12-1-2011

Effects of Globalization on the Gas Engine Manufacturing and Parts Industry in Indiana as Experienced by Those Working in This Sector

Patricia Polastri
Indiana State University

EFFECTS OF GLOBALIZATION ON THE GAS ENGINE MANUFACTURING AND PARTS INDUSTRY IN INDIANA AS EXPERIENCED BY THOSE WORKING IN THIS SECTOR

A Dissertation

Presented to

The College of Graduate and Professional Studies

Department of Applied Engineering and Technology Management

Indiana State University

Terre Haute, Indiana

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

---

by

Patricia Polastri

December 2011

Globalization, technology management, outsourcing, offshoring, emerging economies

COMMITTEE MEMBERS

Committee Chair: M. Affan Badar, PhD

Associate Professor and Chair, Applied Engineering and Technology Management Department

Indiana State University

Committee Member: Gordon Minty, PhD

Professor, Applied Engineering and Technology Management Department

Indiana State University

Committee Member: James Smallwood, PhD

Professor, Applied Engineering and Technology Management Department

Indiana State University

Committee Member: Merwan Mehta, PhD

Professor, Technology Systems Department

East Carolina University

Committee Member: A. Mehran Shahhosseini, PhD

Assistant Professor, Applied Engineering and Technology Management Department

Indiana State University

ABSTRACT

Globalization has often been perceived as the culprit in the decline of employment in several manufacturing industries in the United States. The purpose of this research was to investigate how globalization affected the gas engine manufacturing and parts industry in Indiana during the period of 1998 – 2008, in order to assess the perception of industry professionals as to the characteristics that could, or have, led to globalization through offshoring and outsourcing. Additionally factors for the employment decline experienced in this industry were identified and assessed. For this study an anonymous online survey was conducted targeting individuals directly associated with this industry and holding positions in the areas of engineering and management. The survey addressed the areas of technology, education, globalization/competition and employment. The survey results identified factors such as the influx of foreign goods, quality, workforce skill sets, and automation as competitive deficiencies present in this industry. These results are in contrast to the common perception that offshoring is the main factor for the dislocation of workers related to this sector. Further research in these areas could be conducted to ascertain the interrelated connections, as well as the level of their impact on these manufacturers.

ACKNOWLEDGMENTS

This dissertation would have not been possible without the invaluable help of my dissertation committee led by Dr. M. Affan Badar as Chair, and committee members Dr. Gordon Minty, Dr. Merwan Mehta, Dr. James Smallwood and Dr. Mehran Shahhosseini. I would like to truly express my deepest appreciation and gratitude to each one of them for their contributions and insight and for guiding me through this lengthy and oftentimes exhausting process. They have provided direction and leadership that complimented my efforts academically and professionally. I am personally grateful for the opportunity to have worked with them.

My appreciation and eternal love goes to my beloved mom, Nelly, who planted the seeds of education in me, in my early years, and who taught me that nothing is impossible if we set our minds to it and really work hard for it. Her endless support, encouragement and example are so precious to me. I will always be indebted to you.

My love and gratefulness also goes to my life companion and best friend Dan, who patiently accompanied me in this journey. He has been a great example of endurance and steadiness in all my times of trouble. Thanks for sharing all these years with me and for always believing in everything I did. You have always supported my education efforts. Finally we can take that long-awaited road trip!

I would not like to forget the support of my dear family and especially that of Rosemary, Libertad and Elizabeth for their words of encouragement, strength and plenty of prayers. I am sure their prayers are now answered. Thanks for everything!

My sincere gratitude goes also to my dear friend Todd E. Alberts, for his contagious cheerfulness, plenty of good mood and unconditional support. He taught me a lot of good things and had unparalleled patience in countless opportunities. I really thank you. Seriously.

Finally, my recognition goes to all those not mentioned but who know they contributed in one way or another to the completion of this phase of my life. Thanks.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION AND BACKGROUND

There is strong discrepancy whether or not globalization and outsourcing are actually good for the economy of our country. Globalization, defined as the free movement of labor, capital and goods, has encountered strong opposition as well as equally strong support, among scholars and the general public. There is a mixed perception about the positive or negative effects that globalization has caused to the American workers, especially those employed in the manufacturing industry, which according to Bronfenbrenner and Luce (2004) has experienced the greatest impact than any other economic sector.

Globalization has been an enabler of open markets and consequently global competition which are conducted through outsourcing and offshoring. The term globalization is extensively used, but despite its frequent utilization there is no general consensus about its true meaning. Jovanovic posits that "globalization is defined in business schools as the production and distribution of products and services of a homogeneous type and quality on a worldwide basis" (Jovanovic, 2006). For some people globalization is connected strictly to the area of economics where it first was conceived. Over the last fifteen years globalization has become one of the most studied areas in social sciences, separating to some extent from its economic roots, and now embracing political and cultural aspects of human life. Some scholars even relate globalization to political science and in particular to the field of sociology (Caseli, 2008) .

According to Venkatesan (1992), Quinn (1999) and (2000), and Quinn and Hilmer (1994) outsourcing has a more commonly accepted and established definition; it is referred to as allowing the performance of tasks by outside partners, that otherwise would be performed in-house, as cited by Zhao and Calantone (2003). Similarly they define outsourcing as the means that allows firms to concentrate on a few tasks in order to provide unique and superior value to customers, protect and strengthen its core competencies, and retain or win competitive advantage in the marketplace. It gives the firm access to resources and capabilities that are not available or not easily developed internally. For Corbett (2003) outsourcing is "nothing more and nothing less than a management tool". In the early 80's outsourcing was referred to as the purchasing of manufactured items from an outside firm, but in recent years outsourcing also comprises international trade in services bought abroad (Bhagwati, Panagariya, & Srinivasan, 2004).

Some reports indicate that globalization and outsourcing benefit society by allowing the citizens of a given country to acquire cheaper products manufactured abroad. Simultaneously, other reports indicate that globalization and outsourcing are displacing workers by taking their jobs to countries that can offer lower wages. Goldman Sachs estimates (as cited by Hilsenrath, 2004) "that up to one million manufacturing jobs have been shifted overseas since 2001 by U.S. companies or their suppliers". Marchant and Kumar (2005) explain that "the downside of outsourcing includes the perceived loss of American jobs while firms and stockholders profit" (p. 379).

Despite outsourcing's multiple definitions, it is believed that outsourcing improves the performance of business in areas that do not represent a core competency for the company, liberating capital and resources for investments in areas that do (Corbett, 2003). Heshmati (2003) notes that outsourcing is the firm's response to import competition from low wage countries by

moving non-skilled labor intensive activities abroad . Thus, outsourcing from the U.S. economy is generally for low-value jobs (Bhagwati, et al., 2004).

Judy and D'Amico (1998) note that the U.S. manufacturing industry is outsourcing mainly low-productivity jobs and that Americans should be happy about it, since it allows the country to concentrate on its competitive advantage: highly specialized products. On the other hand, Scott (2007) reports in the Economic Policy Institute Briefing Paper # 188 that the U.S. trade deficit with China from 1997 to 2006 has displaced production that could have led to the creation of 2,166,000 jobs in America. His report affirms that since China joined the World Trade Organization (WTO) 353,000 jobs on average (most of them in the manufacturing industry) were lost to that country.

A report published by Forrester Research and authored by John C. McCarthy (2004) states that the number of jobs lost to outsourcing will amount to 3.4 million by 2015; such a report can only increment the misconception of outsourcing, explains Bhagwati et al. (2004). They argue the accuracy of such reports, since these reports fail to reveal that the U.S. economy lost around 30 million jobs in 2003, but created approximately as many as manifested by the Business Employment Dynamics survey of the Bureau of Labor statistics. Therefore they also exhort the American people to remember that any job losses in the country must be set against job gains obtained through outsourcing from other nations into the United States. Through Foreign Direct Investment (FDI), foreign multinational's investment in the U.S. has created more than 5.4 million jobs by 2002, paying on average 31 percent higher wages than American companies (Slaughter, 2004).

In the manufacturing sector alone, jobs created by foreign multinationals increased from 11 percent in 1997 to 12.7 in 2002 (Slaughter, 2004). According to the Organization for

International Investment, foreign direct investment in the U.S. grew from $179 billion in 1998 to a record high of $325.3 billion in 2008. The main foreign investor during the year 2008 was the United Kingdom with investments reaching $57 billion dollar. However, offshoring (as defined in this paper's definition of terms) destinations such as India, Brazil, China and Mexico also invested billions of dollars in the U.S. through FDI. In 2008, China's investment totaled $1.9 billion; India's investment grew from $1.5 billion in 2007 to $1.9 billion in 2008. Brazil's investment grew from $373 million to $1.6 billion and Mexico's investment grew from $63 million to $2.2 billion from 2007 to 2008. Although preliminary 2008 data shows that most foreign investment was in the American manufacturing industry, there was a 31 percent reduction (from $108 billion in 2007 to $75 billion in 2008) in FDI in the manufacturing industry (Organization International Investment, 2009).

The Commission of the European Communities (1993) as cited by Krugman and Venables, (1995) issued a White Paper stating that "the rise of Third World manufacturing nations has already had serious adverse impacts" for developed nations. According to Krugman (2000) if China continues to grow at 7 percent per year while the U. S. is growing at only 3 percent a year, China will have the world's largest economy by 2025. He also notes that developing countries, as a group, will eventually overtake the economic superiority of developed nations. This, he explains, is not that "America is doing something wrong, but because many other countries are also doing something right" (p. 175). Hagel (2004) is concerned that the U.S. is not producing as many engineers as other countries which, he says, could have devastating consequences for the competitiveness of the country. China is producing 350,000 graduate engineers on a yearly basis, compared to 90,000 in the U.S.; however, the level of education may not be outright comparable.

During the decades of 1960's and 1970's Americans feared that the rise of Japan as an economic superpower would become a threat to the American economy. Craig Barret, CEO of Intel (as cited by Bhagwati, et al., 2004), expressed his concerns about India and China soon having 300 million high-skilled workers and the consequences this might have for the skilled worker within the American economy. Although the main outsourcing destinations for the U.S. continue to be China, India and Mexico, multinational corporations are seeking production opportunities in other Asian and Latin American countries. Bronfenbrenner and Luce's 2004 report to the U.S. - China Economic and Security Review Commission revealed that there has been a major increment in the shift of production to the above mentioned countries. They state that U.S. production has moved to Mexico in 69 cases, 58 to China, 31 to India, 39 to other Asian countries, 35 to Latin America and the Caribbean, and 23 to Eastern and Western European countries, including Canada in this number. It is noteworthy that Europeans have also moved production to China in 55 cases. Hilsenrath (2004) found in a study that the employment trend for 20 large countries revealed that 18 million manufacturing jobs were lost during 1995 – 2003 to outsourcing. The U.S. Department of labor requires from companies that experience workforce reductions of 50 or more workers to state the reason for the layoff. By 2004, only two percent of the layoffs were declared to be a consequence of companies relocating to other countries (Bhagwati, et al., 2004).

Hilsenrath (2004) argues that technology, and not trade, could have played the most important role in the loss of manufacturing jobs worldwide. Adbela and Segal (2007) predict that "the technological revolution that has driven the current wave of globalization will continue. Communication will become cheaper and easier, allowing corporations to spread their operations… around the planet" (p. 104). There are several factors mentioned as the motivators

for the increasing trend in manufacturing mobility: cost reduction, cheaper labor, skills, market expansion, better technology and better systems.

Although companies are somewhat reluctant to publish numbers regarding their offshoring efforts, some estimate that by moving their operations to Asian countries, productivity has tripled (Hagel, 2004). Other reports show that the cost of moving manufacturing operations to China or India involve an increment of tangible and intangible cost that could be as high as 24 percent of the total product cost (Hogan, 2004). According to a survey conducted by the Nirupam Bajpai of the Earth Institute at Columbia University, 70 percent of the respondents stated that cost saving was the main reason for outsourcing followed by increased capacity, affordable labor, and access to better technology (Smith, 2006). Trefler, as cited in Cheung, Rossiter, Yi, (2008) expands the list of motives for outsourcing by including access to a skilled workforce, expansion into growing markets and closer proximity to customers as principal motivators.

Need for the study

There is great discrepancy among scholars and the general public as to what effects globalization has had on Americans, American businesses, and especially for the American workers. The manufacturing industry is often touted as the most negatively affected industry, but even here there is no consensus. Reports show indecisively that Americans benefit from globalization through affordable products manufactured abroad, while on the other hand, millions of jobs are outsourced and offshored to low wage countries, leaving workers without job opportunities. Both sides present evidence supporting their stances, but there is no general consensus. The Bureau of Labor Statistics (BLS) does not keep records of outsourced jobs, thus their positions cannot be confirmed or denied. Indiana has always been a manufacturing hub for

the Midwest as well as the U.S. economy, and consequently has also experienced the loss of manufacturing jobs in the region (Miller, 2005). According to Miller's 2005 analysis of the Indiana manufacturing sector the records indicate that plant closures occurred across all sectors of the State's manufacturing industry, but there was a concentration of plants closing in the automotive manufacturing industry, which is a prominent industry in the State of Indiana. According to the Bureau of Labor Statistics, from 1998 to 2008 the manufacturing industry in Indiana experienced an approximate 25 percent reduction in employment, decreasing from 655,000 employment opportunities to 487,000 (see Appendix C). For the auto parts industry in particular, the decline in employment was larger than 40 percent; employment declined from 90,000 workers in 2000 to only 49,200 by the end of 2008 (Thompson & Merchant, 2010).Thus, the reasons behind the job losses experienced in the State of Indiana need to be determined.

Purpose of the study

Lack of evidence on the actual effects of globalization in the manufacturing industry leaves many questions unanswered. The purpose of this study was to assess the impact of globalization on the Gas Engine Manufacturing and Parts (GEM&P) industry during the time period 1998 – 2008 in general, and in particular to determine whether globalization or technological improvements have caused the decline of employment opportunities in this industry. The industry selected for this research experiences strong global competition both from high-wage and low-wage countries and is thus considered appropriate for this study.

Problem Statement

The problem of this study is to identify the effects of globalization in the Gas Engine Manufacturing and Parts industry in Indiana. These issues may have led companies to outsource and/or offshore their operations from the state of Indiana. A subsequent analysis of the leading

indicators identified through surveying industry experts is done to provide a framework of potential venues of improvements that may reverse potential negative impacts of globalization in Indiana.

The Research Questions

In order to find an answer to the problem statement, the questionnaire revolves around different areas identified as having a direct effect on the Gas Engine Manufacturing and Parts industry. The following research questions have been identified:

1. What is the ownership form (domestic or foreign owned) for the companies operating in this industry in the state of Indiana?
2. What are the main competitive factors in this industry?
3. Under what circumstances are outsourcing and/or offshoring an option for this industry?
4. How is this industry affected by globalization?
5. How important is automation as a competitive tool?
6. Is there evidence that technological improvements in manufacturing have led to the decrease of employment opportunities in this industry?
7. What types of workers were affected the most?
8. Are there any indications that the job losses suffered in Indiana's manufacturing environment for this industry is a consequence of globalization due to companies relocating to other states or outside the U.S.?
9. In the event of companies leaving the U.S. what were the predominant reasons for the relocation?
    a. Labor arbitrage
    b. Skills and/or knowledge not locally available

c. Better manufacturing technology

d. Cheaper production costs and/or proximity to raw materials

e. Market penetration

f. Other

10. How are the high school dropout rates of 30 percent as described in the Alliance for Excellent Education (2009) affecting the availability of workers in this industry?
11. What particular knowledge is required from future manufacturer workers?
    a. Technical skills
    b. Business knowledge
    c. Interpersonal skills
12. What is the perception of the effects of globalization in this industry?
13. Is globalization considered as the main cause for the reduction of employment opportunities in this industry?
14. How has this industry been affected by globalization?

Limitations

The scope of this study was limited to assessing the effects of globalization including outsourcing and offshoring for the selected industry for the time frame from 1998 – 2008. The study sought to unveil whether globalization or technology was the main cause for the decline in employment opportunities in this industry. Economic factors that contributed to unemployment in the manufacturing sector, such as housing market, oil and gas prices, and weak retail were not a direct part of this study, but were discussed when deemed necessary. It was acknowledged that the responses provided by the respondents to the survey were inherent to their own knowledge and experience. This study did not ask the participants whether they had made improvements in

product design, quality, manufacturing process including innovations in research and development to state of the art technology. The study did not ask whether the participants had any partner or partnerships outside the United States. The researcher acknowledged the fact that a different group of respondents may have yielded different results to this study. This fact is inherent to the survey methodology used; different respondents may have expressed different knowledge and/or experience in the subject matter. This difference does not diminish the validity of the study but makes its repeatability difficult in the future. The information gathered for this study included information from state and federal agencies' databases as well as information provided by professional associations. The researcher acknowledges that statistical data gathered from different organizations may not be strictly comparable. This fact however, is a limitation, but does not diminish the validity of the data gathered.

