THE PHILIPPINE DIE AND MOLD INDUSTRY Building Niches Amidst Global Challenges:

A 2018 Study

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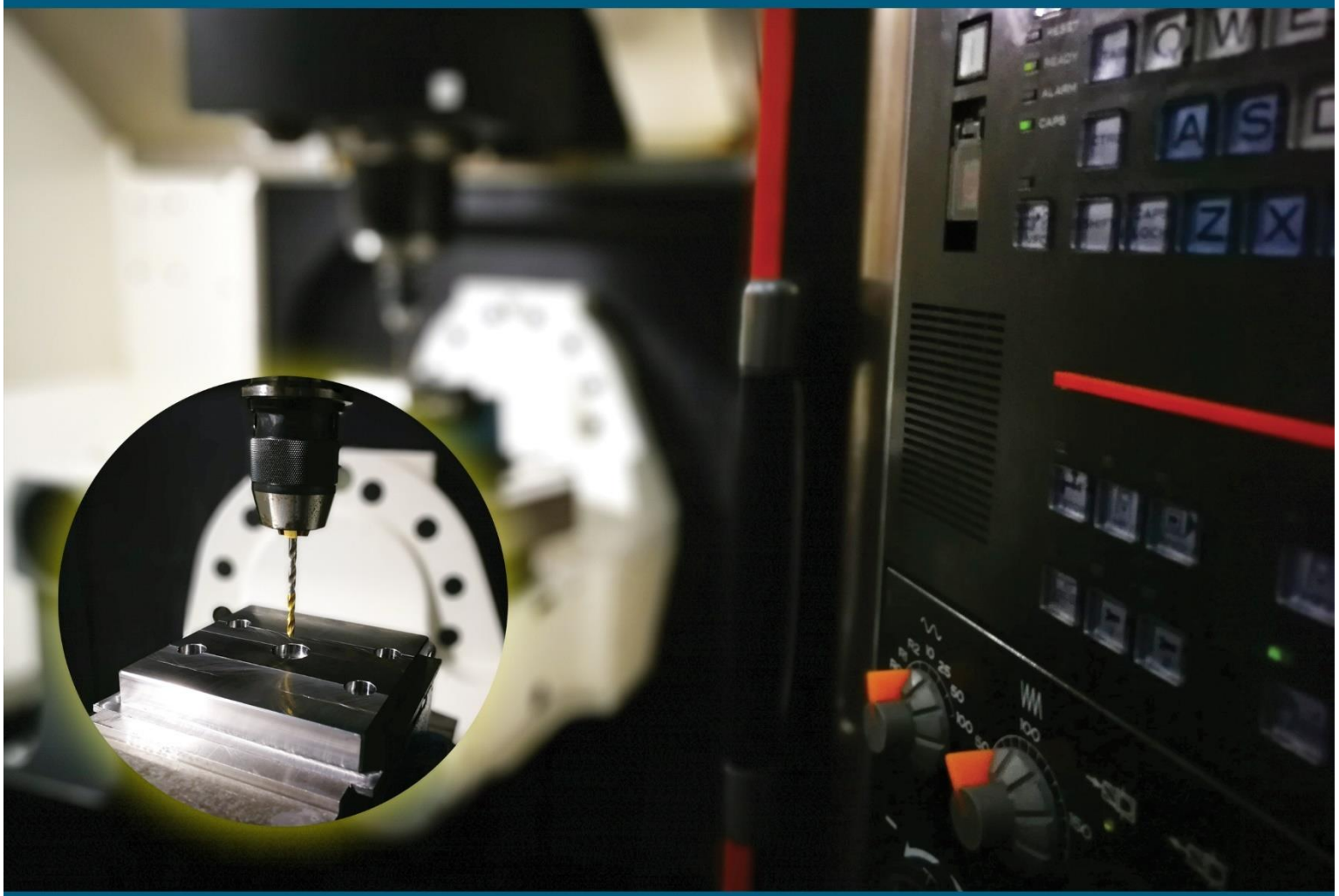

Department of Science and Technology
Metals Industry Research and Development Center

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The Cover: CNC Milling Machine. Picture was taken at MIRDC Die and Mold Solution Center.

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PREFACE

As an output of the recently concluded project entitled, 'Philippine Metalworking Industry Study for Machining, Die and Mold, and Forging Sectors,' this publication presents the results of the 2018 survey of the selected sectors of the metalworking industry. Along with the results are the analyses of various factors influencing the industry's status. Moreover, this report contains insightful recommendations meant for the consideration, not only of the industries but by concerned academic institutions and relevant agencies in the government as well. The Center also recommends this publication as reference material to be used by researchers, whose study outputs are significant factors to the formulation of policies, creative and critical decision-making, and drafting of short, medium, and long-term plans, both on the company and national levels.

The conduct of the 2018 Survey of the Metalworking Industries and the writing of the 2018 Industry Study report were both challenging and eye-opening. They were challenging because the implementation of project activities was not always easy, often stress-filled and risky. They were eye-opening because we had another chance to meet the faces behind the surveyed companies, to hear their stories first-hand. We had the privilege to ask questions, discuss their concerns, and provide technical advice. We had the opportunity to talk with the people whose businesses impact the country's economic stability and growth.

The entire experience was an opportune time for us to step back and see the big picture. With a broader perspective, we get to look at the metalworking industry's current status and see the challenges and successes we shared in the past. Moreover, this places us – the government, the private sector, and the academe – in a better position to chart our strategic direction leading to globally competitive metals, engineering, and allied industries.

It is the pride and honor of the Department of Science and Technology - Metals Industry Research and Development Center (DOST-MIRDC) to serve the local metals, engineering, and allied industries. This publication is a testimony of the Center's unyielding resolve to drive the industries toward global competitiveness, not only because it is our mandate, but because it is a deep-seated commitment. It is our motivation. It is the very reason for our existence.

ROBERT O. DIZON
Executive Director, DOST-MIRDC

ACKNOWLEDGEMENT

The industry study team would like to acknowledge the Department of Science and Technology – Metals Industry Research and Development Center (DOST-MIRDC) for commissioning this undertaking. Without the proper logistical support provided by the Center, this endeavor would not have been possible.

The team would like to thank the DOST-MIRDC Executive Director, Engr. Robert O. Dizon; MIRDC Deputy Executive Director for Technical Services, Dr. Agustin M. Fudolig; Technology Diffusion Division Chief, Dr. Danilo N. Pilar; and Technology Information and Promotion Section Chief, Ms. Lina B. Afable for their steadfast leadership and guidance.

Information provided by the DOST Regional Offices, the Department of Trade and Industry (DTI), the Philippine Economic Zone Authority (PEZA), and the different Local Government Units greatly helped in identifying potential respondents for the study.

The approval, assistance, and information extended by the Philippine Statistics Authority (PSA) enabled the conduct of this study.

The expert analysis and inputs of the consultant from the die and mold industry, Engr. Antonio L. Mangubat, grounded the study to the sectors' perspectives.

The members of the industry study team are sincerely acknowledged for their untiring dedication to further the interest of the metalworking sectors:

Ms. Rosalinda M. Cruz	Ms. Faith P. Macatangay	Ms. Marielle Almira J. Viernes
Mr. Jim Patrick S. Erispe	Ms. Teresita C. Villoso	Ms. Viann P. Alarde
Ms. Josephine R. Esguerra	Ms. Marlyn U. Ramones	Ms. Katherine A. Punongbayan
Ms. Vilma A. Sia	Mr. Ronald L. Agustin	

Appreciation is given to the Planning and Management Division (PMD) for extending personnel support and other related data to accomplish the objective of the Center of providing up-to-date industry studies.

Heartfelt gratitude is expressed to the different metalworking companies that participated during the survey and focus group discussion (FGD) conducted by the Center. Their sincere and open responses proved valuable data in determining the current status of the different sectors studied.

Engr. Eldina B. Pinca	Ms. Zalda R. Gayahan	Dr. Alexander P. Gonzales
Head, Machining Study	Head, Forging Study	Head, Die and Mold Study

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1. INTRODUCTION

1.1. Overview

The design and manufacture of dies and molds represent a significant link in the entire production chain because nearly all mass-produced discrete parts are formed using production processes that employ dies and molds (Altan, Lilly, & Yen, 2001). At present, the manufacturing industry faces severe competition in the global market. The manufacturing industry has to deal with issues such as globalization, digitalization, reliability, specialization, and collaboration to survive (Cho, Leem, & Shin, 2006). These conditions necessitate the Center to look into the present status of the die and mold sector in the Philippines.

Part of the mandate of the Metals Industry Research and Development Center (MIRDC), as stated in Republic Act No. 4724, Sec. 4b (3), is to collect information and statistics for preparation of comprehensive and up-to-date industry studies.

The last industry study conducted by the Center for the die and mold sector was in 2006. The Center sees it fit to do another research focusing on the die and mold sector. For this purpose, its technical and administrative staff engaged in crafting the survey questionnaire, fielding/collecting of data, consolidating, analyzing, and publishing of the study. This time, the MIRDC aimed to look into the current status of the die and mold sector in terms of its industry profile, technical profile, market profile, and research and development requirements.

1.2. Objectives of the Study

The general objective of this study is:

Determine the status of the die and mold sector through its general, industrial, market and technical profile that can be used as a planning and programming tool to target the needs of the industry for further development.

The specific objectives of this study are as follows:

1. Provide an assessment of the die and mold sector in the Philippines in terms of the following:
    a. Industry Profile;
    b. Technical Profile;
    c. Market Profile;

2. Identify the research and development requirements and training needs of the die and mole sector including an assessment of the DOST's investment incentives initiative; and
3. Determine the issues and concerns of the die and mold sector and provide an internal and external environment analysis that could provide the die and mold sector insights in developing their corporate goals.

1.3. Methodology

This study utilized the mixed research method model, which incorporated a quantitative survey method and qualitative interview, focused group discussion (FGD), and document analysis using the Philippine Statistics Authority (PSA) data.

The status of the sector was gathered through the use of survey questionnaire designed by the Technology Information and Promotion Section (TIPS) of the Technology Diffusion Division (TDD) to extract the general profile, industrial profile, market profile and technical profile, including the problems encountered, issues, and concerns, strength, opportunities, weaknesses and threats and business perceptions, expectations and future plans. The Questionnaire was validated and approved by the Philippine Statistics Authority (PSA) with PSA Approval No. MIRDC – 1814 and valid until January 31, 2019. PSA also granted the MIRDC clearance to survey the metals industry die and mold sector in a press release dated March 5, 2018 (see Annex A).

The MIRDC survey team conducted data gathering through field interviews, phone interviews, emailed questionnaire, and observations from April 1, 2018 to October 31, 2018. Data collected were further validated through an FGD conducted on November 28, 2018, and attended by key informants from the various die and mold companies. Data were further validated and analyzed by the Center's expert consultant, Engr. Antonio L. Mangubat.

Respondents were identified through the use of lists of shops/companies from the Department of Trade and Industry (DTI), the Philippine Die and Mold Association (PDMA), and the Philippine Economic Zone Authority (PEZA). Other sources considered were the files of the Business Permit and Licensing Office (BPLO) from the Local Government Units (LGUs) and internet searching.

The study aimed to get the entire population of domestic companies belonging to the Die and Mold Sector in order to obtain reliable data on its current status. The industry study team identified 138 potential respondent-companies but because of limited time, resources and accessibility issues, the industry study team was able to survey 128 respondent-companies only. The list of companies who participated in this study is presented in Annex B.

2. INDUSTRY PROFILE

2.1. Geographical Distribution

A significant portion of the respondent-companies are concentrated in Region IV-A – 62 firms and NCR – 45 firms (see Figure 1). Most of these companies find the location strategic because they have access to raw materials and skilled labor force.

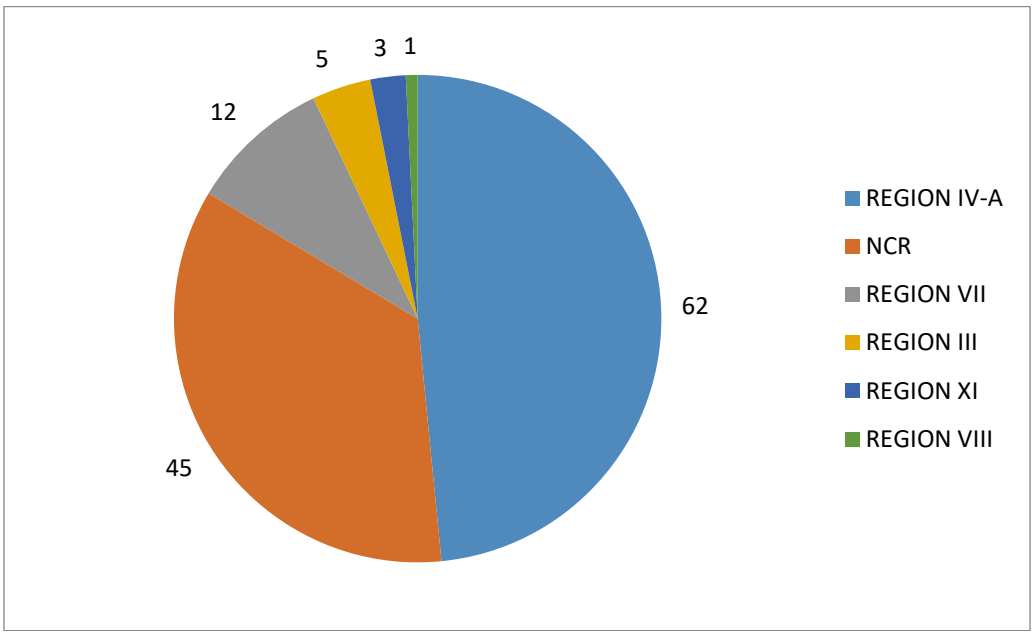


Figure 1. Geographical Distribution of Die and Mold Companies

In terms of economic area, respondent-companies are within or near economic/industrial zones and commercial centers (see Table 1). These locations are strategic because most of the clients of die and mold companies are in these areas.

Table 1. Economic Area of Die and Mold Companies (Multiple Responses)

Economic Area	No of Companies	% Share
Economic/ Industrial Zone	53	37
Other Commercial/ Agricultural/ Industrial Area	33	23
Residential Area with Business Activity	32	23
Shopping Mall/ Center	7	5
Market	6	4
IT Park	4	3
Seaport	4	3
Others	3	2

2.2. Year of Establishment

As seen in Figure 2, the year 1991 to 2000 reflects the peak in the establishment of die and mold companies in the Philippines. Based on the FGD conducted by the Center on November 28, 2018, the enabling factor that contributed to the proliferation of die and mold companies during that period is the establishment of the Philippine Economic Zone Authority on February 21, 1995 by virtue of Republic Act No. 7916 otherwise known as "The Special Economic Zone Act of 1995." The data reflected a downtrend beginning in 2001 in the establishment of new die and mold companies.

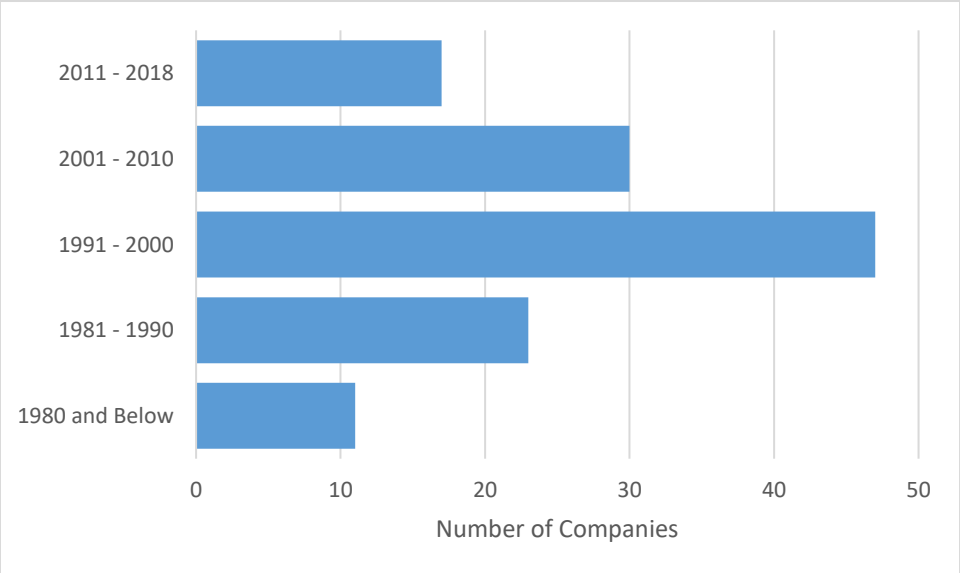


Figure 2. Year Started Operations

2.3. Form of Business Organization

Figure 3 shows that majority of the respondent-companies are corporations mainly due to the high capitalization requirement in establishing a die and mold shop. Precision equipment and machinery for die and mold fabrication are expensive. Single proprietorship companies mostly cater to products not requiring a high degree of precision.

