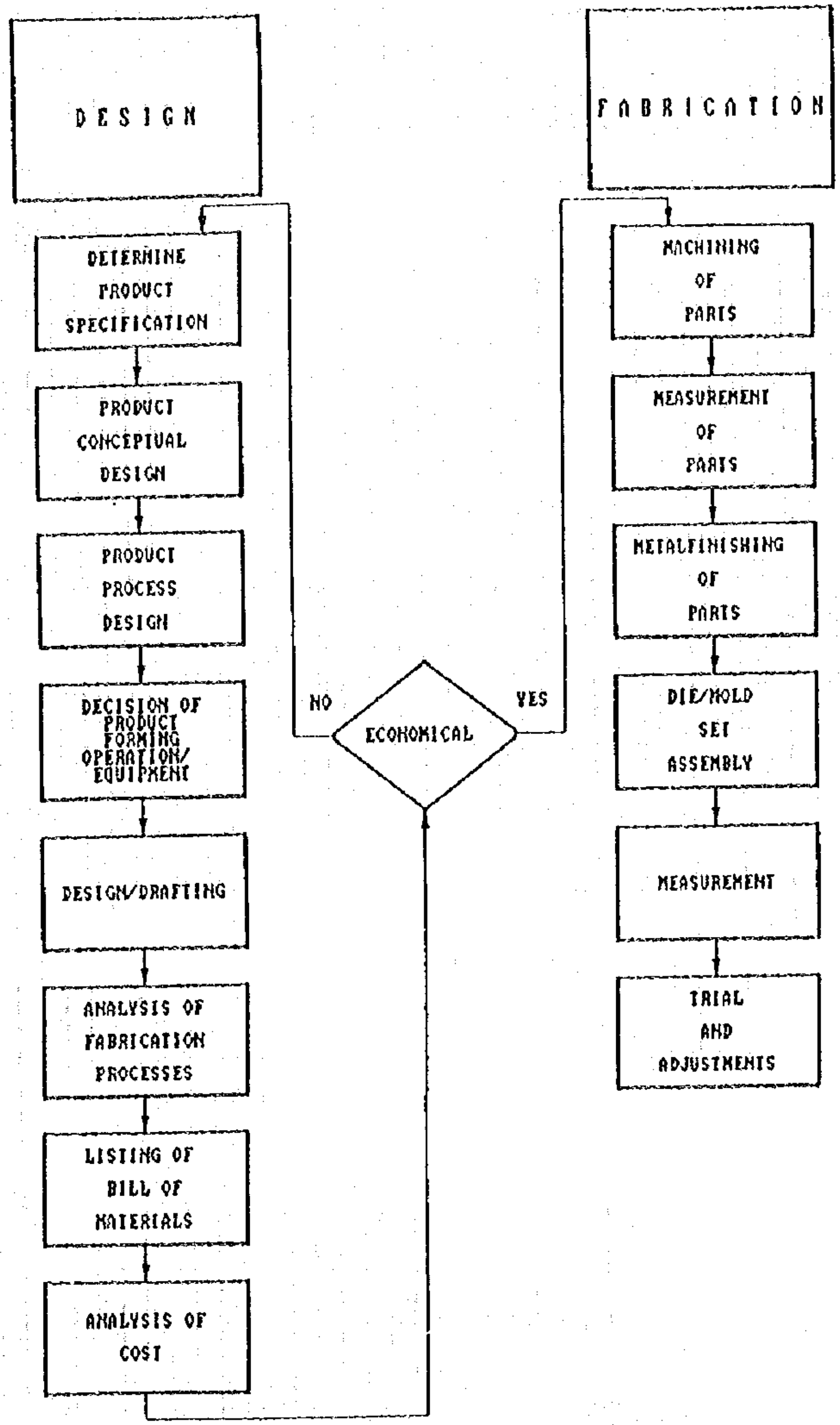


Figure 4
Process flow for die / mold making

Table 10

Distribution of Machine Tools

	No. of Units	% Sub-share	Total % Share
General Purpose Machine Tools			
1. Turning Machines (bench, engine, turret, vertical, etc.)	302	39	33
2. Milling Machines (universal, horizontal, vertical, etc.)	190	25	20
3. Drill Press	99	13	11
4. Boring Machines	52	7	6
5. Grinders (Surface & cylindrical)	126	16	14
Sub-total	769	100	84
Specialized Machine Tools			
1. Copy Lathes	20	13	20
2. Copy Milling Machines	16	11	1.7
3. Jig Boring Machines	11	7	1.1
4. Jig Profile Grinders	18	12	1.9
5. Tool and Cutter Grinders	14	9	1.5
6. Multi-Spindle Drills	6	4	.6
7. Electro Discharge Machines	25	17	3
8. NC/CNC Lathes	13	9	1.4
9. NC/CNC Milling Machines	17	11	1.8
10. Wire-cut EDMs	10	7	1
Sub-total	150	100	16
TOTAL	919		100

machines, jig boring machines, duplex milling machines, profile grinders, centerless grinders, multi-spindle drills, electro-discharge machines (EDM), numerical controlled and computer numerically controlled lathes and milling machines. Among the newest machine tools are wire-cut EDMs and machining centers.

The cumulative specialized machining equipment of the respondent shops is about one hundred fifty (150). Broken down this includes twenty (20) copy lathes, sixteen (16) copy milling machines, eleven (11) jig boring machines, eighteen (18) jigs and profile grinders, fourteen (14) tool and cutter grinders, six (6) multi spindle drills, twenty five (25) EDMs, thirteen (13) NC/CNC lathes, seventeen (17) NC/CNC milling machines and ten (10) wire cut EDMs.

From this tabulation about 84% of the total machine tools of the respondents are composed of general purpose machine tools and only 16% are specialized machine tools. The ratio of general purpose to specialized machine tools is about 5 to 1.

Table 11
Shop Distribution of Specialized Machine Tools

Type of Machine Tools	No. of Shops
Copy Lathes and Mills	14
Jig Boring & Grinding Machines	25
Tool & Cutter Grinders	12
Electro-Discharge Machines	13
NC/CNC Lathes	7
NC/CNC Milling Machines	8
Wire-Cut EDMs	5

In terms of shop distribution of these specialized machine tools as shown in Table 11, only fourteen (14) shops have copy lathes and mills. Twenty five (25) shops have jig boring and grinding machines, and twelve (12) shops have tool and cutter grinders. Among the most sophisticated and expensive machine tools, thirteen (13) shops have EDMs, seven (7) shops have NC/CNC lathes, eight (8) shops have NC/CNC milling machines, and five (5) shops have wire-cut EDMs.

Although there seems to be an abundance of general purpose machine tools, there is a clear indication that 60-70% of these machine tools are more than fifteen (15) years old and are mostly second hand, imported from Taiwan, Japan, Korea, and China. At this condition they are not expected to provide the dimensional accuracy required for tool and die making.

Metal Finishing

As already mentioned, the main metal finishing technologies used for tool and die/mold making are heat treatment and industrial (hard) chrome plating. Of the two, heat treatment is the more essential with twenty one (21) shops indicating that they have heat treatment facilities. Only two (2) shops have electroplating facilities for industrial chrome plating of their dies and molds.

Table 12
Distribution of Shops with Metal Finishing, Quality Control and Design Operations

	No. of Shops
Metal Finishing	21
Quality Control	43
Computer-Aided-Design	6

Quality Control Instruments

Almost all of the facilities practice quality control mainly for dimensional accuracy using basic measuring instruments such as calipers and micrometers. However, only five (5) shops are known to have metrology equipment such as optical comparators, while only one facility is confirmed to have coordinate measuring machine.

Computer-Aided-Design (Drafting)

About six (6) companies are currently utilizing computer-drafting methods; however, none is known to be employing the full capabilities of computer-aided-design where engineering factors such as stress and material flow can be simulated.

Table 12 shows the number of shops with metal finishing, quality control and design operations.

Table 13
Distribution of Production Personnel

	No. of Personnel	% Share
Engineers	82	8
Technicians		
Trade Graduates	344	35
Skilled	276	28
Semi-skilled	128	13
Slightly skilled	160	16
TOTAL	990	100

Note: Technicians denote machinists and tool & die makers

Standardization

In advanced die making countries the standardization of dies and die components has been proven to effectively reduce manufacturing costs and shorten delivery schedules. Among the tool and die parts that can be standardized are guide posts, bushing pins, and springs. In March 1990, Bureau of Product Standards (BPS) adopted JIS Standards as Philippine National Standards for tool and die making covering jigs (5 standards), press dies (11), dies for die casting (5), and molds for plastic (16). Annex 2 lists these Philippine National Standards. However, the observance of these standards has not yet been promoted.

Technical Manpower

Die making skill or expertise is a product of theoretical knowledge and years of quality experience. Thus, inherently there are only a small number of technical personnel that can be legitimately called "tool and die makers", who adequately have both the design and fabrication skills.

For purposes of this study, the technical manpower of the tool and die industry is categorized in the level of engineers, technicians (trade graduates), skilled (1st class workers), semi-skilled (2nd class workers), and slightly skilled (3rd class workers). Table 13 shows the distribution of production personnel in the industry as classified by the respondents.

Majority of the production workers are skilled workers and trade graduates constituting about 28% and 35% respectively. They are performing most of the critical machining processes and the assembly operations. Engineers comprising 8% are usually assigned in the design, drafting and inspection/ quality control departments. Semi-skilled (13%) and slightly skilled (16%) workers perform routine machining, material handling and other manual jobs.

Operating Schedule

Most tool and die shops are operating six working days a week. Seventeen (17) companies indicated operating on a single shift a day, 26 have two shifts a day and only 1 operates on a 24 hour basis.

Raw Materials Consumption / Utilization

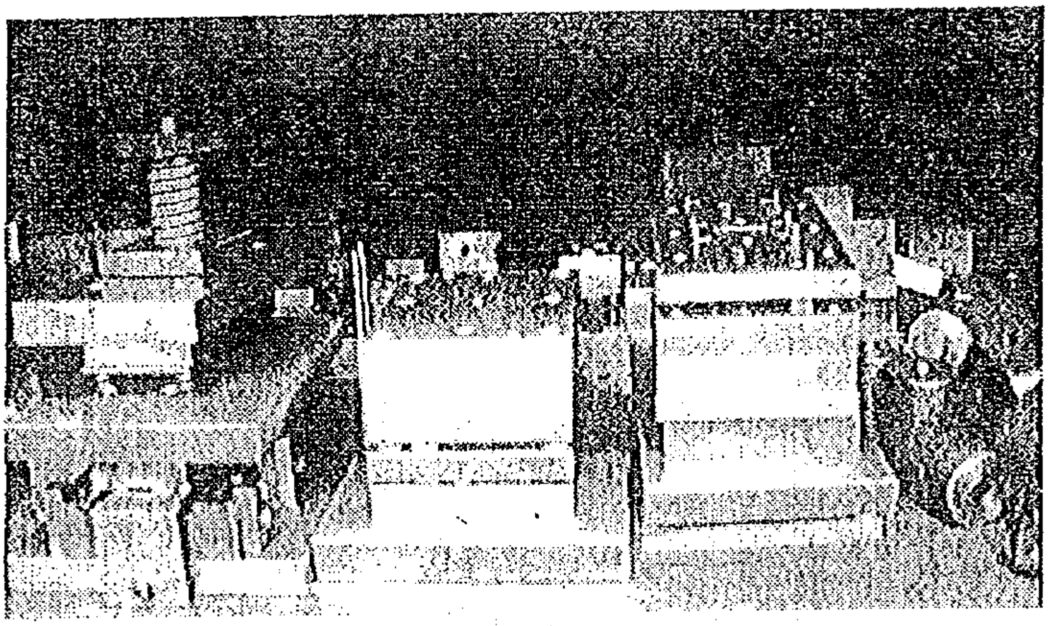
The types of main raw material for dies are ordinary cast steel die set materials, ductile cast iron die materials, carbon tool steel, high speed tool steel and alloy tool steel. High grade materials for high precision and long-life dies are sintered high-speed steel and cemented carbide.

