

The Deloitte logo is positioned in the top left corner. It features the word "Deloitte" in a bold, white, sans-serif font, followed by a small green dot. The background of the entire page is a dark blue field filled with numerous bright, multi-pointed starburst patterns and thin, glowing blue lines that create a sense of depth and connectivity, resembling a network or a starry sky.

**Deloitte.**

**Manufacturing Pennsylvania's Future:  
Regional Strategies That Build From Current Strengths  
and Address Competitive Challenges**

*SUBMITTED TO*

THE INDUSTRIAL RESOURCE CENTERS (IRCs) of Pennsylvania

DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT, COMMONWEALTH OF  
PENNSYLVANIA

TEAM PA FOUNDATION

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Acknowledgements



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## TABLE OF CONTENTS

A. EXECUTIVE SUMMARY .....	8
B. OVERALL APPROACH.....	11
C. PENNSYLVANIA - IMPACT OF MANUFACTURING ON THE ECONOMY AND DRIVERS .....	14
D. IRC REGIONS - IMPACT OF MANUFACTURING ON THE ECONOMY AND REGIONAL DRIVERS .....	44
E. ISSUES BY INDUSTRY FOR DRIVERS .....	125
F. MACRO ISSUES.....	212
1. China/Offshoring .....	213
2. Innovation .....	221
3. Labor.....	225
G. ANALYSIS OF IRC CAPABILITIES .....	227
H. IMPACT OF IRCs ON CLIENTS .....	246
I. GAP ANALYSIS & RECOMMENDATIONS .....	258
J. APPENDIX.....	264

## Glossary

1. CAGR – (Compound Annual Growth Rate) An average annual growth rate over a specified period of time.  
*Mathematical Formula:  $CAGR = (present\ value/base\ value)^{(1/\#of\ years)} - 1$*
2. Cluster – Industries related to driver industries. The relationship is typically as a supplier to or buyer from the driver industry.
3. Driver - Firms that tend to export a high percentage of product outside of the region, have a significant specialization in terms of Location Quotient, and have both large and growing output – tend to be closer to the end customer from a supply chain perspective
  - a. Economic drivers are those drivers that tend to provide significant exports from the region and are in relatively good health in terms of output growth rates
  - b. Emerging drivers are those that are growing in significance within the region though do not yet represent a majority of cluster output for the region
  - c. Declining drivers are those that are in decline from an output and employment perspective
4. Gross State Product – Total annual output by the state (chained to 1996 dollars)
5. Employment – Real number of employees
6. Hill & Brennan's Methodology - Focuses on industries in which the region has its greatest competitive advantage driven primarily by output from the industry. This methodology differs from other driver-cluster methodologies, which often focus on employment levels of an industry to determine whether it is a driver
7. IRC – Industrial Resource Center
8. IMPLAN – An economic impact assessment software that allows the user to develop local-level input-output (I/O) models.
9. Location Quotient - A ratio of region's percent of total output in an industry to the national percent of total output in that same industry  
*Mathematical Formula:*  
 *$(Output\ in\ Industry\ i\ in\ Region\ r / Total\ Output\ in\ Region\ r)$*   
 *$(Output\ in\ Industry\ i\ in\ Nation / Total\ Output\ in\ Nation)$*   
A location quotient greater than one suggests that there is a concentration or specialization of an industry within a region, while a location quotient less than one suggests an industry is not concentrated in the region. The concentration of an industry in a region suggests that the industry is an exporter while the lack of concentration of an industry suggests that the existing industry produces primarily for local consumption and/or that the region must import products produced by the industry.
10. LRD Data – Longitudinal Research Database. Confidential establishment-level data from the Census Bureau. The raw data from the Census of Manufacturers & Annual Survey of Manufacturers (only aggregate/summary data is published) which is available only for certain research projects.
11. NAICS - The North American Industry Classification System developed by the U.S. Census to classify industries. This system is replacing the SIC classification system
12. Output – National GDP or state GSP chained to the 1996 dollar (inflation adjusted)
13. OEM – Original Equipment Manufacturers
14. Productivity – Output per unit of labor (employee) chained to the 1996 dollar (inflation adjusted)
15. SME – Small- and medium-sized enterprises
16. Support Services - Support regional economy with many product and services delivered within the region. These industries typically represent a high number of small firms

- within the region including suppliers, support services, printing, tool and die, etc. They tend to be in the middle of the product supply chain or indirect support to other industries
17. Tier 1 - Suppliers to driver Industry that represent significant steady or increasing output or employment that usually coincides with the success or failure of the drivers. These industries tend to focus on the regional economy but often include some exports. Could evolve into a regional driver if supported correctly – tend to be at the high end of the product supply chain or direct support to other industries
  18. Wealth Creation Index – A tool developed by Deloitte to measure the relative wealth creation that different industries contribute to the economic development of the Commonwealth
  19. Z-score - A measure of the distance from the mean of a distribution normalized by the standard deviation of the distribution.  
*Mathematical Formula:  $Z\text{-score} = (\text{value} - \text{mean}) / \text{standard deviation}$*

## A. EXECUTIVE SUMMARY

In the fall of 2003, the Pennsylvania Industrial Resource Centers (IRCs) and the TEAM PA Foundation commissioned Deloitte to conduct a study of the current dynamics and possible futures of the Pennsylvania manufacturing economy. The goals of the study were four fold:

- 1) Document the past and present importance of manufacturing to the Pennsylvania economy
- 2) Analyze the forces that will shape the possible futures of manufacturing in Pennsylvania
- 3) Assess the economic impact and return on investment of the Industrial Resources Centers
- 4) Identify actions to help achieve a dynamic and prosperous future for manufacturing in Pennsylvania and, in turn, a prosperous future for Pennsylvania through investments in manufacturing

This Executive Summary presents the main findings and recommendations of the study.

### **Findings:**

1. Manufacturing remains an essential element of Pennsylvania's economy, contributing \$64B annually to the Gross State Product. This is by far the largest share of any sector.
2. Manufacturing in Pennsylvania and in America faces new challenges. Pennsylvania has lost 133,000 manufacturing jobs since 1998. This is attributable to the recent recession, to gains in productivity, and to foreign competition and offshore sourcing by transnational manufacturing corporations.
3. The manufacturing sector in Pennsylvania is dynamic. Some industries in the sector are growing and concentrated in the state while others are declining (including many of the traditional manufacturing industries).
4. Sixteen driver industries that produce nearly half of Pennsylvania's manufacturing output have grown and have concentrated in the state in the past ten years. These industries and their associated clusters of in-state suppliers provide a substantial portion of the export earnings of Pennsylvania manufacturing, thus making a major contribution to the prosperity of the Commonwealth.
5. A shift and share analysis of the change in gross product for the entire economy of Pennsylvania from 1999 to 2001 showed that all of the growth in gross product attributable to local competitive factors from 1999 to 2001 and from 2001 to 2003 is attributable to the 16 manufacturing driver industries of the state of Pennsylvania. Without these industries the state would have experienced a profound recession.
6. There is a productivity gap between manufacturers in Pennsylvania and the U.S. average, with the Pennsylvania average significantly below that of the U.S.. The gap is likely the result of price stagnation caused by in-state firms producing a high percentage of commodity products. The price stagnation is likely due to a combination of offshore



competition and price pressure from firms that integrate parts into products for the final consumers (OEMs) and extremely price-sensitive retailers.

7. Economic development policy and strategy is best viewed by analyzing a firm's cash statement. The key to surviving and prospering during the 1990s was process innovation (i.e., being faster, better, and cheaper). In other words, squeezing the middle lines of the cash statement. During the upcoming decade, price pressures will not relent; they will intensify. A key to success in this decade is growing the top line of the cash statement through sales growth. Process innovations will increasingly be introduced through product innovation.
8. The industries that drive Pennsylvania's manufacturing performance, considered as a portfolio, have distinct needs, requiring distinct strategies by Pennsylvania's economic developers
9. The small- and medium-sized firms that are the broad foundation of manufacturing in Pennsylvania face distinct challenges in the global economy. The Commonwealth will prosper if many more small- and medium-sized firms develop well-informed strategies that give them distinctive positions in the marketplace based on product innovation and continuous improvement of enterprise performance. The needs of small- and medium-sized manufacturers in Pennsylvania must be better understood and their voices better heard.
10. Deloitte finds that Pennsylvania's Industrial Resource Center Network has sustained the strong positive impact on the Commonwealth's economy that has been documented in previous studies and that the impact estimates arrived at by NEXUS Associate in their 1999 evaluation remain valid.

### **Recommendations:**

Deloitte's recommendations build from existing competitive advantages of driver industries in the state and respond to competitive threats faced by those same drivers, their supplier industries, and their customers. These recommendations take into account industry experience, both locally and globally. In essence, the recommendations address the key challenges faced by the industries that are the most important to Pennsylvania's manufacturing economy. Each of these recommendations should be tailored to specific industries and to the overall health of the State's manufacturing economy.

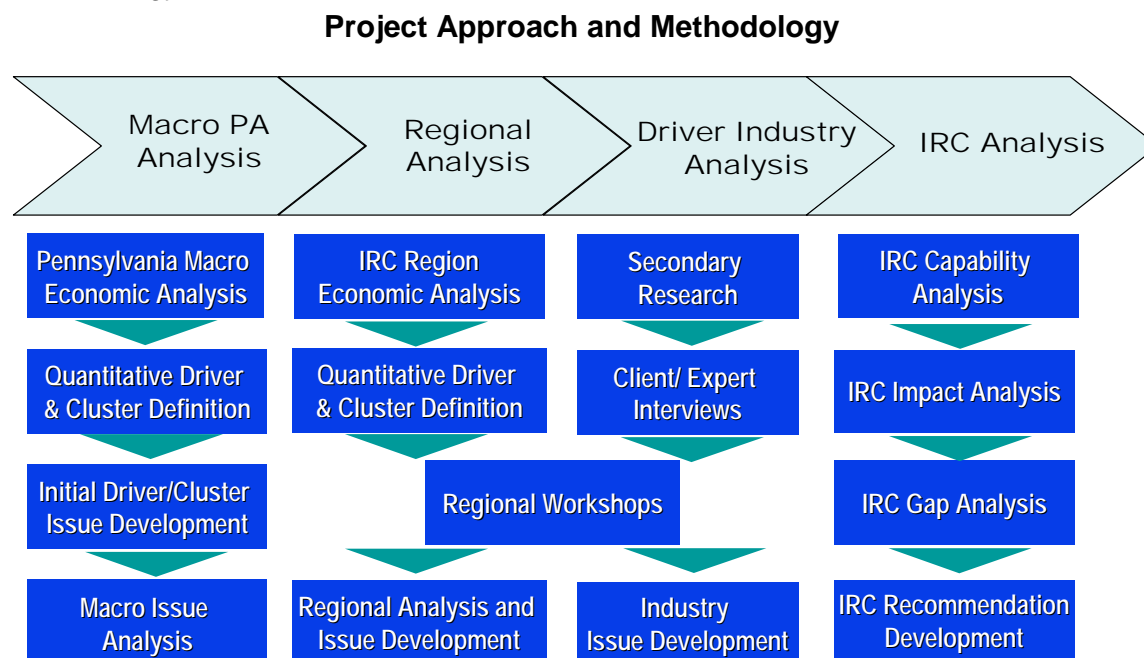
1. Pennsylvania's economic development strategy must address the distinct needs of firms at all levels of growth and competitiveness in the portfolio of driver industries in Pennsylvania's manufacturing base
  - State and regional intermediaries need to support public policies and private investments that can have a positive impact on the cash statement
  - State and regional intermediaries should tailor and create incentives that have a significant impact on the growth of existing firms
    - Find ways to lower barriers to support access to strategic consultation and to develop product innovations to help overcome the challenges that confront small and mid-sized establishments (SMEs)

- Focus attraction efforts on firms that would benefit from current in-state competitive advantages and firms in industries where the state has a disproportionately large market share
  - Address the competitive burdens imposed on manufacturing by excessive tort litigation reform and the escalation in the cost of providing medical benefits (including advocacy on a federal level)
- 
- 2. IRCs should now enhance emerging capabilities to support the emerging needs of SMEs in the Commonwealth
  - Strategy – The IRCs should build a significant capability in assisting SMEs with business strategy. It is critical that SMEs have access to deep strategy capabilities to modify their operations to adjust to market forces. This will provide establishments with the means to react to significant emerging competitive threats, including offshore price pressure, the marginalization of commodity production, quality and sourcing challenges, etc.
  - Product Innovation – The IRC network should develop the management (including market assessment), design, and venture funding capabilities to enable Pennsylvania’s small and mid-sized manufacturers to refresh their product portfolios. Product innovation is a potential solution to the central issue faced by the key industrial drivers in Pennsylvania today—top line revenue growth and the survival of their businesses
  - Process Improvement – The IRC network should continue to expand and invest in process improvement capabilities that can increase productivity and quality within SMEs
  - Workforce Development – The IRCs should support SMEs in finding, developing, and retaining workers with the skills needed for future success
  - Advocacy and Research – The IRC network should support and grow education, advocacy, and research capabilities for SMEs

This study of Pennsylvania manufacturing and its impact comes at a crucial time for manufacturing industries, as they face challenges of economic cyclicity and increased foreign competition -- most recently and notably from China. It is important to understand and support United States manufacturing on a regional basis. This study is a pathbreaking illustration of regional analysis that could be performed for other regions or on a national basis.

## B. OVERALL APPROACH

The graphic below shows Deloitte’s overall approach to this project. A brief overview of the process follows. The Appendix contains a more detailed overview of Deloitte’s approach and methodology.



### Macro Analysis

The approach for this study began with a macro analysis, using Economy.com data to: assess the importance of manufacturing in Pennsylvania, evaluate performance over time, and compare Pennsylvania’s performance to that of comparable regional states and the U.S. To frame this analysis, Deloitte developed the proprietary Wealth Creation Index tool to assess how manufacturing impacts the standard of living in Pennsylvania in comparison to other industries.

Deloitte then used the same economic data, supplemented by IMPLAN input/output coefficient data - in total, twelve economic and two qualitative variables - to identify key driver industries for the Commonwealth and the clusters of related buy/sell industries associated with those drivers. Drivers and clusters were identified using Hill & Brennan’s Methodology, which focuses on industries in which the region has its greatest competitive advantage driven primarily by output from the industry. Deloitte used an output-based methodology because output is a better reflection of manufacturing and takes into account productivity (a highly productive industry may have large output, but employ relatively few people), wealth-building, and the high value of manufactured products. This methodology differs from other driver-cluster methodologies that often focus on employment levels of an industry to determine whether it is a driver. Deloitte then measured the overall health of each driver to determine whether it was an economic driver, an emerging driver, or a declining driver.

- Economic drivers are those drivers that tend to provide significant export from the region and are in relatively good health in terms of output growth rates

- Emerging drivers are those that are growing in significance within the region but do not yet represent a majority of cluster output for the region
- Declining drivers are those that are in decline from an output and employment perspective.

The macro and driver-cluster analyses provided a framework to analyze industries that are critical to the Pennsylvania economy.

## **Regional Analysis**

In addition to the analysis described above for the Commonwealth, Deloitte analyzed each of the seven IRC regions to measure the impact of manufacturing on their economies and identify key driver and cluster industries for each region. Once the team had identified regional clusters, Deloitte and the IRCs held workshops in each region to validate findings and add more qualitative, real-life experience to the numbers. In each workshop, a diverse group of IRC clients discussed the manufacturing environment of the region and key regional and industry-specific issues that SMEs are currently facing. Deloitte then used the quantitative results of the cluster analysis, the qualitative findings from the workshops, and additional secondary research to develop a thorough analysis of manufacturing and key issues for each region.

## **Driver Industry Analysis**

Once the driver industries for the Commonwealth and each region were identified, an analysis was performed to identify and validate the issues for each industry. The Deloitte team conducted extensive secondary research to evaluate the overall dynamics of each industry; the trends and the key issues that each industry faces in the U.S., state, and region, and strategies of successful companies in each region. Identifying and understanding the issues in each industry is critical for the IRCs to determine whether they can assist the manufacturers with these issues and if so, the types of services that would have the greatest potential impact. Deloitte evaluated the historic rationale for each industry's presence in the Commonwealth and IRC region to determine whether location served as a competitive advantage or contribution to the issue facing the industry. The secondary research was then supplemented by primary research, which included interviewing industry experts within the Deloitte network as well as IRC clients representing the industries. Again, the regional workshops were critical for gaining insights into local industry dynamics and needs. Finally, the results of the primary and secondary analysis were used to develop a snapshot of each driver industry and an analysis of the key issues facing each industry.

## **IRC Capability Assessment and Gap Analysis**

Deloitte gathered data on each of the IRCs to understand their strategic plans, service lines, and historical market penetration. This analysis provided a high-level qualitative assessment to compare against industry and regional issues to determine potential service "gaps" and opportunities for IRC investment.

