THE PHILIPPINE FORGING INDUSTRY AMID TRIUMPHS and CHALLENGES:

A 2018 Study

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A 2018 Study

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

ACKNOWLEDGMENT

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 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 our consultant grounded the study to the sector's perspectives.

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

Ms. Rosalinda M. Cruz
Ms. Teresita C. Villoso
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Ms. Vilma A. Sia
Ms. Marielle Almira J. Viernes

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 in determining the current status of the different sectors studied.

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Head, Machining Study

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'The strongest steel is forged by the fires of hell. It is pounded and struck repeatedly before it's plunged back into the molten fire. The fire gives it power and flexibility, and the blow gives it strength. Those two things make the metal pliable and able to withstand every battle it's called upon to fight.'

Sherrilyn Kenyon
The Dark Hunters, Vol. 1

1. Introduction

1.1. Background

Metal components of equipment and machineries of crucial importance in various industries need to be durable – they must be very strong in order to ensure the safety of the users, and the convenience and efficiency of the machineries and equipment in performing the desired application to which they were intended for. Strength and durability are the most salient features of forged metals. Thus, the forging industry, responsible for producing metal products that go into industrial machineries and equipment, carries on its shoulder the responsibility of ensuring the reliability of their products.

The Philippine economy is presently driven by three (3) major sectors: agriculture, forestry, and fishing; industry; and services (DTI, 2017). Cutting across all sectors is the metals and engineering (M&E) industries whose products and services remain critical in the achievement of success. This was how the M&E industries were relevant to nation-building in the past. To this day, the M&E industries, along with its products and services, remain a driver of change.

1.2. Significance of the Study

As the metalworking sector is represented by a wide spectrum of industries, the Department of Science and Technology – Metals Industry Research and Development Center (DOST-MIRDC) regularly conducts the Industry Study of the Metalworking Sector. The Center focuses on a particular M&E industry during the conduct of the industry study. For the year 2018, the forging industry takes the limelight as companies in the forging business are the identified respondents.

The results of the 2018 industry study will play a very significant role in the pursuance of the DOST-MIRDC's mission. The report will be a reference material intended for the use of the forging companies. Relevant macro- and micro-environmental analyses included in this publication will serve as bases for the industry players' investment decisions. In addition, the contents of the study are also intended for the consumption of researchers and policy makers. Up-to-date information and how these are affected by various factors are discussed.

Information gathered will be used to further make the Center's research and development (R&D) initiatives and science and technology (S&T) services more relevant to the metals, engineering, and allied industries and all its stakeholders from

both the public and the private sectors. Industry study results will contribute to making the Center's programs and projects more strategic in delivering services that are appropriate to meet the demands of the industry.

1.3. Objectives of the Study

The study on the forging industry is conducted with the following objectives:

1. To determine the prevailing conditions of the forging industry;
2. To perform a comprehensive analysis of the forging industry's performance based on various influences;
3. To examine the forging industry's level of competitiveness as a result of previous efforts to upgrade facilities, build capabilities, and attract investors, among others; and
4. To formulate thoughtful and practical action plans and recommendations to significantly strengthen and improve the competitive performance of the local forging industry.

1.4. Limitations of the Study

This study specifically covered the local forging industry of the metalworking sector in the Philippines. However, the survey included only the forging shops with mechanized facilities and the survey questions were limited on the General Information, Employment, Equipment, Production Statistics, Production Materials, Business Outlook, Problems Encountered, and Future Expectations and Plans.

2. Methodology

The DOST-MIRDC industry study team conducted the survey through field interviews, phone interviews, and mailed questionnaire. A fillable electronic copy (pdf format) was uploaded in the DOST-MIRDC website, www.mirdc.dost.gov.ph, for respondents' downloading.

There are about 3,211 identified metalworking companies in the country, only eight (8) companies are engaged in the forging business. In 2010, there were a total of 15 identified forging companies; of the 15, only 11 responded to the survey. To maximize the benefits of the Center's 2018 survey of the forging industry, considerations were given to the following concerns:

a. The survey used the 2010-2012 list of forging shops surveyed. To update the list, the industry survey team also used directories, materials from local government units, and the internet to search for potential survey respondents.
b. Shops with manual forging or blacksmithing were excluded in the list of respondent forging shops.
c. The population, which is the total number of shops operating in the Philippines, was also the sampling frame since there is only a handful of forging businesses identified.
d. The primary data were complemented by additional available information/data from the various statistical sources and related industry studies.
e. The supporting data or the secondary data were taken from the compilations of other government agencies such as the export and import from the Philippine Statistics Authority (PSA) and compilations of published facts about forging-related information.

2.1. Sampling Design

The 2018 industry study of the forging industry was a 100% sample survey, that is, a census that collected information from each member of the population. This is because there are only a few forging shops operating in the country, specially that the survey covers forging shops with mechanized facilities only.

2.2. Designing the Survey Instruments

The questionnaire included a list of items that served as tools for the Center to look into the status of the forging industry: respondent companies' profile specifically concerns about workforce, utilization of technology, comparison of production cost against revenue generated, kind and volume of raw materials required, industries served, engagement in R&D, production issues, and business plans and forecasts, among others.

Coping up with the dynamism of the forging industry required some revisions with the survey questionnaire. The survey team, in close coordination with the Industry Study Consultant, came up with changes in the design of the survey questionnaire. The draft was submitted to the Philippine Statistics Authority (PSA) for review and comments. After receipt of the PSA's comments and recommendations on the questionnaire design, the Industry Study team finalized the survey instrument, submitted the final copy to the PSA, and began the survey proper of the 2018 Forging Industry Study.

2.3. Conduct of the Survey Proper

The survey proper was implemented beginning in April 2018 and went all the way until end of November 2018. Simultaneous to the conduct of the survey is the team's research activities. The survey team searched for related materials to be used as references in the report. The main references include the following: (1) The Philippine Mechanized Forging, 1992 (DOST-MIRDC, 1992); and (2) The Philippine Metals and Engineering: 2013 State of the Industry (DOST-MIRDC, 2013). Both are publications of the DOST-MIRDC.

2.4. Conduct of the Focus Group Discussion

Validation of the survey results was done through the conduct of a focus group discussion (FGD), where representatives of company respondents participated and gave their insights.

Results of the recently concluded industry survey were presented to the FGD participants, where they were asked to give their reactions, comments, and opinions. Their inputs were summarized and these were used as additional information to the packaging of a comprehensive industry study report.

3. The Local Forging Industry Players

In 2018, a total of eight (8) companies are engaged in the forging business in the Philippines. Of the eight, only seven (7) companies responded to the survey. All respondent-companies are organized as corporations. The list of company respondents, with their respective products are listed in Table 1.

Table 1. List of Philippine Forging Companies, 2018 Forging Industry Survey

Name of company	Location	Year of establishment	Products
1. Acme Tools Manufacturing, Inc.	Biñan, Laguna	1953	Industrial machinery parts
2. Aichi Forge Philippines, Inc.	Sta. Rosa, Laguna	1995	Automotive components
3. Formosa Forge Philippines, Inc.	Meycauayan, Bulacan	1998	Pole line hardware
4. Icon Steel Forging Manufacturing, Inc.	Tatalon, Quezon City	2010	Automotive components; Spare parts for heavy equipment; Industrial machinery parts; Bolts and nuts; Gun parts
5. Jocelyn Forge, Inc.	Meycauayan, Bulacan	1991	Electrical distribution system (parts and components)
6. Mindanao Forge Company, Inc.	Gingoog, Misamis Oriental	2001	Horseshoe tools; Horseshoe accessories
7. Webforge Philippines, Inc.	Cabuyao, Laguna	1996	Forge-welded steel products

4. The Macro-Environmental Forces that Shape the Local Forging Industry's Landscape

Businesses are influenced by both macro- and micro-environmental factors. Macro-environment refers to political and legal, economic, social, technological, and environmental factors. The identification and assessment of these factors are commonly referred to as PESTLE analysis. The micro-environmental factors, on the other hand, are those that have direct effects and influence on the organization's relationships. These micro-environmental factors include forces such as suppliers, competitors, and new entrants, to name a few. Micro-environmental analysis is best done using a tool called Porter's Five Forces of Industry Competitiveness.

Every business is affected by macro-environmental forces, which may have the power to build businesses, or destroy them, if left unchecked (Frue, 2017). Political and legal, economic, social, environmental, and technological factors are not within the control of any company, but they are generally influencing businesses across various industries.

4.1. Political and Legal Factors

The country's electronics industry boomed during the time of former President Fidel Ramos (1992-1998), while the Information Technology-Business Process Outsourcing (IT-BPO) industry performed excellently during the term of former President Gloria Macapagal-Arroyo (2001-2010). Public-private partnerships and the resurgence of the manufacturing sector were ushered in under the leadership of former President Benigno Aquino III from 2010 to 2016 (Masigan, 2018). In an article for the Business World, Masigan (2018) mentioned that the Duterte administration, after more than two years, has still unclear directions about which industries to champion.

A few months later, Cahiles-Magkilat (2019) wrote that things are looking bright for the manufacturing sector, with special mention of the steel and automotive industries. This is a result of the current administration's attempt to rebuild the domestic industries again through the Manufacturing Resurgence Program (MRP).

The MRP has begun to prove that it has indeed placed the local industries, including the local forging industry, at a better position to partake in the market competition on a global scale. The global forging market is anticipated to exhibit a growth rate of more than 6.32 percent in the 2018-2025 period, according to a report by the KITV4 (2018). Market growth, according to the Stratistics Market Research Consulting (2018), is propelled by growing demand for ferrous metals, rising demand for high-strength metal components, and cost-effective method for metal farming. KITV4 (2018), Stratistics Market Research Consulting (2018), and TechSci Research (2018) all reported that the healthy business of the forging industry is brought about by demands coming from clients in the renewable energy and automotive industries. Asia-Pacific automotive forging market is at $21.6B in 2017, and is projected to go beyond $29B in 2023 (TechSci Research, 2018).

Parallel to the growth and booming businesses in global forging, the government's MRP is gearing up the local industry to more growth and stiffer global competition. A component of the MRP is the government's Comprehensive Automotive Resurgence Strategy (CARS) Program, where Toyota Motor Philippines and Mitsubishi Motor Philippines, Corp. are participating in (Cahiles-Magkilat, 2019). The country is aggressively working on realizing its vision of being a manufacturing hub for certain vehicle models for export to the ASEAN region. This signals a very optimistic future for the forging industry, as the automotive industry is among the top industries it serves. See Figure 1.

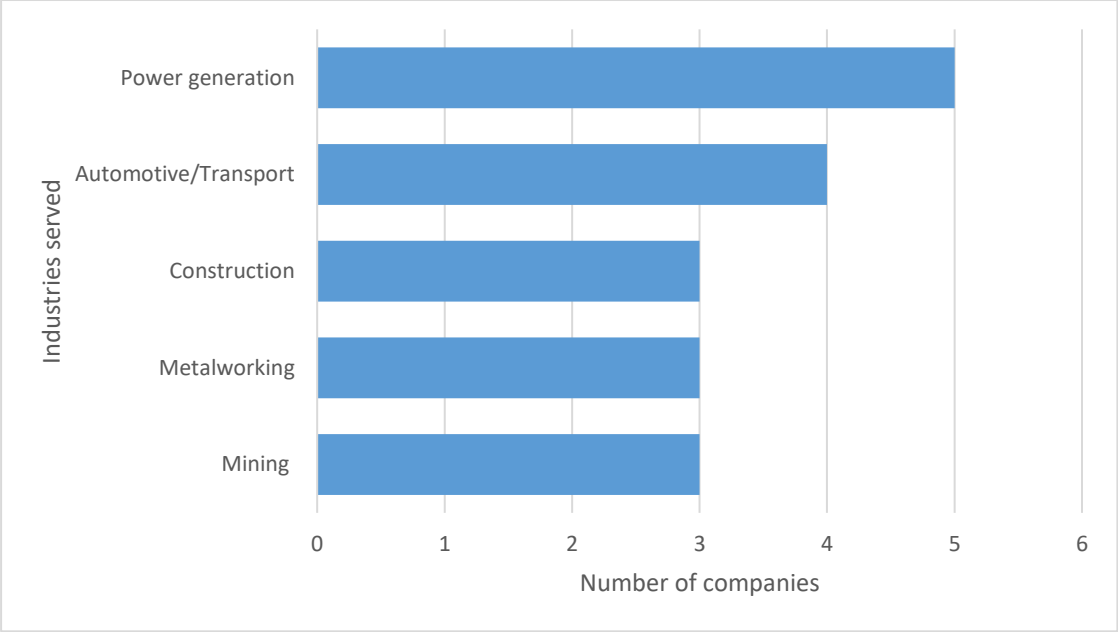

Figure 1. Industries Served by the Local Forging Industry, 2018

Figure 1 shows the number of forging companies involved in businesses serving other industries. Although more companies are serving the requirements of the power generation industry, a bigger portion of the local forging industry's production fulfills the requirements of the automotive industry.