Table 14
Supply Network of Raw Materials

Source	No. of Shops
Local Distributor (Foreign materials)	43
Direct Importation	9
Local Manufacturers	17

Among these, only steel (AISI 1020 and others) can be produced in the Philippines. Seventeen (17) shops responded that some of their sources of raw materials are local manufacturers, indicative that they are using cast iron die materials, while all forty three (43) respondents indicated that their raw materials are procured from local distributors of imported carbon tool steel, high speed tool steel and alloy tool steel, with nine (9) shops are directly importing these. The supply network of raw materials is stated on Table 14.

Only nine (9) firms stated their cast iron or steel raw materials consumption which averages at 27 MT/year. These companies maintained an average inventory of about 3 MT equivalent to be about four (4) months lead time as they indicated. However, it is acknowledged that this is unusually high since the nine (9) mentioned respondents to this section are the large and medium firms.



Sets of tool and die assembly for various applications
(Courtesy of Maximetals Ind., Inc.)

Product Lines / Services

As discussed in the *Industry Profile*, there are twenty nine (29) shops which are classified as independent shops producing molds, simple dies, compound dies, jigs and fixtures, and also provide die repair services. Most of these shops are also heavily engaged in general machining services for industrial parts. Table 15 provides the breakdown of products/services provided by both independent and in-house shops.

The holding companies of fifteen (15) identified in-house shops produces various end-products from the dies and molds they fabricate. Accordingly, six (6) of these firms go on to produce forgings for motorcycle, automotive and other industrial parts, five (5) firms produce plastic products and fifteen (15) firms are engaged in pressworking and stamping. One (1) shop produces molds for manufacturing rubber products while another firm manufactures metal die-cast.

Local Production

Of the forty four (44) respondents, only thirty two (32) provided suitable production data (1990). As there is no fixed correlation between molds and die assembly weight and its price, this study uses "sales" as the more reliable market indicator.

Categorically broken down as shown in Table 16, fourteen (14) shops reported tool and die sales of less than Ps.1M, six (6) shops had turnover between Ps.1M and Ps.2.5M while five (5) shops sold Ps.2.5M but under Ps.5M. In the high turnover groups, two (2) had sales of Ps.5M but less than Ps.10M and five (5) firms manufactured over Ps.10M worth of dies and molds. Extrapolating these production data, total local production of molds and dies is estimated to be Ps.159.5M. This estimate consists of local production for both the local market and the export market.

Of the sales volume of molds and dies generated in 1990 Ps.83.1M were manufactured by the independent shop (reported by 23 shops) accounting for 56%, while Ps.76.4M were produced by the inhouse shops (reported by 8 shops) representing about 44% for their jobbing services.

To explain this close difference despite fewer in-house shops that reported, it can be pointed out that one in-house shop for the biggest manufacturing conglomerate in the country reported a production value of Ps.55M, already accounting for about 37% of the total recorded local production.

Importation

The Philippine manufacturing industry has been heavily relying on imported molds and dies. Table 17 shows the import value from 1987-1990 as classified by the National Statistics Office. Imports of molds and dies have sharply risen from $7.8 M in 1987, to $10.8 M in 1988, and then $13.4 M in 1989 before posting a modest increase to $14.9 M (P402 M) in 1990. This represents almost 100% increase over the four-year period.

Rubber and plastic molds are traditionally the largest type of imports accounting for 43%, (in 1990) followed by dies for stamping, forging, and

Table 15
Product Lines/Services Offered

Product Lines / Services	No. of Shops
Simple Dies	44
Compound Dies	29
Progressive Dies	14
Molds	20
Jigs and Fixtures	14
End Products other than Tool and Die (e.g. machine spare parts, forgings, plastic components, die casts, rubber products)	15
Repair & other Services	4

Table 16
Local Mold and Die Production, 1990
(Classified according to sales range)

Sales	No. of Shops	% Share
Under P1 M	14	44
P1 M to under P2.5 M	6	15
P2.5 M to under P5 M	5	15
P5 M to under P10 M	2	6
P10 M and above	5	16
Total	32	100

pressworking comprising 23%, glass molds represented 14% of the imports and molds for metals and metal carbides comprised 7% of the imports for the same year. Imports of other types of molds and dies not classified in any of the above group accounted for 13% of 1990 imports.

The U.S., Japan, Singapore, and Taiwan have consistently been the major origins of imported molds and dies. Together, they account for almost 70% of the total imports while other countries such as Sweden, Italy, France, the United Kingdom, and Hongkong provide the rest of the 30%. The supply breakdown is as follows: Japan worth 25%, Singapore worth 15%, US worth 15%, and Taiwan worth 15%.

Japan has been the dominant supplier of molds for rubber and plastic. Molds for metal are mainly sourced from Japan and Taiwan. Singapore, U.S. and Japan are the primary sources of dies, while Taiwan has been the leading origin of glass molds.

Figure 5 provides the graphical representation of the annual imports of molds and dies classified according to the countries of origin.

Exports

Table 18 shows the annual exports of dies and molds.

In 1990, the industry posted exports of $0.74 M slightly decreasing from $0.79 M in 1989, $0.6 M in 1988, and $0.63 M in 1987. The countries of the destinations of mold and die exports are the U.S. accounting for 36%, Japan, 20%, and Australia and Luxembourg with 7% each. Other countries of destination comprising the rest of the 30% are Guam, Germany, India, Hongkong, Venezuela, and even North Vietnam.

Figure 6 is a graphical representation of annual exports of molds and dies classified according to countries of destination.

Table 17
Annual Importation of Dies and Molds, $

	1990	1989	1988	1987
Dies	3,399,175	2,369,972	1,971,116	1,332,212
Molds for Metals	1,020,445	848,257	521,865	182,577
Molds for Glass	2,068,132	2,304,708	1,815,793	1,456,506
Molds for Minerals	—	—	31,924	23,182
Molds for Rubber &Plastic	6,349,387	5,645,535	4,836,489	3,805,331
Molds for Other Materials	2,050,741	2,137,013	1,726,103	1,082,124
TOTAL	14,887,879	13,405,485	10,903,290	7,882,132

Table 18
Annual Exports of Dies and Molds, $

	1990	1989	1988	1987
Dies	429,918	620,339	429,845	392,899
Molds for Metals	80,908	21,648	48,458	4,445
Molds for Glass	—	—	4,717	—
Molds for Minerals	—	—	—	—
Molds for Rubber & Plastic	211,548	132,528	49,183	132,824
Molds for Other Materials	207,871	131,153	6,015	101,401
TOTAL	743,161	787,630	601,218	631,569

Total Estimated Demand

Table 19 presents the estimated total demand for molds and dies in 1990 which is about P561.47 M. In terms of supply origin to fill in this total demand, imports heavily dominated providing 72% while local production constituted 28% of this demand.

Of this local production, 87% went to the local market and this is equivalent to only about 24% of the total demand, while 13% of the local production were exported which is equivalent to about 4% of the total demand.

In terms of demand origin, the estimated local demand constitutes 96% of the total demand while the exports (overseas) market constituted 4%.

End-User Industries of Local Molds and Dies

An analysis of the major end-user industries for local molds and dies is provided in Table 20.

The plastic manufacturing industry is the biggest user of local molds used for plastic injection, extrusion, and drawing representing 34.7% of the total local mold/die production, followed by

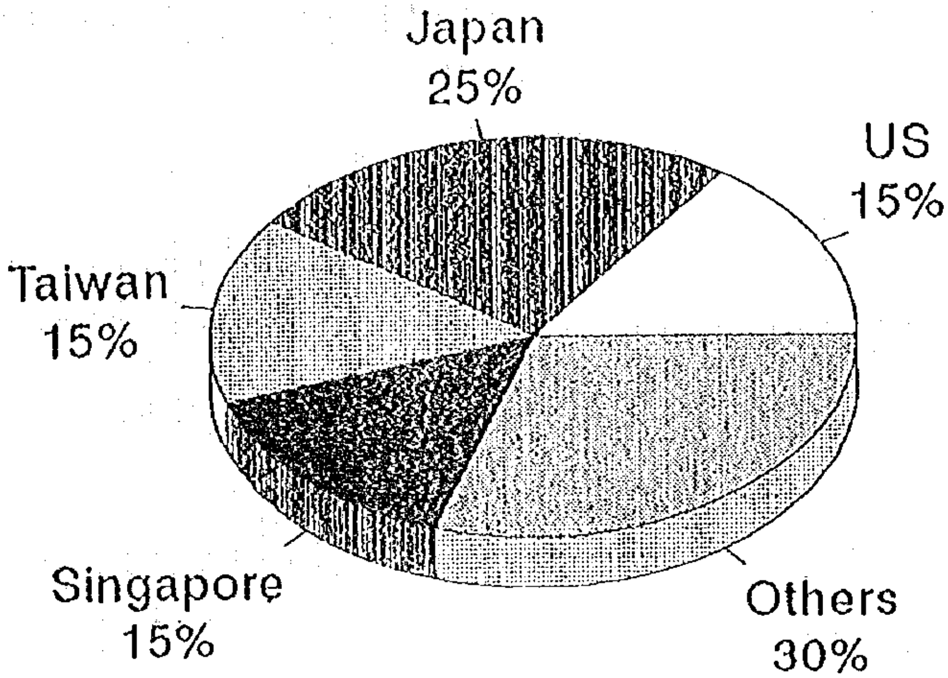


Figure 5
Annual Imports of Molds & Dies by Countries of Origin

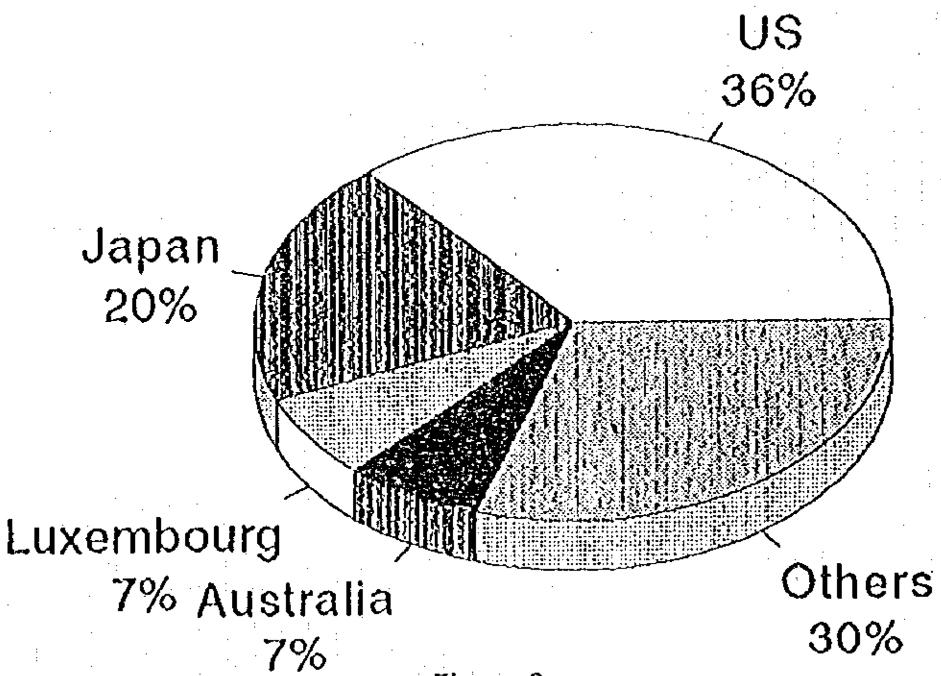


Figure 6
Annual Exports of Molds and Dies by Countries of Destination

Table 19
Total Estimated Demand for Molds and Dies 1990

	Ps, Millions	% Share
Production		28
Local Market	139.44 *(A)*	(24)
Export Market ($0.74 M)	20.06 *(B)*	(4)
Importation ($14.89 M)	401.97 *(C)*	72
Estimated Total Local Demand *(A + C)*	541.41	(96)
Estimated Total Demand *(A + B + C)*	561.47	
		100

