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Technical Note

PHILIPPINE COUNTRY REPORT:
Welding, Metalforming, and Metal Casting Sectors

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ABSTRACT

This paper gives a country report on the status, technology, manpower, and development plans of the welding, metalforming and metal casting sectors of the Metals and Engineering Industry.

Welding is used predominantly by about 1400 small-scale iron works fabrication shops, 35 vehicle chassis and body makers and 13 pipe and tubemakers with an existing aggregate capacity of 300,000 mt. In metalforming, there are 25 bar-rolling facilities, 8 wire rod rolling facilities and 6 structural section rolling facilities with an aggregate of 938,400 MT. There are sixty firms utilizing wire forming techniques to manufacture wire products, while only five firms offer mechanized steel forging. Smithery or hand forging is widely practiced in at least 6 regions of the country. Extrusion technology is used by five firms, while sheet metalforming is widespread in the urban communities. The country has 221 metalcasting plants but only 153 are operating.

Equipment inventory in welding showed that about 60% are metal arc welding machines while 21% are oxy-acetylene welding sets. In metalforming, industry sources have estimated that 60% of the facilities use second hand equipment at least 20 years old. The degree of mechanization of metalcasting plants is low, with only 24% of the parts being partially mechanized.

Manpower needs of the three sectors, according to a study by the National Manpower and Youth Council, are substantial, with about 1800 additional welders, 1700 additional mill workers, 1000 sheet metal workers needed per year up to 1993. No figures are cited for the metalcasting sector.

The strength of all three sectors, and the Metals and Engineering Industry as a whole includes the existence of a large pool of trainable manpower, a large potential domestic market, and to a certain extent product acceptance in the international market. The weaknesses are lack of adequate or up-to-date facilities, difficulty in sourcing good quality low cost raw materials, and the prevailing low productivity levels.

The development plans for the three sectors are taken from the Metals and Engineering Industries National Action Plant 1990-2000, considered as a blueprint towards industrialization of the country. The plan was formulated by a multi-sectoral body composed of government officials, industry captains and members of the academe.

PHILIPPINE WELDING INDUSTRY

Industry Status and Profile

Welding technology has been extensively utilized by several sectors of the Philippine Industry. The most dominant application of the welding process is in the Metals and Engineering Industries while it is gaining greater application in the Construction industry.

The metalworking sector applies the welding process to fabricate metal products notably for ironworks and structural steel frames ranging from windows, grills, gates, furnitures to structural girders, beams, columns and offshore flatforms. Other firms manufacture water tanks and pressure vessels also by welding.

The transport manufacturing sector has welding operations largely for fabrication of bodies and chassis of commercial vehicles and trucks. Pipes and tube mills also have welding stations. Shipbuilders are forerunners in employing welding techniques. Machinery manufacturers assemble their products most often by welding.

Downstream, the Construction industry has started using structural steel frames for high-rise buildings and towers making welding an essential construction technique.

Welding was believed to be introduced into the Philippines at the turn of the century by IRON-IRON Phils., the first recorded metalworking firm in the country. Its facilities were oriented towards ship repair eventually expanding into casting and machining. From then on, a succession of shipyard and engineering works were established carrying with them the advancement of welding technology from oxy-acetylene up to electric welding techniques.

Today, small-scale ironworks fabrication shops are spread across the country, estimated to be about 1,400, generally providing jobbing and repair services. There are at least 10 firms, mostly medium to large sized, that are manufacturing structural steel frames, the biggest three of which have penetrated the Asian market with one successfully venturing into production of offshore flatforms for oil and mining companies worldwide. There are currently about 35 fabricators of bodies and chassis for commercial vehicles and trucks while 13 pipe and tubemakers are existing with an aggregate capacity of 300,000 MT.

With the country's construction industry generally considered fully developed, the mid-70's saw two major construction firms capturing large industrial contracts in the Middle East precipitating a large demand for structural and pipe welders. The Philippines is currently in the midst of a construction. At at least 10 buildings and shopping complexes with structural steel frames have been or are being erected since 1988. In contrast, the mid-80's saw a decline in the shipbuilding industry, reducing the number of significant firms to 5.

