The Philippine Metalworking Industry Profiling Study

ISSN 2362-8847

Department of Science and Technology
Metals Industry Research and Development Center

ISSN 2362-8847

The Cover: Metal production of CHORYO Toolings System, Inc. at Silang, Cavite.

FOREWORD

The Philippine Metalworking Industry Profiling Study of the seven sectors is the first in a series of industry studies prepared by the Metals Industry Research and Development Center (MIRDC), an agency under the Department of Science and Technology. The MIRDC is primarily founded to assist the metals, engineering and allied industries, which has evolved into a significant economic sector whose growth is of utmost importance to different private entities concerned and to the entire country. We shall update all seven sector profiles in a two-year timeline to update the status of the metalworking industry. Recalling that for the previous years, each sector is being updated but it takes long time before we could update the seven sectors, the industry as a whole because of time constraints.

The MIRDC's Profiling Study is an initiative that stemmed from the Center's pursuit of bringing the M & E industries to its competitive best. With this study, the MIRDC aims to present the market profile, give special attention to its problems and concerns, and point out technological trends. These information are useful in the current status of its sector eventually be instrumental to determine the competitive position of the metalworking industry.

This latest study is the result of actual plant visits, personal interviews, e-mailed questionnaires and intensive research. Profiling of all seven sectors will be updated in a two-year timeline to allow us to gather relevant inputs as to the performance of the metalworking industry. Availability of such information will enable the market players, including the MSMEs, to map out their company strategies to survive the competition.

Further, this study will enable the government policymakers to forge solutions to the industries' problems and adopt measures for its further advancement. With all these actions in place, the industry will receive all the most appropriate interventions it needs.

We fondly hope that this study shall be of great service to the industry, researchers, businessmen and public.

ACKNOWLEDGMENT

The Center acknowledges with deep gratitude and appreciation the generous assistance rendered in various ways, by both government and private entities, that made possible the 2013 Philippine Metalworking Industry Profiling Industry Study.

We would like to thank the following:

Industry Research and Study Unit (IRSU) team with Ms. Lina B. Afable, Chief of Technology Information Promotion Section as follows: Engr. Eldina B. Pinca, Ms. Rosalinda M. Cruz, Mr. Jim Patrick S. Erispe and Ms. Concesa T. Cortez. And most importantly, the major editing and comments provided by Dr. Danilo N. Pilar and the unwavering support of Ms. Josephine R. Esguerra, Engr. Adonis T. Marquez and Ms. Zalda R. Gayahan and assistance given by Engr. Wilbert H. Balingit, PME; Engr. Felipe Pachoco and Engr. Benjamin V. Estrellado, PME and Engr. Roy C. Sagrado.

Special thanks also go to the different sectors of metals and engineering industries including the associations such as Philippine Welding Society, Philippine Die and Mold Association Inc., and Metalworking Industry Association of the Philippines (MIAP) National Officers and staff and the MIAP Provincial Chapter Officers. The assistance and unwavering support of these sectors and government agencies such as Regional Offices of the Department of Science and Technology, National Statistics Office and National Statistical Coordination Board have definitely made the conduct of this study easier and a very fulfilling experience.

The team's deep gratitude goes especially to the respondents of the entire Metals and Engineering industries for despite the companies' busy schedule, they made time to accommodate the team in this endeavor.

And most especially to the Ever Living God, the God who called us according to His purpose, Who made possible the conduct of this study. With God's guidance and protection, the team emerged successful after the fruitful journey.

INTRODUCTION

The metalworking industry, otherwise called the engineering industry, represents the entire field of the metal manufacture. It is primarily concerned with the change of the shapes of metals to yield useful products and machine parts. For the purpose of this study, the focus will only be on metalworking which is divided into nine sectors: welding; machining; tool and die; heat treatment; metalcasting; electroplating; forging and stamping; and machine building. The seven sectors were already established which will be the focus and have been studied for the previous years, but the in-depth study of the eighth sector, stamping, is still ongoing. The machine building is exclusively packaged into a so-called program- the Makibayan. [22]

The first issue of the MIRDC Publication "Metalworking Industry of the Philippines" in 1974 defines the metalworking industry as stated in the first paragraph. As mentioned, the industry is divided into fourteen major groups (comprising of 93 branches).[25] After five years (1979), the industry leveled up and was divided into 20 major groups.[22] Currently, the industry is divided into three major industries: the iron and steel industry, the metal engineering industry and the non-ferrous metal industry. The metal engineering industry subdivided into three sectors, namely the metalcasting sector, the metalworking sector and the metal finishing sector. The metalcasting sector which is based on metallurgical engineering includes patternmaking, cast iron founding, cast steel founding, bronze casting, aluminum casting, high pressure die-casting, low-pressure die-casting and investment casting. The metalworking sector is based on mechanical engineering includes tool, die and mold making, steel forging, machining, pressforming, steel fabrication, welding and machine assembly. The metal finishing sector is based on chemical engineering includes metallic coating and organic coating. Metallic coating includes electroplating, calorizing, galvanizing and phosphating, while organic coating includes painting.[24]

TABLE OF CONTENTS

LIST OF TABLES

Welding Sector

Machining Sector

Tool and Die

Electroplating Sector

Metalcasting

Heat Treatment Sector

Forging Sector

LIST OF FIGURES

Welding Sector

Machining Sector

Tool and Die Sector

Electroplating Sector

Metalcasting Sector

Heat Treatment Sector

Forging Sector

The Metals Industry Research and Development Center is continuously conducting a profiling study of the different sectors of the metals and engineering group, covering different regions of the country to update the status of the industry. Primary data like regional distribution of shops, form of business organization, nature and type of business activity, classification according to capital and size of employment, market served and technical profile were gathered. Issues and concerns, including business plans of the shop owners, were also asked during the survey. Information were obtained through the conduct of personal interview during field surveys, electronic mails, and plant visits.

There is a total of 1,417 shop respondents during the survey conducted in 2010-2012 from the seven (7) sectors of the metalworking industry namely: welding, machining, tool & die, electroplating, metalcasting, heat treatment, and forging. With a total labor force of 23,572, the metalworking industry is skill-intensive. Figure A shows the profile of the metalworking sectors' number of respondent shops and percentage share.

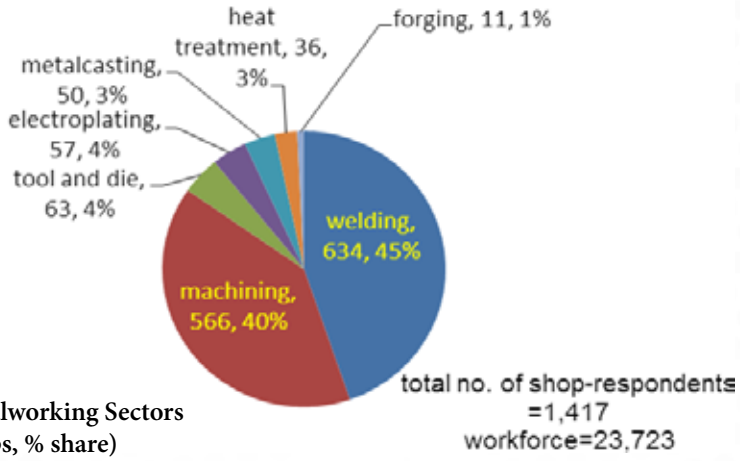

Figure A. Profile of the Metalworking Sectors (number of respondent shops, % share)

Production of the metalworking industry is generally oriented to supplying domestic markets although a few are quite successful in penetrating the export market.

The biggest number of respondents was gathered from the welding sector which comprises 634 shops. It is predominantly (85%) formed as single proprietorship and are mostly engaged in jobbing. Majority of the shops belong to "cottage" category with an investment of less than Php100,000, most of its market come from the automotive/transport industry. Majority (80%) of the shops are categorized as "micro" (1-9 personnel) based on the size of employment. The welding shops have a total of 3,532 workers, and 74% of them were rated excellent by the shop owners. Because of the large number of welding shops that thrive in different places in all regions of the country, competition is the predominant problem of shop owners, followed by insufficient capital. Welded products earned a remarkable share in the export market with a total of US Dollars 5.05 billion for the year 2008-2012. A strong market is seen for the same period as the import of welded products reached US Dollars 19.8 billion.

The machining sector got the second biggest (566 shops) respondents among the seven sectors with a total of 9,431 workers. They are mostly located in Region IV-A where economic zones are situated. Seventy (70)

percent of the shops were established as single proprietorship considering that majority of the shops belong to "micro" category (Php100,000 to 1 million) based on size of capital. Fifty (50) percent of the respondent shops utilized conventional machining equipment and only 23% use upgraded equipment including Computer Numerical Control Machine (CNC). They are into manufacturing, jobbing and repair services. Although most of the machine shop owners have problems on raw materials (i.e. high cost, availability and quality), the respondents, in general, have plans to increase their products and services, and branch out to other places.

The tool and die sector which generally complements machining processes have 63 respondent-shops gathered mostly from Region IV-A with a total of 3,954 production and non-production workers. Majority (75%) were organized as corporation and 72% belong to "small" category (10-99 personnel) based on size of employment. More than half (51%) are engaged in manufacturing and cater mostly to the transportation industry. Its major product lines are motorcycle and automobile parts. Manufacture of aircraft parts is also one of the products of the tool and die shops. There is a considerable contribution of the tool and die products to the economy as the total import reached US Dollars FOB Value 189.86 million and an average of US Dollars FOB Value 37.97 million for the 2008-2012. Also, the total export of tool and die products amounts to US Dollars FOB Value 16.42 million and an average of US Dollars FOB Value 3.284 million for the said period.

The electroplating sector has 57 respondents with a total of 1,309 workers. Majority (26%) of the shops are found in the NCR, followed by Region III (23%). Fifty (50) percent of the shops were organized as single proprietorship, in which majority (33%) of the shops are categorized as "small" (1 million to 10 million) according to capital. Predominantly, (35%) are into the manufacturing business which captures a big market in jewelry industry.

The 50 respondents of the metalcasting sector are mostly found in the NCR where businesses thrive to complement each other's market requirement. The metalcasting shops are predominantly (72%) formed as corporation and majority are medium-scale based on capital, however, the largest number of respondents belongs to the small category according to size of employment. Most (42%) of the respondent shops are engaged in manufacturing and the top three leading market are automotive, construction and agriculture industries. The total workforce of the metalcasting shop respondents is 3,007, majority of whom are evaluated very satisfactory by the shop owners. The importation of metalcasting commodities for 2008-2012 reached US Dollars 6,604 million, and the average for the five-year period totalled US Dollars 1,320 million. There is a total of US Dollars 1,530.6 million FOB Value for metalcasting export commodity and an average of US Dollars FOB Value 306.1 million for the same period.

There are 36 respondent shops for the heat treatment sector and have a total of 1,791 workers. The biggest (64%) number of shops were organized as corporation and are mostly found in the NCR. The shops predominantly are under the "small" category according to size of capital (37%), and also according to size of employment (58%). The import and export of heat treated products got a considerable contribution in the metals and engineering industries. There is a total of US Dollars 481.66 million FOB Value of heat treated export commodity and an average of US Dollars 96.33 million FOB Value for the year 2008-2012. A total import of US Dollars 657.25 million CIF Value and an average of US Dollars 131.45 million CIF Value for the same period.

The forging sector includes smithery shops. This sector, which has the least number of respondents (11 shops), is only the sector among the seven which has a classification of medium to large business according

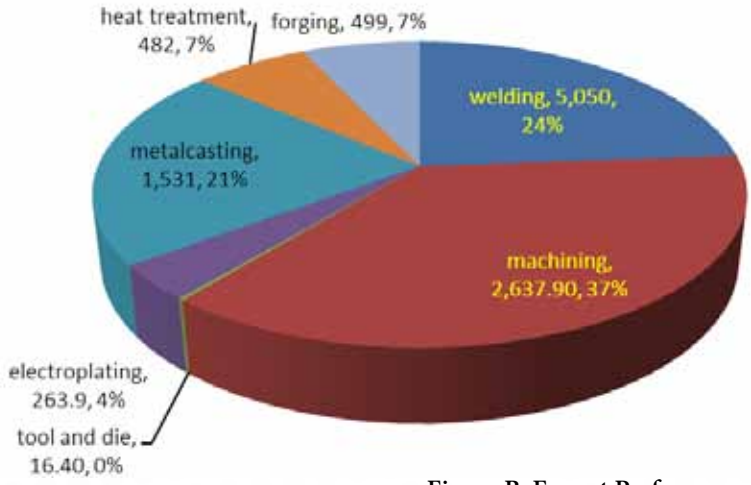

Figure B. Export Performance of the Metalworking Sectors, 2008-2012 (USD million; % share)

to capital. Forging companies cater primarily to the automotive sector although smithery shops offer their sevices primarily to the agriculture and household sectors. Selected forged products got a share in the export market which reached a total of US Dollars 499.44 million for the period 2007-2011.

The metals and engineering industry which is the backbone of major industries plays a significant contribution to the growth of the country's economy. Figure B show the export performance of the metalworking sectors and emphasizes that the export performance of the industry needs to be improved as it has only USD 10.48 billion as compared to the import of metalworked products which amounted to USD 36.56 billion. Thus, the conduct of industry study to update its status is vital as basis for relevant policy formulation of the industry.

THE PHILIPPINE METALWORKING INDUSTRY PROFILING STUDY

WELDING SECTOR

The History of Welding

Middle Ages

Welding can trace its historic development back to the ancient times. The earliest examples come from the Bronze Age. Small gold circular boxes were made by pressure welding lap joints together. It is estimated that these boxes were made more than 2,000 years ago. During the Iron Age, the Egyptians and people in the eastern Mediterranean area learned to weld pieces of iron together. Many tools were found which were made approximately 1,000 B.C.

During the Middle Ages, the art of blacksmithing was developed and many items of iron were produced which were welded by hammering. It was not until the 19th century that welding, as we know it today, was invented.

Welding in the 19th Century

Until the end of the 19th century, the only welding process was forge welding, which blacksmiths had used for centuries to join iron and steel by heating and hammering. Arc welding and oxy fuel welding were among the first processes to develop late in the century, and electric resistance welding followed soon after. Welding technology advanced quickly during the early 20th century as World War I and World War II drove the demand for reliable and inexpensive joining methods. Following the wars, several modern welding techniques were developed, including manual methods like shielded metal arc welding, now one of semi-automatic and automotive processes such as gas metal arc welding, submerged arc welding, flux-cored arc welding, and electroslag welding. Developments continued with the invention of laser beam welding, electron beam welding, electromagnetic pulse welding, and friction stir welding in the latter half of the century. The laser is finding welding applications in automotive metalworking operations. Robot welding is commonplace in industrial settings, and researchers continue to develop new welding methods and gain greater understanding of weld quality. [1]

Most Recent

Friction welding, which uses rotational speed and upset pressure to provide friction heat, was developed in the Soviet Union. It is a specialized process and has applications only where a sufficient volume of similar parts is to be welded because of the initial expense for equipment and tooling. This process is called inertia welding.

Laser welding is one of the newest processes. The laser was originally developed at the Bell Telephone Laboratories as a communications device. Because of the tremendous concentration of energy in a small space, it proved to be a powerful heat. [2]

Significance of the Welding Industry

The welding industry of the Philippines cuts across all industries. It is widely used in various sectors in the economy such as in oil and gas refineries, power generation, petrochemicals, offshore oil rig-drilling, maritime, shipbuilding, cement, mining, quarrying and earthmoving, telecommunications,

infrastructure, transportation, automotive, aviation and aerospace, railroads, foundries, smelters, steel mills, agriculture, food and beverage, construction, manufacturing, fabrication, plant and machinery maintenance, and other industries.

Welding is indispensable in metals engineering and construction industries. Welding is a metalworking process that is used to integrate parts and materials in the construction of buildings, bridges, pipelines or even massive offshore oil and gas rigs. Welding process complements metal fabrication, one cannot produce a single fabricated product without welding process. It serves industries like the agriculture and food sectors in the manufacture of various equipment. Welding is also one of the most critical operations in ship construction. When welds fail, often the whole structure fails. Over sixty years of research and development in the field of welding has provided current ship builders with fabrication processes that are readily automated, can produce consistent welds reliably, and/or can weld thick sections in a single pass for controlled distortion. [3]

In the rural and suburban areas, majority of the market served by metalworking shops is the automotive sector. Different modes of transportation and even agricultural equipment are repaired and fabricated with the aid of welding process. Undeniably, welding plays a crucial role and is a partner of the automotive sector's growth and progress. Thus, it is essential to support and develop the welding industry by conducting research studies that would give an update on the status of the industry, and would serve as basis of policy makers to formulate relevant plans and programs for the welding sector.

The Metals Industry Research & Development Center (MIRDC) conducts industry profiling studies of the different sectors of the metals & engineering (M & E) industries as a means to fulfill its mandate of assisting the industry specially the small-and medium- enterprises (SMEs), which make up a large portion of all the metalworking firms in the country.

In 2010, the Technology Information and Promotion Section (TIPS) included in its plans and programs the conduct of industry profiling to the different regions of the country for the seven (7) sectors of the metalworking industry, namely: heat treatment, welding, machining, electroplating, tool & die, forging and metalcasting. A total of 634 shops were surveyed for the welding sector. Most of the respondents belong to the Small-and Medium-Enterprises (SMEs).

Table 1 shows the Regional Distribution of Welding Shops of the country.

As shown, majority (223 shops or 35.2%) are located in Region IV, 74 (11.7%) are situated in the NCR and the remaining shops are distributed in the different regions of the country. It is observed that for the past ten years, businesses from the National Capital Region (NCR) begun to transfer to Region IV due to lower cost in the acquisition or rental of industrial lots by the business owners. The survey did not include the Autonomous Region of Muslim Mindanao (ARMM) due to its unstable peace and order situation. The welding shops were determined based mainly on the processes involved, product lines and the list of their functional equipment.

Table 1. Regional Distribution of Welding Shops

Area/Location	No. of Shops	Percent Share (%)
NCR	74	11.7
CAR	20	3.2
Region I	59	9.3
Region II	10	1.6
Region III	40	6.3
Region IV	223	35.2
Region V	55	8.7
Region VI	16	2.5
Region VII	18	2.8
Region VIII	26	4.1
Region IX	5	.7
Region X	16	2.5
Region XI	36	5.7
Region XII	15	2.4
Region XIII	21	3.3
Total	**634**	**100.0**

Organizational Structure

Table 2 illustrates the Year of Establishment of Welding Shops

As illustrated, majority (297 shops or 47%) were established in the 2000's, 136 shops (21%) were established in the 1990's, 85 (13%) in the 1980's and 29 (5%) in the 1970's. There are 22 shops (4%) that are already 50 years or more in existence.

Table 2. Year of Establishment of Welding Shops

Year Started	No. of Shops	Percent (%)
1950's	6	1
1960's	16	3
1970's	29	5
1980's	85	13
1990's	136	21
2000's	297	47
2011 onwards	40	6
Did Not Disclose Data	26	4
Total	**634**	**100**

Figure 1 reveals the Form of Business Organization of the Welding Shops.

As revealed, shops were predominantly organized as single proprietorship which totaled to 544 shops or 85%. Next predominant form is corporation which is composed of 45 shops (7%). Only 2 shops (1%) are government institutions, the remaining 5% did not disclose data.

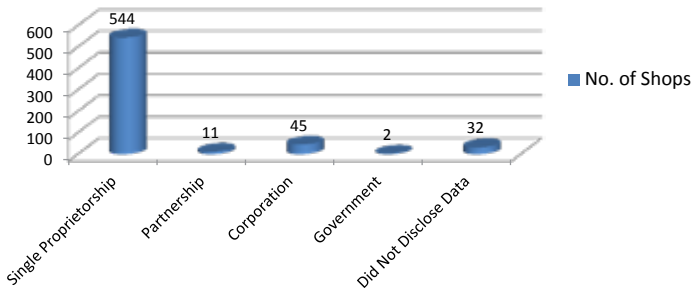

Figure 1. Form of Business Organization

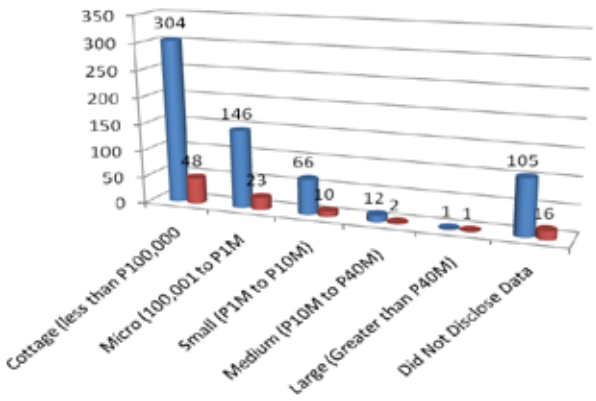

Figure 2. Size of Shops Based on Total Assets

Figure 2 shows the Size of Shop Based on Total Assets.

As shown in Figure 2, majority (304 shops or 48%) of the shops belong to "cottage" category based on total assets, followed by "micro" with 146 shops (23%), "small scale" comprise 66 shops (10%), and only a total of 3% got the share for the "medium" and "large" enterprises. A total of 105 shops (16%) did not disclose data on the size of shop based on capital. It implies that the welding sector is predominantly composed of small businesses as compared to other sectors.

As part of the company profile of welding shops, classifying welding shops according to their assets is one of the most important data to determine the status of the industry.

Table 3. Type of Business Activity

Business Activity	No. of Shops	Percent (%)
Independent	430	68
Captive	20	3
Did Not Disclose Data	184	29
Total	**634**	**100**

Table 3 and Figure 3 indicate the Type of Business Activity of the Welding Shops.

As indicated, 430 shops (68%) are operating as independent, 20 (3%) belong to either captive, service or academe and 184 (29%) did not disclose their business activity. Captive shops are those owned by large manufacturing companies that serve their own requirements. Academe serves as training institutions for students enrolled in technical courses.

Figure 4 illustrates the Nature of Business of Welding Shops. The shops are engaged in different activities to serve the demands and requirements of their customers.

As illustrated, the biggest share is jobbing which comprise 325 shops or 51 percent; followed by repair services, 101 (16%); manufacturing, 81 (13%); and manufacturing & jobbing, 59 (9%). Shops who did not disclose data on their business activity make up 10 percent.

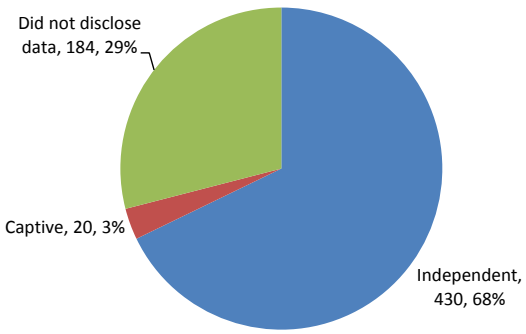

Figure 3. Type of Business Activity

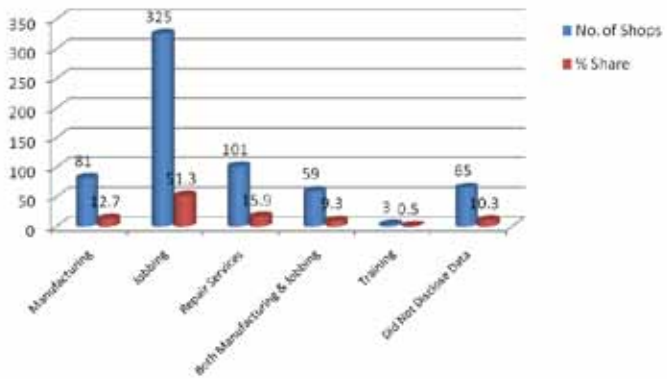

Figure 4. Nature of Business of Welding Shops

Figure 5 presents the Classification of Welding Shops According to Size of Employment.

As presented, 506 shops or 80% of the surveyed shops are predominantly micro of the 634 shops. 84 shops (13%) are "small," and the "medium" and "large" enterprises constitute 1% each.

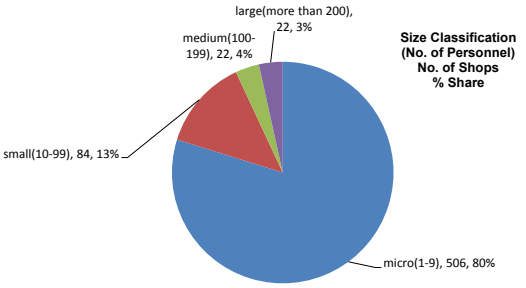

Figure 5. Classification of Shops According to Employment

Employment

Table 4 and Figure 6 illustrate the Classification of Workers and Distribution According to Education.

As illustrated, there are 2,216 (63%) out of the total 3,532 production workers, while 1,316 (37%) are involved in non-production activities. Production workers are directly engaged in production jobs like the welders, machinists, mechanics, quality inspectors and engineers who supervise technical/production jobs. Administrative workers include managers, office workers, utility men or helpers, and drivers. Some shops also employ workers on a contractual basis and accept on-the-job trainees.

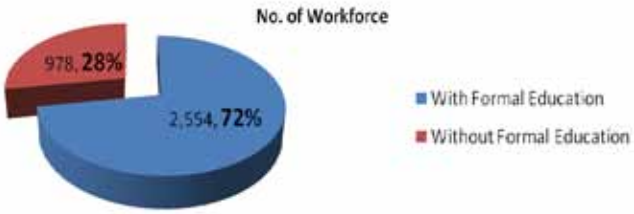

Figure 6. Classification of Workers and Percentage Distribution According to Education

Workforce is the pillar of any organization or institution. It largely contributes to the organization's success or failure depending on the worker's acquired education, training and attitude.

Figure 6 illustrates the breakdown of the workforce into those with and without formal education.

As illustrated, the 634 welding shops employ a total workforce of 3,532.

There are 2,554 personnel (72%) with formal education and 978 workers (28%) without formal education. Formal education includes completion of technical/vocational course with or without attendance to trainings related to the job. Workers with non-formal education acquired their skills through experience. Some shop owners organize in-house trainings to enhance skills and supplement their workers' deficiency in education.

Figure 7 reveals the Level of Proficiency of Workers.

As revealed, 467 (74%) got a rating of Excellent; 21 (3%), Very Satisfactory; 95 (15%) Satisfactory; 4 (1%) Fair; and 47 (7%) cannot measure their workers' performance based on the given criteria.

Table 4. Classification of Workers and Distribution According to Education

Classification of Worker	No. of Worker	%	Distribution of Worker According to Education	No. of Worker	%
Production Worker	2,216	63	With Formal Education	2,554	72
Non-Production	1,316	37	Without Formal Education	978	28
Total	**3,532**	**100**	**Total**	**3,532**	**100**

The competency level of workers and the level of output of the business are directly proportional: the more competent the employees, the higher the productivity level.

Shop owners evaluated the overall performance of their workers with the following set criteria: 5 = Excellent; 4 = Very Satisfactory; 3 =Satisfactory; 2 = Fair; and 1 = Poor. Despite the 28% that constitute the workers who did not acquire a formal education related to their jobs, the 74% overall excellent rating of the shop owners/managers implies that experience and training enable the workers to deliver customer requirements.

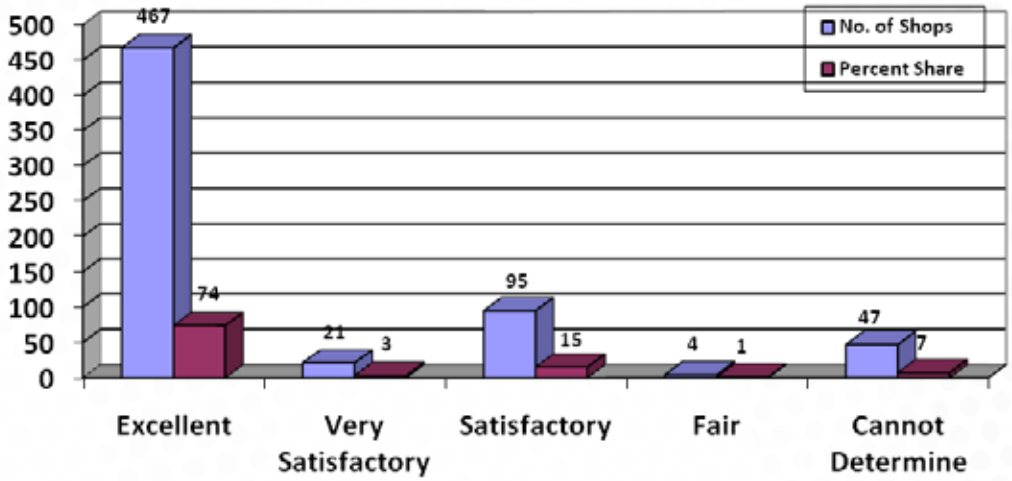

Figure 7. Level of Proficiency of Workers

Product Lines & Services

Welding jobs are continuously in demand due to the nature of service being offered to customers. Welding complements most processes in the fabrication of equipment that cater to various industries in the metals and engineering like agriculture, automotive and food sectors.

The major product lines and services rendered by the respondent-shops are as follows: fabrication of iron and steel products, agricultural, food and industrial equipment, and body building and repair of different types of automobile.

Fabrication of iron and steel products include iron grills, doors, swing, screen doors, sliding doors, shower enclosures, fence, gates, steel trusses, and steel windows.

Agricultural equipment fabricated by welding shops are rice mill, maize/corn sheller, hand tractor, power tiller, reaper, power thresher, grain cleaner, grinder, crusher, pulverizer, mobile dyer, animal feeder milling machinery, and coffee pulper. Respondent-shops fabricate diverse food equipment like bakery & kitchen equipment, mango processing, coconut grater, shell crusher, grain roasting machine, pericarp remover, dryer, sterilizer, wine filtration device, multi crop hydraulic extractor, sorghum, meat grinder, fish dryer, pancit/miki grinding equipment, and sugar cane extractor.

Fabrication of materials with industrial applications like metal parts of equipment, jigs and fixtures, semiconductor parts, precision toolings, and dies and molds are likewise provided by welding shops. Industrial equipment like blocking machine, canning equipment, conveyors and stairs, garbage processing equipment, mechanical rotary composter, multi-purpose rotary segregator and its accessories are among the equipment fabricated by the welding shops.

The transportation industry is one of the sectors that highly require welding services which include: fabrication of tricycle side cars; body building of public utility vehicles and pick-up; repair of auto spare parts like headers and mufflers; and overhauling of heavy equipment. Fabrication and repair of fishing light boats are some of the welding services offered in localities where fishing is the main source of income.

Consumption of Raw Materials

The raw materials used in welding and fabrication by the respondent shops are steel bars (angle bar,

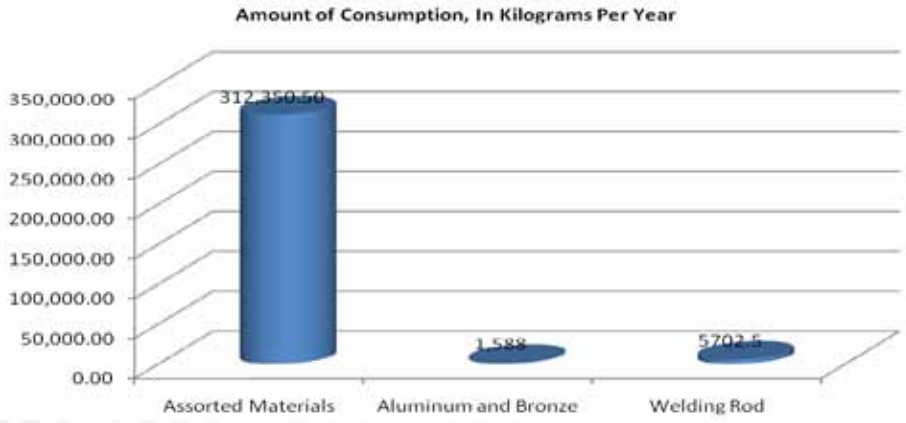

Figure 8. Consumption of Raw Materials of Welding Shops (In Kilograms, Per Year)

round bar, flat bar, square bar and channel bars), mild steel, steel sheets, steel pipes, stainless steel, tool steel, bronze, aluminum, welding rod, and gases, among others. Materials are usually purchased in the local market. Raw materials are classified according to the following: assorted materials, aluminum, bronze, and welding rods.

Figure 8 shows the Consumption of Raw Materials of Welding Shops (In Kilograms,
Per Year).