Assumptions

In order to complete this study the following assumptions were made:

1. The participants of the survey were composed of individuals with appropriate backgrounds and expertise in the area of study.
2. The participants expressed their true and unbiased knowledge in their responses to the survey questionnaire.

Definition of terms

Automotive manufacturing: NAICS Category 336312. This U.S. industry comprises establishments primarily engaged in manufacturing and/or rebuilding gasoline motor vehicle engines and gasoline motor vehicle engine parts, excluding carburetors, pistons, piston rings, and valves. A list of all subcategories comprised under NAICS 336312 is presented in Appendix A.

Bureau of Labor Statistics: The Bureau of Labor Statistics (BLS) for the United States.

Skills: The term skills as defined for the purpose of this study is the academic achievement (years of formal education in the school and academic system) of the individual, and not competencies achieved through informal education. Thus, competencies obtained through several years of experience lacking formal education (like those obtained at a work place through repetition) will be denominated medium level competencies.

Low-skill workers: Individuals with up to high-school diploma.

High skill workers: Individuals holding a College or Bachelor's degree or higher degrees.

Intermediate inputs: Goods or materials that must undergo further processing before they can be sold as a final product.

Labor arbitrage: The financial benefit of buying a comparable service elsewhere to exploit the difference in pricing. In outsourcing, the term is often used to describe the savings an organization will enjoy when it hires work to be done in labor markets offshore, where salaries are less than they are domestically (Offshoring Opportunities, 2005)

Extended Mass Layoff: According to Bureau of Labor Statistics Economic News Release a mass layoff is triggered when a company employing more than 50 employees reports 50 or more initial unemployment insurance claims within a period of 5 consecutive weeks and in which the layoff lasted for 30 days or longer (2010a).

MLS: Mass Layoff Statistics program created by the Bureau of Labor Statistics

STEM: Science, Technology, Engineering, and Mathematics.

Value Added: The U.S. Census Bureau (2010) defines value-added as the measure of manufacturing activity derived by subtracting the cost of materials, supplies, containers, fuel, purchased electricity, and contract work from the value of shipments (products manufactured plus receipts for services rendered).

Outsourcing: The Organization for Economic Cooperation and Development (OECD) defines outsourcing as delegating (part of) activities to an outside contractor. Outsourcing means acquiring services from an outside (unaffiliated) company or an offshore supplier. In contrast, a company can source offshore services from either an unaffiliated foreign company (offshore outsourcing) or by investing in a foreign affiliate (offshore in-house sourcing)(Organization of Economic Cooperation and Development, 2004).

Offshoring: The Organization for Economic Cooperation and Development (OECD) states that the term offshoring is used to describe a business's (or a government's) decision to replace domestically supplied service functions with imported services produced offshore. Offshoring, though, has also (though less frequently) been used to describe the movement of domestic production (and the related jobs) offshore. In this case, the definition focuses not on imports of services from abroad, but on national companies investing offshore. (Organization of Economic Cooperation and Development, 2004).

CHAPTER 2

REVIEW OF LITERATURE

Outsourcing and employment

There are two types of outsourcing, one that relates to labor intensive processes from which jobs are frequently outsourced to developing countries as a result of labor arbitrage; and outsourcing to industrialized countries in which the outsourcing nation benefits from advanced technologies or economies of scale. Regardless of the type, organizations that outsource enhance their profits in their home country (Cheung, et al., 2008). However, most of the turmoil around globalization is related to the outsourcing of labor intensive tasks performed by low skilled workers to developing countries. The outsourcing of jobs to industrialized nations is a topic scarcely discussed by the media and unnoticed by the general public.

In 1995 the Bureau of Labor Statistics created a program called the Mass Layoff Statistics (MLS) with the purpose of tracking the reasons behind layoffs that affected large numbers of employees, and also to assess the need for employment and training for these displaced workers. Since June 2004 the data collected nationally and by each State has been published and for the first time it included questions about domestic and/or international "movement of work". The MLS program asks for the reasons behind the "movement of work" which directly targets the question whether or not the work was moved (or outsourced) out of, or within the United States. Outsourcing information is collected through employer interviews and

identifies the economic reasons for the layoff, the affected workers, and possible reemployment opportunities. Although participation in MLS is voluntary the response rate has been very high; in 2004, a 95 percent response rate was achieved. According to MLS data, mass layoffs reached a peak in 2004, when 5,010 layoffs were recorded affecting 993,511 workers; one fourth of these coming from the manufacturing industry. 366 events of mass layoffs resulted in 480 cases of "movement of work" (domestically and/or internationally) and affected 73,217 workers, two thirds of them employed in manufacturing industries. Complete information was collected for 382 "movement of work" events, showing that 7 out of 10 relocations were domestic while more than 1 out of 4 led to international relocation, from which 74 percent was relocation within the same company. The most geographically affected areas in the U.S. by movement of work were the Midwest and the South. The relocation destinations mentioned frequently in the MLS interviews were China and Mexico. Permanent closures were recorded for the following manufacturing industries: food, transportation equipment, electronic and computer products; these closures were due to reorganization. Company restructuring accounted for 20 percent of layoffs displacing almost 200,000 workers in the same year (Brown & Siegel, 2005). The decline in employment in the U.S. automobile manufacturing and parts for the period 1998 – 2008 is depicted in Figure 1.

The factory workweek, used as a leading indicator of economic activity, showed that for the manufacturing industry, the average weekly hours and overtime hours experienced record lows. "Weekly hours fell below 40.0 for the first time since January 1996, and overtime hours fell to 2.9 – the lowest level since May 1983" reported the BLS in 2008 according to Kelter (p. 22) (2009). The same year record high gas and oil prices affected almost every industry in the country, leading to higher transportation and shipping costs, which companies tried to absorb in

order to maintain their sales numbers; this strategy led to increased job cuts. With higher gas prices (reaching up to $4/gallon) automobile manufacturers experienced a decline in sales and production cuts throughout the year thus accelerating job losses. The U.S. manufacturing sector was significantly hit, states Kelter, sustaining an 875,000 employment loss, reaching a 12.9 million loss, the lowest level since 2002. For the furniture industry the number of job losses was on average 5,000 a month (Kelter, 2009).

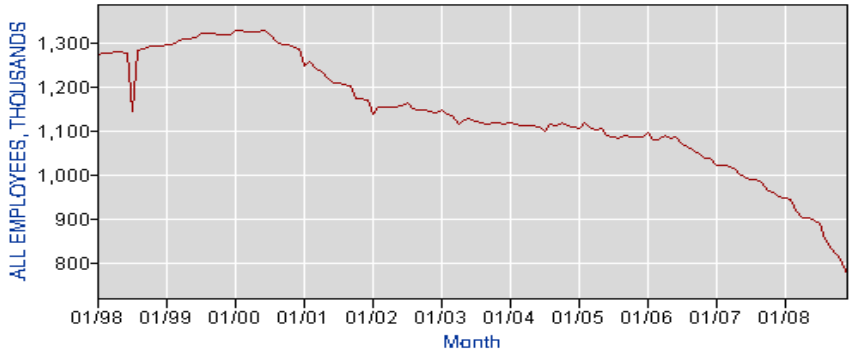


Figure 1: U.S. Automobile Manufacturing and Parts Employment 1998 – 2008. (Bureau of Labor Statistics).

Smith (2006) posits that offshoring has four substantial economic benefits for the outsourcing nation; first, it reduces costs (organizations save approximately 20 to 30 percent by moving their operations overseas) and through the flow of jobs abroad, inflation can be kept at lower levels. Second, and in direct contrast to popular belief, there is a substantial gain in real income (approximately 70 to 80 percent) in the form of lower prices enjoyed by the outsourcing nation. Third, countries having high unemployment usually have a shortage of labor in particular areas that can be covered with outsourcing. And finally, workers displaced by outsourcing can be moved up the value chain to higher value-added/higher productivity jobs. However, Smith recognizes that there is no perfect mobility of labor and that frictions are likely to arise (Smith,

2006). Slaughter (2010) cites a study conducted by Mihir Desai from Harvard University and Fritz Foley from the University of Michigan that has consistently found that companies expanding their operations abroad tend to increase their investment and employment in the United States. For global companies, foreign operations are seen as complementary and not as substitutes. According to Cheung et al. (2008) the gains of offshoring receive much less publicity due to the fact that they do not occur immediately and are difficult to associate with offshoring. Solomon deems that searching worldwide for personnel and production capability is not a new phenomenon, the only difference is that is happening at a much faster pace in an increasingly borderless marketplace (Solomon, 1999).

Education

In 2008, when unemployment was at 5.6 percent, there were 3 million jobs vacant for over six months. These jobs were Science, Technology, Engineering and Mathematics (STEM) related and required higher education skills. By 2009, unemployment rose to 9.4 percent and still there were over 3 million jobs available. According to an analysis based on unemployment related to education, it was found that unemployment rates are negatively correlated with educational levels. Unemployment of those lacking a high school diploma is 4.8 percent higher as compared to those with advanced education, and 15 percent higher compared to those who hold a bachelor's degree. Edward E. Gordon (2009) states that recent school dropout rates at 30 percent levels is a serious deficiency in the American education system, and that "the picture of the U.S. economy that emerges is of abundance and poverty: abundance of labor, poverty of talent…"(p. 35). Gordon (2009) also cites a survey conducted in 2005 in which American manufacturers express that holders of high-school diplomas are poorly prepared even for entry level positions. Thomas Friedman writes that: "…finally we are developing an education gap.

Here is the dirty little secret that no C.E.O. wants to tell you: they are not just outsourcing to save on salary. They are doing it because they can often get better-skilled and more productive people than their American workers" (Friedman, 2005). On the other hand, Vivek Wadhwa, an adjunct professor with the Pratt School of Engineering at Duke University, wrote in a testimony to the U.S. House of Representatives in 2005 that the notion that the U.S. is producing fewer engineering graduates than China and India is erroneous. Wadhwa distinguishes between transactional and dynamic engineers. He contends that dynamic engineers those globally rounded individuals capable of abstract thinking and high level problem solving, and having strong interpersonal skills will be in demand. Transactional engineers, defined as those that possess engineering fundamentals and perform repetitive tasks will experience a decline in demand. Wadhwa suggests that engineers should also possess business education in order to address complex technical and business complex issues, and that they should learn to think as entrepreneurs and innovators (Wadhwa, Rissing, & Gereffi, 2006).

In a report conducted in 2005, Wadhwa found that the statistics frequently cited regarding engineering graduates in India and China are inaccurate, despite the fact that these numbers are provided by the Chinese Ministry of Education, as well as from reports provided by the National Association of Software and Service Companies in India. Wadhwa states that the statistics presented contain not only four-year degrees, but also sub-baccalaureate degrees, certificates, and diploma holders. According to this report, the U.S. awarded 134,406 bachelor degrees; India 112,000 and China 351,537 in 2004 (see Figure 2). Thus, there is no direct comparison with the accredited four-year engineering degree statistics provided by the United States. Another important factor is the quality of education, Wadhwa states that the quality of Chinese graduates is not close to the standards of U.S. graduates. Wadhwa sees a negative correlation between

quality and quantity, with quality suffering at the expense of quantity. Barry Myers, a professor of Biomedical Engineering at Duke University states that" the quality of the students from the renowned Indian Institute of Technology (IIT) is as good as the average American student he teaches at Duke University" (Wadhwa, et al., 2006).

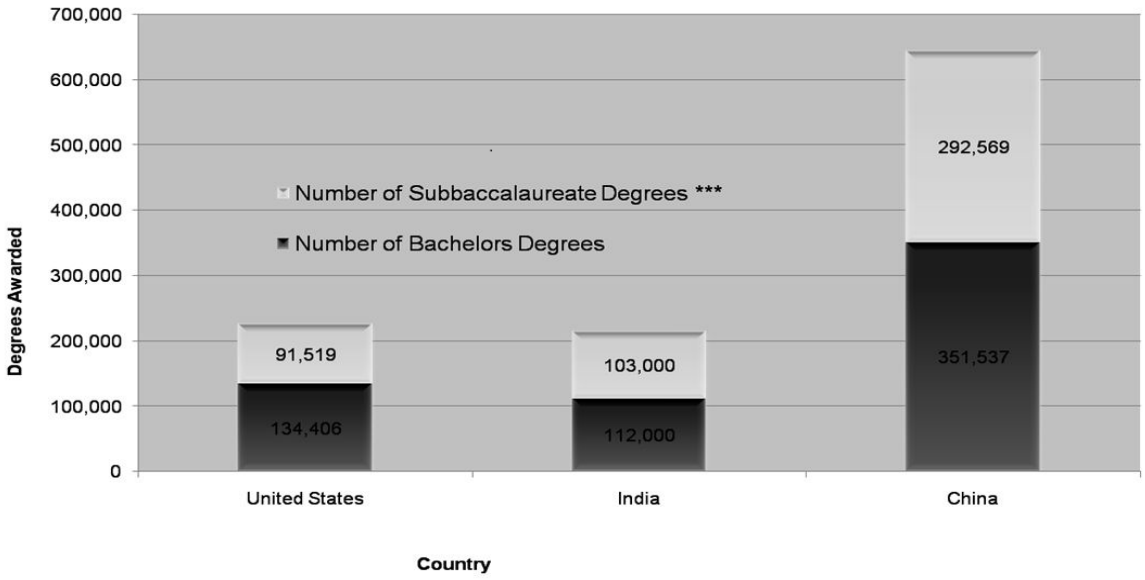


Figure 2. Comparison of Engineering Degrees among the U.S, China and India. (Wadhwa, et al. 2006).

Thus, Wadhwa et al. (2006) foresee a shortage of dynamic engineers in China and India but foresees an abundance of transactional engineers. He warns that producing engineers without first studying the types of engineers that will be needed in the U.S. may have an adverse effect on the job market and lead to further unemployment.

According to the Indiana Department of Education (IDE) and the Outreach Committee Presentation prepared in February of 2010, the United States loses a high school student every 26 seconds, leading to more than 1.2 million high school dropouts every year (Indiana Department of Education, 2010). The Indiana Department of Education states that high school dropouts affect the country's economy directly by lowering tax revenues in all states and by

increasing the cost of social programs; it is estimated that over 25 to 30 years a dropout student can cost a community as much as $500,000 in public assistance, health care and incarceration costs. Harlow (2003) states that it is noteworthy that state and federal prison inmates represent an overwhelmingly high population of school dropouts. In a study conducted by the Bureau of Justice Statistics in 2003 it was found that 75 percent of the country's state prison inmates are high school dropouts while 59 percent of federal prison inmates are high school dropouts. In another study it was found that high school dropouts are 3.5 times more likely to be arrested than their counterparts that completed their education. An increase of only 1 percent in graduation rates would save approximately $1.4 billion in incarceration costs (Alliance for Excellent Education, 2006). Alli et al. (2007) posit that the modern industry is knowledge intensive and jobs will be created for the highly educated; although, it is unlikely that jobs will be generated for the uneducated. Thus, "technology comes from but one place - education. The primary way to accept (or fight it) globalization is through knowledge*"* (Alli, et al., 2007).

Outsourcing and Wages

In 2007, global organizations paid their workers approximately 20 percent above the average of all other jobs in the U.S., spending over $240.2 billion in research and development (Slaughter, 2010). A study about the impacts of outsourcing on manufacturing workers was conducted in 2008 seeking to reveal the effects of outsourcing on the relative wages, and the demand of skilled workers compared to unskilled workers. The study divided the chain of production into upstream and downstream production. Upstream production identifies intermediate inputs such as product design, high-tech components, and research and development activities, all of which are considered skill intensive. Downstream production identifies final goods production such as assembly tasks and is considered in their study as

unskilled. The authors argue that when an upstream company outsources, less skilled tasks can be performed by outside companies, reducing the in-house demand for unskilled workers while simultaneously increasing the demand for high skilled workers. High skilled workers can then concentrate on upstream production activities, increasing productivity and contributing to their product specialization. The results of their study concluded that downstream outsourcing has a positive impact on the wages and demand of high skilled workers relative to unskilled workers. The reason for the positive impact is reflected in the fact that organizations can concentrate and specialize in more upstream production activities that usually demand high skilled workers. At the same time, organizations performing less skill intensive tasks usually tend to employ less high skilled workers. Other findings of the study showed that there is a positive relationship between technology and high-skilled worker demand; and as the authors describe "… machinery and equipment are substitutes for skilled workers, while buildings and other structures are complementary to skilled workers" (Chongvilaivan, Hur, & Riyanto, 2009).