State of Technology

The major welding techniques employed by the industries are electric arc and gas welding. Characteristically, arc welding is used for steel plate applications in construction, metalworking, pipe-making, and ship-building while oxy-acetylene welding is utilized for sheet metal such as vehicle bodies and pressure vessels. Among electric arc welding machines available here are machines for manual metal arc (MMA), submerged arc welding (SAW), flux-cored arc welding (FCAW), tungsten inert gas (TIG), and metal inert gas (MIG). An equipment inventory of welding equipment showed that about 60% are metal arc welding machines while 21% are oxy-acetylene welding sets.

Advancements and modifications of welding processes such as automated welding stations, CNC welding, plasma, electron beam, laser, precision TIG technologies, as well as the development of special electrodes for new steel alloys and non-ferrous metals developed in industrialized countries have not been vigorously adopted by Philippine industries for the apparent reason that factors, namely usage and cost-effectiveness are not yet critical. This means that the use of special steels in the industries is still not extensive while the advantages of automation are still off-set by low labor rates. Consistently, TIG and MIG welding continue to be regarded as specialized techniques while ironworks are adopting the use of inexpensive arc transformer type welding units that were recently developed by a local manufacturer.

Testing services for welds is offered by the Metals Industry Research and Development Center, a government institution, and by at least 2 other private companies covering non-destructive techniques namely penetrant, magnetic particle, radiographic, and ultrasonic testing. Mostly large firms avail of these services.

Manpower

A study of the government's National Manpower and Youth Council in 1988 estimated that there are about 12,000 welders with skills generally limited to MMA, SMAW and FCAW. It was also acknowledged that there are only a handful of accredited welding inspectors. The study also indicated that at least 1,800 additional welders will be needed up to the year 1993.

As part of the government's efforts for industrial training, NMYC regional centers offer basic welding courses, while another agency, the Construction Manpower Development

Foundation has a more rigid program suited for structural steel and piping works. The MIRDC offers welding courses for TIG and MIG processes. A private organization, known as the Welding Industries of the Philippines, also has training programs.

Constraints and Weaknesses of the Industry

The welding industry is burdened by several constraints, foremost of which, is the continued preference and reliance of firms on aged metal arc welding units. Due to this, very few welders even have the opportunity to develop skills in specialised welding techniques such as TIG and MIG.

Another weakness is the general disregard among welding practioners to check and upgrade weld quality through available NDT methods. Only large structural steel fabricators and erectors submit to these methods. Added to this, the industry is hampered by the lack of licensed welding inspectors since accrediting institutes have to be foreign organizations in the absence of one in the country.

The country does-not have an established institute for post-graduate studies in welding metallurgy, design, testing, and new technologies so that special jobs requires the commissioning of foreign experts. Another constraint starting to be felt by large firms is their total dependence on imported special application electrodes.