## **IRC Impact Analysis**

Deloitte's assessment of the impact of Pennsylvania's IRC Network was performed using a three step statistical process with a fourth qualitative step. The foundation of the assessment

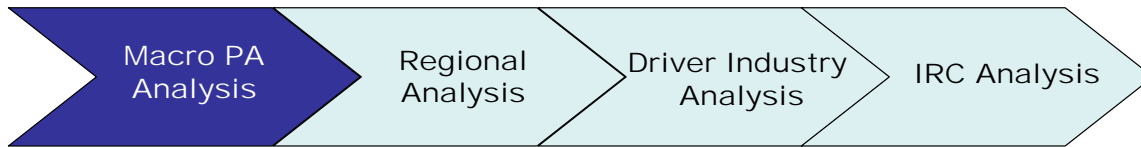
came from a statistical analysis of establishment-level data from the *2003 Harris Selectory Database* for all manufacturing establishments in the Commonwealth of Pennsylvania coupled with activity data for the Pennsylvania IRCs obtained from the Manufacturing Extension Partnership's (MEP) centralized database. Second, the Deloitte team matched non-client establishments with the IRC client firms to determine if the IRC network was selecting clients based on superior credit scores. The matched establishments served as a quasi-experimental control group. The credit scores were compared using matched pair t-tests. In the third part of the analysis, multinomial logistic regression models were run to test the same hypothesis in more rigorous fashion, controlling for the characteristics of each establishment. Finally, qualitative information was collected from over 70 establishments in seven workshops to better understand the impact of the program on IRC client establishments.

## **Recommendations**

Based on the analysis, Deloitte developed recommendations to fill the service gaps identified. Included within the recommendations are positive and negative considerations for the IRCs and potential performance measures.

# C. PENNSYLVANIA - IMPACT OF MANUFACTURING ON THE ECONOMY AND DRIVERS

## Project Approach and Methodology



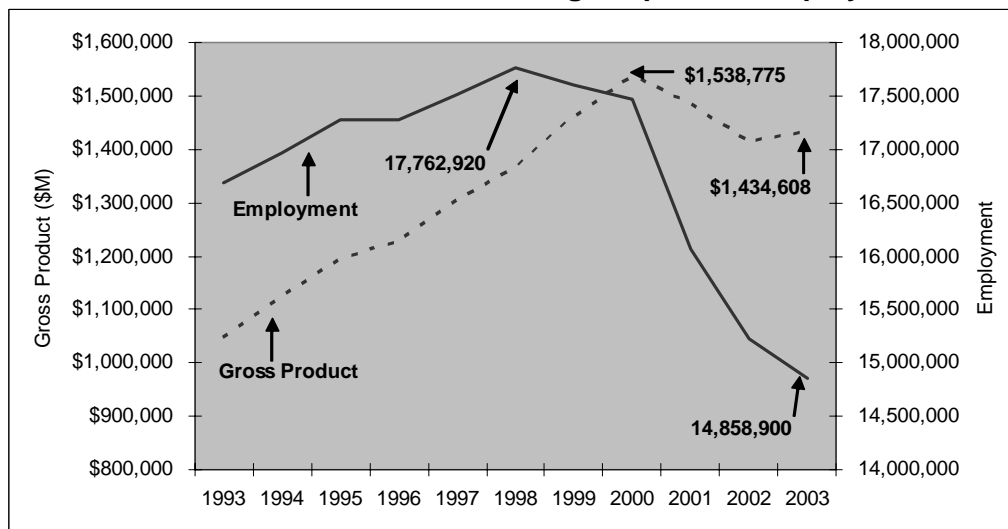
### Overview

The data indicates that the manufacturing sector is an integral part of Pennsylvania’s economy. Manufacturing is the largest economic sector in Pennsylvania, accounting for about 16% of total Gross State Product (GSP) and 12% of total employment. Deloitte’s Wealth Creation Index tool identifies manufacturing as the sector that contributes the most wealth to the Commonwealth’s economy in terms of impact on the standard of living. The downside of such a significant impact by the manufacturing sector is the Commonwealth’s economy was affected slightly more than the average for the U.S. by recent recessions and offshoring, which impacted manufacturing more than other industries.

### Impacts of Recessions on the U.S.

The recent recession led to a 16.2% decline in U.S. manufacturing employment from 17.8 million at its peak in 1998 to 14.9 million in 2003. After the recession of the early 1990s, employment recovery was sluggish, but productivity gains enabled continued growth of gross product. The recession in the early 2000s led to a dramatic decline in employment that has not yet recovered. Although there was also a decline in GDP, it was not as severe as the decline in employment, indicating that productivity (output per employee) was increasing.

**U.S. Manufacturing Output and Employment**

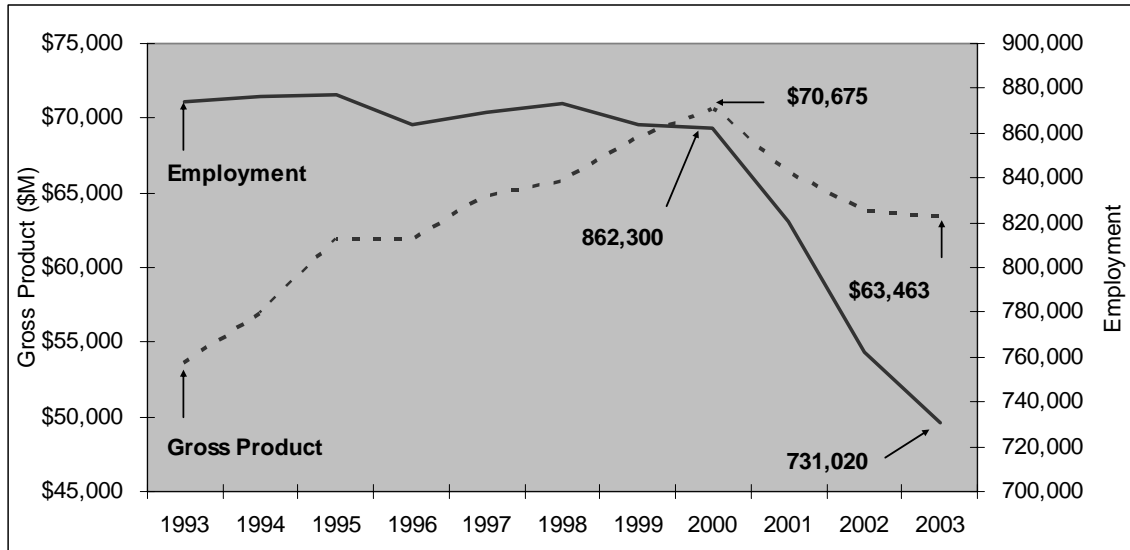


Source: Economy.com

## Impacts of Recessions on Pennsylvania

The recent recession's impact on Pennsylvania was very similar to the U.S. with the decline in employment for both the Commonwealth and the nation at 16.3% since 1998. However, Pennsylvania's employment did not appear to rebound after the early 1990s recession and output has declined more steeply since its peak in 2000. Pennsylvania's manufacturing output dropped by 10.2%, from \$70.7 billion in 2000 to \$63.4 billion in 2003, while manufacturing output in the U.S. declined by only 6.7%, from \$1.5 trillion to \$1.4 trillion, in the same time period.

**Pennsylvania Manufacturing Output and Employment**

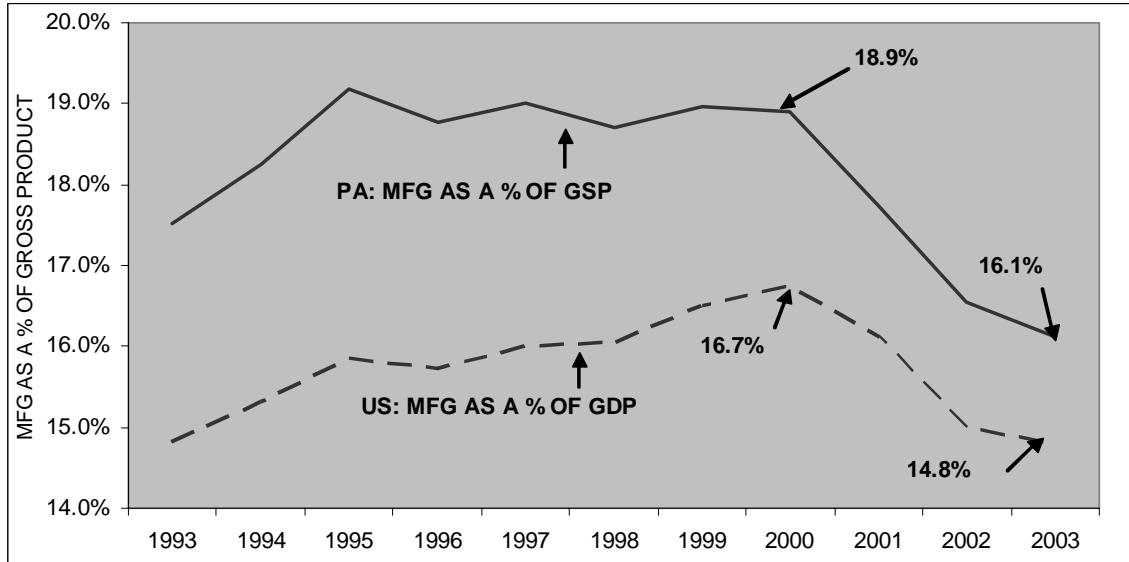


Source: Economy.com

The recession's impact on manufacturing has been disproportionately strong. Manufacturing represented 16.7% of the U.S. GDP in 2000, but its share has declined to a forecasted 14.8% by year-end 2003, indicating that output from other industries has rebounded more effectively from the recession and taken share away from manufacturing.

Pennsylvania's output derived from manufacturing is 16.1%, which is higher than the U.S. average of 14.8%. In the Commonwealth, manufacturing's output as a percent of GSP fell from 18.9% in 2000 to 16.1% in 2003. The fact that a higher than average proportion of Pennsylvania's GSP comes from manufacturing, combined with the disproportionately negative impact of the recession on manufacturing, could explain why Pennsylvania's output was affected more strongly than the U.S. as seen in the previous graph.

## Manufacturing as a Percent of Total Output



Source: Economy.com

Despite the recession and output decline, manufacturing remains Pennsylvania's largest industry. Accounting for 16.1% of the GSP, it is still significantly larger than any other industry sector in the Commonwealth. However, service industries, such as real estate, public administration, and finance and insurance, also contribute a significant portion of the GSP. Sectors that have increased their share of output since 2000 include real estate, finance and insurance, wholesale trade, and transportation and warehousing, as shown in the table below.

### Percent of State Output by Industry

NAICS Industrial Sector	1993	2000	2003
<i>Manufacturing</i>	17.5%	18.9%	16.1%
Real Estate and Rental and Leasing	9.3%	8.9%	9.9%
Public Administration	11.3%	9.8%	9.6%
Finance and Insurance	8.3%	8.0%	8.5%
Retail Trade	6.8%	7.9%	8.1%
Health Care and Social Assistance	9.2%	7.7%	7.5%
Wholesale Trade	4.8%	5.7%	6.2%
Professional, Scientific, and Technical Services	5.5%	5.6%	5.4%
Admin. and Support Services	3.8%	4.1%	4.5%
Transportation and Warehousing	2.8%	3.1%	4.3%
Construction	4.6%	4.4%	4.1%
Information	3.0%	3.5%	3.3%
Other Services (except Public Administration)	3.1%	2.8%	3.1%
Accommodation and Food Services	2.3%	2.6%	2.9%
Utilities	2.7%	2.3%	1.9%
Educational Services	1.7%	1.4%	1.4%
Management of Companies and Enterprises	1.5%	1.4%	1.0%
Agriculture, Forestry, Fishing and Hunting	0.7%	0.8%	0.8%
Mining	0.4%	0.7%	0.7%
Arts, Entertainment, and Recreation	0.6%	0.6%	0.6%

Source: Economy.com



Manufacturing has long been the leading employer in Pennsylvania, but health care and public administration are forecasted to surpass manufacturing in 2003. Manufacturing remains a significant employer with more than 730,000 workers, but employment has decreased by more than 131,000 people since 2000.

### Employment by Industry

NAICS Industrial Sector	1993	2000	2003	2003 Rank
Public Administration	770,390	768,210	795,290	1
Health Care and Social Assistance	643,260	723,040	778,600	2
<i>Manufacturing</i>	<i>873,930</i>	<i>862,300</i>	<i>731,020</i>	3
Retail Trade	605,800	680,130	658,030	4
Accommodation and Food Services	335,710	377,930	396,430	5
Other Services (except Public Administration)	280,020	306,370	317,860	6
Professional, Scientific, and Technical Services	219,620	275,840	275,000	7
Finance and Insurance	262,150	269,560	268,690	8
Admin.and Support Services	194,720	278,190	267,050	9
Construction	196,130	247,310	247,860	10
Wholesale Trade	208,870	226,430	225,590	11
Educational Services	168,040	193,990	209,910	12
Transportation and Warehousing	163,630	195,390	183,900	13
Information	105,260	135,760	129,760	14
Arts, Entertainment, and Recreation	56,300	70,850	73,650	15
Real Estate and Rental and Leasing	57,980	68,540	69,550	16
Management of Companies and Enterprises	52,830	57,160	57,640	17
Utilities	39,270	34,420	30,010	18
Agriculture, Forestry, Fishing and Hunting	29,690	22,590	20,750	19
Mining	20,670	18,290	17,400	20
<b>Total</b>	<b>5,284,270</b>	<b>5,812,300</b>	<b>5,753,990</b>	

Source: Economy.com

## The Wealth Creation Index

The definitive goal of public economic development policy is to sustain and improve the standard of living. It attempts to realize this goal in a two-fold manner: to foster the creation of wealth and to facilitate the distribution of income within the labor market. An important measure of any industry's impact is to assess the wealth created by that industry.

The measurement of wealth creation was championed by Adam Smith. Smith began his exploration of the *Nature and Causes of the Wealth of Nations* by posing a question: What makes some nations poor and others wealthy, some savage and some civilized? Smith tends to equate wealth with civilization and refers to a wealthy society as a civilized society. For Smith, making wealth means producing wealth and production means labor. Smith noticed that some laboring produced wealth and some did not. Some forms of laboring also produced more wealth than other forms. It is this distinction that is of utmost importance and serves as the underlying principle for our Wealth Creation Index. The Wealth Creation Index is a tool developed by Deloitte to measure the relative wealth creation that different industries contribute to the economic development of the Commonwealth.

### Wealth Creation Index: Methodology

The Wealth Creation Index (WCI) is based on four variables:

- Average Output per Employee
- Average Real Wages
- Capital Expenditures
- Shareholder Value

These variables were chosen based on their ability to impact personal, corporate, and regional wealth. Each variable has a value factor and a weight factor. The value factor is a measure of the actual variable while the weight factor weighs the variable based on some measure of size. The value factor is multiplied by the weight factor to get the variable score. The final score for each variable is based on its z-score<sup>1</sup>. The Wealth Creation Index is an average of all the z-scores of each of the four variables. (For a complete methodology, see Appendix)

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<sup>1</sup> Z-score is a measure of the distance from the mean of a distribution normalized by the standard deviation of the distribution. Mathematically:  $Z\text{-score} = (\text{value} - \text{mean}) / \text{standard deviation}$ .

## Wealth Creation Index: Results

### Average Output per Employee

Manufacturing ranks second to real estate and leasing on average output per employee. However, the output produced by real estate is not a measure of production or services provided; it is merely the value of a traded good, for example, a house, and reflects demand for land and location.

AVERAGE OUTPUT PER EMPLOYEE					
INDUSTRY	VALUE FACTOR		WEIGHT FACTOR		Z=SCORE
	AVG OUTPUT PER EMPLOYEE (1993-2001)	OUTPUT AS A % OF PA GSP (2001)	OUTPUT PER EMPLOYEE SCORE		
Real Estate and Rental and Leasing	\$ 492,575	10.0%	49,141.2		3.92
Manufacturing	\$ 73,454	19.6%	14,370.4		0.76
Finance and Insurance	\$ 102,836	9.3%	9,590.3		0.33
Utilities	\$ 230,861	2.4%	5,609.4		(0.03)
Wholesale Trade	\$ 83,230	6.2%	5,162.2		(0.07)
Professional, Scientific, and Technical Services	\$ 75,780	6.2%	4,702.5		(0.11)
Health Care and Social Assistance	\$ 41,149	8.5%	3,503.9		(0.22)
Information	\$ 92,311	3.8%	3,483.9		(0.22)
Retail Trade	\$ 39,228	8.7%	3,426.1		(0.23)
Construction	\$ 69,903	4.8%	3,350.1		(0.24)
Transportation and Warehousing	\$ 60,291	4.7%	2,814.3		(0.28)
Administrative and Support and Waste Management and Remediation	\$ 56,581	4.4%	2,488.4		(0.31)
Other Services (except Public Administration)	\$ 35,039	3.3%	1,169.1		(0.43)
Agriculture, Forestry, Fishing and Hunting	\$ 99,258	1.0%	1,037.1		(0.45)
Management of Companies and Enterprises	\$ 86,201	1.2%	1,007.1		(0.45)
Mining	\$ 103,878	0.7%	760.1		(0.47)
Accommodation and Food Services	\$ 23,678	2.9%	695.8		(0.48)
Educational Services	\$ 29,505	1.6%	463.9		(0.50)
Arts, Entertainment, and Recreation	\$ 32,286	0.6%	201.1		(0.52)

Source: Economy.com

### Average Real Wages

Manufacturing ranks above all other industries on the average real wages score. While the average real wage (value factor) offered by manufacturing is not the highest, it employs a vast number of people and that weighting increases its value in the index. Manufacturing accounts for 20% of all wages and salaries paid in Pennsylvania.