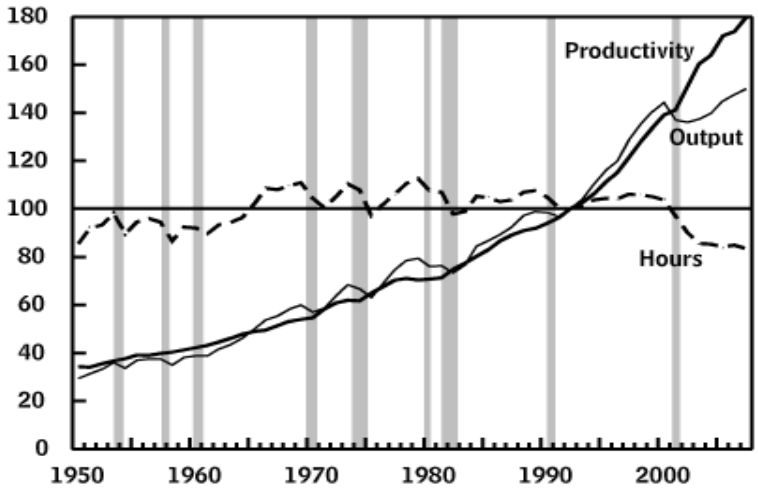
Outsourcing and Productivity

Cheung et al., (2008) present several reasons supporting the stance that outsourcing can increase productivity. They state that by outsourcing, fewer tasks are performed in-house allowing organizations to concentrate and specialize in their core competencies; this can lead to a restructuring of the composition of the organization and an upward shift in the skills of the workforce; capital freed through outsourcing can be invested in capital and technology enhancing activities; outsourcing to high-skill or skill intensive organizations can increase the knowledge of in-house workers through productivity enhancing production processes from their foreign counterparts. According to Sunshine, the rapid growth of productivity has led to a substantial reduction in employment not only in the manufacturing industry, but in all industries.

Brauer (2008) states that from 1973 to 1995 productivity growth in the U.S. was on average 2.7 percent, while for the period 1995 – 2007 the average productivity growth was 4.1 percent. Therefore, says Brauer (2008) productivity in manufacturing has risen one-third since 2000, exceeding that of the overall nonfarm business sector. Figure 3 shows the time series of how productivity (P) increases as a function of labor hours and output

$P = \frac{Output}{hours}$ x 100.

Figure 3. Productivity Increase in Manufacturing (Economic and Budget Issue Brief).



The increase is not due entirely to companies outsourcing to emerging economies offering cheaper labor, but also to the rapid growth in productivity overseas (Sunshine, 2008). American manufacturers have been forced to invest in more and better capital goods and manufacturing techniques to remain competitive in world markets. Thus, these major capital investments have certainly increased output, but they have not increased the number of workers employed (Brauer, 2004). Greider states that the transformation of North America's auto

production has certainly improved efficiency, displaced many workers, and crippled some communities (Greider, 1997).

The Case of Indiana

Employment

The Midwest, consisting of Indiana, Ohio, Michigan, Illinois and Wisconsin, has a long reputation for being the manufacturing hub for automobile manufacturing in the U.S. The Midwest is home of the "Big Three" American automobile manufacturers: General Motors, Chrysler and Ford. Indiana, Michigan and Ohio are the three States with the largest number of auto parts production jobs; more than half of the country's auto part workers are employed in the Midwest. Despite their relevance the media pays considerably more attention to the three automobile manufacturers than to the industry surrounding it; however, the auto parts manufacturing industry is three times as large (Collins, McDonald, & Mousa, 2007). In Indiana, companies that do not produce complete vehicles, but component parts, employed 58 percent of all automotive manufacturing workers in 2008 (Thompson & Merchant, 2010). For a list of companies operating under NAICS 336312 in Indiana see Appendix B.

The state of Indiana is divided into 92 counties, and for decades, it has been the state with the largest manufacturing employment share, providing the state with 36.8 percent of all state and local taxes paid to all governments throughout Indiana. In the 1992 Census of Manufacturers, the leading counties in the State (ranked by employment) were: Marion, Elkhart, Lake, and Allen. These counties accounted for approximately 34 percent of the State's 1992 manufacturing employment; however in 2003 the number was reduced to 20 percent in manufacturing employment. These same counties were the leaders in 1987 when they accounted for approximately 35 percent of the State's employment (Miller, 2005). For the time period 1998

– 2008 the counties: Allen, Elkhart, Gibson, Howard, Madison, Marion, St. Joseph and Tippecanoe averaged more than 4,000 automotive workers per year. During the same period, only 12 counties did not have employment in the automotive manufacturing industry, while most counties had at least 250 employees in the industry. Notoriously, most workers were employed in the automobile part manufacturing industry (Thompson & Merchant, 2010). During the period of 2004 and 2007, 67 percent of the jobs lost in Indiana were in manufacturing and half of these were in the transportation equipment industry (Roesler & Leeuw, 2007)

Automotive manufacturing employment is spread throughout the state, but the northeastern region, the closest to Michigan, is by far the most dominant as shown in Figure 4.

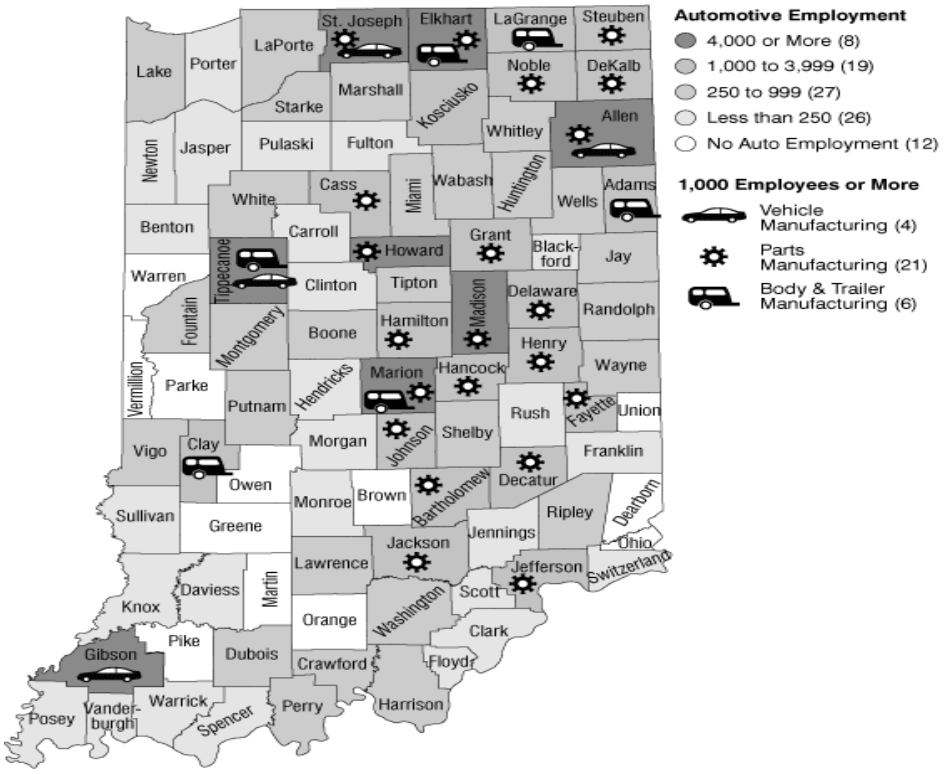


Figure 4. Average Annual County Employment in Indiana 1998 –2008. (InContext, Indiana Business Research Center at Indiana University's Kelley School of Business, 2010).

Indiana had the fastest growth at 15.4 percent among the three largest auto parts manufacturing states (Collins, et al., 2007). The top ten manufacturing industries located in the state account for 86 percent of Indiana manufacturing; motor vehicles and parts is the second largest manufacturing industry in the state, preceded only by the chemical industry, and followed by fabricated metal products. The largest employers in this industry and located in the State of Indiana are listed in Table 1.

Table 1.

Top Automotive Manufacturing Employers in Indiana NAICS 3363. (InContext, Indiana Business Research Center at Indiana University's Kelly School of Business, 2010).

Rank	***Company***	***City***	***Number of Employees***
1	Cummins Inc.	Columbus	34,900
2	Firestone Diversified Products LLC	Indianapolis	11,300
3	Remy International Inc.	Anderson	7,971
4	Remy Inc.	Pendleton	6,800
5	United Components Inc.	Evansville	4,900

Thompson and Merchant (2010) divided Indiana's 80 counties with employment in the automotive manufacturing industry in three distinct clusters: vehicle, body/trailer, and parts in order to analyze their employment and wage trends (see Table 2). They found that 63 counties have almost their entire auto manufacturing workforce (usually more than 95 percent but at least 70 percent) employed in auto parts manufacturing.

Table 2.

Employment by County in Indiana 1998 – 2008. (InContext, Indiana Business Research Center at Indiana University's Kelley School of Business, 2010).

Cluster	***Employment Criteria***	***Number of Counties***	***Avg. Percentage Employment by Automotive Sub-Sector***		
			Motor Vehicle (complete)	Motor Vehicle Body/Trailer	Motor Vehicle Parts
Vehicle	NAICS 3361 of 40 % or more	5	57.0%	16.5%	26.6%
Body Trailer	NAICS 3362 of 65 % or more	12	0.1	90.4	9.5
Parts	NAICS 3363 of 70% or more	63	0.3	3.6	96.0

The U.S. Census Bureau's historical data records for Indiana's manufacturing employment shows that the state reached a peak in 1999, but have since continuously declined as depicted in Figure 5. Collins et. al (2007) have divided 1992 through 2006 intro three periods with respect to employment characterization in the Midwest region that included Indiana. The first period from 1992 – 1995 was characterized by a positive expansion, in which employment and wages in the Midwest grew faster than the total employment in the private sector as well as nationally. The second period from1995 – 2000 was characterized by modest growth with employment growing below the pace of the country as a whole. The third and last period, from 2000 – 2006, erased all the previous gains showing a steep decline in both employment and wages (Collins, et al., 2007).

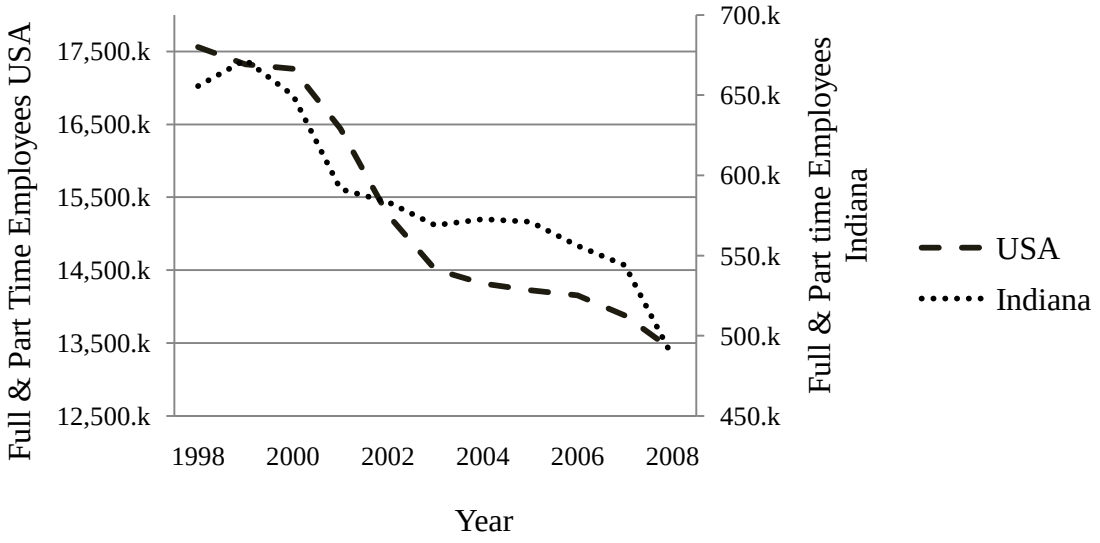


Figure 5. U.S. and Indiana Manufacturing Employment 1998 – 2008. (Bureau of Labor Statistics).

The growth experienced in the first period was driven by increased demand for new domestic vehicles and light trucks. Private employment growth in the Midwest was 9.6 percent while nationally the job growth in the private sector was only 8.4 percent. In the auto parts manufacturing industry the growth was even more significant reaching a high of 7.2 percent in the Midwest compared to the 3.0 percent obtained for this manufacturing sector nationally (Collins, et al., 2007). From 1998 to 2008 the manufacturing industry in Indiana experienced an approximately 25 percent reduction in employment, decreasing from 655,000 employment opportunities to 487,000 (see Appendix C).

For the auto parts industry, the decline in employment was larger than 40 percent; employment declined from 90,000 workers in 2000 to only 49,200 by the end of 2008 (Thompson & Merchant, 2010). The gas engine and auto parts industry (NAICS 336312) experienced a similar unemployment rate; decreasing 35.5 percent from 3,602 to 2,322 employees between 2001 and 2008 (see Appendix D). This reduction is shown in Figure 6. The

decrease of approximately 35 percent is very significant compared to what the U.S. manufacturing industry as a whole experienced during the same period of time.

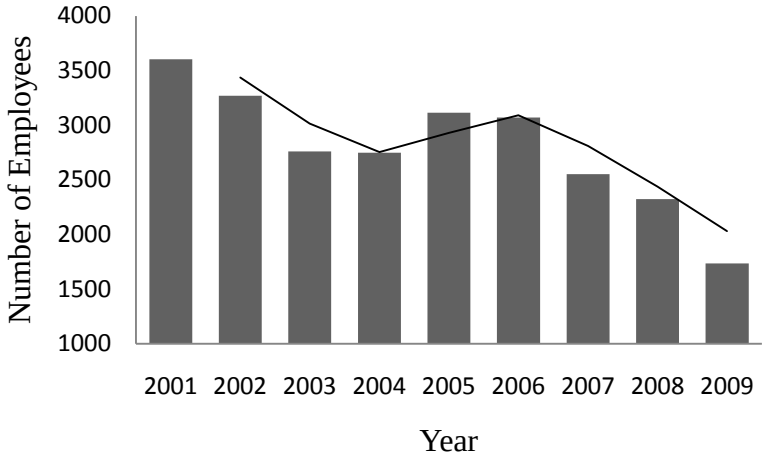


Figure 6. Reduction in Indiana's Employment for NAICS 336312. (Bureau of Labor Statistics, Quarterly Census of Employment and Wages, 2010).

Simultaneously, the number of establishments providing employment in engine manufacturing diminished from 28 establishments listed in 2001 to 25 in 2008 as shown in Appendix E. The automotive industry is likely to continue to decline in Indiana, since the majority of its workers are employed in automotive parts manufacturing (Thompson & Merchant, 2010).

Roesler and Leeuw (2007) state that offshoring is not new to Indiana. Since the Bureau of Labor Statistics started the Mass Layoff System (MLS) in 2004, the movement of work in Indiana shows that for the period 2004 – 2007, only 24 percent of the 44,808 jobs lost in the state were offshored. The stated preferred destinations for the jobs offshored from Indiana, according to the Indiana Department of Workforce development were as follows: Mexico (28), Canada (6), Unknown (5), China (2), England, Brazil and India (1) occurrences of offshoring.

Fisher (2004) states that the primary cause of decline in employment in manufacturing is due to technological advances. Miller supports Fisher's position, stating that the primary driver of the decline in manufacturing employment is increased productivity, which allows manufacturers to increase an additional unit of output with fewer workers; this he says, is the "cause and the cure" for the decline in manufacturing employment (Miller, 2005).

Production

Although public perception emphasizes primarily the loss of jobs to low-wage countries, research data shows that the primary driver of job loss in manufacturing is increased productivity. Manufacturing industries need fewer workers for every unit of output achieved through higher skills and/or higher capital for labor substitution. Technological progress is responsible for the decline in manufacturing employment in Indiana (Miller, 2005). Manufacturing employment in the gas engine and auto parts industry has declined to almost half but productivity has increased. Thus, fewer workers have contributed to increased state and national economic growth as shown in Figure 7. Miller states that potential contributors for the upswing in manufacturing productivity could be due to increased outsourcing and improved supply chain management. Statistics from STATS Indiana for the period 1998 – 2008 show a consistent reduction in the number of production workers employed in the manufacturing industry, while the value added per worker both in Indiana as well as the U.S. has steadily increased throughout the same years. In Indiana, the value added generated from a production worker in 1998 was $68.36 compared to $120.80 in 2008 (STATS Indiana, 2008).