As shown, the highest estimated amount of raw materials consumed per year is assorted materials which reached 312,350.5 kilograms; aluminum and bronze amounts to 1,588 kilograms; and welding rods, 5,702.50 kilograms. Assorted materials are pipes & tubes, steel sheets and steel plates.

Local Production

The estimated total income of the respondent-shops amounts to =P= 73,118,440.00, however, such figure was provided by only 16% of the 634 total shops surveyed. The remaining percentage of the shops cannot determine their income because of unavailable data on production or sales. Other shops did not disclose their production/sales data.

Export Statistics

Table 5 reflects the comparison of 5-Year (2008-2012) Export Statistics of Welded Products (FOB Value, in US Dollars).

As reflected, the FOB Values of metal products utilizing welding processes that reached a total value of US Dollars 5,050,405,856 and the average value for the 5-year period (2008-2012) is USD 1,010,081,17.

Figure 9 clearly illustrates that the highest FOB Value of export in welded products was in 2012 (USD 1,794.9 billion) while the lowest was in 2009 (USD 423.1 million).

As illustrated, there is a consistent upward trend during the five-year period, except in 2009 where a slight fall was experienced.

Figure 9. Comparison of 5-Year (2008-2012) Export Statistics of Welded Products FOB Value (In million US Dollars)

Import Statistics

Table 6 shows the Comparison of 5-Year (2008-2012) Import Statistics of Welded Products (CIF Value, in Million Dollars).

Table 6 presents the total CIF Value of metal products utilizing welding process for the period 2008-2012. Values reached as high as USD 19,757,032,409 and the average value is USD 3,951,406,482.

Table 5. Comparison of 5-Year (2008-2012) Export Statistics of Welded Products

Year	FOB Value (In US Dollars)	Average (2008-2012)
2008	571,272,008	1,010,081,171
2009	423,140,860	
2010	978,049,031	
2011	1,282,980,085	
2012	1,794,963,872	
Total	**5,050,405,856**	

** Source: National Statistics Office, Foreign Trade Statistics in the Philippines).*

Table 6. Comparison of 5-Year (2008-2012) Import Statistics of Welded Products

Year	CIF Value (In US Dollars)	Average (2008-2012)
2008	3,014,524,160	3,951,406,482
2009	2,830,892,343	
2010	4,139,046,737	
2011	4,020,910,646	
2012	5,751,658,523	
Total	**19,757,032,409**	

Figure 10 reveals that the highest CIF Value of import in welded products was in 2012 (USD 5,751.6 billion), while the lowest was in 2009 (USD 2,830.8 billion).

As revealed, there was generally a slight upward trend during the five-year period, except in 2009 and 2011 where slight declines happened.

Market Served

Table 7 and Figure 11 illustrate the sectors served by the Welding Respondent-Shops. Though there are various industries catered to by the welding shops, data reveal that there is a major market for welding jobs.

As illustrated, the welding shops serve various industries. The top three biggest market, which are automotive/ transport, construction and agricultural sectors, comprise 88% of the total customers. The transportation sector which is the biggest client (47%) is served predominantly by the "cottage" category welding shops. The construction sector, which constitutes 23% share of the market, include iron works making and fabrication of overhead frame and overhead tanks. The agriculture sector got 18% share.

Table 7. Sectors Served by the Welding Respondent Shops

Sector	% Share
Automotive/Transport	47
Construction	23
Agricultural	18
Others :Industrial Machinery,Food,Domestic,Shipping,Mining,Semiconductor,Plastic,Cement,Power, PlantsWoodworks, Motor Reconditioning, Sugar Industry, Academe	12
Total	**100**

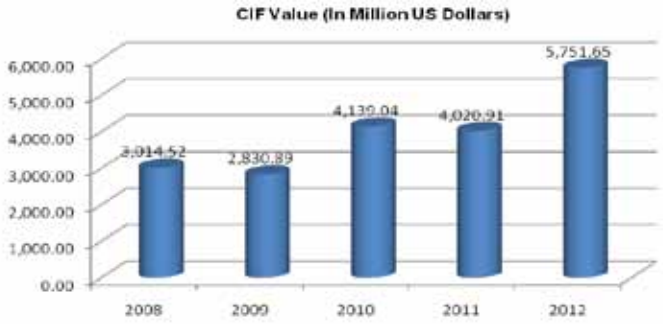

Figure 10. Comparison of 5-Year (2008-2012) Import Statistics of Welded Products (CIF Value, In Million US Dollars)

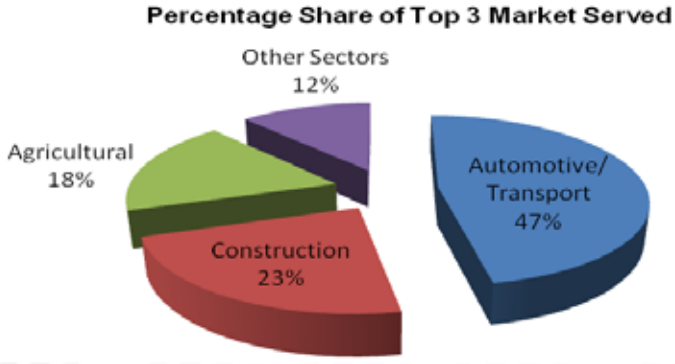

Figure 11. Distribution of the Market Sectors Served by the Welding Respondent-Shops

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the workpieces and adding filler materials to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld.

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam, friction, and ultrasound. While often an industrial process, welding may be performed in many different environments, including open air, under water and in outer space.

Welding is a potentially hazardous undertaking and precautions are required to avoid burns, electric shock, vision damage, among others.

Types of Welding Process

Electric Welding is the process of heating and welding two pieces of metal together using a powerful electric current. It was invented by Professor Elihu Thomson. It requires the use of a specialized device called a dynamo that releases the current used for welding. Unlike more traditional methods, electric welding requires only a minimal amount of skill and understanding on the part of a dynamo operator. He must only learn the proper welding heat of the metal being used, but is not required to learn the more intricate processes of conventional welding. The dynamo used in electric welding is self-regulating, and only needs occasional lubrication to continue working properly. [6]

Oxy-Acetylene Welding is the process that uses the flame produced by the combination of the gases, melts the metal faces of the workpieces to be joined, causing them to flow together. A filler metal alloy is normally added and sometimes used to prevent oxidation and to facilitate the metal union. [7]

Shielded Metal Arc (SMAW) Welding is one of the oldest, simplest, and most versatile arc welding processes. The arc is generated by touching the tip of a coated electrode to the workpiece and withdrawing it quickly to an appropriate distance to maintain the arc. The heat generated melts a portion of the electrode tip, its coating, and the base metal in the immediate area. The weld forms out of alloy of these materials as they solidify in the weld area. Slag formed to protect the weld against forming oxides, nitrides, and inclusions must be removed after each pass to ensure a good weld.

The SMAW process has the advantage of being relatively simple, only requiring a power supply, power cables, and electrodes holder. It is commonly used in construction, shipbuilding, and pipeline work, especially in remote locations.

Metal Inert Gas (MIG) Welding also called **Gas Metal Arc Welding (GMAW**) uses an aluminum alloy wire as a combined electrode and filler material. The filler metal is added continuously and welding without filler material is therefore not possible. Since all welding parameters are controlled by the welding machine, the process is also called semi-automatic welding. The MIG process uses a direct current power source, with the positive electrode (DC, EP). By using a positive electrode, the oxide layer is efficiently removed from the aluminum surface, which is essential for avoiding lack of fusion and oxide inclusions. The metal is transferred from the filler wire to the bead by magnetic forces as small droplets spray transfer. This gives a deep penetration capability to the process and makes it possible to weld in all positions. It is important for the quality of the weld that the spray transfer is obtained.

There are two different MIG welding processes, conventional MIG and pulsed MIG:

Conventional MIG uses a constant voltage DC power source. Since the spray transfer is limited to a certain range of arc current, the conventional MIG process has a lower limit of arc current (or heat input). This also limits the application of conventional MIG to weld material thicknesses above 4 mm. Below 6mm, it is recommended that backing is used to control the weld bead.

Pulsed MIG uses a DC power source with superimposed periodic pulses of high current. During the low current level, the arc is maintained without metal transfer. During the high current pulses, the metal is transferred in the spray mode. In this way, pulsed MIG is possible to operate with lower average current and heat input compared to conventional MIG. This makes it possible to weld thinner sections and weld much more easily in difficult welding positions.

Tungsten Inert Gas (TIG) Welding or **Gas Tungsten Arc Welding (GTAW)** uses a permanent non-melting electrode made of tungsten. Filler metal is added separately, which makes the process very flexible. It is also possible to weld without filler material. The most used power source for TIG welding generates alternating current (AC). Direct current can be used, but due to high heat generation on the tungsten electrode when DC-EP (positive electrode) welding, that particular polarity is not feasible. In some cases DC-EN (negative electrode) is used, however, this requires special attention before welding, due to the arc's poor oxide cleaning action.

AC TIG Welding usually uses argon as a shielding gas. The process is a multi-purpose process which offers the user great flexibility. By changing the diameter of the tungsten electrode, welding may be performed with a wide range of heat input at different thicknesses. AC TIG welding is possible with thickness down to about 0.5 mm. For larger thickness, >5 mm, AC TIG welding is less economical compared to MIG welding due to lower welding speed.

DC TIG Welding with electrode negative is used for welding thicknesses above 4 mm. The negative electrode gives a poor oxide cleaning compared to AC-TIG and MIG, and special cleaning of joint surfaces is necessary. The process usually uses helium shielding gas. This gives a better penetration in thicker sections. DC TIG-welding is applicable for welding thicknesses in the range 0.3 – 12 mm. More and more popular is also pulsed DC TIG-welding, which makes it possible to weld uniform welds with deeper penetration at the same heat input. Pulse frequency is usually in the range 1 – 10Hz.

Gas Tungsten-Arc Welding (GTAW), also known as Tungsten Inert Gas or TIG Welding, uses tungsten electrodes as one pole of the arc to generate the heat required. The gas is usually argon, helium, or a mixture of two. A filler wire provides the molten material, if necessary.

Electroslag Welding (ESW) deposits the weld metal into the weld cavity between the two plates to be joined. This space is enclosed by water cooled copper dams or shoes to prevent molten slag from running off. The weld metal is produced from a filler

wire that forms an initial arc with the workpiece until a sufficient pool of liquid metal is formed to use the electrical resistance of the molten slag. The process requires special equipment used primarily for horizontal welds of very large plates up to 36 inches or more by welding them in one pass as in large machinery and nuclear reactor vessels.

Fluxed-Core Arc Welding (FCAW) uses a tubular electrode filled with flux that is much less brittle than the coatings on SMAW electrodes while preserving most of its potential alloying benefits. The emissive fluxes used shield that weld arc from surrounding air, or shielding gases are used and non-emissive fluxes are employed. The higher weld-metal deposition rate of FCAW over GMAW (Gas Metal Arc Welding) has led to its popularity in joining relatively heavy sections of 1" or thicker. [8]

Table 8. Equipment Used in the Welding Shops

Equipment	Quantity	Quality Control Instruments	Quantity
Welding Equipment		***Other Equipment (cont'n)***	
Shielded Metal Arc Welding (SMAW)	1,386	Bench Drill	15
Oxyacetylene Gas Welding	650	Surface Grinder	13
TIG Welding	210	Shaper Machine	13
MIG MAG Welding	80	Boring Machine	11
AC Welder Set	9	Plasma Cutter	10
MIG Welding	6	Buffing Machine	10
Total	**2,341**	Mechanical Press	8
Other Equipment		Manual/Hand Press	8
Grinder	1264	Drilling Machine	7
Portable Drill	306	Sander	5
Cutter	166	Nibbler	3
Lathe Machine	163	Angle Forming Machine	3
Compressor	108	Hydraulic Punching duplicator	1
Vise grip	82	Crimping Machine	1
Drill Press	73	Threading Machine	1
Cut-off-machine	41	**Total**	**109**
Bender	39	***QC Instruments***	
Shearing Machine	30	Caliper	143
Pipe bender	26	Micrometer	42
Electric Saw	21	Height Gauge	4
Milling Machine	20	Depth Gauge	2
Hydraulic Press	17	**Total**	**191**
Power Hacksaw	17	**Over-all Total**	**5,029**
Roller Press	15		
Total	**2,388**		

Equipment

Table 8 reflects the Equipment Used in the Welding Shops. The type of equipment and tools available in the shops can determine the level of technology the shops have acquired.

As reflected, the most number of welding equipment used by the respondents are Shielded Metal Arc Welding (SMAW) which accounts to 1,386 (31.5%) out of 4,388 available equipment; followed by Oxyacetylene Gas Welding, 650 (15%); TIG Welding, 210 (5%). Other equipment and tools as reflected in the list constitute a very minimal part of the over-all total.

These equipment were acquired either brand new or second hand, and sourced both in the local market and abroad. In addition, the respondents also use quality control instruments like caliper, which is the most utilized tool. Micrometer, height and depth gauge are also available in the welding shops.

PROBLEMS, ISSUES AND CONCERNS

The issues and concerns identified by the welding respondent shops are primarily capital, competition, sourcing of materials, competency and attitude of workers, market and power (electricity) cost.

Majority of the respondents cited capital as one of the issues of the sector. Most of the owners cannot meet their customer's demand due to insufficient available capital for their business operations. Though the Department of Science & Technology had introduced the Small Enterprises Technology Upgrading (SETUP) Program which provides assistance to SMEs in upgrading their equipment and facilities, some constraints, i.e., qualification requirements, deprived them from enjoying the program's benefits. Thus, the shops have no choice but to operate within their capacity as far as capital is concerned.

Workers, competency and absenteeism of staff greatly affect the productivity of the shops. Shortage of skilled welders due to lack of skills training and fast turnover of skilled workers due to lucrative offer to work abroad are some of the concerns of the shop owners. Incentives in many forms could be given to employees to minimize absences incurred by the workers.

Stiff competition that weakens the shops, performance also among the serious concerns is sustaining the business operations of the respondents. High electricity cost, power interruption and maintenance of production equipment take great part in the success and failure of the shops' operations.

PROSPECTS AND TRENDS

Business Outlook

Table 9 shows the Comparison of Business Outlook of Respondent Shops for the Current Semester Versus the Next Semester.

As shown, majority of the respondents did not reveal their business outlook for both current and next semester. However, the perception of respondents is "improving" for both periods, 39% and 41%, respectively.

Plans

Figure 12 illustrates the Welding Shops with Expansion Plans for the Next 5 Years.

As illustrated, 50% of the respondents have expansion plans, 33% have no plans to expand and 17% cannot determine the business trend. The high percentage of respondents who plan to expand their business is an indication of their high hopes that economic activities in the welding sector would pose a positive growth within the next five years.

Despite the various problems and issues encountered by the shops, owners laid down some plans to implement for the next five years of their business operations. Figure 12 illustrates these data.

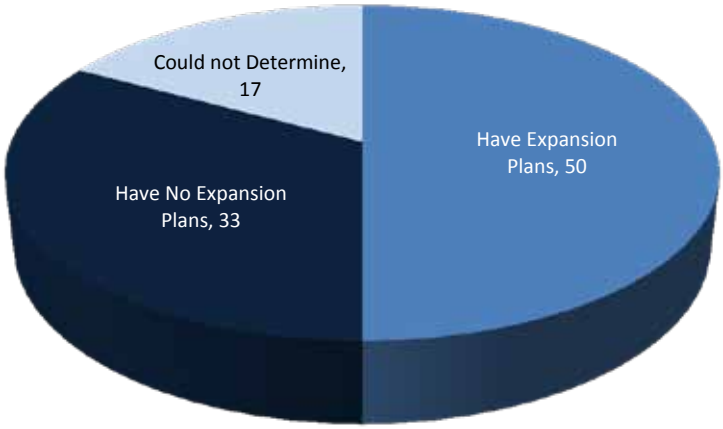

Figure12. Welding Shops with Expansion Plans for the Next 5 Years

CONCLUSION & RECOMMENDATIONS

Conclusion

In the recently concluded survey of the seven metalworking sectors, the welding sector is represented by the largest number of shops (634),which are predominantly comprised of small shops categorized as cottage level whose total assets amount to less than =P=100,000. 85% of the respondents are organized as single proprietorship, 68% are operating as independent shops and 51% are engaged in jobbing.

The welding respondent shops employ a total of 3,532 employees, 60% of which are directly involved in production. Out of the 634 shops, 80% are micro level, a size with 1-9 personnel. 72% of the total employees acquired formal education. Skill, education and good attitude of workers basically contribute to the productivity of a business. The survey revealed that 74% of the total 634 respondents gave a rating of excellent where employee performance is concerned.

Shielded Metal Arc (SMAW) welding, considered as one of the oldest, simplest, and most versatile arc welding processes, is the most utilized, followed by Oxyacetylene and Tungsten Inert Gas (TIG) welding. Most of the respondents are using outdated equipment and tools, as their main problem is insufficient capital.

The sector that highly demands welding services is the transportation sector. As the survey shows the transportation sector's demand from the welding sector reached 53% of the total market, followed by the construction and agricultural sectors. The major product lines and services are body building and repair of different types of automobile, fabrication of iron and steel products, as well as agricultural and food equipment.

Welded products got a considerable portion in the export market in the year 2008-2012 with total FOB Value of US Dollars 5,050.40 million and an average of US Dollars 1,010.08 million for the five-year period. Conversely, the importation of welded products got a significant figure in 2008-2012 reaching a total of US Dollars 19,757.03 million and an average of US Dollars 3,951.40 million. The bulk of imports on welded products is caused by either a shortage of domestic supply or the prevailing competitive market price of imported welded products.

Despite the problems and issues that beset the respondent welding shops, 50% of them have expansion plans for their business operations. It is seen that shop owners have high hopes that the trend of the industry will grow and rise. They are optimistic that the government would acknowledge their significant contribution to the economy, and that they will receive support and assistance from the government.

Recommendations

1. An industry profiling post-survey activity should be included in the plans and programs of the Industry Research & Studies Unit (IRSU) of the Technology Information and Promotion Section.

2. In relation to item #1, the activities to be done are: (1) make a summary of the identified problems and issues of the respondent shops; (2) notify the identified respondents and inform them of probable solutions or assistance that the MIRDC can extend to them. These actions would form part of the sector and regional report. (A project proposal can be prepared for this activity as this would entail considerable amount of budget.)

3. Communicate and coordinate with the regional offices of DOST, DTI, TESDA and regional chapters of Metalworking Industries Association of the Philippines (MIAP) regarding the follow-up activity of industry profiling survey that needs their assistance and intervention.

4. Provide a copy of industry studies conducted by the MIRDC to the regional offices of DOST, DTI, TESDA and regional chapters of MIAP.

5. With regard to welding sector's identified main problem, i.e., lack of capital, Information dissemination on seminars about managing a business, sourcing of capital and other related programs can be initiated by the staff of the Technology Information and Promotion Section (TIPS) of the MIRDC as one strategy to address the issue on lack of capital, the welding sector's main problem.

THE PHILIPPINE METALWORKING INDUSTRY PROFILING STUDY
MACHINING SECTOR

The machining sector is considered and recognized as one of the largest sectors of the metals and engineering industries. It is known that up to 90% of the total workforce of the M & E industries is assigned to machining operations. Most of the machining shops in the country are also engaged in welding, metalcasting, tool and die, heat treatment processes such that they are able to complement the requirements of the transportation and construction sectors of the country.

Objectives of the Study

1. To identify concerns of the machining sector that may be addressed by the government: its needs, particularly in terms of technology and technical capability development; issues; and plans.

2. To come up with a statistical analysis of the 2007-2010 data on import and export statistics of machining commodities which can determine the growth or decline of the industry; and

3. To develop a study that will aid decision-makers and implementers in the industry to formulate policies that can lead to the development and growth of the machining sector.

There were 1,002 respondents gathered from the different sectors (machining, heat treatment, welding, tool & die, forging, metalcasting and electroplating) of the Philippine metalworking industry in different regions of the country during the 2010-2012 survey conducted by the MIRDC. The survey team was able to gather 566 respondent shops from the machining sector. The largest number of machining shops are found in Region IV-A where different industries are operating in Economic Zones. The respondent shops came from all regions except the Autonomous Region of Muslim Mindanao (ARMM). The machining shops shared relevant information based mainly on the processes employed, product lines, and list of their functional equipment, among others.

Regional Distribution

Table 1 shows the Regional Distribution of Respondent Shops. The most number of shops, as shown, are located in Region IV-A. These shops make up 22.1%, while the least number is in Region XIII with a share of less than 1% of the total respondents.

Table 1. Regional Distribution of Respondent Shops

Region	Town/Province	Number of Respondents	Percentage
NCR	Manila	62	11.0
Region I	San Fernando, La Union	34	6
Region II	Tuguegarao, Cagayan	11	2.0
Region III	San Fernando, Pampanga	90	15.9
Region IVA	Calamba, Laguna	125	22.1
Region IVB	Calapan, Oriental Mindoro	15	2.7
Region V	Legazpi, Albay	40	7.1
Region VI	Iloilo City	20	3.5
Region VII	Cebu City	32	5.6
Region VIII	Tacloban City	7	1.2
Region IX	Pagadian City	6	1.0
Region X	Cagayan De Oro	36	6.4
Region XI	Davao	55	9.7
Region XII	Koronadal South Cotabato	11	1.9
Region XIII: CARAGA	Butuan City	4	.7
CAR	Baguio City	18	3.2
ARMM	Cotabato City	0	-
Total		**566**	

Form of Ownership

Table 2 reflects the Regional Distribution of Machining Shops Based on Form of Ownership.

As reflected, the biggest number (398 shops or 70%) are organized as single proprietorship, while the least are organized as cooperative or foundation. The most number of survey respondents are from Region IV-A (125 shops or 22%), followed by Region III (90 shops or 16%). The third largest group is found in NCR (62 shops or 11%), and the least in number (4 shops or 1%) is located in Region XIII.

Table 3 presents the Regional Distribution of Machining Shops Based on Size of Capital.

As presented, most of the shops (205, 36.2%) fall under the micro category where capitalization is concerned. The smallest group (19 shops or 3.4%) are under the large category.

Year of Establishment

Table 4 reflects the Year of Establishment of the Machining Shops.

As reflected, majority (484 shops or 85%) of the shops were established beginning in the 1980's. Only 80 shops (14%) were organized before 1980 while 2 shops (1%) did not disclose data on the year of establishment. There are two shops that are already 60 years or more in existence. Majority of the respondent shops are considered independent shops, rendering metalworking services to customers and are into manufacturing, jobbing and repair services.

Table 2. Regional Distribution of Machining Shops Based on Form of Ownership

Type of Ownership	REGION																Total
	NCR	I	II	III	CAR	IVA	IV-B	V	VI	VII	VIII	IX	X	XI	XII	XIII	
Corporation	38	2	2	12	5	42	0	5	5	17	2	0	7	12	0	0	149
Single Proprietorship	22	32	9	77	13	77	14	35	14	13	5	6	28	38	11	4	398
Partnership	2	0	0	1	0	5	1	0	0	2	0	0	0	2	1	0	14
Cooperative/Foundation	0	0	0	1	0	1	0	0	1	0	0	0	1	1	0	0	5
Total No. of Shops Per Region	62	34	11	90	18	125	15	40	20	32	7	6	36	54	12	4	566

Table 3. Regional Distribution of Machining Shops Based on Size of Capital

Category	REGION																Total	%
	NCR	I	II	III	CAR	IVA	IV-B	V	VI	VII	VIII	IX	X	XI	XII	XIII		
Cottage	1	8	0	32	5	30	5	17	1	2	1	0	11	4	3	1	121	21.4
Micro	17	14	6	39	9	47	5	16	4	7	3	2	10	19	4	3	205	36.2
Small	24	10	3	18	2	29	5	6	10	16	3	4	3	27	4	0	164	28.9
Medium	13	2	2	0	1	14	0	0	1	4	4	0	0	12	3	1	57	10.1
Large	7	0	0	1	1	5	0	0	0	1	3	0	0	0	1	0	19	3.4
Total	**62**	**34**	**11**	**90**	**18**	**125**	**15**	**39**	**40**	**20**	**32**	**7**	**6**	**36**	**54**	**12**	**566**	**100**

Table 4. Year of Establishment of the Machining Shops

Duration	No. of Shops	% Share	
1940-1949	2	1	14
1950-1959	8	1	
1960-1969	24	4	
1970-1979	46	8	
1980-1989	98	17	85
1990-1999	148	26	
2000-2009	206	36	
2010-present	32	6	
Did Not Disclose Data	2	1	1
Total	**566**	**100**	

Employment

Table 5 reveals the Number of Workers of the Machining Shops.

As revealed, the respondent shops employ a total of 9,431 direct workers which are classified into production and non-production workers. Production workers comprise 70%, while non-production workers account for the remaining 30%. Not all the machining shops hire a contract worker, considering that there is only less than 1% share of contract workers among the 566 shops.

Figure 1 shows the Company Size Distribution Based on Total Assets.

Based on total assets, businesses may be categorized into cottage, micro, small, medium, and large. As shown, majority of the shops (205 shops or 36.2%) are classified as micro. The small enterprises rank second at 29%, while large enterprises rank last at 3.4%.

Table 5. Number of Workers of the Machining Shop Respondents

	Direct Workers		Contract Workers
	Production	Non-Production	
Total	**6,602**	**2,829**	**389**
	9,431		

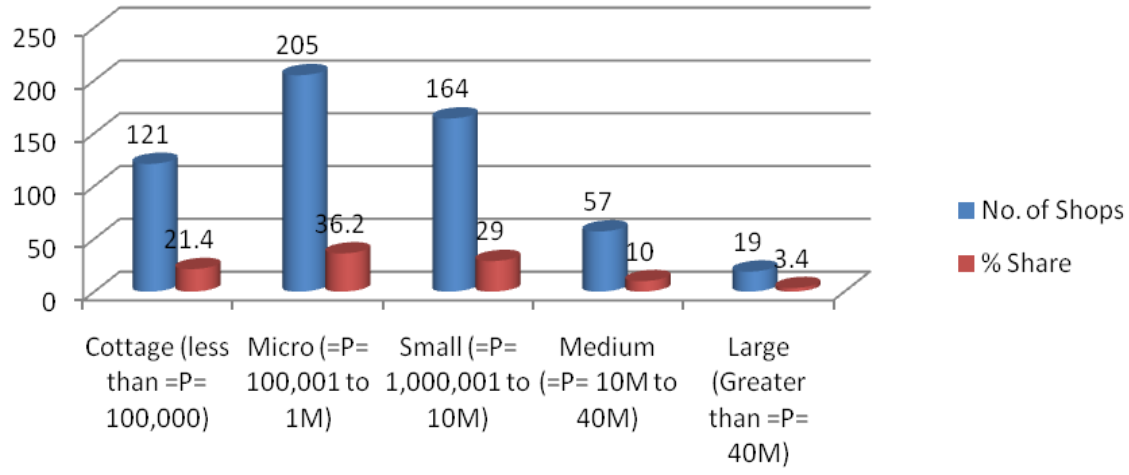

Figure 1. Company Size Distribution Based on Total Assets

Product Lines/Services

The main type of services provided by machine shops can be categorized into the following: machine rebuilding, engine reconditioning, industrial parts fabrication and general repair services. Machine rebuilding involves the restoration of various types of equipment which may include machining of parts, replacement of certain standard parts (i.e., motor, roller bearings, gears, etc.) and assembly and performance testing of such rehabilitated equipment. Engine reconditioning is considered as machine rebuilding but concentrated on reconditioning the central part of that machine, i.e., the engine. [22]

Table 6 displays the Product Lines/Services Produced by the Machine Shops.

As displayed, majority (207 shops, 36.6%) out of the 566 respondents are producing industrial parts; 172 shops (30.4%) are engaged in machine rebuilding services; 68 shops (12%) in engine reconditioning; 52 shops (9.2%) in general repair; and 48 shops (8.4%) offer other machining-related services.

Table 6. Product Lines/Services

Products/Services	No. of Respondent Shops	% Share
Industrial equipment parts	207	36.6
Machine rebuilding	172	30.4
Engine reconditioning	68	12.0
General repair	52	9.2
Other machining-related products/services	48	8.4
Did Not Disclose Data	19	3.4
Total	**566**	**100**

Statistics (Import and Export)

Export

Shown in Table 7 and Figure 2 are the total weight in kilograms of exported machined products from 2008 to 2012 and the corresponding FOB Value in US Dollars. Exports as well as FOB Value show a generally upward trend except for a slight dip in 2009.

Table 7. Export Statistics of Machined Products, 2008-2012 [9]

Year	2008	2009	2010	2011	2012	Total
Weight (Kg)	68,117,272	46,179,371	74,766.447	161,428,328	191,993,711	467,793,448
FOB Value (USD)	370,156,442	276,656,628	434,530,694	536,674,041	1,019,846,228	2,637,864,033

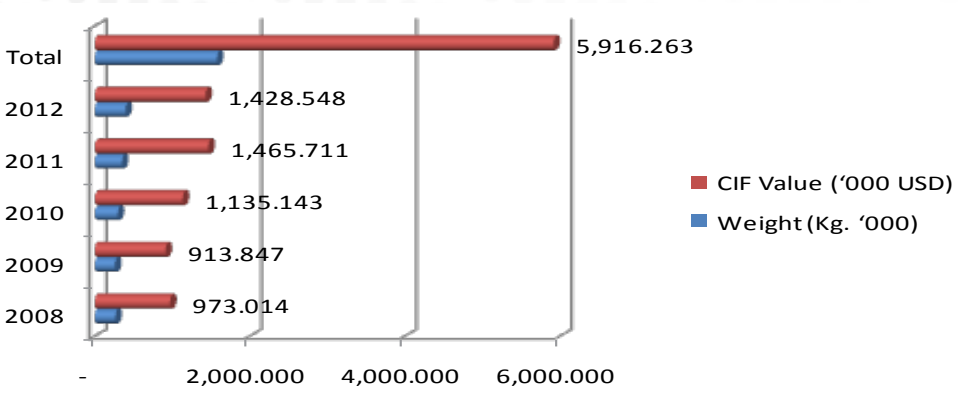

Figure 2. Export Statistics of Machined Products, 2008-2012

Import

Table 8 and Figure 3 show the Import Statistics of Machined Products in 2008-2012.

As shown, an upward and downward trend is seen in the importation of machined products from 2008 to 2012. The highest recorded CIF Value is in 2011, and the lowest in 2009. Correspondingly, the highest value in terms of weight is seen in 2012 and the lowest in 2008.

Table 9 display the top five commodities of Machined Products. Top commodities are dominated by Other parts, followed by screws, bolts, threaded nuts, ball bearings and then by other locks, base metal as third..

Figure 4 exhibits the Top Export Partners of the Philippine Machining Sector from 2008 to 2012.

As exhibited, Japan topped with 627 million dollars followed by Thailand and USA with 498 and 368 million US dollars, respectively.