Strengths and Prospects of the Industry

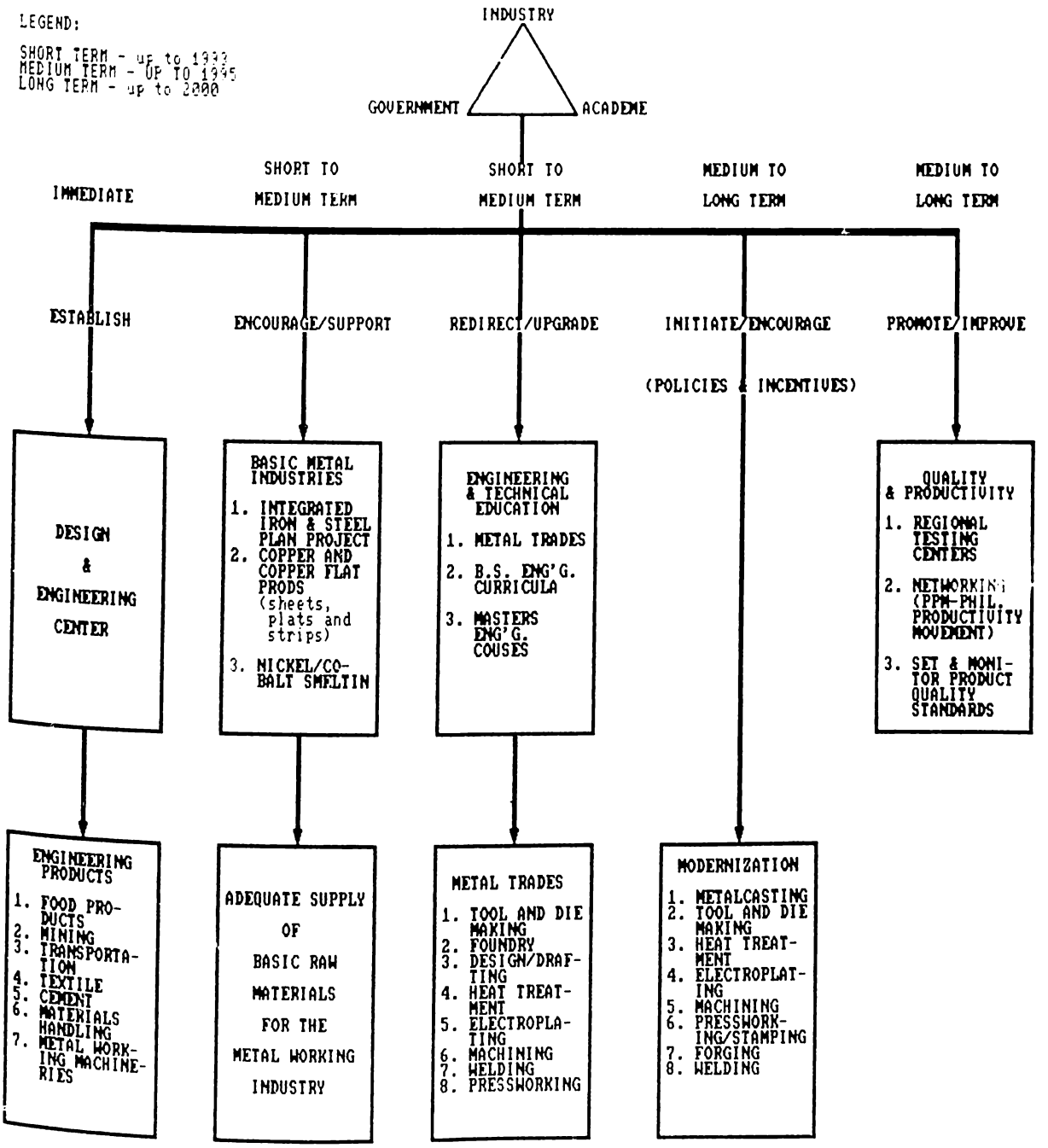
The main strength of the industry, as fully exploited by firms which have penetrated the export market, is its large trainable manpower pool available at very competitive labor rates. The apparent large inventory of welding units, although aged, may also be considered as a strength of the sector since it is capable of meeting any short-term surge in demand. Lastly, the presence of 6 non-special application electrode manufacturers, with a capacity of 15,000 MT satistfying almost 90% of local demand, lends support to the industry.

The short to medium term prospects for the industry appears highly favorable with the anticipated expansion of its major markets and applications such as structural steel materials, industrial pipings, and commercial vehicles and trucks. Added to these, are the foreseen revival of the shipbuilding industry. Another favorable development could be the emergence of welding unit manufacturers which is hoped to improve capability beyond simple arc transformers.

Development Program for the Welding Industry

The Metals and Engineering Industries National Action Plan 1990 - 2000 (see diagram), considered as the blueprint towards the industrialization of the country as formulated by a multi-sectoral body composed of government officials, industry captains,

METALS AND ENGINEERING INDUSTRY NATIONAL ACTION PLAN
1990-2000
SCIENCE AND TECHNOLOGY COORDINATING COUNCIL



and membes of the academe, has identified the welding industry as one of the 7 metalworking technologies that should be modernized. As one of the major components of the Plan, the Development Program of the Welding Industry directs the implementation of the following actions:

A. Rehabilitation and/or Modernization of Facilities

- Imposition of minimal duties on the importation of modern welding units and test instruments.
- Tax credits for firms utilizing locally-fabricated welding equipment and toolings.
- Rehabilitation of training facilities at MIRDC.