Table 20
Breakdown of Major End-user Industries of Local Molds and Dies

Sectors/Industries	% Share
Plastic Manufacturing	34.7
Glass Making	17.8
Semi-Conductor Manufacturing	16.5
Automotive Manufacturing (a)	12.6
Appliance Manufacturing (a)	12.6
Other Pressworking & Forging (b)	4.0
Die Casting	1.5
Rubber Molding	1.0
TOTAL	100

Note:
(a) Metal stamping, drawing and forging excludes plastic, glass and rubber parts
(b) Metal pressworking, stamping, drawing and forging of metal excluding automotive and appliance parts

Table 21
Average Breakdown of Production Cost for Tool and Die Making

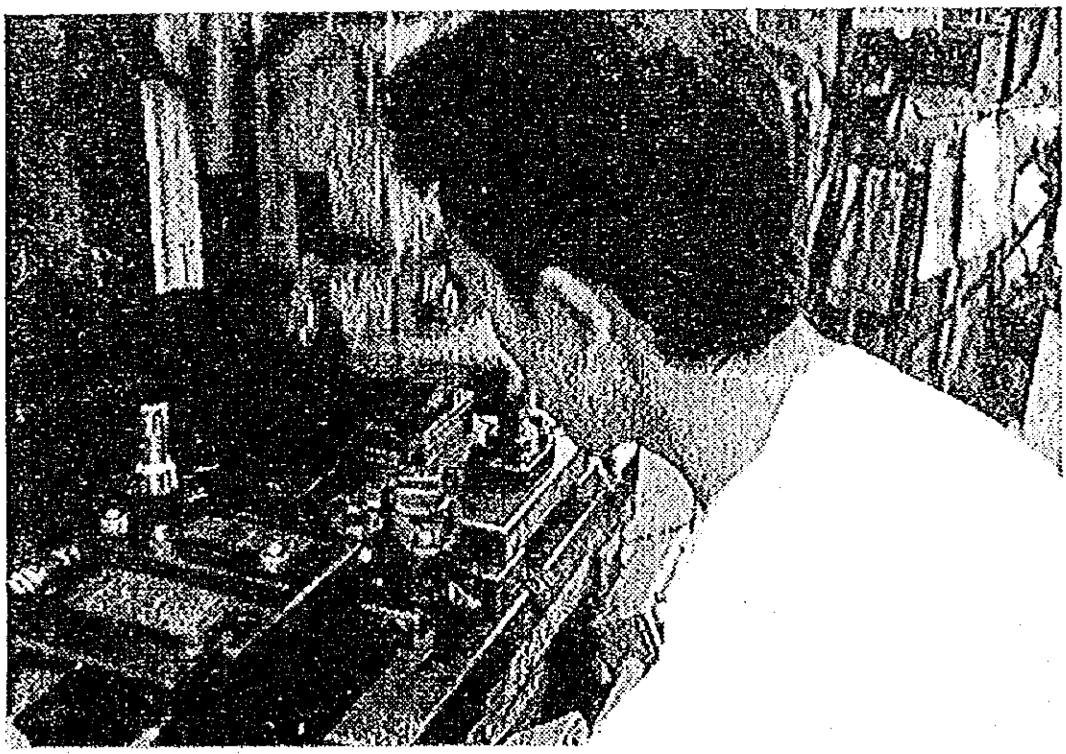
	Ps.	% Share
Direct Raw Materials	604,909	33
Direct Labor	469,973	25
Factory Overhead	773,989	42
TOTAL	1,870,763	100

glass-making firms accounting for 17.8% of the local production market.

Semiconductor manufacturing firms requiring dies for integrated circuit manufacturing constituted 16.5% of the local production market. Both automotive parts manufacturing firms and appliance parts manufacturing firms requiring dies for metal stamping, drawing, and forging operations each account for 12.6% of the total local production. Die requirements of other pressworking, stamping, and forging firms not producing for any of the above sectors represent 4%, while molds for die casting and rubber molding sectors accounted for 1.5% and 1% of the total locally produced dies and molds.

Production Cost Data

The survey elicited only eight respondents for data on production cost for 1990. For purposes of presentation but not necessarily representing a definite profile of the production cost data of the tool and die making industry, Table 21 shows the average breakdown of the cost elements of tool and die making as reported by eight respondents. Direct raw material which consists mainly of steel for mold and die assembly accounts for about 33% of production cost, while direct labor of tool and die makers, general machinists, technicians, and engineers represent about 25%. The remainder of about 42% is categorized as overhead expenses broken into indirect labor (administrative and supervision), power and other utilities, and other factory supplies.



Tool and die mounted on the press
(Courtesy of Maximetals Ind., Inc.)

Problems

The problems and weaknesses of the tool and die making industry is analyzed in several aspects concerning technical capability, manpower, marketing, financial, raw materials, utilities and government regulations.

Technical Capability

Tool and die making technological expertise is basically a function of manufacturing and design capability.

The foremost constraint affecting manufacturing capability is that majority of the machine tools are outdated, limiting production of more complex and higher precision molds and dies. Although there are initial signs of modernization with the growing number of NCs and CNCs, the pace of their acquisition does not seem to adequately match the market demand. Some shops have shown capability to produce fairly complex molds and dies but these are more of exception and their productivity is questionnable.

Another critical factor is the limited design expertise with only a handful of competent die designers available. This can be traced to the fact that the time span of five (5) to ten (10) years to generate die design expertise greatly discourages interested practitioners.

The industry is also facing inadequate technical support facilities, specifically heat treatment and industrial chrome plating, deterring their capability to improve the service life of their molds and dies. In addition, their capability to produce high precision molds and dies beyond the five (5) micron-level can not be supported by existing measuring instruments. To validate this, the MIRDC Metrology Laboratory barely has clients despite the obvious need of tool and die shops for metrology services.

Manpower

One of the major problems of the industry is the chronic lack of tool and die makers, which is attributable to two factors.

The first factor is the over-all insufficient manpower development programs for tool and die making technology. Several institutions are known to be offering tool and die making seminars namely, MIRDC, Metalworking Industries Association of the Philippines, Dualtech Training Center, Meralco Foundation, Technological University of the Philippines, Don Bosco Technical Center, and soon the NMYC. But as verified enrollment schedules are not on a regular basis such that their combined graduates are not sufficient to match the requirements of the industry.

On higher die design and engineering, the DLSU and University of the Philippines are offering tool and die engineering course on their Engineering Masteral degree programs but they are also known to be inactive.

The other factor exacerbating the manpower dilemma of the industry is the continuous exodus of our trained die makers for overseas jobs specially to the Middle East. This has even led to the drain of our trainors on tool and die.

Other manpower related problems cited by the respondents are low employee productivity, arising mainly from lack of skills. High employee turn-over was also reported due to prevalent pirating practices among tool and die shops. Unreasonable unionism was also apparent as two shops were plagued by strikes and one was eventually closed because of this.

Marketing

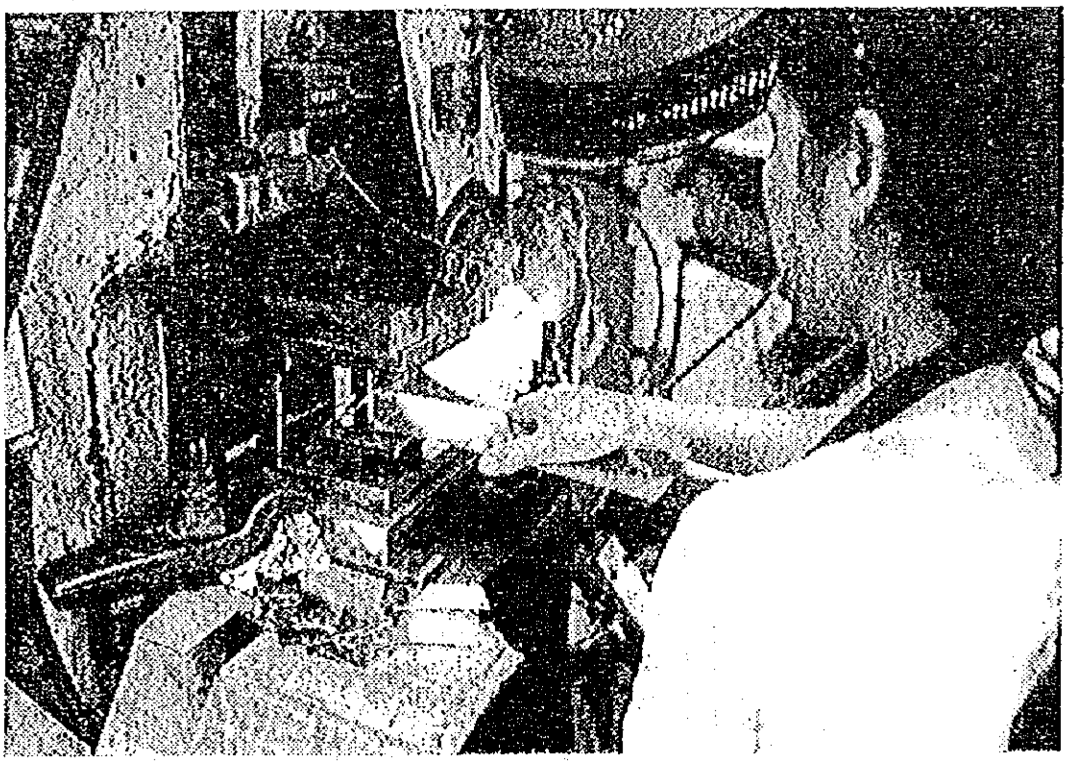
Majority of the respondents have indicated that their foremost marketing problem is the irrational price competition since it is almost impossible to formulate a standard pricing policy for molds and dies.

Some shops have complained of a limited market, while others point to foreign competition as their main market problem. But looking back at the Market Analysis Section, the huge volume of imports seems to validate the latter perception of the respondents and at the same time refuting the former complaint. Majority of the respondents were confident of their product quality, although this can be disputed as one of the main reasons why end-users opt to import their molds and dies rather than have them manufactured locally.

Financing

The lack of suitable financing was consistently pointed out by respondents as one of their main problems, particularly the independent shops. They complained that commercial loans with high interest rates (pegged at 29% at the time of the survey) have been deterring their modernization and expansion plans.

In response to this, the survey team presented a consolidated briefing list of various government soft-term financing programs for start-up, modernization and expansion of the industries under the TLRC, DBP, and SSS. This information was well-received by the shops, but most of them are reluctant on taking their own steps to avail of these financing programs, possibly due to wariness of long processing procedures and heavy collaterals required.



Another example of tool and die mounted on the press (Courtesy of Maximetals Ind., Inc.)