Complementing the program for manufacturing resurgence is the proposed Tax Reform for Attracting Better and High-quality Opportunities (TRABAHO) bill (Cahiles-Magkilat, 2019). Under the TRABAHO bill, Corporate Income Tax (CIT) is proposed to be reduced, which will result to freeing-up of capital for businesses to use for additional investments or hiring more people. The approval of the TRABAHO bill will allow small and medium enterprises (SMEs) to give more jobs to Filipinos, and more importantly, make the business sector more competitive (Padin, 2018). Once approved, forging companies belonging to the SME category will enjoy TRABAHO Bill advantages. The TRABAHO Bill, along with the Inclusive Innovation Industrial Strategy (i^3S) which aims to make all the major economic sectors, i.e. agriculture, services, and industry, more innovative and globally competitive, is envisioned to bring positive results for the country. The i^3S prioritizes 12 major industries (DTI, 2017):

1. Automotive;
2. Electronics and electrical;

3. Aerospace parts;
4. Chemicals;
5. Iron and steel and tool and die;
6. Garments, textiles, and furniture;
7. Shipbuilding;
8. Tourism;
9. IT-business process management particularly knowledge process outsourcing and E-commerce;
10. Agribusiness;
11. Construction; and
12. Infrastructure and logistics

The automotive, construction, metalworking represented by the iron and steel, and tool and die, among the list of priority industries under the i^3S, are also among those served by local forging businesses, as shown in Figure 1.

To say that the products and services of the forging industry are very important contributors to the growth of the country's economy is an understatement. The metal parts and components produced by the forging industry go into machineries and equipment used by a wide variety of industries that provide an even wider variety of services enjoyed by consumers and the public in general.

In 2016, President Duterte signed and approved Ambisyon Natin 2040, the country's national long-term vision. The Ambisyon Natin 2040 is a guide for development planning, which will only be effective if administrations 'build on the gains of their predecessors to ensure continuity and consistency of policies, projects, programs, and initiatives, while also maintaining a certain amount of flexibility,' as stated in the Philippine Development Plan 2017-2025 (NEDA, 2017). Priority sectors for Ambisyon Natin 2040 have already been identified, and these are presented in Figure 2 below.

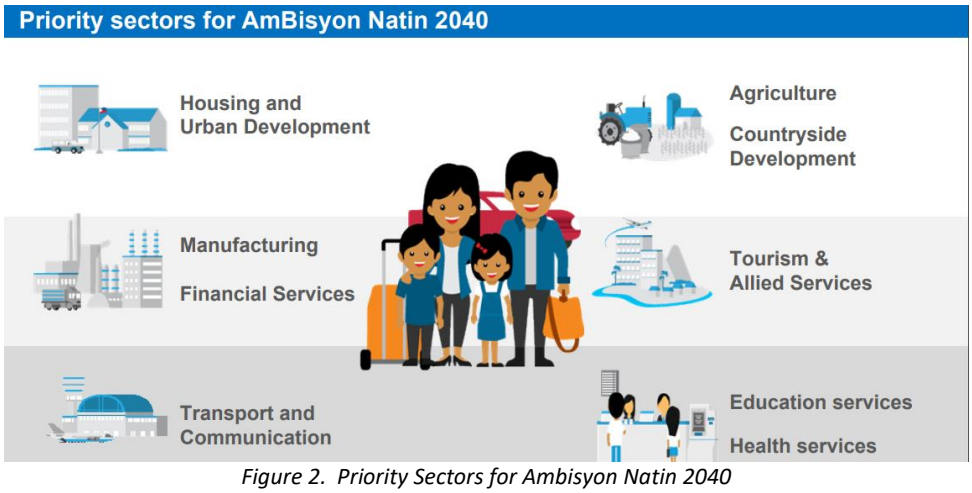

Figure 2. Priority Sectors for Ambisyon Natin 2040

Source: Dela Peña, 2017

The more attention that these industries receive regarding development for innovation and global competition, the more growth opportunities will be for the forging industry. Figure 2 above enumerates the sectors that are prioritized under the Ambisyon Natin

2040. The forging industry, under the manufacturing sector, is seen to benefit from programs of the government. This will mean increased business transactions, wider profit margins, and a generally profitable business environment. But alongside these very optimistic business projections, are also demands in terms of capability, skills, and competitiveness.

But is the local forging industry truly benefiting from these initiatives? Do the forging companies show optimism with all these promising developments?

The 2018 survey of the local forging industry was able to bring out the respondents' positive outlook until the year 2022: all respondents have an optimistic general perception about the forging business; majority say that volume of production will increase; and half of the respondents said that the number of their employees will increase. This positivity is also reflected in the respondents' business expansion plans: 57 percent of the companies plan to offer new product lines and services; 100 percent plan to purchase new equipment; and 71 percent intend to enhance workforce capability.

4.2. Economic Factors

The Philippine economy grew by 6.5 percent in Quarter 1 of 2017. Q1 2018 showed a bigger economy growth, which was at 6.8 percent, owing to the remarkable performance of the manufacturing, other services, and trade (Philippine Statistics Authority, 2018). Masigan (2018) describes our economy as 'fundamentally strong' – in 2017, the service sector expanded by 6.8 percent, then in 2018 expanded to 7 percent. The industry sector, in comparison, grew by 7.3 and 7.9 percent in 2017 and 2018, respectively. The numbers, according to Masigan (2018), prove that the 'country's manufacturing base is expanding, and that industrialization is well on track.'

According to the PSA (2016), the annual family income of Filipino families was approximately P267,000.00, while the annual family expenditure was P215,000.00. This gave the Filipino families saving of an average of P52,000.00. Per capita has increased correspondingly as an effect of the increase in gross domestic product (GDP). Masigan (2018) reported in his article that there was a 20 percent increase in the average income of Filipinos in 2015-2017.

Inflation is a matter that comes to mind when economy is the topic. The rate of inflation is based on the Consumer Price Index (CPI) – a measure of the average price of food products, electricity, gas, and clothing, which make up the standard products and services consumed by a household. Inflation is the rate at which the CPI changes (Bartolome, 2018). Figure 3 presents the monthly inflation rate in the country for the year 2018.

Figure 3. Monthly Inflation Rate in the Philippines, 2018

Inflation rate in August was at 6.4 percent. This shocked the whole country. What the Filipinos did not know was there will be more shocking news when inflation rate ballooned to 6.7 percent in September and October. Even more shocking was the fact that the Philippines had the highest inflation rate among countries in the ASEAN region (Punongbayan, 2018). Figure 4 shows the comparison of inflation rates among ASEAN countries.

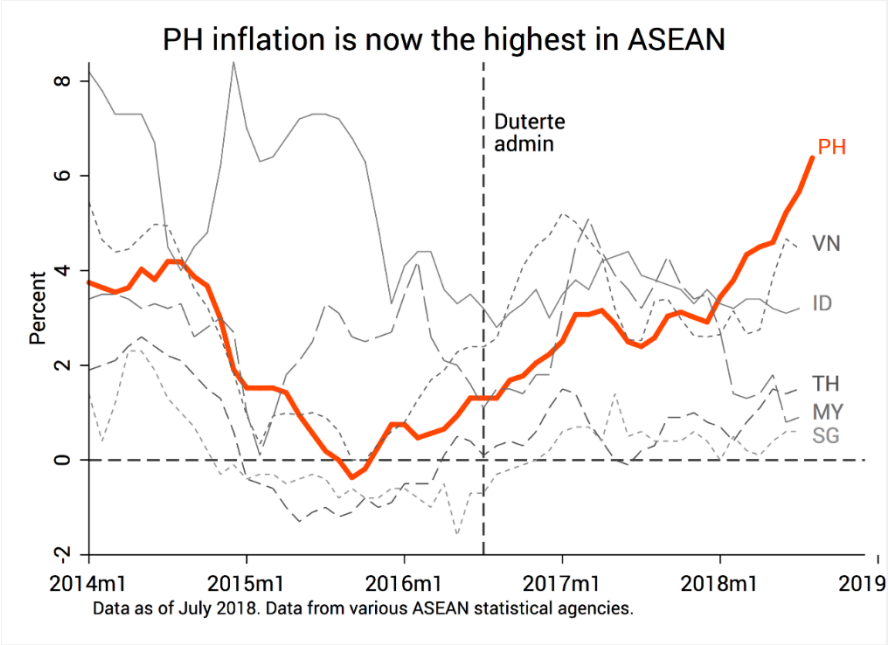

Figure 4. Inflation Rate of Countries in the ASEAN Region, 2018

Punongbayan (2018), in his article, explains that inflation is running away in the Philippines because of two (2) reasons: continuous oil price hike, and continuous weakening of the peso.

How are Filipinos affected by rising inflation rate? As it goes up, peso value goes down. People are able to buy lesser products and services (Bartolome, 2018). High inflation

rates in the Philippines continue to cripple a great majority. Statistics say that more than four (4) in every 10 poor Filipinos have jobs. Poverty continues to be a challenge even to people with jobs, because these are poor-quality jobs that do not pay as much as a rich manufacturing industry would – if only the manufacturing industry was nurtured from the very beginning of the country's attempt to industrialize.

Similar to families and individuals belonging to all societal classes, businesses are also at the mercy of increasing inflation rates. Businesses in the forging industry are no exemption. High inflation rates are felt as increasing cost of equipment, costs of raw materials, costs of operations. What they may have been able to purchase with P1M in the past years, is no longer possible to purchase now even if they have P1M. Prices keep going up, and capitalization is getting more and more prohibitive.

The Philippine economy is largely driven by the micro, small, and medium enterprises (MSMEs), which make up 99.6 percent of all registered businesses, and contribute to 70 percent of the country's total employment (Fong, 2018). Aldaba (2012) presented in her discussion paper the operational definitions of MSMEs, one is based on employment and the other, on assets. These classification schemes are further illustrated by the Senate Economic Planning Office (SEPO) in its 2012 publication. Table 2 presents the MSME classification schemes.

Table 2. Classification Scheme of MSMEs Based on Employment and Asset

Category	Employment	Asset
Micro	1-9 employees	P3,000,000 or less
Small	10-99 employees	P3,000,001 to P15,000,000
Medium	100-199 employees	P15,000,001 to P100,000,000

Source: SEPO, 2012

As the operational definition of MSMEs are based on asset and employment, it has to be pointed out that Figure 5 presents the distribution of forging companies based on their initial capitalization, only to emphasize how some of them were able to grow and level up after several years of being in business.

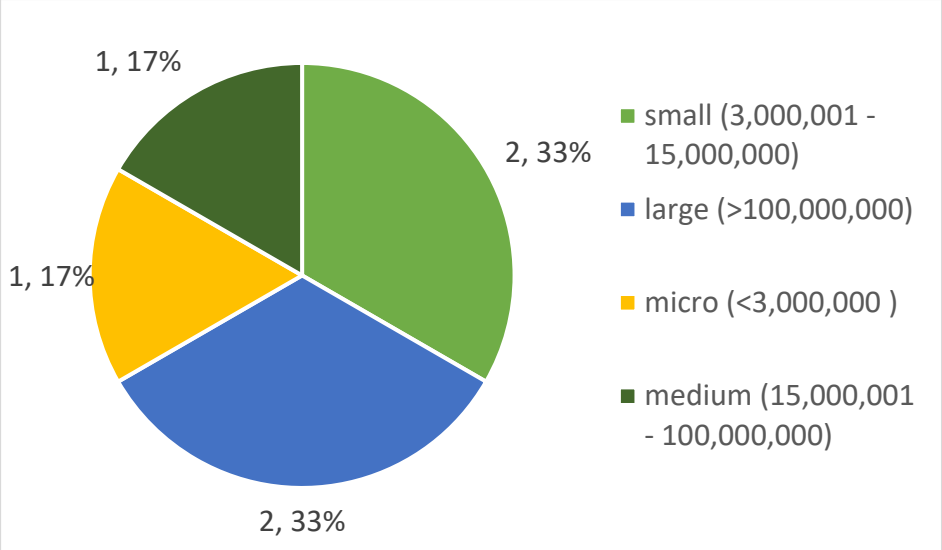

Figure 5. Distribution of Forging Companies Based on Initial Capitalization, 2018 Forging Industry Study

These companies were established in different years where there were different inflation rates. Figure 6 shows that majority of the forging companies are already under the large enterprise category at the time the survey was conducted, meaning they have assets amounting to P100M and greater. To compare with the distribution of companies in Figure 5, where the companies are categorized based on initial capitalization, only two (2) are categorized as large enterprises.