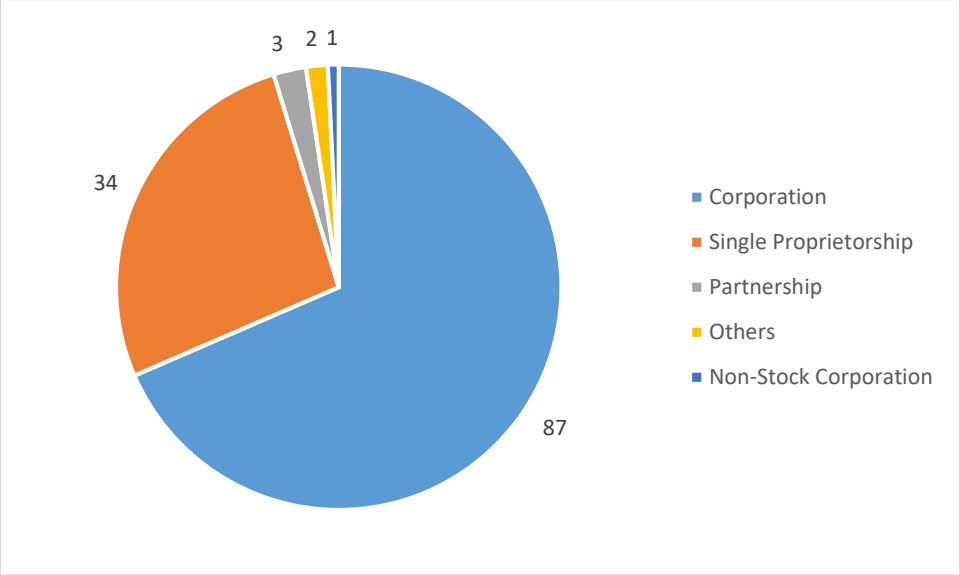


Figure 3. Form of Business Organization

2.4. Nationality and Age of Owners

As shown in Figure 4, a significant percentage of respondent-companies are Filipino owned followed by foreign-owned companies in the PEZA areas which are covered by Republic Act 7042, also known as the "Foreign Investments Act (FIA) of 1991," the law that covers all foreign investments in the Philippines.

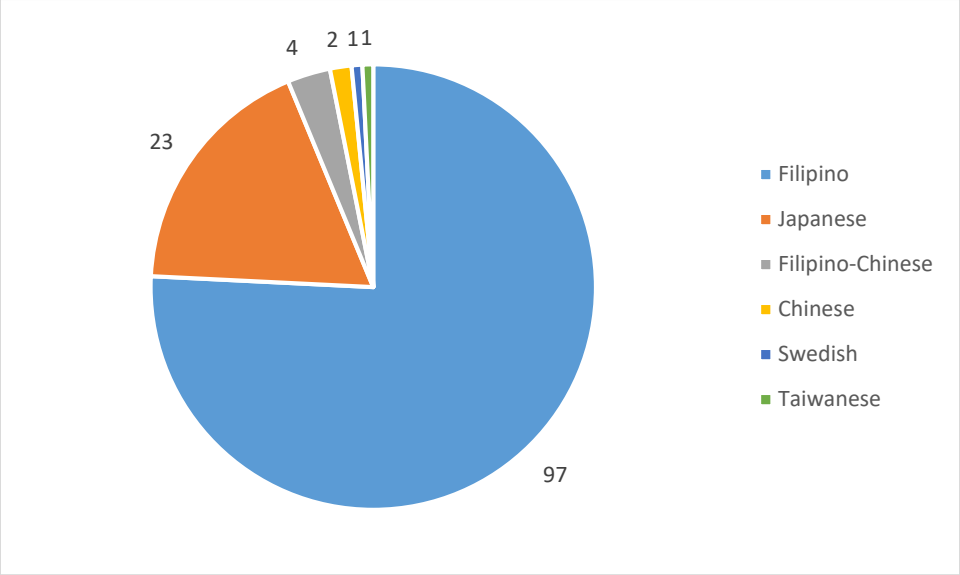


Figure 4. Nationality of Owners

From the data presented in Figure 5, the sector has ageing CEOs or company owners. Majority of the owners' age falls under the 61 to 70 and 51 to 60-year-old category, while the average age of company owners is 59 years old.

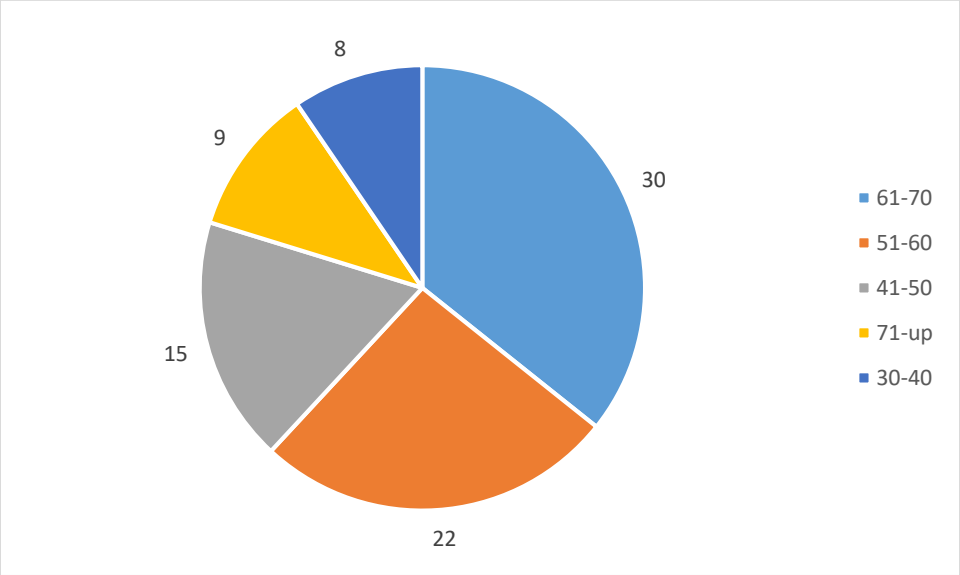


Figure 5. Age of Company Owners

2.5. Type of Economic Organization

About 48% of the respondent-companies are considered establishment and main office based on their type of economic organization as presented in Figure 6. Most of these companies have satellite offices and warehouses distantly located from the main office, while some even have regional plant or branches. On the other hand, 40% of the respondent-companies are considered a single establishment. These companies are those who have just been established with plans for expansion, while some have owners with no interested heirs to assume operation of the company.

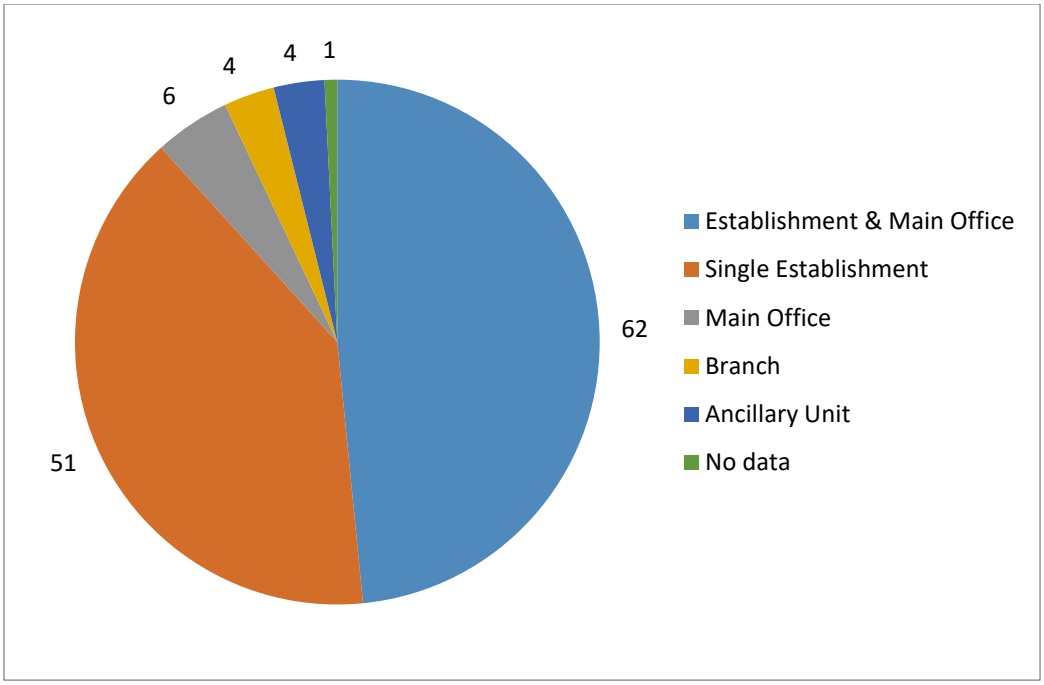


Figure 6. Type of Economic Organization

2.6. In-house Fabrication of Die and Mold

As presented in figure 7, 81% of the respondent-companies fabricate die and mold for their use and the use of other metalworking sectors. Meanwhile, 19% of the respondent-companies design, use, and repair dies and molds; these companies outsource the fabrication of their dies and molds.

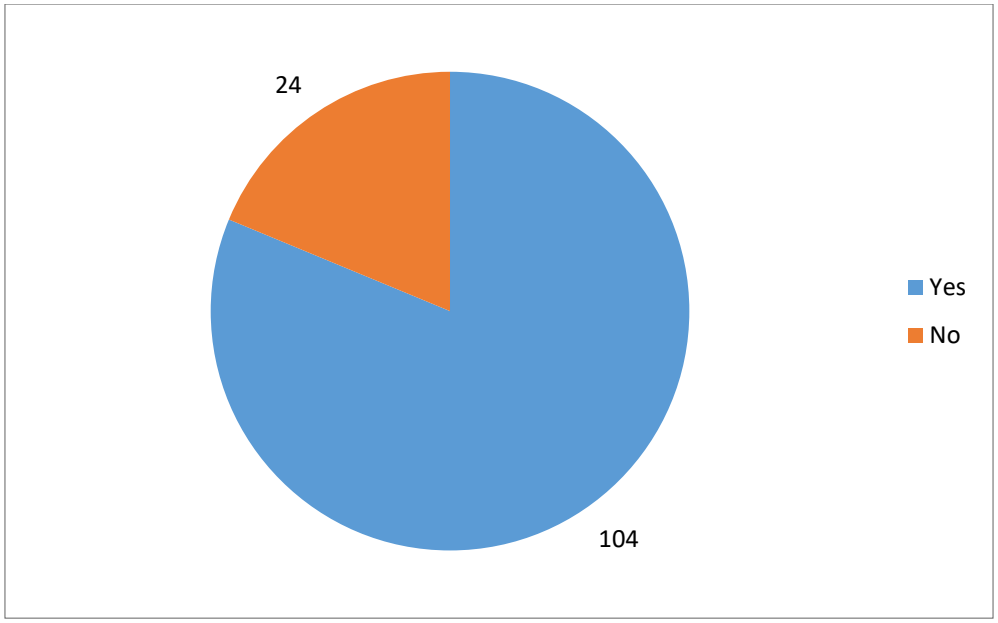


Figure 7. In-house Fabrication of Die and Mold

2.7. Business Operations

Based in Figure 8, 61 respondent-companies or 48% are doing both manufacturing and jobbing works, 51 respondent-companies or 40% are engaged mainly in manufacturing, and 16 or 12% of the respondent-companies are involved only in jobbing. Most of the respondent-companies who are involved in jobbing are micro companies that specialize in the fabrication and repairs of die and mold as well as jigs and fixtures.

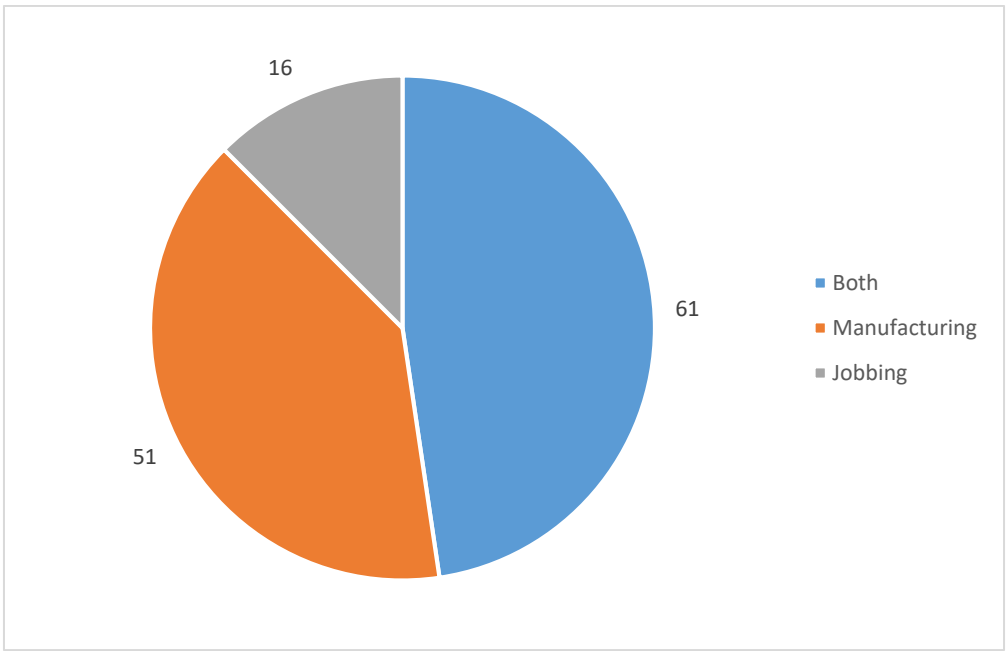


Figure 8. Type of Business Operations

2.8. Initial Capitalization

Majority of the respondent-companies started as micro companies and worked their way to their current status (see Figure 9). As shared by some company owners, they started with only one lathe machine and worked hard to pull out resources to buy additional machines and equipment. Companies with initial capitalization categorized as medium and large are usually companies with foreign counterparts or are receiving foreign investment. Some respondent-companies have difficulty identifying their initial capitalization because they are considered as non-stock/non-profit such as training institutions, while others have lost track because of their financial history.

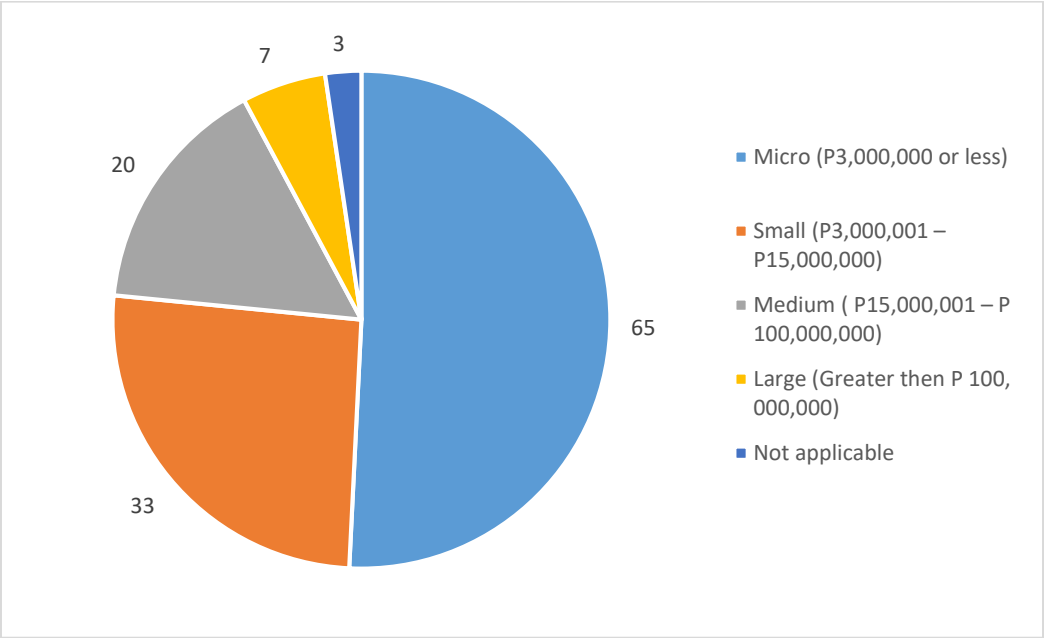


Figure 9. Initial Capitalization

2.9. Classification According to Capital and Employment

Based on the data gathered on capitalization, the die and mold sector has a smaller percentage of companies classified as micro (refer to Figure 10). The sector is high on capitalization requirements particularly in terms of machinery and equipment. As observed, majority of the respondent-companies are small and medium enterprises (SMEs). The same is true of the sector based on its classification in terms of employment (refer to Figure 11).