AVERAGE REAL WAGES					
INDUSTRY	VALUE FACTOR		WEIGHT FACTOR		Z=SCORE
	AVG REAL WAGES (1993-2001)	WAGES AS A % OF TOTAL PA WAGES (2001)	AVG REAL WAGES SCORE		
Manufacturing	\$ 37,665	20%	7,481.8		3.04
Health Care and Social Assistance	\$ 29,821	14%	4,130.4		1.26
Professional, Scientific, and Technical Services	\$ 44,209	9%	3,770.9		1.07
Finance and Insurance	\$ 44,077	8%	3,685.3		1.02
Wholesale Trade	\$ 39,321	6%	2,351.8		0.32
Construction	\$ 35,632	6%	2,134.9		0.20
Administrative and Support and Waste Management and Remediation	\$ 30,603	6%	1,842.8		0.05
Retail Trade	\$ 19,373	9%	1,660.8		(0.05)
Information	\$ 37,402	3%	1,301.4		(0.24)
Transportation and Warehousing	\$ 31,563	4%	1,211.1		(0.29)
Educational Services	\$ 25,394	3%	825.9		(0.50)
Utilities	\$ 55,505	1%	673.7		(0.58)
Other Services (except Public Administration)	\$ 16,907	3%	587.4		(0.62)
Management of Companies and Enterprises	\$ 37,013	1%	530.1		(0.65)
Real Estate and Rental and Leasing	\$ 28,069	1%	373.1		(0.74)
Accommodation and Food Services	\$ 11,951	3%	361.3		(0.74)
Mining	\$ 42,635	1%	213.9		(0.82)
Arts, Entertainment, and Recreation	\$ 20,645	1%	205.8		(0.82)
Agriculture, Forestry, Fishing and Hunting	\$ 17,419	0%	50.0		(0.91)

Source: Economy.com

## Shareholder Value

The shareholder value score is based on the compounded average growth rate of the share price<sup>2</sup> of public companies in Pennsylvania weighted by the share of their market value as a percent of total market value<sup>3</sup> of the industry. Manufacturing ranks fourth on the shareholder value score for Pennsylvania.

SHAREHOLDER VALUE						
INDUSTRY	INDUSTRY MARKET VALUE (2002)	NO OF COMPANIES (2002)	WEIGHTED		Z-SCORE	
			CAGR SCORE (1984 - 2002)			
Wholesale Trade	12,605	10	14.3%		1.26	
Information	41,632	33	12.3%		0.87	
Finance and Insurance	71,232	97	9.2%		0.29	
Manufacturing	106,699	104	8.9%		0.24	
Utilities	10,286	6	6.1%		(0.29)	
Retail Trade	6,946	18	4.4%		(0.64)	
Professional, Scientific, and Technical Services	4,616	16	-1.4%		(1.73)	
Administrative and Support and Waste Management and Remediation	1,792	10	-4.5%		NA	
Health Care and Social Assistance	4,108	7	10.2%		NA	
Mining	1,858	5	15.7%		NA	
Construction	1,551	3	11.7%		NA	
Real Estate and Rental and Leasing	859	3	3.6%		NA	
Transportation and Warehousing	1,561	3	10.1%		NA	
Accommodation and Food Services	3,987	2	-12.6%		NA	
Arts, Entertainment, and Recreation	641	2	38.6%		NA	
Agriculture, Forestry, Fishing and Hunting	56	1	5.6%		NA	
Educational Services	1,425	1	23.7%		NA	

Source: Compustat data

## Capital Expenditure

Capital expenditure is the spending on new structures and equipment by business sector. The manufacturing sector rates third on capital expenditure score. While manufacturing has the largest capital expenditures<sup>4</sup> in Pennsylvania, relative to its overall output it is comparatively moderate.

CAPITAL EXPENDITURE							
INDUSTRY	VALUE FACTOR		WEIGHT FACTOR		CAPITAL EXPENDITURE SCORE	Z-SCORE	
	APPROXIMATED PA CAPEX 2001	US CAPEX AS A % OF US GDP	INDUSTRY CAPEX AS A % OF TOTAL PA				
Utilities	\$ 4,371	50.5%	10.6%	0.053	2.83		
Information	\$ 4,808	34.7%	11.6%	0.040	1.97		
Manufacturing	\$ 8,962	14.0%	21.7%	0.030	1.32		
Finance and Insurance	\$ 5,897	16.1%	14.3%	0.023	0.84		
Mining	\$ 626	44.7%	1.5%	0.007	(0.22)		
Retail Trade	\$ 2,849	9.5%	6.9%	0.007	(0.23)		
Transportation and Warehousing	\$ 1,673	16.1%	4.0%	0.007	(0.23)		
Health Care and Social Assistance	\$ 2,766	8.7%	6.7%	0.006	(0.28)		
Real Estate and Rental and Leasing	\$ 2,860	7.8%	6.9%	0.005	(0.31)		
Educational Services	\$ 1,048	18.5%	2.5%	0.005	(0.35)		
Other Services (except Public Administration)	\$ 965	8.9%	2.3%	0.002	(0.52)		
Arts, Entertainment, and Recreation	\$ 397	17.7%	1.0%	0.002	(0.55)		
Wholesale Trade	\$ 1,028	5.5%	2.5%	0.001	(0.57)		
Professional, Scientific, and Technical Services	\$ 1,087	4.9%	2.6%	0.001	(0.57)		
Accommodation and Food Services	\$ 632	7.2%	1.5%	0.001	(0.59)		
Construction	\$ 747	4.6%	1.8%	0.001	(0.60)		
Administrative and Support and Waste Management and Remediation	\$ 555	3.4%	1.3%	0.000	(0.63)		
Agriculture, Forestry, Fishing and Hunting	\$ 62	1.7%	0.2%	0.000	(0.66)		
Management of Companies and Enterprises	\$ 49	1.2%	0.1%	0.000	(0.66)		

Source: Economy.com, Annual Capital Expenditure Report 2001 by US Census Bureau

<sup>2</sup> The CAGR on share prices is calculated from 1984-2002.

<sup>3</sup> Market value is based on 2002 data from Compustat. Industries which did not have at least 15 companies or \$5B in market value were excluded from the analysis. For a complete methodology and calculations for the wealth index (see appendix).

<sup>4</sup> Capital expenditure for Pennsylvania has been approximated by applying US capital expenditure as a % of industry output to overall Pennsylvania capital spending. Please see appendix for calculations.

## Wealth Creation Index

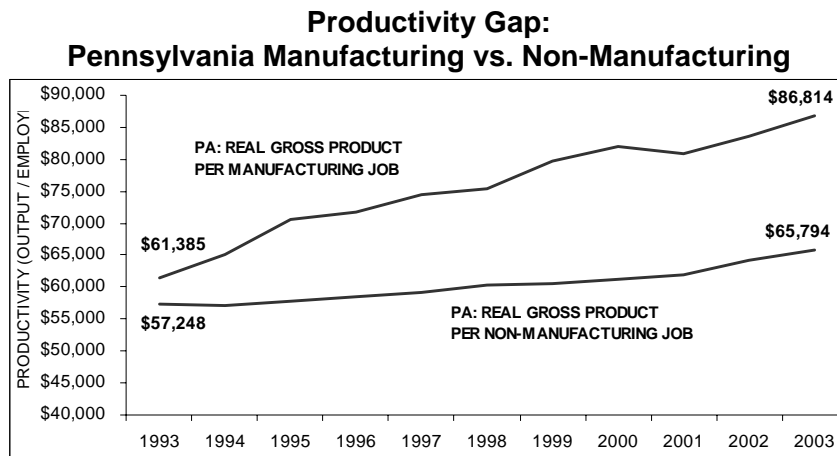
The Wealth Creation Index was computed as the average of z-scores for all variables. Manufacturing ranks as the industry that has created the most wealth in Pennsylvania. It is the single most important driving force of the economy when measured in terms of impact on the standard of living.

WEALTH CREATION INDEX							
	OUTPUT PER EMPLOYEE	AVG REAL WAGES	CAPITAL EXPENDITURE	SHAREHOLDER VALUE			
INDUSTRY	Z-SCORE	Z-SCORE	Z-SCORE	Z-SCORE	TOTAL Z- SCORE	NO. OF VARIABLES	RESULT
Manufacturing	0.76	3.04	1.32	0.24	5.36	4	1.34
Real Estate and Rental and Leasing	3.92	(0.74)	(0.31)	NA	2.87	3	0.96
Finance and Insurance	0.33	1.02	0.84	0.29	2.49	4	0.62
Information	(0.22)	(0.24)	1.97	0.87	2.38	4	0.60
Utilities	(0.03)	(0.58)	2.83	(0.29)	1.93	4	0.48
Health Care and Social Assistance	(0.22)	1.26	(0.28)	NA	0.76	3	0.25
Wholesale Trade	(0.07)	0.32	(0.57)	1.26	0.94	4	0.23
Construction	(0.24)	0.20	(0.60)	NA	(0.64)	3	-0.21
Transportation and Warehousing	(0.28)	(0.29)	(0.23)	NA	(0.81)	3	-0.27
Retail Trade	(0.23)	(0.05)	(0.23)	(0.64)	(1.15)	4	-0.29
Administrative and Support and Waste Management	(0.31)	0.05	(0.63)	NA	(0.90)	3	-0.30
Professional, Scientific, and Technical Services	(0.11)	1.07	(0.57)	(1.73)	(1.35)	4	-0.34
Educational Services	(0.50)	(0.50)	(0.35)	NA	(1.34)	3	-0.45
Mining	(0.47)	(0.82)	(0.22)	NA	(1.51)	3	-0.50
Other Services (except Public Administration)	(0.43)	(0.62)	(0.52)	NA	(1.58)	3	-0.53
Management of Companies and Enterprises	(0.45)	(0.65)	(0.66)	NA	(1.76)	3	-0.59
Accommodation and Food Services	(0.48)	(0.74)	(0.59)	NA	(1.81)	3	-0.60
Arts, Entertainment, and Recreation	(0.52)	(0.82)	(0.55)	NA	(1.89)	3	-0.63
Agriculture, Forestry, Fishing and Hunting	(0.45)	(0.91)	(0.66)	NA	(2.01)	3	-0.67

Source: Economy.com

## Manufacturing Productivity

As shown by the wealth index, manufacturing productivity in Pennsylvania is high relative to other industries. In fact, in 2003, manufacturing productivity will exceed non-manufacturing productivity by approximately \$21,000 (a 30% differential), and this gap has been continually increasing. In 1993, the gap was only \$7,000. From 1993 to 2003, manufacturing productivity grew at a compounded annual average growth rate of 3.2% while non-Manufacturing productivity only grew at 1.3%.



Source: Economy.com

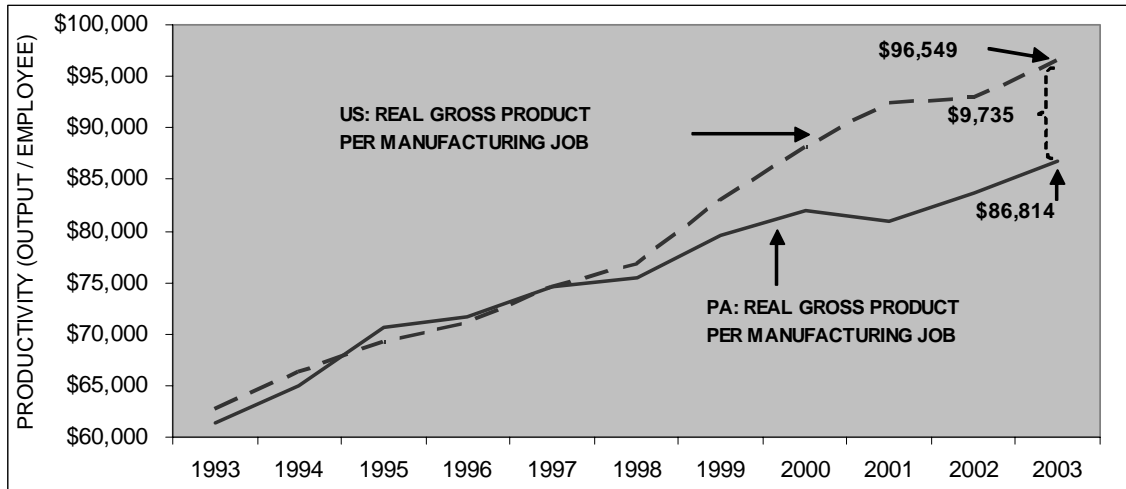
Productivity is a multifaceted concept. While productivity can be instinctively thought of as being directly associated with work effort, total productivity is the value that is added by a firm at its stage of the production process divided by the number of worker hours. This means that at the root of all productivity is the price of the good in question followed by the process engineering and capital associated with the production activity, the cost of intermediate goods, the efficiency of management, and the efforts of employees<sup>5</sup>.

Manufacturing has always been more productive than the non-manufacturing portion of the economy because of the value of the products made, the capital and technical intensity of production processes, and the quality of labor and management. Therefore, the productivity gap between manufacturing and non-manufacturing in Pennsylvania is characteristic of manufacturing and how productivity is measured, not an exception to the rule.

A more relevant and revealing comparison is that between the manufacturing productivity of Pennsylvania and that of the U.S.

<sup>5</sup> Hill, Edward, *Ohio's Competitive Advantage: Manufacturing Productivity*, prepared by The Urban Center, Maxine Goodman Levin College of Urban Affairs, Cleveland State University

## Productivity Gap: Pennsylvania Manufacturing vs. U.S. Manufacturing



Source: Economy.com

While manufacturing productivity in Pennsylvania, as measured by gross product per worker, has grown in the past decade to \$86,814 in real inflation adjusted terms, it lags the national average. In 2003, the U.S. manufacturing productivity average is expected to reach \$96,549 per employee, which is more than 11% higher than in Pennsylvania.

One possible reason for this gap is that the total number of jobs in Pennsylvania did not decrease in proportion to the decline in output. Since Pennsylvania's job loss in the recent recession was about 16.2% but Pennsylvania's output declined less severely at 10.2%, (indicating that output per employee probably increased), this does not seem to explain the gap.

Other possible explanations for the gap could be that Pennsylvania in general missed an opportunity to become more process efficient or that Pennsylvania is dominated by commodity-based manufacturing with low overall value of output and it did not innovate quickly enough to bridge the productivity gap. It is likely that there is some truth in both of these explanations. Since Pennsylvania's gross output per employee was comparable to that of the U.S. until 1998 and the gap between Pennsylvania and the U.S. subsequently grew to \$9,735, it appears that there was some increase in productivity in the U.S. that eluded Pennsylvania over the past five years. Are Pennsylvania's workers really growing less productive relative to the average manufacturing worker nationally? Using the commonly accepted meaning of productivity, physical work effort, this is a dubious explanation for the trends that are evident in the data. The real explanation can be found by understanding the roots of productivity growth.

Productivity at the national level is measured by value added per hour worked. At the state level these data are not available so they are approximated by the value of gross product per worker. There are three ways of increasing total factor productivity: (1) have people work harder or smarter, (2) use more equipment or use existing equipment better—what economists refer to as capital deepening, or (3) increase the value of the product that is being sold. The first is what most people assume happens when productivity grows; but the largest impact on the economy and on productivity takes place through the last two mechanisms. This leads back to a theme of this work: to understand economic development you have to understand the cash

statement. The usual way of thinking about productivity is to make an existing good cheaper (lower operating costs and worker harder or smarter), faster (lowering inventory costs and increase turn), or better (improve quality). These are process innovations. However, another way to increase productivity is to grow the top line of the cash statement. These changes are product innovations.

The challenge to manufacturers in the early years of this decade is that top line revenue growth is more and more difficult to produce in an era of a global glut in manufacturing capacity and much sharper global competition. This is an era where the companies that are closest to the end consumer—large retailers and major original equipment manufacturers—are demanding and getting annual cost reductions on the products and inventory they purchase. If a company does not either own the intellectual capital embodied in its products—either in the form of the product itself or a unique production process, or have a brand identity that consumers will favor, it is a commodity. If an industry sells commodities then the lowest cost producer wins, assuming that quality is equal among firms and that just-in-time delivery demands can be met. In a commodity market the only way to increase productivity is by investing in process innovation. And, if the purchase prices for their goods are falling, the only way a company can increase measured productivity is to worker harder, faster, and smarter, but do so faster than the price of the product is falling. This is what is happening across a broad swath of Pennsylvania's manufacturing base.

Pennsylvania's predominance of commodity-based manufacturing industries (e.g., steel, wood, and glass) have been hard hit by the recession, offshoring, and price competition, leading to erosion in the productivity growth rate. Based on the driver industry mix (see p. 35 for a list of driver industries) within Pennsylvania manufacturing, commodity price stagnation is the most likely explanation for the Commonwealth's productivity gap with the nation.

Deloitte reached this conclusion with two pieces of analysis. First, based on its business consulting experience, Deloitte examined the list of manufacturing driver industries at the state level and identified many that are dominated by commoditized products. The second piece of evidence came from the results of a shift and share analysis.<sup>6</sup> Deloitte calculated two sets of shift-share equations, one for the change in employment and the other for the change in real gross output. Each of these equations was calculated for three different time periods: 1997 to 1999 to capture the end of the expansion phase of the business cycle, 1999 to 2001 to capture the recession, and 2001 to 2003 to capture the recovery (with the caveat that the data used in this last set of equations are projections).