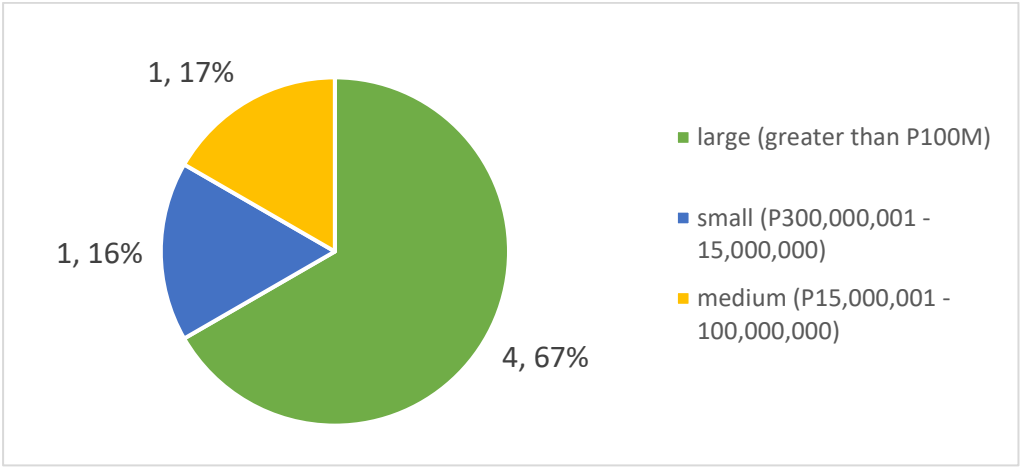

Figure 6. Number of Philippine Forging Companies Based on Present Asset, 2018 Forging Industry Study

The leveling up of the forging companies to reach the large enterprise status may be because some of them have parent companies abroad which are multinational companies that have means to allocate resources to keep these local enterprises in operation. Figure 7 below compares the number of independent companies from those with parent companies.

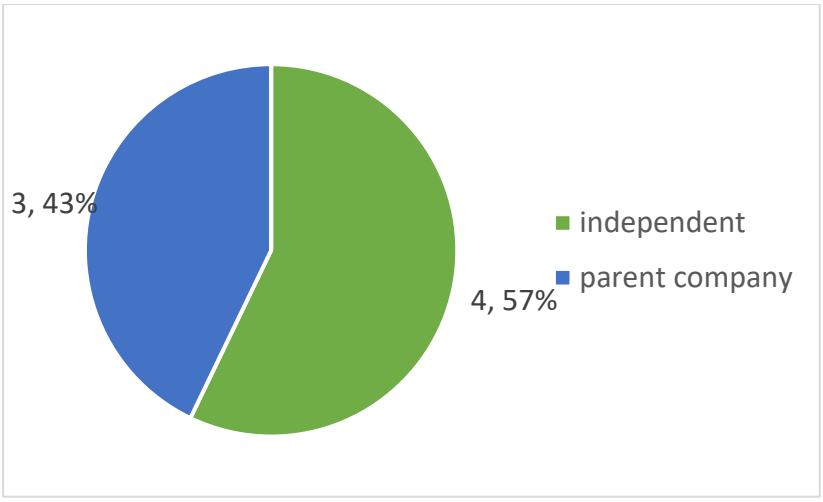

Figure 7. Independent Forging Companies vs. Forging Companies with Parent Companies, 2018 Forging Industry Study

As shown in Figure 7, only three (3) have parent companies. In 2018, there are four (4) companies categorized as large enterprises based on current assets, where there were only two (2) of them based on initial capitalization. The shift of two (2) more companies to becoming large enterprises may then be because of a parent company that provides financial assistance, or may perhaps be an indication that there is indeed a productive and profitable business for the forging industry.

But beneath the enterprises' categories as micro, small, medium, or large are issues that still puts profit margins in the limelight. Some of these are cost of production (Figure 8) and revenue generated per year (Figure 9).

Data gathering from respondent companies about production cost has not always been easy, as expected even from surveys conducted in the past. Based on the figures taken from the DOST-MIRDC's Philippine Mechanized Forging industry study (1992), production cost refers to the amount of money spent by the company to cover for the raw materials (60-65%), indirect cost including overhead expenses, rental, etc. (17-23%), labor (10%), and electricity (7%).

In this year's survey, limited data were also provided by the respondent companies. The breakdown of production cost in 1992 may still be the same as the present cost breakdown, since raw materials, overhead expenses, labor, and electricity are among the factors of operations that require the most resources. Although not all respondents provided answers to this item, the figures provided were added up to arrive at the summary presented in Figure 8.

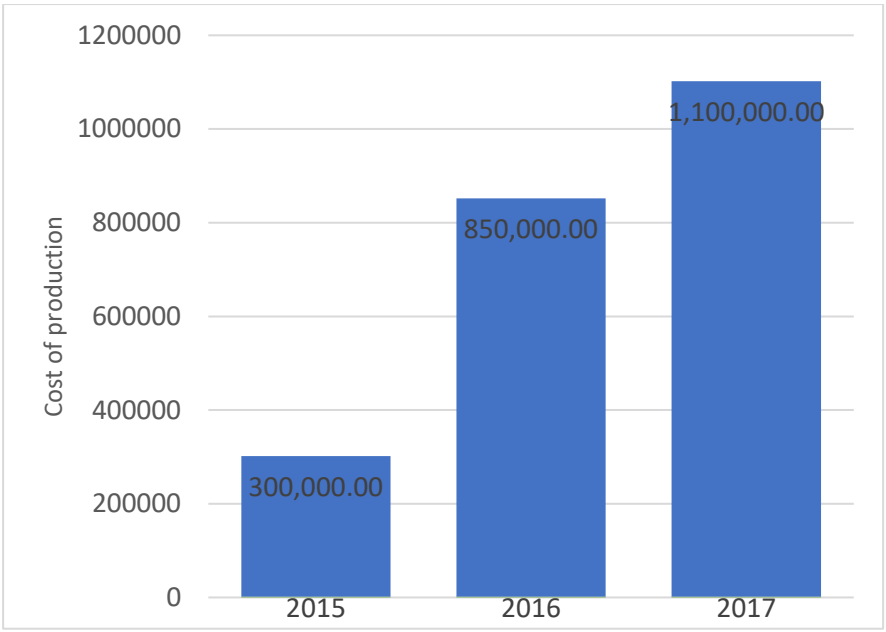

Figure 8. Cost of Production of Local Forging Companies from 2015-2017, 2018 Forging Industry Study

Although production costs refer to the same things such as raw materials, rentals, labor, and electricity, costs clearly show an increasing trend. Inflation is among the key factors that influence this trend. The next question is how much are the forging companies earning. Figure 9 shows revenue from 2015-2017.

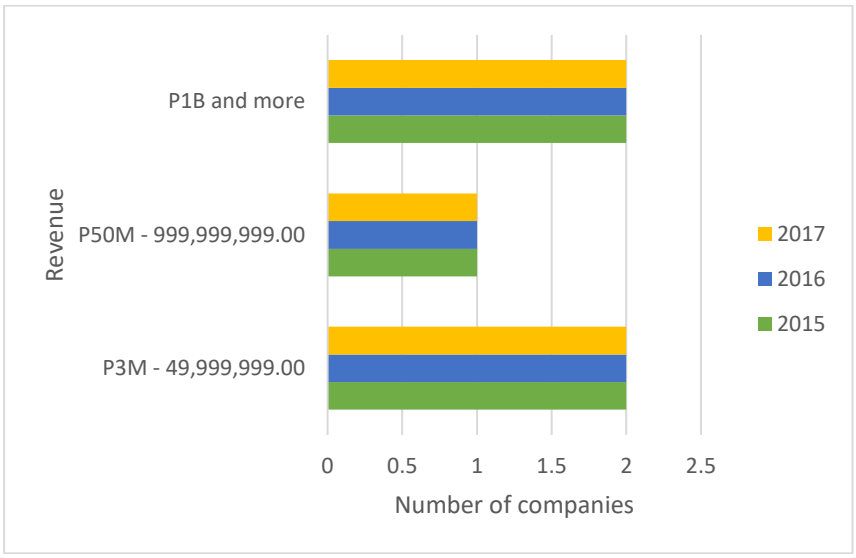

Figure 9. Revenue of Local Forging Companies from 2015-2017, 2018 Forging Industry Study

Again, gathering data that concern money has always been the most difficult part of the survey. Of the seven (7) respondents, only five (5) gave their response. Figure 9 shows that only two (2) forging companies have revenues that hit the P1B mark from 2015-2017. Average production costs rose to more than P1M in 2017, which gave only two companies P1B and more revenues.

Increasing production costs, affected by factors such as high power costs and unstable dollar-peso exchange rate cause major dents on the local forging companies' profit margin. Economic factors such as capital requirements and unreliable revenues are indicators of a challenged local forging industry.

Protecting profit margins is the most crucial concern for businesses. If forging companies are empowered to focus on enhancing competitive advantage, then securing better profit margins will be within arms' reach.

4.3. Social Factors

The Philippines, with a current population of more than 107,000,000, is the 12th most populated country in the world, between Mexico and Ethiopia (World Population Review, 2018). Back in 2017 when the population was only slightly above the 104,000,000 mark, the 25-54 age group had the greatest share at 36.99 percent, followed by the 0-14 age group with 33.39 percent share (Index Mundi, 2018). A huge portion of the population, 70 percent, is of working age (ASEAN Briefing, 2017). Shown in Table 3 are other demographic info.

Table 3. Demographic Profile of the Philippines, 2018

Demographics	Statistics
Age group (2017 est.)	**0-14 years:** 33.39% (male 17,764,826/female 17,050,168) **15-24 years:** 19.16% (male 10,199,389/female 9,780,025) **25-54 years:** 36.99% (male 19,597,675/female 18,964,900) **55-64 years:** 5.97% (male 2,844,739/female 3,375,139) **65 years and over:** 4.49% (male 1,930,273/female 2,748,942)
Median age (2017 est.)	**total:** 23.5 years **male:** 23.1 years **female:** 24 years
Population growth rate (2017 est.)	1.57%
Urbanization (2015-2017 est.)	**urban population:** 44.2% of total population (2017) **rate of urbanization:** 1.57% annual rate of change
Sex ratio (2016 est.)	**at birth:** 1.05 male(s)/female **0-14 years:** 1.04 male(s)/female **15-24 years:** 1.04 male(s)/female **25-54 years:** 1.03 male(s)/female **55-64 years:** 0.84 male(s)/female **65 years and over:** 0.72 male(s)/female **total population:** 1.01 male(s)/female
Ethnic groups (2000 census)	Tagalog 28.1%, Cebuano 13.1% Ilocano 9%

	Bisaya/Binisaya 7.6% Hiligaynon Ilonggo 7.5% Bikol 6% Waray 3.4% other 25.3%
Religion (2000 census)	Catholic 82.9% (Roman Catholic 80.9%, Aglipayan 2%) Muslim 5% Evangelical 2.8% Iglesia ni Kristo 2.3% other Christian 4.5% other 1.8% unspecified 0.6% none 0.1%
Literacy (2015 est.)	**definition:** age 15 and over can read and write **total population:** 96.3% **male:** 95.8% **female:** 96.8%

Source: Index Mundi

Careers and professional choices have indeed changed over the years. The emergence of technologies and various industries all influence the lifestyle and decision-making skills of Filipinos – including careers and jobs. According to CNN Philippine Life (2017), the top 10 most hired occupations on LinkedIn are: (1) sales professional; (2) software developer; (3) customer service specialist; (4) marketing specialist; (5) administration manager; (6) recruiter; (7) IT support specialist; (8) HR professional; (9) IT consultant; and (10) accountant. Interestingly, the 10 highest paying jobs and their corresponding average monthly salary are the following (Gutierrez, 2017):

1. pilots, navigators, and flight engineers P156,823.00
2. geologists working in construction P101,471.00
3. graphic designers P99,658.00
4. art directors P76,612.00
5. industrial machinery mechanics and fitters P76,550.00
6. geologists in mining P71,849.00
7. statisticians P56,759.00
8. crushing, grinding, and chemical-mixing machinery operators P49,646.00
9. communications service supervisors P48,270.00
10. production supervisors and general foremen P47,521.00

Clearly, careers in the forging business are not included in the list of the 'most hired occupations. Young Filipinos who have just gotten out of the university or who have just completed their technical courses are aiming to pursue a career in any one of these top in demand occupations. Hence, forging companies are having difficulty in finding people to hire.

This reality is blatantly reflected in present-day statistics on employment.

Of the three broad sectors – agriculture, services, and industry – the largest portion of the workforce is employed in 2017 by the services sector (Philippine Statistics

Authority). The second largest group is employed by the agriculture sector, and the smallest group is in the industry sector. Although it has the least number of employees, the industry sector has been leading the country's economy with a remarkable growth of 6.1% from 2011 to 2016 (DTI, 2017), and this is attributed to the aggressive performance of the manufacturing industry that includes forging companies.

The 2018 survey of the local forging companies revealed that the industry employs approximately 850 personnel, majority of which (74%) are directly involved in production. Non-production personnel are those working as managers, supervisors, administrators, and other officials. Nearly all employees (90%) are hired as permanent employees. As expected, more than half of the total employees of the forging industry are males.

The respondent companies were asked to indicate the length of stay and years of experience in the forging industry of their employees. Responses show that employees generally gain quite a number of years of experience in the industry (Figure 10).