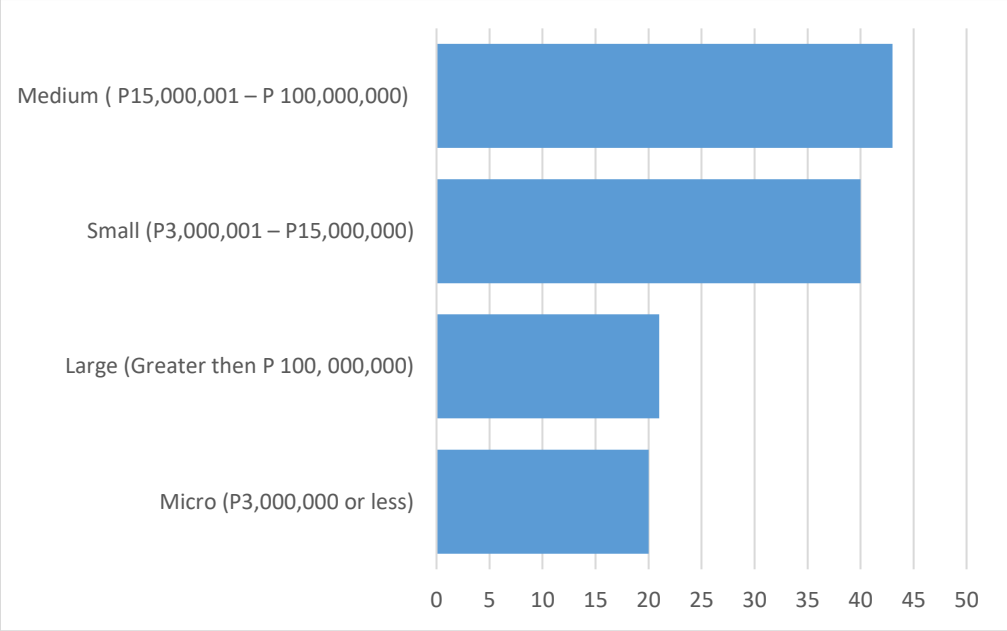


Figure 10. Classification According to Capital

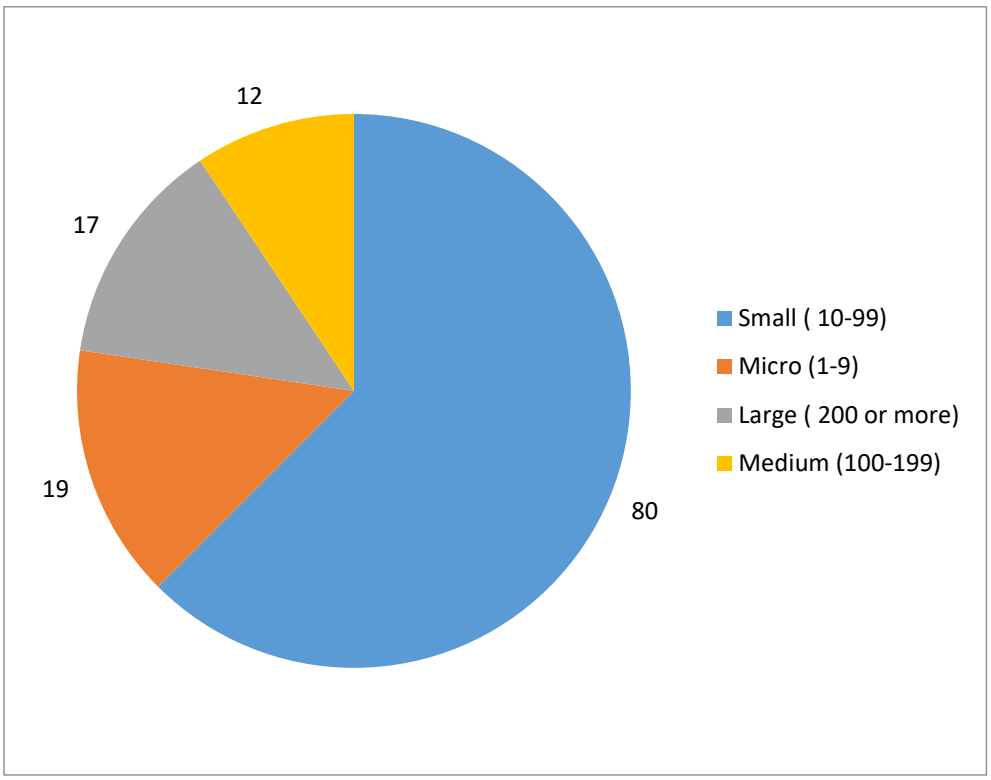


Figure 11. Classification According to Employees

2.10. Distribution of Production, Non-Production, and Contract Workers

In reference to Figure 12, about 71% of the workers of the respondent-companies are involved in production, while 18% are engaged in non-production jobs like marketing, logistics, administration, and others. 8% of the workers are contract-of-service, and 3 percent are handling other tasks not falling under the categories as mentioned above. Majority of the workers involved in production are die and mold technicians and machine operators.

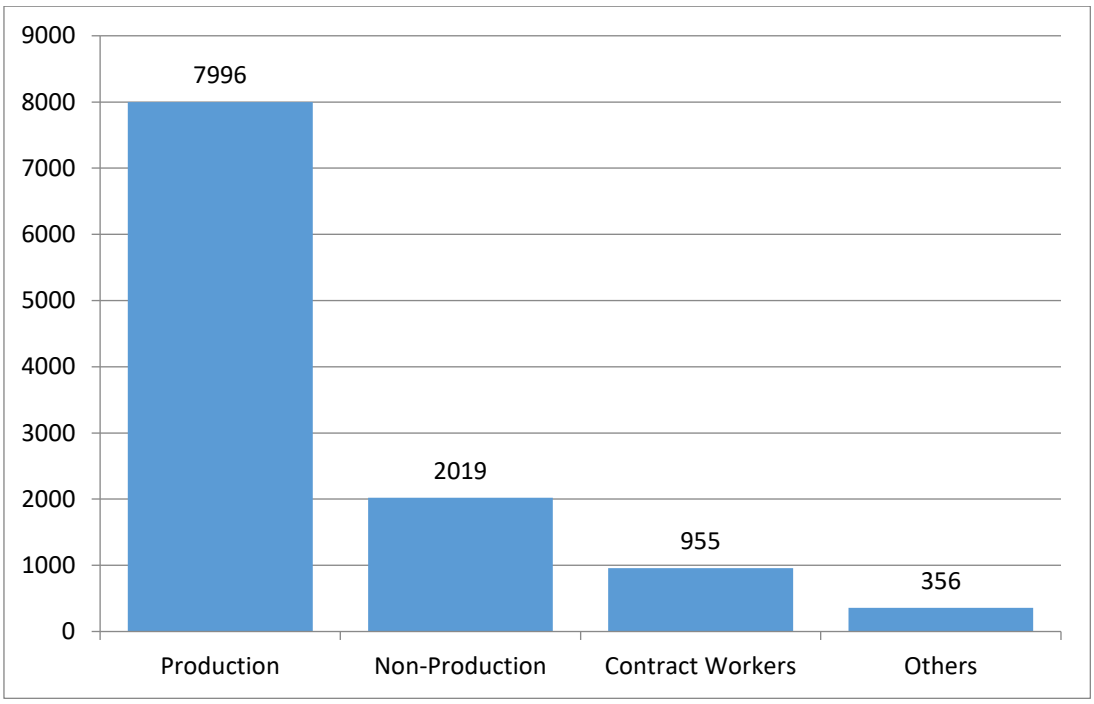


Figure 12. Distribution of Production, Non-Production, and Contract Workers

2.11. ISO Certification/Accreditation

In terms of ISO certification/accreditation, 49% of the respondent-companies do not have certification or accreditation from any certifying/accreditation bodies as presented in Figure 13. Most of these companies are not required by their clients to pursue certification/accreditation. Only those who are engaged in exportation, as well as those who are foreign-owned, have certification or accreditation based on ISO standards.

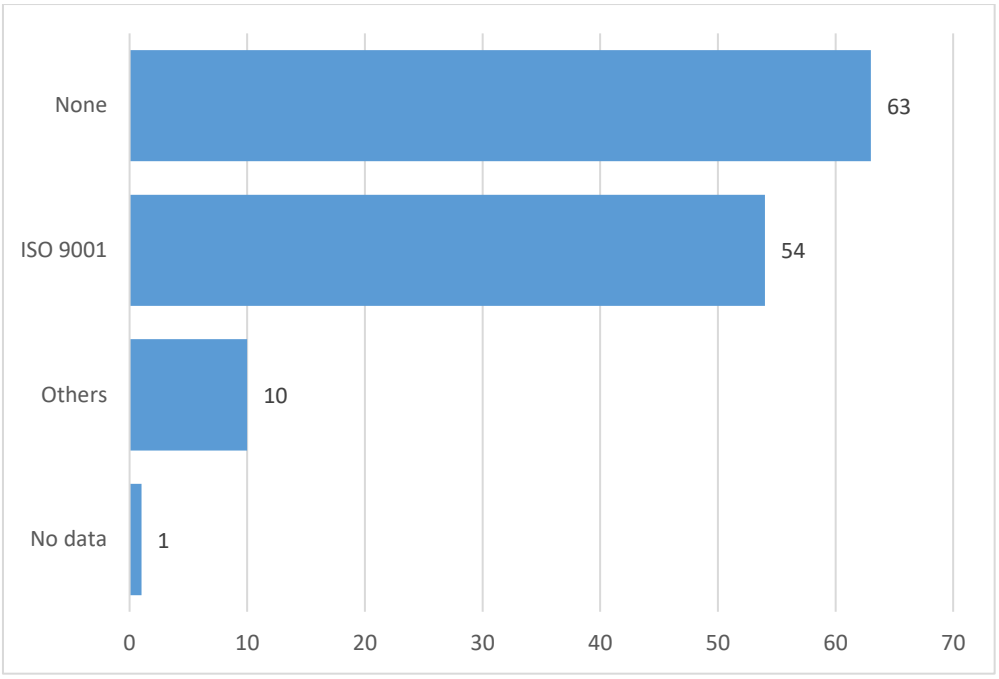


Figure 13. ISO Certification/Accreditation

3. TECHNICAL PROFILE

3.1. Metalworking Processes Employed

As presented in Figure 14, machining, welding, and stamping are the most common metalworking processes related to the die and mold sector. In the fabrication of dies and molds, machining is mostly employed. Dies and molds are commonly used in the stamping process.

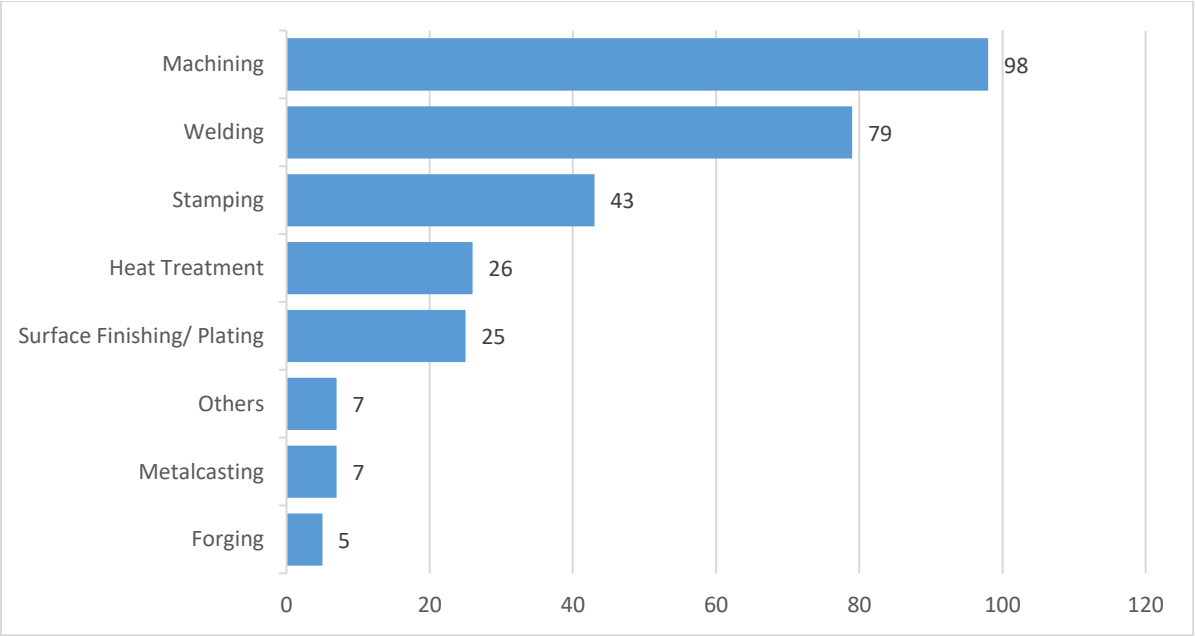


Figure 14. Metalworking Processes Employed (Multiple Responses)

3.2. Die and Mold Equipment

Based in Table 2, 52% of the respondent-companies have NC/CNC Lathe and 33% have NC/CNC Milling. These show that the die and mold industry in the Philippines still uses conventional machining techniques. It is observed that conventional equipment such as lathe and milling machines are usually acquired locally and are second-hand or used condition.

Table 2. Equipment Condition and Mode of Acquisition

Equipment	No. of Companies with Equipment	% of Companies with Equipment	Quantity	Present Condition		Acquisition Status			
				Working	Non-Working	Imported	Local	New	Second-Hand
1. NC/CNC Lathe	66	52	196	194	2	164	32	168	28
2. Copying Lathe	3	2	8	8	0	4	4	8	0
3. Copy Milling	7	5	13	13	0	4	9	10	3
4. NC/CNC Milling	42	33	121	118	3	59	62	89	32
5. Lathe: Bench	89	70	284	279	5	70	214	63	221
6. Turret	4	3	16	16	0	0	16	10	6
7. Vertical	6	5	34	34	0	2	32	11	23
8. Engine	3	2	7	7	0	3	4	3	4
9. Milling: Universal	88	69	282	278	4	46	236	80	202
10. Horizontal Milling	7	5	9	9	0	1	8	1	8
11. Vertical Milling	14	11	46	46	0	6	40	18	28
12. Boring: Cylindrical	9	7	11	11	0	3	8	1	10
13. Vertical/Horizontal Boring	0	0	0	0	0	0	0	0	0
14. Grinding: Surface Grinder	91	71	317	314	3	44	273	189	128
15. Cylindrical Grinder	18	14	24	23	1	3	21	8	16
16. Bench Grinder	40	31	93	93	0	11	82	53	40
17. Drilling: Bench Drill	61	48	120	118	2	20	100	55	65

3.3. Die and Mold Specialized Equipment

Based in Table 3, only a few among the respondent-companies have acquired specialized equipment, such as advanced cutting, drilling, and grinding tools. Advanced machining equipment enables die and mold shops to perform processes such as Subtractive Rapid Prototyping (SRP). SRP provides the designer with feedback about the manufacturability of the design that can save considerable time and money as a part moves from concept to a product (Autodesk, 2014). Specialized equipment also allows shops to handle difficult to machine materials, such as ceramics, super alloys, and other composite materials, especially in the areas of micro manufacturing. Take Electric Discharge Machining (EDM) as an example: EDM has been proven effective in machining of high strength, super tough, and temperature resistance conductive materials. If a shop has EDM, it will be capable of handling designs and materials that are otherwise impossible to execute with conventional machining equipment. Advanced or specialized equipment plays an excellent role in the development of least cost products with more reliable quality assurance (Gurule & Pansare, 2009).

Table 3. Specialized Equipment Condition and Mode of Acquisition

Specialized Equipment	No. of Companies with Equipment	% of Companies with Equipment	Quantity	Present Condition		Acquisition Status			
				Working	Non-Working	Imported	Local	New	Second-Hand
1. Wire-Cut EDM Machine	41	32	80	77	3	46	34	62	18
2. EDM Drill	19	15	31	31	0	17	14	22	9
3. Jig Boring	2	2	2	2	0	1	1	0	2
4. Line Boring	0	0	0	0	0	0	0	0	0
5. Centerless Grinding	2	2	2	2	0	0	2	0	2
6. Profile Grinding	2	2	3	3	0	1	2	1	2
7. Internal Grinding	3	2	3	3	0	0	3	2	1
8. Crankshaft Grinding	0	0	0	0	0	0	0	0	0
9. Jig Grinding	2	2	2	2	0	0	2	0	2
10. Electric Discharge Machine (EDM)	48	38	93	89	4	37	56	64	29
11. Multiple Spindle Drill	2	2	2	2	0	0	2	0	2
12. Tool and Cutter Grinder	7	5	15	15	0	3	12	4	11
13. Vertical Machining Center (VMC)	3	2	12	10	2	0	12	10	2
a. 3-axis CNC Milling	12	9	27	26	1	10	17	20	7
b. 4-axis CNC Milling	2	2	3	3	0	0	3	1	2
c. 5-axis CNC Milling	0	0	0	0	0	0	0	0	0
14. Automatic/Robotics Machine	4	3	6	5	1	2	4	6	0
15. CNC Lathe Milling Combination	2	2	6	6	0	0	6	6	0
16. Sand Blasting Machine	11	9	23	23	0	16	7	19	4

3.4. Die and Mold Quality Control Equipment

Table 4 shows that very few respondent-companies have specialized quality control and measuring equipment. Advanced quality control equipment, such as profile projector, surface tester, atomic absorption spectrometer, and coordinate measuring machine (CMM) are only available to medium and large companies. Most of the respondent-companies do not have their testing and quality control facilities and equipment. They are commonly outsourcing these processes if their clients require testing certifications.