Table 8. Import Statistics of Machined Products, 2008-2012

Year	2008	2009	2010	2011	2012	Total
Weight (Kg. '000)	267,228,063	261,361,559	297,031,109	352,420,990	398,075,061	**1,576,116,782**
CIF Value (in USD)	973,014,775	913,847,758	1,135,143,706	1,465,711,275	1,428,548,037	**5,916,265,551**

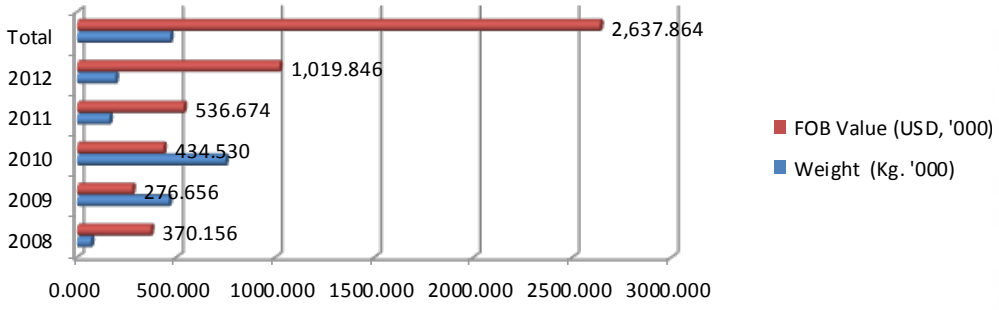

Figure 3. Import Statistics of Machined Products, 2008-2012

Table 9. Top 5 Commodities of Machined Products from 2008-2012

TOP 5 COMMODITIES	2008	2009	2010	2011	2012	TOTAL
Other parts (not including rubber tires, engines,etc.)	31,773,672	25,480,807	31,403,661	38,651,776	443,673,930	570,983,846
Screws, bolts, threaded nuts, ball bearings	44,389,296	47,058,759	76,552,961	30,264,990	33,642,737	231,908,743
Other locks, base metal	21,348,938	25,645,307	44,620,933	49,583,278	24,716,213	165,914,669
Machinery parts & accessories of various machines	22,374,573	48,781,695	20,724,965	36,833,242	25,842,635	154,557,110
Other parts of machinery	78,193,154	10,165,465	14,065,688	20,361,175	25,030,374	147,815,856

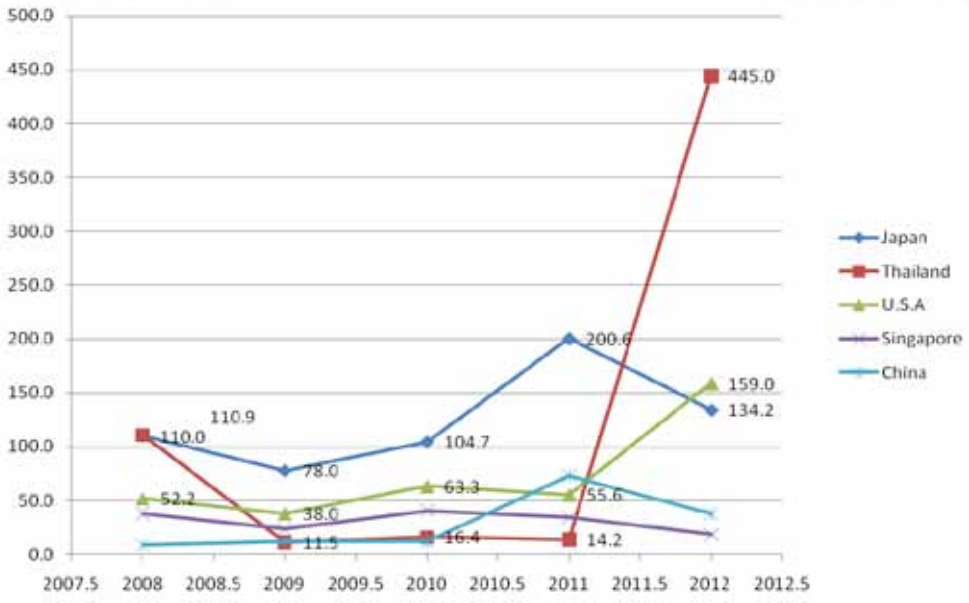

Figure 4. Export Partners of Philippine Machining Sector from 2008-2012

Technical Processes

The machining process utilizes machines to remove metals in the form of chips to produce the desired shapes, sizes, or surface finishes. The process of machining can be classified in a number of ways. One is by the size of individual items, these may be massive, as in sawing or macro, as the chips formed in turning or milling, or micro, as in grinding or honing. Another way of categorizing is by the form of energy used to remove the materials, either mechanical or electrical.

Table 10 reflects the processes used by machine shop respondents. As reflected, 84.7% of the shops are engaged in welding operations. Only a minimal number utilize other processes like metal-casting, heat treatment, electroplating, forging and tool and die.

Table 11 shows that welding and fabrication equipment are the most number of equipment available in the machining shops. It confirms that welding is the most utilized process mostly utilized by shops engaged machining. Only 24% among the tools/ equipment used by the respondent shops constitutes quality control instruments. [10]

Figure 5 illustrates the Distribution of the number of equipment used by the respondent-shops.

As illustrated, the top equipment is the lathe machine, followed by grinding and drilling machines.

Table 10. Processes Used By The Machine Shop Respondents

Processes	No. of Shops	% Share
Welding	478	84.7
Metalcasting	48	11.7
Tool and Die	55	15.3
Electroplating	42	5.9
Heat Treatment	28	8.5
Forging	12	2.4
Total	**663***	**113.2***

* multiple response

Table 11. Equipment Used In Different Metalworking Processes Employed By Respondent-Shops

Kind of Equipment	No. of Units	% Share
Welding & Fabrication Equipment	2,364	23.8
Machining Equipment	4,963	50.0
Quality Control Equipment (caliper, micrometer, spectrometer, toolmakers' microscope, height gauge)	2,387	24.0
Other equipment used in metalworking-related processes	222	2.2
Total	**9,936**	**100.0**

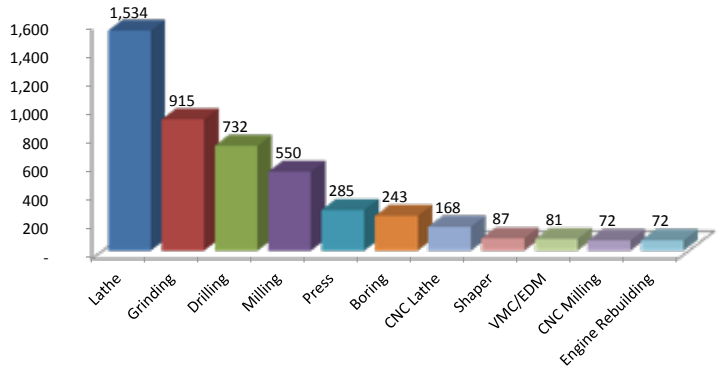

Figure 5. Distribution of the Number of Equipment Used by the Respondent Shops

Table 12 and Figure 6 illustrate the most frequent problems or issues encountered by the shops.

As illustrated, topping the list are the following: raw materials, 146 shops (25.7%); human resources, 88 shops (15.5%); marketing, 60 shops (10.6%); equipment/facilities, 53 shops (9.4%); and utilities, 42 shops (7.4%). Problems in raw materials are substandard quality, high cost and difficulty in sourcing.

Table 12. Problems/Issues Encountered by the Machining Shop Respondents

Problems/Issues	No. Shops	Percent (%)
Raw materials	146	25.7
Human Resources	88	15.5
Marketing	60	10.6
Equipment/facilities	53	9.4
Utilities	42	7.4
Capital	20	3.5
Quality Control	17	3.0
Customer-related issues	14	2.5
Training/technology needs	7	1.3
Other concerns	23	4.1
Could not Determine	96	17.0
Total	**566**	**100**

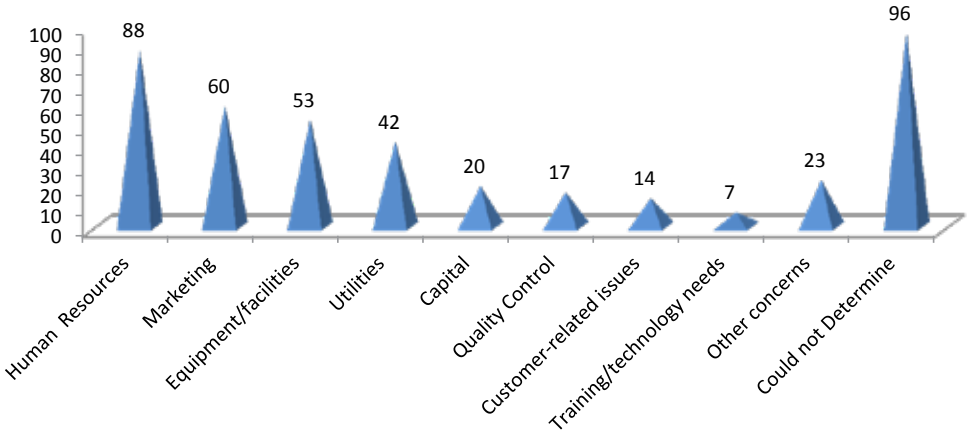

Figure 6. Problems/Issues Encountered by the Respondents, No. of Shops

Plans

Figure 7 shows the Distribution of Plans of the Respondent-Shops for the next five years.

As shown, 369 shops (65%) out of the 566 total respondent-shops disclosed that their plan is to expand either by setting up new branches, acquiring additional equipment, developing new products, and increasing production capacity. Data also revealed that 38 shops (6.7%) indicated that they will maintain their current operation and their plans will depend on the trend of business and availability of capital; 37 shops (6.5%) have plans to relocate to other places or diversify to other product lines; and 122 shops (21.6%) have no plans or cannot determine their plans. The equipment that they would like to acquire are lathe machine, crankshaft grinder and heavy duty bar cutter, grinding and bending machines.

Table 13. Plans of the Respondent Shops for the Next Five Years

Plans	No. of Shops	Percent (%)
Add branch/products	188	33.2
Acquire additional equipment	181	32.0
Maintain current business operation	38	6.7
Other plans (not related to current business)	37	6.5
No Plans	122	21.6
Total	**566**	**100**

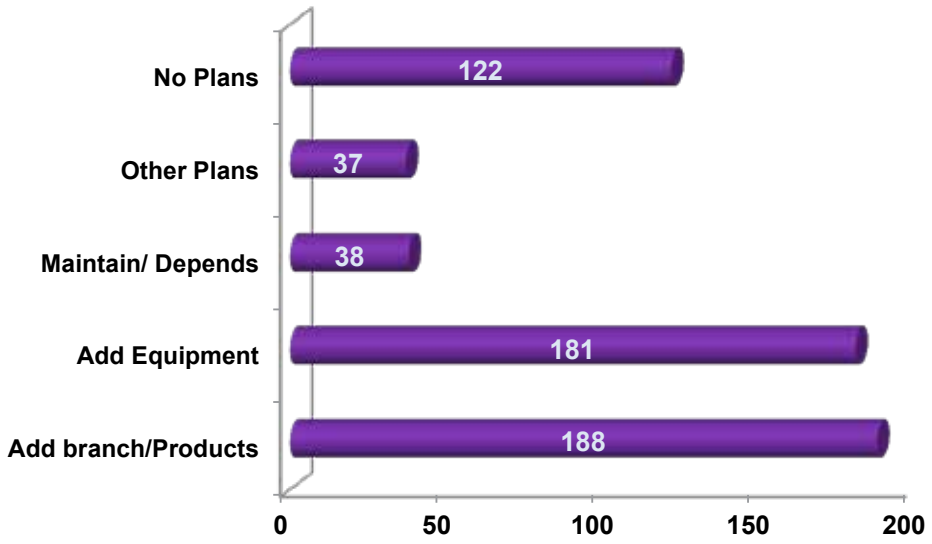

Figure 7. Distributions of Plans for the Next Five Years

Business Outlook

Table 14 presents the business outlook of respondent shops.

As presented, although 122 shops (21.6%) cannot determine their future plans because of some uncontrollable factors, 169 shops (30%) indicated that their business is improving during the current period of survey (1st semester), while 201 shops (35.5%) expressed a positive outlook for the2nd semester.

Table 14. Business Outlook of Machining Shop Respondents

Outlook	1st Semester		2nd Semester	
	No. of Shops	%	No. of Shops	%
Improving	169	30	201	35.5
Deteriorating	42	7.4	21	3.7
No Change	73	12.8	40	7.1
Could not Determine	282	49.8	304	53.7
Total	**566**	**100**	**566**	**100**

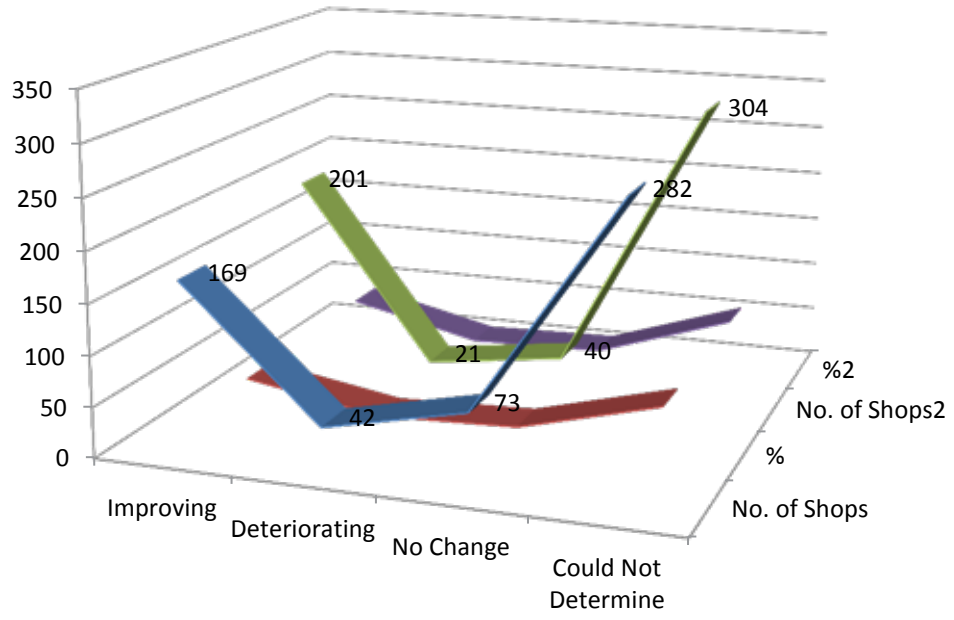

Figure 8. Business Outlook of Respondent Shops

CONCLUSION

Based on the survey conducted, most machining firms are found in Region IV-A, followed by Region III, and the third biggest number of respondents is from the NCR. Majority of the respondent-shops were formed as single proprietorship, followed by corporation. Only a few shops were established as partnership and cooperative. The shop respondents predominantly belong to micro category based on capital. Most of the respondents are considered independent shops, and are into manufacturing, jobbing and repair services. The machining respondent shops employ a total of 9,431 production and non-production employees.

Machined products showed a generally upward trend in importation from 2008 to 2012. The highest recorded CIF Value in US Dollars is in 2011 (US Dollars 1,465.7 Million), while the lowest is in 2009 (US Dollars 913.8 Million).

Machined products got a place in the export market with a total record of FOB Value in US Dollars 2,637,864,033 for the period 2008-2010. The exportation of machined products for the five-year period shows an upward trend, except a slight fall in 2009.

Among other metalworking processes, the welding process complements most machine shops. Although there are diverse problems encountered by the respondent shops, 65% of them have plans to improve and expand their operations. They are still positive that their business will grow despite internal and external factors that pose as threats to their businesses.

THE PHILIPPINE METALWORKING INDUSTRY PROFILING STUDY

TOOL & DIE SECTOR

The Tool and Die Sector, one of the seven (7) sectors of the Philippine Metalworking Industry, is engaged mostly in the manufacturing process and caters primarily to the needs of the transportation industry. The objectives of conducting this study are to determine the status of the tool and die sector and to come up with consolidated information that can be used as a guide for planning, facilities upgrading, workforce development and investment incentives. The primary data were gathered through fielded questionnaires, personal interviews and letters sent by e-mail or by fax to the identified respondents.

Survey was conducted in all regions of the country except in the Autonomous Region of Muslim Mindanao (ARMM) due to the unstable peace and order situation in the region. The tool and die sector includes machine shops whose operations are focused in the manufacture of tools, dies, molds, jigs and fixtures. Tool, die and mold making is a process to convert materials into a required shape using machine tools, either general or specialized.

Figure 1 shows the geographical location of 63 tool and die companies profiled from 2010 to 2012.

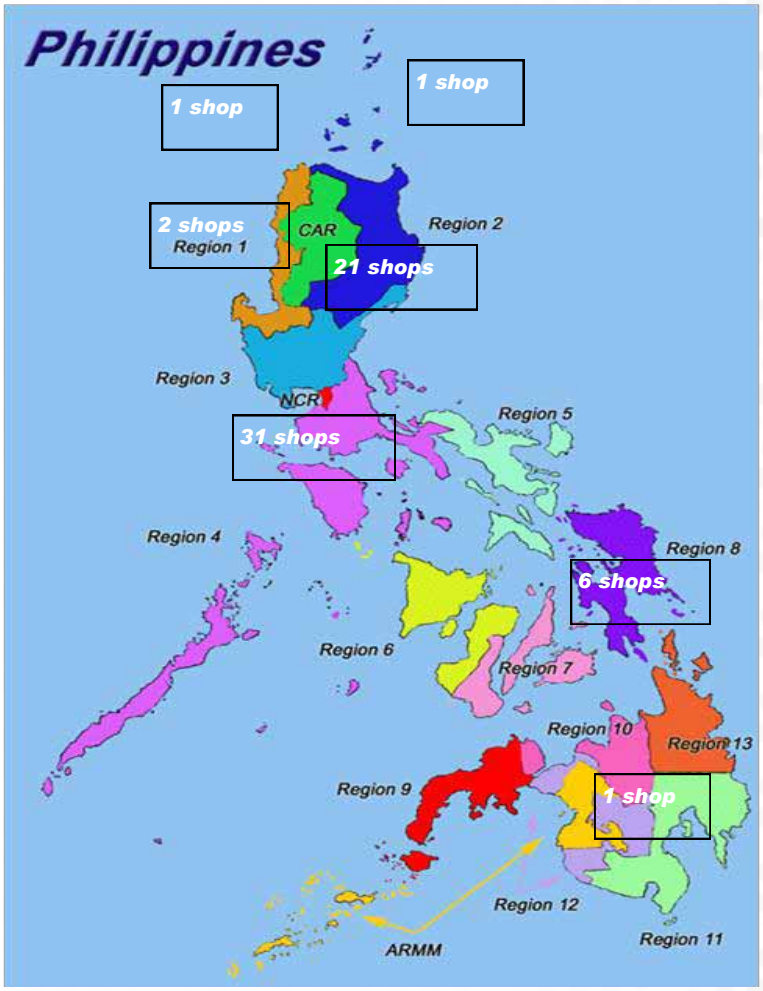

Figure 1. Geographical Location of Respondents, 2010-2012

Organizational Structure

There were 63 tool and die respondents from among the 1,002 metalworking companies profiled nationwide in 2010-2012. The respondents represent seven (7) regions, i.e. , Region I, Region II, Region III, Region IV-A (CALABARZON), NCR and Region XI.

Table 1 shows the Regional Distribution of Metalworking and Tool and Die Respondent Shops from 2010-2012.

As shown, majority of the shops (31 shops or 49%) are located in Region IVA; 21 shops (33%) are located in the National Capital Region; and 6 shops (10%) in Region VII.

Table 1. Regional Distribution of Metalworking and Tool and Die Respondents

Region	No. of Metal working Respondents	Tool and Die Respondents		Region	No. of Metal working Respondents	Tool and Die Respondents
NCR	137	21		VI	26	-
CAR	36	-		VII	47	6
I	83	1		VIII	26	-
II	14	1		IX	10	-
III	115	2		X	38	-
IVA	227	31		XI	68	1
IVB	66	-		XII	20	-
V	66	-		CARAGA	23	-

Table 2 illustrates the regional distribution of tool and die companies based on type of business. As illustrated, the large companies are usually corporations and are found in NCR (16 shops), Reg. IVA (25 shops), and Reg. VII (4 shops).

Figure 2 shows the Year of Establishment of the Tool and Die Respondent-Companies Surveyed.

As shown, majority (24 shops or 38%) were established in the 1990s; 12 shops (19%) in 1980s, and 11 shops (17%) in the 2000s.

Table 2. Regional Distribution of Tool and Die Companies* Based on Type of Business, 2010-2012

Type of Business	NCR	I	II	III	IVA	VII	XI	Total
Corporation	16	1	1	-	25	4	-	47
Government/School	1	-	-	-	1	-	-	2
Single Proprietorship	3	-	-	2	3	-	1	9
Partnership	1	-	-	-	1	2	-	4
Cooperative/Foundation	-	-	-	-	1	-	-	1

** Captive Shops of the government institution or laboratories/shops.*

Figure 3 indicates the Type of Business Organization of the Tool and Die Companies.

As indicated, majority (47 shops or 75%) are organized as corporation; followed by single proprietorship, 9 shops (14%); partnership, 4 shops (6%); government, 2 shops (3%) ; and cooperative/foundation, 1 shop (2%).

Figure 4 shows the Nature of Business Activity of Tool and Die Respondents.

As shown, majority (32 shops or 51%) of the surveyed shops are engaged in manufacturing; 15 shops (24%) are into jobbing; 11 shops (17%) are into both jobbing and manufacturing. The remaining 8% is comprised of businesses that offer R&D services.

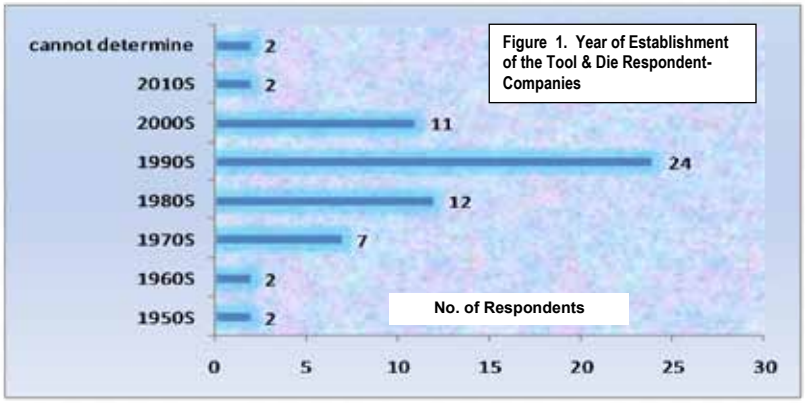

Figure 2. Year of Establishment of the Tool and Die Respondent-Companies

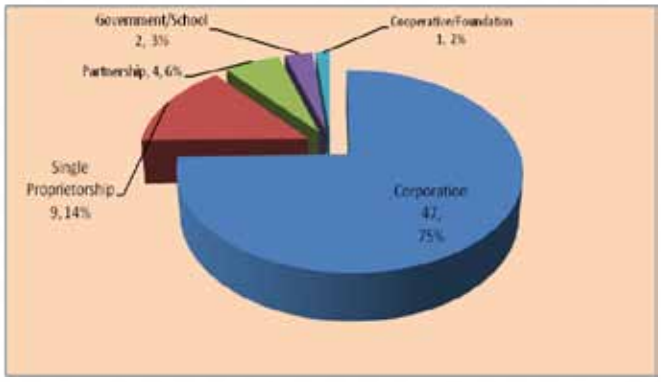

Figure 3. Distribution of Shops According to Type of Business Organization

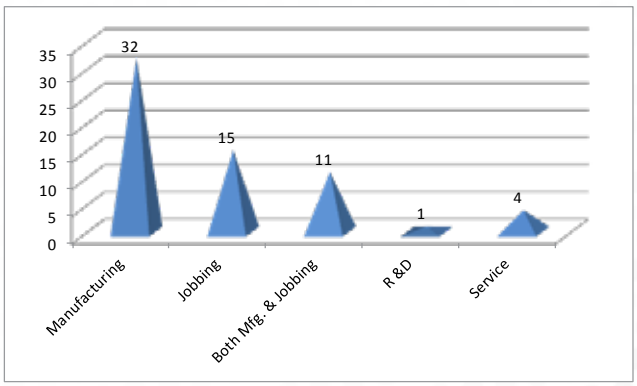

Figure 4. Type of Business Activity of Tool and Die Respondent-Companies

Figure 5 shows Distribution of As presented, majority (61 shops or 97%) are independent companies and 2 shops (3%) are captive or in-house.

A very small portion of the respondent tool and die companies are captive or in-house. Almost all of them (97%) are categorized as independent companies.

Figure 6 shows Size Classification of Tool and Die Respondent-Companies Based on Employment.

As shown, majority (43 shops or 72%) of the respondents are categorized as small; nine shops (16%) are medium; and four shops (7%) are categorized as large. This is a clear representation of how the tool and die respondent-companies are classified based on employment size.

Table 3 displays employment distribution of the tool and die respondent-companies. As displayed, the consolidated employment records of respondent tool and die companies for 2010-2012 gave a total of 3,954 employees with 3,326 deployed in production jobs and 628 for non-production or administrative work. There is a total of 389 workers employed on contractual basis.

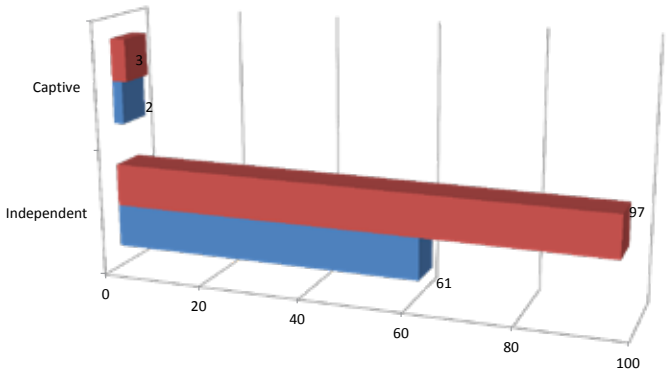

Figure 5. Type of Business Activity of Tool and Die Respondent Companies

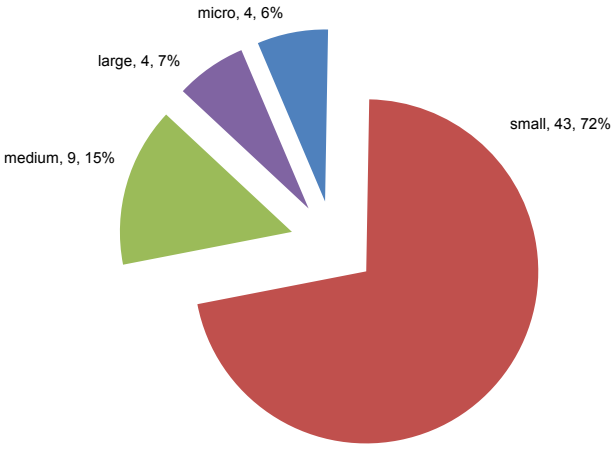

Figure 6. Size Classification of Tool and Die Respondent Companies Based on Employment

Table 3 . Employment Distribution of the Tool & Die Respondent Companies

	No. of Personnel Involved in Production Jobs	No. of Personnel Involved in Non-Production Jobs	Contract Worker
	3,326	628	389
Total	**3,954**		

Product Lines

Table 4 and Figure 7 reveal information on the distribution of tool and die respondent- companies based on product lines. As revealed, majority (38 shops or 60%) of the companies produced end-products. Many of the shops offer tool and die services (28 shops or 44%); while one fourth of the total population repair and other metalworking services (16 shops or 25%). Products like jigs & fixtures, and molds and dies constitute a minimal share of the total products produced by the tool and die companies. Most common end-products include hinges, aircraft parts, metal components of arms and ammunition, motorcycle and automobile parts, and fabricated sheet metal for various applications. 97% of the companies are classified as independent in terms of business activity producing molds, dies, jigs and fixtures. They also provide die repair services and majority of them are heavily engaged in general machining services for industrial machinery parts.

Production

The amount of production of each shop is based on the capability of their resources (manpower and facilities) to convert the jobs into products. The total volume of production of the respondent-shops totals to =P=238,600,000.00. However, this information came from 20 shops only, those who have available data on production.

Table 4. Distribution of Product Lines/Services of Tool & Die Respondent Companies

Product Lines/Services	No. of Respondents	% Share
End-products (aircraft parts, motorcycle & automobile parts, etc.)	38	60
Tool & Die Services	28	44
Molds	11	17
Repair and other metalworking services	16	25
Dies (simple, compound, progressive)	10	16
Jigs & Fixtures	13	21
Total	**116***	**183***

*multiple responses

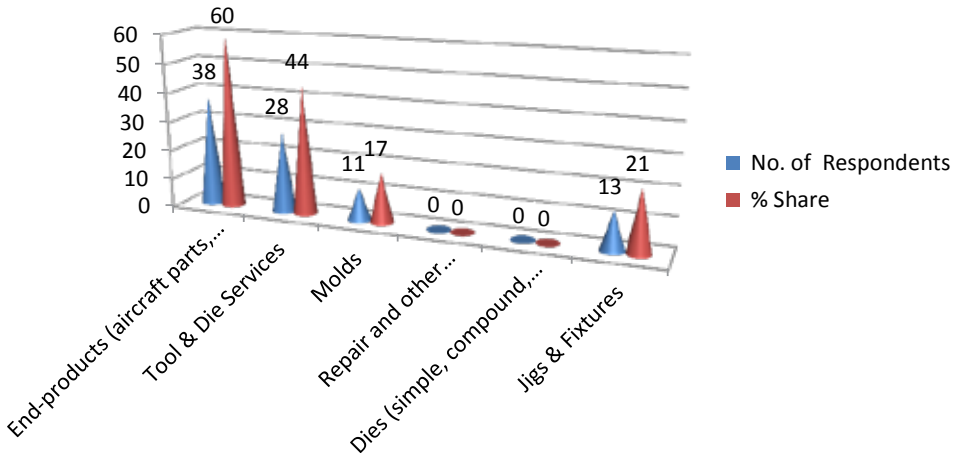

Figure 7. Product/Lines of Tool & Die Respondents Companies

Sectors Served by Tool and Die Respondent Companies

Figure 8 illustrates the sectors served by the tool and die respondent companies. As illustrated, the transport sector is the biggest (27%) market of tool and die companies. Second biggest market is the metalworking sector (19%), followed by electronics and industrial machinery which account to 17% and 15% respectively. Other markets of the tool and die shops, which share a minimal portion of their products and services, are construction, agriculture, food, plastic, pharmaceutical, mining, furniture and appliance sectors. Customers who have negligible contribution to the tool and die market include shipping, bottling, aerospace, power plant and academe.

Import and Export Statistics

Import

Importation is the industry's strategy to meet the demand of the local market by sourcing outside the country the needed materials and products that the local suppliers cannot provide.

Table 5 and Figure 9 reflect the importation of tool and die products from 2008 to 2012. FOB Value totaled to US Dollars 189.862 million in the import of tool and die products and an average of US Dollars 37,972 million in FOB Value for the five-year period. The beginning three-year period (2008-2010) shows minimal growth in the import market. However, a big leap is seen from 2010 to 2011, and remains stable in 2011 and 2012. This behavior is experienced probably due to an increased vitality of the local manufacturing sector which happened under the new administration in 2010.

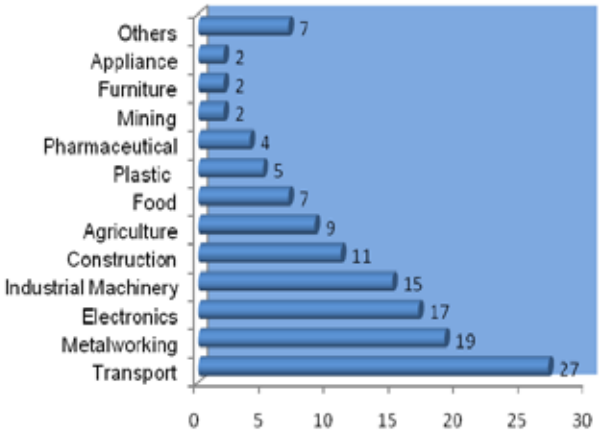

Figure 8. Distribution of Markets Served by Tool and Die Respondent Companies, No. of Shops

*Others- include shipping, bottling, aerospace, power plant and academe

Table 5. Import Statistics of Tool & Die Products, 2008-2012

Year	2008	2009	2010	2011	2012	Total	Average
Weight (in kg. '000)	2,973	3,714	3,209	4,874	4,179	18,948	3,789
FOB Value in US Dollars '000)	32,803	30,310	32,906	48,608	45,235	189,862	37,972

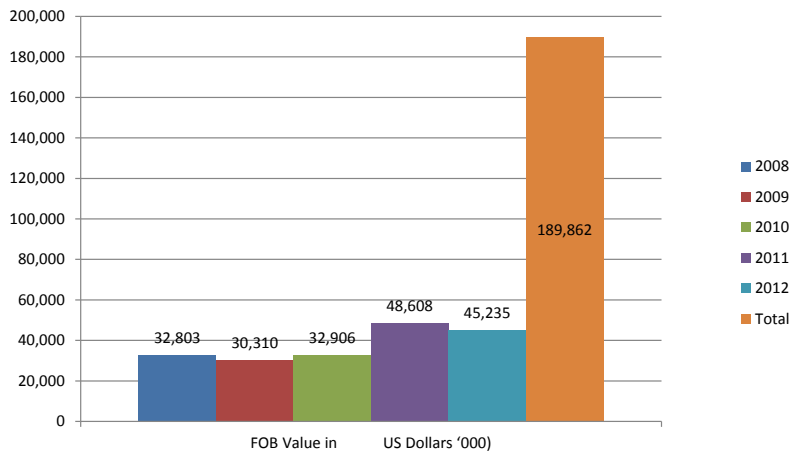

Figure 9. Import Statistics of Tool & Die Products, 2008-2012

Export

Figure 10 shows the export data of tool and die products from 2008-2012. As shown, a total of US Dollars16,420.76 FOB Value and an average of US Dollars 3,284 million were recorded for the five-year period. The total export of tool and die products based on the FOB value (in '000 US Dollars) in 2008 increased until 2009, however a sharp decline (63.5 %) is seen from 2009 to 2010. Data also show a stable trend in 2010 to 2011, as well as a big leap in 2012. [13]

Table 6 shows the export data of tool and die products from 2008 to 2012.