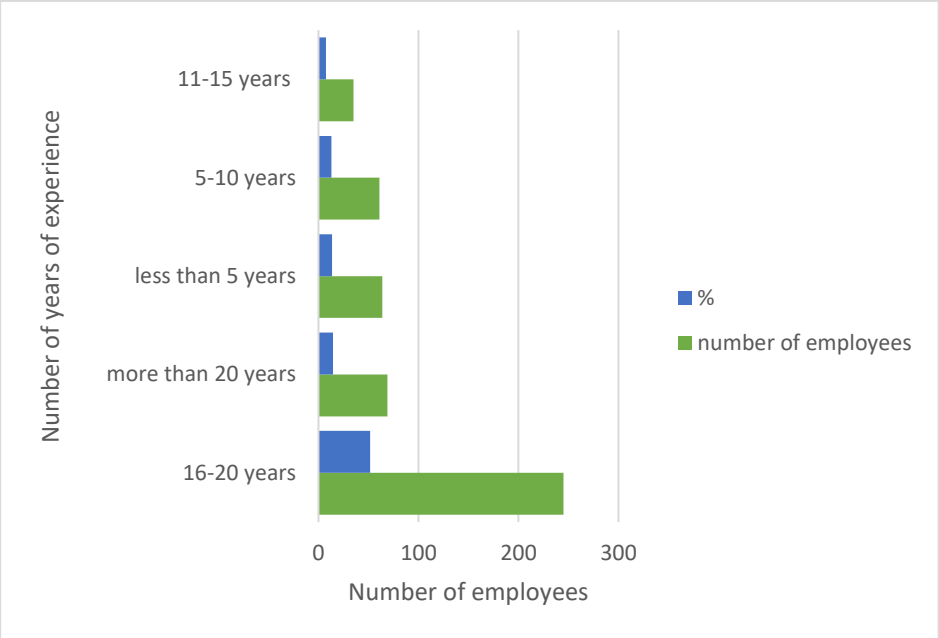

Figure 10. Employees' Number of Years of Experience in the Industry, 2018 Forging Industry Study

Since majority of the employees of the forging industry stay and gain significant work experience, it is not surprising that, in terms of performance ratings, excellently-performing employees top the list at 42% (see Figure 11). Placed in second are employees rated fair at 24% of the total. There are still some employees rated as poorly-performing but are relatively few (1%).

Figure 11. Performance Rating of Employees in the Forging Industry, 2018 Forging Industry Study

But these graphs do not quite give the full picture of employment in the forging industry. despite having employees who stay for considerably long periods and who perform excellently, the forging industry is facing several issues, with human resource at the top of the list.

The 1992 Industry Study of the DOST-MIRDC on the Philippine Mechanized Forging reported that the topmost production problems of the industry were power shortages, which were undeniably a very big concern during those times; high cost of raw materials; and stiff foreign competition. In this present study, the list of problems and issues has already changed with human resource (HR) as primary concern.

Interviews with the forging companies revealed that they have difficulty finding employees to hire. Contrary to what people generally know about mismatch of a huge supply of manpower and very few jobs available, the forging companies are having a hard time looking for people to fill-in available jobs. One respondent company described workers as 'choosy.' As observed, a lot of employees stay only for a few days and do not report back after discovering that the job is really physically demanding. Another issue is on labor concerns specifically regularization and unions. Figure 12 shows the issues of the local forging industry players.

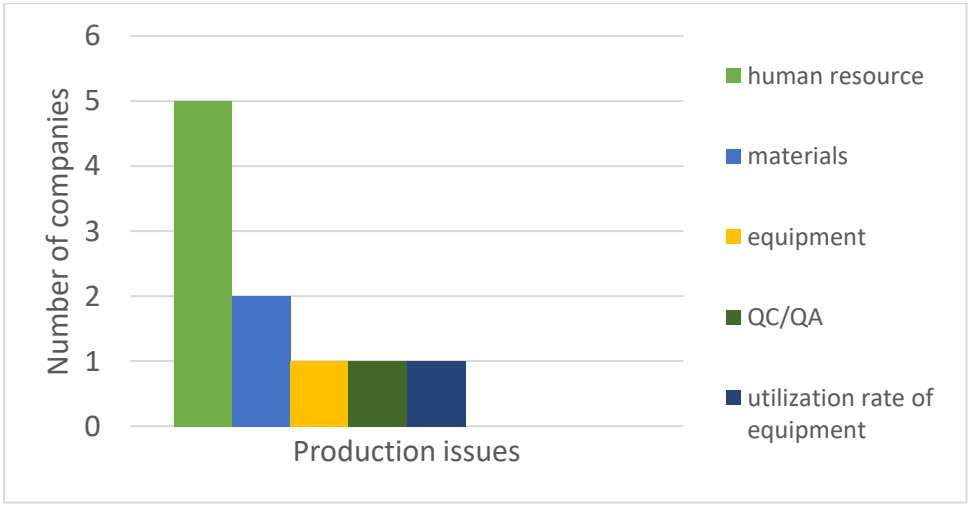

Figure 12. Human Resource Tops List of Production Issues, 2018 Forging Industry Study

The industry's concern regarding the lack of people to hire may best be addressed through training programs whose curricula are up-to-date with the skill sets required by the industry. Workers always look for greener pasture. They leave when there are more attractive jobs for them. So as not to make the problem on the lack of employees to hire any worse, the industry needs a steady supply of workers. Partnerships among the government, the academe, training institutions, and the industry must be forged and nurtured.

4.4. Technological Factors

Forging is a technology-heavy process. Forging businesses rely on advances in technology for the manufacture of various forgings whose characteristics, i.e. strength and durability, are suited to their applications.

Different references define 'technology' as:

'Methods, systems, and devices which are result of scientific knowledge being used for practical purposes.'

- Collins Dictionary

'The study and knowledge of the practical, especially industrial, use of scientific discoveries.'

- Cambridge Dictionary

'The application of scientific knowledge for practical purposes, especially in industry.'

- Oxford Dictionary

'A manner of accomplishing a task, especially using technical processes, methods, or knowledge.'

- Merriam-Webster Dictionary

'Technology can be defined in a narrow sense as the "engineering knowledge needed to create and produce a new product or process" and in a broader sense as "the means for accomplishing a specific task."'

- The Philippine Experience

The forging process requires other complementing metalworking processes to enable a forging company to produce quality metal products, and offer services that fulfill customers' demands end-to-end. According to the DOST-MIRDC's Philippine Mechanized Forging (1992), complementary services and supporting facilities common to a forging company are tool and die, heat treatment, material preparation, and testing. These remain the same metalworking processes employed by forging companies up to the present, with the addition of other processes such as machining, welding, and stamping, to name a few. Figure 13 presents the most common metalworking processes

used by local forging companies. It is worth noting that local forging companies, represented by six (6) out of seven (7) respondents, have heat treatment capabilities. This goes to show that setting up a heat treatment facility is one of the very important considerations for those who are interested to venture into or upgrade capabilities in the forging business.

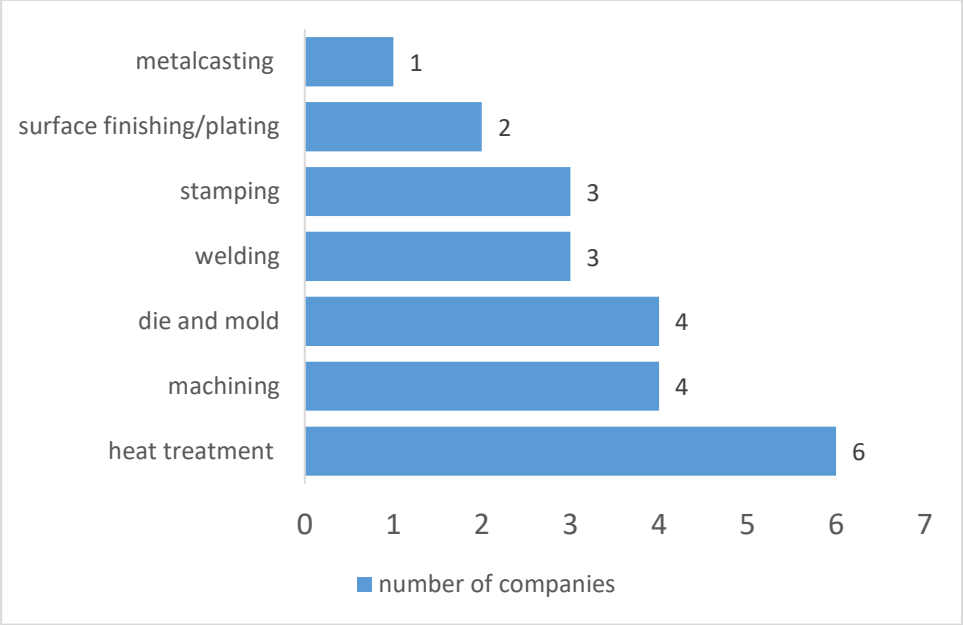

Figure 13. Metalworking Processes Employed by Forging Companies, 2018 Forging Industry Study

Forging, being the unique process behind the production of metal products used as critical components of automotive and trucks, aircrafts, off-highway and heavy construction equipment, mining machinery, among others, is a technology that constantly adapts with the rapid-changing times. This is made possible through the types of forging equipment utilized by local forging companies.

The Cleveland-based Forging Industry Association (2019) and CanForge (2019) identified hammers, presses, and upsetters as the major equipment used to forge metals. Hammers beat the metals rhythmically into shape using controlled and high pressure blows. Presses squeeze metals vertically, while upsetters forge metals horizontally. All these are found in local forging companies. Presented in Figure 14 are the kinds and number of forging equipment used by the industry.

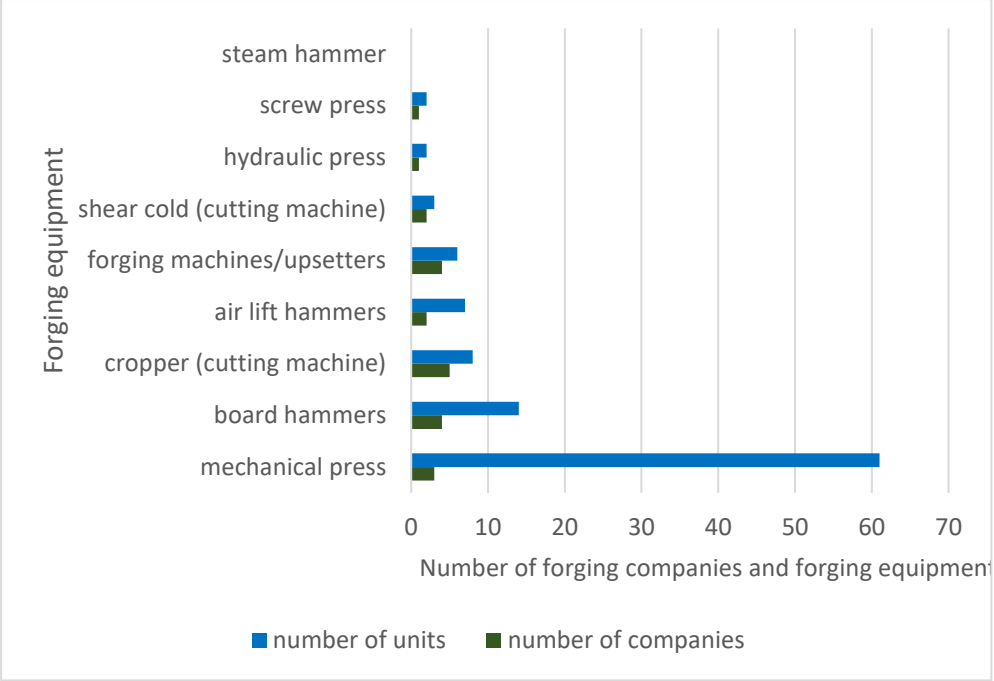

Figure 14. Forging Equipment, 2018 Forging Industry Study

Mechanical presses are the most common forging equipment among forging firms. Steam presses are included in the list of equipment, but the 2018 survey revealed that no forging company is using this at present.

All mechanical and screw presses used by the local forging industry are bought brand new. The hydraulic presses are second hand. The board hammers are acquired either brand new or second hand. All air lift hammers, on the other hand, are second hand; the same is observed for upsetters. Forging businesses are using both brand new and second hand upsetting machines. Majority of these forging equipment, especially the second hand equipment, have already been upgraded. Those which are not yet upgraded are those owned by small forging businesses.

Local forging companies employ heat treatment processes, both annealing and normalizing. Heat treatment capabilities are crucial to the operations and overall business sustainability of forging companies. All surveyed heat treatment equipment are in good working condition.