Utilities

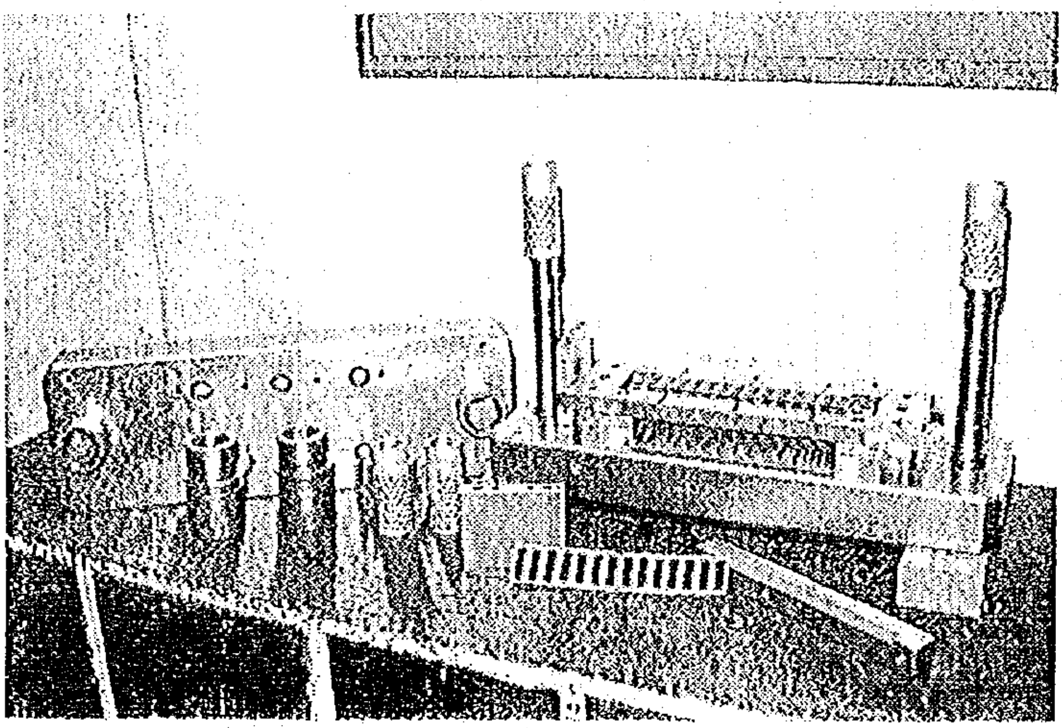
Electricity as a utility problem remains to be the biggest factor affecting the industry, mainly due to the increasing frequency of power interruption causing operational delays. In addition, high power rates contribute a big factor in production cost. Likewise, the industry noted some difficulties in communication and transportation.

Government Regulation

High tariffs on raw materials and equipment remain to be the predominant government regulations affecting the industry. The respondents further stated that this is compounded by the complicated customs procedures.

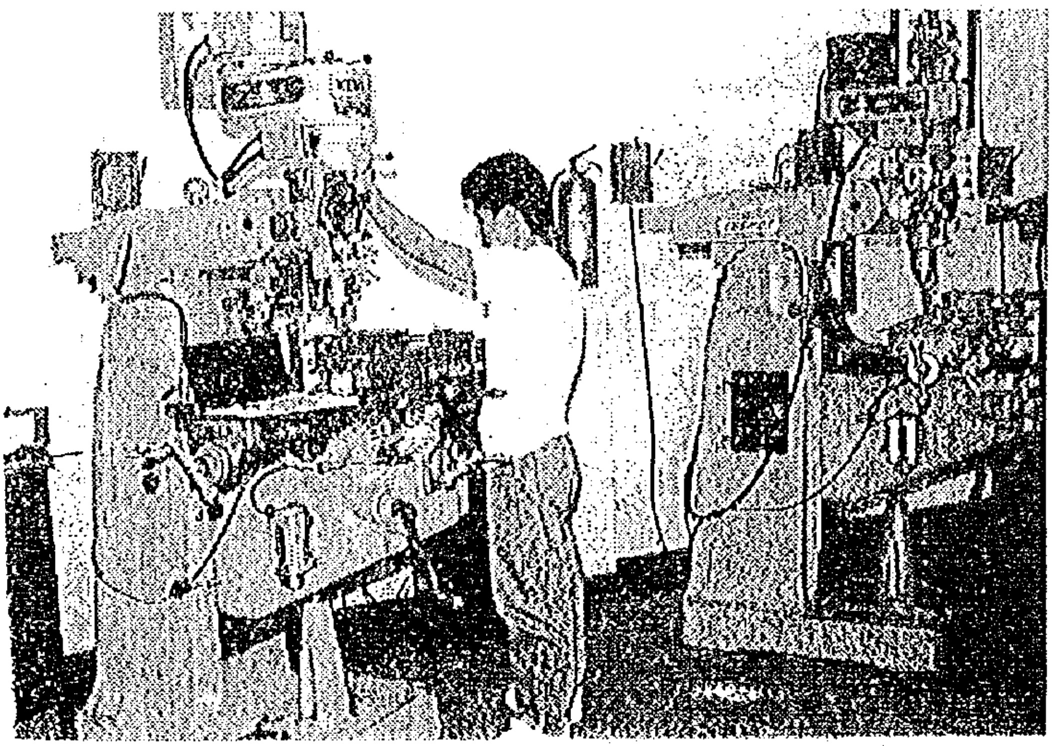
Prospects

Despite the burden of these problems and weaknesses, majority of the companies are still optimistic about the business prospects in the country. Eighteen (18) respondents have indicated expansion plans in terms of additional capacity, eight (8) companies are planning to employ new production processes while ten (10) other companies are considering downstream manufacturing of new products for electronics, automotive parts and metal fasteners. To achieve these they have professed that they will have to adopt major technological advances particularly the use of CAD, CNCs, metrology techniques and metal finishing. However, four (4) other companies commented that



Parts of tool and die assembly used to produce ICs (Courtesy of Oriental Toolmaster) business prospects depend on the country's economic, political, and peace and order stability.

Overall, the industry foresees the following factors will undermine their competitiveness in the market. These are: (1) the increasing use of plastics over previous metal parts, (2) the high acquisition cost of modern equipment, (3) shortage of skilled technical personnel, (4) increase in labor costs, and (5) high interest rates on commercial loans.



Milling machines, equipment used in milling operation for tool and die parts and components
(Courtesy of Oriental Toolmaster)

Chapter VI   Proposed Government Action

The Metals and Engineering Industries National Action Plan 1990 to 2000 was launched by the Science and Technology Coordinating Council (STCC) — Metals and Engineering Technical Planning and Review Committee (TPRC).

Figure 7 provides an overview of the PLAN's 5 major components, namely:

a. The generation of design and engineering expertise for machineries and equipment;

b. The development of basic metal industries;

c. The upgrading of engineering and technical education;

d. Improvement of quality and productivity; and

e. The central component that is the modernization of the metalworking industries.

Under this central component, the Sub-sector Development Programs were formulated to address each metalworking sector, one of which is the Development Program for the Tool and Die Making Industry.

Figure 8 shows the TPRC's Organizational Network composed of various sub-committees tasked to initiate the implementation of these programs. A sub-sector Modernization Steering Coordinator has been assigned to oversee the implementation of each sectoral development program.

This development program calls for concerted multi-sectoral efforts among various government agencies, the private sector and the academe. The Metals Industry Research and Development Center (MIRDC), as the agency mandated to develop the metalworking industry, is expected to be the backbone of the program's implementation.

Development Program for the Tool and Die Industry

Objectives

— Enable the tool and die industry to provide the Metals and Engineering Industries of the Philippines with the required tools, dies and molds for efficient production.

— Upgrade the technology of the tool and die industry to compete effectively in the world market for tools, dies, and molds.

— Increase the number and capacity of tool and die shops capable of producing high quality molds and dies.

Strategy/Programs:

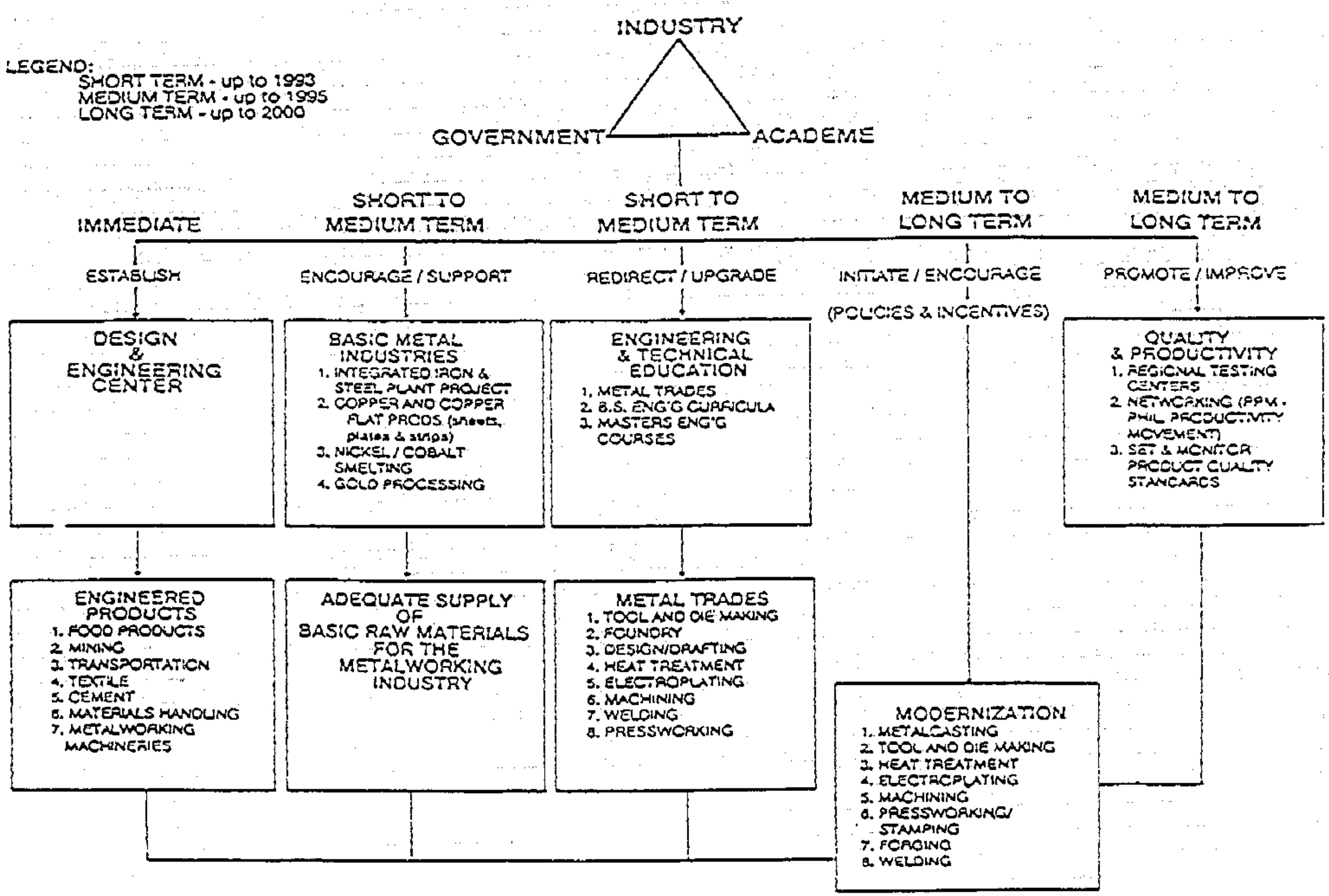
1. Technology Upgrading

a. Commission an in-depth study of existing tool and die making capability in relation to industry requirements to establish development needs.
Implementing Institutions: MIAP - MIRDC - BOI

Figure 7

METALS AND ENGINEERING INDUSTRIES NATIONAL ACTION PLAN 1990-2000

SCIENCE AND TECHNOLOGY COORDINATING COUNCIL



b. Promote the use of Computer-Aided-Design and Computer-Aided-Manufacturing (CAD/CAM) in tool and die making through seminars, demonstrations, facilities time-sharing, etc.
Implementing Institutions:
MIRDC - MIAP

c Conduct a continuing technical consultancy program for tool and die shops. A committed technical team from MIRDC and MIAP shall be formed.
Implementing Institutions:
MIRDC - MIAP

d. Negotiate grants for services of foreign experts who can transfer relevant technologies to Philippine tool and die makers.
Implementing Institutions:
DOST - MIRDC

e. Acquire relevant literatures and materials on modern tool and die making practices that can be disseminated to members of the industry.
Implementing Institutions:
MIRDC - MIAP

2. Facility Upgrading

a. Encourage modernization of tool and die making facilities
   — Repeal the realty tax on new machines
   — Accelerate depreciation period for tool and die making production machineries
   — Reduction of duties on state-of-the art machineries to discourage preference to import out-dated machineries

   Implementing Institutions:
   BOI - BIR - MIAP

3. Rationalization

a. Accreditation Program
An accreditation program shall be formulated and conducted to identify and classify tool and die (jobbing) shops according to their capability to produce specific types of dies and toolings based on set quality standards.
Implementing Institutions:
BPS - MIAP - MIRDC

b. Standardization Program
International standards for tool and die parts, elements, materials, and terminology

The joint BPS - MIAP - MIRDC Committee should make the necessary contacts and formulate proposals to the International Standards Organization (ISO) in Geneva for the early preparation of recommendations for standardizing internationally the most commonly used parts, elements, materials and terminology in die, mold and jigs and fixtures design and manufacture. For the meantime, in the absence of any ISO standard, industry should formulate its own set of standards in terms of design, materials, fits, and tolerances.
Implementing Institutions:
BPS-MIAP-MIRDC Committee

c. Incentives and policy package for Accredited Tool and Die Shops and Members of the Modernization/ Rationalization Program under BOI's Investment Priorities Plan (IPP).