Shift-share analysis is a statistical decomposition technique that takes a change in the variable (such as gross output) and breaks it down into three components: (1) changes that are consistent with the national average growth rate (called the national effect), (2) changes that are consistent with national trends in the industry after subtracting the national growth rate (the industry mix effect), and (3) changes in employment that are attributed to local competitive conditions (the competitive effect). The growth rate in each industry is decomposed and then each of the three effects are added up across all of the industries to calculate the total national effect, the total industry mix effect, and the total competitive effect.

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<sup>6</sup> A full discussion of shift-share analysis is contained in the methodological appendix.



The best way to think about each effect is as an answer to three questions.<sup>7</sup>

1. The national growth effect answers the question: What would the change in gross output have been in Pennsylvania if it grew at the same rate as the national average growth rate?
2. The industry mix effect answers the question: What is the change in gross output that is due to the mix of industries Pennsylvania? If the Commonwealth is dominated by slow growing or declining industries then the industry mix effect would be negative. If it is dominated by fast growing industries it would be positive.
3. The competitive effect answers the question: What is the change in gross output that is attributable to the competitive position of industries in the Commonwealth after taking into account industry mix effects? There are four possible outcomes.
  - Positive industry mix and positive competitive effect (positive-positive) means that the region is a competitive location for a set of fast growing industries. This is the winner's hand.
  - Positive industry mix effect and negative competitive effect (positive-negative) means that the region is unlikely to be a competitive location for these industries that are fast-growing nationally. This indicates local competitive problems. This is an optimistic economic development challenge.
  - Negative industry effect and positive local competitive effect (negative-positive) reflects a local competitive position for a set of declining or commoditized industries. This is what Deloitte calls industries and regions that require transformations.
  - Negative industry effect coupled with a negative local competitive effect (negative-negative) is an indicator of major structural change or decline.

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<sup>7</sup> For ease of exposition we use change in gross output as an example but the same set of questions apply to the change in employment.

The national growth and industry mix effects are combined and displayed along with the competitive effect in the tables below.

	Change from 1997 to 1999		Change from 1999 to 2001		Change from 2001 to 2003*	
	National Growth & Industry Mix Effects	Local Competitive Effects	National Growth & Industry Mix Effects	Local Competitive Effects	National Growth & Industry Mix Effects	Local Competitive Effects
<b>All Industries</b>	25,284,295,350	-3,675,355,350	10,602,422,222	1,364,667,778	19,632,244,319	-191,854,319
<b>Manufacturing Only</b>	5,924,837,201	-1,970,647,201	-778,969,114	-1,562,180,886	-2,381,015,068	-590,294,932
<b>Driver Industries Only</b>	2,073,759,014	-295,849,014	-927,563,600	1,679,643,600	-1,596,306,050	2,258,936,050

\* Data for 2002 and 2003 are projections.  
All data are real 1996 dollars

	Change from 1997 to 1999		Change from 1999 to 2001		Change from 2001 to 2003*	
	National Growth & Industry Mix Effects	Local Competitive Effects	National Growth & Industry Mix Effects	Local Competitive Effects	National Growth & Industry Mix Effects	Local Competitive Effects
<b>All Industries</b>	250,838	-76,408	11,918	81,292	77,994	-128,134
<b>Manufacturing Only</b>	2,472	-8,422	-73,192	30,362	-59,194	-30,456
<b>Driver Industries Only</b>	5,964	-384	-30,143	20,863	-25,355	1,035

\* Data for 2002 and 2003 are projections.

The tables above display data for three different groups of industries. The first lines report on the shift-share results for all industries in Pennsylvania in the three time periods. The second line in each table reports on all manufacturing industries in the Commonwealth. The third line reports on just the manufacturing driver industries in the Commonwealth.

The national growth and industry mix effects were positive for all industries for both output and employment in all three time periods, reflecting the fact that the recession was short and the national economy grew in terms of the value of gross product throughout. However, the story is different when it comes to all manufacturing industries. The national growth and industry mix effects are negative for the two time periods from 1999 to 2003. The entire sector is experiencing decline at the national level. The same holds true for the Pennsylvania's manufacturing driver industries.

The picture changes when the local competitive effect is examined. The local competitive effect is negative for all manufacturing industries in terms of both the value of gross product in all three time periods and the only time the local competitive effect for employment is weakly positive is in the early stages of the recession—from 1999 to 2001.

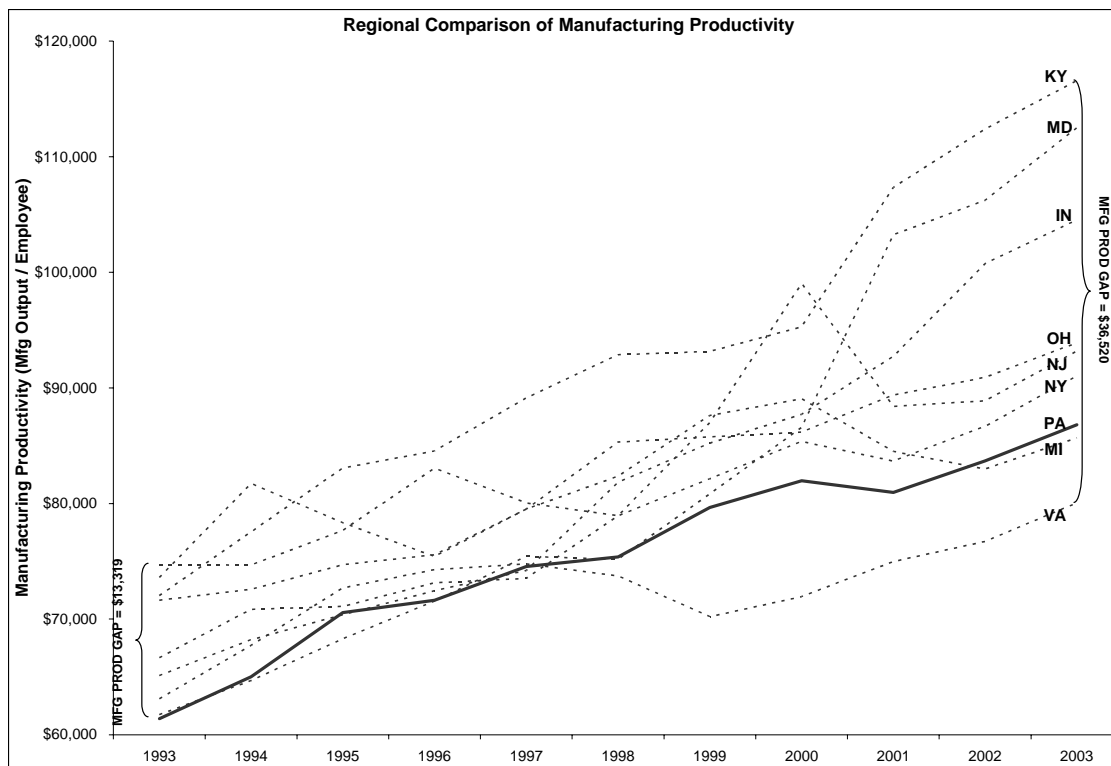
Most strikingly, the local competitive effect of the manufacturing drivers of Pennsylvania's economy for both the change in the real value of gross output and for change in employment is positive from 1999 to 2003. Two-thirds of the positive change in the local competitive effect for all manufacturing employment from 1999 to 2001 is accounted for by the driver industries. In fact, all of the growth in gross product attributable to local competitive factors from 1999 to 2001 and from 2001 to 2003 is attributable to the manufacturing drivers. Without these industries the Commonwealth would have experienced a profound recession.

The relationship between the combined national growth effect and industry mix effect on the one hand and local competitive effect on the other hand for Pennsylvania's *manufacturing drivers* is negative followed by a positive (negative-positive) since 1999. Earlier we stated that this is a sign of a declining or commoditized manufacturing base.

The pattern displayed for all of manufacturing switched from positive-negative from 1997 to 1999, as did the manufacturing drivers, to negative-negative for the value of output from 1999 onward. This is a sign of serious structural decline.

The conclusions from this analysis are sobering. First, the manufacturing base of Pennsylvania outside of the driver industries is experiencing serious structural decline. Second, the manufacturing drivers have supported the Commonwealth's economy since 1999. Third, even the drivers show signs of commoditization, while the non-drivers are commoditized. Finally, the outstanding results reported on elsewhere in this report on the productivity improvements and the impact of the IRC Network were accomplished in the face of an economic storm of gale proportions.

The regional analysis below demonstrates that many states in the multi-state region have increased productivity at a much faster rate than Pennsylvania, leaving the Commonwealth as one of the states with the lowest productivity growth rates in the region. Many of the states that have seen productivity increases have benefited from the development of new industries, especially industries with high sales margins, which often have a higher level of value added per employee than some of Pennsylvania's more traditional, commodity industries.



Source: Economy.com

Deloitte recommends that IRCs help SMEs develop strategies and innovative products that are differentiated, value-added, and help solve a customer's problems or improve a customer's performance (quality, product performance, time-to-market, etc.). Firms that can develop such strategies and products may be able to avoid the commoditization trap, maintain premium prices, and achieve higher profit margins. Several "success stories" of companies that made this transition were shared during the regional workshops. The challenge for the SMEs is to think and act in a new way. Making such changes may also require new or higher levels of employee skills. The IRCs have the opportunity to take the lead in helping SMEs in Pennsylvania base their competitive advantage on innovative strategies, products, and workforce development programs.

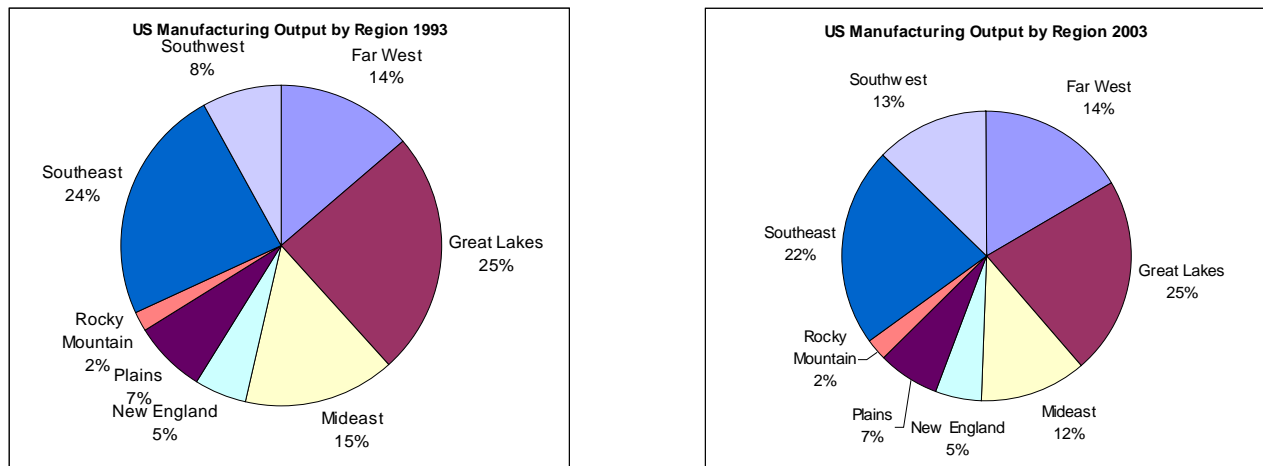
## U.S. Manufacturing Output by Region

The regional division of manufacturing in the U.S. has not changed dramatically in the past decade. The charts below show the share of manufacturing output by region<sup>8</sup>. The Great Lakes region continues to dominate manufacturing, contributing 25% of total U.S. manufacturing output. Apart from the Mideast and the Southeast region, all regions retained or increased their share of total U.S. manufacturing output between 1993 and 2003.

The Mideast region, which includes Pennsylvania, has been particularly hard hit. Its share of U.S. manufacturing output declined from 15% in 1993 to 12% in 2003. The Mideast seems to have lost its share to the Southwest region. Since 1993, the Mideast has grown at less than 1% per year and Pennsylvania has grown at 1.5% per year. On the other hand, the Southwest region has grown at 7.4% per year, and its states of New Mexico, Arizona, and Texas have grown at 15.2%, 13.5% and 5.7%, respectively.

The traditional manufacturing states continue to lead in output, though this historical specialization is a double-edged sword. Traditional manufacturing industries have become highly commoditized and severely impacted by foreign price pressures as a result of continued global supply chain expansion. As commodity-based drivers decline, traditional regional suppliers to those firms are also highly impacted; thus a negative multiplier effect impacts the region.

## U.S. Manufacturing Output by Region



Source: Economy.com; Bureau of Economic Analysis regional classification

Pennsylvania's share of U.S. manufacturing output relative to other states has declined as well. As shown in the table below, Pennsylvania controlled 5.1% of national output in 1993. This has slipped to 4.4% in 2003.

<sup>8</sup> Region Classification: New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont. Mideast: Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania. Great Lakes: Illinois, Indiana, Michigan, Ohio, Wisconsin. Plains: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota. Southeast: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia. Southwest: Arizona, New Mexico, Oklahoma, Texas. Rocky Mountain: Colorado, Idaho, Montana, Utah, Wyoming. Far West: Alaska, California, Hawaii, Nevada, Oregon, Washington.

1993			2000			2003		
State	Mfg GSP	% of US Mfg GDP	State	Mfg GSP	% of US Mfg GDP	State	Mfg GSP	% of US Mfg GDP
California	\$ 105,646	10.1%	California	\$ 200,725	13.0%	California	\$ 160,126	11.2%
Ohio	\$ 70,263	6.7%	Texas	\$ 109,618	7.1%	Texas	\$ 107,266	7.5%
Michigan	\$ 59,313	5.7%	Ohio	\$ 87,989	5.7%	Ohio	\$ 80,877	5.6%
Texas	\$ 58,032	5.5%	Michigan	\$ 79,866	5.2%	<b>Pennsylvania</b>	<b>\$ 63,463</b>	<b>4.4%</b>
New York	\$ 55,771	5.3%	Illinois	\$ 71,274	4.6%	Michigan	\$ 63,296	4.4%
<b>Pennsylvania</b>	<b>\$ 53,646</b>	<b>5.1%</b>	<b>Pennsylvania</b>	<b>\$ 70,675</b>	<b>4.6%</b>	Illinois	\$ 62,110	4.3%
Illinois	\$ 52,470	5.0%	New York	\$ 64,097	4.2%	Indiana	\$ 60,590	4.2%
North Carolina	\$ 44,006	4.2%	North Carolina	\$ 61,625	4.0%	New York	\$ 56,634	3.9%
Indiana	\$ 40,019	3.8%	Indiana	\$ 58,207	3.8%	North Carolina	\$ 54,398	3.8%
New Jersey	\$ 34,587	3.3%	Wisconsin	\$ 45,738	3.0%	Oregon	\$ 53,540	3.7%

Source: Economy.com

## Pennsylvania Competitiveness

Relative to other sizeable manufacturing states, Pennsylvania is “in the middle of the pack” with respect to competitiveness. In 2003, Pennsylvania’s manufacturing output location quotient (LQ)<sup>9</sup> is estimated to be a 1.09, just above the national average. A location quotient greater than 1.0 suggests that there is a concentration or specialization of an industry within a region. The higher the concentration, the more likely the industry is to be an exporter of goods from the state, and, therefore, a wealth-building industry for the state. There are at least thirteen states with manufacturing output greater than \$20 billion that have a location quotient higher than 1.0.

Pennsylvania also is not a high manufacturing growth state. As the chart below shows, in the past six years, Pennsylvania has not experienced any growth in manufacturing output. Among the other 12 sizeable manufacturing states, there were 10 that grew significantly from 1998-2003 thus explaining Pennsylvania’s “middle of pack” ranking in terms of growth and competitiveness.

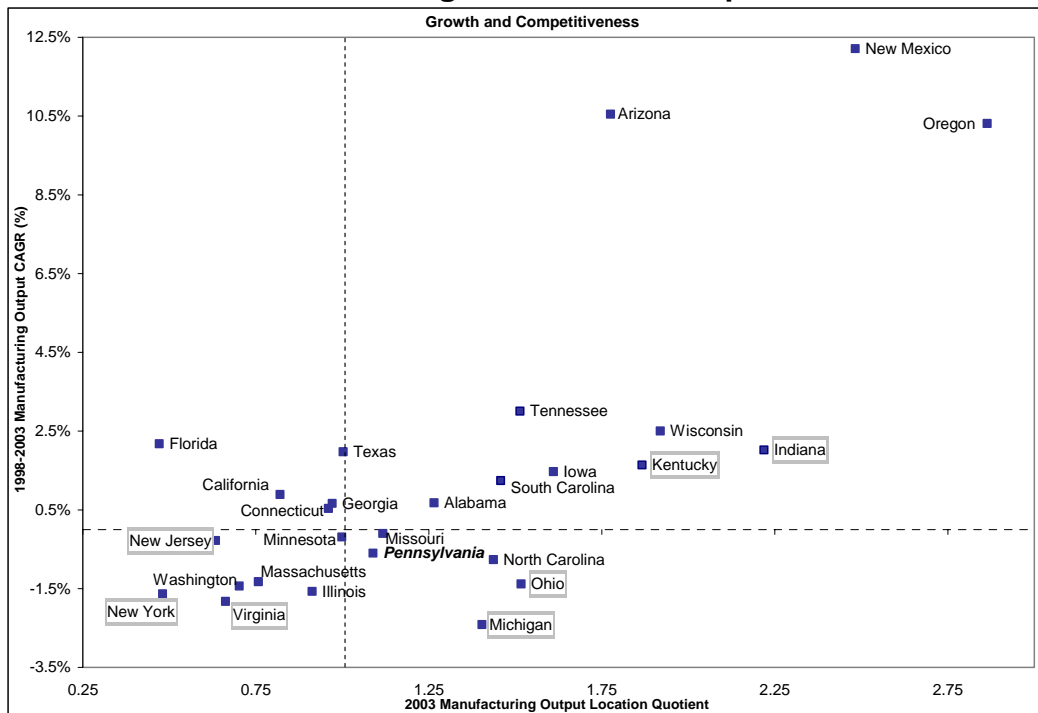
<sup>9</sup> The location quotient (LQ) is the calculated ratio between the local economy and the economy of some reference unit – in our case the national economy. The formula for Current Output Location Quotient is:

$$LQ_{ir}^t = \frac{\text{regional output in industry } i \text{ for year } t / \text{total regional output for year } t}{\text{national output in industry } i \text{ for year } t / \text{total national output for year } t}$$

$$= \frac{Y_{ir}^t / Y_r^t}{Y_{iN}^t / Y_N^t}$$

A location quotient greater than one suggests that there is a concentration or specialization of an industry within a region, while a location quotient less than one suggests an industry is not concentrated in the region. The concentration of an industry in a region suggests that the industry is an exporter while the lack of concentration of an industry suggests that the existing industry produces primarily for local consumption and/or that the region must import products produced by the industry.