B. Quality Upgrading

- The formation of a Welding Inspection and Standardization Board with the following functions:
- Promote the use of NDT methods.
- Formulate and/Adopt welding standards.
- Classify welders according to ILO classifications.
- Licensing of welding inspectors.

C. Skills Upgrading

- Sourcing of more fellowships for post-graduate welding technology thereby developing a corps of local welding specialists.
- Expansion of MIRDC and NMYC regional training programs.

PHILIPPINE METALFORMING INDUSTRY

Industry Status and Profile

The most widely utilized Metalforming technologies by the Philippine Metals and Engineering industries are bending, pressworking, punching and shearing, forging, rolling, wireforming, and extruding.

In terms of capitalization, rolling mills comprise the biggest sector of metalforming technology users. There are about 25 bar-rolling facilities, 8 wire rod rolling facilities and 6

structural section rolling facilities with annual capacities of 516,000 MT, 271,000 MT and 151,400 MT, respectively. Next to this sector, are more than 60 medium to large sized firms utilizing wire-forming techniques to manufacture wire products ranging from nails, G.I. wires, wire ropes, wire fences, springs, and electrical wires and cables.

Significant mechanized steel forging is offered by 5 firms two of them strictly utilizing rotary forging technology for the production of grinding steel balls used by the mining industry. The remaining three facilities have a combined annual capacity of merely 25,000 MT. The main market of the two dominant facilities are automobile components such as crankshafts, pistons, connecting rods, and various forgings required for mining, construction, railroad and agricultural applications while the smallest firm with a capacity of only 600 MT per year specializes in the production of bolts, nuts, screws, tool bits, as well as vehicle repair tools.

Smithery or hand-forging is widely practiced by at least 6 regional communities all over the archipelago producing cutlery items such as scissors, razors, knives, various types of cutting blades, and other agricultural implements.

Extruding technology has been prominently applied by 5 firms in the manufacture of aluminum extrusions particularly achitectural and construction frames, bus bodies and appliances.

Sheet metalforming shops appear to be the most numerous among the industry as they are mostly open-front shops found in every industrial district employing operations such as punching, bending, shearing, and cold-roll-forming. Prominent among these are auto body rebuilders employing tinsmithing (manual) techniques while existing in tandem with motor repair shops. These rebuilders started proliferating during the 1980's due to the ageing fleet of passenger cars.

Mechanized sheet metalforming is widely utilized by metal product manufacturers. About 35 firms fabricate bodies of new commercial vehicles and trucks using steel sheets. There are 20 companies manufacturing tin cans from tinplates while 15 metal containers manufacturing companies produce drums and pails with roll-forming operations.

Thirteen firms are engaged in sheet metal forming to produce corrugated and roll-formed roofing sheets with aggregate annual capacity of 391,000 MT. Bending and roll-forming are utilized in the production of pipe tubes undetaken by 14 firms.

Bending, and pressworking operations are also used in the production of household appliance components such as bodies of air conditioners, refrigerators, ovens, and parts of electric fans. Other sheet metalworks locally undertaken are fabrication of air-conditioning ducts and vents, filing cabinets, roofing drains, and metal storage tanks.

State of Technology

The first metalworking technology in the country can be considered as the art of forging ironware (commonly referred to as blacksmithing) for bladed weapons and farm

implements such as iron plows, a tradition dating back to the thirteenth century and passed on from generation to generation. Centuries hence, blacksmithery is still a flourishing trade in several regional communities, but a more reliable indication of the country's state of metalforming technology can be provided by a general assessment of the sector's equipment inventory.

Industry sources have estimated that 60% of metalforming facilities are second-hand equipment at least 20 years old particularly rolling, wire drawing, and pipe making facilities. Mechanical pressworking machines constitute about 45% (2,700 units) of total metalforming equipment while simple shearing, bending, and punching machines have been estimated to be about 2,100 units, accounting for about 40% of the inventory. Rolling, wire-forming, extrusion, and forging equipment round-up the remaining 15%.

Thus, owing to the generally aged condition and the heavy dominance of simple manual machines of the sector's equipment inventory, it may be safely stated that metalforming firms have not kept pace with advancement and modifications in terms of automation, precision, capability and capacity evident in systems currently in use in industrialized countries. Of particular significance, is the limited capability of forging facilities even while the advantages of mechanized forging have been gaining for wider application in the industries.