Technological changes pose challenges to the economic growth of a country. These challenges have become more pronounced as the effects of the Fourth Industrial Revolution (I4.0) are taking its toll worldwide. The Philippines ranked 56th in the 2017-2018 Global Competitiveness Index Rankings (Schwab, 2017). The ranking is based on the compilation of information and data compiled by the World Economic Forum (WEF), which defined competitiveness as 'the set of institutions, policies, and factors that determine the level of productivity of an economy' (Schwab, 2017). Important concepts that influence productivity and long-term prosperity are organized into 114 indicators which serve as guide in the scoring of performances of individual economies. The indicators are further grouped into 12 pillars, with the Department of Science and Technology (DOST) involved in contributing to the attainment of three (3) pillars: (1) technological readiness; (2) business sophistication; and (3) innovation (DOST, 2016).

All three have something to do with how an economy is able to face and overcome challenges brought about by technological change. Technological readiness measures the agility of an economy in terms of adopting existing technologies to enhance the productivity of its industries. Business sophistication examines the businesses' overall networks and individual firms' operations and strategies to increase efficiency in the production of goods and services. Innovation, as the last pillar, considers the possibility of integrating and adopting technologies as economies approach the frontiers of knowledge (DOST, 2016). Out of a total of 137 countries, the Philippines ranked 83rd in technological readiness, 58th in business sophistication, and 65th in innovation (Schwab, 2017).

The country aims to become a first world, but it is technological change that propels long-term economic growth of other countries that reached first world status. For the country to make this change happen, science and technology spending, including R&D, must be raised to 2 percent of the GDP which means a value that will reach around P240 billion a year according to the National Economic and Development Authority (Business Mirror, 2017). Singapore leads ASEAN countries in R&D spending, with a GDP and gross domestic expenditures on R&D (GERD) ratio of 2.1 percent and an R&D workforce of 7,252 researchers per million. Malaysia is second with 1.13 percent GDP-GERD ratio and 2,593 researchers per million.

The Philippines' S&T spending is the lowest among its ASEAN neighbors. GDP-GERD ratio was at 0.11 percent in 2009, 0.2 percent in 2017, and is projected to reach 0.5 percent in 2022. There were 180, and 270 researchers, scientists, and engineers (RSEs) per million in 2009 and 2017, respectively. The country is aiming to reach at least 300 RSEs per million in 2022 (Dela Peňa, 2017).

Although both public and private sectors are engaged in R&D initiatives, R&D spending apparently is not given priority in the country for many years, basing on the Philippines' ranking on the Global Competitiveness Index, particularly on the technological readiness and innovation pillars. This is not a country-wide priority, and the same is true for a great number of industries including the forging industry. Unfortunately, the industry, like the rest of the country, is under-spending in R&D (Department of Science and Technology, 2015). Figure 15 shows the forging companies' appetite for R&D spending.

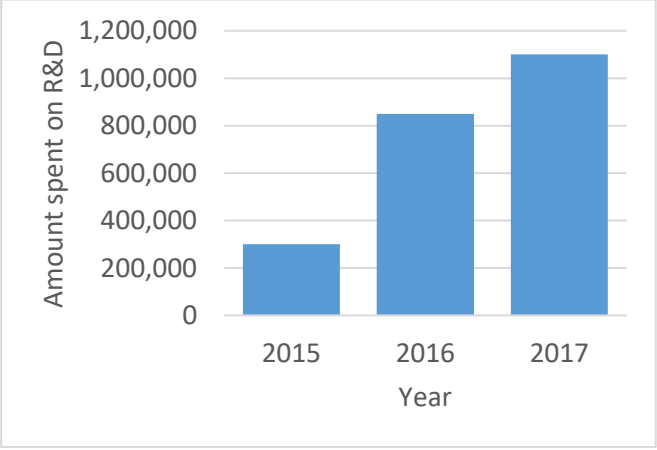

Figure 15. R&D Spending of Local Forging Companies, 2018 Forging Industry Study

Figure 15 presents the R&D expenditure of the industry over a three-year period, 2015-2017. These figures, however, came from the responses of only two (2) respondents. The industry's R&D initiatives are factors that influence its advancement. The survey team learned that five (5) out of the seven (7) respondent companies are engaged in new product development. Our local forging companies are involved in new product development, i.e. barrel for gun parts and improvement of cross-arm hardware, to name a few. Similarly, five (5) out of seven (7) forging companies also are engaged in new method development. One (1) out of seven (7) respondent companies said that it does not allot budget for R&D. One, on the other hand, claimed that the company spends on R&D, but it is not budgeted. Their R&D activities and expenditure are just an 'on the go' basis.

Now, this very low budget allotted to R&D and the industry's attitude toward R&D point us to the question: how does the industry really view R&D? How do they define R&D, and how do they perceive its impacts on the company's growth? These questions will be answered later in this report.

As a research and development institute (RDI), the DOST-MIRDC services are categorized as follows: (1) technology development; (2) technology transfer; and (3) technical services. The survey results gave an affirmation of the Center's relevant role to the forging industry. Asked to identify what services they are interested to avail from the Center, the respondents gave various answers that encompass all three categories of the services it offers. Figures 16-18 summarize the local forging industry's responses.

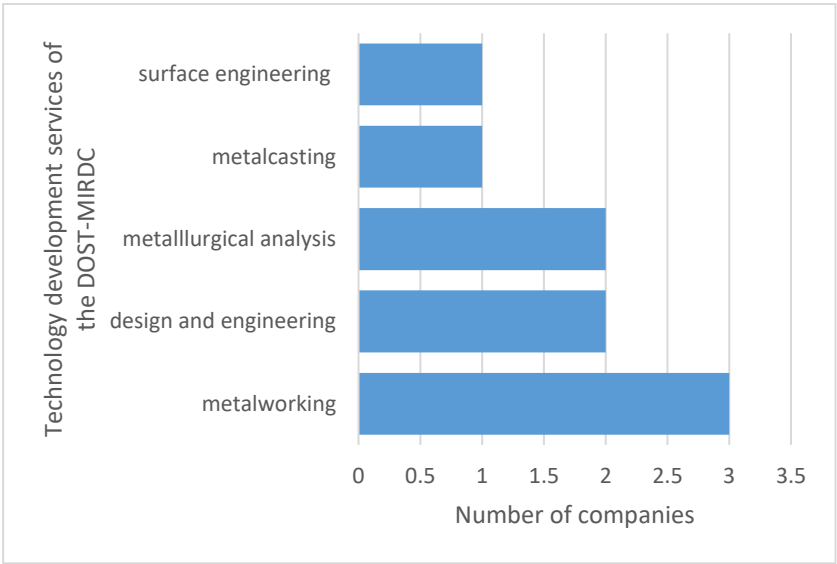

Figure 16. Number of Forging Companies Interested to Avail of the DOST-MIRDC's Technology Development Services, 2018 Forging Industry Study

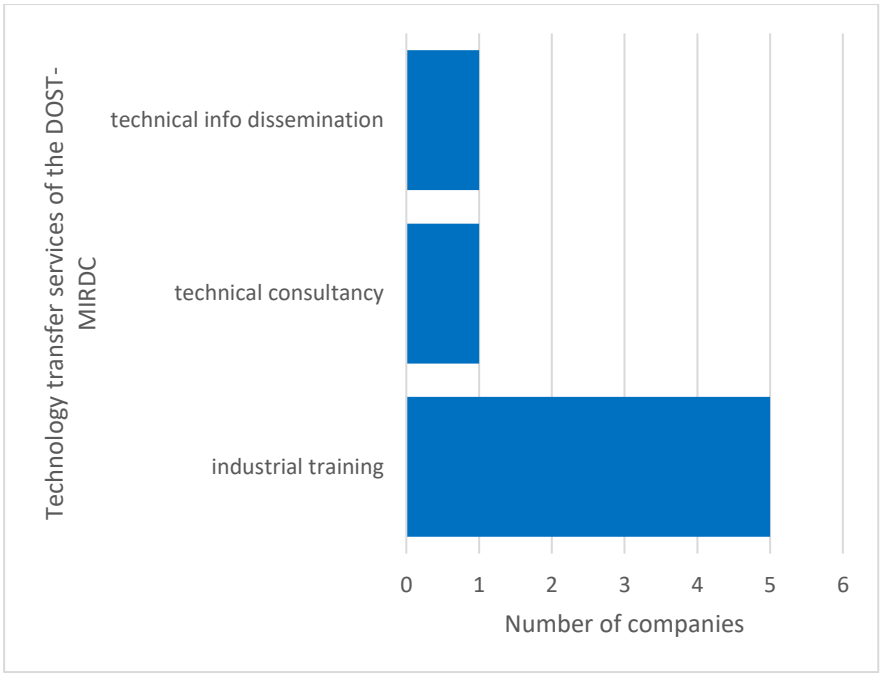

Figure 17. Number of Forging Companies Interested to Avail of the Center's Technology Transfer Services, 2018 Forging Industry Study

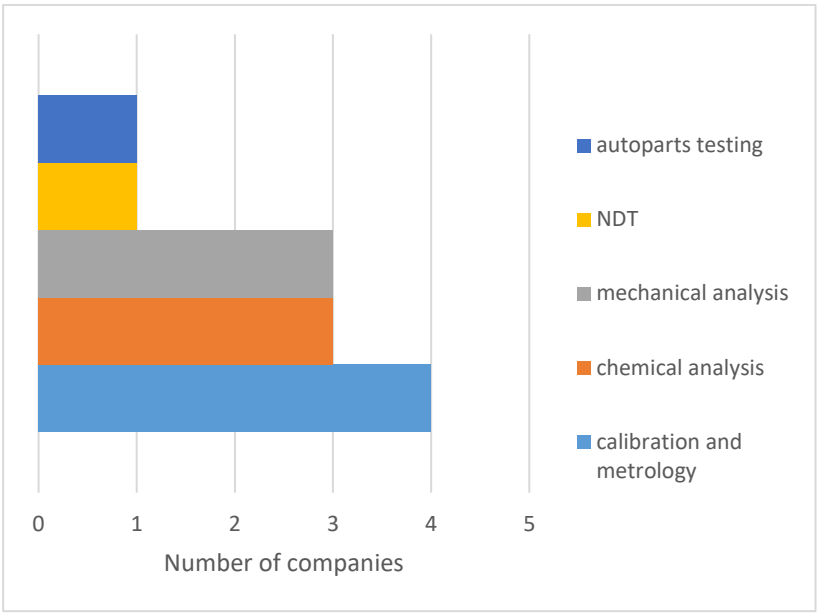

Figure 18. Number of Forging Companies Interested to Avail of the Center's Technical Services, 2018 Forging Industry Study

The R&D and innovation culture among the local forging companies need to be supported and nurtured. Fortunately, the survey revealed that all forging companies are aware of the existence of the DOST-MIRDC, and most of them have already availed of the Center's services as part of the compliance to their customers' requirements. Although very small in size, the forging industry benefits from the services of the DOST-MIRDC.

4.5. Environmental factors

As an effect of its location on earth, the Philippine climate is described as predominantly hot and humid, with plenty of typhoons typically from June to November. The country has been hit by the El Niño phenomenon, giving the Filipinos a number of water and agriculture issues to think and strategize about. Also, the Philippines is found in a particular spot on the planet called the Pacific Ring of Fire, which indicates higher risks to earthquakes and volcanic eruptions (ASEAN Briefing, 2017).

Although prone to many natural calamities like earthquakes, typhoons, flooding, and volcanic eruptions, among others, the Philippines is proud of its rich mineral resources. Named by the Asian Development Bank (ADB) as the fifth most mineralized country in the world, 30 percent of the land is believed to contain important metallic mineral deposits that are results of volcanic geology. As such, the Philippines is rich in geothermal resources, and is in fact, the second largest geothermal producer, second only to the US (ASEAN Briefing, 2017).

The 2018 survey of the forging industry revealed that the power generation industry is its top client. Given the prevailing environmental conditions due to the geographical location of the Philippines, the forging businesses serving the power generation industry will continuously have jobs, most especially when natural phenomena like typhoons, flooding, and earthquakes occur. As pointed out by the ASEAN Briefing (2017), power generation using geothermal resources remains a viable business in the country. Forging companies are therefore at the center of business activities where power generation is concerned.

Business for forging companies appear very vibrant under the leadership of the current administration, owing to the Build, Build, Build (BBB) Program. The major railway projects, establishment of industrial parks, airports, energy facilities, flood control facilities, water resource projects, and irrigation systems, make up the BBB program. These infrastructure projects, which target to increase government spending to P8 to P9 trillion from 2017 to 2022, are aimed to develop industries and result to the creation of jobs and improvement of Filipino lives (Mawis, 2018). Again, the forging industry is among the most in-demand downstream industries, particularly because the construction industry is taking center stage amid all the infrastructure projects of the government.

On the other hand, however, environmental concerns are exerting pressure among the local forging industry players. The forging companies are faced with the issues regarding aerosol emissions and fluid and byproduct recycling (FIA, 2019). Immediate formation of aerosol results from the contact of the die lubricant with high-temperature parts during the forging process. Aerosol also forms when the die lubricant comes in contact with smoking parts in cooling bins (Park, 2011). Environmental protection-related requirements advocate reuse and recycle policies, and the education in the usage of natural resources – which are quite impossible for the forging industry whose operations are heavily dependent on the use of power and oil-based products.