## State Manufacturing Growth and Competitiveness



Source: Economy.com; Includes states with > \$20B in 2003 Manufacturing Output; Shaded states are regional peers

An examination of states with high location quotients and growth rates reveals that they have focused efforts on developing the environment for a specific manufacturing industry to prosper and dominate the state's manufacturing landscape. Oregon, Arizona and New Mexico, in the top right hand corner of the chart above, have all grown as manufacturing states due to the growth and dominance of the semiconductor industry. They now account for a little over 50% of semiconductor output in the nation, increasing from 22% in 1993. In Oregon, semiconductors have grown at 20% per year over the past five years. They account for \$37 billion in output – over half the manufacturing output in the state. Similarly, semiconductors grew at 19% a year in Arizona and 16% a year in New Mexico<sup>10</sup>.

Manufacturing investment in nontraditional manufacturing states is typically not for commodity-based production. Investing in more value-added industries provides a higher likelihood of a positive multiplier for the region.

Indiana, Kentucky and Tennessee are dominated by automotive manufacturing. In the past decade, automotive manufacturing has grown strongly at over 6% per year in these states. In 2003, automotive manufacturing is expected to account for over two-thirds of Kentucky's \$31 billion output and over a quarter of Indiana and Tennessee's manufacturing output.

Pennsylvania's location quotient has declined over the past decade, indicating that its competitiveness is declining. This decline is average with the region and Pennsylvania remains

<sup>10</sup> Pennsylvania was competitive in the semiconductors industry in 1993. It accounted for a little over 4% of national output while Oregon, Arizona New Mexico accounted for between 6-9% each. In 2003, Pennsylvania accounts for only 1.3% of the semiconductor output.

in the middle of the pack compared with regional states. However, a location quotient that is both average and declining indicates a need for Pennsylvania to take action to help its manufacturing sector remain competitive. Other states, such as Indiana and Kentucky which have focused on building new manufacturing industries within their borders, have had increases in competitiveness as a result.

#### Manufacturing Output Location Quotient

	1993	2003	Change
Indiana	1.95	2.22	0.27
Kentucky	1.60	1.87	0.26
Ohio	1.72	1.52	-0.20
Michigan	1.69	1.40	-0.28
<b>Pennsylvania</b>	<b>1.18</b>	<b>1.09</b>	<b>-0.09</b>
Virginia	0.87	0.66	-0.21
New Jersey	0.89	0.63	-0.25
Maryland	0.54	0.62	0.08
New York	0.64	0.48	-0.16

Source: Economy.com

We have seen that Pennsylvania is average among states in terms of competitiveness and growth for manufacturing. Focusing now on states within the Commonwealth's region, we see that Pennsylvania's manufacturing output is the second largest for any regional state (see table below) but growth rate for the past three, five and ten years lags other states. While other states have weathered the recent recession fairly well, Pennsylvania has been particularly hard hit with an average annual output decline of 3.5% from 2000-2003. This may be a result of Pennsylvania's historical reliance on commodity industries that were highly affected by the recession, offshoring, and price competition. Over the past decade, Pennsylvania's manufacturing sector has performed about average with other regional states, growing about 1.5% on average each year.

#### Manufacturing Output by State

	2003	00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)
Maryland	\$ 17,253	4.6%	4.6%	4.3%
Kentucky	\$ 31,387	2.0%	1.6%	4.1%
Indiana	\$ 60,590	1.3%	2.0%	3.8%
<b>Pennsylvania</b>	<b>\$ 63,463</b>	<b>-3.5%</b>	<b>-0.6%</b>	<b>1.5%</b>
Ohio	\$ 80,877	-2.8%	-1.4%	1.3%
Michigan	\$ 63,296	-7.5%	-2.4%	0.6%
Virginia	\$ 24,785	-1.8%	-1.8%	0.5%
New York	\$ 56,634	-4.0%	-1.6%	0.1%
New Jersey	\$ 33,337	-7.2%	-0.3%	-0.3%

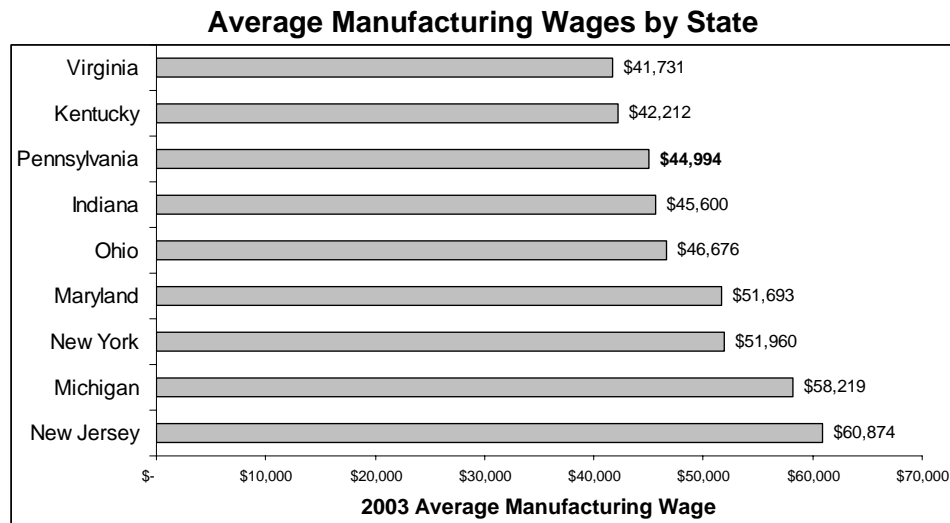
Source: Economy.com

High wages in manufacturing help contribute to individual income and good standards of living for employees and their families. High wages are also a factor in attracting workers at all levels to an industry or region. Average manufacturing wages in Pennsylvania are low compared to regional peers. At approximately \$45,000 in 2003, Pennsylvania is modestly higher than only



two other regional peers – Kentucky and Virginia. It is substantially lower than the \$50,000+ wages of Michigan, New Jersey and New York. Manufacturing wages may simply be lower in Pennsylvania than in other states because of cost of living differences. For example, the cost of living is lower in Erie than it is in New York City. However, this may not account for all of the difference. The wage differential may also be a reflection of differences in unionization levels or skills levels of workers. Highly unionized industries, such as automotive manufacturing in Michigan, often command higher wages. Also, highly skilled and management workers typically have higher salaries than those with lower skill levels.

From an investment attraction standpoint, the state typically competes well when combining labor and logistics operating costs for those industries focused on Mid-Atlantic and Northeast markets.



Source: Economy.com

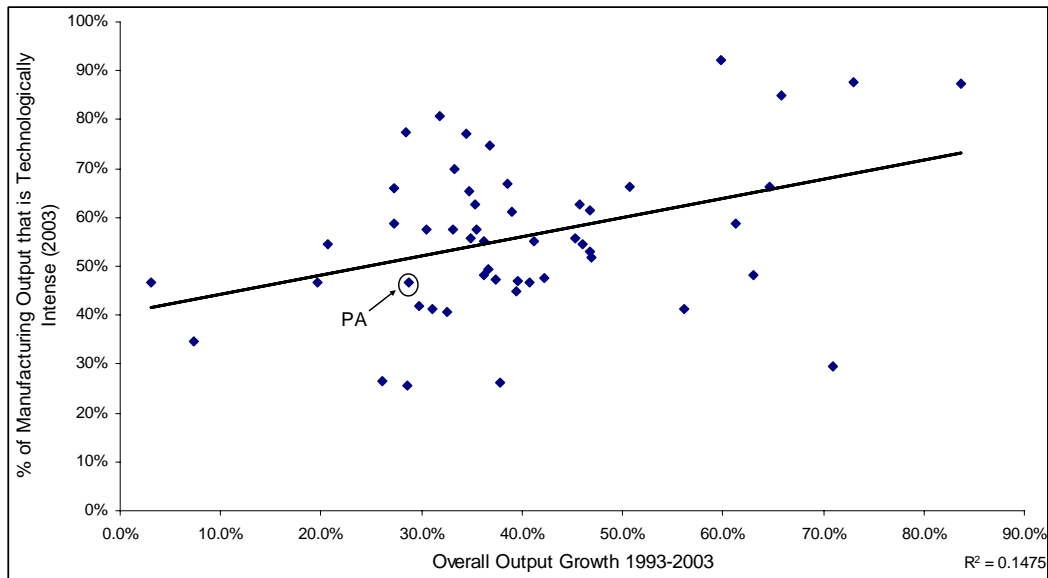
## Technology and Its Importance

The importance of the use of technology and its impact on industrial productivity has been touted as one of the most important determinants of economic well being. However, the end result of public economic development policy is sustaining the well-being of the region through wealth creation and the distribution of income, not technology development for its own sake<sup>11</sup>. If the use of technology has a direct impact on gross product and thus on economic well-being, then the onus is on economic development policymakers to advocate and promote technology-intensive industries.

The following chart attempts to draw a relationship between overall output growth and percentage of output that is technologically intensive. It appears that for a state, the greater the percentage of output that is technology intensive, the greater the overall output growth. This helps confirm the relationship between technology and overall economic well-being.

<sup>11</sup> Hill, Edward, *Ohio's Competitive Advantage: Manufacturing Productivity*, prepared by The Urban Center, Maxine Goodman Levin College of Urban Affairs, Cleveland State University

## Technology-Intensive Industries and Overall Growth



Source: Economy.com

In the above chart, technology-intensive industries are defined as intense users of technologically sophisticated labor. Daniel Hecker<sup>12</sup> of the US Bureau of Labor Statistics identified two sets of industries that are intense users of technologically sophisticated labor: very intense and moderately intense users of technologically sophisticated labor.

**Very intense technology industries** employ at least five times the US average<sup>13</sup> of research and development workers and technologically-oriented workers per thousand workers.

**Moderately intense technology industries** employ between two and five times the US average.

<sup>12</sup> Hecker, Daniel, "High-technology employment: A broader view," Monthly Labor Review (June 1999): 18-28. It must be noted that Hecker's method of classifying technology intensive industries has its limitations. Some industries may be utilizing technology intensive processes and know-how, but it is not possible to identify all the output generated by technology intensive processes or identify employment in all high-tech activities. It is, however, possible to count employment of all scientists, engineers, and technicians—workers who create and apply new technologies in a particular industry. A document from the Congressional Office of Technology Assessment (*Technology, Innovation, and Regional Economic Development*, U.S. Congress, Office of Technology Assessment, Sept. 9, 1982) points out that high-technology firms typically use state-of-the-art techniques, and, in terms of quantifiable resources, such firms devote a "high" proportion of expenditures to research and development and employ a "high" proportion of scientific, technical, and engineering personnel. Therefore, for the purposes of this research, Daniel Hecker's method of classification based on research workers will be used, keeping in mind its limitations.

<sup>13</sup> Hecker calculated that the average number of R&D workers per 1,000 employees across all industries at the three-digit level of the Standard Industrial Classification (SIC) in the US is three and that the average number of technologically oriented workers per 1,000 is 38.

## Pennsylvania's Specialization in Technology-Intensive Manufacturing

An examination of Pennsylvania's industry landscape reveals that the Commonwealth has very few industries that are intense users of technologically sophisticated labor. Total technology-intensive gross product in Pennsylvania is 12.5% of overall gross product, compared to a 14.3% U.S. average and 15.0% for regional peers. A sizeable portion of this differential is due to the lack of moderately intense technology industries in the state. Manufacturing industries that can be classified as moderately intense in technology comprise only 4.8% of overall gross product. This figure is more than a third less than that of Pennsylvania's regional peers, which have 8.1% of their overall gross product in moderately technology-intensive industries. Pennsylvania is also lower than the U.S. average of 5.9%.

The story for very technology-intensive manufacturing is slightly better. Pennsylvania (3.6%) exceeds its regional peers (2.3%) in concentration of manufacturing industries that employ very technology intensive labor. However, this figure is lower than the U.S. average of 4.4%

Pharmaceuticals manufacturing is probably the primary industry that is driving Pennsylvania's technology-intensive average. Pharmaceuticals manufacturing employs very technologically sophisticated labor and is specialized in Pennsylvania.

### Pennsylvania Output from Technology-Intensive Industries, 2003

	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Output in Private Sector	<b>12.5%</b>	<b>15.0%</b>	<b>14.3%</b>
Moderate Technology Intensive Manufacturing	4.8%	8.1%	5.9%
Services	2.3%	2.4%	2.1%
Very Technology Intensive Manufacturing	3.6%	2.3%	4.4%
Services	1.9%	2.2%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

Source: Economy.com

### Pennsylvania Employment in Technology-Intensive Industries, 2003

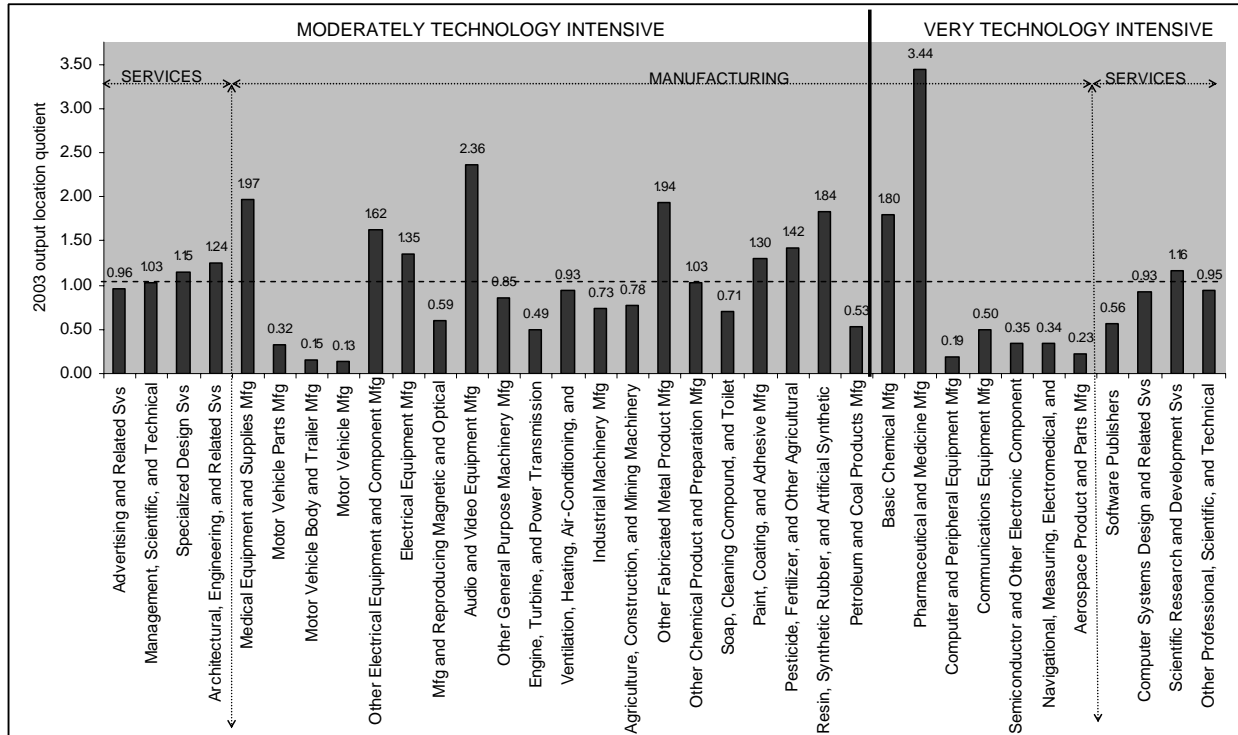
	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Employment in Private Sector	<b>8.9%</b>	<b>10.9%</b>	<b>9.7%</b>
Moderate Technology Intensive Manufacturing	3.1%	4.4%	3.3%
Services	2.2%	2.6%	2.4%
Very Technology Intensive Manufacturing	1.8%	1.5%	2.0%
Services	1.7%	2.3%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

Source: Economy.com

Pennsylvania has a specialization in only ten out of a possible 27 technology-intensive manufacturing industries. As previously mentioned, pharmaceuticals is a standout on the very technology-intensive side with a location quotient of 3.44. Other notable industries are medical equipment, basic chemicals, resins and synthetic rubber, fabricated metal products, audio and video equipment and electrical equipment manufacturing.