As process and products become more and more engaged in miniaturization, the need for precision measuring tool and quality control equipment become

necessary. The ability to monitor the behavior of machine tools and cutting processes is essential both from a research perspective as well as in industrial applications, such as adaptive control, condition monitoring, process optimizations, and quality control (Norman, 2006). Advanced metrology methods, particularly in rapid prototyping, is essential in the advanced manufacturing industry (Durakbasa, Poszvek, & Bauer, 2015).

Table 4. Quality Control Equipment Condition and Mode of Acquisition

Quality Control Equipment	No. of Companies with Equipment	% of Companies with Equipment	Quantity	Present Condition		Acquisition Status			
				Working	Non-Working	Imported	Local	New	Second-Hand
1. Profile Projector	14	10.9	16	15	1	0	16	15	1
2. Die Test Indicator	22	17.2	75	74	1	8	67	68	7
3. Surface Tester (Surftest)	7	5.5	8	8	0	1	7	8	0
4. Gauge Block	22	17.2	35	35	0	1	34	30	5
5. Pin Gauge	19	14.8	44	44	0	2	42	44	0
6. Granite Plate	66	51.6	80	80	0	10	70	74	6
7. Hardness Tester	38	29.7	43	43	0	8	35	35	8
8. Atomic Absorption Spectrometer	1	0.8	1	1	0	1	0	1	0
9. Vernier Calipers	123	96.1	786	786	0	70	716	762	24
10. Digital Calipers	94	73.4	365	364	1	31	334	352	13
11. Micrometers	100	78.1	609	609	0	32	577	605	4
12. Height Gauge/Height Master	30	23.4	57	57	0	3	54	54	3
13. Coordinate Measuring Machine (CMM)	14	10.9	17	16	1	4	13	15	2
14. Toolmaker's Microscope	9	7.0	11	11	0	4	7	11	0
15. Profilers	2	1.6	2	2	0	1	1	2	0

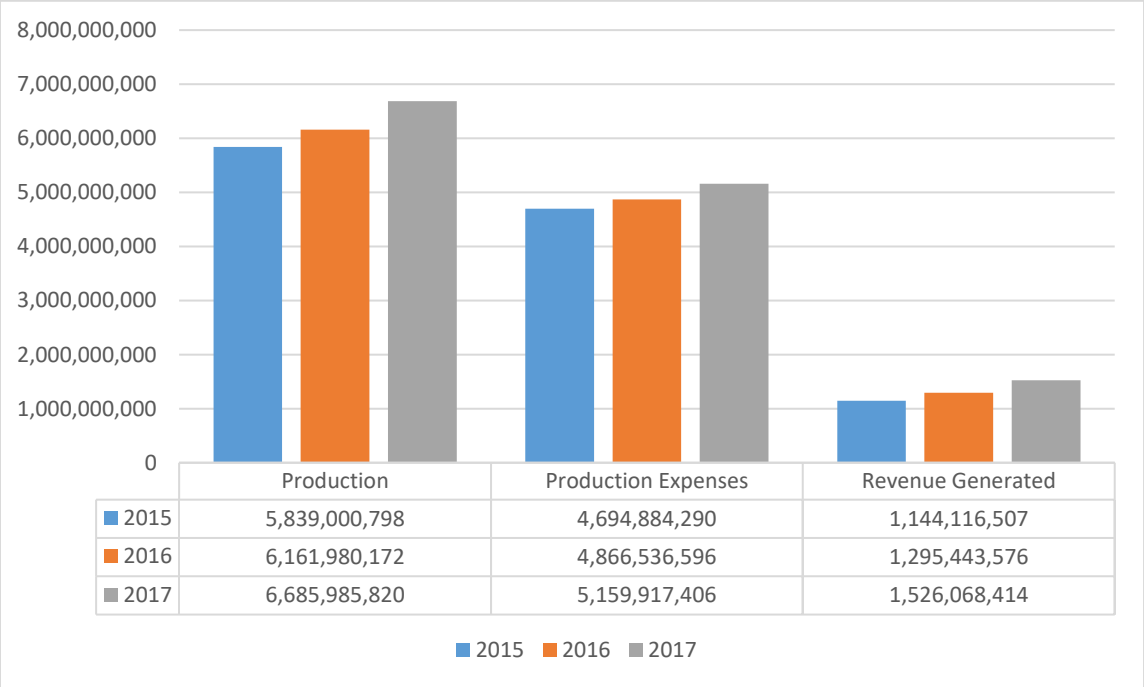
In a special chapter report published by the Asian Development Bank (2009), the respondent SMEs identified new machinery or equipment as the most important source of technological innovation. The data on equipment acquisition status above shows that the die and mold sector in the Philippines has limited capabilities in acquiring new machinery for technological innovation. Most of the machines acquired by the sector are second-hand conventional lathe and milling machine. With the current equipment owned by most of the respondent-companies, it is clear that the sector is not prepared for rapid prototyping production in the scale like that of most advanced countries. Most of the local die and mold shops rely mainly on the skills of their labor force.

In its current state, the paradigm that could support the local die and mold sector to become competitive is craft production. More and more consumers are inclined to purchase customized products and move away from uniformed mass-produced products. According to Schmitz (1990), flexible tools and machines augment the craftsman's skills and ability to produce more varied products. This process is in line with flexible specialization. Most advanced industry engaged in mass production could not easily shift from one mode of production to the other because they have highly specialized machines and equipment. Small shops usually have more flexible sets of machinery and equipment to handle flexible work output. This factor can place them at a more advantageous position if they could seize a market segment. According to Dabbas, Hassan, & Ateyat (2017), if the industry can combine in-depth knowledge and experience of experts with advanced tooling, the industry can create a complete solution and achieve unprecedented results.

4. MARKET PROFILE

4.1. Production, Production Expenses, and Revenue Generated

As presented in Figure 15, the die and mold sector shows an upward trend based on sales and revenues from 2015 to 2017. Based on the data gathered, the sector gained an average of 10% increase in revenue generated per year. The die and mold sector is continuously growing at a steady pace.



	Production	Production Expenses	Revenue Generated
2015	5,839,000,798	4,694,884,290	1,144,116,507
2016	6,161,980,172	4,866,536,596	1,295,443,576
2017	6,685,985,820	5,159,917,406	1,526,068,414

Figure 15. Production, Production Expenses, and Revenue Generated, 2015-2017 (in Pesos)

4.2. Exporting Activities

Majority of the respondent-companies are manufacturing products including dies and molds for the local market (see Figure 16). Most of the companies are producing parts or components intended for local assembly. During the interview, most of these companies are indirectly involved in exports. It means that they are providing parts or components to companies that are directly involved in exportation.

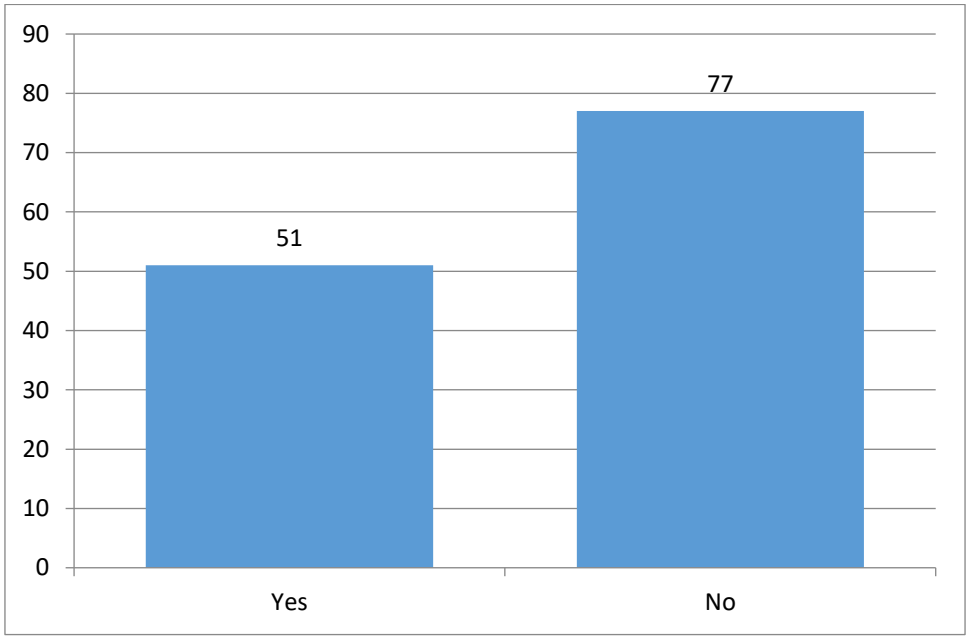


Figure 16. Exporting Activities

4.3. Imports and Exports Status

The Philippine export of dies and molds by product types are reflected in Table 5. For 2017, the top export of the sector are dies for drawing or extruding metals, which is valued at $7,447,222.00. Both in 2015 and 2016, the top export of the sector are molds for metal or metal carbides. Also, there was a significant drop in export value in 2016 as compared to 2015, but was compensated by the increase in export value in 2017.

Table 5. Philippine Exports of Dies and Molds by Product Type (FOB Value in US$), 2015-2017

Commodities	2017		2016		2015	
	Value	% Share	Value	% Share	Value	% Share
Total Exports	17,091,492.00	100.00	8,777,619	100.00	13,515,361.00	100.00
Dies for drawing or extruding metal	7,447,222.00	43.57	622,795	7.10	1,257,140.00	9.30
Molds for mineral materials	3,450,667.00	20.19	300,971	3.43	648,690.00	4.80
Other molds for metal or metal carbides	2,613,553.00	15.29	3,176,962	36.19	8,358,263.00	61.84
Molding patterns	2,258,660.00	13.22	71,000	0.81	107,127.00	0.79
Other molds for rubber or plastics	662,204.00	3.87	3,657,066	41.66	2,901,415.00	21.47
Molds for rubber or plastics, injection or compression types	436,816.00	2.56	423,083	4.82	110,210.00	0.82
Molding bases	171,660.00	1.00	383,661	4.37	31,030.00	0.23
Molds for glass	50,710.00	0.30	139,281	1.59	89,876.00	0.66
Molds for metal or metal carbides, injection or compression types	-	-	2,800	0.03	11,610.00	0.09

Source: Foreign Trade Statistics of the Philippines, PSA

Japan is the top destination of exported dies and molds products of the Philippines as shown in Table 6. In 2016, both Japan and the United States of America experienced a sudden decrease in value of Philippine export; in contrast, the Republic of Korea showed a substantial increase.

Table 6. Philippine Export Markets of Dies and Molds (FOB Value in US$), 2015-2017

Commodities	2017		2016		2015	
	Value	% Share	Value	% Share	Value	% Share
Total	17,091,492.00	100.00	8,777,619	100.00	13,515,361.00	100.00
Japan	8,039,015.00	47.04	3,938,950	44.87	9,147,613.00	67.68
United States of America	3,487,760.00	20.41	62,207	0.71	781,945.00	5.79
Germany	1,674,908.00	9.80	28,948	0.33	31,840.00	0.24
Hong Kong, China	1,160,756.00	6.79	146,597	1.67	94,187.00	0.70
Thailand	802,543.00	4.70	1,813,772	20.66	937,585.00	6.94
Malaysia	666,477.00	3.90	164,973	1.88	261,468.00	1.93
Czech Republic (Czechoslovakia)	266,333.00	1.56	871,418	9.93	675,705.00	5.00
Mexico	226,231.00	1.32	550	0.01	126,041.00	0.93
Republic of Korea	201,715.00	1.18	4,821,049.00	54.92	91,068.00	0.67
Vietnam	187,840.00	1.10	82,478.00	0.94	108,490.00	0.80

Source: Foreign Trade Statistics of the Philippines, PSA

In terms of imports of dies and molds products, molds for rubber or plastics of injection or compression types are the top imports of the Philippines, which is valued at $48,177,264.00 in 2017 (refer to Table 7).

Table 7. Philippine Imports of Dies and Molds, by Product Type (CIF Value in US$), 2015-2017

Commodities	2017		2016		2015	
	Value	% Share	Value	% Share	Value	% Share
Total Exports	126,026,062.00	100.00	91,813,322	100.00	52,644,239.00	100.00
Molds for rubber or plastics, injection or compression types	48,177,264.00	38.23	18,780,208	20.45	9,364,833.00	17.79
Dies for drawing or extruding metal	21,978,550.00	17.44	11,974,760	13.04	5,095,521.00	9.68
Other molds for rubber or plastics	20,541,689.00	16.30	28,786,543	31.35	13,545,056.00	25.73
Other molds for metal or metal carbides	9,759,776.00	7.74	8,584,045	9.35	8,596,123.00	16.33
Molding bases	8,271,222.00	6.56	5,148,270	5.61	2,767,501.00	5.26
Molds for metal or metal carbides, injection or compression types	4,795,730.00	3.81	990,365	1.08	530,613.00	1.01
Molds for mineral materials	4,794,045.00	3.80	5,869,209	6.39	4,081,457.00	7.75
Molding patterns	3,975,801.00	3.15	6,984,388	7.61	5,922,180.00	11.25
Molds for glass	3,261,721.00	2.59	4,009,525	4.37	2,476,395.00	4.70
Ingot moulds and ladles, used in metallurgy or in metal foundries	470,264.00	0.37	686,009	0.75	264,560.00	0.50

Source: Foreign Trade Statistics of the Philippines, PSA

As shown in Table 8, Japan, Republic of Korea, the Peoples Republic of China, and the United States of America are the top suppliers of Philippine dies and molds in 2017.

Table 8. Top Suppliers of Philippine Dies and Molds Requirements (CIF Value in US$), 2015-2017

Commodities	2017		2016		2015	
	Value	% Share	Value	% Share	Value	% Share
Total	126,026,062.00	100.00	91,813,322	100.00	52,644,239.00	100.00
Japan	29,710,208.00	23.57	26,288,050	28.63	14,038,388.00	26.67
Republic of Korea	21,574,454.00	17.12	8,556,188	9.32	4,821,049.00	9.16
People's Republic of China	21,129,971.00	16.77	21,580,048	23.50	11,250,760.00	21.37
United States of America	11,018,283.00	8.74	9,110,329	9.92	4,437,074.00	8.43
Malaysia	8,161,633.00	6.48	4,116,981	4.48	2,686,020.00	5.10
Taiwan	7,986,031.00	6.34	4,010,595	4.37	3,237,927.00	6.15
Hong Kong, China	6,912,020.00	5.48	4,708,083	5.13	3,229,552.00	6.13
Singapore	5,604,757.00	4.45	4,393,414	4.79	2,858,327.00	5.43
Thailand	3,220,303.00	2.56	1,423,030	1.55	808,146.00	1.54
Germany	2,723,886.00	2.16	2,851,385	3.11	2,969,091.00	5.64

Source: Foreign Trade Statistics of the Philippines, PSA

Figure 17 shows that Philippine imports of dies and molds and other related products exceed the Philippine exports to a high degree, a situation that reflects a domestic die and mold sector that is very much import-dependent. This characteristic makes the sector, from an economic viewpoint, brittle because it will be susceptible to multiple external forces such as exchange rate, tariff, customs fees, and the demand in the international market. The current imports and exports status of the local die and mold sector is in a dependency state. The observation of economic theorist like Raul Prebisch featured this phenomenon. In Prebisch (1993; Prebisch & Pollock, 2006) view, primary commodities, parts, and components from poorer countries are exported to rich countries, which will, in turn, be transformed into consumer products to be sold back again to poorer countries. The "value-added" in the manufacturing process is significantly higher than the mark-up value for primary commodities, parts, and components. This cycle will even make it hard for emerging economies to develop because their export will not be able to compensate for their higher import cost (Ferraro, 2008).

On the other hand, this information also shows opportunity for the die and mold sector to improve or expand because our country has a high demand for dies, molds and other related tooling and products. The industry needs to foster a better economic model to boost Philippine industrialization as envisioned by the present administration (Villar, 2018).