The following shall be institutionalized and made available:

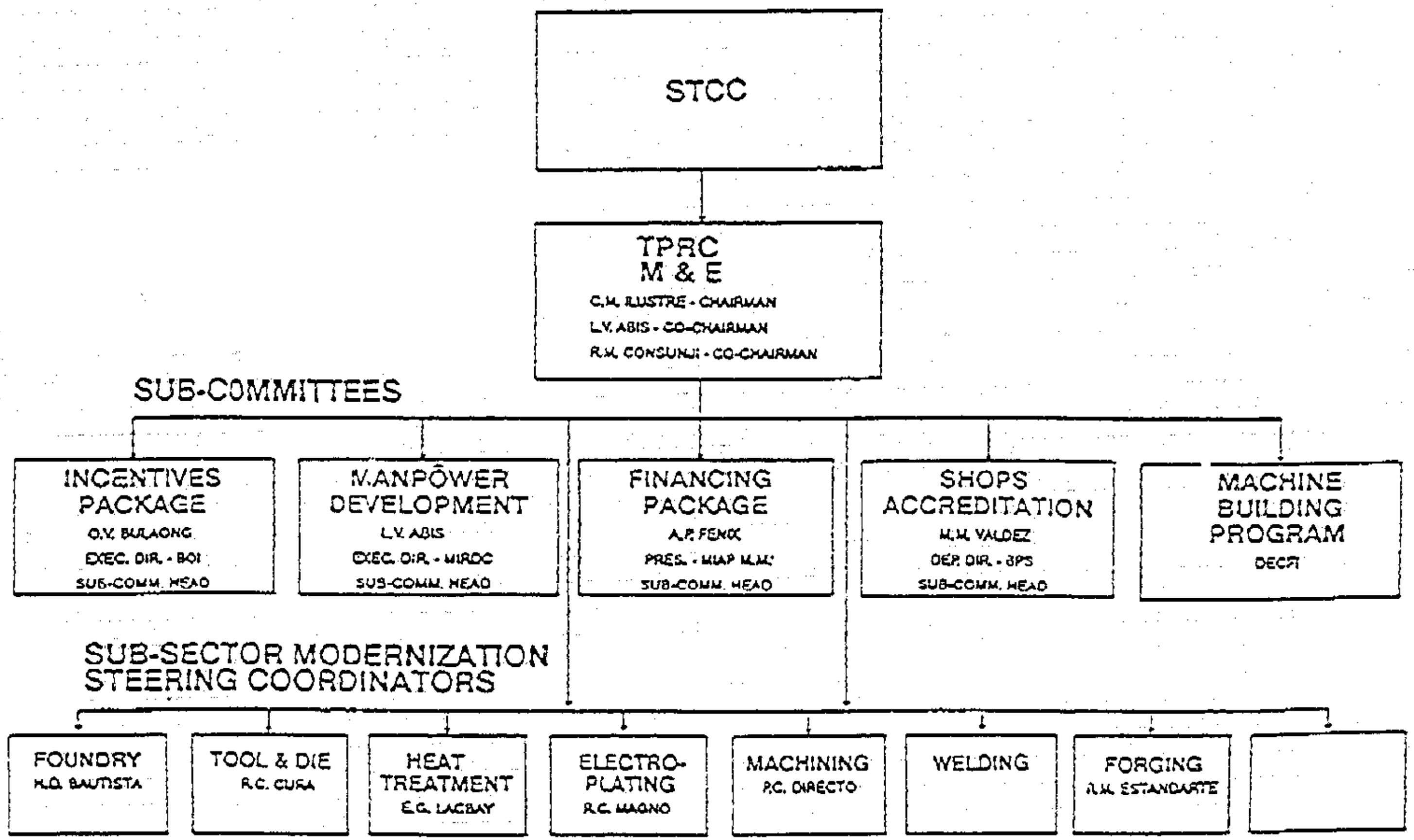
Figure 8

SCIENCE AND TECHNOLOGY COORDINATING COUNCIL

TECHNICAL PLANNING AND REVIEW COMMITTEE

METALS AND ENGINEERING SECTOR

ORGANIZATIONAL NETWORK



— Tax exemption on imported capital equipment not locally manufactured
— Tax credits for purchase/use of locally fabricated equipment
— Only accredited firms can participate in the government procurement system under Executive Order 285 s. 1987
— Priority endorsement and guarantee to secure soft loan packages. A Memorandum of Agreement to this effect shall be linked under TLRC's Export Industry Modernization Program. Initial estimated credit facility needed by tool and die shops — Ps.150M
— Only accredited firms shall be promoted by the Bureau of Export Trade and Promotions and Commercial Attaches
— BOI registered firms shall be asked to prioritize sourcing products from accredited firms
— Priority in availing of assistance under Technical Consultancy Program

Implementing Institutions:
DTI/BOI - DOST/MIRDC - TLRC - MIAP

4. Raw Materials Sourcing

a. Encourage class AA foundries to undertake development and production of special tool steels to provide an alternative to outright importation of the basic material.

As an incentive, the BOI shall list production of special tool steel as pioneer enterprises.
Implementing Institutions:
BOI - PFS - MIAP

b. Designate the steel service centers as bulk-buying entities of imported special tool steels from which they can be bought at a competitive cost.
Implementing Institutions:
MIAP - SSC - DTI

5. Institution Development/ Upgrading

a. Establish Regional Service Centers (RSCs) for tool and die technology.

The function of RSCs are training, testing, technology transfer and product development. Initial pilot regions for tool and die RSCs are XII, III, VII, and X.
Implementing Institutions:
DOST - DTI - MIAP

b. Designate the Design and Engineering Center as the tool and die design center where up-to-date facilities (computers, plotters, etc.) are available to service industry needs.
Implementing Institution:
DECFI

c. Set up an Information center in tool and die making technology.
Implementing Institutions:
MIRDC - MIAP

d. Provide direct assistance to engineering universities and other technical training institutions to acquire advanced instructional machining equipment such as CNC and copy milling machines.
Implementing Institutions:
DOST - PATE - NMYC

6. Manpower Development and Skills Upgrading

a. Conduct an in-depth study on the manpower needs of the industry both in numbers and minimum skill level required.

b. Establish the integrated, industry-based Training and Skills Upgrading System, responsive to the findings of 6a.
   - — Distinct training ladders will be adopted each for tool and die makers, designers and tool room machinist.
   - — The system shall encourage close cooperation and collaboration between training institutions and the industry (such as MIAP, MIRDC, Meralco Foundation, Manila Technician's Institute, Dualtech) through an appropriate network.
   - — The system shall institute mechanisms to provide appropriate incentives to participating firms.

   Implementing Institutions: Major training institutes

c. Form a Tool and Die Design and Making National Trainors Pool to be a ready technical resource for different training institutions.
   - — The pool shall have twenty (20) trainors.
   - — The Government, through MIRDC, shall commit to train and retain 10 trainors for the pool.
   - — The industry, through MIAP, shall commit to make available 10 industry experts for the pool.
   - — Safeguards and incentives shall be adopted to retain and further develop the trainors pool.

   Implementing Institutions: MIAP - MIRDC - DOST - Other training inst.

d. Identify leading engineering institutions/universities in the regions which may immediately serve as the regional training facilities for tool and die technology, as part of the RSC concept as in 5a and 5d.

   Implementing Institutions: DOST - PATE - NMYC

e. Negotiate grants for foreign fellowships in the field of tool and die making. Participants in these study grants must make themselves available to the industry for multiplier effect.

   Implementing Institutions: DOST - DTI

f. Establish post-graduate courses in tool and die design and making in our leading engineering universities.

   Implementing Institutions: DOST - PATE - UP

g. Provide local study tours to tool and die making practitioners particularly from the regions to more progressive firms in Metro Manila.

   Implementing Institutions: MIAP - DTI

Several action plans of the Development Program have already been initiated:

a. Sectoral Study

This sectoral study itself is the first action of the TPRC for the tool and die making industry. As stated in the objective, this study aims to highlight the importance of the industry and provide directions on the industry assistance needs of the sector.

b. Technical Consultancy Program

Under the Manufacturing Productivity Extension Program of the DOST, six (6) of the respondents in this study have already received extensive technical consultancy and advisory services to improve their production capability and increase their productivity and quality. In 1992, another phase of MPEX is being scheduled with more tool and die shops expected to be beneficiaries.

c. Promotion of CAD/CAM

In cooperation with DOST-PCS CAD/CAM Center which was inaugurated in 1991, the use of CAD/CAM is being extensively promoted utilizing MIRDC equipment while software programming is provided by the CAD/CAM Center.

d. BOI-IPP

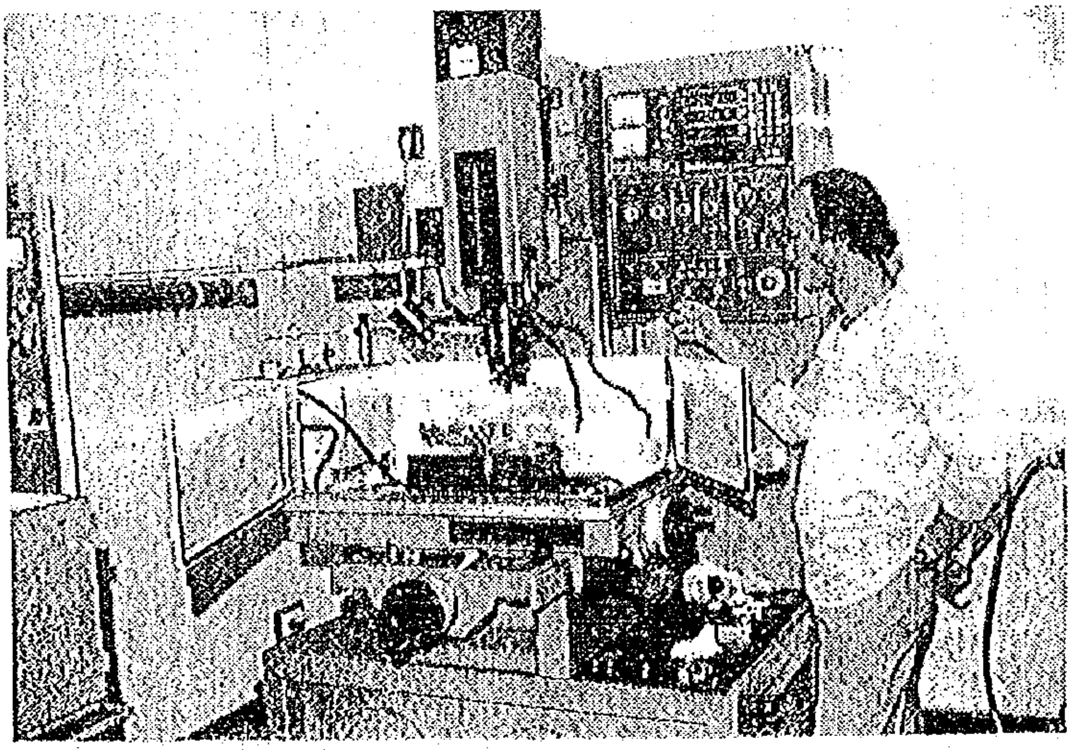
The Board of Investments -- 1991 Investments Priorities Plan has listed that start-up modernization and expansion of tool and die making shops are eligible for fiscal and policy incentives, notably tax exemption on imported capital equipment not locally manuf...tured.