# Pennsylvania Level of Specialization in Technology-Intensive Industries



Source: Economy.com

## Pennsylvania Manufacturing Driver-Cluster Analysis

### Pennsylvania Overview

Deloitte's economic analysis yielded sixteen driver industries for the Commonwealth of Pennsylvania. Driver industries were identified based on the variables described in the Appendix Macro Analysis section of this report, which focus on degree of specialization in Pennsylvania and industry output or value added in manufacturing. This approach may yield different results from previous studies that emphasized employment to determine key drivers.

### Pennsylvania Drivers (ranked by 2003 output dollars)

Industry	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)	1993-2003 Output LQ Growth (%)
Pharmaceuticals	\$6,684	0.7%	4.6%	5.2%	3.44	12.6%
Electrical Equipment	\$4,612	4.6%	5.9%	7.9%	1.42	-18.5%
Plastics	\$2,818	1.8%	2.9%	5.0%	2.22	53.0%
Printing*	\$2,287	-2.2%	-1.4%	-1.0%	1.95	41.0%
Food**	\$2,149	-1.7%	-0.2%	0.3%	2.35	26.8%
Paper	\$2,109	-1.8%	-1.1%	0.4%	2.55	71.7%
Basic Chemicals	\$1,944	-3.5%	0.1%	-0.7%	1.80	9.4%
Metalworking Machinery	\$1,842	0.7%	-0.2%	7.7%	1.35	8.7%
Architectural and Structural Metals	\$1,653	-1.1%	0.4%	2.3%	1.97	16.9%
Machine Shops - Screw, Nut, & Bolt Mfg	\$1,614	0.9%	1.2%	6.5%	1.56	10.0%
Other Fabricated Metals	\$1,398	-1.8%	-1.2%	2.4%	1.94	27.6%
Wood Products	\$1,302	-1.5%	-0.5%	2.5%	1.43	53.7%
Furniture	\$1,271	1.0%	1.7%	2.8%	1.61	61.3%
Resin, Rubber and Fibers	\$1,248	-3.6%	0.2%	0.7%	1.84	11.8%
Glass	\$ 938	-5.3%	-3.7%	0.5%	3.50	23.5%
Medical Equipment	\$ 855	5.7%	3.8%	2.4%	1.97	92.4%

Source: Economy.com

\* Printing may include printing services

\*\* Food data represents Sugar and Confectionary and Bakeries and Pasta industries only

Note: CAGR (Compound Annual Growth Rate) is average annual growth rate over a specified period of time.

CAGR is calculated using the following formula:  $CAGR = (\text{present value}/\text{base value})^{(1/\text{#of years})} - 1$

There are a number of reasons that particular industries have historically been or are now based in Pennsylvania and are economic drivers. One reason is access to natural resources or raw materials, such as wood or coal. Unfortunately, many of these industries have become commoditized and are now in decline as more of the industry's production moves elsewhere (either offshore or to other U.S. regions with additional resources or lower labor costs). An example would be Pennsylvania's steel industry, which is still important to the state but in decline. Many industries that have traditionally been based in Pennsylvania because of access

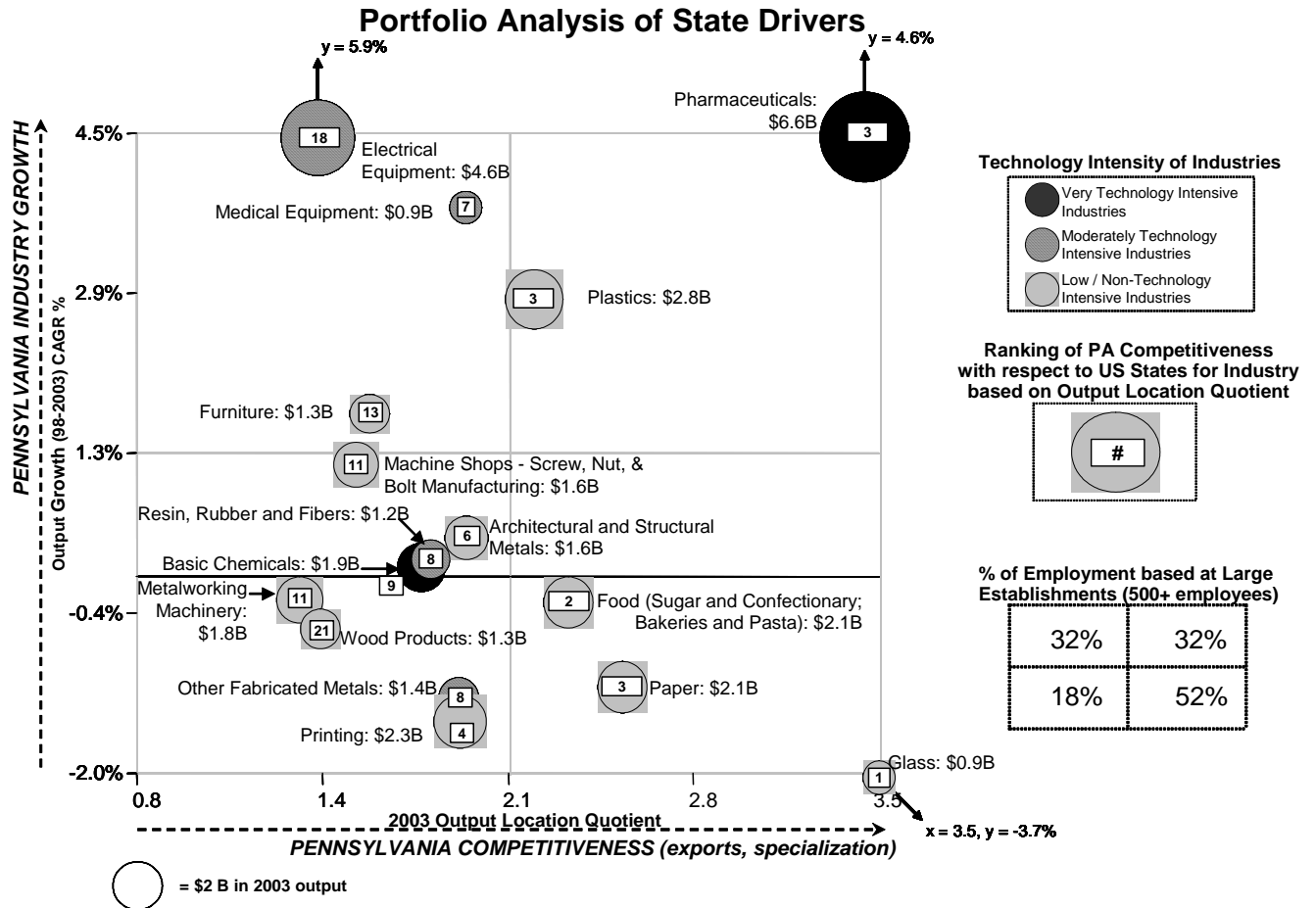
to raw materials are “supplier” industries; they produce goods such as glass containers or steel plates that become inputs to other local industries. Other “supplier” industries include printing and paper products, industries that often develop to support local or regional firms with products they need, such as packaging.

Another reason that industries establish themselves in Pennsylvania is because of the state’s easy distribution access to major East Coast population centers. Food products are an example of such an industry. Firms that produce in Pennsylvania and ship to other areas often become economic drivers because their level of exports out of the state is strong. Proximity to other related industries is another incentive for firms to locate in Pennsylvania. For example, the medical equipment industry has a strong presence in the state because it has close ties with the pharmaceuticals industry.

For each driver industry, Deloitte’s economic analysis included a cluster analysis that determined the other manufacturing industries that are suppliers to the driver and those that are buyers of the driver’s output. It is important to understand such buy-sell relationships because the dynamics of driver industries will affect supplier and buyer industries as well. For example, when motor vehicle production declined, the market for Pennsylvania industries supplying motor vehicle materials and parts declined as well. The decline of steel mills adversely affected downstream firms that produce products made of steel. Conversely, sawmills are a driver industry that help support other industries for the state, including furniture manufacturing and construction. A complete list of manufacturing buy-sell industry clusters for each driver is included in Section E of this report.

## Driver Portfolio Analysis for Pennsylvania

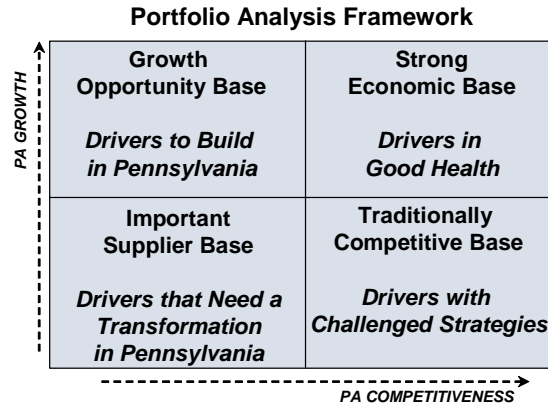
In order to evaluate the strategic position of driver industries and their development needs, it is helpful to analyze them as a portfolio. The chart below shows Pennsylvania's drivers represented by the location quotient. The X axis represents the industry's level of specialization and exports, and the Y axis shows each industry's average annual growth over the last five years. Thus, the industries in the upper right-hand quadrant are industries with high growth and a high degree of specialization in Pennsylvania, and those in the lower left-hand quadrant have had slower growth and have a lesser degree of specialization.



Source: Economy.com, Harris Infosource

## Quadrant Analysis

Each quadrant of the chart represents a group of industries facing similar strategic issues and opportunities. Therefore, the dynamics of each quadrant will drive economic development objectives and IRC service needs.



### Upper Right Quadrant – Strong Economic Base Drivers

**Quadrant Description:** This quadrant shows industries that can be regarded as Strong Economic Base drivers. The industries are typically dominated by large establishments, have experienced stable growth and are highly competitive in Pennsylvania. These industries are generally in good health. For Pennsylvania, these industries are pharmaceuticals and plastics.

**Economic Development Objective:** In order to sustain growth, support competitiveness as it relates to the cash statement with a focus on policy and infrastructure.

### Lower Right Quadrant – Traditionally Competitive Base Drivers

**Quadrant Description:** This quadrant has industries that are highly competitive and regionally specific for Pennsylvania and manufacture commodity products. In recent years, they have suffered a cyclical decline. These companies' strategies may be challenged and they rely on new product development and process improvement for growth and financial health. For Pennsylvania, these industries are food (sugar and confectionary, bakeries and pasta), glass, and paper products

**Economic Development Objective:** Sustain viability of regional competitiveness as growth slows down in the national industry and support diversification.

### Lower Left Quadrant – Important Supplier Base

**Quadrant Description:** This quadrant contains diverse industries dominated by small manufacturing establishments. Relative to other quadrants, they are less competitive than the other drivers in Pennsylvania and are not growing. There is an opportunity to move these industries up the value chain. Pennsylvania has a number of drivers in this quadrant, including: Machine shops; resin, rubber, and synthetic fibers; architectural and structural metals; basic chemicals; metalworking machinery; wood products; printing; and other fabricated metals.

**Economic Development Objective:** Retain stronger, more aggressive segments of industries by focusing on firm-level strategies.



### **Upper Left Quadrant – Growth Opportunity Base**

**Quadrant Description:** This quadrant contains industries that have grown significantly over the past six years but are not strongly competitive in Pennsylvania. Within this quadrant there may be emerging drivers - those that have the opportunity to become stronger output drivers for the state. Industries in this quadrant include: electrical equipment, medical equipment, and furniture.

**Economic Development Objective:** Provide opportunities to sustain and increase competitiveness in the state. Opportunities have to be addressed industry by industry.

### **Conclusion – Pennsylvania Drivers**

Pennsylvania's manufacturing industries and the drivers of the state's economy have shifted greatly. Many of the state's traditional base industries, such as steel and railroad manufacturing, have declined and others, such as wood and coal products, have become commoditized. For all of the driver industries, it is important to focus on process improvement to maintain competitiveness. It is also important, especially for SMEs, to focus on innovation to improve business strategy, products or processes in order to drive growth or move up the value chain into more sustainable, profitable niches.

There are plenty of opportunities for Pennsylvania's economy to continue to thrive. The pharmaceuticals industry has doubled in size over the past ten years and has helped drive growth in other related industries such as medical equipment by establishing a regional presence and strong level of specialization. It is important for the Commonwealth to identify other emerging driver industries and provide opportunities for these industries to grow and increase competitiveness in the state. Deloitte analysis identified electrical equipment manufacturing as a potential emerging driver. Further evaluation of specific industry dynamics can uncover other opportunities.

Pennsylvania, due to its proximity to East Coast population centers and comparative wages, will remain a viable option for investment in manufacturing. The core focus should continue to be on those industries that have or can associate a comparative advantage by locating in Pennsylvania. With this in mind, it is critical for Pennsylvania to maintain a diverse, robust portfolio of significant suppliers to the key driver and potential emerging driver industries.

## Public Policy Issues

In addition to business issues, Deloitte found several public policy issues that manufacturers across Pennsylvania are facing. These issues are also consistent with the findings of the Pennsylvania Chamber of Business and Industry Membership Survey released in September 2003. In that survey, when asked what the top business issue that companies would like to see the Chamber address, the top answers were health care costs, taxes, economic and business development, and tort reform. These answers are highly consistent with those that manufacturers raised to Deloitte during the regional workshops (although taxation did not appear to be as key of a concern in the workshops as other firm-level issues and health care costs were) and those highlighted by businesspeople in TEAM PA's 2003 business survey, which found health care costs, taxes, and environmental regulations to be the top public policy issues. While there are some actions that companies can undertake to ameliorate the impact of these issues, it is important that there are entities that can create a collective voice to express the concerns, priorities, and points of view of the many SMEs in Pennsylvania to both Commonwealth and national legislators.

### Top Business Issue Companies Would Like the Pennsylvania Chamber to Address

Business Issue	% of Respondents
Health Care reform act/costs	21%
Taxation reform	13%
Economic and business development	11%
Tort reform/legal regulation/litigation reform	10%
Business taxes	6%

Source: Pennsylvania Chamber of Business and Industry 2003 Membership Survey, September, 2003

## Health Care Costs

Health care costs have been rapidly increasing for the past decade. Forecasts for the future do not indicate that any relief is on the way. Health insurance costs for U.S. companies are expected to increase by 16% in 2003 and 12% in 2004<sup>14</sup>. While healthcare reform remains on the priority list for legislators, there does not appear to be a simple solution to the problem of escalating costs. Many companies are requiring employees to pay a larger portion of healthcare costs in order to relieve the cost burden on the company, but cost sharing or making other changes to benefits is more difficult for companies that are highly unionized and/or have a large pool of retirees. Many traditional manufacturing firms fall into this category. This is an especially difficult issue for SMEs who have less flexibility to make changes and less resources to pay the increasing costs.

## Taxes

Both taxation reform and business taxes ranked among the top five priorities in the Chamber survey. Although this issue varies by region within Pennsylvania (for example, Pittsburgh now has one of the highest business tax rates in the country) taxes are a consistent concern across the Commonwealth. In the Chamber study, the greatest percentage of the respondents concerned about higher taxes are among companies whose annual sales are \$16-50 million and are located in western Pennsylvania, the manufacturing hub of the state. While taxes are

<sup>14</sup> "Get Used to the Pain", *Business Week*, October 20, 2003

certainly an important element of the Commonwealth's overall economy, it is important to optimize business taxes in order to promote economic development and attract new investment in Pennsylvania. Tax and other incentives are often important deciding factors in corporate investment decisions.

## Tort Reform

Tort reform is another major issue impacting Pennsylvania firms. In the Chamber survey, this issue was rated highly important by all responding firms, but it was rated most important by companies with sales of \$16-50 million. Without caps on "pain and suffering" claims, SMEs are susceptible to potentially crippling lawsuits. In addition, lack of such reform and the potential costs of such suits increase manufacturers' insurance costs. A 1999 study by Pennsylvania State University estimated that costs of the tort system in Pennsylvania were more than 2.5% of the GSP and increasing at a rate of 4-9% annually.<sup>15</sup> Fear of legal liability can change the way that businesses, government and professionals provide goods and services, often in ways that are not consumer-oriented. Tort reform can bring economic benefits: A National Bureau of Economic Research study estimated that states that adopt lawsuit abuse reforms experienced employment growth, productivity growth, and growth of total output. The Pennsylvania State study indicated that Pennsylvania tort reform efforts could produce an a 2% increase in GSP and an additional 34,000 jobs, among other economic benefits.

## Infrastructure

Infrastructure (capital, real estate, roads, etc.) does not appear to be a major concern among SMEs, although there may be some minor regional or local concerns. With some minor regional exceptions, very few issues around infrastructure arose in the workshops and Deloitte's research. This finding is validated in TEAM PA's survey, which found that the vast majority of respondents were satisfied with the current infrastructure.