The same observation is apparent in "The Philippine Tool and Die Industry: A 2006 Study" conducted by the MIRDC. In terms of ratio, Figures from 2015 to 2017 significantly improved from the last study which includes data from 2003 to 2005. In 2005, the ratio of export over import is 1:14 (MIRDC, 2006); in 2015, 1:4; in 2016, 1:10; and in 2017, 1:7. In 2015, the exchange rate is 45.5028 Philippine Peso (PHP) per 1 US Dollar (USD), while in 2017, it rose to 50.4037 PHP per 1 USD (Bangko Sentral ng Pilipinas). This increase in value is a big burden to an import-dependent industry.

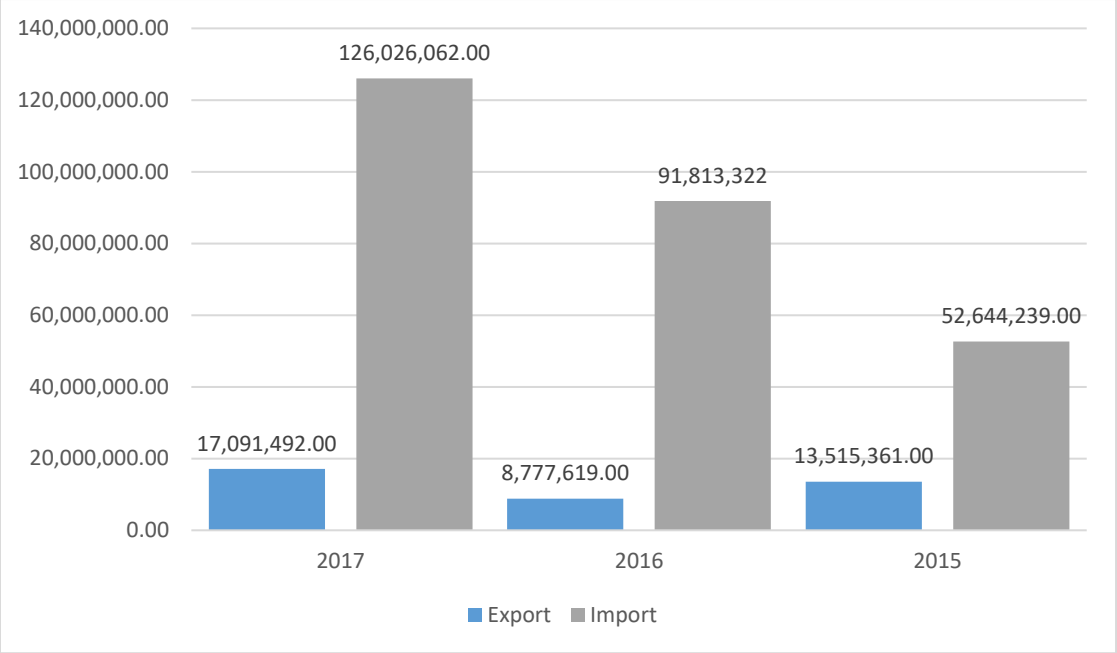


Figure 17. Philippine Import and Export of Dies and Molds

4.4. Sectors Served

In reference to Figure 18, the major sectors being served by the die and mold makers are industrial machineries, automotive or transportation, and semiconductor or electronics. Based on the interview with respondent-companies, the die and mold sector commands a favorable margin of profit catering to the semiconductor industry. The die and mold companies specializing in semiconductor enjoy advantages, such as smaller space requirement, smaller machines and equipment, and a lower inventory of raw materials; but requires a higher degree of precision, specialized tools and equipment, and heavy dependency on highly skilled machinists and technicians.

Die and mold companies serving the industrial machinery and automotive industry cannot command higher mark-up value due to stiff competition. The advantage of companies serving these sectors is that they enjoy higher volumes of die and mold requirements from their clients. The downside is that they require a larger space for machinery and equipment. Storage and transportation of raw materials and output products also contribute to increased space requirements and operational cost.

The die and mold sector serves a wide variety of industries in terms of scope and specialization. This characteristic is one of the reasons why most of the respondent-companies feel that there is minimal market competition in the sector. The die and mold sector in the Philippines is capable of serving other industries, such as food, construction, metalworking, appliance manufacturing, agriculture, medical, gifts, toys and houseware, aerospace, shipping, mining, elevator/escalator, electrical distribution, electrical, and education industries.

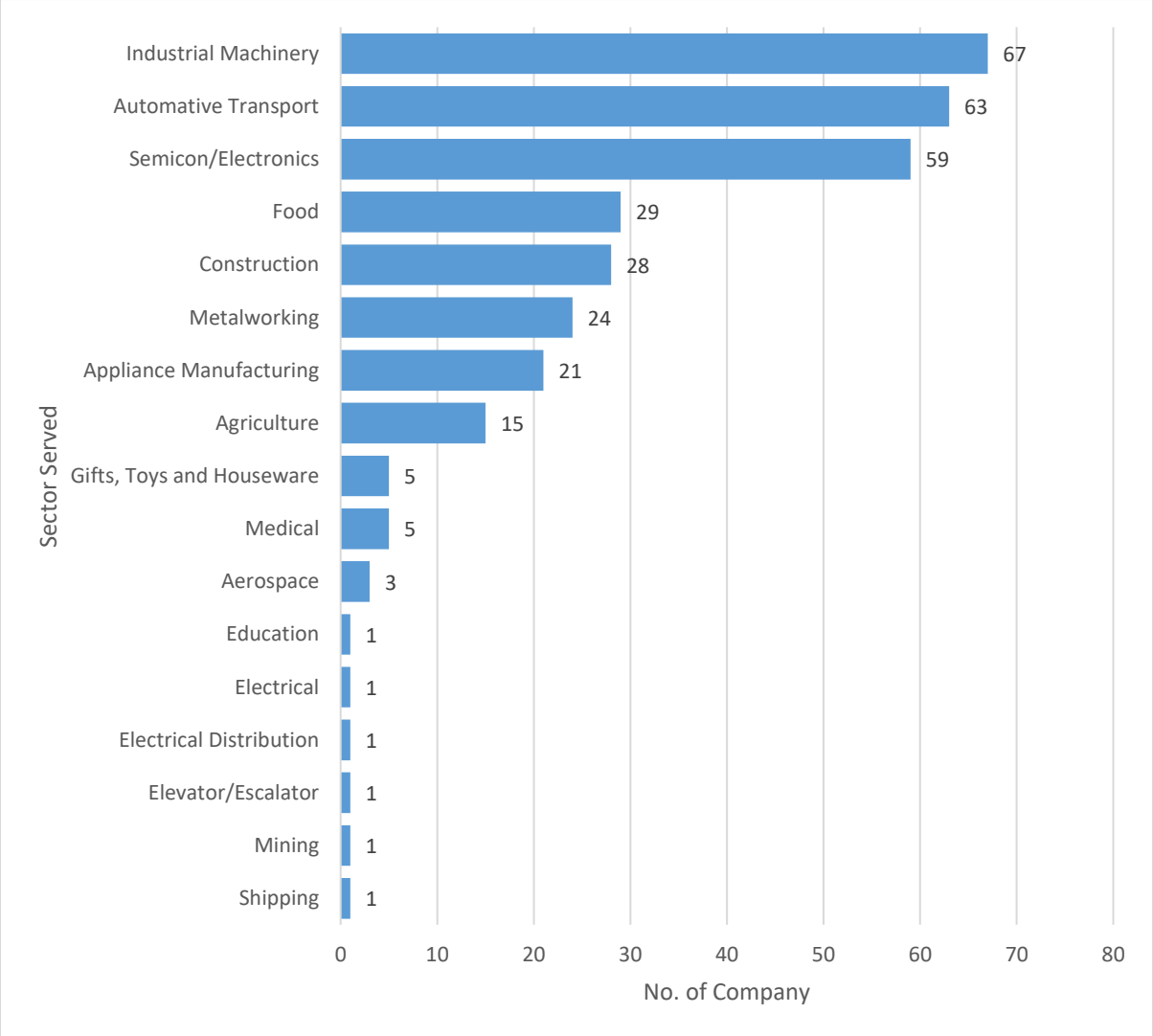


Figure 18. Sectors Served (Multiple Responses)

4.5. Competition in the Target Market

Most of the respondent-companies perceive that competition among the die and mold makers are just slight to no competition at all as presented in Figure 19. Based on interviews as well as inputs during the FGD, the sector is highly specialized and diversified. Very few companies compete within the same market segment. Those that specialize in the semiconductor are not competing with those that specialize in automotive or mining. The die and mold industry has its own niche in the metals industry. Individual companies are aware of each other's expertise. This knowledge and familiarity help the sector to work with one another rather than compete.

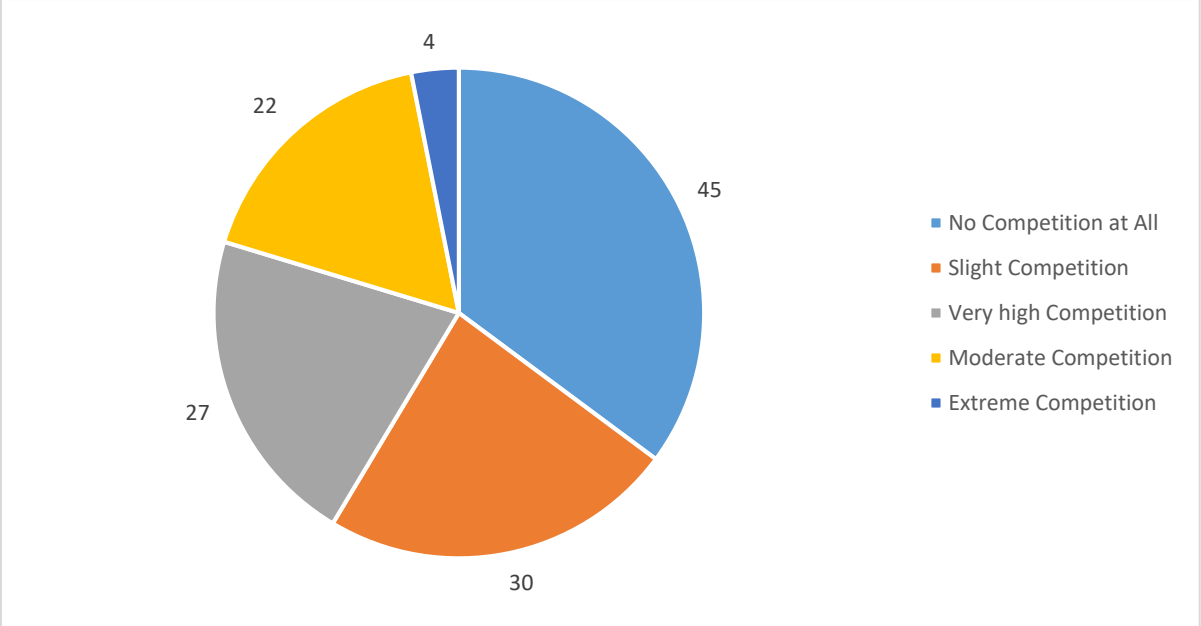


Figure 19. Competition in the Target Market

4.6. Product Lines/Services Employed

Figure 20 shows the most common product lines of the respondent-companies. As shown, 48 out of 128 respondent-companies have end-products; most of these companies are producing plastic or rubber products or components. This is a good indicator of the vital role of the die and mold sector in the productivity of other industries.

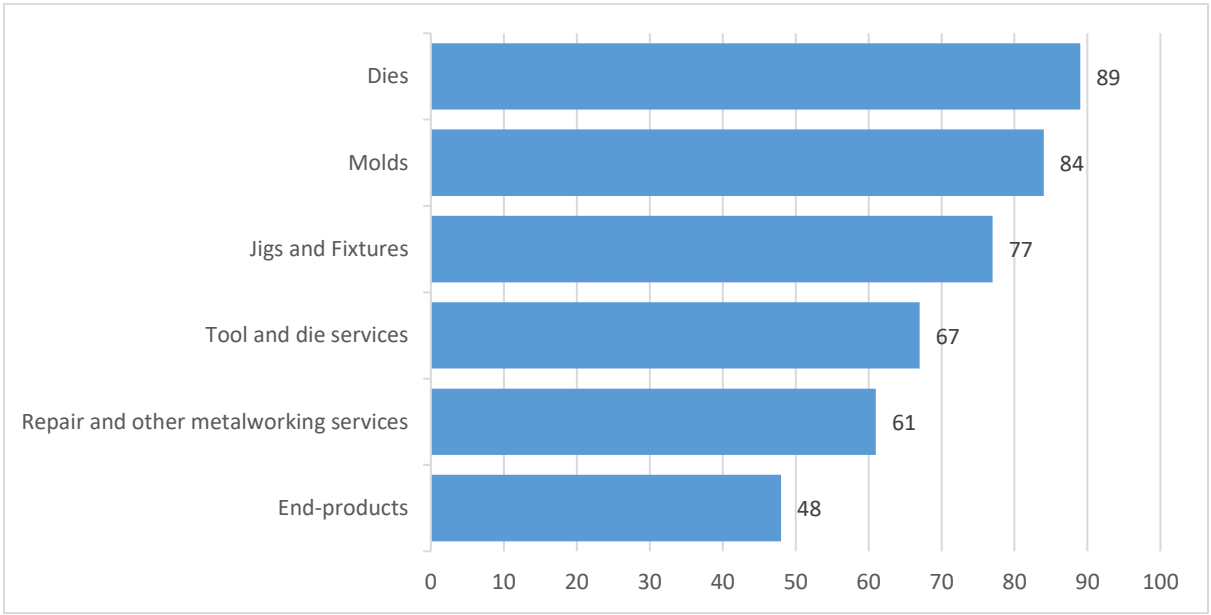


Figure 20. Product Lines/Services Employed by the Die and Mold Sector (Multiple Responses)

4.7. Customers' Quality Requirements

As reflected in Figure 21, almost all of the respondent-companies stated that their customers are particular to dimensional and other specifications of the dies and mold. There are customers that require testing of their dies and molds. Other requirements include quality assurance or ISO certification, metal composition certification from the suppliers, hardness, as well as surface plating and finishing.

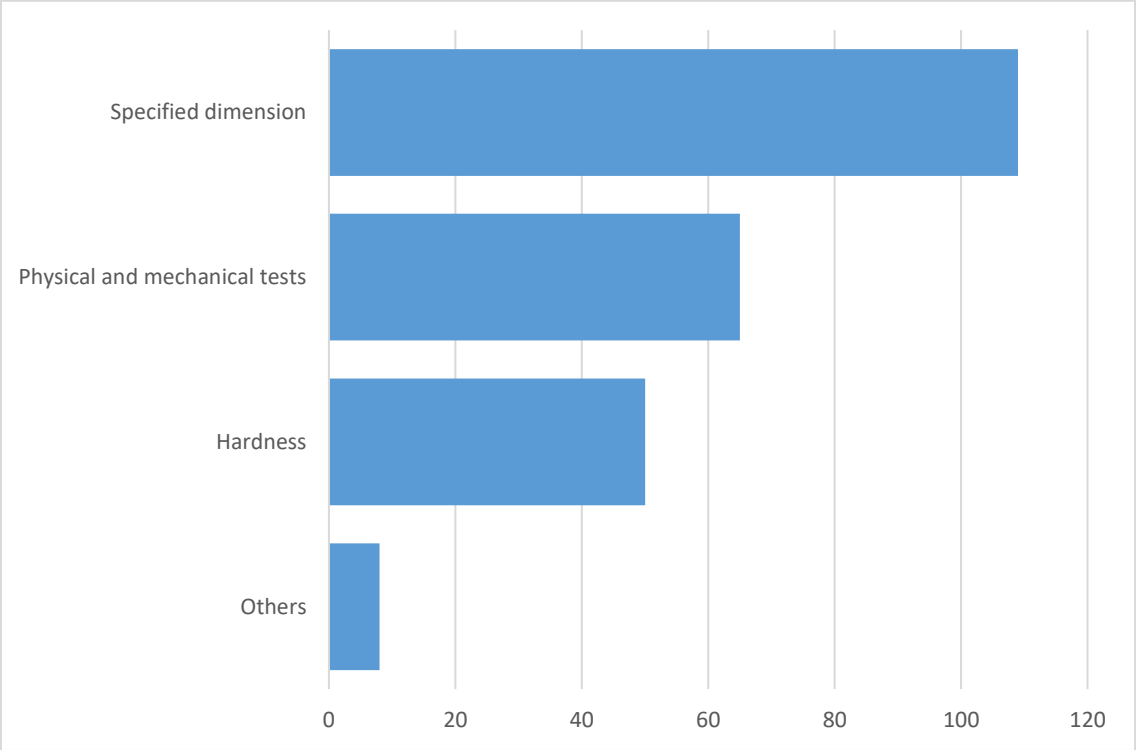


Figure 21. Customers' Quality Requirements (Multiple Responses)

4.8. Perception about the Status of the Philippine Die and Mold Industry

As shown in Figure 22, 84% of the respondent-companies are optimistic in their perception of the status (2018-2022) of their industry. The respondent-companies are still confident that the industry can sustain its operations and support its growth targets. Those that are uncertain and pessimistic are companies whose businesses are affected by foreign competition and cheaper China products such as those catering to the requirements of the mining industry. These companies are in the process of shifting to other industries. Those whose perception depends upon other circumstances are companies very much affected by changes in demand from the industries they are serving such as those catering to the automotive industry. When big car companies, e.g., Ford Philippines, move their manufacturing location to other countries, local companies supplying their parts and components requirements are severely affected.