Manpower

A study conducted by the National Manpower and Youth Council (NMYC) in 1988 estimated that there are about 12,000 pressworkers and 7,000 sheet metalworkers. Sources at the Metals Industry Research and Development Center approximate rolling and mill operators to be about 3,000 while blacksmiths are numbered at about 500. The NMYC study also indicated that at least 1,700 and 1,000 additional pressworkers and sheetmetal workers, respectively, will be needed by 1993.

Unlike other metal trades machining and welding, there is virtually no formal skills training system for metalforming technology in the country. Only MIRDC's regional training programs for smithery can be considered as a program in this direction. The basic source of generating skilled workers for this sector is thus left to on-the-job application in firms and enterprises themselves.

Constraint and Weaknesses of the Industry

The most pressing constraint is the limited production capability of the sector's equipment and facilities, notably for products requiring precision tolerances and specific metal properties. Partly inhibiting the opportunity of firms to upgrade is that local machinery manufacturers can only produce shearing, bending, simple stamping and pressworking machines.

Added to this is the condition that pressworking and forging facilities are hindered by inadequate tool engineering support services. The sector is also hampered by deficient

technical knowledge of its manpower mainly attributable to the absence of a formal skills training program for metalforming trades.

Strengths and Prospects of the Industry

As with other sectors of the Philippine industry, the metalforming sector's main strength is the large trainable manpower pool available at very competitive rates. In the Philippines drive towards industrialization by the year 2000, the market prospects for the sector appears favorable. The current boom of the construction industry augurs positively for manufacturers of rolled bars, roofing sheets, pipes and wire products. Fabricators of bodies for commercial vehicles and trucks are now looking ahead up to the medium-term requirements for more vehicles to alleviate the transport crisis. The expansion itself of the metalworking industry shall require the corresponding expansion of the metalforming sector specifically for pressworked and forged components of machineries and equipment.

Development Program for the Forging Industry

The Metals and Engineering Industries National Action Plan 1990 - 2000, considered as the blueprint towards the industrialization of the country as formulated by a multi-sectoral body composed of government officials, industry captains, and members of the academe, has identified the forging industry as one of the 7 metalworking technologies that should be modernized. As one of the major components of the plan, the Development Program for the Forging Industry directs the implementation of the following actions:

A. Modernization/Technology Upgrading

- Reduction of tariff duty on forging equipment of high capacity, precision and automation.
- Acquisition of mechanized forging facilities at MIRDC to be utilized for extension services.
- Classification/Accreditation of forging facilities as the basis for industry assistance services.
- Institution of a Technical Consultancy Program for forging technology.

B. Quality Upgrading

- Standardization of materials, tolerances and strength of forged products.
- Conduct of a public awareness compaign on the advantages of forging and using forged products.

C. Skills Upgrading

- Institution of a skills training program for pressworking and forging technology.
- Implementation of an MIRDC tool and die training program to improve tool engineering support services.

PHILIPPINE METALCASTING INDUSTRY

Industry Status and Profile

Metalcasting has been a trade in the Philippines since 1870 and it was only in the twentieth centry that various types of metalcasting plants proliferated, so that, today a total of 221 metalcasting plants are identified and 62% are located in Metro Manila. However, at present only 153 or 69% of these metalcasting plants are operating.

The country's metalcasting industry is subdivided into cast iron, steel and non-ferrous sectors. The non-ferrous sector is the biggest followed by cast iron. Machinery industry is the major market for metalcasting products taking up 80% of the total tonnage produced while construction comes second at 13%. The biggest market for gray iron casting is the factory machinery sector while the mill machinery sector is the biggest market for white iron and steel casting. The automotive industry is the market for ductile iron and non-ferrous casting, and the construction industry for malleable iron castings.

Total domestic demand of casting products in 1987 was recorded at 217,000 metric tonnes while local production was only at the level of 142,000 metric tonnes. Plant utilization based on the rated capacity of the facilities is below 50%.