As shown, the average weight in kg (1,000) is 327,060 and 3,284,000.

Table 7 reflects the Philippines' Top Export Commodities for 2008 to 2012 of the tool and die sector. As reflected, the top export commodities during the six year-period showed a pattern of varying demand.

Figure 11 shows the export partners of tool and die sector from 2008 to 2012.

As shown, the top export destinations of the tool and die sector are Japan (US Dollars FOB 8.239 million), followed by Thailand (US Dollars FOB 2.491 million), and the third is China (US Dollars FOB 2.02 million). [14]

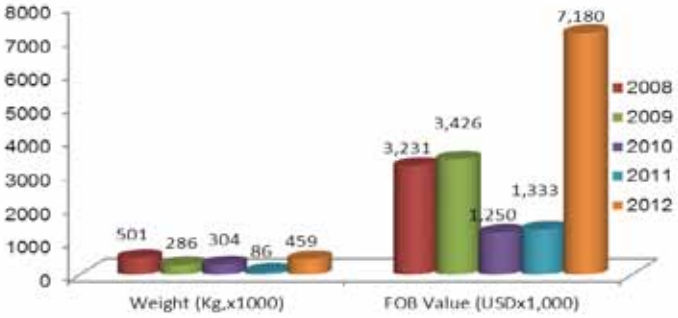

Figure 10. Export Data of Tool and Die Products from 2008-2012

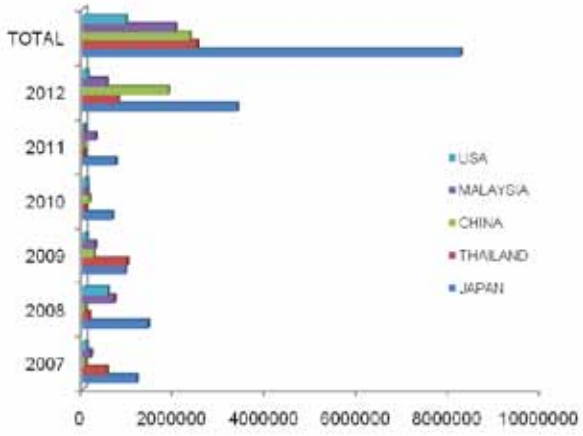

Figure 11. Export Partners of Tool and Die Sector from 2008 to 2012

Table 6. Export Data of Tool and Die Products from 2008-2012

Year	2008	2009	2010	2011	2012	Total	Average
Weight (in kg. '000)	500.79	285.59	303.95	86	459	1,635.33	327.06
CIF Value in US Dollars '000)	3,231.05	3,426.30	1,250.41	1,333	7,180	16,420.76	3,284

Table 7. Philippines' Top Export Tool & Die Commodity, 2008 to 2012

Commodity	2008	2009	2010	2011	2012	Total
Other moulds for rubber or plants	1,617,132	1,998,329	731,884	486,345	3,089,299	7,992,989
Dies for drawing or extruding metal	11,597	52,220	2,138	16,842	2,358,359	2,441,156
Moulds for rubber or plastics, injection or compression types	286,131	700,672	243,610	319,165	254,082	1,803,660
Other moulds for metal or metal or metal carbides	795,460	318,420	56,352	88,993	252,659	1,511,884

Tool, die and mold making involves equipment-intensive operations requiring specialized machine tools, as well as metal finishing and quality control equipment. The equipment can be categorized into general metal machines and specialized metal machines - the products of which are molds, tools and dies, and jigs and fixtures. These products are precision metal components installed in a forming machine as a pattern to form the shape of a variety of end products which can be made of metal, glass, rubber, ceramics, or any form of the newly-developed composite materials. [12]

Technical Process

The processes that are employed in tool, die and mold companies are either machining or metal casting. Figure 12 illustrates the metalworking processes employed by tool and die respondent companies. The processes employed are mostly machining (90%); welding and fabrication (56%); and press working (33%). The tool and die shops generally employ more than one metalworking process, as there are several inter-metalworking processes. The output of one process could also serve as an input to another process.

Equipment

Tables 8 presents the tool and die equipment used by the respondent companies. As presented, 34 units (2%) are Computer Numerical Control (CNC) Lathe Machines; 53 units (3%) are Electrically Discharge Machines (EDM); and 39 units (2%) are CNC Milling Machines. Other equipment used in the tool & die companies contribute only a minimal

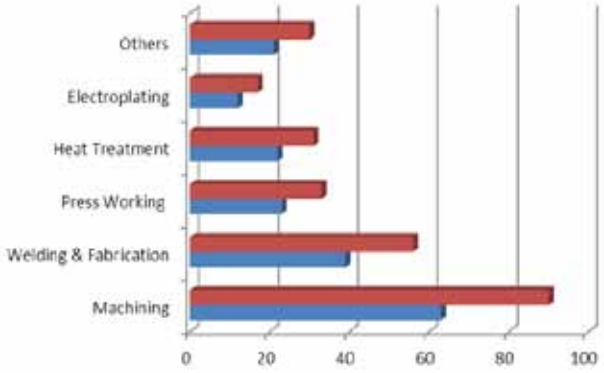

Figure 12. Metalworking Processes Employed by Tool and Die Respondent Companies

Table 8. Tool & Die Equipment Used by the Respondent Companies Respondent Companies

Tool & Die Equipment	No. of Units
CNC Lathe	34
EDM	53
CNC Milling	39
Vertical Machining Center, Numerical Control & related-equipment	9
Conventional Lathe & other machining- related equipment	654
Other metalworking equipment (multispindle drill, jig boring, engraver)	300
Quality instruments & other Related tools & equipment	512
Total	**1,601**

share of the total number of equipment utilized in the shops. Computer Numerical Control Machine is a machine that is controlled by a computer running programs.

Table 9 and Figure 13 reflect the distribution of raw materials utilized by the respondent companies. As reflected, stainless steel is the most commonly used material which accounts to 30%, while cast iron and galvanized are the least utilized materials.

Table 9. Top Raw Materials Commonly Utilized by the Respondent Companies

Raw Material	No. of Responses
Stainless Steel	21
Mild Steel/MS Plates	16
Steel Plates/Bars/Sheets	15
Tool Steel	15
Aluminum	14
Cast Iron/Galvanized Iron	10
Others (CRS, Brass, Bronze, Copper)	23
Total	**114***

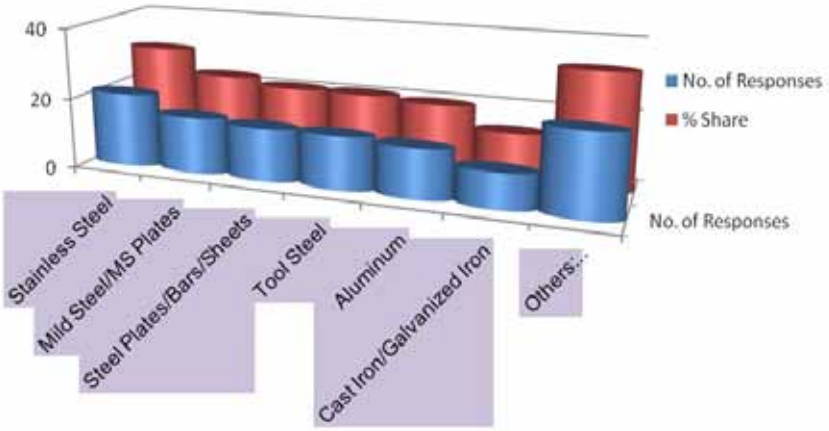

Figure 13. Distribution of Raw Materials Utilized by Respondent Companies

Problems

The problems enumerated by the tool and die companies that affect production are trivial but vital.

Figure 14 illustrates the distribution of responses regarding problems and issues encountered by the respondents.

As illustrated, their responses include raw materials (16 shops or 25%); human resources (14 shops or 22%); utilities (5 shops or 8%); quality control (5 shops or 8%); marketing and equipment/facilities (each worth 5% share). Other problems like quality control, capital, and utilities such as waste treatment, electricity, equipment, lay-out and utilization rate constitute 19% of the over-all problems cited by the respondents.

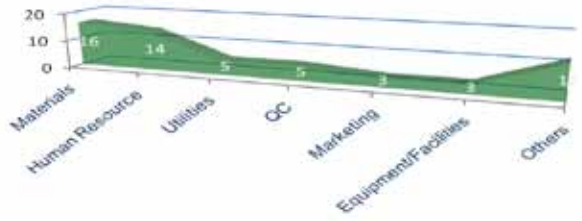

Figure 14. Distribution of Responses for the Problems, Issues Encountered by the Respondents

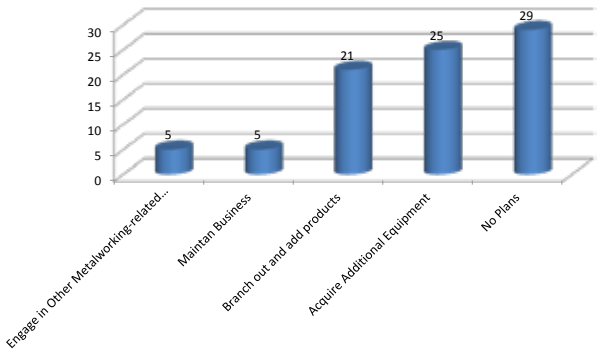

Figure 15. Distribution of Responses on the Plans for the Next Five Years of the Respondents

Plans & Business Outlook

The managers, who are mostly owners of the respondent companies, have formulated plans to undertake for the next five years.

Figure 15 shows the distribution of responses on the plans for the next five years. As shown, majority (41%) of the respondents would like to expand through acquisition of additional equipment. Others (35%) plan to expand through setting up additional branch and product lines, while 16% have no expansion plans.

Table 10 and Figure 16 indicate the business outlook of tool and die company respondents for the First and Second Semester of 2011. As indicated, most respondents (44%) said the business is improving for the 1st semester and (51%) for the 2nd semester.

Table 10. Business Outlook of Tool & Die Company Respondents

Perception	No. of Respondents	% Share
1st Semester:		
Improving	18	44
Deteriorating	5	12
No Change	7	17
2nd Semester:		
Improving	21	51
Deteriorating	1	24
No Change	6	15

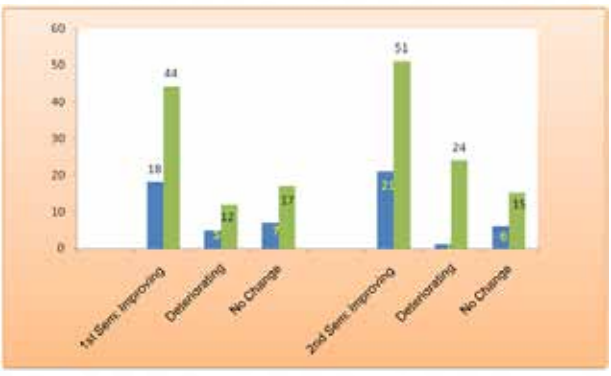

Figure 16. Business Outlook of Tool and Die Respondent Companies

Summary

There is an estimated 125 tool and die companies identified in 2010, however, only 63 respondents were gathered during the survey conducted in 2010-2012. The respondent companies are mostly concentrated in the National Capital Region, Region IV-A and Cebu. Majority were established in the Year 1990's. Most of these companies (97%) are independent, not subsidiaries of a bigger company. Based on product lines, 42% are into jigs and fixtures, 23% produce moulds and 18% are engaged in tool and die services including repairs. The size classification based on employment reveals that most of them fall under the "small" category, with 10 to 99 personnel. A few of the shops offer jobbing services and undertake research and development activities, but apparently, most of the respondents (68%) are into manufacturing.

The import of tool and die products gained a considerable increase from 2010 to 2011, and exhibited a stable level within the next two-year period (2011 and 2012). This behavior is experienced probably due to an increased vitality of the local manufacturing sector which happened under the Aquino administration.

The bulk of export products of a country is one of the indicators of a strong economy. In 2012, a remarkable rise in the exportation of tool and die products is seen, an increase of almost 500% from 2011. Both the import and export data show a strong market for tool & die products.

The most available equipment of the tool & die shops are conventional lathe machines, although there are some shops who are already using CNC Lathe, CNC Milling and Electro Discharge Machines (EDM). Raw materials ranks number one among the problems of the respondent companies. Issues on the availability of materials or substandard quality are also among their concerns. Other problems such as attitude of human resources, and training and skills of personnel are important things to be looked into by the owners and managers of the tool & die shops.

Generally, the business outlook of the respondents for the two semesters during the conduct of survey is improving. Most of the shops' plans for the next five years is to expand by setting up additional branches, increase product lines and processes and acquire additional equipment.

Conclusion

The tool and die sector profile is totally different from the machining, electroplating, welding and other sectors' profile. It has its own customers and the demand is also consistently increasing. However, the problems experienced by other sectors such as lack of quality raw materials and need for technology upgrading are also the perennial issues that need the intervention of the government for this sector.

Recommendations

1. Training of managers and supervisors in the field of Total Quality Management System, with special focus on work area lay-outing, financial, process and product documentation, is recommended to be conducted by the MIRDC and TESDA tool and die companies.

2. Inclusion of post-survey activities in the plans and programs of MIRDC-TIPS namely:

2.1 Summary of the identified problems and issues of the respondent companies.

2.2 Communicate to the respondents the probable solutions that MIRDC could extend to them.

(These activities will form part of the met-

alworking sector and regional project proposal as this would entail a considerable amount of budget.)

3. Coordinating and collaboration with the regional offices of DOST, DTI, TESDA and regional chapters of the Metalworking Industries Association of the Philippines (MIAP) regarding the follow-up activity of the Industry Profiling study.

4. Provision of a copy of these studies to the regional offices of DOS, DTI, TESDA and regional chapters of the Metalworking Industries Association of the Philippines (MIAP).

5. Conduct of information seminars on sourcing of raw materials and capital, managing business and people, and advanced commercialized technologies to address the most pressing demands of the tool and die sector.

6. Review of the implementation of the tool and die sector roadmap updates on significant change in the growth of the sector.

THE PHILIPPINE METALWORKING INDUSTRY PROFILING STUDY

ELECTROPLATING SECTOR

Electroplating is a useful process. It is widely used in industry for coating metal objects with a thin layer of a different metal. The layer of metal deposited has some desired property, which metal of the object lacks. For example, chromium plating is done on many objects such as car parts, bath taps, kitchen gas burners, wheel rims and many others.

Electroplating is a process that uses electrical current to reduce dissolved metal cations so that they form a coherent metal coating on an electrode. The term is also used for electrical oxidation of anions onto a solid substrate, as in the formation of silver chloride on silver wire to make silver/silver-chloride electrodes. Electroplating is primarily used to change the surface properties of an object (e.g. abrasion and wear resistance, corrosion protection, lubricity, aesthetic qualities, etc.), but may also be used to build up thickness on undersized parts or to form objects by electroforming.

The process used in electroplating is called electrodeposition. It is analogous to a galvanic cell. The part to be plated is the cathode of the circuit. In one technique, the anode is made of the metal to be plated on the part. Both components are immersed in a solution called an electrolyte containing one or more dissolved metal salts as well as other ions that permit the flow of electricity. A power supply supplies a direct current to the anode, oxidizing the metal atoms that comprise it and allowing them to dissolve in the solution. At the cathode, the dissolved metal ions in the electrolyte solution are reduced at the interface between the solution and the cathode, such that they "plate out" onto the cathode. The rate at which the anode is dissolved is equal to the rate at which the cathode is plated, vis-a-vis the current flowing through the circuit. In this manner, the ions in the electrolyte bath are continuously replenished by the anode.
Other electroplating processes may use a non-consumable anode such as lead or carbon. In these techniques, ions of the metal to be plated must be periodically replenished in the bath as they are drawn out of the solution. The most common form of electroplating is used for creating coins such as pennies, which are small zinc plates covered in a layer of copper. [7]

This study covers the results of survey conducted in eight (8) regions of the country in 2010-2012 to get data specifically on the electroplating sector.

Figure 1 illustrates the geographical distribution of electroplating shops.

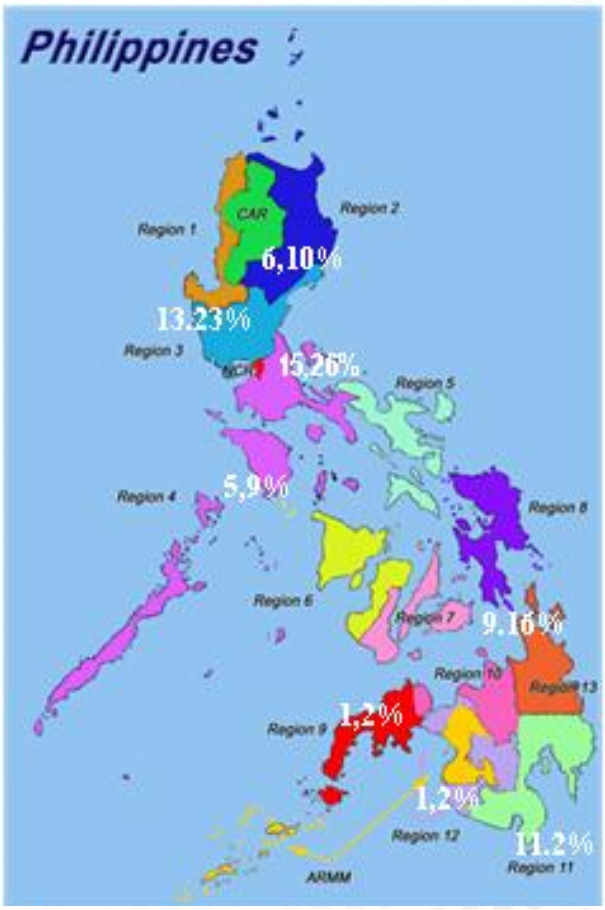

Figure 1. Geographical Distribution of Electroplating Shops

Table 1 illustrates their regional distribution: 39 shops (68%) are in Luzon covering 4 regions, 13 shops (23%) in the Visayas, and five shops (9%) in Mindanao. There were 57 electroplating shops identified during the conduct of industry profiling survey in 2010-2012.

As illustrated, the top three locations of electroplating shops are NCR, Region III and Region VII with 15, 13, and 9 shops, respectively.

Figure 2 reflects the form of business organization of the respondent-shops.

As reflected, 29 shops (50%) are organized as single proprietorship and 22 shops (39%) as corporation. Partnership and government institution comprise only 3 shops (6%), a very small percentage share.

Figure 3 shows the size of shops based on total assets.

Information gathered from the survey implies that only few big businessmen in the country invest in the electroplating business.

As shown, most (19 shops or 33%) belong to small enterprises, followed by micro, 11 shops (19%) and cottage, 10 shops (18%). Ten (10) shops (18%) did not disclose data on the size of shop based on total assets. Only 4 shops (7%) constitute the medium and large (3 shops or 5%) categories.

Table 3 presents the Regional Distribution of Shops According to Total Assets.

As presented, a closer look at these companies reveals that medium and large-scale companies are found in the NCR and Region VII, only 1 medium-size shop is found in Region III. Majority of the cottage-size shops are found in Region III, while most of the small-scale shops are located in Region VII.

Table 1. Regional Distribution of Electroplating Shops

Region	No. of Shops	% Share
NCR	15	26
CAR	6	10
III	13	23
IV-A	5	9
VI	4	7
VII	9	16
IX	1	2
X	1	2
XI	2	3
XII	1	2
Total	**57**	**100**

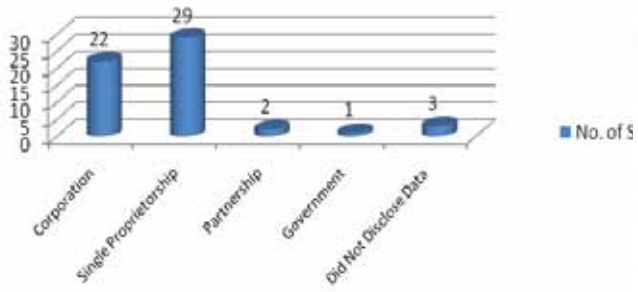

Figure 2. Form of Business Organization

Table 2. Size of Shops Based on Total Assets

Classification	No. of Shops	% Share
Cottage = (Less than Php 100,000)	10	18
Micro = (Php 100,001 to 1,000,000)	11	19
Small = (Php 1,000,001 to 10 M)	19	33
Medium = (Php 10,000,001 to 40 M)	4	7
Large = (Greater than Php 40 M)	3	5
Did Not Disclose Data	10	18
TOTAL	**57**	**100**

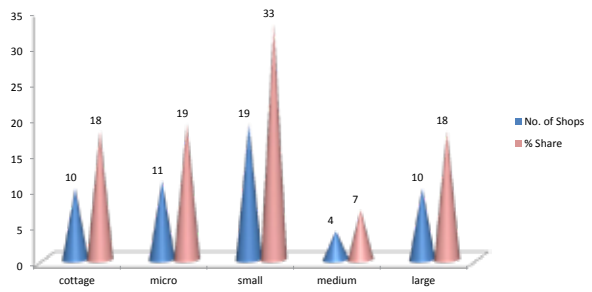

Figure 3. Size of Shops Based on Total Assets, Percentage Share

Table 4 presents the shops according to type of operation.

As presented, all the 57 electroplating respondent-shops are classified as independent shops. As to type of operation, majority (20 shops or 35%) are into manufacturing, 19 shops (33%) offer jobbing services, and 8 shops (14%) are engaged in both jobbing and manufacturing.

Employment

Figure 4 illustrates the Classification of Personnel Employed by the Electroplating Shops.

As illustrated, there is a total of 1,309 personnel employed in the 57 electroplating shops. Of this figure, 973 (74%) are production workers and 324 (25%) are administrative personnel. There is only a minimal portion of contractual workers in this sector.

Figure 5 shows the Level of Proficiency of Workers Employed by the Electroplating Shops.

As shown, most (17 shops or 30%) of the respondents rated their personnel's performance as satisfactory and 4 shops (7%), excellent. 21 shops (37%), however, did not give a rating.

Table 4. Shops According to Type of Operation

Type	No. of Shops	% Share
Manufacturing	20	35
Jobbing	19	33
Both Manufacturing & Jobbing	8	14
Did Not Disclose Data	10	18
TOTAL	**57**	**100**

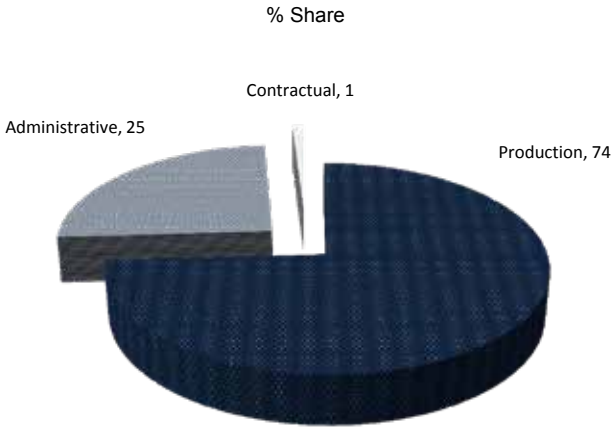

Figure 4. Classification of Employees, Percentage Share

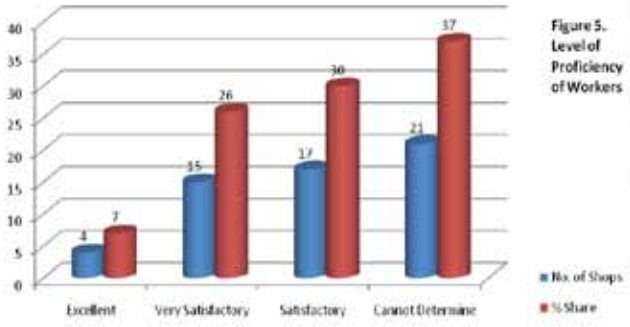

Figure 5. Level of Proficiency of Workers

Table 3. Regional Distribution of Shops According to Size

Location	Cottage	Micro	Small	Medium	Large	Did Not Disclose Data	TOTAL
NCR		7	1	2	2	3	**15**
CAR	4		1			1	**6**
III	6	2	2	1		2	**13**
IV-A		1	3			1	**5**
VI			4				**4**
VII		1	5	1	1	1	**9**
IX						1	**1**
X						1	**1**
XI			2				**2**
XII			1				**1**
TOTAL	**10**	**11**	**19**	**4**	**3**	**10**	**57**

Export Statistics

Table 5 and Figure 6 show the Export Statistics of Electroplated Products for the period 2008-2012.

Data on exported electroplated products are presented in Table 4 and Figure 6. FOB Value reached its highest (114.9 million US Dollars) in 2010 and dropped to its lowest (6.3 million US Dollars) in 2012. There is a consistent upward trend from 2008 to 2010, however, a steep decline is seen between 2010 and 2011. A further decline in exports is experienced in 2012.

Import Statistics

Table 6 and Figure 7 depict the Import Statistics of Electroplated Products for the period 2008-2012.

As depicted, the highest FOB Value (in million US Dollars) of imported electroplated products was recorded in 2010 (878.8 million US Dollars), and the lowest (278.1 million US Dollars) in 2012. There was a consistent upward trend from 2008 to 2010, however, a slight decline from 2010 to 2011 is seen, and a sharp fall is seen from 2011 to 2012.

Both the export and import data on electroplated products reached their peaks in 2010, and pose at the bottom in 2012. It implies that electroplated products performed excellently in the year 2010.

Table 5. Export Statistics of Electroplated Products, 2008-2012

YEAR	2008	2009	2010	2011	2012	Total
WEIGHT (GK)	36,708,211	89,888,660	112,375,845	11,318,120	4,998,485	**255,289,321**
FOB Value (US $)	45,282,144	84,689,895	114,887,949	12,653,676	6,346,368	**263,860,032**

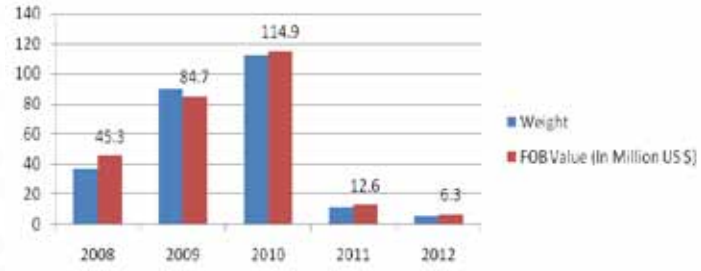

Figure 6. Export Statistics of Electroplated Products, 2008-2012

Table 6. Import Statistics of Electroplated Products, 2008-2012

YEAR	2008	2009	2010	2011	2012	Total
WEIGHT (GK)	339,983,166	532,552,218	864,560,019	423,559,260	283,158,715	**2,443,813,378**
CIF VALUE (US $)	365,356,445	539,183,483	805,791,067	805,791,067	278,112,999	**2,794,235,061**

Market Served

Table 7 and Figure 8 reveal the Market Served by the Electroplating Shops.

As revealed, majority (24 shops) cater to the jewelry industry. Data further present other sectors being served by local electroplating shops.

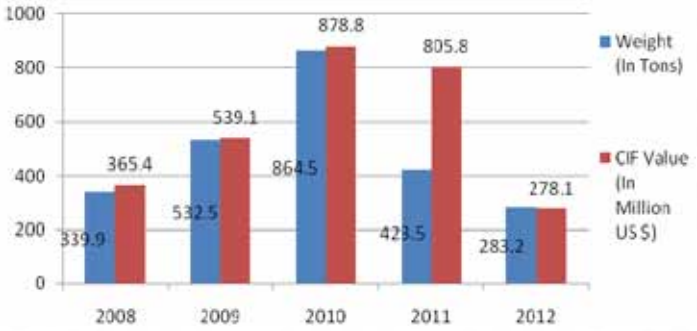

Figure 7. Import Statistics of Electroplated Products, 2008-2012

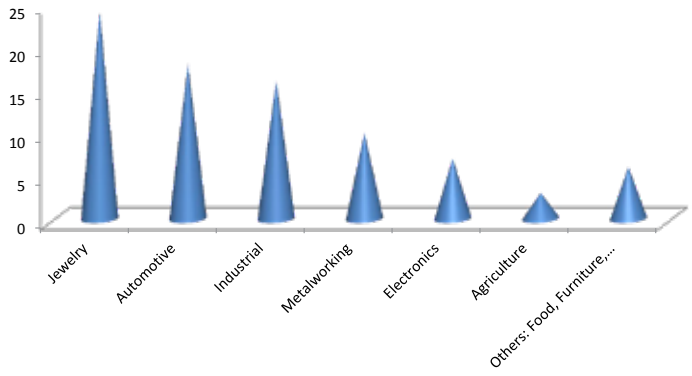

Figure 8. Market Served by the Electroplating Shops

Business Outlook

Table 8 reveals the Comparison of Business Outlook of Respondent-Shops.

As revealed, 33% (19 shops) says that business is "improving" for the current semester. Varying views are also presented, as well as compared with business outlooks for the next semester.

Table 8. Comparison of Business Outlook of Respondent Shops (Current Semester Versus Coming Semester)

Outlook	Current Semester	%	Coming Semester	%
Improving	19	33	27	47
Deteriorating	8	14	4	7
No Change	13	23	9	16
Cannot Determine	17	30	17	30
Total	**57**	**100**	**57**	**100**

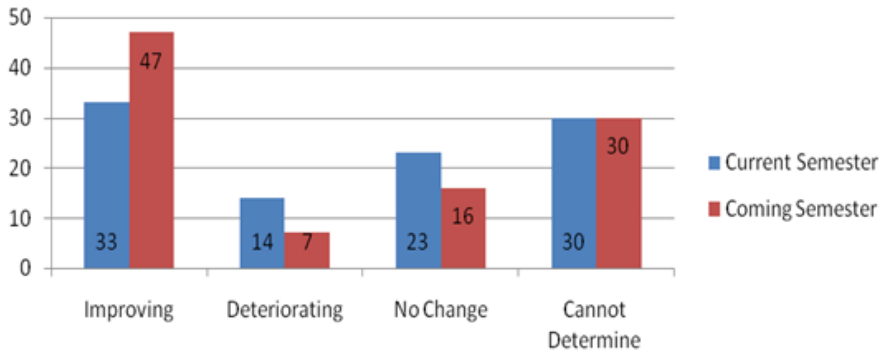

Figure 9. Comparison of Business Outlook of Respondent Shops (Current Semester Versus Coming Semester)

Table 9 outlines the problems and issues encountered by the respondent-shops.

As outlined, problems on materials which include issues on quality, cost, sourcing and water supply is the predominant problem of 36.4% (24 shops) of the survey respondents. Marketing concerns and issues on human resources are other problems identified by 28.7% (19 shops) and 18.2% (12 shops), respectively. Other problems like equipment, financing, waste treatment and plant lay-out contribute a minor share (16.7%) among the issues and concerns of the shops.

Table 9. Problems Encountered by Electroplating Shops

Problem Area	Issues	No. of Shops	% Share
Materials	Low Quality of Materials	12	(24) 36.4
	High Cost of Materials	8	
	Sourcing	3	
	Lack of Water Supply	1	
Human Resource	Attendance	2	(12) 18.2
	Lack of Skilled Workers	7	
	Lack of Training	3	
Marketing	Strategy	5	(19) **28.7**
	Quality Control	8	
	Capacity	3	
	Lack of Market	1	
	Rental	1	
	Delayed Delivery	1	
Equipment	Lack of Upgraded Equipment	2	(4) **6.1**
	Utilization Rate	2	
Financing	Capital	2	(3) **4.5**
	Taxes	1	
Others	Waste Treatment	3	(4) **6.1**
	Work Lay-out	1	
Total		**66**	**100**

CONCLUSION & RECOMMENDATIONS

Conclusion

The National Capital Region (NCR), Region III and Region VII are the top three locations of electroplating shops. Fifty percent of the shops are organized as single proprietorship and majority belong to small enterprises. All the 57 electroplating respondent shops are classified as independent, and a great number of these shops are into manufacturing.