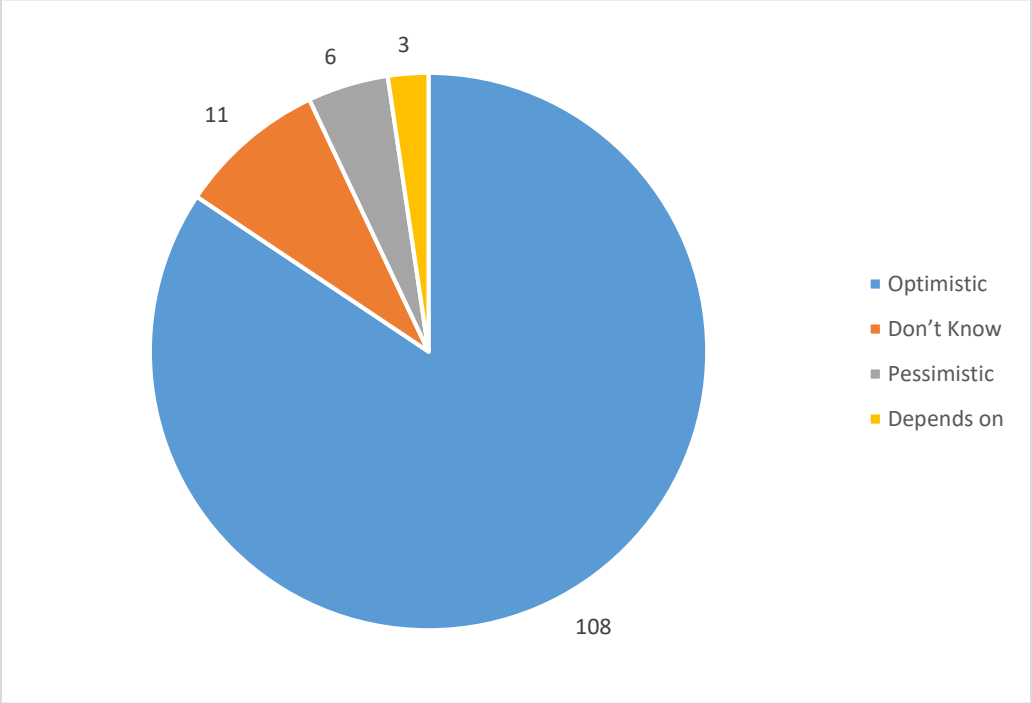


Figure 22. Perception about the Status of the Philippine Die and Mold Industry, 2018-2022

Respondent-companies prefer tool steel, stainless steel, plates, sheets, bars, aluminum, and mild steel as raw materials (see Table 9). Generally, respondent-companies purchase their raw materials from local suppliers who are direct importers. According to the respondent-companies, they have to maintain an inventory of raw materials because of occasions where there are limited supplies in the local market. Raw materials purchase orders are made in advance to avoid delay in the processing of job orders. Some companies who do not want to wait and compete with local suppliers directly import their input materials from international suppliers. Usually, companies import tooling such as carbide, tungsten, and titanium. The volume of raw materials consumed by respondent-companies depends on the sector they are serving. Dies and molds for semiconductors are usually small and utilize a small amount of raw materials. Dies and molds for automotive and industrial machinery are large, where the weight of a single die can reach over a ton. Plastic and rubber are included in the list to identify the demand for die and mold products and services in the plastic and rubber products manufacturing market.

Table 9. Source and Volume of Raw Materials

Raw Materials	Source of Raw Materials*		Volume of Raw Materials**		
	Local	Imported	No. of tons from LOCAL sources	No. of tons from FOREIGN sources	Total no. of kg/tons
Tool Steel	57	0	113.8	0	113.8
Stainless Steel	54	3	253.4	0	253.4
Plates/Sheets /Bars	53	4	1,187.10	0	1,187.10
Aluminum	51	2	64.6	1	65.6
Mild Steel	49	3	198.6	12,000.00	12,198.60
Cold Rolled Steel (CRS)	46	1	22.4	0	22.4
Shafts & Rods	41	0	1,110.40	0	1,110.40
Copper	37	1	65.7	0	65.7
Brass	29	2	10.2	1	11.2
High Speed Steel	28	0	3.7	0	3.7
Pre-Hardened Steel	26	1	500.4	0	500.4
Plastic	17	2	16.5	1,000,051.90	1,000,068.40
Rubber	11	1	0	4	4
Ductile Iron	11	0	0.6	0	0.6
Grinding material	8	0	0.2	0	0.2
Others	0	11	1.0	420.8	421.8

*Multiple Responses
**Open Ended Responses

5. RESEARCH AND DEVELOPMENT

5.1. Research and Development Involvement and Requirements

As depicted in Figure 23, the majority of the respondent-companies do not engage in research and development (R&D). For PEZA companies, foreign counterpart handles the R&D function. For most die and mold companies, they follow the specifications provided by their clients in the technical drawings. Those that have R&D are also involved in manufacturing or employ other processes, such as stamping, plastic injection, and composite metal injection. Only a handful requires a patent or intellectual property registration or have produced new process, new product, invention, or discovery. Generally, their involvement in R&D is in the creation of prototype dies and molds. Respondent-companies usually outsource testing and analysis of materials and products to companies or institutions with analysis and testing facilities such as the DOST-MIRDC.

For needed technologies, some respondent-companies request assistance in the field of robotics and mechatronics. Others request assistance in the area of fabrication and/or training for on-site turbine repair, advanced coating for cutting tools, diamond film coating process, and rubber mold fabrication. They also suggested fluid dynamic software training and assistance for upgrades and minimization of trial and error.

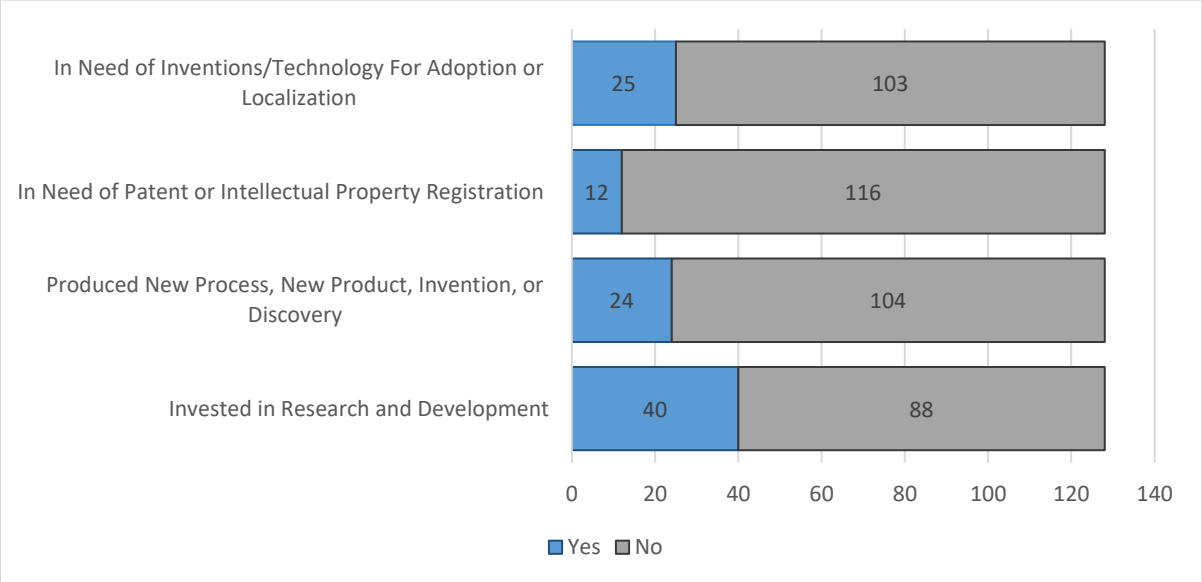


Figure 23. Involvement in Research and Development

5.2. Suggested R&D Programs, Training Needs, and Other Related Programs

Below are the lists of R&D programs, training needs, and other related programs to improve the status of the die and mold sector in the Philippines as suggested by the respondent-companies.

5.2.1. R&D Programs

The suggested R&D programs are as follows:

- Advance agriculture implements/equipment
- Aging testing
- Automation of machines
- Designing power plant turbine
- Software development and training to maximize machine efficiency
- Development of an affordable process for identification of metal composition. With a problem like blowholes, it needs technology to identify the proper properties of materials. Most of the time, properties of metals are not indicated, and X-ray of materials is expensive.
- Development of heavy-duty bolts and nuts
- Development of local injection simulation software
- Development of new equipment on precision cutting
- Development of rubber compound
- Development of surface finishing processes such as die and mold mirror polishing finish
- Development of technology/training on mold making of connectors of syringe like in Germany and Switzerland
- Development of submarine gating processes and technology
- Research on automotive parts to minimize the use of gasoline and to address air pollution
- Diamond film coating technology
- Hot runner mold technology
- Metal injection molding technology
- Metals 3D printing
- Micromachining technology
- PCV design and prototyping
- Precision measurement technology at 24 microns accuracy
- Rubber coating process
- Resins production
- Program to improve the facilities for hot chrome plating and sandblasting
- Prototyping design in muffler airflow including airflow software development

- Research on sourcing of raw materials and supply chain management
- Robotics and mechatronics for shop automation
- Rubber mold design development
- Surface treatment technology particularly chemical etching
- Technology to prolong the utilization rate of dies and molds. Hardness quality of mold in the Philippines is noticeable compared to other countries. In comparison, local mold can last only ten years while imported molds can last 20 years, particularly from European countries.
- Coil testing technology
- Wire cutting technology

5.2.2. Training Needs

The various training needs of the die and mold sector are as follows:

- Advanced machining technology and processes such as 5-axis machining
- AutoCAD, reading of technical drawings
- CAD/CAM engineering training
- Character Development
- CNC operations, machining, welding, and other technological enhancement
- Computer Aided Designing – Computer Aided Manufacturing (CADCAM)
- Constant training/skills development especially for our new graduates in machining
- Continue support on TESDA
- Continuous training on mold design
- Dimensional metrology
- Good manufacturing practices/5s
- Internal training in different metalworking processes
- Leadership and workplace safety training
- Progressive molding design training
- Rubber mold designers/fabricators training
- Seminar and training of safety officer and first aid responder
- Training in design making, parameters setting, and technical understanding to avoid trial and error
- Training in determining metals classification
- Training in improving employees attitude
- Training on advanced mold assembly
- Training on Die and Mold Designing
- Training on full proof mold designing
- Training on heat treatment of die and mold
- Training on new equipment on precision cutting

- Training on technical drawing and interpretation of drawings
- Training on troubleshooting and analyzing of problem specific in die and mold
- Cutting Tools familiarization and classification
- Different CAD/CAM software training
- Mold flow simulation software
- Plating requirements for specific material

5.2.3. Related Programs Needed by the Die and Mold Sector

Aside from R&D and training requirements of the die and mold sector, other identified requirements are as follows:

- Provision of actual machines to be used during training or study
- Adoption/benchmarking of new technologies that are already available abroad
- Marketing and advertisements for newly produced or developed technologies
- Seminars and trainings on new die and mold fabrication technology
- Create incentives that will encourage young people to engage in die and mold industry
- Create programs to locate local sources of raw materials to lessen production cost
- Development of local advance machines (CNC) supported by government
- Establishment of a school specializing on die and mold
- Evaluation of the salaries of toolmakers to minimize fast turnover
- Government initiated development on the mold making process to match the quality of molds from China
- Government intervention on business-academe tie-ups
- Government intervention on the plight of Philippine skilled labor force
- Government subsidies on machines and equipment
- Marketing of products and services of the die and mold sector
- Program to improve the cost and quality of raw materials
- Programs to localize metal inputs/equipment
- Standardization for mold making

5.3. DOST's Investment Incentives Initiative

Since the initiation of the Small Enterprise Technology Upgrading Program (SET-UP) in 2002 (Asma, 2015), it has become a continuing program of the DOST which aims to improve the micro, small, and medium enterprises' (MSMEs) capabilities and productivity by introducing technological innovations in their operations. DOST is extending assistance through granting of loans with zero interest to MSMEs to allow them to upgrade their machines and equipment. It also extends technical support through training and consultancy services (DOST-NCR, 2019).

Based on the data gathered from a pool of 128 respondent-companies, only 42 or approximately 33% have heard of the DOST SETUP program, and only 17 or about 13% have availed of the grant (see Figure 24). During the interview with respondent-companies, most of those who have not heard of the DOST SETUP program want to upgrade their machines and equipment. Some of the micro and small shops even resorted to the traditional street loans like Five – Six to purchase additional tools and equipment like second-hand lathe or milling machines with higher capacity. These micro and small shops find it difficult to produce required documents to avail of bank loans which offer lower interest. Companies who have heard of the DOST SETUP program but did not avail of the financial assistance simply avoid having additional loan obligations, even one that provides no interest. Some of these companies do not wish to upgrade at all because of the fear that no one will continue the business because their children chose other careers rather than a technical one.

On the other hand, some companies who have availed of the DOST SETUP program and who intend to renew their loans to further improve their operation became disinterested because, according to them, the application process is tedious even for those seeking renewal of financial assistance.

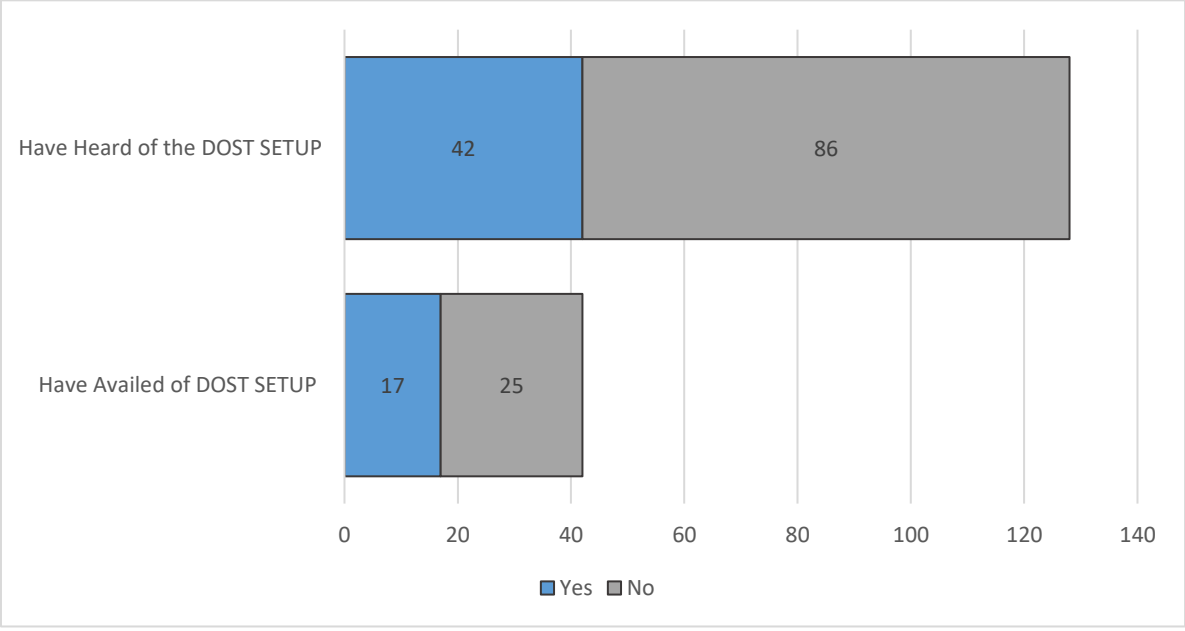


Figure 24. Die and Mold Shop who Availed of DOST SETUP

The DOST must intensify the promotion and implementation of the SETUP program. Based on the testimonies of respondent-companies who were benefited by the program, it enabled them to expand their clientele and to accept job orders that were previously beyond their capabilities. The program provided them with the opportunity to upgrade their equipment and facilities.