For the seven year period, from 1981-1987, the industry contributed an average of about P2.5 billion per year to GNP. In 1987 alone, contribution to GNP was about P3.3 billion. Export from the same seven year period averaged to US$ 4.7 million per year. Industry exportation in 1987 earned US$ 5.7 million. The industry employed about 8000 direct employees in 1987.

STATE OF TECHNOLOGY

The industry has sufficient know-how of the casting technology but it lacks modern equipment. Hence, equipment upgrading, is needed more than know-how upgrading, although both are necessary for plant and product improvement.

About 24% of the foundries are partially mechanized. Most of the mechanization is in the molding, coremaking, and cleaning areas and to lesser extent, melting and metal handling. Very few foundries have a sand handling system. There has also been an improvement in the chemical analysis equipment which has made analysis faster.

Productivity in the foundry industry is measured in tonnes of castings produced per man-month or man-year. The country's company productivity in 1987 was 1.51 tonnes per man-month (t/m-m) for gray iron, 2.57 t/m-m for steel, 0.47 t/m-m for bronze, and 0.95 t/m-m for aluminum.

Standardization of casting product is being worked out at present to classify casting products into class A (automotive grade), class B (building grade), and class C (Common grade). Of the 153 operating metalcasting plants, only 24% are capable of producing engineered castings which match the international standards.

Strengths and Weaknesses of the Industry

Considered strengths of the industry are: a) Existence of a larged potential domestic market. Domestic demand for 1987 was about P7.2 billion and is expected to increase in the succeeding years; b) Acceptance in the international market. Export value in 1987 was recorded at US$ 5.7 million; c) Local availability of the appropriate technology. These technologies are available at the Metals and Engineering Industry Research and Development Center and Philippine Foundry Society. ; and d) Existence of trainable manpower. There is an ample supply of trainable manpower and excellent training facilities from the government institutions.

The industry, however, is burdened by the following; a) Lack of adequate facilities. The industry is reluctant to modernize mainly due to the high cost it entails.; b) Low productivity. This is related to the inadequacy of facilities. Further, the following problems are causes of concern in the industry; a) price, sourcing, availability of quality raw materials; b) low manpower productivity; c) poor product quality; d) high power rates and unreliable supply of energy; and e) inefficient communications and transportation facilities.

Needs and Prospects of the Industry

The industry needs the following to justify its growth: a) Assistance in identifying foreign market. Since most of the foundries are small enterprises, it is very expensive for them to carry such foreign market study.; b) Upgrading of facilities. This is an urgent need to cope with present market demand for quality and quantity of the product.; c) Upgrading of manpower skills. d) Low cost financing. The industry has been experiencing very minimal net profit due to the high interest rates being paid.; and e) Duty free importation of basic raw materials. Most of the raw materials cannot be produced locally, thus they are sourced thru importation. Giving duty-free importation of basic materials would improve the competitive position of the industry.

Foundry business is moving up due to the present favorable economic climate and the market demand for metal castings. For the short-term, activities for the foundry, product quality can be improved, delivery time can be assured, and competitiveness can be achieved through the institutionalization of cooperative buying of materials to achieve proper sourcing,

consistent quality and lower price, and upgrading foundries to meet minimum requirements for the production of consistently acceptable quality castings. In the long term, continuous attendance to and honing on the initial activities set forth in the short-term, would lead to high quality and productivity comparable to industrialized countries.

Developmental Program of the Metalcasting Industry

In an effort to upgrade existing metal casting plants to improve product quality and cost effectiveness through increased plant productivity, efficient material/ energy utilization, training of personnel, effective quality control, reduction of waste and other related production technologies, the government initiated the metalcasting rationalization program.

Firstly, government, in cooperation with the metalcasting industry associations, is moving toward the standardization of different locally produced metalcasting products. Product standards for gray iron castings and malleable iron castings have already been formulated.

Secondly, institutionalization of consultancy program will be developed. Under this, a full time team of metalcasting experts shall be formed and shall conduct in-plant technical visits to all identified metalcasting plants to provide consultancy techniques to improve quality and productivity. The team will also educate/update metalcasting personnel on relevant foundry technologies.

Third, manpower development of the industry is likewise looked into in the rationalization effort of the industry. Training programs will be initiated only in regions where foundries will continue to operate.