A total of 1,309 personnel makeup the workforce of the 57 electroplating shops, 74% of the population are production workers and only 26% are administrative personnel. Most employers rated their personnel's performance as satisfactory, though some shops did not reveal their workers' performance rating.

Jewelry industry is the major market of the electroplating shops since almost all kinds of jewelry undergo electroplating process. Exports and imports of electroplated products reached their peak in 2010 and took a nosedive in 2012. It implies that the strongest market of electroplated products was in 2010 during the 5-year period (2008-2012).

Although there are prevailing problems, primarily issues on materials, most of the respondent shops are positive that their business conditions will improve and grow.

Recommendation

Since the electroplating sector contributes considerably to the country's economic activity, the Center must strengthen its capability to assist the sector's SMEs. Support could be extended to the SMEs through seminars/workshops and consultancy services in electroplating processes. Likewise, the MIRDC can recommend solutions in sourcing of materials to help the SMEs address their issues and concerns.

THE PHILIPPINE METALWORKING INDUSTRY PROFILING STUDY
METALCASTING SECTOR

The metalworking Industry serves the various fabricating industries and produces diverse products for agriculture, construction, and other various industrial applications. The metalcasting sector is found upstream, following the primary process of mining the mineral ores and extracting the metal from them. The sector serves as the source of raw materials within the engineering industry and provides machinery, toolings, and parts used in other industries, such as agriculture, housewares, chemical/petrochemical, water/sewerage, machinery, mining, cement, electronics, automotive, defense/ armaments, and medical/dental. Almost every metal product processed by the engineering group invariably starts from the metalcasting sector. [17]

This study covers the results of survey conducted in eight (8) regions of the country from 2010-2012 to get data specifically on the metalcasting sector.

Objectives of the Study

1. To provide an assessment of the metalcasting industry in terms of facilities, manpower, and investment requirements.
2. To identify the needs of the metalcasting industry in terms of technology requirements and technical capability of manpower, issues and concerns, as well as the plans of local metalcasting shops that could be addressed by the government.
3. To come up with a statistical analysis of the 2008-2012 data on import and export statistics of metalcasting commodities which can determine the growth or decline of the industry.

Methodology

The primary data were gathered through an industry profiling survey of 1,002 shop-respondents. Data were obtained through fielded survey questionnaires, personal interviews, and actual plant visits. Questionnaires were designed and distributed to elicit responses that will reflect the present profile of the industry, its structure, nature of business activity, market served, level of production and consumption, its technology and worker's training requirements, and other issues and concerns that can be addressed with government intervention.

Scope and Limitations of the Study

This study covers the general profile of the metalcasting sector with its operational aspects, market analysis, problems and issues, and business condition. The 50 shop-respondents are located in NCR, Regions I, IV-A, VI, VII, IX, X, XI and XII. The survey covered 50 respondent-shops, which is almost 50 % of the total number (102) of shops listed under the DTI-registered metalcasting shops as of the survey period. With the number of respondents, the Technology Information and Promotion Section (TIPS) was able to meet its target number of metalcasting shops as indicated in the 2010 Plans and Programs of the TIPS.

Some of these data covered in the survey are initial paid-up capital, year of establishment, volume and cost of production, number of personnel employed, business outlook, among others. It has to be noted, however, that a number of respondents did not disclose all the information needed or cannot determine the right answer to the survey questionnaire form. It is assumed that the shop respondents did not keep a record of their business data or intentionally refused to reveal a part of their business profile. Nevertheless, these limitations did not hinder the study to achieve its objectives.

There were 1,002 shop-respondents gathered from the different sectors (machining, heat treatment, welding, tool & die, forging, metalcasting and electroplating) of the Philippine Metalworking industry during the conduct of survey by the MIRDC survey team in 2010-2012. Based on the 2003 Philippine Metalcasting Industry Study conducted by the MIRDC, there were 195 identified metalcasting shops. However, as of the period of this study, there were only 102 metalcasting shops listed under the DTI-Registered Metalcasting Shops, a drop of 48% from the previous study.

Table 1 shows the regional distribution of metalcasting shops. As shown, the highest number of metalcasting shops surveyed in nine (9) regions of the country are found in the National Capital Region (28 shops or 56%), Region IV-A (7 shops or 14%), and Region VII (6 shops or 12%) where a lot number of businesses thrive and industrial zones are located. No metalcasting shops were identified in Regions II, III, IV-B, V, XII, CARAGA, and Cordillera Administrative Region (CAR) during the survey. Not included in the survey is the Autonomous Region of Muslim Mindanao (ARMM). Metalworking processes are predominantly welding and fabrication. The respondent metalcasting companies were determined based mainly on the processes employed, product lines and the list of their functional equipment.

Figure 1 displays the Geographical Distribution of Metalcasting Respondent-Shops.

Table 1. Regional Distribution of Metalcasting Shops

Area/Region	No. of Shops	Percent (%)
NCR	28	56
CAR	0	-
Region I	2	4
Region II	0	-
Region III	0	-
Region IV-A	7	14
Region IV-B	0	-
Region V	0	-
Region VI	2	4
Region VII	6	12
Region IX	1	2
Region X	2	4
Region XI	2	4
Region XII	0	-
CARAGA	0	-
ARMM	0	-
Total	**50**	**100**

Figure 1. Geographical Distribution of Metalcasting Respondent Shops.

Table 2. Year of Establishment of Metalcasting Shops

Year Started	No. of Shops	Percent (%)
Before 1960	3	6
1960 – 1970	7	14
1971 – 1980	8	16
1981 - 1990	13	26
1991 – 2000	7	14
2001 – 2010	9	18
Did Not Disclose Data	3	6
Total	**50**	**100**

Table 2 shows the Year of Establishment of the Respondent Shops.

As shown, metalcasting shops in the country are various ages. As shown, majority of the shops (13 shops or 26%) were established between 1981 and 1990; 9 shops (18%) were formed between 2001-2010; and 8 shops (16%) started the business in 1971-1980. The year of establishment of respondent shops are shown in Table 2.

Organizational Structure

Figure 2 reveals the distribution of shops according to form of business organization.

As revealed, the metalcasting companies were predominantly organized as corporation, (36 shops or 72%); ranking second are those categorized as single proprietorship (10 shops, 20%); 1 shop (2%) is a partnership; and 1 shop (2%) as government institution. Two shops (4%) did not disclose their form of business organization.

Figure 3 reflects the Distribution of Shops According to Type of Business Activity.

As reflected, most respondents (82%) are independent. Five respondents, however, did not disclose this information.are operating as independent shops. If classification is based on type of activity, the shops are categorized as independent and captive. Independent shops are shops that do not have a mother company to sustain their operation: they can stand alone; and they generate income by offering their products and services to their customers. Captive shops, on the other hand, are shops who do not accept jobs from customers. Their services specifically cater to the requirements of their own shops.

Table 3 and Figure 5 categorize the Distribution of Shops According to Capital.

As categorized, the shops according to capital, most of the shops (17 shops or 34%) are medium-scale enterprises. Next are the small enterprises (11 shops or 22%), followed by the micro enterprises (9 shops

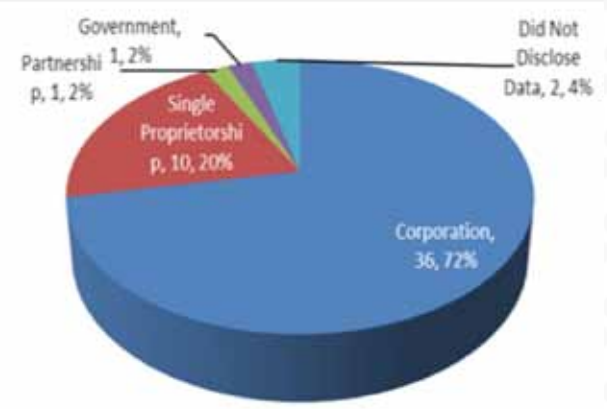

Figure 2. Distribution of Shops According to Form of Business Organization

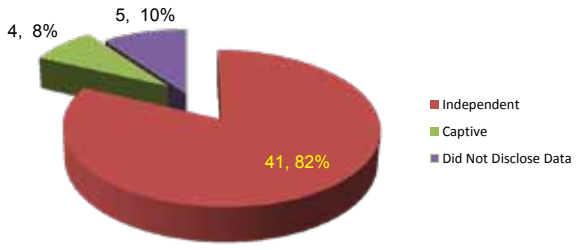

Figure 3. Distribution of Shops According to Type of Business Activity

Table 3. Distribution of Shops According to Size of Capital

Capital	Number of Shops	Percent (%)
Micro (=P=100,000 – 1 Million)	9	18
Small (=P=1,000,001 Million – 10 Million)	11	22
Medium (=P=10,000,001 – 40 Million)	17	34
Large ((More than =P=40 Million)	8	16
Did Not Disclose Data	5	10
Total	**50**	**100**

or 18%). Very few (8 shops or 16%) are categorized as large enterprises. Five (5) shops (10%) did not disclose their business capital.

Employment

Figure 6 illustrate the Distribution of Shops According to Size Employment.

As illustrated, shops categorized as "small" enterprise based on employment have 10-99 personnel. The small enterprises make up 68% of the survey respondents. Medium enterprises, with an employee population of 100-199 staff, represent 14% of the respondents.

Table 4 presents the Workforce Employed in the Shops.

Table 5 presents the Workforce Employed in the Shops.

As presented, direct workers constitute 85% of the metalcasting sector's total workforce, while 15% are employed on contractual basis. Direct workers are engaged in both production and non-production activities. Production workers composed the metals technologist, machinist, and other staff who are directly performing metalcasting activities and other related jobs. Engineers who supervise and monitor those who are engaged in technical functions also belong to the production workforce.

Table 4. Distribution of Shops According to Size of Employment

Classification According To Capital	Number of Shops	Percent (%)
Micro (1-9 personnel)	5	10
Small (10-99 personnel)	34	68
Medium (100-199)	7	14
Large ((More than 200 personnel)	3	6
Did Not Disclose Data	1	2
Total	**50**	**100**

Table 5. Workforce Employed in the Shops

Direct Workers		Contract Workers
Production	Non-Production	
2713	294	540
3,007		

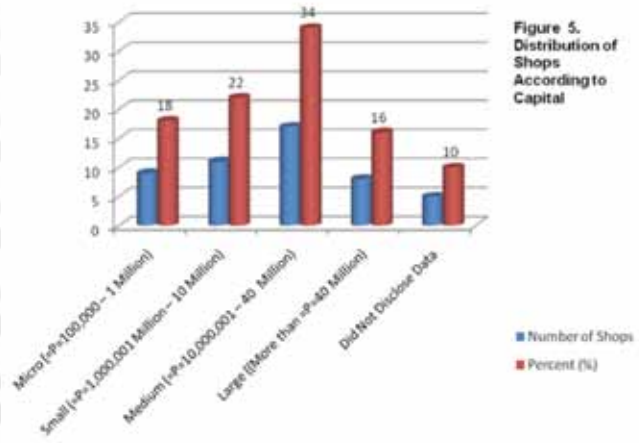

Figure 5. Distribution of Shops According to Capital

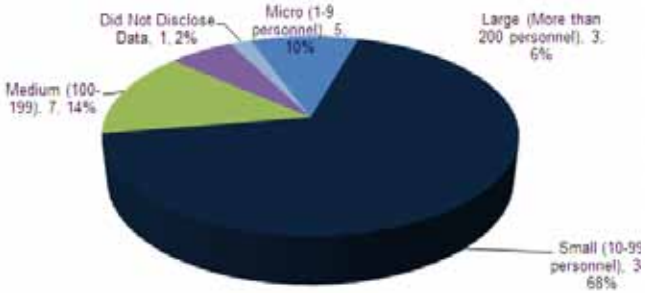

Figure 6. Distribution of Shops According to Size of Employment

Table 6 shows the proficiency of Workers of the Metalcasting Shops.

As shown, 14 shops (28%) gave a very satisfactory rating, when asked to evaluate their workers' performance. A Satisfactory rating was given by 8 shops (16%); 3 shops (6%) rated their employees as Excellent; and 1 shop (2%), Fair. 24 shops (48%) did not give a rating of their employees' performance.

Figure 7 illustrates the proficiency of workers.

As illustrated, the employees are rated by the manager or supervisor based on their proficiency at work. Almost half of the respondents were not able to disclose their rating to their workers. Possible reasons are: fear of customers' rejection for their lower ratings to their workers; ignorance and workers are not willing to accept underratings.

Table 6. Proficiency of Workers

Proficiency	No. of Shops	Percent (%)
Excellent	3	6
Very Satisfactory	14	28
Satisfactory	8	16
Fair	1	2
Could not Determine	24	48
Total	**50**	**100**

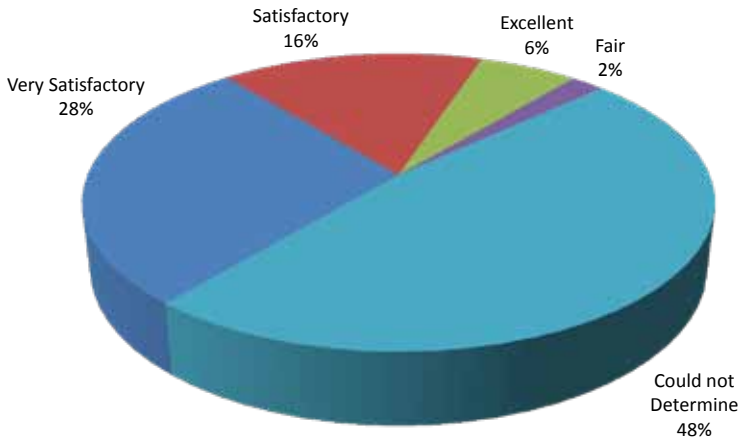

Figure 7. Percentage Distribution of Proficiency Level of Workers

Product Lines/Services

The Philippine metalcasting industry continues to survive in spite of high production cost and competitive price of imported products which greatly affect the industry's business activities. The industry produces goods and products that cater to the needs of the different sectors of the metalworking industry like agriculture, food, transportation, mining, cement, sugar, paper and energy. Some of its products are tractor spare parts and water pumps which are used in agriculture. For the food sector, cast iron sizzling plates, burner stoves, super kalan & kitchen grate. Automotive parts like impeller, propeller, brake drum, brake disks, brake lining, and underchassis parts are some cast products produced for the transportation sector. Other products like metal connectors, jaw crushers, rollers for woodworks, V-pulley used in machines, equipment and ship parts are critical products that are used for different applications. Cast products like rivets, bell, hanger, cast iron pipes and fittings are used in diverse applications. Cast emblematic jewelries contribute income to the industry as it caters to big local and foreign markets.

Raw Materials

The raw materials used by the respondent shops are sourced locally and abroad, but majority of the shops use local materials because of one or both of these reasons: imported materials have a high cost; and they can use local materials to make products suited to their application. The following raw materials are used by the metalcasting shops surveyed:

- iron scrap;
- foundry coke;
- 4140;
- 1045;
- 4340;
- CI steel;
- bronze scrap;
- aluminum;
- ferro alloys;
- mild steel;
- stainless steel;
- dies;
- hi-speed steel;
- copper;
- ferrous;
- gray cast iron;
- ductile cast iron;
- pig iron;
- scrap cast iron;
- powder coating paint;
- aluminum;
- moulding materials;
- BI;
- MS scrap;
- aluminum (scrap & ingots);
- brass; plates;
- shafting;
- bentonite;
- silica sand;
- rod;
- pipe;
- plate;
- furan;
- resin;
- silicon;
- sodium carbonate;
- dolomite;
- chromite;
- activated C;
- GI sheets;
- GI plates;
- C bars;
- angle bars;
- GI pipes;
- special steel;
- wrought iron;
- tool steel;
- CRS;
- steel bars;
- bronze;

- brass;
- Mg bronze;
- 1045 CR;
- square bars;
- G.I.sheets and
- binders.

Cost/Volume of Consumption

Table 8 tabulates the Distribution of Shops with Data on Production.

As tabulated, there are 31 shops or 62% out of 50 respondent shops who have available data on volume/cost of production per year and 19 shops (38%) who cannot determine or provide data. It is noted that the number of shops who cannot determine data on consumption were also the shops who cannot determine data on production. The breakdown of volume/cost of production (expressed in two different units, i.e., in tons per year and peso per year). The volume of production in tons per year of 25 shops reached 16,867.3 tons, while 6 shops reported their production in peso amounting to Php650.7 million per year.

Table 8. Distribution of Shops With Data on Production

	No. of Shops	Percent (%)
With Data	31	62
Cannot Determine	19	38
Total	**50**	**100.0**

Contribution to the Economy

The 2010 Annual Survey of Philippine Business and Industry (ASPBI) surveyed 75 firms belonging to the metalcasting sector. The sector employed more than 4,500 workers and contributed Php3.074 Trillion or 0.0298% of the value added manufacturing.

Table 9 shows the Summary Statistics of Selected Metalcasting Products for 2010.

Table 9. Summary Statistics of Selected Metalcasting Products

	Casting / foundry of iron	Casting / foundry of steel	Aluminum and aluminum-based alloy casting	Copper and copper-based alloy (bronze, brass) casting	Zinc and zinc alloy casting; casting of non-ferrous metal, n.e.c.	**Total**
Number of establishments surveyed	18	15	31	5	6	**75**
Value of Output (P1,000,000)	517.741	376.706	4,200.118	7,308.270	932.367	**13,335.2**
Value Added (P1,000,000)	144.694	145.395	974.779	1,463.819	346.120	**3,074.807**
Value Added / Value of Output	27.95%	38.60%	23.21%	20.03%	37.12%	**23.06%**
Total Cost (P1,000,000)	399.801	290.343	3,462.927	6,331.839	677.604	**11,162.51**
Intermediate Cost (P1,000,000)	351.855	192.307	2,938.311	5,491.160	551.114	**9,524.747**
Total Number of Employees	**716**	**532**	**2,157**	**555**	**562**	**4,522**

Source: 2010 ASPBI, National Statistics Office
Notes: Data above refer to the following 2009 PSIC Codes: 24311, 24312, 24321, 24322, 24323, 24329

The ASPBI determines the industrial classification of an economic unit based on the activity from which the unit derives its major income or revenue. The classification is based on the 2009 Philippine Standard Industrial classification which is aligned with the International Standard Industrial Classification of all economic activities Revision 4.0.

Notes:
A. Value of Output of Philippine manufacturing: Php 3,581,916,250,000.00
B. Value Added of Philippine manufacturing: Php 1,031,341,114,000.00
C. Value of Output of Metalcasting Sector: Php 13,335.202,000.00
D. Value Added of Metalcasting Sector: Php 3,074,807,000.00

Source of data: 2010 ASPBI
Computations: Contribution of Metalcasting to PH manufacturing:
C / A = 0.372% (of value of output) D / B = 0.298% (of value added)

Trade Performance (Import & Export)

Table 10 illustrates the Trade Statistics of Metalcasting-related Commodities from 2007 to 2011. Cast products are used across varied industries either as 'pure' castings or as part of machinery and equipment.

Materials and supplies include waste and scrap of various metals, alloys, and other metallic compounds used to produce castings. As has been raised time and again, the Philippines continues to export waste and scrap of metals to the detriment of the local foundries that have to compete with the prices offered by foreign users.

The top imports and exports for cast iron, steel, bronze, aluminum emphasize discrepancy in materials and supplies.

Imported products with cast iron include: a) pumps for liquids, whether or not fitted with a measuring device; liquid elevators; b) air or vacuum pumps, air or other gas compressors with fans; c) electric generating sets and rotary converters; d) parts suitable for use solely or principally with 1) spark-ignition reciprocating or rotary internal combustion piston engines and 2) compression-ignition internal combustion piston engines (diesel or semi-diesel); e) electric motors and generators).

Industry Value Chain

Figure 10 shows the Markets Served by the Metalcasting Shops.

Table 10. Trade Statistics of Metalcasting-related Commodities (in '000 US$)

Category	2007		2008		2009		2010		2011	
	Qty *(in '000 kgs)*	**Value** *(in '000 US$)*	**Qty** *(in '000 kgs)*	**Value** *(in '000 US$)*	**Qty** *(in '000 kgs)*	**Value** *(in '000 US$)*	**Qty** *(in '000 kgs)*	**Value** *(in '000 US$)*	**Qty** *(in '000 kgs)*	**Value** *(in '000 US$)*
IMPORTS										
Materials and Supplies	135,728	104,211	111,671	111,334	96,731	65,995	111,244	93,500	80,398	118,140
Cast Iron	156,685	626,632	131,753	592,855	126,626	545,779	162,768	747,517	160,305	886,204
Cast Steel	56,516	149,689	72,207	175,660	85,741	175,552	73,218	214,223	83,762	282,033
Cast Bronze	11,755	31,891	7,519	40,179	6,133	40,739	6,298	46,391	8,577	69,696
Cast Aluminum	3,025	16,353	7,785	55,247	11,374	139,230	67,133	255,737	1,737	13,158
EXPORTS										
Materials and Supplies	1,026,192	1,024,899	1,026,104	673,438	539,834	649,943	693,237	704,110	717,896	177,415
Cast Iron	16,944	112,515	11,240	96,244	12,675	84,763	14,035	138,918	9,675	115,974
Cast Steel	22,773	59,728	9,293	53,801	6,666	36,172	7,124	44,276	8,700	51,333
Cast Bronze	2,161	24,968	2,064	23,132	1,680	18,111	1,893	20,942	2,329	27,321
Cast Aluminum	173	1,242	98	743	4	45	14	143	29	248
SURPLUS (EXPORTS > IMPORTS)										
Materials and Supplies	890,463	920,688	914,432	562,104	443,103	583,949	581,993	610,610	637,499	59,276
DEFICIT (EXPORTS < IMPORTS)										
Cast Iron	139,741	514,117	120,513	496,611	113,951	461,016	148,733	608,599	150,630	770,230
Cast Steel	33,743	89,961	62,913	121,859	79,074	139,380	66,094	169,947	75,062	230,700
Cast Bronze	9,594	6,923	5,455	17,047	4,453	22,628	4,405	25,449	6,248	42,375
Cast Aluminum	2,852	15,111	7,687	54,505	11,370	139,184	67,118	255,594	1,708	12,909

Source: Foreign Trade Statistics, National Statistics Office
** Note: Figures may not round up due to rounding off errors;*

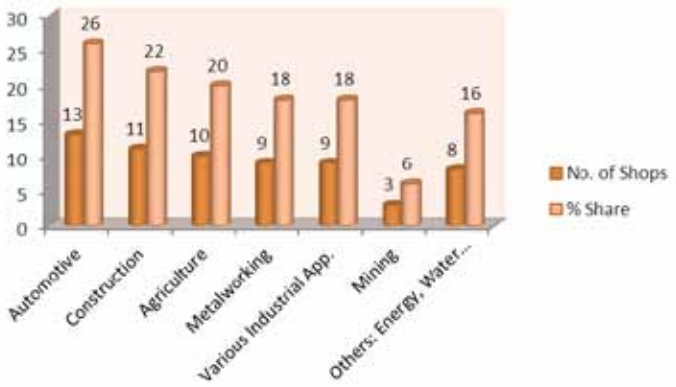

Figure 10. Markets Served by the Metalcasting Shops

Table 10. Comparison of 5-Year Statistics of Metalcasting Export Commodity (2008-2012)

Year	2008	2009	2010	2011	2012	Total	Average
FOB Value US Dollars ('000)	202,168	155,349	222,909	227,654	722,546	1,530,626	306,125

Note: *Most shops have multiple responses

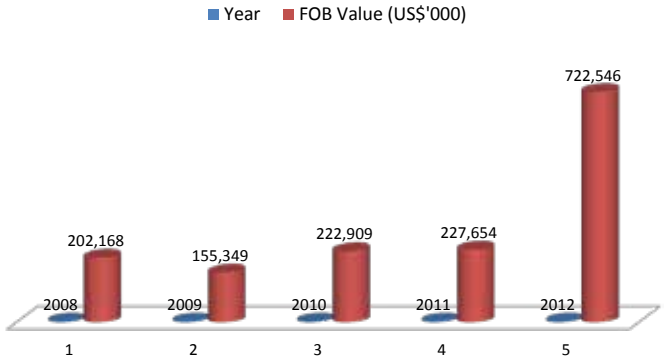

Figure 11. Comparison of 5-Year Statistics Data of Metalcasting Export Commodity (2008-2012)

Table 11. Comparison of 5-Year Statistics of Metalcasting Import Commodity (2008-2012)

Year	2008	2009	2010	2011	2012	Total	Average
FOB Value (US$ '000)	935,227.80	849,679.58	1,083,952.37	1,406,659.23	1,788,874	6,604,392.98	1,320,878

Figure 12. Comparison of 5-Year Statistics of Metalcasting Import Commodity (2008-2012)

As shown, the automotive sector is the biggest market for metalcasting products and services, followed by the construction and agriculture sectors. Products of the metalworking sector and their various industrial applications have a big share in the market.

Metalcasting serves as provider of raw materials to other industries. Forward linkages with downstream industries should be developed.

Import & Export Trade Statistics on Metalcasting Commodity

Export

Figure 11 displays the comparison of 5-Year Statistics of Metalcasting Export Commodity.

As displayed, it gives a closer look at the five-year statistics of metalcasting export commodity. The highest FOB Value of export in metalcasting commodities was in 2012, and the lowest was in 2009. The export of metalcasting products in 2010 and 2011 is almost identical. The remarkable export performance in 2012 is a 217.39% leap from the 2011 exports.

The FOB Value during the five-year period totaled to USD 1,530,626 and registered an average of USD 306,125.

Import & Export Trade Statistics on Metalcasting Commodity

Import

Figure 12, on the other hand, offers a glimpse of the metalcasting import commodity from 2008-2012. The highest value of import in metalcasting commodities was in 2012, and the lowest was in 2009. It is noted that the value of export and import of metalcasting commodities are highest in 2012, although in terms of FOB Value, it is evident that the importation of metalcasting commodities is much higher (US$ FOB 1,788,874) than the value of export commodities (US$ FOB 722,546).

Metalcasting involves pouring liquid metal into a mold which contains a hollow cavity of the desired shape. The liquid metal is then allowed to cool and solidify. The solidified part, known as a casting, is ejected or broken out of the mold to complete the process. Casting is most often used for making complex shapes that would be difficult or uneconomical to make by other methods. Casting processes have been known for thousands of years, and widely used for sculpture, especially in bronze, jewelry in precious metals, and weapons and tools. [18]

Table 12 presents the List of Equipment Used by the Metalcasting Respondent Shops.

As presented in Table 12, majority (195 units or 42%) of the equipment are used in fettling or cleaning process, 90 units or 20% are utilized in melting, 90 units or 20% are categorized as measuring instruments, and 59 units (13%) are used in the preparation process. Only 21 units (4%) are used in testing and quality control, and 3 units (1%) are categorized as auxiliary tools or equipment.

Table 12. Equipment Used by Respondent Shops In Metalcasting Process

Name of Tool/Equipment	No. of Units	%
Preparation & Molding	**59**	**13**
Sand Mixer	16	
Molding Machine	32	
Shake-out Machine	11	
Melting Equipment	**90**	**20**
Induction Furnace	21	
Reverberatory Furnace	1	
Crucible Furnace	22	
Blasting Furnace	18	
Arc Furnace	3	
Cupola Furnace	22	
Shell Firing Furnace	2	
Vacuum Casting Machine	1	
Fettling and Cleaning Machine/Tool	**195**	**42**
Grinder/Grinder (Swagging)	139	
Cut-off Machine	13	
Swing Frame	22	
Knock-off machine	1	
Blower	1	
Sander	1	
Dewaxer	1	
Pneumatic Hammer	17	
Testing & Quality Control Instruments	**21**	**4**
Pyrometer	4	
Hardness Tester	6	
CO2 Analyzer	1	
Metallurgical Microscope	1	
Portable Microscope	2	
Spectrometer (OES)	3	
Universal Testing Machine	1	
Leak Testing Machine	3	
Measuring Instruments	**90**	**20**
Caliper	65	
CMM	3	
Micrometer	22	
Auxilliaries	**3**	**1**
Air Compressor	3	
Total	**458**	**100**

Table 13 presents the Enterprise Plan of the Metalcasting Shops for the Next 5 Years.

As presented, 18 shops (34%) have set plans to increase in production, add product lines and expand their technical capabilities. Expanding, branching out, adding and training personnel are plans mentioned by 16 shops (30%). There are 9 shops (17%) who want to acquire high technology machines, e.g. CNC milling, digital instrument, induction furnace, vacuum emissions spectrometer and metal injection machine. The metalcasting shops indicated diverse plans in the next five (5) years despite the problems that they have encountered and identified during the course of their business operations.

Table 13. Enterprise Plan of the Metalcasting Shops for the Next 5 Years

Plans	No. of Shops*	Percent (%)
Increase in production, add product lines, expand company's technical capabilities.	18	34
Expand, branch out business, add & train personnel.	16	30.1
Acquire high technology machines (CNC Milling, Digital instrument, Induction Furnace, Vacuum Emissions Spectrometer, metal injection machine)	9	16.9
Continue operation, improve casting operation (venture into ceramic casting)	6	11.3
Expand to other metalworking processing (electroplating, machine shop)	3	6
Conduct research & development of other products to cater other industries like, cement, mining industry, petrochemical	4	7.5
Upgrade facilities, additional plant for titanium	4	7.5
To be an equipment manufacturer, develop equipment for small farmers	2	3.8
Outsourcing	1	1.8
To be an internationally recognized metalcasting shop	1	1.8

Note: *Most shops have multiple responses

PROBLEMS/ISSUES & CONCERNS

Table 14 reflects the Problems Encountered by the Respondent Shops.

As reflected, most of the respondents (18 shops or 36%) have diverse concerns on raw material, e.g. high cost, substandard, difficulty in sourcing, scarcity of scrap metals, export of scrap metals and contaminated scrap. There are eight (8) shops (16%) who have problems in power, e.g. high cost, not enough supply and power interruption. Four (4) shops (8%) identified manpower, i.e. lack of skilled workers (engineers and technicians) in foundry practices as their problem. Other diverse issues enumerated in Table 14 also affect business operations of the respondent shops.

Table 14. Problems Encountered by the Metalcasting Shops

Problems/Issues	No. of Shops*	Percent (%)
Raw material (high cost, substandard materials, difficulty in sourcing, scarcity of scrap metals, export of scrap metals, contaminated scrap)	18	36
Power (high cost, not enough supply, power interruption)	8	16
Manpower (Lack of skilled workers in foundry practices- engineers & technicians)	4	8
Lack of customer/job	4	8
Low product quality (casting defects, rejected products)	3	6
Equipment (capacity, efficiency)	2	4
Competitors (big shops)	1	2
Quality of product	1	2
Attitude of worker	1	2
High tax	1	2
Processing of dolomite	1	2
Influx of imported products (China)	1	2
Testing of materials is delayed	1	2
Heat treatment process is required	1	2
Needs additional manpower and training	1	2
Supply of water is not enough	1	2
Waste disposal (high cost)	1	2
Marketing of products & services	1	2
Business trends (ups and downs) of business	1	2
TOTAL	**52***	

Note: * Some shops have multiple answers

Conclusion

The metalcasting sector continually contributes to the economic activity of the country as it plays a vital role in the growth of the metals and engineering industries. The automotive sector, which is the biggest market of the metalcasting sector, continues to be tough, thereby sustaining the demand for metalcasting products and services. The construction sector, placed second among its markets, also remains on the boom as seen in the fast emergence of buildings in the urban areas intended for residences and business purposes.

Although raw materials and power remain as the major issues of the shop owners, most of them have plans to improve their business operation in the next five (5) years. Increase in production that may eventually lead to business expansion and branching out is among the plans of majority of the shop owners.

Through the continued efforts of the MIRDC in upgrading the status of the metalcasting sector, appropriate initiatives will be undertaken by the government. These are aimed in providing the industry with needed assistance and support thus, will contribute to its sustenance and growth.