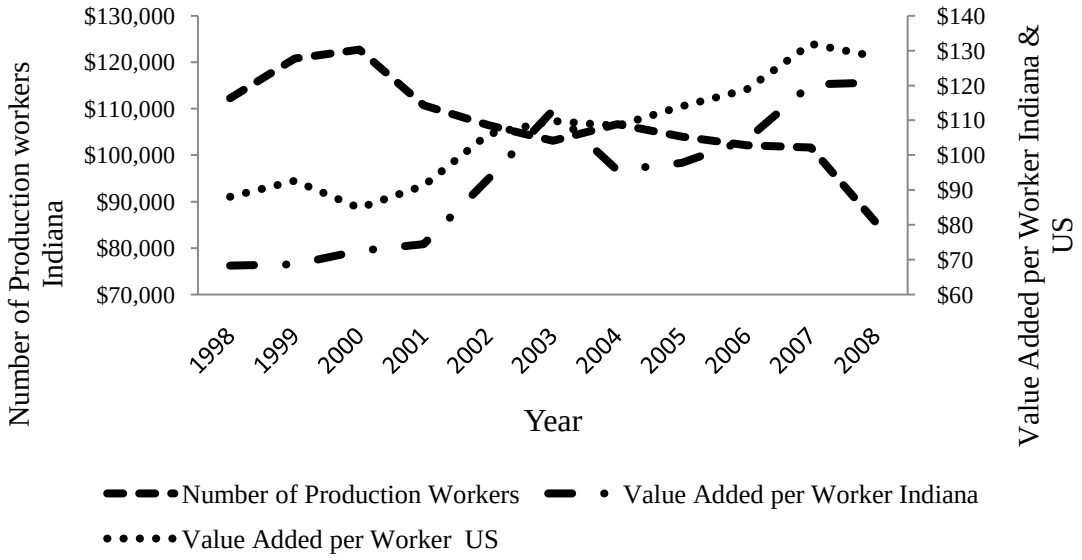


Figure 7. Value Added per Worker in Indiana and the U.S. (STATS Indiana)

Data shows that productivity is the major driver in the decline of employment in manufacturing, and this is consistent with Miller (2005), Fisher (2004), and Roesler and Leeuw's (2007) position stating that increased productivity has the largest impact on employment in manufacturing, and not outsourcing/offshoring as it is oftentimes perceived. Although outsourcing and offshoring are responsible for the loss of some jobs, their impact on employment is not as dramatic as perceived. Figure 7 presents clearly that the number of production workers in manufacturing is declining, but the value added per worker both in Indiana and the U.S. is on the rise.

Education

Manufacturing jobs have been especially important for those without education or formal training beyond high school (Miller, 2005). In a report prepared for the Indiana Chamber of Commerce Foundation by Futureworks, it was found that the U.S. has serious workplace skills problems; nationally approximately 50 percent of adults have low literacy skills; for Indiana

around 960,000 to 1.23 million have literacy skills below the minimum standard to obtain employment in a knowledge based economy (Futureworks, 2005). In the 2008 Indiana's Adult Education and Workforce Skills Performance Report (Indiana Chamber of Commerce, 2008), it was found that the state has the sixth largest population for ages 25 – 64 who completed high school but did not continue with college education; the state ranks 34th in the nation in the percentage of non-traditional students participating in postsecondary education. The study also shows that 12 percent of Indiana's population between the ages of 25 – 64 has not completed high school. Figure 8 depicts the number of high school dropouts in the State of Indiana for the years 1998 – 2008.

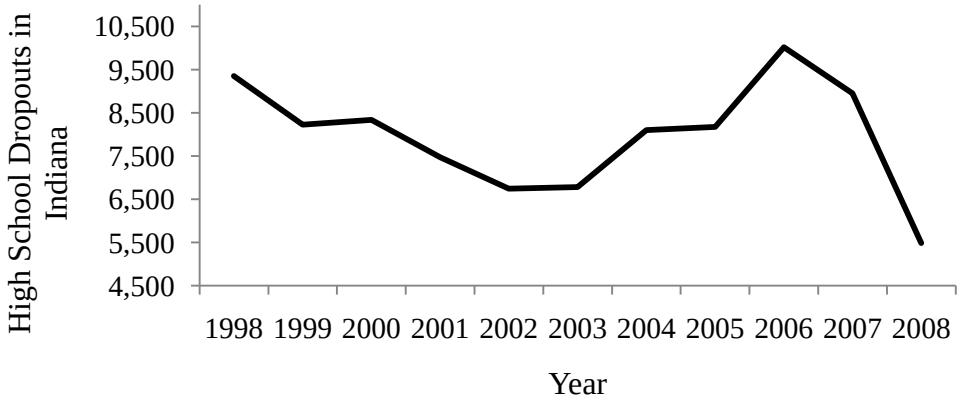


Figure 8. High School Dropouts in Indiana 1998 – 2008. (Indiana Department of Education, 2010).

Another study concluded that "even if Indiana was to become the best-performing state on measures of high-school completion, college participation and graduation of traditional-age students, it would still fall short of reaching the level of educational attainment needed to be globally competitive" (Indiana Chamber of Commerce, 2008). In the 21st century, 60 percent of

all jobs will require skills that are possessed only by 20 percent of the current workforce (Futureworks, 2005).

Walter (2010) explains that John Howard, Director of the National Institute for Occupational Safety and Health sees a shift in the pattern of employment, and that a college education might not be the key to future employment. He states that from 2010 to 2020 around 30 percent of Americans in their 20's will work towards a college degree, but only 60 percent of future jobs will require a degree. Indiana's workforce is not as well educated or skilled as other comparable regions in the country. In educational attainment (high-school, 2 – year associate degrees, four year degrees and advanced degrees) Indiana ranks in the bottom quartile of states or worse (Ball State University, 2003).

The Indiana Department of Education reported that in 2007, approximately 24,700 students did not graduate from Indiana's high schools, representing a lifetime loss for the state of more than $6.4 billion for that class alone. The report estimates that if Indiana's high schools graduated all students with the necessary preparation for college the state would save almost $40.3 million a year in community college remediation costs and lost earnings. Simultaneously the state would experience crime related savings and additional revenue of approximately $152 million each year if the male high school graduation rate increased by just 5 percent (Indiana Department of Education, 2010). The situation experienced in Indiana is described as "Dropout Pandemic" by the Indiana Department of Education and emphasizes the current crisis affecting the state. According to the National Center for Public Policy and Higher Education, from 100 Indiana 9^{th} graders only 72 graduate from high school, 44 enter college, 33 achieve the status of sophomores, but only 22 attain graduation within six years. Indiana's graduation rates are depicted in Figure 9.

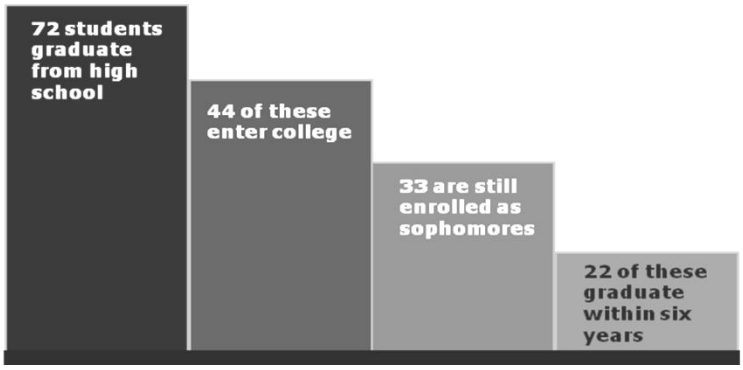


Figure 9. Higher Education Graduation Rates in Indiana. (National Center for Public Policy and Higher Ed, 2004)

Alli et al. (2007) state that the most fundamental lesson from the globalization of markets is that the education and skills of the workforce and managers are the dominant firm's competitive weapons (p. 94). Wadhwa posits that competitiveness is a function of the graduation rates of engineers and scientists; … "Reality: It is all about age, workforce education and skills" (Wadhwa, 2011)

The review of literature shows that the manufacturing industry in Indiana in general and the auto parts manufacturing industry in particular have been a major employer in the Midwest. The disappearance of manufacturing jobs in the area is leaving manufacturing workers unemployed, and the general perception usually contends this is the result of globalization. The educational level of manufacturing workers in the area seems to be another factor contributing to their unemployability in an economy that seeks to implement technology in order to remain competitive in the global market. However, there is still discrepancy whether globalization or technological improvements are causing the decline in employment in this industry in Indiana.

CHAPTER 3

METHODOLOGY

Overview

To uncover the effects of globalization on the Indiana gas engine manufacturing and parts industry, an online survey was conducted targeting this industry, the Indiana Chamber of Commerce, the Engine Manufacturers Association, and the Society of Manufacturing Engineers. The survey respondents for this study were directly associated with the gas engine manufacturing industry in Indiana and hold positions within the areas of engineering, management, or alike. The selected companies were operating under the NAICS 336312 classification. The participants were asked to assess the effects of globalization they have experienced in their respective organizations and within their industry. The participants were also asked to give insight about the broad skills set required from future manufacturing workers to secure the stability and subsistence of this industry within the U.S.

The Online Survey Method

Kaplowitz, Hadlock, and Levine (2004) point out that there are many advantages to using the internet for surveying purposes; they highlight primarily the cost savings associated with eliminating printed material and postage fees, and the time that can be saved by receiving data in electronic form. For this study, the researcher also selected the use of the internet and an anonymous survey method. The word "anonymous" referred to the fact that the researcher could

only approach the target respondents and request their input, without having the possibility to associate a certain answer to a given respondent. This way, the respondents had confidence that their entries were not tracked or saved in any form that would jeopardize their integrity or position at the organizations they represented. For the online survey the program Qualtrics was provided by Indiana State University and utilized for this research. Qualtrics provided each response that was received with an untraceable identification code ID similar to: R_cNNy4Y9tjpDF26g. Thus, any possible matching between respondent and response was totally eliminated, assuring the anonymity of the responses.

In order to increase response rates Dillman proposed that a prenotice contact seemed to have the strongest response impact (2000). The researcher decided to approach the respondents by phone and by email to make an initial first contact with them and explain the purpose of the study. The respondents then received an email (see Appendix F) with detailed information about the study and were given the link to the survey. The respondents were informed that the survey could be accessed at any time from any computer any day of the week. The survey was open from March 23, 2011 until midnight on April 29, 2011. The respondents were informed of this time frame in the email sent to them. In the preparation of the survey special attention was given to the number of questions in the questionnaire. Since surveys are known for low response rates, the researcher opted to follow Dillman's approach in making the survey questionnaire not to exceed a maximum of 30 questions. It is noteworthy that the questionnaire divided the respondents at an early stage into American and foreign owned organizations, and that some questions were triggered depending on their form of ownership. The researcher then proceeded to collect and refine the judgments of the experts from this survey and summarize their responses in statistical form. The data obtained in the survey consisted mainly of words and not numbers.

Analysis and interpretation of the responses individually, and in groups, were necessary to bring order and understanding. Taylor-Powell (2003) explained that a "qualitative approach seeks to provide understanding from the respondent's perspective. It tries to answer the question "what is unique about this individual or issue?". Usually the feedback results for surveys takes the form of a statistical summary of the group response in the form of mean and median (Rowe & Wright, 1999).

Survey Validation Procedure

The researcher made use of her Dissertation Committee to proof read the material for feedback regarding clarity (i.e. that questions were clear and legible) and correctness before it was sent to a selected panel for validation. Internal validity, the extent to which the survey design, and the data it yields, will allow the researcher to draw accurate conclusions about the cause-and-effect, as well as additional relationships, within the data (Leedy & Ormrod, 2010) was achieved by approaching four professors at different universities and one PhD Candidate at Indiana State University. These individuals were considered knowledgeable and possessed substantial expertise in the area of research. For the validation process the survey questionnaire was sent electronically to this group of experts who were expedient in providing feedback and improvements to the questionnaire. Their suggestions and improvements were consequently incorporated in the questionnaire. The researcher also followed the guidelines of the Indiana State University Institutional Review Board (IRB) in the creation of this study. The researcher was granted permission from IRB on March 16, 2011 to continue with this study. Qualitative research was defined by Strauss and Corbin (1990) as "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (p. 17). The results of this research sought to understand or explain how globalization had affected

the industry under study. The researcher acknowledged the fact that a different group of respondents may have yielded different results to this study. This fact is inherent to the survey methodology used; different respondents may have expressed different knowledge and/or experience in the subject matter. This difference does not diminish the validity of the study but makes its repeatability difficult in the future.

Survey Population

According to Van Zolingen "Participants are experts that give opinions on facts in the future" (van Zolingen & Klaassen, 2003). For this study the responders were all directly associated with gas engine and parts manufacturing in Indiana. The requirement to be considered as a participant in this study was that the interviewee must have at least 2 years of industry working experience or 3 years for all non-industry specific positions. The participants were requested to share their knowledge and experience in the area of technology, globalization, and employment by providing their views about the present and future of the industry under study. They also were asked to give insight about potential factors that could help manufacturing workers to compete in a globalized world, as well as their opinion about the broad skills set that future manufacturing workers may need to possess in order to secure their work in this challenged industry.

The Survey

The review of literature uncovered different factors supposedly affecting the industry under study. In order to explore those factors, the researcher divided the survey in five different areas: company ownership, employment, education, technology, and globalization/competition. This division was disguised and unnoticeable for the participants in the survey. The questionnaire provided to the respondents failed to define the terms "skills" and "education" as

listed in the definition of terms. Consequently, the respondents may have answered to questions related to education based on their own definitions of skills and education. The survey purposely did not ask for personal demographic data or any data that would expose the identity of the interviewee or the company they represented. Thus, in order to establish a difference between domestic and foreign ownership, the survey asked for the ownership form (domestic or foreign) of the company or parent company. This difference triggered a subset of questions that explored other relevant factors as a consequence of their ownership form. The other areas in the survey: employment, education, technology, and globalization/competition were identical for domestic and foreign owned companies. As stated in Chapter 1, the questionnaire focused around the five areas identified as having a direct effect on the manufacturing industry in Indiana. The survey was sent to 19 companies as listed in the Indiana Chamber of Commerce membership records. The number of companies comprised in this study differed with the number of companies provided by the Bureau of Labor Statistics for the year 2008. This difference was due to the fact that in 2011, when this study was conducted, some of these companies were no longer active in Indiana (See Appendix E).

Conclusion of the Survey

The survey concluded with an open ended question that sought to unveil the personal opinion of the respondent as to what they considered the most dramatic impact of globalization has been on this industry. This final question had the specific purpose of unveiling any other factor that may not have been considered in the review of literature or uncovered by the researcher in the creation of the survey.

CHAPTER 4

RESULTS

Chapter 3 discussed the methodology used to collect and analyze the data gathered from the online survey. This chapter presents the raw data and the subsequent analysis of the survey results. Again, the problem of this study was to identify the effects of globalization in the Gas Engine Manufacturing and Parts industry in Indiana. These issues may have led companies to outsource and offshore their operations from the State of Indiana. The purpose of this study was to assess the impact of globalization on the Gas Engine Manufacturing and Parts industry during the time period of 1998 – 2008 and to determine whether globalization or technological improvements have caused the decline of employment opportunities in this industry within the State of Indiana. The knowledge gained from this study can help identify any negative factors affecting this industry in order to correct these factors and allow this manufacturing sector some insight toward a possible improvement.

Discussion of the Data

As previously noted, employment in the Gas Engine Manufacturing and Parts industry in Indiana has decreased from 3,602 to 2,322 employees during the time period covered by this study. The data gathered was analyzed and the issues of missing or incomplete data in the survey responses were addressed. Missing or incomplete data was adjusted accordingly, which reduced the amount of valid responses in the sections this problem appeared. The response rate of the

survey was significant, with 18 out of 22 responses recorded. Since the survey was of an anonymous character, the researcher could not verify whether each response came from each of the different companies contacted for this study. Therefore, the possibility that two or more responses could come from one single company, but from different individuals, still exists. The survey results indicate that the majority of respondents were domestically owned companies (14) and only 3 were foreign owned U.S. based companies, having their parent company in the industrialized countries of Germany, Great Britain, and France. One company's ownership form remained undisclosed. The survey did not contain demographic information from the participants or any specific identifiable information about the company they represented. In the cases where 14 answers were gathered, the reader should not infer that only domestic companies answered those questions. The composition of the respondents, regardless of the amount of answers, remains unknown to the researcher. In order to unveil a competitive advantage based on the ownership form of the company, participants were asked whether or not they perceived a benefit in four different areas based on the nationality of their company. The four areas were: having access to better technology, a larger pool of skilled workers, access to foreign markets, and financial capital. Fourteen answers were gathered. The results obtained in the survey for the domestically owned companies showed that in regards to the perception of advantage by having access to better technology, 36 percent of respondents stated that they perceived a benefit, 50 percent of the respondents were indecisive, while 14 percent of the respondents disagreed with this statement.