5. Micro-environmental Factors That Influence Industry Competitiveness (Porter's Five Forces of Industry Competitiveness)

Developed in 1979 by Michael E. Porter of the Harvard Business School, the Five Forces of Competitive Position Analysis is a globally accepted tool to assess and evaluate a company's competitive strength and position. Through Porter's Five Forces, a company is able to determine where its power lies, what products and services have potential profitability, and how the company can best cope with unique challenges of the industry (Chartered Global Management Accountant, 2013). Considering each force, pressure may be identified as either low, medium, or high. Knowledge of how these forces are influencing business landscapes are effective decision-making tools for the industry as a whole.

5.1. Suppliers exert medium pressure among local forging companies.

Forgings are rarely physically seen in assemblies and equipment (Forging Industry Association, 2019). These forged metals usually serve as component parts inside airplanes, automobiles, tractors, ships, engines, missiles, oil drilling equipment, and all sorts of capital equipment.

The DOST-MIRDC's Philippine Mechanized Forging (1992) reported that the forging industry uses steel bars, shafts, and rods as the main raw materials for their production - 90 percent of the industry's requirements are sourced from suppliers abroad.

At present, local forging companies import more than 12,000 metric tons of iron plates, sheets, bars, and steel billets, bars, and rods. These are the materials that go into forgings. There are only a few major players among the surveyed forging companies, and their raw material importation makes up the entire importation activities of the local forging industry. In 2018, major players in the forging business import 100% of raw materials from countries such as Japan, China, and Taiwan.

Philippine forging companies, and all other metalworking firms, rely on foreign suppliers for their steel requirements. In fact, the country placed sixteenth and seventeenth in the global ranking of steel importers in 2016 and 2017, respectively (International Trade Administration, 2016) and (International Trade Administration, 2017). Steel imports reached 3.2 million metric tons in 2015, and 8.1 million metric tons in both 2016 (International Trade Administration, 2016) and 2017 (International Trade Administration, 2018). The country's overall steel imports come from these top country-sources: China, with the most significant share, 50 percent; Thailand, 11 percent; Russia, 10 percent; Japan, 9 percent; and Vietnam, 6 percent.

Forging companies import top commodities like ball bearings, screws and bolts for metal, and grinding balls. Suppliers of forged products include China, India, and Japan.

Of the three country-sources, China is the top supplier with 64.9 percent share, India is ranked second with 10.8 percent share, and Japan is ranked third, with a share of 9.7 percent (PSA, 2017).

Dr. Ronald Mendoza, economist and policy expert, warns the country of depending heavily on China (Bonquin, 2018). It is good that local forging companies are also importing from other countries so that there are alternatives. The industry is facing big risks if majority of imported forged metals are sourced from China. Aside from China being the lead supplier of the country's steel requirements, the dispute between the Philippines and China as claimants on the West Philippine Sea remains unsettled. Thus, supplier power poses medium pressure on the industry.

5.2. Buyers exert low pressure among local forging companies.

Based on the 2018 industry study, power generation and automotive are the two leading industries served by local forging companies. The construction of new power plants in the next coming years is going to be a major focus of the power generation business - foreseen to grow in the period from 2018 to 2029 - for the following reasons: (1) there is a need to replace old ones; and (2) more supply of electricity is needed to allow more growth (Ver, 2018).

Consequently, power distribution companies are among those being served by the forging industry. Meralco used to dominate the field, but its market share has continuously slipped from 56 percent in 2016, to only 34 percent in March, then dropped to 31 percent by the end of June 2018. According to the Business World (2017), market shares are now divided with other retail electricity suppliers (RES) licensed by the Energy Regulatory Commission (ERC), namely: Aboitiz Energy Solutions (18 percent), and Phinma Energy Corp. with 9 percent share.

The automotive industry, on the other hand, remains a very profitable market for the forging industry. With the participation of Toyota Motor Philippines and Mitsubishi Motor Philippines Corp. in the government's CARS Program (Cahiles-Magkilat, 2019), the increasing vehicle sales due to the rising disposable income, and the expanding construction and logistics sectors that is projected to raise the demand for commercial vehicles across the Asia-Pacific region (TechResearch, 2018), the forging industry has a wide customer base to keep its business going.

However, there is one major issue here. For the forging companies to qualify as suppliers, particularly to the automotive industry, they would have to offer really competitive prices. This is an exciting challenge for local forging players, if only they are competing in a level playing field. Apparently, this is not the case. Most big automotive and motorcycle companies, supposedly the forging industry's major clients, are either owners or major shareholders of forging companies in Thailand and Indonesia – a fact that makes the playing field for local forging players far from being level.

It is a good thing that apart from the automotive and power generation industries, local forging companies have other industry-clients as well. Table 4 presents the industry's clients and the specific products they require.

Table 4. Forgings Required by Various Industries, 2018 Forging Industry Study

Industry served by the local forging companies	Specific forged products required
1. Automotive	Transmission gears Steering components Under chassis parts
2. Power distribution	Hardware components such as: Anchor rods Oval eyebolt Clamps
3. Agriculture	Farm implement type Horse shoe
4. Mining	Grinding balls Conveyor Rollers Digger tooth
5. Railway	Brake parts
6. Hardware	All types of hammers Bolts Nuts
7. Motorcycle	Kick start Crankshaft Steering arm

The local forging industry is unquestionably a very vital player in the manufacturing industry as it currently possesses capabilities to produce various forged products necessary for the operations and continuous business of the industries it serves. As a matter of fact, the respondents were confident to say that they are able to constantly meet their customers' quality requirements. Figure 19 presents these quality requirements.

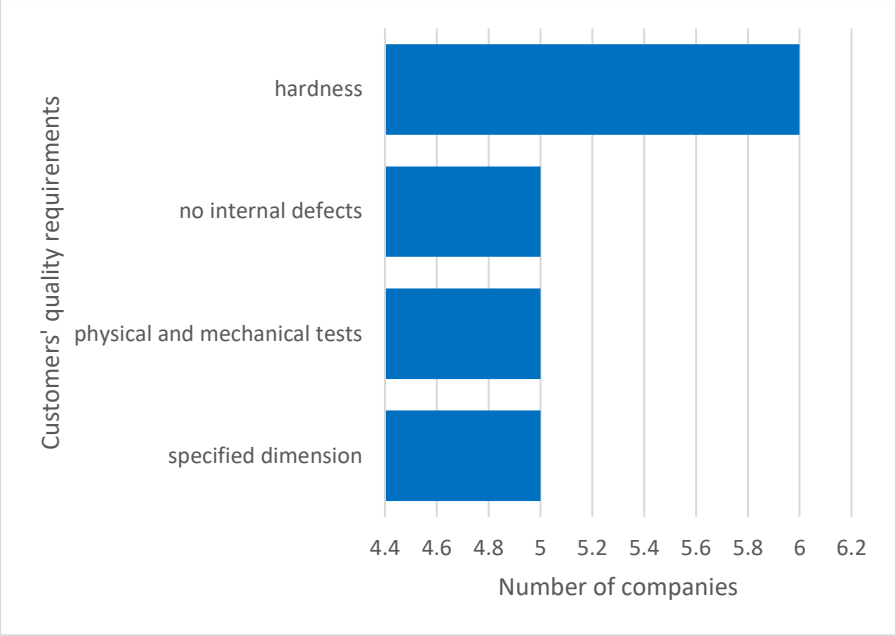

Figure 19. Customers' Quality Requirements, 2018 Forging Industry Study

There is low threat of buyer power, for the market is not dominated by one player alone. The forging industry has a number of clients to choose from, and this is a healthy condition for forging businesses since no single client can dictate the price.

5.3. Local forging companies feel a very strong pressure caused by competitive rivalry.

As mentioned, there are only eight (8) local forging companies, with data available only from seven (7) of them. In the local scene, the forging companies are already serving niche markets. Although there may be overlapping supply chains, they are not rivals. Previously mentioned also is the fact that forging companies are in a harmonious relation, there exists like a big brother-small brother hand-holding relationship. The mentoring and assistance come in the form of spill-over of jobs, subcontracting, or training. They have established among themselves a healthy business ecosystem where one is allowed to grow and benefit from the other.

But the global scene is a totally different story. A global network of researchers from various fields of expertise have developed the Global Value Chain (GVC) framework over the last two decades with the purpose of understanding the globalization phenomenon (Duke University Center on Globalization, Governance & Competitiveness, 2016). According to the Duke CGGC (2016), value chain 'describes the full range of activities that firms, workers, and supporting institutions around the world perform to bring a product from conception through production and end use.

A number of local forging companies reported serving customers in the foreign market. The country is presently identified to take part in the production of parts and components, particularly the electronics, wiring, and aluminum components, as well as systems and modules including electrical and electronics system and chassis system (Duke Center on Globalization, Governance & Competitiveness, 2016). These are products where the local forging industry can compete in. Duke CGGC (2016), in its SWOT analysis, described the country's strengths as the following: established global footprint in the wire harnesses segment; commitment of leading industry stakeholders, industry associations, the DTI-BOI; competitive labor environment; effective Philippine Economic Zone Authority (PEZA) regime; and provision of incentives to lead firms via the CARS Program. However, gaps in supply chains, small market for motor vehicles, widespread smuggling of cars, and low to moderate support for R&D activities weaken the Philippines' role in the automotive GVC. Local forging companies are facing strong competition with forging companies in the ASEAN region, most specially in Thailand and Vietnam. Figure 20 shows the number of forging companies engaged in export.

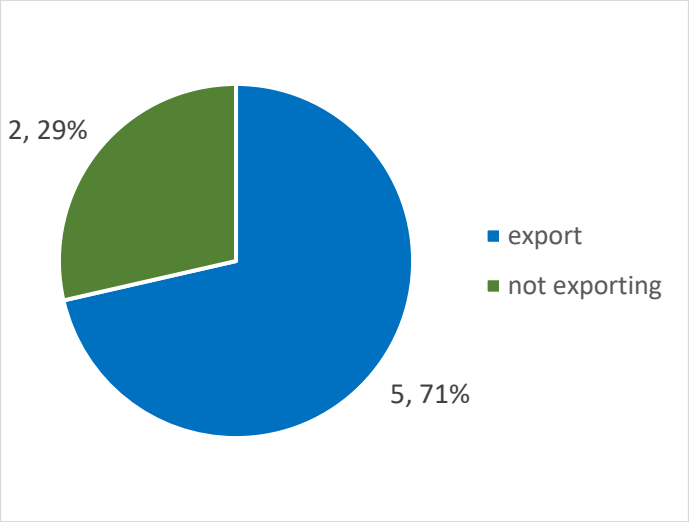

Figure 20. Number of Forging Companies Engaged in Export, 2018

Based from survey results, 71 percent of the local forging companies are either direct or indirect players in the export market. Countries of destination of locally forged products include Japan, USA, Hong Kong, Singapore, Thailand, and Indonesia. Other products are shipped to customers located in Thailand, Guam, Saipan, and Kazakhstan.

Entry to and maintaining a strong foothold in the GVC requires that companies are Industry 4.0 (I4.0) enabled, since the implementation of I4.0 will lead companies toward the attainment of optimization of operational costs and quicker reaction to market demands that keep becoming unpredictable all the time (Paul, 2016). The question on the Philippines' readiness for the challenges brought about by the widespread implementation of I4.0 is best answered by Aldaba (2018): many industries are still in Industry 3.0, defined by automation through electronics and information technology, but some are still in Industry 2.0, those with capability for mass production via assembly line and electricity, transitioning into Industry 3.0. Unfortunately, survey results show

that local forging companies are more in the I3.0 phase. This makes the local forging industry, in general, less globally competitive.

5.4. Products of local forging companies face high pressure from substitute products.

According to the Harvard Business School Institute for Strategy and Competitiveness (n.d.), when a new product or service meets the same basic need in a different way, industry profitability suffers. The threat of substitution is high if the substitute offers an attractive high-performance trade-off relative to the industry's product or if the buyer's cost of switching to the substitute is low.

Research says that growing automotive industry, and rising investment in renewable energy, high strength metal components, and cost effective methods of metal farming are the major driving forces of the global forging market. However, the increasing usage of casting or stamping process, rising demand for plastics as substitute, environmental rules and regulations, and availability of light materials for automotive manufacturing are restraining the global forging market (KITV, 2018).

The local forging industry identified the automotive industry as one of their top industry clients. This is so because many parts of a vehicle, particularly the engine and the transmission, need to be strong – these parts need the strength that only the forging process can give (Mazda, 2018). Being the most complex components of a car (AAMCO Colorado, 2017), additional layers of know-how and complexity appear with each technology upgrade in transmission systems. At first, transmissions were all manual, with their complexity determined by the number of gears to be managed (AAMCO Colorado, 2017). All these gears are made by the forging industry. Then came the automatic transmission. Today, more transmission technologies are coming out. Transmission evolution covers continuously variable transmission (CVT), double clutch, and 8- or 9-gear slushboxes. Although their function of transferring the power of the engine to the wheels remain the same, their fuel efficiency feature is a threat to the existence of manual transmissions and even the traditional five-speed automatics (AAMCO Colorado, 2017). The CVT technology increases the threat of substitute to the products of the forging industry as it is making some components like gears, cogs, and moving parts, obsolete (Deliotte, 2017).