6. ANALYSIS AND RECOMMENDATIONS

6.1. Production Problems, Issues, and Concerns of Local Die and Mold Shops

Figure 25 shows the common production problems, issues, and concerns encountered by the respondent-companies in their operations. Human resource concern is the most common. There is a very high rate of attrition of skilled workers especially those who specialized in the design and fabrication of dies and molds. Based on the interviews conducted and the qualitative responses of respondent-companies, most workers will acquire one or two-year experience in the Philippines and then apply for overseas work. The Philippine die and mold sector is becoming a training institution for the international metalworking industry.

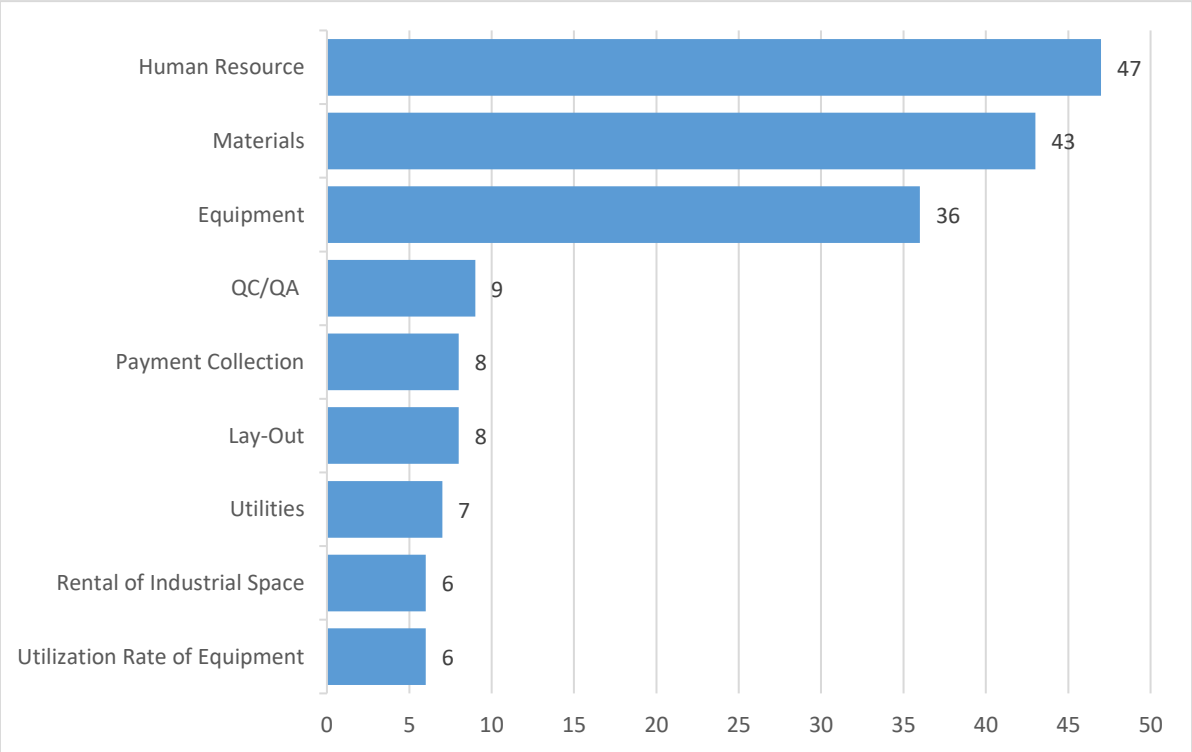


Figure 25. Production Problems, Issues and Concerns

Concerns and issues on raw materials are also common among the respondent-companies. The lead time for the availability and delivery of raw materials

is getting longer forcing companies to maintain higher inventory to avoid production downtime. This issue further strains the financial resource of the companies. In addition, the respondent-companies are complaining about the price and varying quality of local raw materials. There is a standard price per part or component maintained by global manufacturers. It is difficult for the Philippine metalworking industry to compete globally especially in terms of price when compared to dies and molds from China, Taiwan, or Thailand.

Equipment is also a primary concern for the industry. Most lathe and milling machines owned by the respondent-companies are second-hand. As observed by the survey team during plant visits, some machines are even remnants of the American colonial period in the Philippines. Though these machines are time-tested in terms of durability, incidences of downtime because of mechanical failures become more and more frequent. According to the respondent-companies, new and upgraded machines are costly, while cheaper machines are not durable and reliable.

Other minor concerns are the establishment of quality control systems, rental fees and space, the utilization rate of equipment, high cost of utilities particularly on power or electricity, and payment collection scheme with clients. The respondent-companies relayed that suppliers of raw materials observe a 30-day payment collection period from delivery of materials, while clients ask for a 60- to 90-day payment period as required by their accounting system. The two-month difference also adds up to the cash flow problem of respondent-companies.

The die and mold sector in the Philippines has a lot of potential based on the data gathered through this study and statistics from the PSA, but it also has problems and concerns. The demand for die, mold, and other related tools and products is steadily increasing. The Philippine die and mold sector needs to align its current capabilities and address its shortcomings with the present market conditions to take advantage of the opportunities available for the sector. Presented below are the SWOT and PESTEL Analysis of the Philippine die and mold sector.

6.2. Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

Strengths and weaknesses of companies are internal factors that companies have control of, while opportunities and threats are external factors that companies have no control of, but both affect their operations.

Responses for strengths and weaknesses are chosen from six categories - very strong, strong, neutral, weak, very weak, and none/not applicable depending on the respondents' perception on the status of their companies pertaining to the different factors provided.

Table 10 shows the strengths and potential weaknesses of the respondent-companies. As ranked, the primary strengths are their reputation, quality of products and/or services, and their location. Since die and mold companies have specific specialization, their reputation among manufacturing industries is well established, especially those companies that have existed for more than 10 years. Connected to

an established reputation is the quality of products and/or services. During the interview, it was shared by the respondent-companies that they experienced very few reworks or rejections related to die and mold design and fabrication. Company location also is seen as a strength because clients prefer to outsource jobs to companies within or proximate to their locality.

Table 10. Strengths and Weaknesses of Die and Mold Sector

Strengths/Weaknesses	Mean Score	Verbal Interpretation	Rank
Reputation	4.38	Strong	1
Quality of Products and/or Services	4.34	Strong	2
Location	4.09	Strong	3
Production Efficiency	4.07	Strong	4
Internal Quality Control System	4.02	Strong	5
Facilities and Equipment	3.97	Strong	6.5
Market Reach	3.97	Strong	6.5
Output Capacity	3.96	Strong	8
Financial Resources	3.88	Strong	9
Marketing Strategy	3.83	Strong	10
Pool of Skilled Manpower	3.80	Strong	11
Internal Research and Development	3.40	Neutral	12

The significant weaknesses of the respondent-companies are internal research and development, pool of skilled manpower, and marketing strategy. Though the mean score of these items falls under the strong and neutral category, the scores can be improved. Otherwise, these weaknesses can be potential problems for the sector. During the interview, some of the respondent-companies still resort to trial and error in the prototyping stage resulting in considerable wastage in labor hours and materials. The Human Resource Department of some respondent-companies also finds it difficult to hire a skilled workforce. This condition forces them to accept individuals with rudimentary skills and training them consumes a lot of labor hours for both the trainees and trainers diverting needed hours for production. Most of the respondent-companies categorized as small and medium have no marketing office; company owners usually handle the marketing function. Some micro companies rely entirely on walk-in clients and referrals.

Responses for opportunities and threats are also chosen from six categories – fast improving, improving, unchanging, declining, fast declining, and none/not applicable depending on the respondents' perception on the experiences of their companies in relation to outside forces relevant to their operations.

Table 11 shows the opportunities and threats of respondent-companies. Based on the ranking, the opportunities to take advantage of are the perceived satisfaction of their customers, the demand for their products and/or services and the demand for complementing products and/or services. Almost all respondent-companies are unanimous in saying that their customers are more than satisfied with their work

resulting in continuous patronage of their products and services. During the period of this study, the respondent-companies also perceived that demands for dies, molds, and other related products and services are also increasing. One reason for the increase in demand is complementing products and services. Metalworking companies are continuously in need of die and mold services, such as those for stamping and forging operations. The plastic and rubber products industries also contribute to this demand.

Possible threats are the tax policy, foreign competitors, and substitute products and/or services. Though the mean scores show that the threats remain unchanged, these can be sources of potential problems if not properly monitored. Most companies view the new tax policy or the Tax Reform for Acceleration and Inclusion (TRAIN) program as a nuisance. On the one hand, the TRAIN places the industry on a disadvantageous position in terms of its effect on the price of raw materials, the cost of their final output, and its impact on the demand for complementing products and services. Moreover, respondent-companies view the next stage of the implementation of the TRAIN law as an immediate threat which might affect the benefits extended to PEZA-located companies. Foreign competitors, particularly dies and molds coming from China, are seen as a significant threat. China companies enjoy a notable advantage over local companies: they have their government's support in terms of tax incentives and their raw materials are considerably cheaper. The Philippines is not alone in this struggle to survive in the metals industry. Even the United States' metals industry is struggling to compete in a China-dominated metals and steel industry. Chinese industry enjoys advantages in export rebates and quotas, subsidized financing, weak labor, safety, and environmental regulations, and the likes. There are also multiple countervailing and anti-dumping cases against Chinese steel products in the United States (Tang, 2010)

Table 11. Opportunities and Threats of Die and Mold Sector

Opportunities / Threats	Mean Score	Verbal Interpretation	Rank
Customer Satisfaction	4.18	Improving	1
Demand for Products and/ or Services	3.87	Improving	2.5
Complementing Products and/or Services	3.87	Improving	2.5
Market for Products and/or Services	3.85	Improving	4
Supply Chain/ Raw Materials	3.75	Improving	5
Partnership/ Linkages	3.57	Improving	6
Government Assistance & Subsidies	3.38	Unchanged	7
External Research and Development	3.30	Unchanged	8
Local Competitors	3.28	Unchanged	9
Substitute Products and/or Services	3.20	Unchanged	10
Foreign Competitors	3.17	Unchanged	11
Tax Policy	2.86	Unchanged	12

Manufacturers prefer to import large-sized dies and molds from China because these are cheaper according to respondent-companies during the interview. During

the FGD conducted by the Center, substitute products for local dies and molds are second-hand or used dies and molds coming from other countries notably China. Though second-hand dies and molds are a threat in local die and mold production, they are also seen as an opportunity because second-hand dies and molds need restorations and repairs.

6.3. Political, Economic, Social, Technological, Environmental, and Legal (PESTEL) Factors Analysis

The purpose of PESTEL is to produce knowledge and insight to guide strategic decision-making (SIMPATHY Consortium, 2015). It is linked to the SWOT analysis because it provides external environment assessment to determine possible opportunities and threats. In a fast-changing global condition, PESTEL can help a company to have a certain degree of preparedness for upcoming changes that might affect their operations. Outcomes of PESTEL analysis are essential for risk management and expansion feasibilities.

6.3.1. Political factors

According to Dr. Karl Deutsch (1970), politics is the making of decisions by public means, that is, by elections, referenda, laws, court judgments, administrative regulations and decisions, and the like. Political factors (Unicef, 2015) may include the following:

- Government policies: National, state/provincial, local, other
- Government resource allocations
- Stakeholder needs or demands
- Lobbying/campaigning by interest groups: local, national, and international. Influences/pressures from international actors, e.g., other governments, international organizations, etc.
- Armed conflicts
- Changes in power, influence, and connectedness of key relevant actors/groups
- Expected direction of future political change: future policy prospects; upcoming elections and the possible change in government (local, state, national) and its consequences; other relevant political trends

Table 12. Political Factors and their Potential Effects to the M&E Industries

Issues/Factors	Potential Effects to the M&E Industries
The Board of Investments (BoI) priority industries are manufacturing, agriculture, fishery, forestry, strategic services, innovation drivers, mining, renewable energy, and tourism.	M&E sectors related or aligned to the priority industries mentioned in the BoI Investment Priorities Plan (IPP) specifically on strategic services can lobby for government assistance and subsidies.

"Strategic services" includes aircraft maintenance, repair and overhaul, and state-of-the-art engineering, procurement and construction services. "Innovation drivers" include research and development that lead to commercialization of new technologies as well as business incubation.	
According to the BoI "there is a deliberate policy to shift investments to the countryside." There, the BoI will specify criteria that manufacturers need to meet to qualify for incentives, such as requirements on employment generation, investment, and technology transfer. What is clear in the IPP, however, is that "except for modernization projects, only projects located outside Metro Manila may qualify for registration" with the BoI for incentives (Canivel, 2017).	Metal and allied industries outside of Metro Manila will receive potential assistance to upgrade their technology and boost their production output.
DTI Roadmap includes developing the Auto and Machinery Industry by 2022-2025	The administration will implement programs in developing the Philippine automotive and machinery industry.

6.3.2. Economic factors

Prof. Robert Schenk (2003) defined economics as a social science that examines how people choose to use limited or scarce resources in attempting to satisfy their unlimited wants. Economic factors (UNICEF, 2015) may include the following:

- Economic situation: local, national, regional, global
- The economic situation of specific relevant communities or population groups (including employment, taxation, mobility, etc.)
- Economic situation and prospects of any relevant industries
- Infrastructure: local, national, and others
- The financial situation of key partners or other relevant entities
- Availability of private sector resources relevant to the project/initiative
- Expected direction of economic change: prevailing economic trends, trade and market cycles; expected economic interventions by governments and their consequences; other relevant economic trends

Table 13. Economic Factors and their Potential Effects to the M&E Industries

Issues/Factors	Potential Effects to the M&E Industries
The Economy of the Philippines is the 40th largest in the world, according to the 2018 International Monetary Fund (IMF) statistics based on GDP. The Philippines is considered a newly industrialized country, which has an economy transitioning from one based on agriculture to one based more on services and manufacturing. The Gross Domestic Product per capita in the Philippines was last recorded at 7599.19 US dollars in 2017 when adjusted by purchasing power parity (PPP). The GDP per capita in the Philippines, when adjusted by Purchasing Power Parity, is equivalent to 43 percent of the world's average. GDP per capita PPP in the Philippines averaged 4969.71 USD from 1990 until 2017, reaching an all-time high of 7599.19 USD in 2017 and a record low of 3796.90 USD in 1993. Source: Trading Economics On the forecast by Global Construction Perspectives and Centre for Economics and Business Research, the Philippines will enter the world's top 25 economies by 2032. Source: World Economic League Table 2018	Positive economic feedback from the IMF and other developing economy monitoring institutions will boost the confidence of foreign and local investors to devote more financial resources to the country that will benefit the manufacturing industry. Manufacturing opportunities directly drive the M&E Industry, which is one of the major contributors to the economic development of the country. The manufacturing industry needs competent work force with the required knowledge and skills to increase productivity.

6.3.3. Social factors

Emile Durkheim (2014) defined social factor as the reason why people within a society seem to do the same basic things, such as where they live, what they eat, and how they interact. Social factors (UNICEF, 2015) may include the following:

- Demographics and population trends
- Health among populations
- Education levels
- Access to essential services
- Public perceptions (of an issue, an initiative, an organization or other actors).

- Relevant customs, traditional beliefs, attitudes (e.g., towards children, adolescents, gender, etc.)
- Media views
- Role models, celebrities, spokespersons
- Knowledge, attitudes, and practices of a particular population group (with regard to a relevant issue)
- The potential for knowledge exchange
- Migration (which also has political, economic and legal dimensions)
- Major relevant events (upcoming or already happening) and cultural trends
- History, to the extent that it affects social attitudes and perceptions
- Factors in social identity, e.g., religious, socio-ethnic, cultural, etc.
- Dynamics of how social change happens in the given context
- Management style, staff attitudes, organizational culture (within a major relevant organization)
- Expected direction of social change: broad trends in change of social attitudes (e.g. towards a relevant issue); other relevant social trends
- Credibility of information sources or communication channels (e.g. media outlets, well-known individuals, etc.) among a target population. Reach of information sources/communication channels among a target population

Table 14. Social Factors and their Potential Effects to the M&E Industries

Issues/Factors	Potential Effects to the M&E Industries
Facebook and YouTube with over 1B unique users per month. According to Hootsuite and United Kingdom-based consultancy We Are Social Ltd., Filipinos spend more time on social media sites than anyone else in the world, going online roughly four hours and 17 minutes a day. Source: inquirer.net	Opportunity to market M&E products and services Promote products and services online with ease Enable market expansion by providing a more accessible platform for coordination and transmittal of designs and prototypes Faster business transactions with partners in industry and with clients
According to the PSA, engineering and engineering trades is in 3rd place among the most popular academic fields among college graduates based on the 2010 Census of Population and Housing. Source: PSA Statistics	Education remains to be the hope of the marginalized to balance social inequalities. Engineering continues to be one of the top choices among students, ensuring the country's continuous supply of qualified workforce in the M&E industries.