Domestic owned companies seem to be equally divided in their perception of advantage due to having access to a larger pool of skilled personnel. Forty three percent of the respondents equally agreed, and disagreed, with this statement while 14 percent stated that they were

uncertain about this statement. Domestically owned companies do not seem to enjoy a direct benefit in regards to having access to foreign markets as 50 percent of domestic companies respondents disagreed with this statement, followed by 29 percent that perceived a benefit, and 21 percent stated that they neither disagree nor agree with this statement. When asked for access to financial capital, 64 percent stated that they do not see a benefit in this area, followed by 29 percent that were uncertain. Only 7 percent of the respondents stated a perceived benefit in this area. The difference in their perception in the four areas described above is shown in Figure 10. From these results it can be concluded that American owned companies do not seem to benefit in any of the four areas investigated.

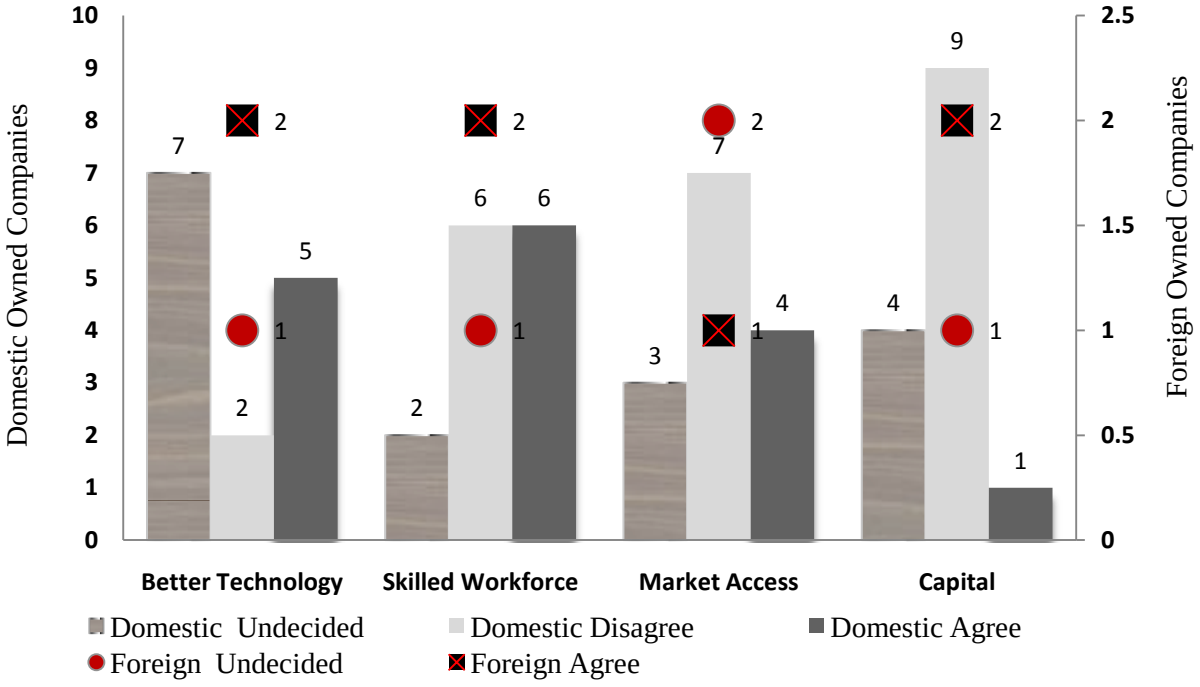


Figure 10. Frequency Distribution of Perceived Benefit by Ownership Form.

For comparison purposes, foreign owned companies were also asked if they perceived a benefit in the same areas. Three responses were gathered. The results show that for foreign owned companies the respondents considered only the range of choices between agree or undecided in their answers; none of them entirely disagree with any of the statements proposed. Thus, their responses show that two out of three foreign owned companies agree with having benefit in the areas of access to better technology, a skilled workforce, and capital. Only one respondent stated that they were uncertain of any benefit in these three areas. On the issue of access to foreign markets, two respondents were uncertain about having any benefit, while one respondent perceived to have a benefit. These results show that in contrast to domestic owned companies, foreign owned companies perceive an advantage in the areas of having access to better technology, a skilled workforce, and capital. It is relevant to this study that these companies stated their ownership in Europe and not in Asia, since the perception of global competition and consequently job losses usually blames Asian countries and not European ones.

Fourteen responses were gathered and the survey results show that 71 percent of the respondents regardless of ownership form responded that free trade has led to the overflow of similar products manufactured abroad. This fact is forcing local manufacturers to reduce their price in order to remain competitive. However, 22 percent of the respondents disagree with this statement, while 7 percent remained undecided. This is seemingly interesting since the U.S. government has expediently sought to increase the number of Free Trade Agreements (FTAs) between the U.S. and foreign nations in order to expand the export markets of domestic companies. At the moment there are 11 Free Trade Agreements with 17 different nations, and the United States has recently negotiated FTAs with Korea, Panama, and Colombia, but these agreements have not yet been enacted (Export Gov, 2011). From their responses it can be

inferred that this industry in Indiana perceives FTAs as a negative factor of globalization and not as a potential opener of new markets. Since FTAs are mutual agreements of trade, there is no reason for domestic manufacturers not to exploit foreign markets in a similar manner foreign competitors target the U.S. market for their products.

The survey asked the respondents to rank order - from very important to least important - five different areas considered as potential competitive factors in a globalized economy. The five areas were: superior quality, educated workforce, competitive prices, automated processes, and offshoring. The respondents were asked to value each area separately from the most to the least important. Fourteen responses were gathered. The responses obtained to this question show that 64 percent of the respondents surveyed consider quality as the most important competitive tool, followed by 57 percent that stated having access to a local educated workforce as the second most important competitive tool. The third category deemed as important by 50 percent of the respondents was offering competitive prices. Figure 11 depicts the relevance of each factor as stated by the respondents. Competitive prices are a function of the manufacturing process employed in the creation of a product and the availability of similar products on the market. Foreign competitors are proliferating on the U.S. market, driving down the prices, and forcing domestic companies to become more efficient in their manufacturing process. It is noteworthy that foreign competitors are not only basing their production on cheap labor, but they are also investing in capital goods and consequently improving their manufacturing industry. New machinery is improving their manufacturing processes, making them more efficient, and lowering the production cost per unit; the sum of these factors is making them more competitive in the global market.

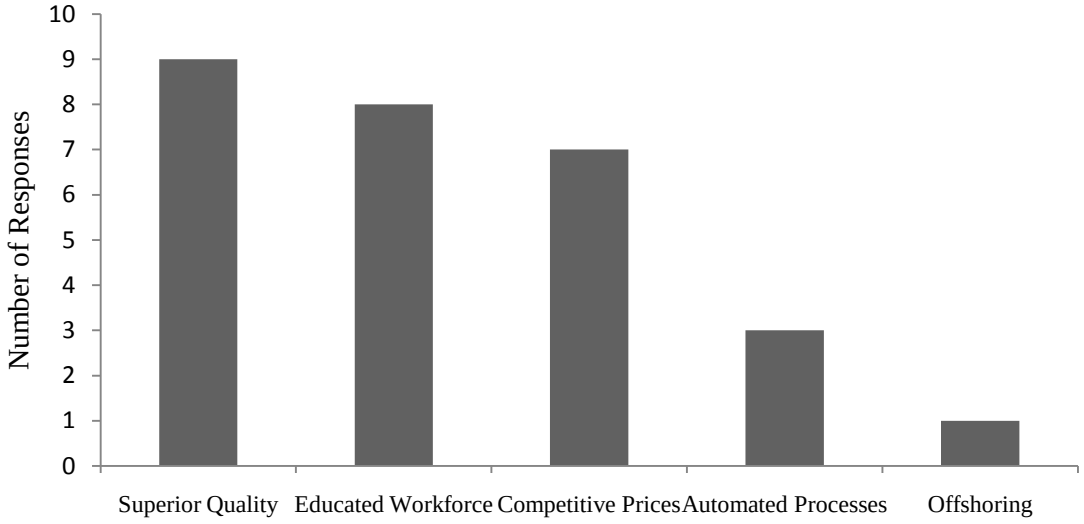


Figure 11. Potential Competitive Factors As Stated By The Survey Respondents

The least relevant competitive factors were the implementation of fully automated processes, as well as outsourcing and offshoring to achieve cheaper labor and/or manufacturing cost benefits. From 15 responses, the majority of respondents or 60 percent, stated that based on current conditions it is unlikely that they will outsource or offshore any manufacturing operations to an emerging economy. Twenty percent stated that based on current conditions they would agree to outsource and offshore, while the other 20 percent remain unsure about outsourcing. However, 57 percent of the respondents admitted that they would consider outsourcing and offshoring to primarily emerging economies like China, India, and Mexico if they deemed this would give them a business advantage like having access to better technology, or to a larger pool of a qualified workforce. Other destinations named as possible outsourcing destinations were Canada and Germany, but to a much lesser extent.

Related to the question of how globalization has affected this industry in Indiana 16 responses were gathered and 88 percent of respondents concurred that the number of competitors

from developing countries has increased, and competition consequently has increased. However, they do not deem the market as saturated and there is still room for further competition.

Unanimously, all the respondents agree with the statement that foreign products have penetrated the domestic market. In an open ended question, the respondents had the opportunity to state what they considered was the most dramatic impact of globalization on their industry. Their responses indicate the following:

- That domestic manufacturers are being replaced with U.S. based foreign companies
- They perceived an increased loss of employment opportunities due to offshoring to low-cost labor countries
- The loss of domestic jobs, both technical and non-technical
- Loss of sales due to loss of demand for domestic products
- The shift of offshoring Research and Development to other nations
- Labor unions add excessive cost to production, leading to further offshoring
- Productivity increases driving prices downwards

The accessibility of foreign products to the American market was also considered troublesome by the respondents who state that similar products can be easily obtained through the internet. Ninety four percent of the respondents consider that similar products manufactured abroad are of lesser quality than domestically manufactured products.

In the area of technology, the survey investigated whether achieving higher levels of automation was an important factor for this industry's global competitiveness. Fifteen responses were tabulated in this area. The results show that 73 percent of the respondents considered that achieving higher levels of automation is an important competitive tool. Only 13 percent were uncertain about this factor's importance for competitiveness. However, when inquired whether

becoming fully automated was deemed as a major priority, 14 responses were recorded. From those responses only 29 percent perceived a benefit from becoming fully automated. The vast majority, 71 percent were uncertain about the relevance of full automation from a competitive standpoint, although they considered automation has a major impact in their competitiveness. Higher levels of automation lead to more reliable and consistent processes that consequently increase productivity. Automation at the same time reduces variance caused by human error.

Judy and D'Amico (1998) stated that automation will continue to displace low-skilled or unskilled workers on the manufacturing floor, and that this sector may even disappear. Based on similar observations encountered in the review of literature, the survey explored the issue of unemployment due to technological advances in this manufacturing industry. The participants were asked whether they agreed with the statement that technology is displacing low-skilled or unskilled manufacturing workers in this industry, and 15 responses were gathered. Since the researcher failed to provide the respondents with explicit explanations for the terminology of "skills" and "education" used in this study, the respondents might have answered to these questions based on their own understanding of low-skilled or unskilled workers. Their definition might not be directly in accordance with the researcher's, definition of terms as listed in Chapter 1. Their responses are summarized in Figure 12.

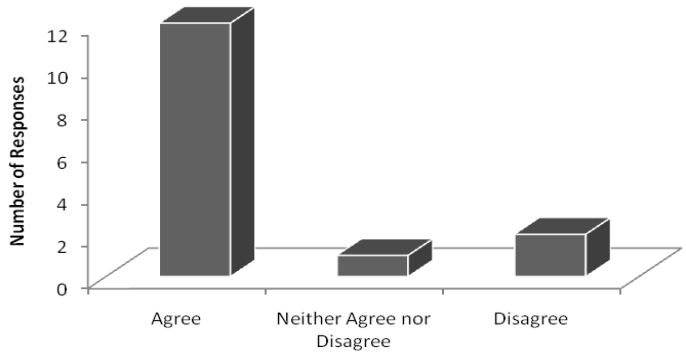


Figure 12. Perception of Technology Displacing Low-Skilled or Unskilled Manufacturing Workers.

In the area of automation, 15 responses were gathered. Eighty percent of the respondents agree that technology is replacing workers at the lower levels of the manufacturing ladder in this industry. Only 13 percent did not agree with this statement, while 7 percent preferred not to take a stand at all on this issue. A subsequent question explored the past experience of the participants in this area. The survey directly asked whether any new technology implemented within the past 10 years at their respective organizations had any impact on the company's employment rates. Fifteen answers were gathered. A slight majority, 53 percent of the respondents, stated that when new technology was implemented employment rates were negatively affected. For 27 percent of the respondents, the introduction of new technology did not seem to have a negative impact on employment rates and workers were not affected. Though, 20 percent of respondents were not certain about how the implementation of new technology had affected their workforce and abstained from supporting either side. Eighty percent of the respondents concur though that when employment is affected, lower-skilled and unskilled workers are mostly affected. Figure 13 depicts the breakdown of affected job categories when new technology was implemented. This

figure shows that when new technology was implemented executives and department/division managers were not affected, while production workers and technicians were significantly affected. When no technology was implemented the effect on workers remained unchanged. As also found in the review of literature, there is an obvious correlation between educational achievement and job security palpable in this industry as well. The higher the educational level of the individual the less affected they are by the introduction of new technology. Fifty percent of the respondents agree that automated manufacturing processes replace less skilled workers. Thus, based on these results and the review of literature it can be concluded that new technology will continue to dislocate primarily low-skilled and unskilled workers, while holders of higher degrees will not be as affected.

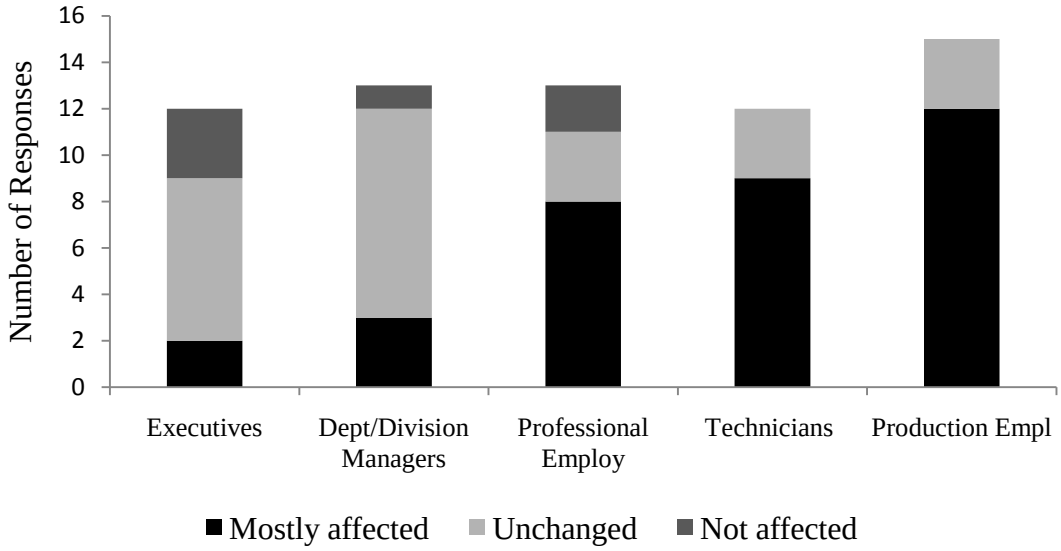


Figure 13. Perceived Job Categories Affected by the Implementation of New Technology

The survey inquired further whether or not the skill set of the workforce at the time of the implementation was sufficient to deal with the new technology. Fourteen responses were gathered. Half of the respondents were unsure about this fact, while 29 percent considered that

the skill set of the workers at the time of the implementation was not sufficient to deal with the new technology. Only 21 percent considered that their current workforce could manage the new technology. The respondents stated that the lack of skills encountered resulted on the other hand, in the positive fact of hiring new skilled workers. From the answers gathered it can be deduced that automation is equally destroying as well as creating employment opportunities. Less skilled workers are being replaced by technology and automation. These machines require knowledge and expertise that can be provided only by high-skilled workers, who were not previously present on the manufacturing floor. Thus, it can be concluded that the face of the manufacturing industry is changing from labor intensive production processes to high tech intensive. Fewer workers will be needed on the production floor while productivity will continue to increase.