e. Standardization

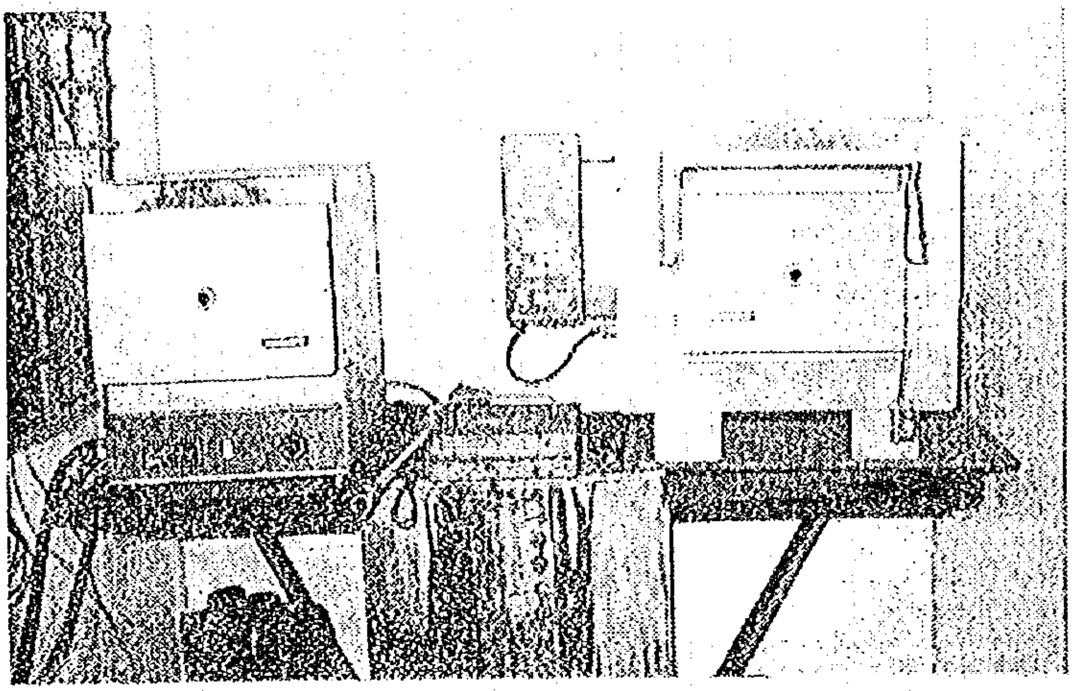
In March 1990, the Bureau of Product Standards promulgated thirty seven (37) Philippine National Standards for tool and die making covering jigs, press dies, dies for die casting and molds for plastic.

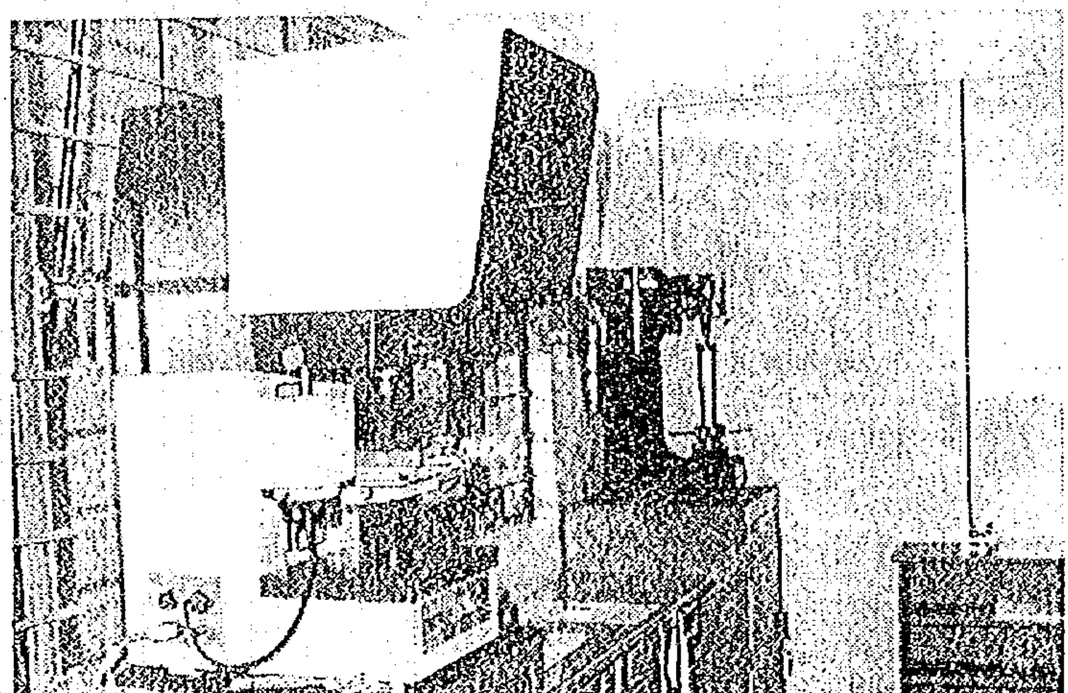
f. Comprehensive Tool & Die Making Design and Making Training Program

This is a two-phase program initiated in August 1990, designed to initially form a Tool and Die Trainors Pool and then conduct a two year comprehensive industry training program. The three (3)-month trainors training program has produced fifteen (15) trainors from MIRDC, the industry and the academe. These trainors are now conducting the second phase for fifteen (15) industry personnel up to 1993. §§§



Specialized machine for tool and die making
(wire cut EDM)
(Courtesy of Oriental Toolmaster)





Equipment used in controlling the quality of tool and die parts and components (above, chamber furnace for heat treatment purposes; below, hardness tester & profile projector) (Courtesy of Oriental Toolmaster)

Annex 1
List of Tool & Die Making Facilities, 1990

RESPONDENTS

• Independent Shops

Amber Trading & Supply Co., Inc.
Anvil Metalshop Corp.
Base Corporation
Ben San Machineries & Engineering
Carding Machine Shop
Centric Industrial Services, Inc.
Creative Trade Center
Directric Industries, Inc.
Fu's Machinery Works
Gablee Machinery Works, Inc.
Great Tooling System, Inc.
Harvester Machine Works, Inc.
I-Tung Trading and Machinery Center
Jarc Manufacturing & Machine Shop
Key Mould Maker
Leo Santos Metal Engraving & Machine Works
Meralco Foundation, Inc.
Metals Industry Research & Development Center
Mould Tech. Center Phils.
Ner Industrial Services Corp.
Oriental Toolmaster Corp.
R. Cura Engineering
Rencar Engineering
RGA Resource Development Enterprises
SEV Corporation
Solid Technology Services, Inc.
TDE General Machine Shop
Ultrasonic Plastic Mould Machine Shop
Yaw-Otz-Mawh Industries & Engineering Works

• In-House Shops

Acme Tools Mfg. Co., Inc.
ANI Forge Phils., Inc.
Arco Metal Products Co., Inc.
C.P. Big Value Corp.
Cathay Industrial & Mill Supply, Inc.
Centrola Phils., Inc.
Grasco Industries, Inc.
Manly Plastics, Inc.
Marsteel Corp.
Maximetal Industries, Inc.
Mould Maker Corp.
Precision Brass Fabricator
Romacar Technologies, Inc.
San Miguel Packaging Products
Toho - AG&P Metal Forming Corp.

NON-RESPONDENTS

Annama Engineering
Arty Foundry & Machine Shop
Buenthur Engineering Works
Don Bosco Technical Institute
Goodwill Machine Shop Co.
Hi-Mark Engineering & Machine Shop
JRS Engineering and Machine Shop
Macsan Metalcraft Ind. Co.
Maric Metal
Mega Tech. Dev't. & Mktg. Corp.
Morales Engineering Works
Nahicyle Prods. Mfg. Corp.
Philfran Machine Shop
Primal Engineering & Machine Works
Product Assurance & Technologies Corp.
Santech Corp
Solid Parts Corp.
Tool and Die Asia Cooperative

Annex 2
List of Philippine National Standards Adopted from Japanese Industrial Standards (JIS) Total = 37 Standards

[Jigs and Fasteners]

[Jigs]

JIS B 5201 (1989) Jig Bushings and Accessories
JIS B 5211 (1989) Washers for Jigs and Fixtures
JIS B (1989) Locating Pins for Jigs and Fixtures
JIS B 5226 (1989) Hexagon Nuts for Jigs and Fixtures
JIS B 52 (1989) Clamps for Jigs and Fixtures

[Dies]

JIS B 5004 (1975) Punch Holder and Die Holder for Press Dies
JIS B 5007 (1986) Guide Posts and Guide Bushes for Stamping Dies
JIS B 5009 (1981) Punches or Press Dies
JIS B 5012 (1986) Coiled Helical Springs for Stamping Dies
JIS B 5013 (1989) Die Sets for Press Dies
JIS B 5031 (1975) Accuracy Test for Press Die Sets
JIS B 5060 (1989) Steel Die Sets for Press Dies
JIS B 5061 (1989) Plates for Press Dies
JIS B 5062 (1989) Dowel Pins for Press Dies
JIS B 5063 (1989) Die Bushings for Press Dies
JIS B 5064 (1986) Shoulder Screws for Stamping Dies

[For Die Casting]

JIS B 5101 (1989) Holding Blocks and Cavity Inserts for Die Casting
JIS B 5102 (1989) Guide Pins of Dies for Die Casting
JIS B 5103 (1989) Ejector Pins of Dies for Die Casting
JIS B 5104 (1989) Return Pins of Dies for Die Casting
JIS B 5105 (1989) Guide Pin Bushes of Dies for Die Casting

[For Plastics]

JIS B 5106 (1989) Main Plates of Moulds for Plastics
JIS B 5107 (1989) Guide Pins of Moulds for Plastics
JIS B 5108 (1989) Ejector Pins of Moulds for Plastics
JIS B 5109 (1989) Locate Pins of Moulds for Plastics
JIS B 5110 (1989) Guide Pin Bushings of Moulds for Plastics
JIS B 5111 (1989) Locate Rings of Moulds for Plastics
JIS B 5112 (1989) Sprue Bushings of Moulds for Plastics
JIS B 51[illegible] (1989) Spacer Blocks of Moulds for Plastics
JIS B 5114 (1989) Shouldered Ejector Pins of Moulds for Plastics
JIS B 5115 (1989) Ejector Guided Support Pillars of Moulds for Plastics
JIS B 5116 (1989) Support Pillar of Moulds for Plastics
JIS B 5117 (1989) Ejector Sleeves of Moulds for Plastics
JIS B 5118 (1989) Support Pillar Bush of Moulds for Plastics
JIS B 5119 (1989) Taper Locks of Moulds for Plastics
JIS B 5120 (1989) Disc Spacer of Moulds for Plastics
JIS B 5121 (1989) Flat Ejector Pins of Moulds for Plastics

資料4－3 MIRDCにて実施した金型研修コース内容

COMPREHENSIVE TOOL, DIE AND MOULD MAKING TRAINING PROGRAM

(Two Years, 1993-1994)

Duration : Phase I & II = 18 months
Phase III = 6 months
----
24 months

Program Content : The program consists of three (3) phases

- Phase I: Related Theory is designed to equip the trainees with the theoretical and technical inputs including behavioral programs aimed at modifying their attitudes towards a more positive outlook.
- Phase II: Skills Training is designed to provide the trainees with the necessary skills required of a skilled tool, die and mould maker.
- Phase III: On-the-job Training in private tool and die shops is designed to expose the trainees in actual tool, die and mould making activities.