6.3.4. Technological factors

Technology refers to the techniques and knowledge in utilizing raw materials to produce food, tools, clothing, shelter, means of transportation, and weapons (Macionis, 2006). Technological factors (UNICEF, 2015) may include the following:

- Population groups' access to technologies
- Patterns of use of existing technologies (which may be changing, e.g., evolving use of mobile phones)
- New technologies that could impact the context significantly or that could be used to achieve objectives
- Technologies and related infrastructure/manufacturing / importing requirements for an initiative to succeed
- Possible replacement/alternative technologies
- Potential for innovation
- Technology transfer, access, licensing issues, other issues related to intellectual property rights
- Foreseeable technological trends: economic and social impact of adoption of existing technologies; the rate of technological change; other technological trends

Table 15. Technological Factors and their Potential Effects to the M&E Industries

Issues/Factors	Potential Effects to the M&E Industries
The Philippines has an average fixed-line broadband speed of 5.5 megabits per second (mbps) which is the slowest in the Asia-Pacific region in 2017, while the fastest was South Korea, with 28.6 mbps. Source: Statista.com	Mitigates the Philippine M&E industries' competitive advantage in promoting products and services due to slow internet speed. The internet makes business easy with e-commerce and other online activities which requires faster connectivity. Internet helps businesses for fast and reliable delivery of goods and services to their customers. Poor internet speed could negatively impact on the delivery of products and services.
The USA continues to dominate R&D spending with an allotment of estimated $19,471Bil or 2.8% of its GDP in 2018. China ranks 2nd with R&D spending of $24,102Bil or 1.97% of their GP. The Philippines belongs to the countries with low R&D spending and ranks 59 in the world with R&D spending of $1.47B in 2018 or about 0.77% of the country's GDP. Source: 2018 Global R&D Funding Forecast The Philippine is rank 73rd in the Global Innovation Index 2018. Source: Global Innovation Index 2018	Majority of the SMEs under the M&E industries are not undertaking R&D. Low budget on R&D stall the productivity and innovative output of the industry. Countries with high R&D spending enable them to produce and sell the latest advanced technology in the market.

6.3.5. Environmental factors

The environment is the totality of all the external conditions affecting the life, development, and survival of an organism. An environmental indicator is a parameter or a value derived from parameters that points to, provides information about and/or describes the state of the environment, and has a significance extending beyond that directly associated with any given parametric value. The term may encompass indicators of environmental pressures, conditions, and responses (OECD, 2008; United Nations, 1997). Environmental factors (UNICEF, 2015) may include the following:

- Contextually relevant environmental issues: global (e.g., climate change), regional (e.g., flooding, droughts, etc.) or local (e.g., contamination of water supplies)
- Relevant environmental regulations or requirements (e.g., for assessing potential climate change impacts of specific activities, conforming to national or international environmental regimes, etc.)
- Environmental impacts of planned or ongoing operations
- Climate, seasonality, potential impacts of weather
- Trends or expected future developments in the environment
- Geographical location

Table 16. Environmental Factors and their Potential Effects to the M&E Industries

Issues/Factors	Potential Effects to the M&E Industries
The Philippines was fourth in the world among countries hit by the highest number of disasters over the past 20 years, according to 2015 data of the United Nations Office for Disaster Risk Reduction (UNISDR).	Investors might be discouraged to invest their capital in areas with high environmental risk such as the Philippines.
The Philippines has the lowest ecological footprint (1.1 gha) among the Southeast Asian nation. Source: The Manila Times, May 10, 2018 The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. The Kyoto Protocol was adopted in Kyoto, Japan on 11 December 1997 and entered into force on 16 February 2005. The detailed rules for the implementation of the Protocol were adopted at COP 7 in Marrakesh, Morocco in 2001, and are referred to as the "Marrakesh Accords." Its first commitment period started in 2008 and ended in 2012.	The present administration aims to transform the Philippines into a highly industrialized nation, hence industry expansion as a response is expected. The metalworking industry is energy intensive, and the major contributor to the Philippine ecological footprints is the energy sector. Fifty-four percent (54%) of greenhouse gas (GHG) emissions of the Philippines came from the energy sector (Climatelinks, 2016).

The Philippines signed the agreement on 15 April 1998. Source: 2019 United Nations Framework Convention on Climate Change	
The Philippines is leading in nickel production in the world. According to the Mines and Geosciences Bureau, the Philippines' metallic production value went down by 23% from PHP 140.15 billion in 2014 to PHP 108.21 billion in 2015, lagging by PHP 31.94 billion. DENR's move has lifted global nickel prices to a one-year high above $11,000 a ton.	Metals industry relying on locally produced raw materials will be affected by the drop of local production.

6.3.6. Legal factors

Legal as a concept is defined as posited by the courts as the inference or imputation of the law, as a matter of construction, rather than established by actual proof (Black, 1990). Legal factors (UNICEF, 2015) may include the following:

- Human rights (including but not limited to child rights and gender rights)
- Existing legislation having an impact on any relevant factors (economic, social, technological, environmental or other factors relevant to the issue), or affecting population groups relevant to the issue, or impacting the work of the organization or its partnerships
- Pending or future legislation
- International treaties/agreements, either existing or in preparation
- Standards, oversight, regulation, and regulatory bodies, and expected changes in these
- Ethical issues

Table 17. Legal Factors and their Potential Effects to the M&E Industries

Issues/Factors	Potential Effects to the M&E Industries
Intellectual Property in China China's history of weak intellectual property rights (IPR) protection, is well documented in the United States Trade Representative's "Special 301" report. In this report, China has been placed in a priority category of offender countries every year since the report was first released in 1989.	Metalworking industries from China with products violating IPs could find its way to the Philippine market.

2nd tranche of the Tax Reform for Acceleration and Inclusion (TRAIN) aims to repeal at least 120 special laws on investment incentives and consolidate them under one omnibus incentive code. **Investment Incentives Laws** Omnibus Investments Code of 1987 (EO 226) Bases Conversion and Development Act of 1992 (RA 7227) The Special Economic Zone Act of 1995 (RA7916 as amended by RA8748) Regional or Area Headquarters, Regional Operating Headquarters and Regional Warehouses Act (RA 8756) Export Development Act of 1994 (RA 7844) Tourism Act of 2009 (RA 9593)	M&E industry can better compete internationally by taking advantage of the legally provided incentives.

6.4. Consultant's View and Recommendations

There is a need to focus on semiconductor mold fabrication. The biggest export of the Philippines, which involves the metals industry, is the semiconductor and electronics parts and components. Filipino-owned die and mold companies do not have the competency to fabricate semiconductor molds because of limitations in technology and machines which require large capitalizations or investments. Presently, semiconductor companies in the Philippines are buying their mold tool in nearby countries like Singapore, Malaysia, South Korea, and recently, in China.

Semiconductor mold is different from a plastic injection mold. The semiconductor processes use a heater to heat the mold at approximately 190 degrees Celsius while cold water is used to cool down the mold in the injection molding process. Semiconductor mold uses thermoset resin, while the injection mold is using thermoplastic resin.

Fabrication of mold for semiconductor is complicated: it requires high-skilled machinist and state-of-the-art machine tools. The heat treatment process is also critical because some parts will undergo a sub-zero tempering process to prevent too much thermal expansion of metal during the operation. This process requires a vacuum furnace, which is limited in the Philippines.

Equipment requirement for semiconductor die and mold fabrication.

1. EDM (Micro Finish)
2. Wire Cut EDM (Micro-finish)
3. CNC Machining Center
4. Surface Grinder (Bed size, 1000mm x 700mm)
5. Profile Grinder
6. Cylindrical Grinder
7. Vacuum Furnace
8. Jig Grinding
9. Cryogenic Treatment (Sub-zero tempering)

Human Resource Issues

Skilled metalworkers are in demand not only here but overseas. Poaching of skilled workers is rampant in the metalworking industry. Bigger companies can afford to hire skilled employees from micro companies because they can provide better compensation and additional benefits. But it is not a guarantee that skilled labor will stay with them forever. Some machinists stay for at least five years not only to develop their skills, but to attain a minimum of five years of experience to get employed overseas.

Metalworking companies should reach out to educational and training institutions within their area for a possible partnership to have a pool of reliable workforce and to incorporate the skills required by the industry in their curriculum.

Values formation should be given priority in all facets of the Philippine education system, focusing more on loyalty, integrity, industry, and nationalism.

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ANNEX A: PSA PRESS RELEASE

REPUBLIC OF THE PHILIPPINES
PHILIPPINE STATISTICS AUTHORITY

PRESS RELEASE

PSA Grants Clearance to the Conduct of the Survey of Metalworking Industry: Die and Mold Sector

Date of Release: March 5, 2018
Reference No. 2018- 058

On 27 February 2018, the Philippine Statistics Authority (PSA) granted clearance to the conduct of the Survey of Metalworking Industry: Die and Mold Sector of the Metals Industry Research Development Center (MIRDC) under the Department of Science and Technology (DOST).

The survey aims to determine the present status of die and mold sector by collecting information on the general, industrial, market and technical profile that can be used to inform plans and programs that aim develop the industry. Specifically, the survey aims to assess the need for facilities upgrading, workforce skills development, investment incentives that will help improve the die and mold sector through the implementation of the most appropriate programs by the government and various relevant organizations.

The data items to be collected in the survey include the following:

- general information of establishments
- employment of establishments
- export market
- indicator such as production and sales
- equipment, instruments utilized and raw materials used
- problems, issues and concerns in die and mold sector
- business outlook and plans

The survey will collect data from die and mold establishments located in the National Capital Region (NCR), Region III (Central Luzon), Region IVA (CALABARZON), Region VII (Central Visayas), and Region XI (Davao Region) and will start in March 2018. A total budget of Php 750,000.00 will be utilized for personal services, maintenance and other operating expenses (MOOE) such as travelling expenses, supplies and printing of materials and capital outlay.

Results of the survey are expected to be released in September 2018.

The survey was reviewed and cleared for conduct under the Statistical Survey Review and Clearance System (SSRCS), a mechanism being implemented by the PSA by virtue of Rule 28 of Implementing Rules and Regulations (IRR) of Republic Act (RA) No. 10625 to:

PSA Complex, East Avenue, Diliman, Quezon City, Philippines 1101
Telephone: (632) 938-5267

- ensure sound design for data collection;
- minimize the burden placed upon respondents;
- effect economy in statistical data collection;
- eliminate unnecessary duplication of statistical data collection efforts; and
- achieve better coordination of government statistical activities.

In line with this, the PSA enjoins establishments in the regions covered to support the said survey.

For further information on SSRCS, please contact the Statistical Standards Division (SSD) of the Standards Service (SS) with telephone numbers (02) 376-1928 and (02) 376-1931, and email address: ssd.staff@psa.gov.ph or ssdss.staff@gmail.com.

FOR THE NATIONAL STATISTICIAN:

ROMEO S. RECIDE
Assistant Secretary
(Deputy National Statistician)
Officer-in-Charge

MEPE/CJA/PARSB/MPR

ANNEX B: LIST OF RESPONDENT DIE AND MOLD SHOPS

National Capital Region (NCR)

Caloocan City

1. Maximetal Industries, Inc.
2. MD Juan Enterprises

Las Pinas City

1. Ahztech Machine Shop

Makati City

1. NDE Digi Tech, Inc.

Mandaluyong City

1. BDC Industrial & Allied Corporation
2. DBTC Mandaluyong
3. Dienamik Tool Services
4. ICON Metal Industries Corporation
5. Janus Mfg.
6. NER Industrial Services Corporation
7. Oriental Toolmaster Corporation
8. PUMA Spring & Rubber, Inc.
9. YRS Motorcycle Modification, Inc.

Manila

1. Flouseal Engineering Service
2. Polysar Industrial Sales Corporation

Marikina City

1. Precision Foundry of the Philippines, Inc.
2. RAS Tooling Specialist

Muntinlupa City

1. AC-10 PRECISION TOOLS, INC
2. DASH Industrial & Machine Shop
3. INCA Philippines, Inc.
4. LA Rota Tools and Die Services, Inc.
5. Rollmaster Machinery & Industrial Services Corporation

Parañaque City

1. Arcenal Machine Engravels & Tooling Services
2. HDM Technologies Inc.
3. Polytechnic Mfg.

Pasig City

1. Autubus Industries, Inc.
2. EVAPIA Precision Toolings

Quezon City

1. Alsofi Engineering Works
2. Blue Steel Industries, Inc.
3. Chrome Dazzler Corporation
4. GECAR Machine Solutions, Inc.
5. I-Tung Plastic Mould Engineering Company
6. KAMICO Enterprises
7. Nito Seiki Mfg. Corporation

Taguig City

1. Cutting Edge Materials Processing Corp.
2. Gerbag Industrial Technologies
3. KEBA Engineering
4. Magnetic MHP Tool and Die Fabrication
5. Mars Machine Shop
6. NSB Engineering
7. Vveex Corporation

Region III

Bulacan

1. Engineering Machine Shop
2. Formosa Forge, Inc.
3. Jocelyn Forge, Inc.
4. LDC Engineering
5. Perezonic Engineering Services

Region IV-A

Cavite

1. Aries Technologies, Inc.
2. Castem Phil. Corporation
3. Choryo Toolings System, Inc.
4. Creative Diecast Philippines
5. ERML Trading and Engineering Services
6. Fatec Corporation
7. Fravinz Enterprises, Inc.
8. HARMO Technology Corporation
9. JFB Tech Philippines, Inc.
10. Kea Industrial Corporation
11. M2 Fabrication, Inc.
12. Metalmate Precision Tech Corp.
13. Philmetal Products, Inc.
14. PTON Corporation
15. Riclet Technological Mfg., Inc.
16. S Bros Precision, Inc.
17. Tri-R Allied Industries, Inc.
18. Worksbell Technologies, Inc.

Valenzuela City

1. Mega Samsotite
2. Starmold Machine Shop
3. TESCO Multisales, Inc.

Laguna

1. ACME Tools Manufacturing Co, Inc.
2. Aichi Forging Company of Asia, Inc.
3. Alliance Industrial Machines, Inc.
4. Ambrose Industries
5. Anglamar Tool Makers Technology
6. ARREM Industries, Inc.
7. Bernatech Precision
8. Chorokawa Technologies, Inc.
9. Crutech and Tooling Precision
10. ESJ Precision Tooling
11. Ito Seisakusho Philippines Corp.
12. JGM Philippines, Inc.
13. JMY Precision & Industrial Services
14. Kinergy Philippines, Inc.
15. Kyoei Dietech Philippines, Inc.
16. Malasaga Trading Corporation
17. MAM Precision Toolings
18. Maretech Precision Toolings and Industrial Services
19. Matex Planetary Drive International, Inc.
20. Millennium Toolings & Fabrication
21. Mina Technology Philippines Corp
22. MPM Asia, Inc.
23. Nogalo's Enterprises
24. Optitech Machine Tools
25. Philippine Precision Technology, Inc.
26. Planex Technology, Inc.
27. Prov 3 Tooling and Metal Fabrication
28. Richtech Industrial Supply Company
29. Stamp Form Metalworking, Inc.
30. Tri-Fusion Precision Corporation
31. Utsuta Metal Stamping Phil., Inc.
32. VJF Precision
33. Web Forge Philippines, Inc.

Batangas

1. Barleta Precision Mfg., Inc.
1. Kasai Advanced Mfg. Philippines, Inc.
2. New Sun Machine Shop
3. Nissin Precision Philippines Corp.
4. RTS Toolmaker Tech
5. SOHBI KOHGEI Philippines, Inc.

Region VII

Cebu

1. Accu-Form, Inc.
2. Cebu Iwakami Corp
3. Cebu United Polymer Corporation
4. Center for Cebu Light and Metalworking, Inc.
5. FAG Engineering Group
6. FILJAP Trading International
7. IA Engineering Works
8. MAKOTO Metal Technology, Inc.
9. Philippine Kenko Corporation
10. Precision Forming Corporation
11. Precision Machinist Corp.
12. Tamiya Philippines, Inc.

Rizal

1. A1 Tool & Die Machine Shop
2. AB Manalang Engineering Services & Industrial Supply
3. Adzer Engineering
4. Antipolo MRM Precision Tool and Die, Inc.
5. CVC Precision Tooling
6. JRM Industrial Tooling Services

Region VIII

Leyte

1. Solid Base Machining Center

Region XI

Davao

1. Davao Beta Spring, Inc.
2. Metro Ace Plastic Industries
3. Uniwide Rubber and Metal Industry

ANNEX C: SURVEY PICTURES


THIS PLANT HAS WORKED
DAYS
WITHOUT LOST TIME ACCIDENT
TARGET ZERO ACCIDENT


JAS


Allied Industries, Inc.


INCA
INCA PHILS., INC.


JAS
MACHINE SHOP
AND ENGINEERING WORKS


Uniwide Rubber
And Metal Industry


SAFETY + FIRST

MIRDC DIE AND MOLD INDUSTRY STUDY TEAM

TOP MANAGEMENT

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Agustin M. Fudolig, Dr. Eng.
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