When questioned about to what extent the respondents would agree that the transition from low-tech and labor intensive manufacturing to high-tech and fully automated processes could be the predominant factor responsible for the decline in manufacturing employment opportunities, fourteen responses were gathered. Forty percent of the respondents disagree with this statement, and they do not deem technology as the main driver for reduced employment opportunities in this sector. Twenty seven percent are not certain to support or reject this statement, while 33 percent deems this transition as the cause for unemployment.

To compare the effect of technology on employment rates, the respondents were asked whether they considered that globalization caused the decrease in employment in this industry. Eighteen responses were gathered. Sixty six percent of the respondents consider that globalization (outsourcing and offshoring manufacturing jobs) is responsible for the loss of job opportunities in this industry. Seventeen percent of the respondents were not certain to either support or reject this statement, while the last 17 percent of the respondents did not consider

globalization as the reason. The results gathered show that the majority of the respondents focus on globalization as the primary cause of unemployment. The respondents do not consider technology as a main cause for job dislocation, but regard outsourcing and offshoring as the main, if not the only responsible for such a decline. However, the Bureau of Labor Statistics data shows that only 1 out of 4 relocations recorded actually leaves the United States. It can be then concluded that the respondents considered outsourcing and offshoring as responsible for the decline of employment opportunities based on perception and not on fact.

A subsequent open ended question explored what the respondents considered as the major driver for the decline in employment in this area. Their responses targeted globalization as the main cause for job dislocation while disregarding any technological advances as a possible factor for employment decline. The respondents offered the following items as having been influenced by globalization:

- Has increased the availability of higher quality parts at lower cost than domestic products
- Increases in global outsourcing to low cost labor countries
- Foreign companies are unwilling to work with American suppliers
- Foreign competition is gaining market share on the American market
- The industry is moving to southern states
- Executives are not considering the long term effects of outsourcing, but only the short gains in the form of labor cost reductions
- Worldwide competition and pressure to reduce price from OEMs
- Drop in demand due to increased amount of suppliers

Similar statements as those listed above were encountered in the review of literature for the manufacturing industry as a whole; however, there was no clear indication that the industry under study had experienced global competition affecting employment in such a direct and negative manner. To further investigate how globalization had affected this industry in Indiana, the respondents were queried about the reasons for any layoffs experienced in this industry between 1998 and 2008. The absolute majority, 100 percent, stated that the main reason for a layoff was a decrease in product demand. Fifty percent stated that domestic products were not competitively priced in relation to foreign brands as the second reason for any layoff. Twenty five percent of the respondents stated unskilled labor, while 17 percent of the respondents did not experience any layoff in their organizations. Only 8 percent of the respondents considered that more efficient manufacturing processes required less labor leading to layoffs. The respondents consequently seem to have a tendency to blame globalization and not technological improvements as the main reason for the decline in employment in this industry.

Since new technology is being introduced in most manufacturing processes and in almost all industries and sectors, the survey inquired whether the current and future workforce has the necessary skills to deal with new technology. To assess the educational levels and skills of the current workforce, the survey explored how high school dropouts affect the accessibility of current and future manufacturing workers in this industry. Twelve responses were collected. The respondents agreed unanimously that in the future there will be a shortage of a qualified workforce which will lead to other nations surpassing, and even coming to dominate, manufacturing areas in which the U.S. previously excelled. Half of the respondents foresee a seemingly difficult future for the U.S. manufacturing industry and believe that the American manufacturing industry may even disappear to the benefit of foreign competitors. Outsourcing

and offshoring are also perceived by 42 percent of the respondents as an imminent necessity in the future due to the lack of a qualified domestic workforce. Fourteen responses were gathered, and fifty seven percent of the respondents stated that outsourcing should be approached as a business strategy only when the organization faces serious challenges that jeopardize its own survival. For the companies that outsourced any operation within the last 10 years, the main reason for outsourcing was to exploit advantageous business incentives offered abroad, like lower taxes and accessibility to raw materials. Other reasons stated were more lenient environmental regulations, strategy to penetrate new markets, and access to low cost labor and components. However, at present 80 percent of the respondents would not consider outsourcing any manufacturing process to a low cost country only with the purpose to obtain a labor arbitrage advantage.

The survey explored the area of education as a competitive factor in the global arena, and 15 responses were gathered in this area. Eighty seven percent of the respondents considered that education in the areas of mathematics and science are extremely important to withstand competition and technological advances from foreign competition. Eighty percent of the respondents consider that current manufacturing workers need to improve their skills in primarily technical areas. Seventy three percent of the respondents consider interpersonal skills as an important factor, while 47 percent deemed business knowledge an important area that needs improvement. Technical competitiveness is undoubtedly the major competitive factor in the area of education. The shortage of a qualified workforce was often mentioned in the review of literature as a major problem in the manufacturing industry. The survey investigated further where this industry currently find the workforce they need. The respondents state that manufacturing workers are mostly found at:

- 2-year technical colleges and Universities
- Unemployed experienced workers
- Hands-on experienced workers
- Engineering departments
- Current workers working for competitors
- Workers must be trained on site

The survey questionnaire explored whether higher education was relevant for technical competency and global competitiveness. Twelve answers were gathered. The findings are shown in Figure 14. The results show that 75 percent of the respondents agree that certifications provided by industrial organizations and 2 year technical colleges provide the necessary skills and knowledge required for this industry.

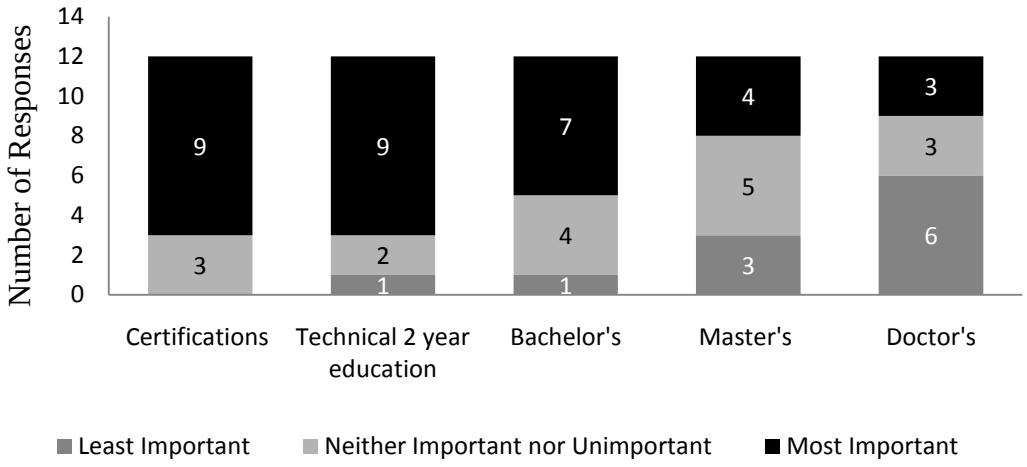


Figure 14. Relevant Educational Achievement as Stated by the Survey Respondents

Fifty eight percent of respondents state that university studies at the Bachelor's level provide the technical education required. Advanced degrees at Master's and Doctoral levels are deemed less relevant for this industry. The review of literature discussed the fact that in the 21st

century, most of the jobs will require skills that are possessed only by 20 percent of the current workforce, and that many of those jobs are in areas still unknown to us. Certainly, technological improvements are also requiring more sophisticated skills that may have not been created yet. According to the review of literature, skills, and not a specific degree, might have a significant effect on job attainment in the future.

The results show that domestic owned companies do not seem to enjoy any benefits in the areas explored, while foreign owned companies expressed some perceived benefits due to their ownership form. Regardless of ownership form, respondents stated that they deem products manufactured abroad are of lesser quality than those manufactured domestically. The educational level of the manufacturing workforce in this industry is considered limited. Employees with low, or no formal education, seem to be mostly affected by the introduction of new technology in the manufacturing floor. The introduction of technology in the manufacturing process is displacing low-skilled workers. However, the respondents deemed globalization as the main reason for any negative impact suffered on employment rates in this industry.

CHAPTER 5

SUMMARY AND DISCUSSION

This chapter presents a summary of the results drawn from this survey as well as some recommendations for future research. As previously mentioned, a qualitative survey can only provide the respondent's perspective in a subjective manner. Thus, this study sought primarily to understand the effects of globalization on the gas engine manufacturing and parts industry in Indiana as experienced by those individuals working in this industry. The responses obtained in the survey showed a divergence of experience in some areas while others seemed to have more commonality. However, the results gathered in this study were valuable in bringing some understanding to how globalization and technology have impacted this industry in Indiana.

Despite the theories that anticipate the U.S. manufacturing industry will succumb to the advantage of developing nations, this industry can still constitute one of the main pillars of the nation's economy. The results of this exploratory research demonstrate that the perception of the manufacturing industry under study is similar to that of the opinion of the general public. Insufficient empirical studies are available at present to give globalization its well deserved merit as a driver for opportunity and improvement for all involved. The fact that globalization enhances competition should be regarded as a means to further development and discovery, and raise the bar by which U.S. companies need to perform in order to compete globally. Indiana and

U.S manufacturers alike are, as a result, pushed to continuously improve their production process and become more efficient in order to remain as a player in a globalized world.

Globalization is certainly putting the gas engine manufacturing sector of Indiana to the test. This industry is facing real challenges with competition and workforce issues. This competition is not exclusively associated with foreign competitors and products manufactured abroad; it is the daily struggle of trying to attract future workers to an industry that is tainted by the old image of Henry Ford's assembly line and job losses due to offshoring. Oftentimes manufacturing jobs are portrayed by layoffs, the offshoring of jobs to developing countries, and unsanitary working conditions. The manufacturing industry's image has been regarded by many as its own worst enemy. If the manufacturing industry in Indiana is to survive, great effort should be dedicated to depart from this dated image and promote manufacturing as the exciting industry it actually is; an industry that has certainly reinvented itself as high-tech in the 21st century. The industry itself, but also trade schools and universities, have the task to make this face lift possible and make it known. Future manufacturing workers must first be reassured that there is job security and potential for growth in this industry. Marketing campaigns should engage potential workers showing them the new face of this industry and the many possibilities therein. The United States Department of Labor provides a country wide and state specific apprentice sponsorship programs that could be utilized to spark the interest of potential students in technical related areas necessary in this industry. On-the-job apprenticeships provide hands-on experience and successful students are usually employed by the sponsoring company. This manufacturing industry needs qualified individuals capable of managing sophisticated technologies, and apprenticeships might be a feasible and affordable way to spread that knowledge.

Conclusions

The first part of the questionnaire explored advantages or benefits based on the form of ownership of the companies operating in Indiana. The results obtained in this survey indicate that domestic owned companies do not seem to enjoy any benefit in the areas explored. On the other hand U.S. based foreign owned companies perceive some benefits in their access to better technology, a knowledgeable workforce, and financial capital. In the area of globalization, regardless of ownership form, the majority of respondents agreed that the most negative effect of globalization experienced by this industry was increased competition that leads to the abundance of similar products on the U.S. market, but manufactured abroad. The majority also judged that products manufactured abroad were of lesser quality than those manufactured in America. These products are offered at lower and more competitive prices which forces domestic manufacturers to reduce their price despite the costs incurred in the manufacturing of the product. The majority of respondents stated that at present they would not consider outsourcing to an emerging economy; however, this position could change if future market conditions became favorable or the survival of the company was endangered.

The employment area explored how globalization had affected this industry specifically on this sector. The results show that employees with no formal education, or scarce education, were mostly affected by the introduction of new technology. Low-skilled and unskilled workers seemed to be the first employee category to be replaced by equipment when automation was implemented into the manufacturing floor. The results show that the majority of respondents considered increased competition as one of the major negative impacts related to globalization. They also stated that globalization was, according to their knowledge and experience, the main responsible for the decline in employment opportunities in this industry. The results of the

survey showed that employment security and education are correlated; a workforce that possesses higher education and technological skills is at less risk of being replaced with automation.

In the area of education there was consensus among the respondents about the fact that, in the future, the U.S. will experience a shortage of a qualified workforce. This situation may give other nations a dominating manufacturing position in areas where the U.S. used to excel. The majority of respondents affirmed that the increasing number of student dropouts from the school system and the scarce availability of a knowledgeable workforce were creating substantial problems for this industry. The respondents stated that education in the areas of science and mathematics was extremely important to withstand competition, and also that the current school system was not providing the basic skills required to secure a job in this industry. The vast majority stated that the workers in this industry needed to improve their technical skills, followed closely by interpersonal skills. Business knowledge and entrepreneurial thinking were not considered relevant by the respondents at this time. Technical knowledge was considered by far the number one competitive tool for this industry. The respondents stated that certifications provided by industrial organizations and 2- year colleges bestowed future manufacturing workers with the skills and competencies necessary in this industry.

The respondents expressed repeatedly a negative experience or consequence suffered by globalization. They considered that the decrease in product demand as well as the issue of domestic products not being competitively priced compared to foreign products was a negative aspect of globalization. The respondents shared a similar stance regarding globalization's negative effect on employment rates. Their perception expressed mainly that globalization had

affected employment negatively, but it did not include technological improvements as a plausible factor for the employment decline experienced in this industry.

In the area of technology the majority of respondents considered that achieving higher levels of automation was an important competitive factor. This fact supports the view of those stating that the manufacturing industry is actually changing from labor intensive tasks to high-tech processes. The vast majority of respondents acknowledged that technology was replacing workers at the lower levels of the manufacturing ladder. The respondents that implemented new technology in their manufacturing process also experienced that the implementation of new technology had a negative impact on employment numbers. They stated that this negative impact was felt mostly by the low-skilled and unskilled workers in their companies. Employees with higher education or skills were barely affected or non-affected at all, when new technology was implemented. This fact could be described as positive as well as negative for the manufacturing worker. The implementation of new technology replaced low-skilled and unskilled workers, but simultaneously the introduction of automation stimulated the hiring of high-skilled and knowledgeable workers capable of managing the new technology. The fact that technological improvements led to a substantial decrease on employment opportunities for workers with less or no formal education was vaguely acknowledged by the respondents. If the implementation of new technology is causing the actual reduction of employment opportunities in this industry, then technology should be acknowledged as such and not globalization, outsourcing, and offshoring. This difference is seemingly important since globalization is usually held responsible for the dislocation of workers in the manufacturing industry while technological improvements are scarcely discussed in this context. Thus, this would support the stances of Miller (2005), Fisher (2004), and Greider (1997) discussed in the review of literature who indicated that

technological improvements increase productivity and is this fact that is the cause and the cure of the decline of employment in the manufacturing sector.

The results of the survey concluded that the respondents deemed globalization as the main responsible for any negative impact suffered on employment rates in this industry, while the introduction of new technology and automation did not seem to be recognized as a potential contributor to declining employment rates in the gas engine manufacturing and parts industry.

From this study the researcher concluded that the factors explored in this survey such as education, technology, globalization/competition, and employment are deeply interrelated which often can create a vicious cycle, where the effect of one factor reverberates on another. Globalization was mainly perceived as a negative factor that led to increased competition, urging domestic manufacturers to deliver more superior quality products than that of foreign competitors. To achieve this level of quality at competitive prices, domestic manufacturers need to improve their manufacturing processes through investment in capital goods and increased automation. However, the scarcity of a qualified workforce may deter investment in capital goods since current manufacturing workers lack the technical skills required to deal with new technologies. In order to overcome this obstacle and mitigate the effects of globalization, education in technical areas is necessary. It is the accessibility of a knowledgeable workforce that will decide the future of the manufacturing industry in general, and this industry in particular. The lack of a knowledgeable workforce will continue to push the manufacturing industry to become more automated and to increasingly rescind from their need of labor, or it will force them to offshore when qualified domestic labor becomes unavailable.

The only way to withstand competition is through education. Without an educated workforce no industry will be able to survive, and our world will become with or without us "One World Ready Or Not" as Greider (1997) once stated.

Recommendations for Further Research

The researcher noted during the conduction of this study, that the companies operating under NAICS 336312 in Indiana were very diverse and consequently may have experienced the impact of globalization and technology in different ways. Thus, in further studies it would be advisable to segment the companies operating in this industry by different means, such as specific location in Indiana, company size, revenue, or technological similarity other than solely by their NAICS classification. This would make the comparison among companies more uniform and provide better information regarding their actual composition and competitiveness. Another recommendation would be to select two comparable companies and conduct a case study instead of a survey; this would bring more quantitative data for analytical purposes than a survey. However, the researcher recommends this approach only when the researcher has the certainty that he/she has the appropriate connections to the companies under study in order to guarantee the accessibility of records and viability of the study.