Recommendations

1. Identify more metalcasting shops as respondents to the Metalworking Industry Profiling Study to come up with a data that will give a better representation of the metalcasting sector in the country.

2. Strengthen the MIRDC's joint undertaking with the DOST Regional Offices, the Philippine Metalcasting Association, Inc. (PMAI), and other National Government Agencies like the Department of Trade and Industry in bracing effort to assist the small and medium enterprises (SMEs) through technical expertise and funding program.

3. Undertake initiatives in enhancing the dissemination of its technologies, training and consultancy services to suit the needs of the respondent shops based on the data gathered during the survey.

THE PHILIPPINE METALWORKING INDUSTRY PROFILING STUDY

HEAT TREATMENT SECTOR

Metals are essential materials in the fabrication of equipment, tools, machineries and machine parts. Though there are diverse kinds of metals with their respective applications, the metallurgist's goal is to develop and optimize their desired mechanical properties. This can only be achieved through the so-called "heat treatment process."

The heat treatment sector plays a crucial role in the metals and engineering industries as it complements and supports other metalworking processes like machining and metalcasting.

Heat treating is a group of industrial and metalworking processes used to alter the physical, and sometimes chemical, properties of a material. The most common application is metallurgical. Heat treatments are also used in the manufacture of many other materials, such as glass. Heat treatment involves the use of heating or chilling, normally to extreme temperatures, to achieve a desired result such as hardening or softening of a material. Heat treatment techniques include annealing, case hardening, precipitation strengthening, tempering and quenching. It is noteworthy that while the term heat treatment applies only to processes where heating and cooling are done for the specific purpose of altering properties intentionally, heating and cooling often occur incidentally during other manufacturing processes such as hot forming or welding.

Complex heat treating schedules, or "cycles," are often devised by metallurgists to optimize an alloy's mechanical properties. In the aerospace industry, a super alloy may undergo five or more different heat treating operations to develop the desired properties. This can lead to quality problems depending on the accuracy of the furnace's temperature controls and timer.

Annealing consists of heating a metal to a specific temperature and then cooling at a rate that will produce a refined microstructure. The rate of cooling is generally slow. Annealing is most often used to soften a metal for cold working, to improve machinability, or to enhance properties like electrical conductivity.

Quenching is a process of cooling a metal very quickly. This is most often done to produce a martensite transformation. In ferrous alloys, this will often produce a harder metal, while non-ferrous alloys will usually become softer than normal. [7]

Figure 1 illustrates the geographical distribution of heat treatment shops.

As shown, there are 22 shops (61%) located in Luzon, 8 shops (22%) are situated in Visayas and 6 shops (17%) are found in Mindanao. This study covers the data of 36 heat treatment respondent shops surveyed from ten (10) regions of the country in 2010-2012.

Table 1 shows the Regional Distribution of Heat Treatment Shops.

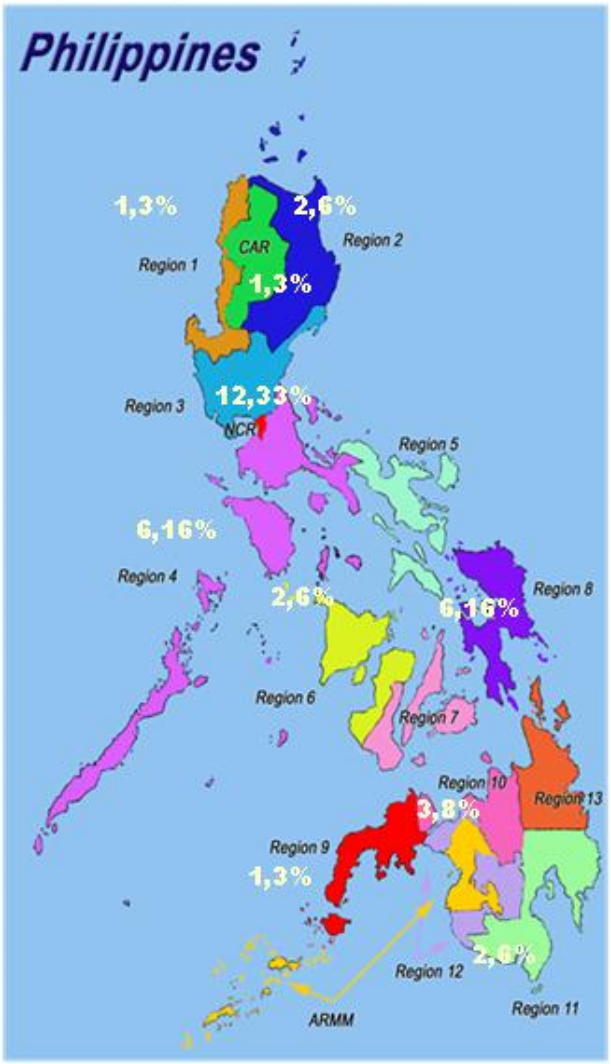

Figure 1. Geographical Distribution of Heat Treatment Shops

Table 1. Regional Distribution of Heat Treatment Shops

Region	No. of Shops	% Share
NCR	12	33
CAR	1	3
I	1	3
II	2	6
IV-A	6	16
VI	2	6
VII	6	16
IX	1	3
X	3	8
XI	2	6
Total	**36**	**100**

Table 2. Form of Business Organization

Region	No. of Shops	% Share
Corporation	28	64
Single Proprietorship	8	22
Partnership	3	8
Government	1	3
Did Not Disclose Data	1	3
Total	36	100

As illustrated, 12 shops (33%) are located in NCR, 6 shops (16%) are situated in Region IV-A, and 6 shops (16%) are found in Region VII. The rest of the regions constitute only a small share of the total respondent-shops.

Table 2 & Figure 2 reflect the Form of Business Organization of the Heat Treatment Shops.

As reflected, 28 shops (64%) are organized as corporation, eight (8) shops (22%) as single proprietorship, three (3) shops (8%) as partnership and one (1) shop (3%) as government. A small percentage of shops did not disclose data on the form of their business organization. The heat treatment shops assume various forms of organization.

Table 3 and Figure 3 shows the Classification of Heat Treatment Shops Based on Total Assets.
As shown, majority (21 shops or 58%) of the 36 respondent shops are classified as small-scale, followed by "medium" (6 shops or 17%); "large," (4 shops or 11%); and "micro," (3 shops or 8%).

Table 3. Classification of Heat Treatment Shops Based on Total Assets

Capitalization	No. of Shops	% Share
Micro (Php 100,001 to 1 Million)	3	8
Small (Php 1,000,001 to 10 Million)	21	58
Medium (Php 10,000,001 to 40 Million)	6	17
Large (Greater than Php 40 Million)	4	11
Did Not Disclose Data	2	6
Total	**36**	**100**

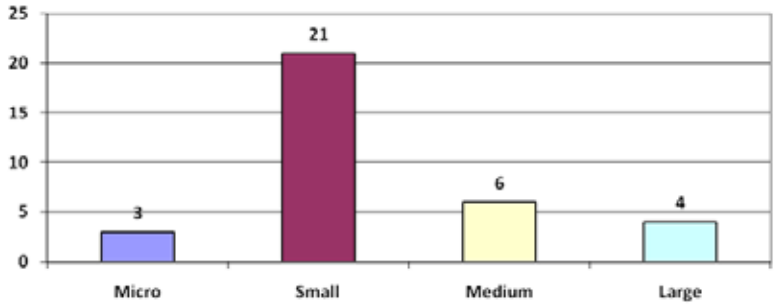

Figure 3. Classification of Shops Based on Total Assets, Distribution According to Number of Shops

Table 4. Regional Distribution of Shops According to Size

Location	Micro	Small	Medium	Large	Did Not Disclose Data	Total
NCR	2	4	1	3	2	**12**
I		1				**1**
II	1	1				**2**
CAR		1				**1**
IV-A		4	2			**6**
VI		1	1			**2**
VII		4	1	1		**6**
IX		1				**1**
X		2	1			**3**
XI		2				**2**
Total	**3**	**21**	**6**	**4**	**2**	**36**

Table 4 presents the Regional Distribution of Shops According to Size.

As presented, the small-scale category shops, which represent the majority of the heat treatment sector, are more or less dispersed across the country. The medium, large, and micro-scale enterprises are not as evenly distributed.

Table 5 and Figure 4 illustrate the Number of Shops According to Type of Operation.

As illustrated, among the heat treatment shops surveyed, majority (13 shops or 36%) are into manufacturing. Survey also revealed that 10 shops (28%) offer jobbing services, and 8 shops (22%) are into both jobbing and manufacturing. Five shops (14%) of the respondents did not disclose data.

Table 5. Shops According to Type of Business Operation

Type of Operation	No. of Shops	% Share
Manufacturing	13	36
Jobbing	10	28
Both	8	22
Did Not Disclose Data	5	14
Total	**36**	**100**

Employment

Figure 5 reflect the classification of Personnel Employed by Heat Treatment Shops.

As reflected, there is a total of 1,791 personnel employed in the heat treatment shops. The distribution is as follows: production personnel (1207 or 67%); administrative staff (387 or 22%); and contractual workers, (97 or 11%).

Figure 6 shows the Level of Proficiency of Workers Employed by the Respondent Shops.

The shop owners were asked to rate the proficiency of their employees, as this is an important part of the study.

As shown in Figure 6, four (4) shops (28%) rated their personnel's performance as Very Satisfactory, seven shops (19%), Satisfactory; four shops (11%), Excellent; and two shops (6%), Fair. Most (13 shops or 36%) of the shop owners did not reveal their workers' rating performance.

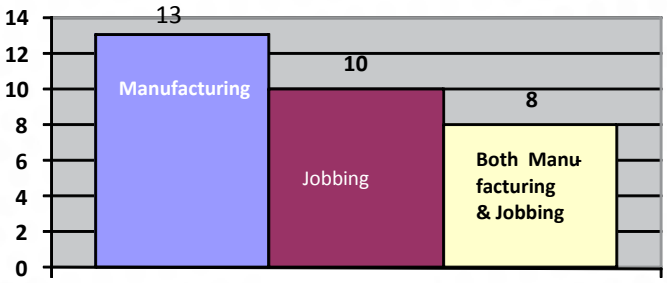

Figure 4. Number of Shops According to Type of Operation

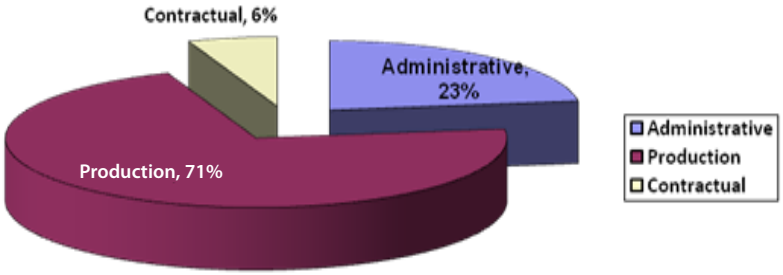

Figure5. Classification of Personnel

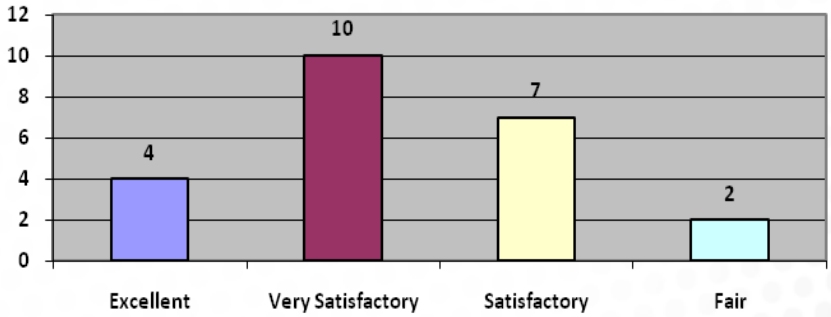

Figure 6. Level of Proficiency of Workers Employed by the Respondent Shops.

Market Served

Table 6 indicates the Market Served by the Heat Treatment Shops.

As indicated, majority (26 shops) caters to the industrial/metalworking industry, 10 shops offer their products and services to the automotive sector, and nine shops provide services to the electronics segment of the industry. Only a small portion of the total respondent shops cater to other sectors like mining, agriculture, construction, pharmaceutical, fire arms, aerospace, food and shipping.

Table 6. Market Served by the Heat Treatment Shops

Market	No. of Shops
Industrial/Metalworking	26
Automotive	10
Electronics	9
Mining	4
Agriculture	4
Construction	3
Pharmaceutical	2
Others : Fire Arms, Aerospace, Food, Shipping	4

Import Statistics

Table 7 shows the import statistics of heat-treated products, 2008-2012.

As shown, there is an average of 131million in US Dollars and 42 million in kilograms.

Figure 7 reveals the Import Statistics of Heat-Treated Products for the period 2008-2012.

As revealed, there was a minimal up and down trend in the CIF Value of the imported heat-treated products from 2008-2012, except in 2009 to 2010 where a big leap` is noted, from 77.6 million US Dollars to 289.3 million US Dollars. The lowest (76.2 million US Dollars) CIF Value is seen in 2008.

Table 7. Import Statistics of Heat Treated Products

Year	2008	2009	2010	2011	2012	Total	Average
Weight (GK)	54,454,029	38,690,911	39,701,456	45,130,753	32,231,453	**210,208,602**	**42,041,720**
CIF Value (US$)	76,197,971	77,609,174	289,279,194	114,438,004	99,722,697	**657,247,040**	**131,449,408**

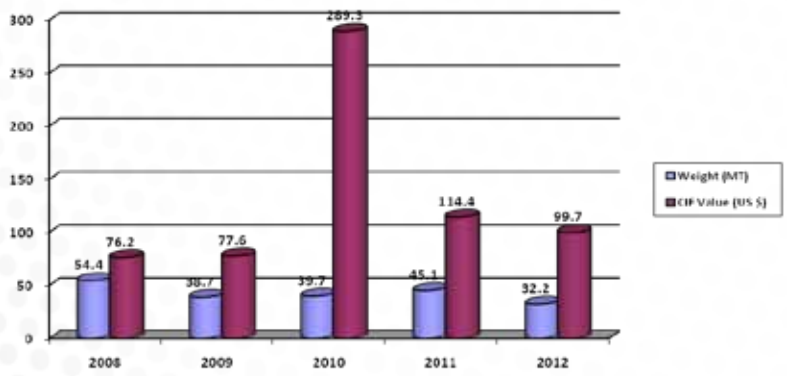

Figure 7. Import Statistics of Heat–Treated Products, 2008-2012

Although the CIF Value in US Dollars reached its peak in 2010, the highest recorded weight of heat-treated products is in 2008. It implies that there is a considerable increase in price of heat-treated products in 2010.

Table 8 shows the export statistics of heat-treated products, 2008-2012.

As shown, the average weight is 23 million in kilograms, while the FOB Value is 9 million in US Dollars. A difference of 93% when compared to the CIF Value..

Figure 8 displays the Export Statistics of Heat-Treated Products for the period 2008-2012.

As displayed, there was an up and down trend of the FOB Value in US Dollars of the exportation of heat-treated products from 2008-2012, however, it reached its highest (131 million US Dollars) in 2011 and lowest (50.3 million US Dollars) in 2009. There was no significant increase in weight of heat-treated products for the 5-year period.

Table 8. Export Statistics of Heat–Treated Products, 2008-2012

Year	2008	2009	2010	2011	2012	Total	Average
Weight (GK)	17,066,502	14,166,331	30,033,224	32,733,628	22,270,249	**116,269,934**	**23,253,986**
FOB Value (US$)	77,711,124	50,290,393	124,863,046	131,018,810	97,781,157	**481,664,53**	**9,633,290**

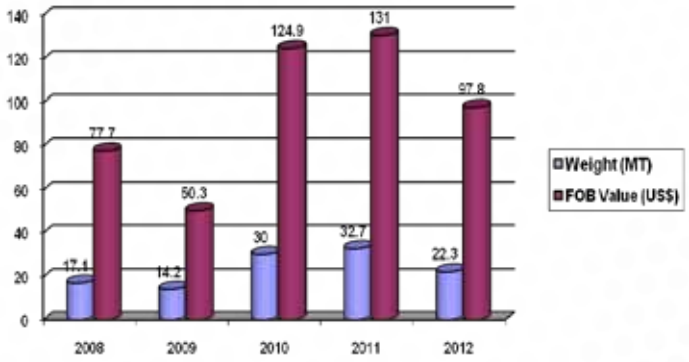

Figure 8. Export Statistics of Heat–Treated Products, 2008-2012

Equipment

Table 9 shows the List of Available Equipment/Tools Used by the Heat Treatment Shops.

As shown, the furnace is the most (31 units) available equipment in the heat treatment shops, followed by hardness tester and heat treatment oven.

Table 9. List of Equipment/Tools of the Heat Treatment Shops

Equipment	No. of Equipment
Furnace (crucible, induction, blasting)	31
Hardness Tester	13
Heat Treatment Oven	9
Cupola	3
Pneumatic Rammer	3
Cooling Tower	3
Shot Blasting Machine	3
Normalizing Equipment	2
Hi-Frequency Heater	1
Heat Treatment Forklift	1
Sand Reclaimer	1
Tempering Equipment	1
Direct Hardening	1
Case Hardening	1
Solution Heat Treatment	1
Flame Hardening	1
Spheroidizing	1

Problem Areas

Table 10 identifies the problems and issues encountered by the respondent shops.

As identified, majority (20 shops or 44.4%) of the shops have diverse issues on materials; human resources and marketing, which have equal share, 10 shops (22.2%); financing, 3 shops (6.7%); and equipment, 2 shops (4.5%).

Table 10. Problems Encountered by the Heat Treatment Shops

Problem Area	Issues	No. of Shops	Percentage (%)
Materials	Low Quality of Materials	11	(20) **44.4**
	High Cost of Materials	4	
	Sourcing	5	
Human Resources	Attendance	1	(10) **22.2**
	Attitude	5	
	Lack of Skilled Workers	4	
Marketing	Strategy	4	(10) **22.2**
	Quality Control	2	
	Capacity	2	
	Delayed Testing Results	2	
Financing	Capital	2	(3) **6.7**
	Taxes	1	
Equipment	Lack of Upgraded Equipment	1	(2) **4.5**
	Power Interruption	1	
Total		45*	100.0

Business Outlook

Table 12 reveals the Business Outlook of Respondent-Shops.

As revealed, 15 shops (42%) have an "improving" outlook on the current semester; three (3) shops (8%), "deteriorating"; and six (6) shops (17%), "no change". For the coming semester, 16 (17%) have "improving" outlook; 1 shop (3%), "deteriorating" and 6 shops (17%), "no change." Although majority of the respondents are very optimistic that their business will do better the coming semester, more than 30 percent cannot determine their business condition and cannot forecast the business trend for the coming semester. This sector is dominated by optimistic businesses.

Figure 9 shows the comparison of distribution of number of respondents of business outlook for the current semester versus the coming semester.

Table 12. Business Outlook of Respondent-Shops (Current Semester versus Coming Semester)

Business Outlook	Current Semester	%	Coming Semester	%
Improving	15	42	16	44
Deteriorating	3	8	1	3
No Change	6	17	6	17
Cannot Determine	12	33	13	36
Total	**36**	**100**	**36**	**100**

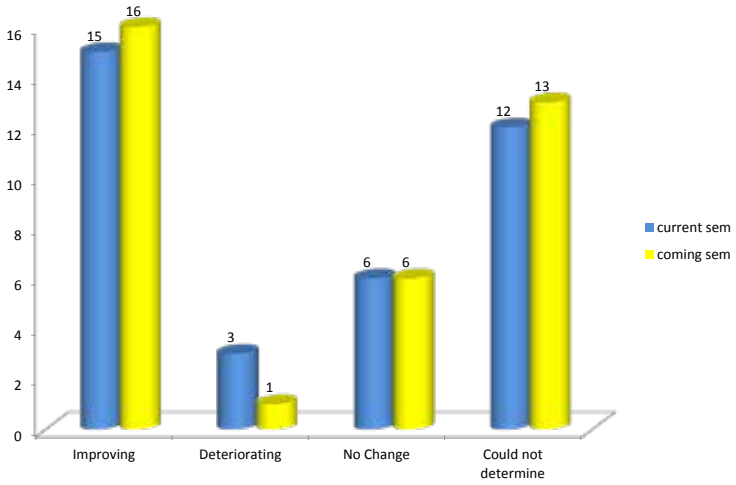

Figure 9. Comparison of Business Outlook of Respondent (Current Semester versus Coming Semester)

The most number of heat treatment shops are found in the NCR and majority of them are organized as corporations. A large number of shops are classified as small-scale industries based on capital.

All the 36 respondent shops are independent with regard to type of business activity. The respondents are predominantly engaged in manufacturing, almost 30% offer jobbing services, and only more than 20% are into both jobbing and manufacturing.

There are a total of 1,791 employed in the 36 heat treatment respondent shops. Of these, 67% are production personnel and 22% are administrative personnel. Only 11% are contractual workers. Although 28% of the shop owners rated their workers' performance as very satisfactory, most of them cannot determine the measurement of their workers' skills. The major market of the heat treatment shops is the industrial/metalworking industry, followed by the automotive and electronics sectors. Only minimal portion of the total respondent shops cater to other different sectors like mining, agriculture, construction, pharmaceutical, fire arms, aerospace, food and shipping.

There was a minimal up and down trend in the CIF Value of heat-treated products from 2008-2012, except in 2009 to 2010 where a big leap is seen, from 77.6 million US Dollars to 289.3 million US Dollars. The lowest (76.2 million US Dollars) CIF Value is reflected in 2008. Although the CIF Value in US Dollars reached its peak in 2010, the highest recorded weight of heat-treated products is revealed in 2008. It implies that there is a significant increase in price of heat-treated products in 2010.

An up and down trend of the FOB Value in US Dollars of the exportation of heat-treated products from 2008-2012 is seen. However, it reached its highest (131 million US Dollars) in 2011 and lowest (50.3 million US Dollars) in 2009. There was no significant increase in weight of heat-treated products for the five-year period.

Despite the problems encountered by the respondent-shops, almost 50% of them have an "improving" outlook on their current and future business condition. It implies that the heat treatment respondent-shops have high hopes that their business could be sustained and even grow.

THE PHILIPPINE METALWORKING INDUSTRY PROFILING STUDY

FORGING SECTOR

The forging sector is one of the vital sectors of the metals and engineering (M&E) industry. Although it is the smallest among the seven (7) metalworking sectors (machining, tool and die, electroplating, metalcasting, heat treatment, welding) in the Philippines, forging shops cater primarily to industries like automotive, agriculture and other industries that are mostly engaged in manufacturing. Forging products are used primarily as vital components of various equipment and machineries.

The forging sector can be subdivided into: (1)small-scale smithery shops, which employ manual forging tools; and (2)mechanized forging shops, which utilize heavy tools and equipment in its processes. Manual forging, referred to as smith forging, smithing or smithery involves the application of hammer blows by hand on a material placed on an anvil. This is done while the material is heated to its plastic deformation range. Bellows or air compressors are used to increase temperature of the reheating flame. Smithery shops are mostly household enterprises whose main products may either be cutlery items such as scissors and knives or agricultural implements such as plows. Smithery shops are found in various areas of the country.

This study covers both the mechanized forging and smithery process. Respondents of the forging shops are mostly found in the National Capital Region and Region IV-A, while smithery respondent-shops are located in Region I. Mechanized forging shops make use of equipment such as hammers, presses, upsetters (or forging machines), and other specialized types of forging equipment (ring rolling mills, rotary forging machines, and radial forging machines), whereas smithery shops simply use manual forging hammer, chisel, bench grinder, pile, tong and conventional furnace.

Figure 1 shows the geographical distribution of forging shops.

As shown, the four mechanized forging shops are generally located at the NCR and Calabarzon while smitheries are found in Region I.

Figure 1. Geographical Distribution of Forging Shops

The MIRDC conducted an Industry Profiling of the different metalworking sectors of the country in 2010-2012.

As shown in Table 1 and Figure 2, there are seven (7) mechanized forging and four (4) smithery shops, which are all located in Luzon, mostly in the NCR and Region IV-A.

Table 2 shows the Year of Establishment of Forging Shops.

As reflected, there is one forging company which is already 60 years in existence, and a smithery shop which has been operating for more than 50 years now. Six (6) of the forging shops were organized as corporation, only one (1) as single proprietorship. All the respondent-shops are operating as independent, they are not a subsidiary of a bigger company. Two of the four smithery shops are into jobbing, while the other two are engaged in manufacturing. All the forging shops are engaged in manufacturing.

Table 3 illustrates the initial capitalization of the forging/smithery shops.

As illustrated, all the smithery shops have only a capitalization of less than Php100,000, while the forging shops have a capitalization of Php500,000 to more than Php20 million.

Table 4 shows the classification and frequency of shops according to capital.

As shown, the mechanized forging shops are classified into medium and large, while the smithery shops belong to cottage and micro level.

Table 1. Regional Distribution of Forging/Smithery Shops

Region	Location	No. of Shops
Mechanized		
NCR	Quezon City	1
	Valenzuela City	2
Region III	Bulacan	1
Region IV-A	Laguna	3
Smithery		
Region 1	Ilocos Norte	1
	La Union	3
Total		**11**

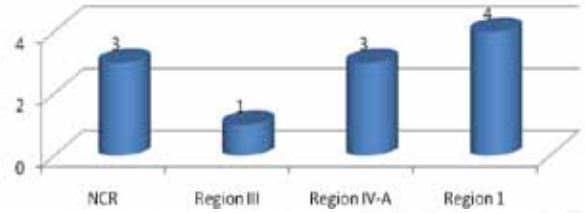

Figure 2. Regional Distribution of Forging/Smithery Shops

Table 2. Year of Establishment of Forging/Smithery Shops

Year of Operation	No. of Shops	
	Mechanized	Smithery
60 years and above	1	0
50 – 59 years	0	1
40 – 49 years	0	0
30 – 39 years	2	1
20 - 29 years	1	1
10 - 19 years	1	0
Less than 10 years	2	1
Total	**7**	**4**

Table 3. Initial Capitalization of the Forging/Smithery Shops

Capitalization	No. of Shops	
	Mechanized	Smithery
Less than =P= 100,000	-	4
=P= 101,000 to =P= 500,000	3	-
=P= 501,000 to =P= 1 M	2	-
=P= 1,000,001 M to =P= 10 M	-	-
=P= 10,000,001 M to =P= 20 M	-	-
Above =P= 20 Million	2	-
Total	**7**	**4**

Table 4. Classification and Frequency of Shops According to Capital

Classification	No. of Shops	
	Mechanized	Smithery
Cottage (< =P= 100,000)	-	3
Micro (=P= 100,001 - 1M)	-	1
Small (=P= 1M-10M)	-	-
Medium (=P= 10M-40M)	4	-
Large (greater than =P= 40M)	3	-
Total	**7**	**4**

Product Lines/Services

The Philippine forging and smithery sector continues to survive as the remaining shops still enjoy a niche in the market despite high production cost and competitive price of imported products. Forging products are poleline hardware, high tensile bolts and nuts, carbide tip cutting tools, idlers and pulleys, and automotive parts.

Products of the smithery shops are handtools like bolo, knife, bareta, axe and pike. Lamp house and stove burner are also some of the products of the smithery shops used in household applications. Products and services that cater to the requirements of the metalworking sector are fabrication of wrought iron furniture, window grills and metal components of trophy.

The processes used by the forging shops are hot forging, machining, threading, heat treatment, aluminum melting and die casting. One forging shop is engaged in the buy and sell of scrap iron.

Market

The sector remains significant in its contribution to other industries like the agriculture, household, construction, metalworking, cement and milling. The forging shops cater primarily to automotive/ transport sector. Smithery shops offer their sevices primarily to the agriculture and household sectors.

Raw Materials

The raw materials used by the respondent shops are aluminum (scrap and ingots), cold rolled steel, mild steel plate, shafting, 1045 steel, 4140 steel, 4340 steel, low carbon, low alloy steel, dolomite, chromite, activated C. The source of materials of the forging shops are mostly imported, while the smithery shops use local materials considering the nature and size of the business.

Volume of Consumption and Volume of Production

The total volume of production of the seven (7) forging shops reached an estimated weight of 39,983.26 metric tons and its volume of production totalled 41,279.22 metric tons. The smithery shops have no available data on their volume of consumption and production.

Performance/Benefits of the Industry

a. Contribution to the economy

Table 5 provides data taken from the Annual Survey of Phillipine Business and Industry (ASPBI) conducted by the National Statistics Office (NSO). Based on the results, the output of 112 establishments engaged in forging, pressing, stamping and roll-forming of metal products reached P24.19-Billion in 2010.

The firms employed roughly 7,000 workers and contributed a value added of P3.9-Billion to the manufacturing sector during the period covered. The contribution of the forging sector could not be extracted separately since the metalworking activities mentioned had been lumped together in the survey.

Although there are only a very small number of

Table 5. Selected Summary Statistics for Forging, Pressing, Stamping, and Roll-forming of Metal Products (PSIC Code: 25911)

	2008	2010
Number of establishments surveyed	90	112
Value of Output (P1,000)	22,005,218	24,195,438
Value Added (P1,000)	4,100,831	3,493,900
Value Added / Value of Output	24.49%	17.64%
Total Cost (P1,000)	19,128,516	21,474,071
Intermediate Cost (P1,000)	16,742,412	19,805,270
Total Number of Employees	7,387	7,754

Source: 2008 and 2010 ASPBI, National Statistics Office

forging companies, the contribution of the sector should not be overlooked without considering the sector's forward linkages since forged parts usually require further processing.

b. Trade Performance

A lot of metal products can be manufactured using different processes such as casting, machining, forging, or even as a welded or assembled part. For the metal products identified below, an assumption was made that forging was the 'dominant' process used during production.

The values of selected forged products being exported by the Philippines from 2007-2011 are shown in Table 6. Bolts and nuts could be considered as the country's top exported forged product. Second in rank are the various types of bearings. It is interesting to note that among the items included in handtools and cutlery, anvils and portable forges come out as our top export.

Table 6 and Figure 3 reflect the Philippine Exports of Selected Forged Products.

As reflected, in 2011, the exports of threaded bolts, nuts and screws were valued $84.19-Million while exports of bearings (various types of ball and roller bearings, transmission shafts and cranks, etc) reached $28.72-Million. Exports of anvils and portable forges (whether hand/pedal operated) reached $1,445.92-Million, almost 80 percent of the value of all exported handtools and cutlery. The exports of the selected forged products was estimated at $123.27-Million.

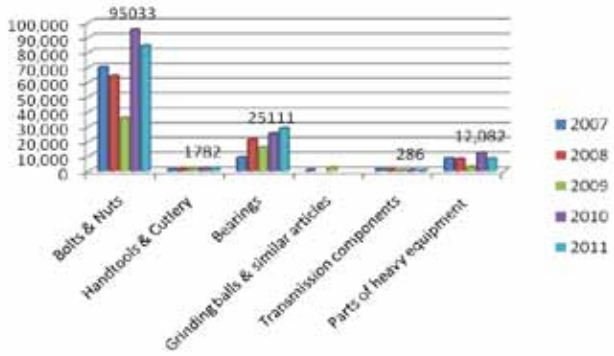

Figure 3. Philippine Exports of Selected Forged Products (in '000 US$) [9]

Table 6. Philippine Exports of Selected Forged Products (in '000 US$) [9]

Description	2007	2008	2009	2010	2011	Total
Bolts and Nuts (threaded articles such as bolts, nuts, and screws)	69,611	64,029	35,597	95,033	84,195	**348,465**
Handtools and Cutlery (spades, shovels, forks, rakes, axes, files, rasps, pliers, spanners & wrenches, hammers, screwdrivers, vice, clamps, anvils, portable forges, shears, knives, cutting blades and scissors)	814	994	1,411	1,782	1,821	**6,822**
Bearings (ball bearings, roller bearings, transmission shafts)	9,237	20,981	15,925	25,111	28,727	**99,981**
Grinding balls and similar articles for mills	389		2,212	-	-	**2,601**
Transmission components (roller chain, parts of articulated link chain, flywheels and pulleys, clutches and shaft couplings, gears and gearings, chain sprockets, etc)	869	548	263	286	201	**2,167**
Parts of heavy equipment and machinery (parts of sawmill machines, machinery for crushing/grinding solid materials, concrete/mortar mixers, stone, ceramic, concrete, working machines, etc)	8,543	7,768	2,673	12,082	8,328	**39,394**
TOTAL	**89,466**	**94,322**	**58,083**	**134,297**	**123,274**	**499,442**

* Note: Figures may not round up due to rounding off errors

Table 7 provides data on Philippine imports of selected forged products from 2007-2011. Bearings (specifically ball bearings) is on top of the list of imported forged product. It should also be noted that the Philippines export and import threaded bolts, nuts and screws. This suggests the existence of a market for bolts and nuts not captured by local manufacturers.