**Satisfaction with Infrastructure**

Infrastructure Service	Percent Satisfied*
Public Water	75%
Public Sewer	75%
Zoning/Land Use	73%
Road Systems	80%
Telecommunications	86%
Public Transportation**	32%
Energy/Utilities	89%

Source: TEAM PA Business Calling Program report 6/30/03

\*"Satisfied" measured as a statewide response of "Excellent" or "Adequate"

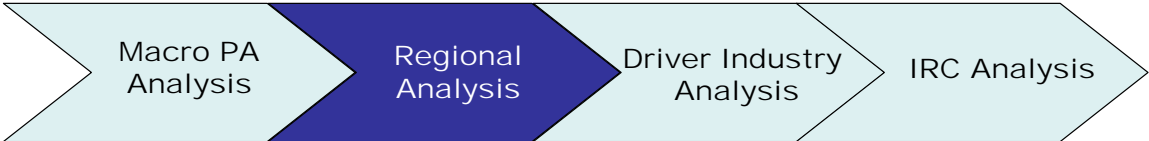
\*\* Note: Public transportation response of "N/A" was 61%; the majority of the remaining respondents were satisfied

<sup>15</sup> *"Projected Economic Impact of Civil Justice Reform on the Pennsylvania Economy"* Prepared by The Institute for Policy Research and Evaluation of the Pennsylvania State University, January, 1999.

# D. IRC REGIONS - IMPACT OF MANUFACTURING ON THE ECONOMY AND REGIONAL DRIVERS

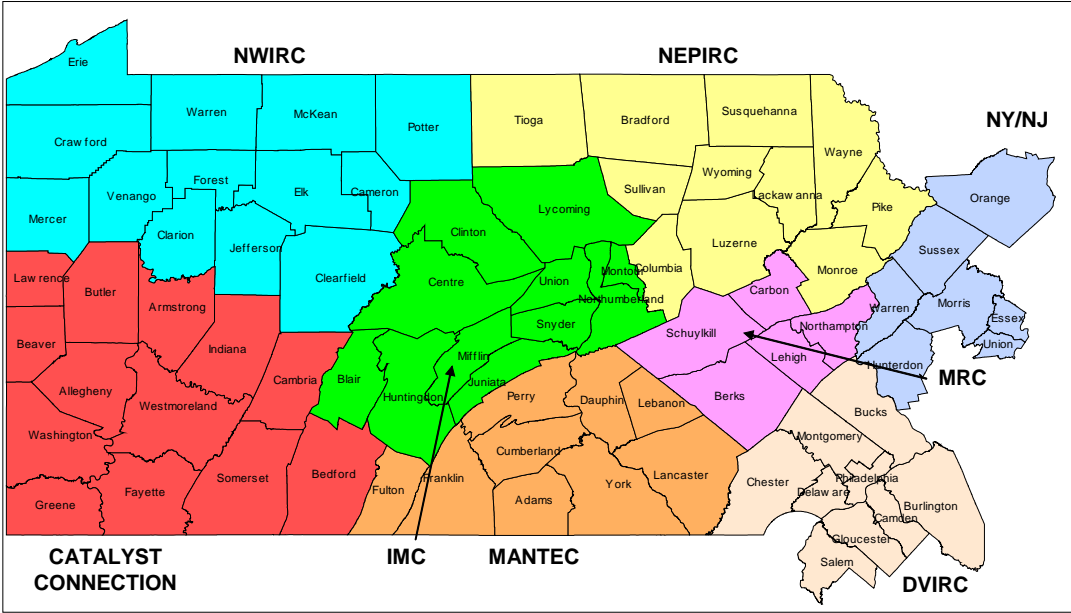
## Regional Analysis

### Project Approach and Methodology



Because Pennsylvania’s manufacturing environment varies fairly significantly across geographic regions, it is important to understand the contribution of manufacturing to each region as well as the drivers and dynamics of each region’s manufacturing economy. The following section illustrates Deloitte’s analysis of the manufacturing economy of each IRC region to understand macro factors driving regional wealth-building, such as the importance of manufacturing to the regional economy, wages, and level of specialization in technology-intensive manufacturing industries. The regional analysis continues with an overview of the manufacturing industries that were identified as drivers for each region’s economy, a portfolio analysis that shows each industry’s size, growth and competitiveness, and productivity analysis for the driver industries and the region. Each section concludes with a summary of the region’s key manufacturing characteristics, regional key issues, and some potential needs for IRCs services.

The map below shows each IRC region and the counties that they encompass.



The regional analysis is divided into the following sections:

### **Region Analyzed**

This section discusses the counties that are included in the region and gives a brief overview of the manufacturing environment in the region.

### **Importance of Manufacturing to the Region**

This section shows the size and growth performance of the manufacturing sector compared with other industries in each region. It also covers the historical importance of manufacturing to the region and discusses traditionally important industries to provide an overall snapshot into manufacturing's impact on the region.

### **Personal Income**

As discussed in the macro analysis of the state, wealth-building is a critical measure to understand the impact of manufacturing on the state and regional economy. The average wage for an industry is clearly a significant factor in understanding wealth. Strong wages in manufacturing help to contribute to individual income and good standards of living for employees and their families. In this section, Deloitte reviews average wages for manufacturing versus other industries in the region to evaluate how manufacturing is contributing to personal wealth-building.

### **Technology Intensity**

Deloitte mapped the region's NAICS by their technological intensity based on the definition developed by Daniel Hecker of the U.S. Bureau of Labor Statistics. Hecker identified the following two classifications for industries that are intense users of technologically sophisticated labor:

- **Very intense technology industries** employ at least five times the U.S. average of research and development workers and technologically oriented workers per thousand workers
- **Moderately intense technology industries** employ between two and five times the U.S. average

Thus, it can be beneficial for economic development to invest in developing industries with some degree of technology intensity.

For each region, this report shows the degree of specialization in moderately intense and very intense technology industries, as measured by the region's output location quotient for the industry. The location quotient measures the ratio of region's percent of total output in an industry to the national percent of total output in that same industry. Location quotients greater than 1.0 indicate that the region has a greater than average degree of specialization in the industry.

Since highly skilled (and, presumably highly paid) levels of employment are one of the significant benefits of technology-intense industries, Deloitte also analyzed each region's

employment in these industries to determine the region's performance relative to the state, the region, and total U.S.

## **Regional Drivers**

For each region, Deloitte's economic analysis, described in a previous section of this report, identified all of the industries that are considered economic drivers in that region. This section of the report discusses the driver industries and their dynamics for the region including size, growth rate, and level of competitiveness as defined by the location quotient. For each driver industry, Deloitte's economic analysis included a cluster analysis that determined the other manufacturing industries that are suppliers to the driver and those that are buyers of the driver's output. It is important to understand such buy-sell relationships because the dynamics of driver industries will affect supplier and buyer industries as well. For example, the decline of steel mills adversely affected downstream firms that produce products made of steel. A complete list of manufacturing buy-sell industry clusters for each driver is included in Section E of this report.

## **Driver Analysis**

In order to evaluate the strategic position of driver industries and their development needs, it is helpful to analyze them as a portfolio. This section shows regional drivers in a chart format with the X axis representing their level of specialization and exports as represented by the location quotient. The Y axis shows each industry's average annual growth over the last five years. The industries that are in the upper right-hand quadrant have high growth and a high degree of specialization in PA. Those that are in the lower left-hand quadrant have had slower growth and have a lesser degree of specialization. Each driver industry is represented by a "bubble" that shows the industry's relative size in terms of output. The colors of each industry "bubble" on the chart show the degree of technology intensity for that industry.

## **Productivity**

This section illustrates the relative productivity of manufacturing and driver industries for each region, compares productivity for the industries to each other, and compares manufacturing for each region to the average for Pennsylvania and the U.S. This analysis highlights any regional or industry-specific performance leaders and issues.

## **Conclusions**

For each region, a conclusions section summarizes the manufacturing environment and its dynamics. This section includes any important regional issues or considerations and recommendations for IRC actions based on regional issues.

## Regional Comparison

The table below shows a summary of each IRC region in Pennsylvania and provides an overview of the relative size and growth of manufacturing for each region. The Philadelphia area served by the Delaware Valley IRC has the largest manufacturing sector with \$23.7 billion in output, followed by the Pittsburgh area served by Catalyst Connection with \$11.4 billion. It is most likely that these two regions lead the Commonwealth because they have the highest population concentrations. Many manufacturing industries serve the local population, so areas with higher populations will have higher levels of manufacturing activity. Manufacturing output did not grow in any region during the past three to five years, as industries were affected by the national recession, price-based competition, and other macroeconomic issues. Over the past ten years, however, manufacturing has grown in every region of Pennsylvania, with some of the smaller regions (Northeastern Pennsylvania and North Central Pennsylvania) having the highest growth rates. Although it is the largest region in terms of output, the Philadelphia area has had the slowest growth in recent years and was also the region most affected by the recent economic downturn.

Region	2003	00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)
	Manufacturing Output (\$M)			
DVIRC	\$ 23,680	-5.0%	-1.0%	0.6%
CC	\$ 11,444	-3.0%	-0.3%	2.0%
MANTEC	\$ 10,874	-3.0%	-0.9%	1.8%
MRC	\$ 7,061	-4.2%	-0.7%	0.8%
NWIRC	\$ 5,489	-2.9%	-1.1%	2.0%
NEPIRC	\$ 4,321	-1.8%	0.5%	2.4%
IMC	\$ 3,926	-0.2%	1.5%	2.7%

Source: Economy.com

## Catalyst Connection

### Region Analyzed

The Catalyst Connection IRC serves SMEs in southwestern Pennsylvania, which includes Pittsburgh and the surrounding area. This region has been long associated with manufacturing activity, such as steel and steel products, and is home to a number of excellent academic institutions such as Carnegie-Mellon University and University of Pittsburgh.

Deloitte's analysis for Catalyst Connection covered the following counties:

- Allegheny
- Armstrong
- Beaver
- Bedford
- Butler
- Cambria
- Fayette
- Greene
- Indiana
- Lawrence
- Somerset
- Washington
- Westmoreland



## Importance of Manufacturing to the Region

The Pittsburgh region has long been one of the manufacturing centers of the United States due to its convenient location near population centers and transportation. Nicknamed “Steel City”, it has been a stalwart of the steel industry due to its proximity to raw materials and has been a strong supplier to other related industries, such as supplying the auto industry with raw materials. As those industries have begun to decline in recent years, the region has needed to cultivate other industries in order to maintain its strong economy.

Despite the decline of some of the region’s more prominent industries, manufacturing remains the number one industry sector in southwestern Pennsylvania, accounting for more than \$11 billion in annual output and 12.8% of the region’s total output. It is also the fourth-largest sector for employment in the region, employing more than 128,000 people. The average annual output growth rate for manufacturing over the past ten years has been 2.0%, about average for all industries within the region. However, manufacturing was more adversely affected by the recent recession than other industries. Manufacturing’s output growth rate over the past three years was (3.0%), well below the region’s average of 1.8%.

**Regional Output and Growth Rate by Industry**

Industry	Employment	2003 Output	00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)	Industry Output as a % of Regional Output
<b>Manufacturing</b>	<b>128,545</b>	<b>\$ 11,444</b>	<b>-3.0%</b>	<b>-0.3%</b>	<b>2.0%</b>	<b>12.8%</b>
Real Estate and Rental and Leasing	16,400	\$ 8,942	5.9%	2.9%	2.5%	10.0%
Finance and Insurance	61,178	\$ 7,745	4.2%	3.9%	3.5%	8.7%
Retail Trade	159,301	\$ 7,709	2.6%	2.6%	3.5%	8.6%
Public Administration	174,368	\$ 7,686	2.0%	1.0%	0.9%	8.6%
Health Care and Social Assistance	187,774	\$ 6,957	1.6%	0.9%	0.0%	7.8%
Wholesale Trade	51,762	\$ 5,588	5.3%	3.5%	4.0%	6.2%
Professional, Scientific, and Technical Services	67,666	\$ 4,909	-1.3%	0.6%	0.6%	5.5%
Construction	66,211	\$ 4,444	-0.2%	1.3%	1.0%	5.0%
Administrative and Other Support Services	63,114	\$ 3,843	4.1%	2.6%	1.6%	4.3%
Transportation and Warehousing	49,072	\$ 3,505	5.2%	3.1%	4.5%	3.9%
Information	29,658	\$ 3,147	1.3%	4.0%	3.6%	3.5%
Other Services (except Public Administration)	83,544	\$ 3,006	4.4%	2.2%	1.8%	3.4%
Accommodation and Food Services	98,799	\$ 2,818	5.6%	3.7%	3.7%	3.2%
Utilities	9,263	\$ 2,339	-4.5%	-0.6%	-1.0%	2.6%
Mining	10,174	\$ 1,786	3.0%	2.3%	8.1%	2.0%
Educational Services	53,255	\$ 1,305	0.2%	-0.9%	0.7%	1.5%
Management of Companies and Enterprises	16,260	\$ 1,091	-10.7%	-5.6%	-3.1%	1.2%
Agriculture, Forestry, Fishing and Hunting	4,358	\$ 590	14.0%	13.8%	5.8%	0.7%
Arts, Entertainment, and Recreation	18,453	\$ 572	1.2%	0.2%	1.1%	0.6%
	<b>1,349,153</b>	<b>\$ 89,426</b>	<b>1.8%</b>	<b>1.8%</b>	<b>2.0%</b>	

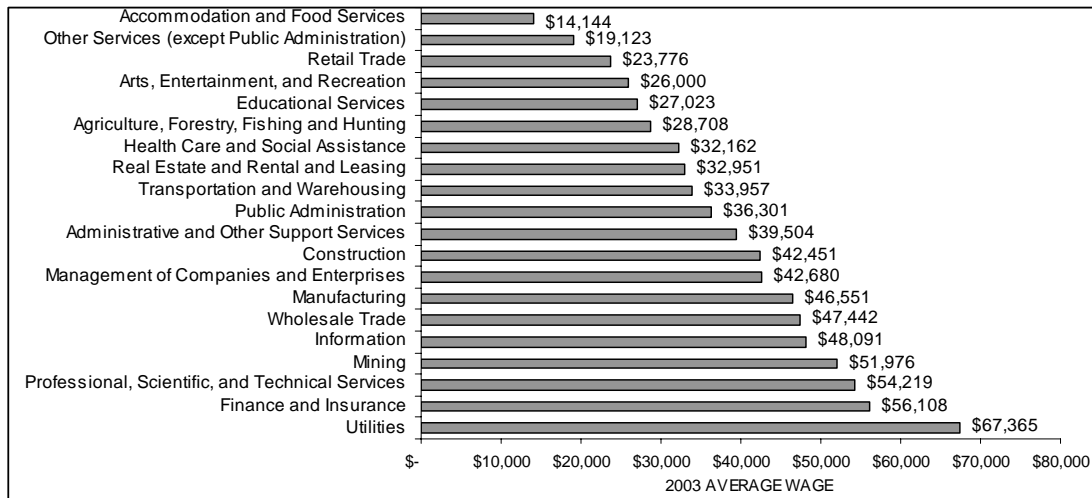
Source: Economy.com

## Personal Income

High wages in manufacturing help contribute to individual income and high standards of living for employees and their families. They are also a factor in attracting workers at all levels to an industry. In Catalyst Connection's region, manufacturing wages are fairly high relative to other industries; there are six industries in the region with higher wages.

High wages may also be a double-edged sword if they reflect relative age and experience of the workforce or the potential burden of retirement benefits and pensions. Replacing workers who are retiring and managing pension costs associated with these workers may be a challenge. This appears to be an especially large problem for the steel industry, which, with its unionized work force, has had heavy health care and pension burdens that seem to have severely impacted companies operating on thin margins in a commoditized business. Industry restructuring has allowed some companies to avoid these cost burdens and operate with a much lower cost structure, while others declare bankruptcy and the Pension Benefit Guaranty Corp. picks up the burden, and still others are trying to remain competitive under their old cost structure.

**Regional Average Wages by Industry**

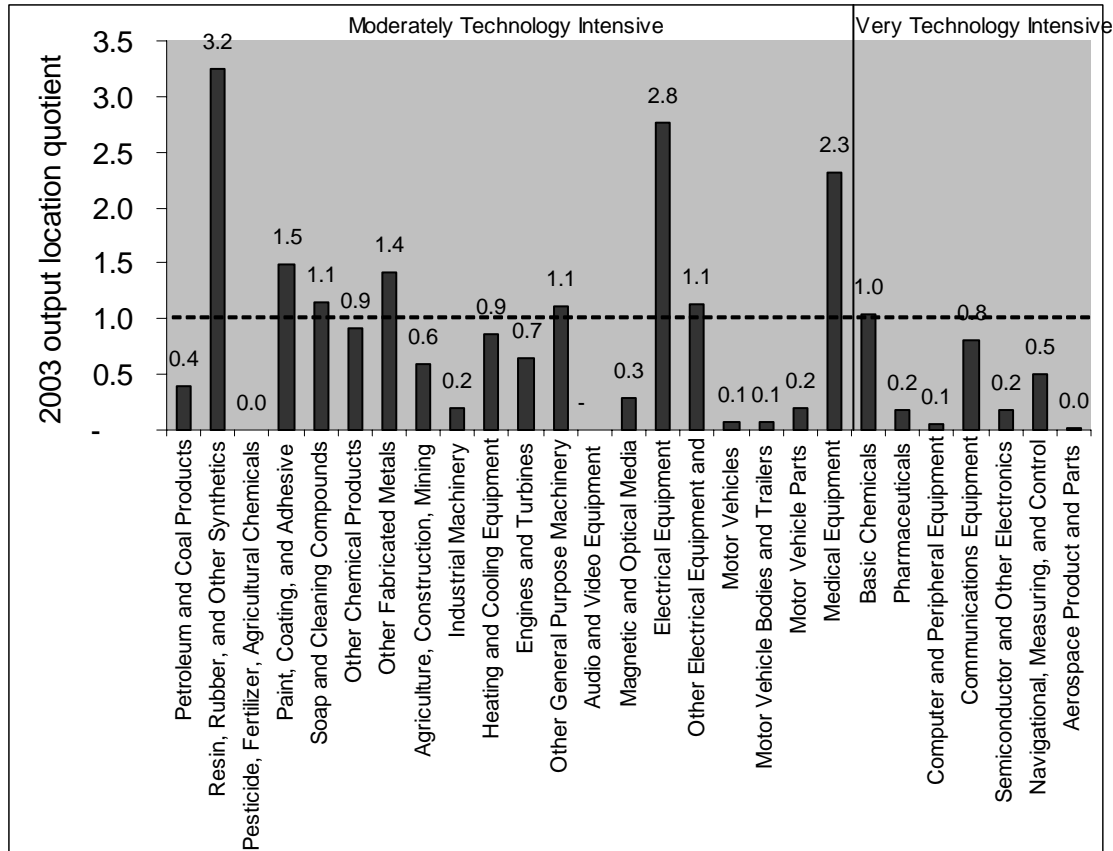


Source: Economy.com

## Technology Intensity

Southwestern Pennsylvania's specialization in moderately technology intensive manufacturing industries exceeds specialization in industries that are very technology intensive. The region is strong in several moderately intensive industries, most notably resins and other synthetic materials, electrical equipment, and medical equipment. The region does not have a high degree of specialization in any very intense technology industries, although basic chemicals is at an average level in the region. Glass manufacturing, one of Catalyst Connection's most regionally competitive industries, is classified as low technology.