The researcher also noted after the fact, that the survey sent to the respondents did not explain the researcher's definition of what level of education was to be understood related to the designations of low and high skilled workers. This lack of information in the survey could have induced the respondents to answer according to their own definition of what he/she considered low and high skilled workers, and this might have been inconsistent with the researcher's definition. Therefore, a recommendation for future research would be to confirm that all respondents have the same understanding of every concept used in the research study.

Another area that could be further investigated is whether any of the companies comprised in this study had a partner or partnership agreement with a company outside the United States. Further research in this area could explain whether companies with partnerships outside the U.S. experience a more positive impact of globalization in their industry than those with no partnerships outside the U.S.

For this study the researcher did not include specific questions regarding areas like product design, quality, manufacturing process, and innovations in research and development. The researcher recognized after the study was concluded that questions in these areas could have provided valuable information in the assessment of the global competitiveness of the companies operating in this industry. The information obtained through these questions could be the basis for a direct comparison with the level of technological advancement achieved by foreign competitors in this industry.

REFERENCES

Adbela, R., & Adam, S. (2007). Has Globalization Passed its Peak? *Foreign Affairs*.

Alli, A. M., Winter, G., & May, D. (2007). Globalization: Its Effects. *International Business & Economics Research Journal, 6 Nr. 1*.

Alliance for Excellent Education. (2006). Paying Double: Inadequate High Schools and Community College Remediation. (August).

Alliance for Excellent Education. (2009). High School Dropouts in America - Fact Sheet.

Ball State University. (2003). *Indiana Manufacturing Education and Training Initiative*.

Bhagwati, J., Panagariya, A., & Srinivasan, T. N. (2004). The Muddles over Outsourcing. *Journal of Economic Perspectives, 18*(4), 93-114.

Brauer, D. (2004). What Accounts for the Decline in the Manufacturing Sector. *Economic and Budget Issue Brief.*

Brauer, D. (2008). Factors Underlying the Decline in Manufacturing Employment Since 2008. *Economic and Budget Issue Brief, Dec 23, 2008*.

Bronfenbrenner, K., & Luce, S. (2004). The Changing Nature of Corporate Global Restructuring: The impact of Productin Shifts on Jobs in the US, China and Around the Globe. *Cornell University, ILR School, 10/14/2004*.

Brown, S., & Siegel, L. (2005). Mass layoff data indicate outsourcing and offshoring work. *Monthly Labor Review,* 3-10.

Bureau Of Labor Statistics. (2010a). *Extended Mass Layoffs (Quarterly) News Release*.

Bureau Of Labor Statistics. (2010b). Quarterly Census of Employment and Wages, Original Data Value.

Caseli, M. (2008). Measuring... What? Notes on Some Globalization Indices. [Article]. *Globalizations, 5*(3), 383-404.

Cheung, C., Rossiter, J., & Yi, Z. (2008). Offshoring and Its Effects on the Labour Market and Productivity: A Survey of Recent Literature. [Article]. *Bank of Canada Review*, 15.

Chongvilaivan, A., Hur, J., & Riyanto, Y. (2009). Outsourcing types, relative wages, and the demand for skilled workers: new evidence from U.S manufacturing (Vol. Vol 47, pp. 18 - 33). Economic Inquiry.

Collins, B., McDonald, T., & Mousa, J. A. (2007). The Rise and Decline of Auto Parts Manufacturing in the Midwest. *Monthly Labor Review, October 2007*(2007), 14 -20.

Corbett, M. F. (2003). *The Outsourcing Revolution: why it makes sense and how to do it right*. Chicago, IL: Dearborn Trade Publishing.

Dillman, D. (2000). *Mail and Internet Surveys: The Tailored Design Method*. New York: Wiley.

Export Gov. (2011). US Free Trade Agreements. Retrieved March 20, 2010, from http://www.export.gov/FTA/index.asp

Fisher, E. O. N. (2004). why are we losing manufacturing jobs? *Federal Reserve Bank of Cleveland*(July).

Friedman, T. L. (2005). *The world is flat : a brief history of the twenty-first century* (Vol. 1st). New York: Farrar, Straus and Giroux.

Futureworks. (2005). *A Demand-Side Strategy to Meet Indiana's Workforce Basic Skills Challenge*: Indiana Chamber of Commerce.

Gordon, E. (2009). The global talent crisis. *The Futurist*(Sep-Oct), 34-39.

Greider, W. (1997). *One World, Ready or Not*. New York: Simon & Schuster.

Hagel, J. I. (2004). Offshoring goes on the offensive. *McKinsey Quarterly*(2), 82-91.

Harlow, C. (2003). Education and Correctional Populations. *Bureau of Justice Statistics, NCJ 195670*(January 2003).

Heshmati, A. (2003). Productivity Growth, Efficiency and Outsourcing in Manufacturing and Service Industries. *Journal of Economic Surveys, 17*(1), 79-112.

Hilsenrath, J. E. (2004). Behind Outsourcing Debate: Surprisingly Few Hard Numbers. *The Wall street Journal Classroom Edition*. Retrieved from www.wsjclassroomedition.com/outsourcing/out_numbers.htm

Hogan, J. B. (2004). Going Offshore's Easy, RIGHT? *Manufacturing Engineering, 133*(No. 6).

InContext. Indiana Business Research Center at Indiana's University Kelly School of Business. (2010). Segmenting Indiana's Automotive Manufacturing Industry: Jobs and Wages. *INContext, Vol 11*(No. 3).

Indiana Department of Education. (2010). Crisis: High School Dropouts. *www.doe.in.gov/dropoutprevention/docs/2010-02-17-WebEx/dropout_presentation-edited.ppt*.

Indiana Chamber of Commerce. (2008). *Indiana's Adult Educaiton and Workforce Skills Performance Report*.

Jovanovic, M. N. (2006). *Location of Production: Local vs. Global Game*. New York: Nova Science Publisher.

Judy, R., & D'Amico, C. (1998). *Workforce 2020: Work and Workers in the 21st Century* (Vol. 4th). Indianapolis, Indiana: Hudson Institute.

Kaplowitz, M. D., Hadlock, T. D., & Levine, R. (2004). A Comparison of Web and Mail Survey Response Rates. *Public Opinion Quarterly*, *68*(1), 94-101.

Kelter, L. (2009). Substantial job losses in 2008: weakness broadens and deepens across industries. *Monthly Labor Review, Vol 132*(No 3), 20-33.

Krugman, P. (2000). Can America Stay on Top? *The Journal of Economic Perspectives*, *No 14*(1), 169-175.

Krugman, P., & Venables, A. J. (1995). Globalization and the Inequality of Nations. *The Quarterly Journal of Economics, CX*(4).

Leedy, P. D., & Ormrod, J. E. (2010). *Practical Research, Planning and Design*. Boston, MA.

Marchant, M. A., & Kumar, S. (2005). An Overview of U.S. Foreign Direct Investment and Outsourcing. *Review of Agricultural Economics, 27*(3), 379-386.

McCarthy, J. C. (2004). Near-Term Growth of Offshoring Accelerating. *Forrester Research Inc., May 14, 2004*.

Miller, T. P. (2005). *What Indiana Makes, Makes Indiana*: Central Indiana Corporate Partnership.

Offshoring Opportunities. (Ed.) (2005).

Organization International Investment. (2009). Foreign Direct Investement in the US.

Organization of Economic Cooperation and Development. (2004). *Definitions*.

Roesler, J., & Leeuw, A. (2007). Offshoring and Near-Shoring: Movement of Work Studies. *InContext Indiana's Workforce and Economy, October 2007*.

Rowe, G., & Wright, G. (1999). The Delphi Technique as a forecasting tool: issues and analysis. *International Journal of Forecasting, 15*, 353-375.

Scott, R. (2007). *Costly Trade with China, Millions of US jobs displaced with net job loss in every state*. Washington, DC: Economic Policy Institute.

Slaughter, M. J. (2004). Insourcing Jobs, Making the Global Economy Work for America. *Insourcing Jobs, 2004*.

Slaughter, M. J. (2010). How to Destroy American Jobs. *The Wall Street Journal*.

Smith, D. (2006). Offshoring: Political Myths and Economic Reality. *World Economy, 29*(3), 249-256.

Solomon, C. M. (1999). Moving Jobs to Offshore Markets: Why It's Done and How It Works. [Article]. *Workforce, 78*(7), 51.

STATS Indiana. (2008). ASM Production Workers in 2008 (NAICS based data).

Strauss, A., Corbin J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques.* . Newbury Park, CA: Sage Publications, Inc.

Sunshine, R. A. (2008). Factors Underlying the Decline in Manufacturing Employment Since 2000. *Economic and Budget Issue Brief*.

Taylor-Powell, E. R., Markus. (Ed.) (2003). Wisconsin: Board of Regents of the University of Wisconsin System.

Thompson, M. F., & Merchant, A. A. (2010). Segmenting Indiana's Automotive Manufacturing Industry: Jobs and Wages. *INContext, 11*(3).

US Census Bureau. (2010). Annual Survey of Manufacturers, Definition. *Census Gov*.

van Zolingen, S. J., & Klaassen, C. A. (2003). Selection processes in a Delphi study about key qualifications in Senior Secondary Vocational Education. *Technological Forecasting and Social Change, 70*(4), 317-340.

Wadhwa, V. (2011). Engineering: Shortage or Glut: Duke University. Pratt School of Engineering.

Wadhwa, V., Rissing, B., & Gereffi, G. (2006). Industry Trends in Engineering Offshoring. *SSRN eLibrary*.

Walter, L. (2010, May 25, 2010). AIHce 2010: The Future of Work and the Aging Work Force. *EHS Today*.

Zhao, Y., & Calantone, R. J. (2003). The Trend Toward Outsourcing in New Product Development: Case Studies in Six Firms. *International Journal of Innovation Management, 7*(1), 51.

APPENDIX A: NAICS 336312 DEFINITION

This U.S. industry comprises establishments primarily engaged in manufacturing and/or rebuilding gasoline motor vehicle engines and gasoline motor vehicle engine parts, excluding carburetors, pistons, piston rings, and valves.

Entries	NAICS 2007 Corresponding Index
336312	Assembly line rebuilding of automotive and truck gasoline engines
336312	Bearings (e.g., camshaft, crankshaft, connecting rod), automotive and truck gasoline engine, manufacturing
336312	Connecting rods, automotive and truck gasoline engine, manufacturing
336312	Crankshaft assemblies, automotive and truck gasoline engine, manufacturing
336312	Cylinder heads, automotive and truck gasoline engine, manufacturing
336312	Engine block assemblies, automotive and truck gasoline, manufacturing
336312	Engines and parts (except diesel), automotive and truck, manufacturing
336312	Flywheels and ring gears, automotive and truck gasoline engine, manufacturing
336312	Fuel injection systems and parts, automotive and truck gasoline engine, manufacturing
336312	Fuel pumps, mechanical, automotive and truck gasoline engine, manufacturing
336312	Gasoline engine parts, mechanical (except carburetors, pistons, piston rings, valves), automotive and truck manufacturing
336312	Gasoline engines, automotive and truck, manufacturing

336312	Governors for automotive gasoline engines manufacturing
336312	Internal combustion engines, automotive and truck gasoline, manufacturing
336312	Manifolds (i.e., intake and exhaust), automotive and truck gasoline engine, manufacturing
336312	Positive crankcase ventilation (PCV) valves, engine, manufacturing
336312	Pumps (e.g., fuel, oil, water), mechanical, automotive and truck gasoline engine (except power steering) manufacturing
336312	Rebuilding automotive and truck gasoline engines
336312	Rocker arms and parts, automotive and truck gasoline engine, manufacturing
336312	Timing gears and chains, automotive and truck gasoline engine, manufacturing

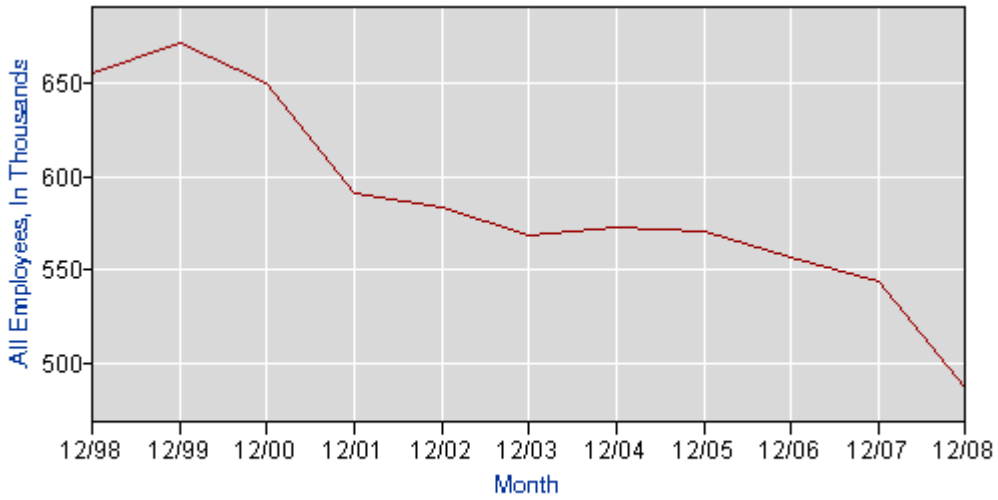
APPENDIX B: LIST OF COMPANIES UNDER NAICS 336312 IN INDIANA

Name	*Location*
Avis Industrial Corp	Upland
Benteler Automotive Corp	Fort Wayne
Cummins Inc (2)	Columbus
General Products Angola Corp	Angola
Hapco Rebuilders Inc	Terre Haute
Indy Cylinder Head	Indianapolis
International Fuel Systems Inc	Anderson
J & C Water Systems Inc	Elkhart
Jasper Engine Exchange Inc (2)	Leavenworth
Keihin North America Inc	Greenfield
Performance Rod & Custom Inc	Boonville
Pierce Co Inc	Upland
Stage Ninja LLC	Indianapolis
Millennium Industries Corp	Ligonier
KUS Inc Zollner Div	Fort Wayne
Ryobi Die Castings USA Inc	shelbyville
Tri State Cylinder Head Inc	Evansville

State and Area Employment, Hours, and Earnings
Original Data Value

Series Id: SMS18000003000000001
Seasonally Adjusted
State: Indiana
Area: Statewide
Supersector: Manufacturing
Industry: Manufacturing
Data Type: All Employees, In Thousands
Years: 1998 to 2008

Year	Dec
1998	655.6
1999	672.1
2000	649.9
2001	591.4
2002	583.5
2003	568.9
2004	572.7
2005	571.0
2006	556.3
2007	544.1
2008	487.3

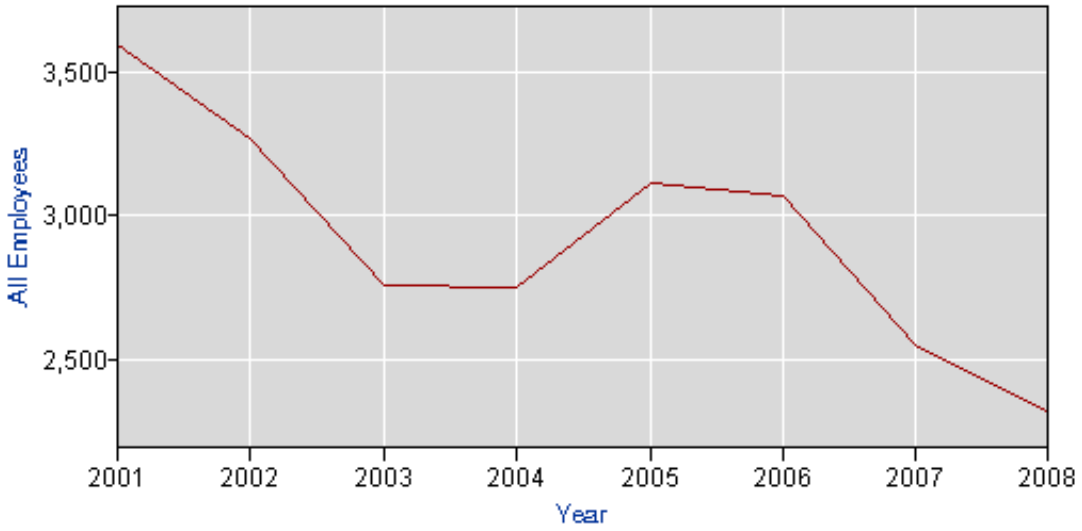


US Bureau of Labor Statistics

Quarterly Census of Employment and Wages
Original Data Value

Series Id: ENU18000105336312
State: Indiana
Area: Indiana -- Statewide
Industry: NAICS 336312 Gasoline engine and engine parts mfg.
Owner: Private
Size: All establishment sizes
Type: All Employees
Years: 2001 to 2008

Year	Annual
2001	3602
2002	3270
2003	2760
2004	2748
2005	3114
2006	3069
2007	2551
2008	2322



Source: US Bureau of Labor Statistics

APPENDIX E: NAICS 336312 ESTABLISHMENTS OPERATING IN INDIANA

Quarterly Census of Employment and Wages
Original Data Value

Series Id: ENU18000205336312
State: Indiana
Area: Indiana -- Statewide
Industry: NAICS 336312 Gasoline engine and engine parts mfg.
Owner: Private
Size: All establishment sizes
Type: Number of Establishments
Years: 2001 to 2008

Year	Annual
2001	28
2002	30
2003	30
2004	27
2005	28
2006	27
2007	26
2008	25

Source: US Bureau of Labor Statistics

The number of companies comprised in this study is less than the number of companies showed in the above graph. The difference is due to the fact that some of these companies were no longer in business in 2011, when this study was conducted.