As more and more cars coming up with new models with the CVT, the threat of substitute products to forged metal components that go into transmission systems become higher and higher.

5.5. New entrants in the industry pose low pressure among local forging companies.

Existing rivals are not the only threats to firms in an industry. New firms entering the industry affect the competitive environment, too. According to the QuickMBA (1999) in its discussion of Porter's Five Forces focusing on the threat of new entrants,

> *'in theory, any firm should be able to enter and exit a market, and if free entry and exit exists, then profit should always be nominal. In reality however, industries possess characteristics that protect the high profit levels of firms in the market and inhibit additional rivals from entering the market. These are barriers to entry.'*

Barriers to entry work the same way as barriers to exit. A company considering to exit the industry has to face challenges related to exit barriers, especially for capital-intensive businesses.

In the last survey of the forging industry conducted by the DOST-MIRDC in 1992, there were seven (7) forging companies, namely:

1. Acme Tools Manufacturing Company, Inc.;
2. Marsteel Corporation;
3. Armco Marsteel Corp.;
4. Philippine Forge, Inc.;
5. Cathay Industrial and Mill Supply;
6. Toho-AG&P Metal Forging Corp.; and
7. Pilipinas-YTK Industries, Inc.

After 26 years, there are eight (8) forging companies; this study was able to gather data from seven (7) respondent-companies only. There appears to be a great barrier to entry, as there remains a handful of local forging companies. As indicated in Table 1 on page 13, the newest addition to the forging industry was established in 2010. No other forging company was established after 2010.

On a global scale, high capitalization requirement is identified as the top entry barrier to the forging industry. According to the Transparency Market Research (2017), well established players are dominating the forging industry because of the capital-intensive nature of the business. This is true about the forging industry. Acquiring modern forging equipment is expensive enough, and setting-up and laying out of production equipment requires an even larger cost, which serves as a big barrier for those who wish to enter the industry.

6. SUMMARY AND CONCLUSION

6.1. Most of the forging industry's issues will be addressed through the establishment of an integrated steel mill.

For so many years, the industry relies heavily on imported raw materials. The country has no integrated steel mill, thus the industry largely depends on importation. Back in 2012, the steelmaking industry was threatened by the entry of steel products from China sold at lower costs than those produced locally (Lucas, 2012). This condition was primarily the reason why establishment, expansion, and modernization of the domestic steel industry is prevented. Whether raw materials or finished forged products, China remains one of the countries of origin of Philippine imports and the local forging industry's stiffest competitor at present.

The solution may take a long while before benefits can be felt, but it still lies on the country's need for the setting-up of an integrated steel mill. Fortunately, things are looking pretty good for the industry as the country is seriously taking steps to address this requirement with the $4.4 billion integrated steel manufacturing project of the HBIS Group Co. Ltd. and Huili Investment Fund Management Co. Ltd. of China, in partnership with the Philippines' SteelAsia Manufacturing Corp. (Cahiles-Magkilat, 2019). The project is aimed at setting up port operations, sintering, coking, pelletizing, iron-making, steel-making, and steel rolling facilities that will occupy 305 hectares of land in Mindanao's PHIVIDEC Industrial estate (Desiderio, 2018).

It is very ironic how a country that is very rich in minerals, such as the Philippines, exports these minerals to be processed abroad, and pays such high costs for imported raw materials. With the integrated steel mill, the country will have the capability to process products of the mining industry so that raw materials will be available locally.

6.2. Forging companies have seasonal businesses, and thus, will need clear guidelines on flexible regularization of employees.

Forging companies contribute to employment, albeit very small. Although employees are hard to find, the consolation forging companies get is that their employees stay long in the industry and gain expertise. Even so, forging companies are not exempted from problems caused by human resource-related issues. First off, the newly-hired often do not last long. Secondly, regularization is a big issue among forging companies. Generally, jobs are seasonal for forging companies. They cannot afford to take on employees on a permanent basis, because operational costs will go sky-high especially during off-peak season. For this, the industry is going to benefit from guidelines that allow flexibility for forging companies that have seasonal businesses. Thirdly, labor unions are also a concern for them. Some companies encourage the formation of labor-management cooperation, rather than the creation of labor unions.

Local forging companies are very few, then till now. Most are categorized as SMEs based on size of employment, but more than half are considered large enterprises based on present assets. Power generation, automotive, mining, metalworking, and construction are the top five (5) industries served by the local forging companies. But capitalization is a very huge obstacle, as costs grow higher year after year. It takes a risk-taker to decide to pour in more investments in the business.

Fortunately, the government programs and projects paint a very positive vision for the forging industry. There are the Build, Build, Build Program, the Manufacturing Resurgence Program (MRP), and the Comprehensive Automotive Resurgence Strategy (CARS) Program, to name a few, that hold promise of a very robust business environment for the forging industry. In addition, Ambisyon Natin 2040, is a long-term vision that includes the manufacturing sector in its grand plans for the country.

The local forging industry, along with the plans and programs of the Duterte government, stand a great chance of succeeding in the very stiff market competition which is a result of the globalization phenomenon. Foreign investors are taking note and taking advantage of the Philippine economy's growth as reflected in the rise in foreign direct investments (FDI). Capital equity in 2018 came mostly from Singapore, Hong Kong, the United States, and Japan and were routed to businesses engaged in profitable operations including the manufacturing industry (Rey, 2018). Because the forging companies are serving clients in the power generation, automotive, mining, and construction industries, among others, local forging companies are faced with opportunities of a wide market base.

6.4. Local forging companies must carefully consider investment options to take advantage of the Industry 4.0 phenomenon.

Global competition is a major challenge to the forging industry, particularly the Industry 4.0 phenomenon. Local forging companies, especially those engaged in the export market, have to face rigid competition with forging companies that are more I4.0 enabled.

A more reliable internet connection is necessary for increased automation in the production floor, and for establishing contact with suppliers, buyers, and end-users online. The internet technology has created drastic changes in the way we conduct business, in the way we interact, and in every way that we live our lives. This is a time when industries have to seriously consider online business transactions to take advantage of real-time communications with potential clients. In addition, if the Philippines is to take part in and benefit from the I4.0 phenomenon, connectivity is one factor that is needed to reach success.

The telecommunications industry is presently dominated by PLDT and Globe. The publication of the Department of Information and Communications Technology (DICT) of the guidelines for the entry of a third major telecom operator in the market in 2018 is

a welcome news for millions of Filipino internet users and subscribers. The identification of the Mislatel consortium that includes China Telecom raises the public's expectations for a better and faster connectivity. Once faster internet connectivity is rolled-out, businesses, including our local forging companies, will be in better shape to join local and global market competition.

6.5. Success of local forging companies depends on two strategies: unity through revival of an industry association; and maintenance of a pool of skilled manpower through strengthened linkages among the government, the industry, and the academe and other training institutions.

Issues and challenges, such as the difficulty in finding people to hire, raw materials testing failure, equipment breaking down, etc., are best dealt with through the cooperation of all forging companies, with consultancy and guidance of relevant government agencies, plus the linkage with the academe and other training institutions. It is very important that the local forging industry gets its act together in order to face the stiff competition in a global scale, because not doing anything about emerging opportunities will definitely leave the Philippines behind. Equally important, too, is the country's move to unite the forging industry players and identify shared goals.

6.6. Forging is a technology-driven business. Local forging companies must be open to employ S&T services and to engage in R&D-intensive activities.

The forging companies contribute to enriching the manufacturing capabilities of the country. Most of the local enterprises are engaged in batch or mass manufacturing, only one is involved in one-off or job type of production. There is higher degree of sophistication for companies doing batch or mass production. Generally, forging companies need to have a heat treatment facility. Data gathered from the survey show that hardness is among the top quality requirements demanded by the market among forging companies. Investments for the forging companies therefore must include maintenance and continual upgrading of the in-house heat treatment facility for purposes of capability enhancement and market competitiveness.

There is R&D spending among forging companies, as survey respondents revealed that the amount allotted for R&D is on an increasing trend in the last three years. Expenses were allotted for new product and new process development. But the country as a whole is spending too little for R&D, and this is a major concern that must be given attention, if we truly intend to be among the highly competitive economies in the world. On a more positive light, local forging companies are aware of the DOST-MIRDC, with most of them have already availed of the Center's services. They remain interested with the services offered by the Center: on top of the list are metalworking technology development, industrial training, and calibration and metrology services. This is a good indication of the companies' willingness to deliver science and technology-based

businesses. After all, long-term economic growth is driven by a strong science and technology foundation.

6.6. Micro-environmental influences drive the competitiveness of the forging industry, and local players have to keep an eye on threats of substitution and competitive rivalry.

Forging companies import raw materials. Luckily, not one single supplier controls the import transactions of the forging industry. Raw materials come from Japan, China, and Taiwan, with more than half of the imports coming from China. High inflation rates contribute to the rising costs of raw materials, and the country also has to pay conscious efforts to the Philippine-China relations regarding territorial disputes. But the government's moves to seal beneficial partnerships with China somehow eases the tension. The medium pressure from suppliers is best handled through the establishment of a well-nourished relation with foreign economies. Buyer power is causing low pressure on the industry. Not one single client has the power to dictate the cost of forged products. There is a diverse market for products of the forging industry. Local forging companies need not worry about threats from new entrants. Capitalization required for a business to enter the industry is very prohibitive. Major expenses include purchase of equipment, layout of production floor, work space to rent or acquire, manpower to hire. The list may go on, and the cost is definitely going to shoot up so high that investment may sound not so encouraging.

However, there is high pressure from threat of substitution and competitive rivalry. R&D initiatives of big names in the automotive industry have given rise to various transmission technologies. The introduction of the continuously variable transmission (CVT) in compact vehicles is changing the landscape for the forging industry. The CVT transmission utilizes lesser forgings. Other materials are used as substitutes to forgings. Further advancement of the transmission technology is seen to make some forged components obsolete. Unfortunately, this will create a big blow to the market base and the profit margins of the forging companies serving the automotive industry.

Also giving strong pressure to the forging industry is competitive rivalry. The world is a very big marketplace and clients have the options at the tip of their fingers. For as long as forging businesses have online presence, clients even from abroad can find them and be interested with their services. But if local forging companies are pitted with foreign forging companies with better skills and capabilities, their foreign competitors will be the best choices of customers.

The products and services of the forging businesses are industry-specific. Certain products go to power generation, others are needed in the automotive, while others go to mining. Forgings are necessary for other industries to perform their businesses. There is simply no way that the manufacturing industry can produce their products and offer their services if there is no forging industry to speak of. Clearly, the local forging industry is essential for a complete and globally competitive Philippine manufacturing sector.

7. RECOMMENDATIONS

Going back to these questions posed in Section 4.4. Technological Factors:

'Now, this very low budget allotted to R&D and the industry's attitude toward R&D point us to the question: how does the industry really view R&D? How do they define R&D, and how do they perceive its impacts on the company's growth?'

Michael Porter, from the Harvard Business School, introduced the concept of the value chain (Harrison, 2018), which looks in on the full range of activities involved from conceptualization up to delivery of a product or service. Porter is quoted in the article of Harrison (2018) saying,

> *'Competitive advantage cannot be understood by looking at a firm as a whole. It stems from the many discrete activities a firm performs in designing, producing, marketing, delivering, and supporting its product. Each of these activities can contribute to a firm's relative cost position and create a basis for differentiation.'*

In order to address the technology needs of the forging industry, and of any industry for that matter, Porter's value chain analysis is a very effective tool. Figure 21 presents the value chain model.