Detailed Curriculum : **Phase I - Related Theory**

- Technical Mathematics
- Technical Drawing
- Engineering Materials
- Metrology
- Communication Arts, Effective Human Relations and Work Ethics

Phase II - Skills Training

- Shop Safety
- Tool Crib Maintenance
- Basic Machine Tool Operations
  - ⇒ Offhand Tool Grinding
  - ⇒ Drilling
  - ⇒ Shaping
  - ⇒ Turning
  - ⇒ Milling
  - ⇒ Grinding

- Specialized Machining Practices
  - ⇒ Copy Milling
  - ⇒ Pantographing
  - ⇒ Jig Boring
  - ⇒ Surface & Cylindrical Grinding
  - ⇒ Tool and Cutter Grinding
  - ⇒ Eroding (EDM)
  - ⇒ CNC Machining
- Related Technology
  - ⇒ Jigs and Fixtures
  - ⇒ Cams and Gears
  - ⇒ Pneumatics and Hydraulics
  - ⇒ Welding
  - ⇒ Heat Treatment
- Tool and Die Making
  - ⇒ Bench Work Assembly
  - ⇒ Cutting Dies
  - ⇒ Forming Dies
  - ⇒ Bending Dies
  - ⇒ Forging Dies
  - ⇒ Die Casting
  - ⇒ Plastic Injection Mold

No. of Participants : Thirteen (13) technical school graduates
One (1) high school graduate
One (1) mechanical engineering graduate

Admission Reqmts. : Graduates in metalworking or engineering related courses who are presently unemployed

Admission Fee : Free of charge

INTEGRATED TOOL AND DIE DESIGN AND MAKING TRAINING PROGRAM

(Two Years, 1991-1993)

PHASE I	:	TRAINERS TRAINING
Duration	:	180 hours
Program Content	:	Three (3) short courses on • Basic Tool and Die Making • Advance Tool and Die Making • Plastic Mold Making 80% actual shop practice
Detailed Curriculum	:	See Annexes A1, A2, and A3
No. of Participants	:	Four (4) industry personnel Ten (10) MIRDC personnel
Admission Reqmts.	:	Graduates in metalworking and engineering related courses who are presently employed by industry
Admission Fee	:	Free of charge

PHASE II	:	INDUSTRY PERSONNEL TRAINING
Duration	:	2 years
Program Content	:	Four (4) industry personnel to render twelve (12) hours per month re; design, advanced tool and die making and specialization courses Theoritical inputs and machining courses including supervision of hands-on training to be handled by six (6) MIRDC trainors Teaching techniques
Detailed Curriculum	:	See Annex A4
No. of Participants	:	Fourteen (14) industry personnel
Admission Reqmts.	:	Graduates in metalworking and engineering related courses who are presently employed by industry
Admission Fee	:	Free of charge

Annex A1 - PHASE 1 COURSE OUTLINE FOR:

BASIC TOOL AND DIE MAKING

- Types of presses - principles and uses.
- Shearing Die, Shearing Die with Guide Plates only without Guidepost, Blanking Die with and without Guidepost, Punching Die with and without Guidepost, Piercing Die,
- Fine Shearing Die or Shaving Die, Side Trimming Dies
- Notching Dies, Shallow Drawing Dies, Coining Dies
- Measurements
- Standard Parts of Die, Shearing and/or Cutting Details, Shearing Force
- Cutting Clearances, Strip Rails, Punches
- Die Blocks, Retainers, Screws, Dowel Pins.
- Punch and Die Block Assembly, Punch and Retainer
- Pilot Pins, Die Setting and Sampling
- Press Forming Die, Bending Die, Deep Drawing Dies, Material Flow, Drawing Stages, Depth of Drawing and Sheet Metal Thickness.
- Reverse Redrawing, Deep Drawing with Rounded Humps and Pads, Assembly of Deep Drawing Dies, Workpiece Setting, Die Setting and Sampling and Repair
- Compound Die and its Details, Strip Materials
- Material selection for different Die Components

Annex A2 - PHASE I COURSE OUTLINE FOR:

ADVANCED TOOL AND DIE MAKING

- Introduction, Progressive Die and/or Lamination Die, Compound Die, Trimming Die
- Mathematical Method, Graphical Method
- Percentage Strip Scrap and/or Strip Utilization, Scrap Bridges
- Bending Dies, Curling Die, Coining Die
- Forming Die, Compound and Trimming Die using rubber pad
- Extrusion Dies (Hot or Cold)
- Forging Dies (Drop Hammer and Press Forging)
- Die-Casting Dies
- Materials Selection for different types of Dies
- Specialized Machining of Die Components

Annex 13 - PHASE I COURSE OUTLINE FOR:

PLASTIC MOLDS AND PLASTIC MOLDING TECHNIQUE

- Introduction, Molding Presses, Types of Molds, Design of Detailed Parts
- Ejector Half or Rear Cavity and Frames
- Cover Cavity or Front Cavity and Frames
- Ejector System
- Cores, Slides and Loose Mold Pieces
- Gating, Design of Mold Assembly, Manufacturing of Detailed Parts of Plastic Molds
- Milling Operations - Individual Inspection, Group Inspection, Quality Control
- Turning Operations - Individual Inspection, Group Inspection, Quality Control
- Grinding Operations - Individual Inspection, Group Inspection, Quality Control
- Special Machine Operations - Individual Inspection, Group Inspection, Quality Control, Manufacturing Processes in the Mold Assembly Sections
- Cooling and Heating System, Gating
- Mold Testing and Product Inspection
- Plastic Materials and Product Design
- Material Specification for Mold Parts and Heat Treatment
- Repair and Maintenance of Molds
- Production - Automation

Annex M- Phase II COMPREHENSIVE TRAINING PROGRAM COURSE CONTENTS

I. RELATED CLASSROOM (THEORY)

MATHEMATICS:

o Fundamental Processes of Shop Math.	18 hrs.
o Application of Algebra to Shop Calculations	18
o Trigonometry	36 hrs.
o Geometry (Plane & Solid)	18
o Compound Angles	36
o Mechanics	18
o Strength of Materials	18

DRAFTING:

o Fundamentals	36 hrs.
o Detailing of Jigs & Fixtures	36
o Die Detailing and Blue Print Reading	36
o Cams and Gears	36
o Description Geometry	48 hrs.

SCIENCE:

o Machine Tool Technology (Basic)	36 hrs.
o Machine Tool Technology (Advanced)	36
o Machinery's Handbook	36
o Ferrous and Non-Ferrous Metals	18
o Metals Characteristics	18
o Numerical Control and E.D.M.	18
o Die Theory	18

ELECTIVES:

o Hydraulics	36 hrs.
o Drafting	48
o Design and Constructions	48
o Die Design I	36
o Die Design II	36
o Completion Drawing (Die)	36
o Jigs & Fixtures Design and Construction	36
o Process (Materials Handling & Automation)	36
o Welding Technology & Laboratory	36
Total Lecture Hours	882 hrs.

II. WORK EXPERIENCE SCHEDULE (ACTUAL)

o Tool Crib	100 hrs.
o Bench	400 "
o Drill Press: Sensitive, Heavy Duty, Radial	100 "
o Lathe: Small and Large Capacities	200 "
o Milling Machines	400 "
o Grinding Machines	600 "
o Jigboring Machines	200 "
o EDM/CNC Machines	800 "
o Heat Treatment and Welding Practice	150 "
o Precision Inspection	300 "
	3,250 hrs.

Total Duration = 882 + 3,250 = 4,132 hrs.

24 months 2 years

Where: No. of hours/day = 8

資料4－4 1997 MIRDC Seminar Schedule

METALS INDUSTRY RESEARCH & DEVELOPMENT CENTER
Industrial Training Section
General Santos Ave., Bicutan, Taguig, Metro Manila
Tel. Nos. 837-04-31 to 38 locals 464/465/467
Fax No.: 837-04-30
DOST Line: 837-31-71 to 90 local 2402

1997 MIRDC Seminar Schedules
January-December

SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE	SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE
ANALYSIS & TESTING					
1. Basic Electroplating Processes	Feb. 10-15; Jun. 23-28; Aug. 18-23; Nov. 24-29 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	3,000.00	5. Fundamentals of Corrosion	Feb. 17-20; Jun. 2-5; Aug. 4-7 Mon.-Wed. 9-4 & Thurs. 9-5 25 hrs.	2,500.00
2. Basic Non-Destructive Testing	Jan. 20-25; Mar. 17-22; Jul. 21-26; Nov. 24-29 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	3,500.00	6. Industrial Calibration	Jan. 23-25; Mar. 6-8; May 15-17; Jul. 10-12; Sep. 18-20; Nov. 20-22 Thurs. 1-7 Fri. 9-4 & Sat. 8-5 20 hrs.	2,500.00
3. Chemical Analysis of Metals	Feb. 5-8; Jul. 2-5; Aug. 13-16; Nov. 19-22 Wed.-Fri. 9-4 & Sat. 8-5 25 hrs.	3,000.00	7. Metallographic Failure Analysis	Feb. 24-28; May 26-30; Sep. 22-26; Dec. 1-5 Mon.-Thurs. 9-4 & Fri. 9-2 28 hrs.	2,500.00
4. Dimensional Metrology	Jan. 13-18; Mar. 3-8; Jun. 2-7; Jul. 21-26; Sep. 22-27; Nov. 24-29 Mon.-Fri. 1-7 & Sat. 8-5 38 hrs.	4,000.00	8. Metal Identification & Selection	Mar. 3-5; Jun. 9-11 Oct. 6-8 Mon.-Tues. 9-3 & Wed. 9-4 16 hrs.	1,500.00

SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE	SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE
ENGINEERING, PRODUCTION & PLANNING					
1. Basic Computer-Aided Design	Jan. 13-18; May 26-31; Aug. 18-23; Dec. 1-6 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	4,500.00	7. Operations Planning & Cost Control	Apr. 21-26; Sep. 8-13 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	2,500.00
2. Design of Jigs & Fixtures for Industrial Application	Feb. 3-8; Jun. 30-Jul. 5; Oct. 13-18 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	2,500.00	8. Product Costing	Jan. 13-18; Jun. 23-28; Oct. 20-25 Mon.-Fri. 9-4 & Sat. 8-5 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	2,500.00
3. Die Design for Industrial Application	Mar. 17-22; Jul. 14-19; Nov. 17-22 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	2,500.00	9. Production Planning & Control	Jan. 27-Feb. 1; May 5-8; Sep. 15-20; Dec. 1-6 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	2,500.00
4. Intermediate CAD	May 12-17; Sep. 8-13 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	4,500.00	10. Technical Drawing	Apr. 21-26; Sep. 29-Oct. 4 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	2,500.00
5. Metalcasting Cost Estimation	Mar. 10-14; Sep. 1-5 Mon.-Fri. 9-4 30 hrs.	2,500.00	11. Technical Drawing with CAD	Jun. 16-21; Jul. 28-Aug. 2; Nov. 3-8 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	4,500.00
6. Metalworking Cost Estimation	Jun. 30-Jul. 4; Oct. 27-31 Mon.-Fri. 9-4 30 hrs.	2,500.00			

SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE	SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE
MANAGEMENT & SUPERVISORY			***METALCASTING***		
1. Effective Time Management	Mar. 6-9; Jun. 2-5; Oct. 13-16 Mon.-Thurs. 9-4 24 hrs.	1,500.00	1. Basic Foundry Practice	May 5-9; Nov. 24-28 Mon.-Fri. 9-4 30 hrs.	2,500.00
2. Feasibility Study Preparation	Jul. 7-18; Sep. 22-Oct.3 Mon.-Fri. 9-4 & Sat. 8-5 68 hrs.	4,500.00	2. Foundry Melting Practices	Jun. 23-27; Sep. 8-13 Mon.-Fri. 9-4 30 hrs.	2,000.00
3. Project Evaluation, Monitoring & Supervision	Jul. 28-Aug. 2; Aug. 25-30; Nov. 17-22 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	3,000.00	3. Foundry Patternmaking	Apr. 14-18; Oct. 13-17 Mon.-Fri. 9-4 30 hrs.	2,000.00
4. Project Management	Aug. 4-8; Oct. 27-31 Mon.-Fri. 9-4 30 hrs.	2,500.00	4. Foundry Quality Control	Jun. 2-6; Nov. 3-7 Mon.-Fri. 9-4 30 hrs.	2,000.00
5. Supervisory Development	Jan. 27-Feb. 1: Jul. 21-26; Nov. 10-15 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	3,000.00	5. Investment Casting	May 26-30; Sep. 29-Oct. 3 Mon.-Fri. 9-4 30 hrs.	2,000.00

SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE
METALWORKING		
1. Heat Treatment of Steels	Jan. 27-31; May 19-23; Oct. 20-24 Mon. & Fri. 9-3 Tues.-Thurs. 9-4 26 hrs.	3,000.00
2. MIG MAG Welding	May 12-17l; Aug. 18-23; Nov. 10-15 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	7,000.00
3. SMAW & OAW	Feb. 17-22; Jun. 16-21; Sep. 22-27 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	4,000.00
4. TIG Welding	Apr. 14-19; Jul. 7-12; Oct. 6-11 Mon.-Fri. 9-4 & Sat. 8-5 38 hrs.	6,000.00
OTHER PROGRAMS		
1. Establishment of Preventive Maintenance	Jun. 13-14; Sep. 5-6 Fri. 9-4 & Sat 8-5 14 hrs.	2,000.00
2. Records Management	Mar. 11-15; Aug. 25-29 Tues.-Fri. 9-4 & Sat. 8-5 30 hrs.	2,000.00

SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE
TRAINER'S TRAINING		
1. Moderating & Facilitating Techniques	May 19-24; Sep. 1-6 Mon.-Sat. 8-5 40 hrs.	
2. Organization & Management of a Training Program	Apr. 21-26; Oct. 20-25 Mon.- Sat. 8-5 48 hrs.	3,000.00
3. Training Media & Methods (Visualization & Presentation Techniques)	Feb. 20-22; Jul. 10-12 Thurs.-Sat. 8-5 24 hrs.	
4. Trainer's Training I	May 5-10; Sep. 29-Oct. 4 Mon.-Sat. 8-5 48 hrs.	2,500.00
5. Trainer's Training II	Aug. 26-30; Nov. 18-22 Tues.-Sat. 8-5 40 hrs.	3,500.00

SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE	SEMINAR/WORKSHOP	SCHEDULE	SEMINAR FEE
PACKAGE PROGRAMS	*(Package programs per company's request)*				
BEHAVIORAL PROGRAMS			*OTHER TECHNICAL PROGRAMS*		
1. Teambuilding	24 hrs.				
2. Effective Human Relations & Work Ethics	24 hrs.		5. Molding Sand, Properties & Control	30 hrs.	
OTHER TECHNICAL PROGRAMS			6. Shell Molding	30 hrs.	
1. Length Calibration	14 hrs.		7. Gemstone Cutting & Polishing	24 hrs.	
2. Foundry Casting Design	30 hrs		8. Techno-Demo on Gemstone Cutting & Polishing	18 hrs.	
3. Casting Defects & Remedies	18 hrs.				
4. Ductile Iron Production	30 hrs.				

NOTE:

- o Civil Service Commission (CSC) accredited Government Training Institution (GTI-00503-0594).
- o Continuing Professional Education (CPE) units on selected technical seminars/workshops.
- o All schedules are tentative. Please confirm your reservations at least TWO WEEKS BEFORE the seminar schedule.
- o Confirmation of RESERVATION upon receipt of the duly accomplished RESERVATION FORM.

PHILIPPINE DIE AND MOLD ASSOCIATION

Vision

The Philippine Die and Mold Association seeks to promote the rapid modernization of the Philippine die and mold industry by fostering closer cooperation between and among the members of the industry, the academe, and the government and by serving as a catalyst in consolidating their efforts and in mobilizing available resources with the end in view of enhancing the capability of the die and mold industry to meet the demands of the local and export market under the standards of global excellence.

Thrusts

1. Policy advocacy and support

To formulate, initiate, and advocate policies and strategies for the rationalization of the mold and die industry, review the existing industry policies, and closely monitor the implementation thereof.

2. Industry consolidation and network-building

To establish a network or linkages with industry leaders, partnerships, corporations, associations, or persons engaged in die and mold making, here and abroad, for purposes of exchanging views and information, establishing bases for cooperation, or undertaking collaborative activities for the advancement of the interests of the die and mold industry.

3. Information dissemination

To establish a center for information dissemination on researches, technologies, and policies and programs pertaining to or affecting the mold and die industry.

4. Technical capability upgrading

To promote closer collaboration between and among the industry, the academe, and the government in upgrading the technical capability of educational institutions offering subjects on took mold, and die making and in conducting training programs for skills-improvement of people involved in the industry.

5. Establishment of common research and technical facilities and creation of a pool of technical consultants

To establish common research and technical facilities for the industry and create a pool of technical consultants of such nature as may advance the common interests of the industry.

PHILIPPINE DIE AND MOLD ASSOCIATION, INC.

C/o MIRDC, Gen. Santos Avenue, Bicutan, Taguig, Metro Manila
Tels. 837-0431 to 38 Loc. 463; Fax: 837-0430

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   Fax: 3610231

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   747 Sgt. Bumatay St., Plainview
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   T 5325629; 5319355; 5319860
   Fax: (632) 5315586

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Fax: 364-42-41

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Mount View Industrial Park
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14. MR. EDUARDO R. LACBAY — Trustee
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Gen. Santos Ave., Bicutan, Taguig, M.M.
T 8370431 to 38
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15. MR. DOMINGO I. BAGAPORO — Trustee
Board of Investments
Industry & Investments Bldg.
385 Sen. Gil J. Puyat Avenue
City of Makati
DL 8958214 TL 8976682 loc. 259, 247, 257
Fax: 8953649

PHILIPPINE DIE AND MOLD ASSOCIATION, INC.
DIE CASTING AND FORGING SECTOR

1. *Acme Tools Manufacturing Co., Inc.*
2. *Aichi Forging Company of Asia, Inc.*
3. *Cathay Industrial and Mill Supply, Inc.*
4. *GST Philippines, Inc.*
5. *Kaiwa Metal Products*
6. *Marsteel Corporation*
7. *Metalcast Corp.*
8. *Pilipinas YTK Industries, Inc.*
9. *Tanchaoco Manufacturing Corp.*
10. *Toho Metal Processes Corp.*

PHILIPPINE DIE AND MOLD ASSOCIATION, INC.
ELECTRONICS AND SEMICONDUCTOR TOOLING SECTOR

1. *Adzer Engineering*
2. *Anglamar Tool Maker*
3. *ATF Resources*
4. *Azana Precision*
5. *Base Corporation*
6. *Dienamiktool*
7. *Evapia*
8. *FAD Industrial*
9. *Moulding Technology Inc.*
10. *HDM Automation Center*
11. *Intertool*
12. *KEBA Engineering*
13. *La Rota Tool and Die*
14. *Limarcelo Trading Corp.*
15. *LMP Tooling Components System*
16. *MAF-Micromachining Corp.*
17. *Microtool*
18. *MRM Tool & Die Master*
19. *Oriental Toolmaster Corp.*
20. *Pacific Electromagnetics Corp.*
21. *Ramcar Tool and Die, Inc.*
22. *Techni-Tool Eng.*
23. *Techno Molds, Inc.*
24. *Teknoware Eng'g. Co.*
25. *TESA*
26. *Unitech*

26\. *VL Advanced Technology*

GOVERNMENT SECTOR

1. *Board of Investments*

2. *Metals Industry Research and Development Center*

PHILIPPINE DIE AND MOLD ASSOCIATION, INC.
METAL STAMPING SECTOR

1. *Albert Metalcraft*
2. *Anvil Metalcraft Corp.*
3. *Aries Engineering*
4. *Azkcon Group of Cos.*
5. *Carparts Manufacturing, Inc.*
6. *Creative Trade Center*
7. *Directric Industries, Inc.*
8. *DKP Enterprises*
9. *Fabricator Phils.*
10. *IMF International Corp.*
11. *Jett Dynamics*
12. *M.D. Juan Enterprises, Inc.*
13. *Maximetal Industries, Inc.*
14. *Meralco Foundation*
15. *Metaflex Cylinder Inds., Inc.*
16. *NER Industrial Services Corp.*
17. *Optitech Machine Tools*
18. *P & R Parts*
19. *Phil. Tool and Die Center, Inc.*
20. *Radium Engineering Supplies, Inc.*
21. *R. Cura Engineering*
22. *Roberts Radiator Corp.*
23. *Sankei Phils., Inc.*
24. *Simon's Ind'l. Metalworks Corp.*
25. *Standard Electric Mfg. Corp.*
26. *Toyo Machine Center*
27. *Victory Industrial Co., Inc.*
28. *Visayan Machine Shop and Eng'g Works*

PHILIPPINE DIE AND MOLD ASSOCIATION, INC.
PLASTIC, RUBBER & PACKAGING SECTOR

1. *I-tung Plastic Mold Engineering Co.*
2. *Laguna Da-ichi*
3. *MACLIN Electronics*
4. *Manly Plastic, Inc.*
5. *Ramcar Technology, Inc.*
6. *Solid Parts*

PHILIPPINE DIE AND MOLD ASSOCIATION, INC.
TECHNOLOGICAL RESOURCES SECTOR

1. *Bon Industrial Supply*
2. *COSA Liebermann Corp. (Phils), Inc.*
3. *Deckel Phils.*
4. *Dynamicro Corp.*
5. *Filsonics (Makino) Integrated Machine Tool Sales*
6. *Gapilven Trading Corp.*
7. *Gaylan Technologies*
8. *German-Asian High Tech Corp.*
9. *Intrasteel*
10. *Jeppe Technical*
11. *Lionapex Phils. Inc.*
12. *Machinebanks' orp.*
13. *Maruka*
14. *Mesco, Inc.*
15. *Metal Improvement, Inc.*
16. *Nichei Pilipinas*
17. *Nicklaus Sales Corp.*
18. *Penta Technological Products*
19. *RMC Equipment*
20. *Saarstahl Phils.*
21. *Sandvik Phils., Inc.*
22. *Silangan Machinery*
23. *Sodick Co., Ltd.*
24. *Special Steel Products, Inc.*
25. *Team Asia Corp.*
26. *Techno Products & Services, Inc.*
27. *Uptown Industrial*
28. *Victor Machinery Corp.*

JICA