APPENDIX F: SURVEY INTRODUCTION

The following email was sent to the target population for this study.

Dear Mr (Mrs) ----------,

I am a Doctoral Candidate in Manufacturing Engineering with specialization in Technology Management* from Indiana State University in Terre Haute, IN. I am currently researching an area of potential interest in your line of work.

As we know, globalization has opened new doors to international business, but at the same time is making American manufacturing more vulnerable to foreign competition. Technology at the same time has been displacing workers in the manufacturing industry for several years.

We would like to determine the impact of globalization and technology in Indiana and on the manufacturing industry.

Therefore, we ask you to share with us your opinion of how these two factors may have affected your industry by answering a short survey. We know that most people do not have time to answer lengthy surveys, therefore ours is very short and to the point!

There are not very many companies left in this industry here in Indiana **that is why every opinion counts.** The survey is online and it is entirely anonymous.

Please click on the following link to access the survey, and let us find a way to keep the manufacturing industry alive.

https://indstate.qualtrics.com/SE/?SID=SV_bwnuDGYpOchGz8o

Since you are a key person in the manufacturing area, I would really appreciate if you could forward the survey link to those you consider appropriate.

The survey will be open until April 29, 2011.

We need your input to make this happen!
Thanks for your kind participation and if you would have any questions, please do not hesitate to contact me.

Patricia Polastri - PhD Cand
Applied Engineering and Technology Management
College of Technology
Technology Bldg. Office 201H

* The degree should read: Doctoral Candidate in Technology Management with specialization in Manufacturing Systems.

APPENDIX G: SURVEY RESULTS

1. Have you always been an American owned company?

#	Answer	
1	Yes	14
2	No	3
3	N/A	1

2. Because you are an American owned company in comparison to non-domestic companies, do you benefit from?

#	Question	Disagree	N/A	Agree			
1	having access to better technology than your foreign competitors	2	7	5	14%	50%	36%
2	having access to a larger pool of skilled personnel	6	2	6	43%	14%	43%
3	having access to foreign markets that can be targeted through trade agreements	7	3	4	50%	21%	29%
4	having access to stronger financial support than your foreign competitors	9	4	1	64%	29%	7%

3. In what order would the factors listed below be important for your organization to remain competitive, or to achieve a competitive advantage in a globalized world? Drag and Drop your option in their order of importance: (1) the most important -- (5) the least important

#	Answer	Most Important	N/A	Least Important			
1	By offering the most competitive prices in the market	7	3	4	50%	21%	29%
2	By offering superior quality than the competition	9	2	3	64%	14%	21%
3	By implementing fully automated manufacturing processes that are reliable and deliver consistent quality	3	5	6	21%	36%	43%

4	By Outsourcing/offshoring to low cost countries in order to keep personnel costs down	1	0	1	50%	0%	50%
5	By having access to a local educated workforce that meets global standards	8	4	2	57%	29%	14%

4. Would you consider that Globalization, defined as the "free flow of goods, capital and labor across international boundaries" and the increase of diverse Free Trade Agreements between the United States and foreign nations...

#	Question	Disagree	N/A	Agree			
1	Has had a direct impact on your organization's willingness to explore the possibility of outsourcing some operation(s) to a foreign country	3	5	6	21%	36%	43%
2	You would not consider outsourcing since there are no business/technology/labor advantages to manufacturing abroad	8	3	3	57%	21%	21%
3	Outsourcing should be approached as a business strategy only when the organization faces serious challenges that risk its own survival	3	3	8	21%	21%	57%
4	Free trade has led to the overflow of similar products manufactured abroad and forces US manufacturers to reduce their price	3	1	10	21%	7%	71%

5. Please enter the country of your parent company?

Text Response

Canadian 1984 - 1889 German 1998 - 2005

Great Britain

France

6. In Indiana, companies that do not produce complete vehicles, but only produce component parts, employed 58% of all automotive manufacturing related workers in 2008. How do you feel about the influence of each of the following factors on your industry?

#	Question	Disagree	N/A	Agree			
1	The number of competitors from developing countries has increased	1	1	14	6%	6%	88%
2	Foreign products are penetrating the American market	0	0	16	0%	0%	100%
3	Lower quality products manufactured abroad are easily accessible on the market	0	1	15	0%	6%	94%
4	High quality products manufactured abroad are easily accessible on the market	4	5	7	25%	31%	44%
5	The market is saturated and competition is relatively low in this industry	8	8	0	50%	50%	0%

7. Globalization is frequently blamed for reducing the amount of manufacturing jobs in America. Would you agree with the statement that "Globalization (outsourcing/offshoring) has caused the decrease of employment opportunities in your industry in Indiana"?

#	Answer		
1	Disagree	3	17%
2	Neither Agree nor Disagree	3	17%
3	Agree	12	66%

8. In the event that your organization experienced personnel reductions within the last 10 years, what category of employees were mostly affected? Check all that apply.

#	Question	Mostly affected	Un changed	Non-affected			
1	Executives	2	7	3	17%	58%	25%
2	Department/Division Managers	3	9	1	23%	69%	8%
3	Professional Employees (holders of a 4 year degree)	8	3	2	62%	23%	15%
4	Technicians (some schooling)	9	3	0	75%	25%	0%
5	Production Personnel (no formal education)	12	3	0	80%	20%	0%
6	No personnel reduction were experienced in our organization	1	5	1	14%	71%	14%
7	Other. Please explain	0	0	0	0%	0%	0%

9. Indiana has experienced a decline in the number of companies involved in the Gas Engine Parts Manufacturing industry in the past 10 years. What do you think has been the major driver for this decline? Please explain.

Text Response

1 Technology and improved productivity, unions, foreign government supplementing exports,

2 The ability to buy higher quality parts at a lower cost from other countries.

3 The use of automation in conjunction with outsourcing to lower cost markets along with too many MBA's not valuing employees as human capital.

4 I believe there are a many different factors that have played a part. It should be noted that Toyota Manufacturing (TMMI), numerous racing organizations, and other automotive related businesses have grown in Indiana in the last ten years. I don't know enough to say that the industry has declined; perhaps it is just changing faces.

5 Poor management from Detroit auto makers and unwillingness for foreign to work with American suppliers

6 Auto sales and production is down. More import of parts.

7 Increase in domestic manufacturing productivity combined with some foreign competition gaining market share

8	movement of industry to Southern States
9	Global outsource to low cost labor countries
10	Part cost without considering the "hidden" cost of doing and conducting business with foreign countries. Executives are looking at short term gain from this cost reduction, but lose in the long term.
11	not involved in this business
12	Greed of share holders to gain profits on their investments and corporate exc. high salaries and by outs
13	Competition worldwide and forced price reductions from the OEMs.
14	Drop in demand and more players involved

10. Since you are not (or no longer) an American owned company, please provide the following information:
What was the main reason for selling to a foreign owned company?
Were there any American owned bidders at the time of sale?

11. Has your company experienced any layoffs between 1998 - 2008 that were related to:(Please check all that apply)

#	Answer		
1	A decrease in product demand	12	100%
2	Excessive unskilled personnel	3	25%
3	Excessive skilled personnel	0	0%
4	Products not competitively priced in relation to foreign products	6	50%
5	No layoffs were experienced in our company	2	17%
6	Other. Please explain	1	8%

Other. Please explain

More efficient manufacturing processes that require less labor.

12. In which of the following areas do you think future manufacturing workers need to improve their skills the most in order to remain competitive in the global arena? Please select one

#	Answer	1	7%
1	Cultural Knowledge/Sensitivity	12	80%
2	Technical competitiveness	2	13%
3	Business Management knowledge	0	0%
4	None of the above	0	0%
5	Other. Please explain		

13. Since you answered technical competitiveness needs improvement, how important to do you consider the following educational paths for technical competency

#	Question	Most Important	N/A	Least Important			
1	Certifications provided by specific industrial organizations	9	3	0	75%	25%	0%
2	Technical 2 year education	9	2	1	75%	17%	8%
3	University studies at Bachelors level	7	4	1	58%	33%	8%
4	University studies at Master level	4	5	3	33%	42%	25%
5	University studies at Doctoral level	3	3	6	25%	25%	50%
6	Other. Please explain	0	0	2	0%	0%	100%

Other. Please explain

Can you teach the desire to have pride in one's own work?

14. Since you answered "none of the above" in the previous question, what do you think are the three most important characteristics of a future manufacturing worker?

#	Answer		
1	The FIRST most important characteristic is	0	0%
2	The SECOND most important characteristic is	0	0%
3	The THIRD most important characteristic is	0	0%

15. In your opinion/experience, where do you find the most skilled and educated manufacturing workforce for your specific industry?

	Text Response
1	Experienced workforce that is unemployed and technical colleges
2	From competitors within the industry or similar industries. They are not being produced in the post secondary schools.
3	From the existing employee ranks. Skilled labor in my mind are those with years of employment history and hands on experience.
4	The workforces I see with the most pride and skill are those in the racing industry. Each person, not just those that build the vehicles, takes pride in being on the team. All workers should do that.
5	Engineering departments
6	Experienced workers
7	In existing businesses
8	Two year technical colleges
9	Colleges
10	From trade schools
11	Universities
12	We have to train them ourselves through local trade schools
13	Within the local area (advertising) or through technical/vocational centers.

16. Would the availability of a knowledgeable workforce in emerging economies be a sufficient factor to make you consider moving your manufacturing abroad?

#	Answer	3	20%
1	Yes	12	80%
2	No		

17. Since your answered YES to the prior question, which of the following country/countries first come to mind as a potential outsourcing destination?

#	Answer	3
1	China	2
2	India	2
3	Mexico	1
4	Canada	1
5	Germany	0
6	Brazil	0
7	Israel	0
8	South Africa	0
9	Other. Please Explain	

18. Because you are a foreign owned company, do you benefit from:

#	Question	Disagree	N/A	Agree
1	having access to better technology supplied from your parent company	0	1	2
2	having access to a larger pool of skilled personnel abroad	0	1	2
3	having access to foreign markets that were not targeted before	0	2	1

4	having stronger financial support from your parent company	0	1	2

19. High school dropout rates are reaching levels of 30% in the US. In Indiana around one million adults have literacy skills below the minimum standard to obtain employment in a knowledge based economy. What impact do you think this situation may have for your specific industry? Please check all that apply

#	Answer		
1	A future shortage of a qualified workforce	12	100%
2	Outsourcing/offshoring is imminent due to lack of a qualified workforce	5	42%
3	The manufacturing industry of the US will succumb to foreign manufacturing	6	50%
4	Other nations will dominate manufacturing areas in which the US had previously excelled	12	100%
5	Other, please explain	1	8%

Other, please explain
Most manufacturing jobs are being filled by a low educated workforce that are supported by a government that capitalizes on the advantage.

20. SME's Kris Nasiaka states that baby boomers (those born between 1946 and 1964) benefited from extensive training programs when hired, while today employers expect new hirees to have higher degree of technical, business and interpersonal skills. How relevant do you consider these skills in your organization?

#	Question	Most Important	N/A	Least Important			
1	Technical competency	14	0	1	93%	0%	7%
2	Business knowledge	7	6	2	47%	40%	13%

3	Interpersonal skills	11	4	0	73%	27%	0%
4	Other. please explain	2	0	0	100%	0%	0%

Other. please explain

Advanced Manufacturing Concept Knowledge

21. Education is the pillar of technological breakthroughs. Pisa studies show that the US is falling behind or not being as good as the Organization Economic Cooperation; Development (OECD) nations in areas of mathematics and science. How important do you think is education in these specific areas to withstand competition and technical advances abroad?

#	Answer		
1	Very Unimportant	1	7%
2	Neither Important nor Unimportant	1	7%
3	Very Important	13	87%

22. Thomas Friedman, author of the book "The World is Flat" states that companies outsourcing to low cost countries are doing so to get "better skilled and more productive people". In the event that your company outsourced an operation or process within the last 10 years, what was the reason for doing so? Please, check all that apply

#	Answer	
1	Advantageous business incentives (lower taxes, raw material accessibility etc)	6
2	Access to a qualified workforce	2
3	Lenient environmental regulations	3
4	Business strategy to penetrate new markets	3
5	Proximity to customer base (OEMs)	2
6	Other. Please explain	3

Other. Please explain

Selling parts to our own company in China where they add a ring so that we could sell the product in China

Low cost labor and components

Low cost unskilled labor

23. Technology is creating fully automated processes in which labor is no longer required on the production floor. Some high tech processes are monitored by one single person possessing high technological skills.

#	Question	Most Important	N/A	Least Important			
1	How important is it for your organization's competitiveness to achieve higher levels of automation	11	2	2	73%	13%	13%
2	To become fully automated is a major priority for global competitiveness	4	10	0	29%	71%	0%

24. Authors of the book "Workforce 2020" state that "automation will continue to displace low-skilled or unskilled workers in America's manufacturing...but that the new jobs created will be safer, more stimulating, and better paid than the ones they replace... The US will retain almost no comparative advantage in low-skilled manufacturing and jobs in this sector will disappear or be available at depressed wages. Would you agree with their vision that technology is displacing low and/or unskilled manufacturing workers in your industry?

#	Answer		
1	Disagree	2	13%
2	Neither Agree nor Disagree	1	7%
3	Agree	12	80%
4	Other. Please explain	0	0%

25. Technological advances are created every day and everywhere. If new technology (operations/processes) has been implemented in your organization within the past 10 years, was there any indication that the ....

#	Question	Disagree	N/A	Agree			
1	New technology implemented in the organization had no direct impact on employment rates	8	3	4	53%	20%	27%
2	New technology was above the skill set of the current workforce and high skilled workers were hired.	4	7	3	29%	50%	21%
3	Technology made the manufacturing process automated and less skilled workers were replaced by the new technology	4	4	7	27%	27%	47%

26. To what extent would you agree that the transition from low-tech & labor intensive manufacturing to high-tech and fully automated processes could be the predominant responsible for the deep decline in manufacturing employment opportunities during the last 10 years in the US?

#	Answer		
1	Disagree	6	40%
2	Neither Agree nor Disagree	4	27%
3	Agree	5	33%

27. Based on current conditions, how likely would your organization be to move some manufacturing operations to an emerging or developing country within the next 5 years?

#	Answer		
1	Unlikely	9	60%
2	Undecided	3	20%
3	Likely	3	20%

28. In your opinion, what has been the most dramatic impact of globalization on your industry?

Text Response

1 Several US based competitors have been dissolved and replaced by foreign competitors - European and Asian

2 It has forced us to evaluate cost and quality at every level. In doing so, it has led us to place profit margin ahead of market share. This has resulted in us constantly considering how and where to increase productivity and quality, for less.

3 An MBA lack of understanding of true costs of operation. A lack of LEAN implementation and lack of true leadership

4 All business succeeds and die based on revenue minus costs. The lower cost is the easier it is to survive for a business. Of course, there is always a balance to that, such as product quality. Nonetheless, at the end of the day, globalization has changed the way our industry gets goods to market.

5 Executives, Government, and Unions

6 Loss of sales and employment to low labor cost countries

7 The shift of R&D overseas

8 The playing field in which American manufacturers compete is very uneven. The U.S. Government must recognize the importance of regaining economic stability. America is what it makes; this is the basis for which we will remain a leading economic power.

9 The domestic manufacturing industry misunderstanding of total cost of doing business in a foreign country and the unjustified cost of unskilled labor do to the strength of labor unions.

10 loss of demand for our products

11 Loss of American jobs, both technical and nontechnical.

12 Productivity Increase

13 The increased competition has left a glut of capacity which has driven prices downward. The ability to command a fair profit margin on products and services is the result of this globalization.