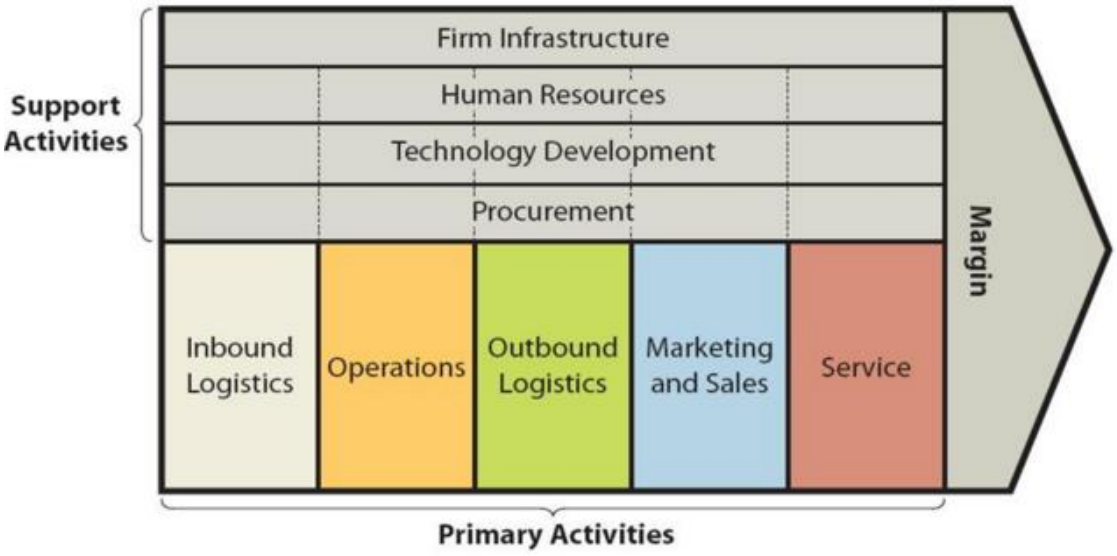

Figure 21. Michael Porter's Value Chain Model
Source: Research Methodology

The value chain model defines the technologies that companies use in carrying out various primary and support business activities. Figure 22 below identifies various technologies in each of the stages of the value chain.

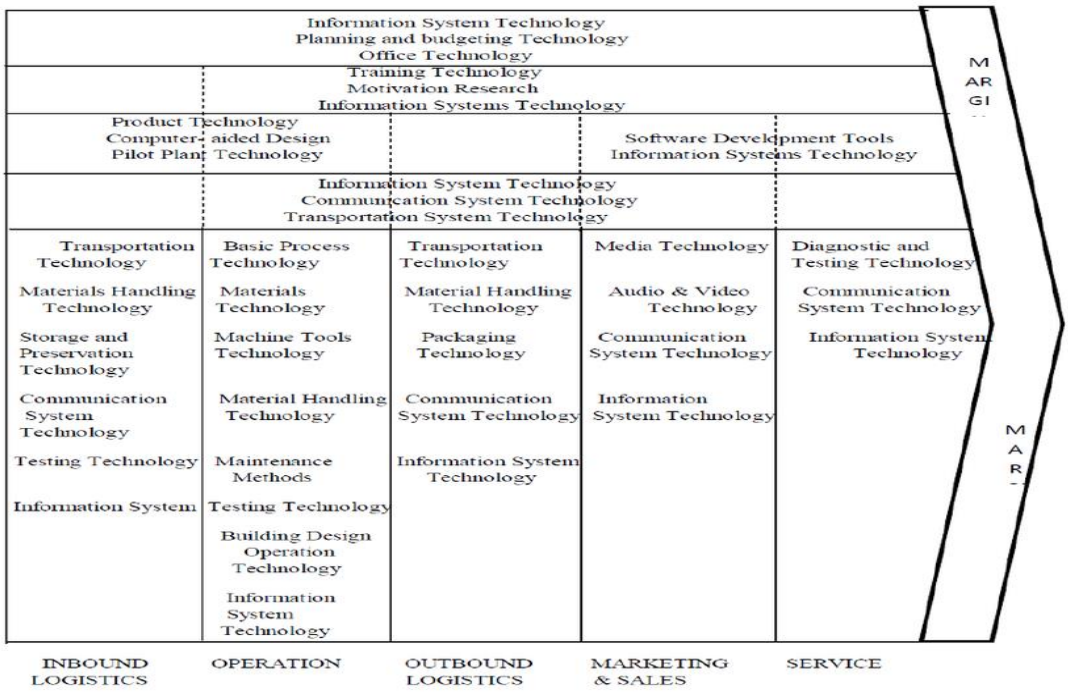

Figure 22. Representative Technologies in a Firm's Value Chain
Source: Posadas, 2015

R&D is given varying definitions by various sources.

'R&D refers to the work a business conducts for the innovation, introduction and improvement of its products and procedures. It is a series of investigative activities to improve existing products and procedures or to lead to the development of new products and procedures.'

- Investopedia

'R&D is a systematic activity combining both basic and applied research, and aimed at discovering solutions to problems, or creating new goods and knowledge. R&D may result in ownership of intellectual properties such as patents.'

- Business Dictionary

This is where analysis of the value chain of the company, or of the industry in general, comes in. The value chain presents the primary and support activities of the industry. Each activity is further broken down into technologies relevant to its delivery. Engaging in R&D will result to improvement of products and services in a particular activity in the value chain, be it under primary or support activities, that will allow product or service differentiation. Ultimately, R&D will result to the enhancement of the company's competitive advantage.

R&D must be considered both on the firm and industry levels. R&D activities, which entail R&D spending, are necessary for industries to improve and produce

newer and better technologies. These include technologies used for primary business activities such as Materials Handling, Basic Process, Communication Systems, Media, and Diagnostic and Testing Technologies, and those used in support activities such as Planning and Budget Technology, Training Technology, Pilot Plant Technology, and Software Development Tools (Posadas, 2015), to name a few.

Taking into consideration the value chain of individual companies, technologies for specific stages of the value chain will be closely examined. R&D expenditure, then, will be more defined and focused. In the end, investment allotted for R&D will redound to the company's enhanced competitive advantage.

Review strengths and weaknesses of the company's value chain. Local forging companies and the forging industry is recommended to study their value chain closely and determine where strengths and weaknesses lie within the primary and support activities in their business operations. To reiterate, primary and support activities are presented in Table 5 below.

Table 5. Primary and Support Activities and Their Corresponding Representative Technologies

Business activities	Key components	Representative technologies
Primary	Inbound Logistics	Transportation Technology Materials Handling Technology Storage and Preservation Technology Communication System Technology Testing Technology Information Systems Technology
	Operation	Basic Process Technology Materials Technology Machine Tools Technology Material Handling Technology Maintenance Methods Testing Technology Building Design Operation Technology Information Systems Technology
	Outbound Logistics	Transportation Technology Material Handling Technology Packaging Technology Communication System Technology Information Systems Technology
	Marketing and Sales	Media Technology Audio and Video Technology Communication System Technology Information Systems Technology
	Service	Diagnostic and Testing Technology

		Communication System Technology Information Systems Technology
Support	Firm Infrastructure	Information System Technology Planning and Budgeting Technology Office Technology
	Human Resource Management	Training Technology Motivation Research Information Systems Technology
	Technology Development	Product Technology Computer Aided Design Pilot Plant Technology Software Development Tools Information Systems Technology

With the value chain analysis, companies will be able to identify cost drivers and see where reductions can be made, which activities may be linked. The value chain analysis will also enable companies to pinpoint which activities to outsource, and where they can focus their resources to strike product or service differentiation. As such, they will establish their competitive edge. Figure 23 summarizes the threats to the local forging companies, as revealed by the respondents themselves.

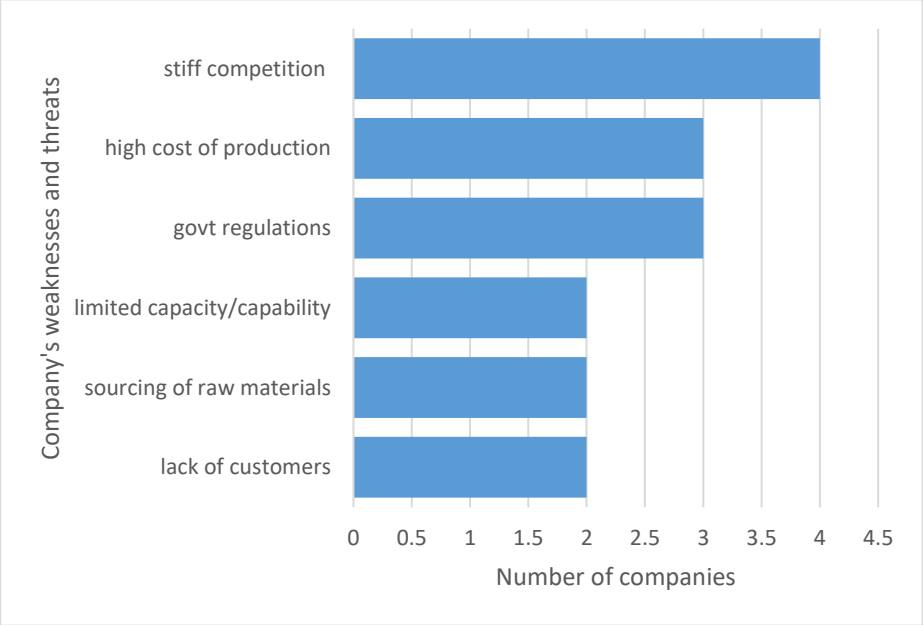

Figure 23. Weaknesses and Threats to Local Forging Companies, 2018 Forging Industry Study

It is also through diligent analysis of the value chain that forging companies will have a better perspective on where to focus financial resources to address R&D requirements. Figure 23 shows that stiff competition ranks first, and high cost of production comes second in the list of forging companies' weaknesses. It will take careful analysis of a company's value chain to identify exactly where improvements are needed. There are better competitors because these companies are able to harness their competitive

advantage, allowing them to offer customers competitive prices while protecting their profit margins.

A closer and more purposeful look at the value chain will likewise enable companies to further improve on their strengths. Figure 24 presents the forging companies' strengths and opportunities.

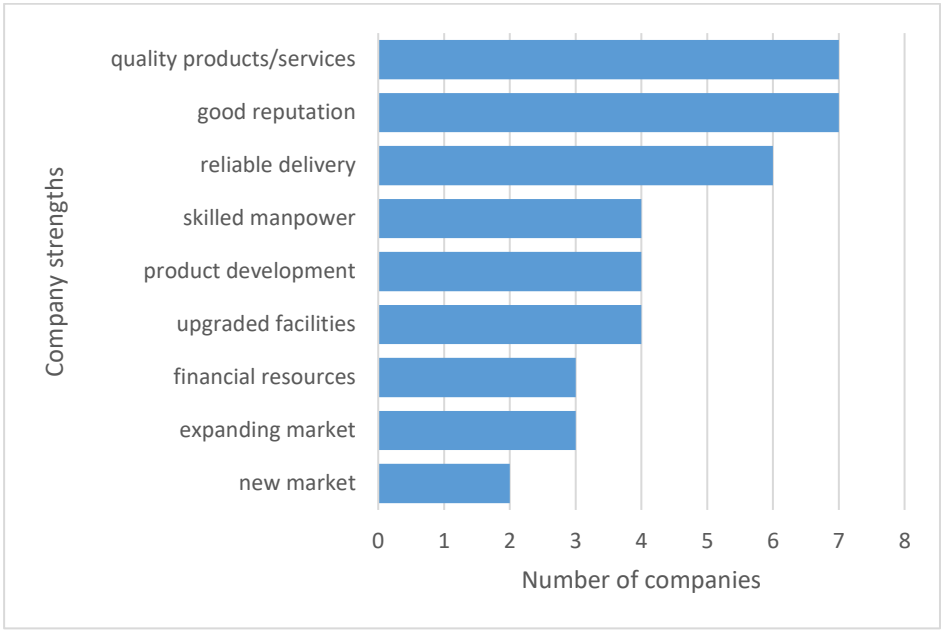

Figure 24. Strengths and Opportunities of Local Forging Companies, 2018 Forging Industry Study

Engage in R&D. Engaging in R&D results to the creation of new technologies, a fact that is appealing to any business since technologies help improve existing products and processes. Where the forging companies are already taking advantage of business opportunities as a result of offering quality products and services, or of having good reputation, and reliable delivery, among others, R&D activities to further improve products and processes in every step in the value chain will ensure continual growth and effective protection of profit margins. In doing so, forging companies can protect their business interests more effectively.

Take advantage of business opportunities in the automotive and transportation industries. Opportunities for business are pouring in from the automotive and transportation industries, as seen with the programs implemented by the government. The i^3S, for one, prioritizes a number of industries, and the automotive industry is at the top of the list. Forging companies already serving the needs of the automotive industry are encouraged to further develop effective manufacturing techniques for bigger cost- and time-savings through R&D initiatives.

The Duterte administration's Build, Build, Build program envisions the establishment of airports, energy facilities, and railway projects, to name a few. This program presents so many opportunities for the local forging companies, as these infrastructure projects will rely heavily on forged components.

Consider investing in Industry 4.0 capability building. I4.0 is large driven by technologies such as automation, robotics, and artificial intelligence. I4.0-enabled manufacturing is characterized by cloud computing and machine learning, and is fueled by real-time data. Forging companies, in order to compete with regional counterparts, have to build I4.0 capabilities. Competitive rivalry with foreign and more advanced forging companies will continuously make the gap larger if local forging companies choose to remain in the same stage of competitiveness, which, based on studies, remain to be in I1.0 or I2.0 level.

With the booming global, regional, and local activities, not to mention with all the support of the government through its programs and projects, the manufacturing sector's future is looking bright. Trickling down to all industries that make up the manufacturing sector, including the forging industry, are benefits that come with the increased businesses, widening potential market base, and increasing opportunities of global value chain integration.

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