In 2011, imports of forged products reached $189.66-Million. Of the total, imports of various types of bearings reached $73.86-Million while the imports of bolts and nuts were valued at $37.63-Million. The Philippines also imported $27.98-Million worth of transmission components, the bulk of which was for gears and gearing, chain sprockets, ball or roller screws, and gear boxes.

Figure 4 presents the Philippine imports of selected forged products (in '000 US$) from 2007-2011.

As presented, a comparison of the import data from 2007 to 2011 shows higher demand for bearings and bolts and nuts.

Except for bolts and nuts, imports far outweigh exports for each commodity group. As a result, the country continues to sustain a trade deficit on forged products.

c. Industry Value Chain

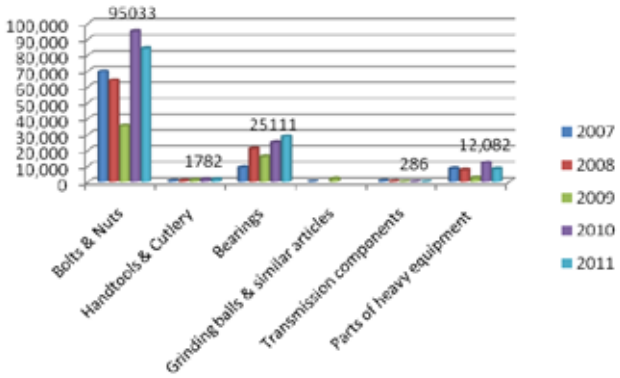

Figure 4. Philippine Imports of Selected Forged Products

Table 7. Philippine Imports of Selected Forged Products (in '000 US$) [9]

Description	2007	2008	2009	2010	2011	Total
Bolts and Nuts (threaded articles such as bolts, nuts, and screws)	24,741	24,970	22,877	28,200	37,637	**138,425**
Handtools and **Cutlery** (spades, shovels, forks, rakes, axes, files, rasps, pliers, spanners & wrenches, hammers, screwdrivers, vice, clamps, anvils, portable forges, shears, knives, cutting blades and scissors)	7,150	8,201	7,932	9,381	13,170	**45,834**
Bearings (ball bearings, roller bearings, transmission shafts)	35,528	37,715	42,902	53,978	73,865	**243,988**
Grinding balls and similar articles for mills	5,860	8,498	15,968	20,420	25,114	**75,860**
Transmission components (roller chain, parts of articulated link chain, flywheels and pulleys, clutches and shaft couplings, gears and gearings, chain sprockets, etc)	18,305	23,944	23,171	2,463	27,989	**95,872**
Parts of heavy equipment and machinery (parts of sawmill machines, machinery for crushing/grinding solid materials, concrete/mortar mixers, stone, ceramic, concrete, working machines, etc)	6,120	7,120	5,903	8,683	11,890	**39,716**
TOTAL	**97,706**	**110,452**	**118,757**	**123,127**	**189,667**	**639,709**

* Note: Figures may not round up due to rounding off errors.

Forged products are used in various industries such as the automotive, mining, metalworking, construction, and shipping. Figure 5 below shows the interrelation between the various metals and engineering processes. Most metal products can be manufactured using different processes such as casting, machining, forging, or even as welded or assembled part. In a way, metalworking processes compete with each other. The output of one process could also serve as an input to another process.

Table 8 shows the value of Philippine imports of forging-related equipment and machinery. The above data however does not reveal the specific type of equipment imported for the period. Between 2007 to 2011, imports of forging equipment and machinery averaged $2.2-Million annually.

Table 8. Philippine Imports of Forging Equipment and Machinery

Description	2007	2008	2009	2010	2011
Forging / die-stamping machines (including presses) and hammers for working metal **(PSCC 846210)** in '000 US$	*2,549*	*1,469*	*1,326*	*3,475*	*1,847*
Netweight in '000 kgs	**408**	**438**	**273**	**393**	**368**
Anvils; portable forges; hand / pedal-operated grinding wheels with frameworks **(PSCC 820580)** in '000 US$	*83*	*117*	*42*	*92*	*112*

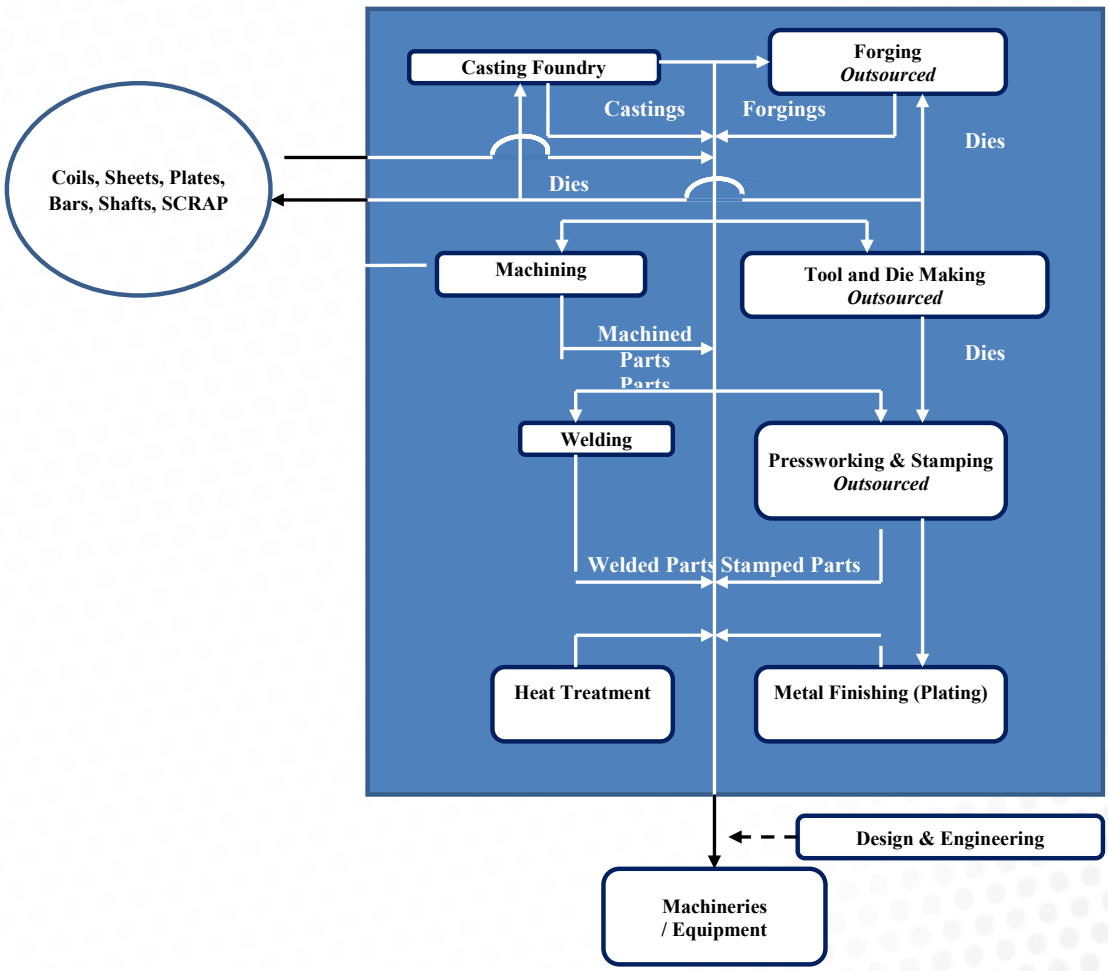

Figure 5. Metals and Engineering Industry Structures by Process Metalworking and Allied Engineering Group [20]

Forging process is done where metal is pressed, pounded or squeezed under great pressure into high strength parts known as forgings. The forging process can create parts that are stronger than those manufactured by other metalworking processes. Forging differs from the casting (or foundry) process as metals used to make forged parts are not melted and poured as in the casting process. [21]

Level of Technology

Table 9 enumerates the List of Equipment used by Local Forging Shops.

As enumerated, the mechanized forging equipment utilized by local companies are hammers, presses, upsetters (or forging machines), and other specialized types of forging equipment (ring rolling mills, rotary forging machines, and radial forging machines). Smithery shops, on the other hand, use manual forging hammer, chisel, bench grinder, pile, tong and conventional furnace.

Table 9. List of Equipment Used by Local Forging Shops

TYPES OF FORGING EQUIPMENT
Hammer Board Air-lift Steam Spring
Presses Mechanical Hydraulic Screw / Eccentric
Upsetters
Specialized / Sophisticated Equipment Rotary Forging Machines Ring Rolling Machines Radial Forging Machines
QC Equipment / Instruments Caliper

PROBLEMS/ISSUES

The problems identified by the forging respondent shops are substandard materials, quality control of products, waste treatment, processing of dolomite and human resources. Also, one of the forging shop's concerns is the need for assistance from the government on the acquisition and upgrading of forging technology. For smithery shops, the number one problem is insufficient capital to improve their processes and facilities.

Business Outlook

The business outlook of the forging and smithery shop respondents is improving despite the issues and problems encountered by the respondent shops.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The forging sector which is among the smallest of the seven (7) sectors (machining, tool & die, electroplating, metalcasting, heat treatment, welding) of the metalworking industry, constitute medium and large companies according to capital. Two among the seven forging shops have an initial capitalization of more than P20 million. It implies that an intensive capital investment is needed to put up a forging company considering the equipment and facilities required for its operation.

Although there is only a small number of forging shops operating in the country compared to other sectors, its contribution to the export market is felt as the total export of selected forged products for 2007-2011 reached US Dollars 499.4 million.

Recommendations

1. MIRDC could assist the Forging companies in the accesss of testing facilities, consultancy services and design engineering.

2. The Center must identify more forging and smithery shops in the different regions of the country to come up with a closer picture of the status of the industry.

LIST OF METALWORKING SHOPS

WELDING SHOPS

NCR

1 Fabriweld Bldg. Systems, Inc.
2 Familia Ina Glass & Al. Services
3 Pleasant Valley Way Gen Msde
4 Perfect Kitchen
5 JSM Aluminum Corporation
6 Index Gear Machinery
7 Well Engineered Products Company, Inc
8 NTPI Int'l, Inc.
9 EBF Machine
10 LDA Machine Shop
11 Tiger Machiery and Industrial Corp.
12 Gapit Machine Shop
13 R. R. Llanes Aluminum & Construction
14 Herminio Welding Shop
15 John Vinam Welding Shop
16 Dely's Vulcanizing and Welding Shop
17 CJ Al Glass and Steel Works
18 DJM Truck Body Builder
19 JR Cawagas Welding Shop
20 Marcial Welding Shop
21 Rollpet Welding Shop
22 Boboy Welding Shop
23 Eddies Radiator and Welding Shop
24 Monzycle Vulcanizing and Welding Shop
25 Val Welding Shop
26 Jason Welding Shop
27 MJ welding Shop
28 ARUI Enterprises
29 Roni Welding Shop
30 Macatdon Brother's Enterprises
31 Villamin Wood & Iron Works
32 MBB Motor Shop
33 Marano's Vulcanizing & Welding Shop
34 Alex Welding Shop
35 Peñola Metal Works
36 Phil Medil Pental Specialties
37 ED Welding Shop
38 RC Welding Shop
39 Laydarios Welding Shop
40 Excel Q Tooling and Fabrication Shop
41 Caloy and Gonzales Auto Shop
42 Prim - E Welding Shop
43 M.A.E. Iron Works Glass Aluminum
44 Nesperos Welding Shop
45 Maliwat Welding Shop
46 JOCO Vulcanizing & Welding Shop
47 Aren Sidecar Contractor
48 July Side Car Contractor
49 Conqueror Int'l, Inc.
50 Obet Metalworks
51 RBS Stainless Steel Fabrication
52 Ariel Welding Shop
53 Oscar Welding Shop
54 A.V. Nopuente Welding Shop and Auto Service
55 Irene Welding Shop
56 VL Advanced Technology, Inc.
57 Zeller Plastic Philippines
58 La Rota Tool and Die Services
59 Dash Engineering and Machine Shop
60 PCS Machine Shop and Fabrication
61 Gonzales Iron Works
62 Kawatetu Philippines
63 FVM Tinsmith Industrial Sales
64 Cromoland Stainless Steel Fab. Shop
65 MCA Iron Works Glass and AL
66 Gub's Iron Work
67 3 HAN Iron Works
68 88 Iron Works
69 B.S.S.M Metal Sheet Fabrication
70 MLT Wood and Iron Works
71 Rendel Metal Craft
72 Dassa Metal Craft
73 Padilla's Machine Shop
74 Alhpa Machinery and Eng'g. Corp.

I

75 Ricky Tricycle Shop
76 Nelson Tricycle Shop
77 Jaimes Tricycle Shop
78 Reyes Welding Shop
79 Antonio "Tony" Welding Shop

80 Amintad Tricycle Shop
81 3G & A Tricycle Body Repair Shop
82 Damian Tricycle Shop
83 Dado Welding Shop
84 Nolasco Metal Craft
85 339 Builders
86 Gil's Welding Shop
87 J. Madarang Welding Shop
88 Ressteel Iron Works
89 SORIA's Welding Shop
90 Abaya Welding Shop
91 Zabala Welding Shop
92 E.C. Dueñas Side Car
93 Natomo Manufacturing Co.
94 Joel de Guzman Welding Shop
95 Ador Tractor Repair Shop
96 EMF Welding Shop
97 Don Mariano Marcos Memorial State University
98 J & J Muffler & Stainless Steel
99 Tenorio Tricycle Shop
100 JMF Motors
101 Pit's Vallo Motor Works
102 Benz Side Car
103 Salazar Side Car
104 Constantino Side Car
105 3rd Madrid Iron & Sash Works
106 Alvin Welding Shop
107 Green Parts Metal Craft
108 Terrado's Metalcraft
109 AJ Lozada's Motorcycle Repair Shop
110 Ronzjie Ashly Welding Shop
111 GM Machine Shop
112 JC Ico Welding Shop
113 Payanig Merchandise
114 Philgerma Manufacturing, Inc.
115 Concepcion Tapallas Welding Shop
116 Muñoz Machine Shop
117 Barte Machine Works
118 JR Gonzales Iron Works
119 JC Clauna Welding Shop
120 Clarina Shop
121 CA Welding Shop
122 La Fuerza Enterprises
123 Triclops Engineering
124 MDB Metal and Stainless Center
125 DM Baylon Bakery Equipment Fab.
126 Ayson Welding Shop
127 Big Five Sidecar Center
128 Weldingan ni Ledo
129 Pidiong Panday Welding Shop
130 Datuin Machine Works
131 D.U.A Farm Implements Repair & Assembly Shop
132 AJ. Nobleza Motors & General Services
133 Malabed Metalcraft

II

134 Datuin Machine Shop
135 Top Ace Motor Works
136 Lily of the Valley Organic Farms
137 MCO Machine Shop
138 TCY Machinery Works
139 R & E. Machine Shop
140 Ledda's Iron Works
141 Aramed Auto Repair and Welding Shop
142 Alver Iron Works
143 D'Gal's Iron Works
144 Annrey's Iron Works
145 Robert Woodworkd
146 Salty Iron Works
147 Cruz Iron Works
148 Lit Iron Works
149 Loida's Iron Works
150 Rhod Iron Works
151 James machine shop
152 SR Ramser Machine and Welding Shop
153 Dolphin Mech'l & Elect'l. Services

CAR

154 Fast Way Engineering and Machine Works
155 Philtech Metal Design and Fabrication
156 Bon Wiser Construction and Machinery Fabrication
157 Earthgaver Agritech
158 Freeway Machine Shop
159 Genez Farm Machinery and Iron Works
160 Atin Marketing & Metal Craft
161 Agricorp Machineries
162 FG Stove Fabrication
163 ACT-Machineries & Metal Craft Corp.

III

164 Mechaphil, Inc.
165 C.B. Thattlill
166 Esteban Machine Shop

167 Bantog Mini Rice Thresher
168 Mario Zafra Welding and Machine Shop
169 Fernando's Machine Shop
170 GMC Stainless Steel Fabricator Enterprises
171 Sales Steel Fabraication and Builders
172 Subic Machine Shop
173 Translift Port Equipment Services, Inc.
174 Daimaro Machine Shop
175 De Jesus Welding Shop
176 DM Vigo Machine Shop
177 Triple R. Welding Shop
178 U Rodriguez and Sons
179 3 Zizters Stainless Steel
180 RB Yumol Industries
181 JGB Machine Shop
182 New QC Tinsmith
183 20. MBM Metal Works
184 Pinoy Agro
185 De Vega Metalcraft
186 FG Avendaño Machineries
187 CITI Steel Fabrication
188 ESJ Contracting Services
189 Ben March Machine Shop
190 Apolinar Daguz
191 Totoy Banca Sons Machine Shop and Tool Shop
192 Bernabe's Technology & Eng'g. Works
193 EBP Machine Shop
194 Icatech Engineering
195 Robello Tek Engineering
196 Michael Repair Shop
197 Toto Side Car
198 BD Welding Shop
199 Bugoy Welding Shop
200 GT Side Car Welding Shop
201 Mendoza Welding Shop
202 ACC Metalcraft
203 Agriventa Enterprise

IV

204 Dario Machine Shop Calibration Center
205 APL Welding Shop
206 Malijan Motors
207 Glass Aluminum Steel
208 Tabern Motor and Welding Shop
209 Barangay Construction Supply
210 Mario Muffler and Headers & Welding Shop
211 J44 Autocare and Services
212 LIA Enterprises
213 Ruftech
214 First Infinity Steel Builders Corporation
215 Jetro Car Aircon and Welding Services
216 Macasadia Glass and Al. Supply
217 She Auto Glass and Aluminum Supply
218 Jeson Repair and Welding Shop
219 R & M Welding Shop
220 M.V.P. Machine Shop
221 Julius Side Car Rebuilder
222 Edwin Welding Shop
223 Adriano Carandang Welding Shop
224 Joel Repair Shop
225 Efren Andiape Welding and Fabrication
226 Jeff Machine Shop
227 San Sebastian Side Car Body Builder
228 Rodelas Side Car
229 Randy Side Car Welding Shop
230 Rene Kalaw Welding Shop
231 SRMS Mechanalysis, Inc.
232 Sampaloc Muffler
233 Japjap Machine Shop
234 Efren Eniape Welding and Fabrication
235 Darwin Iron Works
236 P. Magsaysay Welding Shop
237 Samy/Bani Romero Marasigan
238 Andrew Welding Shop
239 Nhortscrow Shop, Painting, and Vulcanizing
240 JC Cariaga Welding Shop
241 Godofredo Reyes Welding Shop
242 Celca Fabrication and Welding Shop
243 Tayabas Welding Shop
244 Esmeliro Welding Shop
245 Resty Hao Welding and Motor Shop
246 Carmelen Welding Shop
247 Felipe Welding Shop
248 228 Welding Shop
249 Joey Side Car & Welding Shop
250 George Sadia Welding Shop
251 Emman Welding Shop
252 Jun Espolon Welding Shop
253 Jamin Welding Shop
254 Garcia Welding Shop
255 Cheng Muffler & Welding Shop
256 Maharlika Machine Shop & Eng'g. Works

257 Etoy Welding Shop
258 Masagana Vulcanizing and Welding Shop
259 Lucena Master Engineering Shop
260 M.B. Sidecar Welding Shop
261 Edgar Welding Shop
262 Morales Welding Shop
263 Artemio Castillo Machine Shop
264 Welding & Vulcanizing Shop
265 SIA's Machine Shop & Welding Shop
266 Team Vylee Welding Shop
267 MICMOC Welding Shops
268 LTS Muffer Center
269 Ogie Welding
270 Sazon Cocofiber
271 TAM Machine Shop & Welding Fab.
272 Aldong Welding
273 Gilbert Welding Shop
274 Aron's Enterprises
275 Rebulados Welding
276 Rolly Side Builder
277 LJ Tricycle & Side Car Builder
278 RV Farm Machineries Fabrication
279 ECJ Al & Metal Fabrication
280 VL Industech Corporation
281 Alas Cortez Side Car Maker & Steel Fab.
282 RGMD Engineering Works and Gen. Services
283 Princena Machine Shop
284 RB Welding Shop
285 Mag's Machine Shop & Eng'g. Works
286 Kwik-Way Engineering Works
287 ABD Metal 'Fabrication
288 Grasco Industries
289 Hi-Tecg Machine Shop
290 Anvil Metalshop Corp.
291 Hernandez Engineering Works
292 Ponciano Machine
293 Francisco Lantican
294 Diestro engineering and Machinery
295 Castalone Welding
296 L.G. Lopez Machine Shop Ind'l. Sales & Tech'l. Service Corp.
297 Mariñas Technologies, Inc.
298 Agricultural Machinery Development Program, CEAT
299 CATE Machine Shop
300 Dobule JJ Fabrication, Welding and Auto Electrical
301 Rockstar Machine Shop and Fabrication
302 Gemstar Engineering Services
303 Skan Machine Shop & Rewinding Services
304 Soluna Stainless Fabrication
305 ARB Machine Shop
306 Melinda Glass Aluminum and Iron Works
307 GRJ Stainless and Sheet Fabrication
308 Zoom A Trading
309 Angeles Iron Works
310 JDM Tooling Technology
311 C.L.P. Metal Industries & Precision Tools
312 PPJ Machine Shop
313 Prov 3 Tooling and Metal Fabrication
314 Navera Metalcraft
315 Palao Machine Shop
316 Triple D Trading & Fabrication
317 Bernatech Precision
318 Technologix Machine Shop
319 Pallega welding Shop
320 Aguilar Machine Shop
321 A.O. Umali Enterprises
322 Nolie Motor Shop and Machine Shop
323 Sixto Metal & Wood Craft
324 ACC Auto Parts and Industrial Services
325 Cabuyao Glass & Steel Fabrication
326 Peoplenet Welding Shop
327 Legaspi Glass Al Iron Works and Woodworks
328 St. James Machine Shop
329 Almadin Welding Shop
330 Tagapo Glass & Steel Fabrication
331 RMS Raffys Machine Shop
332 Jay and Mark Enterprises
333 Industrial Design & Equipment Expertise, Inc.
334 Blairwin Tech.
335 R.E.V.O.H Coderes Cycle Parts & Welding Shop
336 JRM Machine Shop & Fabrication
337 D. Zapata Machine Shop
338 J.Suarez Machine Shop & Engine Rebuilder
339 Larva Welding Shop
340 Princena Machine Shop
341 Suarez Machine Shop

342 O.D.Garcia Glass and Aluminum Supply
343 MESPO Iron Works
344 Molino Sidecar Maker
345 Durabuilt Metal Fabricator
346 Dudes Iron Works
347 Bernatech Builders
348 678 Aluminum Fabricator and Glass Supply
349 DTA Glass and Al Supply
350 7621 Sash and Woodworks
351 GL Malijan Glass Aluminum
352 Dragon Welding Shop
353 Legal Autoworks
354 RVR Side Car
355 6 Gear
356 Drench Auto Works
357 Biga Aluminum Glass Supply
358 Reynaldo Locsin Welding
359 Rico Car Repair
360 GM Laudato Iron Glass & Steel Works
361 Parreño Builders
362 Far East Glass and Aluminum Construction
363 Roam Builders
364 Kuya Vhic Welding Shop
365 RS Unitech Corporation
366 Leo Machine Shop
367 Maximo Pel Welding Shop
368 Western Motors and Machine Works
369 Andy Boy Motorshop
370 John Kattlyn Welding Shop
371 Tao Tao Welding Shop
372 Armac Auto Repair and Machine Shop
373 Zapanta Welding Shop
374 Father and Son Welding Shop
375 Ely Welding Shop
376 JVAL Repair and Welding Shop
377 Poloncoy Welding Shop
378 Edwin Bunay's Metalworks
379 Kerry Metalcraft
380 Eddie Garcia Welding Shop
381 GM Vulcanizing & Welding Shop
382 GMJ Welding Shop
383 Ralleta Welding Shop
384 Rezeilyn Welding Shop
385 Ubog Archetechtural & Landscaping Products
386 RR Metalworks
387 Naw-Ruz Welding Shop
388 Greg Danganan Machine Shop
389 Git John Welding Shop
390 RM Estores Welding Shop
391 Valencia Welding Shop
392 AXL Welding Shop
393 JMR Welding Shop
394 Villajos Welding Shop
395 RJ Welding Shop
396 Koritso Metalcraft
397 Malanaw Welding Shop
398 De Jesus Welding Shop
399 Sodoy Welding Shop
400 JCW Welding Shop
401 Corazon Roda Welding Shop
402 Antaran Welding Shop
403 Efraem Maggay Welding Shop
404 EBL "Arsing" Welding Shop
405 CNL Motors
406 Torrel Commercial & Industrial Works
407 Materdei Auto Parts & Battery Center
408 JMJ Welding Shop
409 Marc Peter Welding Shop
410 Fortunato Welding Shop
411 Berma Auto Repair Shop
412 Morada Welding Shop
413 QMC Car Care Center
414 Nonie Marcelo Welding Shop
415 De Jesus Welding Shop
416 Gabute Welding Shop & Blacksmith
417 JJKS Welding Shop
418 Ken Janu Metal Works & Repair Shop
419 Alvin Welding Shop
420 SMS Machine Shop & Engine Rebuilding
421 Resy Motorworks
422 Estrada Repair Shop
423 Aquel Iron Works
424 Darnel's Iron Works
425 FAMES Welding Shop
426 Madrona Motorshop

V

427 Pandos Auto Aircon, Refrigeration
428 Jeres and Welding Shop
429 Althea WS & Industrial Iron Works
430 Fernandez Welding Shop
431 Beroy Welding Shop

432 Lito Welding and Repair shop
433 Ibañez Welding Shop
434 JGAB Steel Works
435 R. Fernandez Welding Shop
436 Dodong Welding Shop
437 Prim's Welding Shop
438 Lomaad Welding and Auto Repair Service
439 Butch Barotel Welding & Repair Shop
440 Ponching Ogaya Welding and Repair Shop
441 Huertax Welding Shop
442 Salvacion Machineries Trading
443 Tanon Auto Repair Shop
444 Roger Steel Structural Fabrication
445 Popoy Welding Shop
446 IER Machine Shop
447 DHK Welding and Machine Shop
448 Adonez Nonoy dela Cruz Engineering Works
449 Pearl Machine Shop
450 M.E. Masinag Welding and Fabrication Shop
451 Calibre Machine Shop
452 Marol Metal Works
453 Mamoso Car Tire Car
454 5E Repair Auto Repair
455 Bornoc Auto Body Repair Shop
456 Rowena Auto Repair Shop
457 Anlourd Metalworks & Welding Shop
458 Charis Steel Works
459 Dars' Auto Repair Shop
460 Raulo MS and Auto Supply
461 Romeo Baldo Welding Shop
462 Tetrahedron Welding Shop
463 Ador Welding Shop
464 Manding Welding Shop
465 D'Engineer Motor Works
466 Arnel Untalan Machine Shop & Fabrication
467 Kay Brod Welding Shop
468 Zentaur Motors and Auto Repair
469 Alex Acuzar Metalcraft
470 ADE Enterprises
471 Laurañanac Machine Shop and Welding Shop
472 Fabia Welding Shop & Iron Works
473 Dioquino Machine Shop and Welding Shop
474 Budz Welding Shop
475 Cecilio Domdom Welding Shop
476 Tropics Agro Industries, Inc.
477 Alamo Metal Craft
478 S.N. Villa Steel Fabrication & Repair Shop
479 New Dames Metal Craft
480 Myre Agri-Ventures Fabrication & Engineering Services
481 MAS Steel Fabrication

VI

482 Victor Welding Shop
483 Glaslumina Marketing
484 Cesar Machine Shop
485 Jaspe Light Steel Industries, Inc.
486 Berba-Flex Technologies
487 Gascon Pipe Bending
488 Jorge Machine Shop
489 Lopez Engineering and Gen. Services
490 Harder Machine Shop and Auto Services
491 Ballejesa Repair Shop
492 Homma Industries
493 Mindanao-Siblilan Machine Shop
494 Len & Sam Welding Shop & Machine
495 Naning's Furniture Shop
496 Alota Engineering Works
497 V-Roy's Repair & welding Shop

VII

498 Servicemec Industrial Corporation
499 St. John Bosco Systems, Inc.
500 Center for Cebu Light Engineering and Metalworking, Inc
501 Center of Industrial Technology Inst., Inc.
502 B-Nels Trading Engineering Services
503 4A's Development Corp.
504 Wellmade Motors & Development Corporation
505 BIT International College
506 Tecson Iron Works
507 RJ Iron Works
508 Hermie's Metal Furniture & Design
509 Bohol Machine Shop & Engineering Works
510 Corrales Welding Shop
511 Nambatac Metal Works & Machine Shop
512 Champion Trading & Machine Shop
513 FZS Machine Shop
514 Tagbilaran City Machine & Repair Shop
515 CEDE Machine & Metal Industry Corp.

VIII

516 Floaters Built Tire Shop & Machine Shop

517 Heba Machine Shop
518 Alajas Machine Shop
519 Estrada Machine Shop
520 GGTIU Enterprises
521 G & D Autoworks and Welding Shop
522 Allison Welding Shop
523 Herson Automotive and Iron Works
524 FJ Steel & Iron Works
525 Pasalo Welding Shop
526 Elwins Metalcraft Center
527 R F D Metalcraft and Machinery
528 NEMS Metalcraft
529 Alajas Machine Shop and Steel Fabrication
530 RM Armea Enterprise
531 Patok's Welding Shop
532 4J's Welding Shop
533 Alfredos Welding
534 Fredo's Welding Shop
535 JRM Welding Builders
536 Orlando Welding Shop
537 RLS Builders & Welding Shop
538 RBL Welding
539 Sogod Uptoan Welding Shop
540 Cabadbaran Welding Shop
541 Marte Technove Machine Craft Ind.

IX

542 Pimentel Creative Builders Enteprises
543 Buca Welding Shop
544 Calimot Shop
545 CITI Metal Marketing & Services
546 Southern Philippines Agri-Machinery Center (SPAMCE)

X

547 Elegant Chem Alloy
548 Paras Machinery Works
549 Cabanducos Iron Works
550 Las Doce Welding Shop
551 Jacksons Enterprises
552 Grecanz Trading and Eng'g. Services
553 Kwik-Way Engineering Works
554 H-Speed Re-Builders, Inc.
555 TAN's Engineering Services
556 Grand Engineering
557 Dansons Enterprises
558 Sambar Machine Works and Auto Repair
559 MUST - CIIT
560 Xavier University -Ateneo de Cagayan
561 DBC Machineries Corporation
562 ELDS Engineering Works

XI

563 Asentista's Engineering Construction Supply
564 New Tri-Star Machine Shop Company
565 Davao Motorcycle Machine Shop
566 Julaton Construction and Supply
567 Davao NCG Engineering Services
568 Cortek Manufacturing
569 Payo Manufacturing Corporation
570 Buhangin Machine Shop and Automotive Repair
571 FB Shutters & Services
572 Kyla Metal Stitch
573 Basco Metal Supply Hardware
574 RJLO Auto Repair Shop and M/S
575 Jesus Andebor & Sons Welding Sons
576 Deco Machine Shop
577 Davao Techno Craft
578 Rainbow J & N Steel Body Making & Repair Shop
579 Chenamiah Machine & Molding Shop
580 Omandle Jacalan Machine and Welding Shop
581 FCL Metals and Services
582 Mundo Welding and Machine Shop
583 Jing Welding Shop
584 REL Steel Works
585 Tadeco Livelihood & Training Center
586 Topline Engineering
587 FGA Engineering and Machine Shop
588 Win's Machine Shop
589 COR Jesu College
590 Trade Skill Machine Shop
591 RL Builders Machine Shop
592 Rynel's Machine Shop
593 Legaspi Machine Shop
594 Taño Welding Shop
595 TESDA Provincial Training Center
596 Daganuio Blacksmith Welding Shop
597 Don Bosco Training Center
598 Bebot Welding Shop

XII

569 Winch Construction & Eng'g. Services
600 Gensan Contractors Multi Purpose

Cooperative
601 Rafols Integrated Machine Shop
602 Carmel John Machine Shop
603 Edwin Ian Machine Shop & Engg. Works
604 Leg Work Engineering
605 Pascual Bakery Equipment Services
606 Ron-Ron Steel Fabrication
607 Daikkha Dehumidifier Mech'l. Dryer Fab. Center
608 Baldon Tinsmith
609 Cabato Repair & Welding Shop
610 Becson Machine Shop
611 Panlaque Engineering Works
612 Cabusas Machine Shop & Fabrication
613 Tacurong Machine Shop

XIII

614 AG Leones Welding Shop
615 Annavil's Welding Shop
616 AR Welding Shop
617 BM Welding's Repair Shop
618 Buenavista Welding Shop
619 Cañete Welding Shop
620 Cherobert welding shop
621 DA Welding Shop
622 Earth Station Welding Shop
623 E & B Car Care Welding Shop
624 Emie-Rose Welding & Repair Shop
625 2 Kit Welding Shop
626 Lisa Grace Welding Shop
627 Marmar Welding Shop
628 Mejorda Welding Shop
629 Mezielyn Welding Shop
630 Natnat Welding Shop
631 Nicer Welding Shop
632 Tandang Auto Parts Shop
633 Toto Mamoso Repair & Welding Shop
634 VJ,s Metalcraft

MACHINING SHOPS

NCR

1 New Asia Foundry
2 Hapheng Engineering & Machine Shop
3 Flamingo Metal Works
4 Odeon Machinery & Metal Fabrication Co.
5 Regal Metal Craft Corp.
6 Gold Star Foundry, Inc.
7 Alliance Foundry Shop
8 Joemica Machine Shop
9 RFC Industries
10 Well Engineered Products Company, Inc.
11 Alkast Metal Craft Industries
12 PCS Machine Shop and Fab.
13 New Franco Machine & Gear Work Corp.
14 BDC Industrial & Allied Corporation
15 NTPI International, Inc.
16 Phil. Vacuum, Pumps & Party Parts Trading Corp.
17 ARMSCOR
18 RBS Stainless Steel Fabrication
19 VL Advanced Technology, Inc.
20 Zeller Plastik Philippines, Inc.
21 La Rota Tools & Die Services
22 Dash Engineering & Machine Shop
23 AC-10
24 Padilla Machine Shop
25 Jaemasco Machine Shop
26 HDM Technologies, Inc.
27 Alpha Machinery and Engineering Corporation
28 Integral Machine Tools, Inc. (Tradesphere Industriail Commodities, Inc.)
29 Cura Engineering
30 Sanford Corporation
31 C.C. Barleta Machine Shop Service Center
32 Techno Molds, Inc.
33 Progressive Metal Resources, Inc.
34 SCIC Industrial Corp.
35 Fabriweld Bldg. Systems, Inc.
36 Cutting Edge Materials Processing Corp.
37 Rosmax Engine Rebuilder, Inc.
38 D.F. Gascon Metalcraft Industries
39 L.E.B. Machine Shop
40 Excel-Q Tooling & Fabrication Specialist
41 Caloy Gonzales Auto Shop & Painting Services
42 Cancorp, Inc.
43 Evapia Precision Toolings Co.
44 Gleatech Automotive Machine Shop
45 Nito Seiki Manufacturing Corporation
46 Grand Engineering & Foundry Corp.
47 Chrome Dazzler Corp.
48 Bengar Industrial Corp.

49 Metals Industry Research & Development Center (MIRDC)
50 Rich Metal Products Corp.
51 Global Die Cast & Forging, Inc.
52 Samso-Tite Plastics, Inc.
53 La Suerte Metal Casting & Machine Shop
54 EBF Machine
55 LDA Machine Shop
56 RNL Machine Shop
57 Mankwok Engineering & Machine Shop
58 Evasco Machine Shop
59 SOH Technologies
60 Supercast Foundry & Machinery Corp.
61 Tiger Machinery & Industrial Corp.
62 Fortress Metal Shop

I

63 Green Parts Metal Craft
64 G.M. Machine Shop
65 PAYANIG Merchandise
66 PHILGERMA Manufacturing, Inc.
67 Muñoz Machine Shop
68 Barte Machine Works
69 JR Gonzales Iron Works
70 La Fuerza Enterprises
71 New Metropolitan Machine Shop
72 Triclops Engineering Services
73 Barangay Machine Works
74 Untalan Machine Shop
75 Bullymar Machine Shop
76 Datuin Machine Shop
77 Meneses Muffler, Lathe Works
78 Gotomanga Machine Shop
79 Aces Commercial
80 RESSTEEL Iron Works
81 New Prestoza
82 GEF-C Machine Shop
83 Candon BSB Machine Shop
84 J.S.Y. Machine Shop
85 P. Arzadon Machine Works
86 Marlito C. Datuin Machine Works
87 D.U.A. Farm Implements Repair and Assembly Shop
88 Silver Machine Shop
89 Natomo Manufacturing Co. (Natomo Light Metal Craft - 1990's)
90 Don Mariano Marcos Memorial State University-North La Union Campus
91 Arzadon Enterprises Car Services & Machine Works
92 De Guzman Machine Works Prestoza
93 Datuin Machine Works
94 P. Arzadon Machine Works
95 Greg's Agri-Machine Repair Shop
96 De Guzman Machine Works

II

97 Genez Farm Machinery & Iron Works
98 ATIN Marketing and Metal Craft
99 Luzon Engineering Works & Parts
100 ACT Machineries & Metal Craft Corporation
101 Agricomp Machineries & Construction Corporation
102 Vizcaya Machine Shop
103 Malasig Machine Shop
104 Bon Wiser Construction & Machinery Fabrication Center
105 Earth Saver Agritech
106 A-4 Machine Shop
107 Freeway Machine Shop

CAR

108 R & E Machine Shop
109 MAC Machine Shop
110 TCY Machinery Works
111 Jack's Industrial & Development Corp.
112 Joey's Machine Shop
113 Top Ace Motor Works
114 MCO Machine Shop
115 Citi Motors Corp.
116 Datuin Machine Works
117 SR Remser Machine and Welding Shop
118 Asco Engineering & Machine Shop
119 James Machine Shop
120 Untalan Machine Shop
121 Palaganas Machine Shop
122 Dolpin Mechanical & Electrical Services
123 Estgene Machine Shop
124 Three Brothers Machine Shop
125 Aurochs Aerospace Precision Manufacturing Corp.

III

126 Alterson Trading & Machine Shop
127 Bacarisas Machine Shop

128 Bataan Engineering & Engine Rebuilder
129 Bataan Machine Shop
130 Blare Machine Shop
131 Daimaro Machine Shop
132 D.M. Vigo Machine Shop
133 Marvel Builders and Mechanical Works
134 R.S. Machine Shop
135 RIA Machine Shop
136 Townwest Machine Shop
137 B.P.S.U.
138 Government Arsenal, DND
139 Pinoy Agro (formerly O.H.Y. Enterprise)
140 Bert Machine Shop
141 F.G. Avendaño Machineries
142 Citi Steel Fabrication
143 ESCJ Contracting Services
144 Ben March Machine Shop
145 Bernabe Machine
146 Apolinar Daquiz
147 Totoy Banca Rono Machine and Tool Shop
148 Bernabe's Technology & Engineering Works
149 A.C.N. Trading Machine Works
150 EBP Machine Shop
151 J & V Machine Rebuilder
152 ICATECH Engineering
153 Robello Tek Engineering
154 Coco's Machine Shop
155 Talastas Machine Shop
156 Roberto Machine Shop
157 Luel Tech
158 Mendoza Welding Shop
159 JMG Machine Shop
160 Royal Machine Shop
161 Arriola Machine
162 ACC Metalcraft
163 Fullweld Machine Shop & Engineering Works
164 B. Sacare Machine Shop
165 NTDCY 888 Global Enterprise (Agriventa Enterprise)
166 LDC Engineering Services
167 CDS Machine Shop Co.
168 Perozonic Engineering Services
169 Juliana Machine Shop
170 Abel Machine Shop
171 Mechaphil, Inc.
172 ASP Machine Shop
173 Auto Check Parts & Services
174 Sunday Machine Works
175 Domingo Bongon Machine Shop
176 Metro Machine Shop
177 Livingstone Engineering Works
178 Angeles Machine Shop
179 Adel Machine Shop
180 Boni Machine Shop
181 C.B. Thattalil
182 F. Bongon Machine Shop
183 Lino & 4M Machine Shop
184 Dale Mathis Studio, Inc.
185 U. Rodriguez & Sons
186 Tarlac State University
187 3 Zizters Stainless Steel
188 M.B.M. Metal Works
189 R.B. Yumul Industries
190 JGB Machine Shop
191 Datu Machine Shop
192 Eastern Machine Works, Inc.
193 Ed Noel Machine Shop
194 Fernando's Machine Shop
195 GMC Stainless Steel Fabricator Enterprises
196 RS Tamayo Gen. Mdse. & Machine Shop
197 Salles Steel Fabrication and Builders
198 Subic Machine Shop
199 Tamayo Machine Shop
200 Translift Port Equipment Services, Inc.
201 Polarmarine, Inc.
202 Esteban Machine Shop
203 Bantag Mini Rice Thresher
204 JR Machine Shop
205 VL Machine Shop & Engine Rebuilder
206 Adriano Machine Shop
207 Amihan Machine Shop
208 Valencia Machine Shop
209 Hernandez Machine Shop
210 Sebastian Machine Shop
211 Cortez Machine Shop
212 Blas Machine Shop
213 Ben Machine Shop
214 Lino's Machine Shop
215 Mario Zafra Welding Machine Shop
IVA JAPJAP Machine Shop
217 Salvie Rubber & Machine Shop
218 Dario Machine Shop Calibration Service Center

219 LIA Enterprises
220 Ruftech
221 First Infinity Steel Builders Corporation
222 N.V.P. Machine Shop
223 Jeff Machine Shop
224 SRMS Mechanalysis
225 FMCS Machineship
226 Citizen Machinery Phils. Inc.
227 Metals Engineering Resources Corp. (METERCOR)
228 Delon's Machine Shop
229 Red V Machine Shop
230 Avanzado Machinery Works
231 Garcia's Machine Shop
232 Jabrica Engineering Works
233 Cheng Muffler & Welding Shop
234 Maharlika Machine Shop & Engineering Works
235 Lucena Master Engineering Shop
236 M&B Machine Shop & Motor Works
237 Artemio Castillo Machine Shop
238 SIA's Machine & Welding Shop
239 Tam Machine Shop and Welding Fabrication
240 ECJ Aluminum and Metal Fabrication
241 RV Farm Machineries Fabrication
242 MESPO Iron Works
243 Dudes Iron Works
244 CC Machine Shop
245 Drench Autoworks
246 GM Laudato Iron, Glass & Steel Works
247 Parreño Builders
248 Roam Builders
249 Molino Machine Shop
250 L. Angeles Machineries Corp. (LAMACO)
251 HS Technology Phils., Inc.
252 Works Bell Phils., Inc.
253 KEA Industrial Corp.
254 Aries Technologies, Inc.
255 Sankei Phils., Inc.
256 Jojo Machine Shop
257 Spanola Machine Shop
258 Noli & Annie Machine Shops
259 Mamaril Machine Shop
260 J.B. Machine Shop
261 Creative Die Cast Phil. Corp.
262 R.S. Unitech Corporation
263 Emil Machine Shop
264 Leo Machine Shop
265 Manalo's Machine Shop
266 Non-Stop Machine Shop
267 Metal Mate Precision Technology Corp.
268 Greatech Phils.
269 Famous Secret Precision Machining, Inc.
270 RAS Golden Machinery Corp.
271 VL Industech Corporation
272 New Guia Electrical Machine Shop
273 Square Machine Shop (Suarez Machine Shop)
274 RGMD Engineering Works & General Services
275 Princena Machine Shop
276 Mag's Machine Shop & Engineering Works
277 Kwik-Way Engineering Works
278 J. Dela Cruz Machine Shop
279 ABD Metal Fabrication
280 Roño Machine Shop
281 Plastmann Industrial Corporation
282 Ito-Seisakusho Phils. Corp.
283 Philippine Precision Technology, Inc.
284 Kinergy Phils., Inc.
285 L & R Machine Shop
286 ESJ Precision Tooling
287 Sta. Rosa Aluminum Products
288 Grasco Industries, Inc.
289 Ponciano Machine Shop
290 Hernandez Engineering Works
291 Hi-Tech Machine Shop
292 A.R.B. Machine Shop & Engine Rebuilder
293 Anvil Metalshop Corp.
294 Philips Respironics (RCM)
295 Ambrose Industries, Inc.
296 Francisco Lantican
297 Diestro Engineering & Machinery
298 L.G. Lopez Machine Shop, Industrial Sales & Technical Services Corp.
299 Lambs Agri-Mechanical
300 Mariñas Technologies, Inc.
301 Agricultural Machinery Development Program, CEAT
302 FVC Philippines
303 Mary Check Trading
304 Uni-Machine Metal Fabricator

305 Malasaga Trading Corp.
306 United Parens Manufacturing Co. (UPMC)
307 Palao Machine Shop
308 France J Technician Machine Shop
309 Triple D Trading & Fabrication
310 Bernatech Precision
311 Checkpoint Machine Shop
312 Aguilar Machine Shop
313 Nolie Motor Shop & Machine Shop
314 C4JS Machining & Engineering Works
315 ACC Auto Parts& Industrial Services
316 Cabuyao Glass & Steel Fabrication
317 St. James Machine Shop
318 Silver Machine Shop
319 CATE Machine Shop
320 Rockstar Machine Shop and Fabrication
321 Gemstar Engineering Services
322 Skan Machine Shop and Rewinding Services
323 JDM Tooling Technology
324 CLP Metal Industries & Precision Tools
325 PPJ Machine Shop
326 Prov 3 Tooling and Metal Fabrication
327 RMS Raffy's Machine Shop
328 EVC Machine Shop
329 VJF Precision Toolings Corp.
330 J. Suarez Machine Shop and Engine Rebuilder
331 D. Zapata Machine Shop
332 JRM Machine Shop and Fabrication
333 R.E.V.O.H. Coderes Cycle Parts & Welding Shop
334 Blairwin Tech.
335 Industrial Design & Equipment Expertise, Inc.
336 Antipolo MRM Precision Tools & Die, Inc.
337 Adzer Engineering
338 CVC Precision Toolings
339 Fil-Asia Shutters, Corp.
340 Transman Engine Rebuilders, Inc.
341 RAA Calibration & Machine Shop

IV

342 General Motors & Machine Shop
343 Salvie Rubber & Machine Shop
344 Armac Auto Repair & Machine Shop
345 Zapanta Welding Shop
346 J. Val Repair & Welding Shop
347 Jose Marichu Welding Shop
348 SGC Motorworks
349 Comprehensive Engineering Works & Machine Shop
350 Western Motors & Machine Works
351 MS Machine Shop
352 Gonzaga Motors & Machine Works
353 MATERDEI Auto Parts & Battery Center
354 SMS Machine Shop & Engine Rebuilding
355 Resy Motorworks
356 Greg Danganan Machine Shop

V

357 Marol Metal Works
358 Bornoc Autobody Repair Shop
359 Anlourd Metalworks & Welding Shop
360 Charis Steelworks
361 Dar's Auto Repair Shop
362 Raymond Machine Shop
363 Ravalo Machine Shop & Auto Supply
364 Barrientos Machine Works
365 Totoy Untalan Machine Shop
366 Tetrahedron Welding Shop
367 D' Engineer Motor Works
368 Tol's Machine Shop
369 Arnel Untalan Machine Shop & Fabrication Side Car and Grills
370 Untalan Machine Shop (UMS)
371 Triple Auto Works & Machine Shop
372 Alex Acuzar Metalcraft
373 ADE Enterprises
374 Laurañanac Machine Shop & Welding Shop
375 Fabia Welding Shop & Iron Works
376 Dioquino Machine Shop & Welding Shop
377 Miyaku Metalworks
378 Lito Welding & Repair Shop
379 JGAB Steelworks
390 Salvacion Machineries Trading
381 Roger Steel Structural Fabrication
382 TER Machine Shop
383 DHK Welding & Machine Shop
384 Adones "Nonoy" Dela Cruz Engineering Works
385 Pearl Machine Shop
386 Calibre Machine Shop
387 Tropics Agro Industries, Inc.
388 Hi-Power Machine Shop

389 Luzonian Machine Shop Co.
390 Iriga Joe Machine Shop
391 MAS Steel Fabrication
392 New Dames Metal Shop
393 Myre Agri-Ventures Fabrication & Engineering Services
394 Alamo Metal Craft
395 S.N. Villa Steel Fabrication & Repair Shop
396 Naga Champion Machine Shop Corp.

VI

397 Cesar Machine Shop
398 Jaspe Light Steel Industries, Inc.
399 Berpa-Flex Technologies
400 Gascon Pipe Bending
401 Jorge Machine Shop
402 Lopez Engineering & General Services
403 Harder Machine Shop & Auto Services
404 Ballejera Repair Shop
405 Doligosa Machine Shop Corp.
406 E&R Engineering
407 HOMMA Industries
408 Ramos Diversified Enterprises Corp.
409 RJB Contractor & Marketing
410 RU Foundry & Machine Shop Corp.
411 Eduard Metal Industries
412 Warlen Industrial Sales Corp.
413 Apollo Machine Shop
414 Alternative Indigenous Development Foundation, Inc.
415 Technopacer Engineering Services
416 Baronesa Metal Corp.

VII

417 Servimec Industrial Corporation
418 F.A.G. Machine Shop and Service Co.
419 P and L Industrial Options
420 United Rebuilders, Inc.
421 Base Engineering
422 St. John Bosco Systems, Inc.
423 Center for Cebu Light Engineering and Metalworking, Inc.
424 Center of Industrial Technology Institute, Inc.
425 B-Nels Trading Engineering Services
426 Machine Systems Corporation
427 Prime Parts
428 Suarez Bros. Metal Arts, Inc.
429 4A's Development Corp.
430 Wellmade Motors & Development Corp.
431 Dedon Manufacturing, Inc.
432 Maitland-Smith Cebu Inc.
433 Cebu Iron Foundry Corp.
434 Cebu Mitsumi, Inc.
435 FZS Machine Shop
436 Champion Trading & Machine Shop
437 Nambatac Metal Works & Machine Shop
438 Bohol Machine Shop & Engineering Works
439 Bohol Island State Universtity
440 Tagbilaran City Machine & Repair Shop
441 CEDE Machine & Metal Industry Corp.
442 Alota Engineering Works
443 Piamonte Machine Shop
444 Manu Calibration Center
445 Kwik-Way Engineering Works
446 Mindanao-Sibulan Machine Shop
447 V-Roy's Repair and Welding Shop
448 Len & Sam Welding Shop & Machine

VIII

449 Floaters Built Tire Shop & Machine Shop
450 Heba Machine Shop
451 Estrada Machine Shop
452 Alajas Machine Shop
453 Alajas Steel Fabrication & Machine Shop
454 RM Armea Enterprise
455 Marte Technova Machine Craft Ind.

IX

456 ZCSFC Zamboanga Chapter/MIAP
457 Pimentel Creative Builders Enterprises
458 Lawis Repair Shop
459 Melvin Engine Repair/Machine Shop
460 Power Motor Service
461 New Nonagon Engineering Services

X

462 Grecanz Trading & Engineering Services
463 Paras Machinery Works Corporation
464 Kwik-Way Engineering Works
465 Hi-Speed Rebuilders, Inc.
466 Four Stroke Auto Repair
467 Cabanducos Iron Works
468 5T's Machine Shop
469 TAN's Engineering Services
470 Minfred Machine Shop
471 Risym Machine Shop

472 EIE Machine Shop
473 Orophil Industries
474 Ben Sy Machine Shop
475 Golden Engineering
476 Grand Engineering
477 First Asian Metals Corporation
478 Jacsons' Enterprises
479 Edison's Machine Works Corp.
480 Dansons Metalcraft
481 Sambar Machine Works and Auto Repair
482 KEN Machine Shop
483 Hi-Q Engineering
484 E & H Engine Reconditioning
485 J & N Machine Shop & Auto Repair Shop
486 VNV Machine Shop
487 3M Machine Shop & Engineering Services
488 JE Machine Shop
489 Locas Machine Shop
490 R.A.C. Industries
491 Xavier University-Ateneo de Cagayan
492 MUST-CIIT
493 ELD Engineering Works & Machine Shop
494 MACH & TECH
495 Inshala Marketing
496 MAMK Machine Shop
497 DBC Machineries Corp.

XI

498 Asentista's Engineering and Construction Supply
499 New Tri-Star Machine Shop Company
500 Davao Motorcycle Machine Shop
501 City Engineer's Office (Motorpool)
502 MWI Builders Corp.
503 TESDA XI-RTC KPUTC Davao
504 University of Mindanao
505 MFC Quality Machine Shop
506 Davao NCG Engineering Services
507 COKTEK MFG.
508 Texas Maxwell Fueltech Manufacturing
509 Payo Manufacturing Corporation
510 Buhangin Machine Shop and Automotive Repair
511 FB Shutters & Services
512 Kyla Metal Stitch
513 Basco Metals Supply Hardware
514 Fred's Machine Shop
515 RJLO Auto Repair Shop and M/S
516 DECO Machine Shop
517 JAS Machine Shop & Engineering Works
518 AEG Engine Reconditioning & Machine Shop Co.
519 4CS Machine Shop
520 Davao Techno Craft
521 Rainbow J & N Steel Body Making & Repair Shop
522 Chenaniah Machine & Welding Shop
523 Omadle Jacalan Machine Shop & Welding Shop
524 FCL Metals & Services
525 Mundo Welding & Machine Shop
526 Jing Machine Shop
527 REL Steel Works
528 JJJS Machine Shop
529 TADECO Livelihood & Training Centre
530 Topline Eng'g.
531 F.A. Engineering & Machine Shop (FAEMS)
532 Win's Machine Shop
533 Cor Jesu College
534 Trade Skill Machine Shop
535 RL Builders Machine Shop
536 Rynel's Machine Shop
537 RMS Machine Shop
538 Redulla Machine Shop
539 TESDA Provincial Training Center-Davao Oriental
540 Quimada Machine Shop
541 Deganio Blacksmith-Welding Shop
542 Don Bosco Training Center
543 J.O. Hinggo Trading Corp.
544 ZPS Machine Shop
545 VC Garcia Industrial
546 B-Multiline Engineering, Foundry and Construction
547 JO-NAG Microstar Co.
548 Agdao Integrated Machine Shop and Calibrating Services
549 Jotag Machine Shop
550 IVSA Machine Shop
551 Reysabs Industrial Sales and Services
552 GS Manres Incorporated

XII

453 Winch Construction & Engineering

Services
554 O-RRR Engineering Works
555 Hermie Machine Shop
556 Figuracion Machine
557 Jazul Machine Shop
558 Edwin Machine Shop & Engineering Works
559 Rafols Integrated Machine Shop
560 Carmel John Machine Shop
561 Tacurong Machine Shop
562 Panlaque Engineering Works
563 Berson Machine Shop

XIII

564 VJ's Metalcraft
565 Tandag Auto Parts Shop
566 Glen Machine Shop
567 3N's Machine Shop

TOOL AND DIE SHOPS

1 BDC Industrial & Allied Corporation
2 NTPI International Inc.
3 ARMSCOR
4 VL Advanced Technology, Inc.
5 La Rota Tools & Die Services
6 Dash Engineering & Machine Shop

ELECTROPLATING SHOPS

1 AA Industrial Chrome Plating Co.
2 Brilliance Metal Services
3 RIRSAN Electroplating
4 ARMSCOR
5 La Rota Tools & Die Services
6 HDM Technologies, Inc.
7 C.C. Barleta Machine Shop Service Center
8 D.F. Gascon Metalcraft Industries
9 Perfect Kitchen
10 Chrome Dazzler Corp.
11 D'gold & Chrome Plating Specialist
12 Metals Industry Research & Development Center (MIRDC)
13 Rich Metal Products Corp.
14 Well-Ever Electroplating Shop
15 Quality Chrome, Inc.
16 Taurd Craft Corporation
17 PDES Batong Asul, House of Silver International
18 Arellano's Silver Craft
19 MCM Silver Craft
20 Mar Menz Silver Craft
21 Ibay's Silver Shop
22 Dengs & Boy Genevae Merchandise and Jewelry Repair Shop
23 Kyle Jewelry
24 Jun & Rosie Acero Jewelry
25 Erni Lyn Jewelry Shop
26 John Ray Jewelry Shop
27 EL Triple-J
28 R & J Jewelry
29 PSB Jewelry
30 Aida's Jewelry Repair Shop
31 E & C Jewelry
32 Laricels Jewelry
33 Francis Gold & Silver
34 Chizpas Jewelry
35 KEA Industrial Corp.
36 VL Industech Corporation
37 Grasco Industries, Inc.
38 Ambrose Industries, Inc.
39 Shuyen Fabrication
40 Gascon Pipe Bending
41 Egger Form Plating
42 Jaruda Steelworks
43 HOMMA Industries
44 Cebu Jewelers Multi Purpose Cooperative
45 Cebu Quality Electroplating
46 Arden Classic
47 Fashion City Corporation
48 Italkarat, Inc.
49 Base Engineering
50 Richman Exponent
51 Suarez Bros. Metal Arts, Inc.
52 Cebu Mitsumi, Inc.
53 ZCSFC Zamboanga Chapter/MIAP
54 First Asian Metals Corporation
55 JAS Machine Shop & Engineering Works
56 Beta Chrome, Inc.
57 Winch Construction & Engineering Services

METALCASTING SHOPS

NCR

1. Kimbee Machinery & Foundry Company, Inc.
2. New Asia Foundry

3. Regal Metal Craft Corporation
4. Virgo Metal Casting
5. Gold Star Foundry, Inc.
6. Alliance Foundry Shop
7. Alkast Metalcraft
8. Makati Foundry, Inc.
9. Asa Metal Products, Inc.
10. Precision Foundry of the Phils.
11. Cura Engineering
12. Sanford Corporation
13. Progressive Metal Resources, Inc.
14. SCIC Industrial Corporation
15. D.F. Gascon Metalcraft Industries
16. Nova Unlimited Foundry Manufacturing Corp.
17. Relucio Progress Foundry Industries, Inc.
18. Fabricast Industries, Inc.
19. Grand Engineering & Foundry Corp.
20. Metals Industry Research & Development Center
21. Global Die Cast & Forging, Inc.
22. Caster Metal Products
23. La Suerte Metalcasting & Machine Shop
24. SOH Technologies
25. Supercast Foundry & Machinery Corp.
26. Tiger Machinery & Industrial Corp.
27. Fortress Metal Shop
28. Karuhatan Metalcasting & Machineworks Corp.

I

1. Natomo Manufacturing Co. (Natomo Light Metal Craft - 1990's)
2. Philgerma Manufacturing Corp.

IV

1. Citizen Machinery Philippines Corporation
2. Metals Engineering Resources Corp. (METERCOR)
3. Creative Die Cast Philippines, Corp.
4. RAS Golden Machinery Corp.
5. Sta. Rosa Aluminum Products
6. FVC Philippines
7. Mary Check Trading

VI

1. RU Foundry & Machine Shop Corp.
2. Baronesa Metal Corporation

VII

1. Cebu Jewellers Multi Purpose Cooperative
2. Italkarat, Inc.
3. Suarez Bros. Metal Arts, Inc.
4. Cebu Iron Foundry Corp.
5. Castalloy Technology Corp.
6. Maitland-Smith Cebu, Inc.

IX

1. New Unity Foundry, Engineering, Machine Shop and Hardware

X

1. Orophil Industries
2. First Asian Metals Corporation

XI

1. V.C. Garcia Industrial Corporation
2. Multi-line Engineering, Foundry & Construction

HEAT TREATMENT SHOPS

1 Odeon Machinery & Metal Fabrication Co.
2 ARMSCOR
3 La Rota Tools & Die Services
4 AC-10
5 HDM Technologies Inc.
6 Cura Engineering
7 C.C. Barleta Machine Shop Service Center
8 Techno Molds Inc.
9 Evapia Precision Toolings Co.
10 Grand Engineering & Foundry Corp.
11 Metals Industry Research & Development Center (MIRDC)
12 Tiger Machinery & Industrial Corp.
13 PHILGERMA Manufacturing Inc.
14 Genez Farm Machinery & Iron Works
15 Agricomp Machineries & Construction Corporation
16 Top Ace Motor Works
17 Metals Engineering Resources Corp. (METERCOR)
18 Philippine Precision Technology Inc.
19 Kinergy Phils., Inc.
20 Sta. Rosa Aluminum Products
21 Grasco Industries, Inc.
22 VJF Precision Toolings Corp.
23 HOMMA Industries
24 Baronesa Metal Corp.
25 St. John Bosco Systems, Inc.

26 Center for Cebu Light Engineering and Metalworking, Inc.
27 Suarez Bros. Metal Arts, Inc.
28 ASSAB Pacific PTE. LTD-Philippine Branch
29 Castalloy Technology Corp.
30 Cebu Mitsumi, Inc.
31 ZCSFC Zamboanga Chapter/MIAP
32 Orophil Industries
33 First Asian Metals Corporation
34 DBC Machineries Corp.
35 Basco Metals Supply Hardware
36 JAS Machine Shop & Engineering Works

LIST OF FORGING SHOPS INCLUDING SMITHERY

NCR
1 Icon Steel Forging Manufacturing, Inc.-50
2 Cathay Industrial & Mill Supply, Inc-
3 Global Die Cast & Forging, Inc-

III
1 Formosa Forge Phils., Inc.

IV-A
1 Acme Tools Manufacturing Co., Inc
2 Aichi Forging Company of Asia, Inc.
3 Mary Check Trading, Inc.

I
1 Rodrigo Blacksmith
2 Elpidio Macanas Blacksmith
3 Nestor Naray Blacksmith
4 Pidiong Panday Welding Shop

REFERENCES

1. http://en.wikipedia.org/wiki/welding
2. http://www. cwaevents.org/news/importance-welding-construction- indust
3. http://en.wikipedia.org/wiki/welding
4. http://www.wisegeek.com/what-is-electric-welding.htm
5. http://www.ajeepthing.com/welding.html
6. http://www.advantagefabricatedmetals.com/oxyacetylene-welding.html
7. http://www.answer.com
8. ASPBI, National Statistics Office.2010.
9. National Statistics Office, Foreign Trade Statistics in the Philippines
10. MIRDC Publication.The Philippine Machining Industry Profile.1993.
11. ASPBI, National Statistics Office.2008-2012.
12. MIRDC Publication, The Philippine Tool and Die Industry Study. 2006.
13. Exports, Foreign Trade Statistics.National Statistics Office.2008-2012.
14. Imports, Foreign Trade Statistics.National Statistics Office.2008-2012.
15. Exports, Foreign Trade Statistics.National Statistics Office.2008-2012.
16. Imports, Foreign Trade Statistics.National Statistics Office.2008-2012.
17. MIRDC Publication, The Philippine Metalcasting Industry Study. 2003.
18. http://en.wikipedia.org/wiki/Metalcasting
19. http://www.answer.com
20. The Mechanized Forging Industry of the Philippines, MIRDC.
21. U.S. Forging Industry Association, http://forging.org/forging-facts#1
22. Metalworking Industry of the Philippines, MIRDC, Philippines. 1974.
23. Philippine Metals and Engineering Industries, National Action Plan, 1990- 2000, MIRDC, MM. Philippines. 1991.

DEPARTMENT OF SCIENCE AND TECHNOLOGY

METALS INDUSTRY RESEARCH AND DEVELOPMENT CENTER

MIRDC Compound, Gen. Santos Avenue
Bicutan, Taguig City, 1631 Metro Manila
P.O. Box 2449 Makati, 1229 Metro Manila, Philippines
Telephone Nos.: (632) 837-0431 to 38 (connecting all departments)
Fax Nos.: (632) 837-0613 and 837-0479
Website: http://www.mirdc.dost.gov.ph
E-mail: mirdc@mirdc.dost.gov.ph