**Regional Level of Specialization in Technology-Intensive Industries**



Source: Economy.com

Because technology-intensive industries are underdeveloped in the region, employment in these industries is also underdeveloped. Manufacturing employment in technology-intensive industries for this region lags Pennsylvania, regional, and national peers.

**Regional Employment in Technology-Intensive Industries**

	CC	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Employment in Private Sector	7.7%	8.9%	10.9%	9.7%
Moderate Technology Intensive				
Manufacturing	2.6%	3.1%	4.4%	3.3%
Services	2.5%	2.2%	2.6%	2.4%
Very Technology Intensive				
Manufacturing	0.8%	1.8%	1.5%	2.0%
Services	1.8%	1.7%	2.3%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

## Catalyst Connection Drivers (ranked by 2003 output dollars)

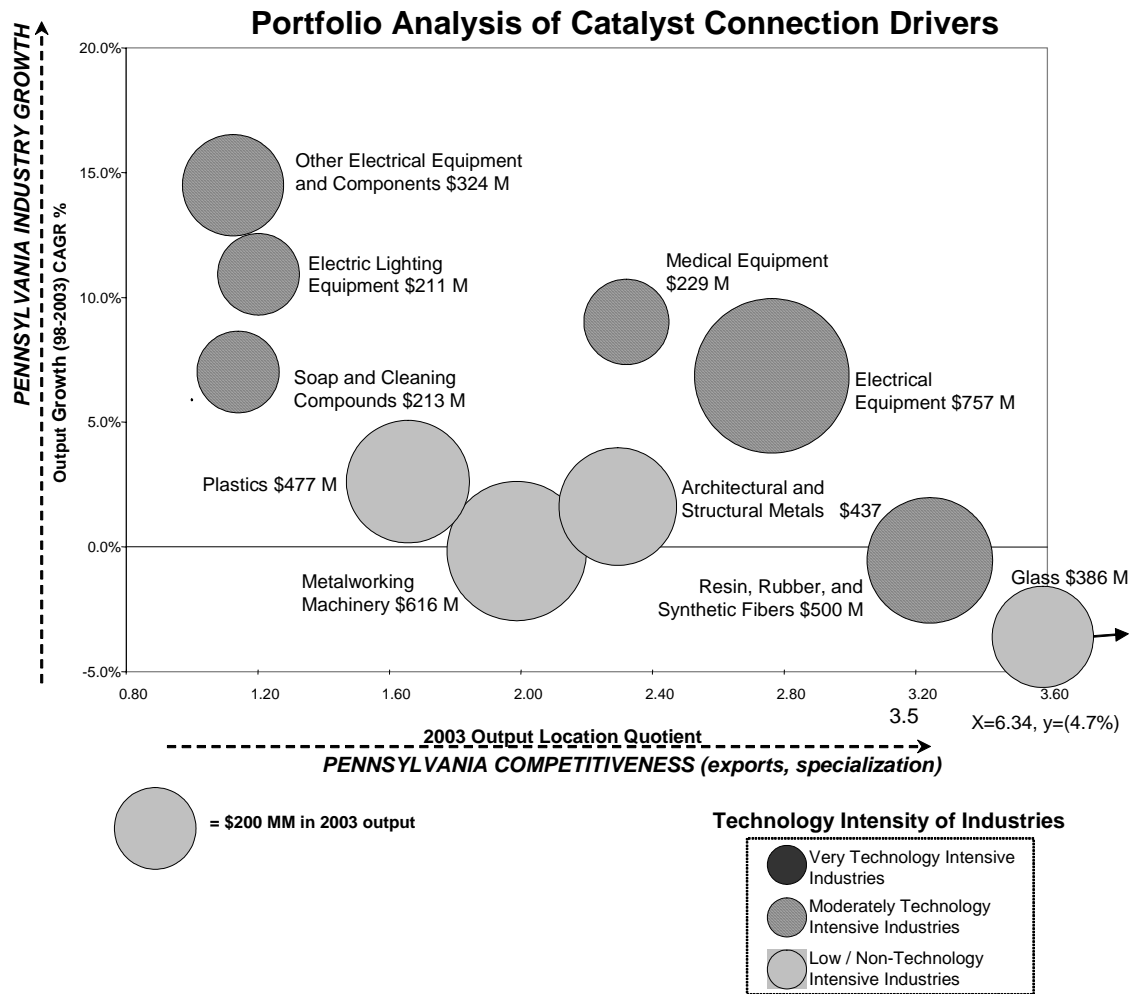
Industry	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)	1993-2003 Change in LQ	Number of Establishments
Electrical Equipment	\$ 757	5.9%	6.9%	9.1%	2.76	(0.07)	62
Metalworking Machinery	\$ 616	1.2%	-0.2%	8.4%	1.99	0.32	140
Resin, Rubber, and Synthetic Fibers	\$ 500	-5.1%	-0.5%	2.2%	3.24	0.86	17
Plastics	\$ 477	2.6%	2.6%	4.2%	1.66	0.52	130
Architectural and Structural Metals	\$ 437	0.2%	1.6%	3.4%	2.29	0.60	276
Glass	\$ 386	-6.6%	-4.7%	-0.4%	6.34	0.86	54
Other Electrical Equipment and Components	\$ 324	16.3%	14.5%	13.0%	1.13	0.41	48
Electric Lighting Equipment	\$ 211	11.4%	10.9%	13.2%	1.20	0.05	17
<b>Emerging Driver Industries</b>							
Medical Equipment	\$ 229	12.1%	9.0%	3.5%	2.32	1.28	66
Soap and Cleaning Compounds	\$ 213	4.0%	7.0%	8.3%	1.14	0.53	30

Source: Economy.com, Harris Infosource

The economic analysis yielded eight drivers and two emerging drivers for the region that Catalyst Connection serves.

Traditionally, this was a region driven by the steel industry due to a location near natural resources and transportation. As the steel industry declines, other industries have emerged as economic drivers but metal-products industries remain important to the region. In terms of new drivers, electrical equipment industries have emerged over the past decade as drivers and it appears that medical equipment and soap are emerging drivers. The drivers represent a fairly diverse set of industries, which to some extent helps alleviate the dangers of the region's dependence on any one single industry for its economic health.

## Portfolio Analysis of Catalyst Connection Drivers



Source: Economy.com

The driver and portfolio analysis reveals a number of strong growth industries: three electrical equipment-related industries, medical equipment, and soap and cleaning compounds. It also reveals several industries with a strong level of competitiveness as measured by the location quotient, including: Glass; resins, rubber, and other synthetics; electrical equipment; medical equipment, and architectural and structural metals. The growth of these drivers indicates an opportunity to fill the economic gap left by drivers, such as steel, that have declined.

There are opportunities for Catalyst Connection to build on these industries to drive growth or further build regional specialization. There are also opportunities to help lower-growth, less-specialized industries such as plastics and metalworking machinery increase their growth or specialization by focusing on strategies to help companies in these industries innovate, move up the value chain, and improve operations.

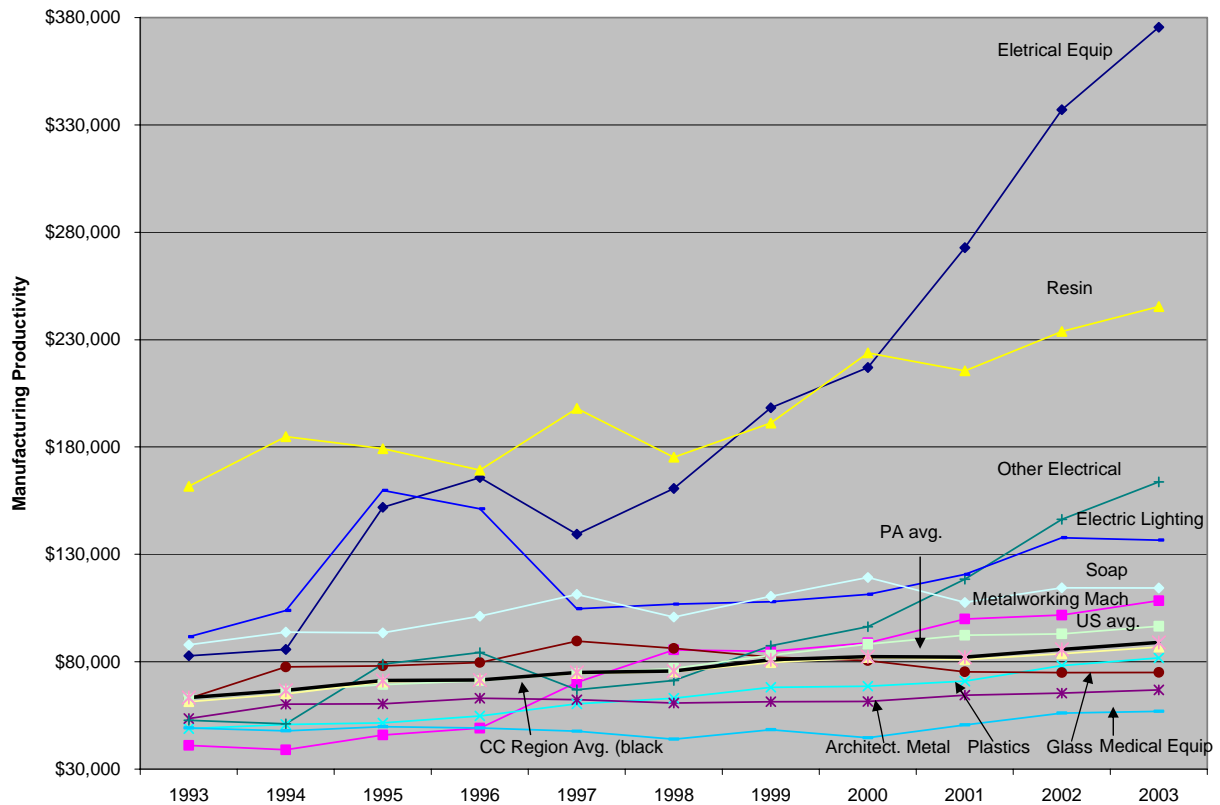
The portfolio analysis also shows that Catalyst Connection has six driver industries that are moderately technology-intensive and that most of those industries have strong growth rates.

These industries can represent opportunities for economic development if the region cultivates their continued growth.

Some of the more traditional industries in this region such as plastics, architectural and structural metals, metalworking machinery, and glass, all have negative to low growth rates. All of these industries other than glass have moderate location quotients. These industries tend to be ones in which products are becoming commoditized and competition is often price-based, sometimes leading to revenue declines. For these industries, it is important to develop strategies to differentiate firms and products in order to increase differentiation and regional competitiveness. It is also important to make the production process as lean and efficient as is reasonable in order to sustain profitability and overall company performance.

## Productivity in Driver Industries

### Productivity by Industry Productivity = Output per Employee



Source: Economy.com

In Southwestern Pennsylvania, average productivity for manufacturing is \$89,028, which is slightly higher than the Pennsylvania average of \$86,814 but lower than the U.S. average of \$96,549. Trends in productivity changes have closely mirrored Pennsylvania over the past ten years, with an overall average annual productivity growth rate for the region of 3.1%. Leading industries in terms of productivity are electrical equipment and resin. Productivity in electrical equipment nearly quadrupled from \$82,779 output per employee in 1993 to \$375,559 in 2003. Productivity in resin has increased more than 50% from \$161,689 to \$245,476. Other industries with very high levels of current productivity include other electrical equipment, which has also seen impressive increases in productivity over the past ten years, and electrical lighting equipment. Metalworking machinery has also seen impressive growth, increasing from \$41,004 in 1993 to \$108,435 in 2003. Lower productivity industries that have seen slower increases in output per employee over the past ten years include medical equipment, glass, and architectural and structural metals.

### Average Productivity by Industry – Catalyst Connection

	1993-2003		
	1993	2003	CAGR
Electrical Equipment	\$ 82,779	\$ 375,559	14.7%
Resin, Synthetic Rubber and Fibers	\$ 161,689	\$ 245,476	3.9%
Other Eletrical Equipment	\$ 52,732	\$ 163,742	10.8%
Electric Lighting Equipment	\$ 91,635	\$ 136,619	3.7%
Soap and Cleaning Compounds	\$ 87,897	\$ 114,295	2.4%
Metaworking Machinery	\$ 41,004	\$ 108,435	9.2%
Plastics	\$ 48,836	\$ 81,792	4.8%
Glass	\$ 62,948	\$ 75,000	1.6%
Architectoral and Structural Metals	\$ 53,543	\$ 66,844	2.0%
Medical Equipment	\$ 49,160	\$ 56,895	1.3%
U.S. Average	\$ 62,757	\$ 96,549	4.0%
PA Average	\$ 61,385	\$ 86,814	3.2%
CC Region Mfg. Average	\$ 63,343	\$ 89,028	3.1%

Source: Economy.com



## Conclusions

The decline of the steel industry had a significant impact on Southwestern Pennsylvania's economy. As traditionally strong industries have declined, the region's economic driver industries have begun to shift and take advantage of other local natural and knowledge resources. Manufacturing remains critical to the region, accounting for nearly 13% of the region's output. Wages in manufacturing remain competitive, offering workers a good standard of living. Although the region does have a moderate degree of specialization in moderately technology-intensive industries, specialization and employment in technology-intensive industries lags both regional and national peers, indicating that there may be an opportunity to drive employment and economic growth by investing to attract or build industries with moderate to high technology intensity. With its richness of educational and research institutions, the region is developing an R&D infrastructure and economic base of entrepreneurs and SMEs that can be helpful in attracting technology-intensive industries. In particular, electrical equipment-related industries have emerged as drivers for this region. There may be an opportunity to attract and cultivate related industries, such as component suppliers, to build more of a cluster around the drivers and create a regional competitive advantage.

The region's more traditional industries remain strong and continue to be economic drivers, but many are suffering from negative or slow growth. These industries may need help developing new long-term business strategies or ways to innovate and develop new products that bring higher margins and help move firms away from commoditization. They probably also need assistance in becoming as efficient and lean as manageable in their production process and supply chain in order to increase or maintain profitability, especially those that are currently forced to compete on price for their products and, therefore, may be suffering from revenue declines.

Regional Issues (based on workshops and Deloitte Research):

- Connectivity of small firm suppliers versus regional large firm drivers in industries such as electrical equipment
- Commoditization of traditional base industries, such as steel, causing a decline in output and jobs as the region transitions away from those industries
- From an attraction of new investment standpoint, Rust Belt perceptions

Catalyst Connection opportunities:

- Build programs that link educational institutions with manufacturers to provide R&D resources or help develop more technology-intensive industries in the region
- Help "traditional" manufacturing industries develop growth and innovation strategies that focus on moving up the value chain and avoiding the trap of commoditization
- Help all manufacturers with process improvements/lean manufacturing so that they can achieve or maintain profitability, especially in low-growth or competitive industries
- Help identify and attract new industries to the region, especially those in the clusters that support electrical equipment and medical equipment manufacturing to build more of a local competitive advantage for those industries and capture more local value from them.

## Northwest Pennsylvania Industrial Resource Center (NWIRC)

### Region Analyzed

The NWIRC serves SMEs in Northwestern Pennsylvania. Containing the foothills of the Appalachian Mountains, the region is rich in natural resources that have made it strong in manufacturing wood and powdered metal products, plastics, and tooling and machining operations.

Deloitte's analysis for the NWIRC covered the following counties:

- Cameron
- Clarion
- Clearfield
- Crawford
- Elk
- Erie
- Forest
- McKean
- Mercer
- Jefferson
- Potter
- Venango
- Warren

## Importance of Manufacturing to the Region

Much of this region's manufacturing history has been built on its natural resources. For example, wood and metal products have been a base driver for the region. Erie, Pennsylvania's only lake port city, has been a manufacturing center since before the Industrial Revolution. The region is home to a variety of manufacturing industries ranging from plastics to furniture.

Manufacturing is the number one industry sector in Northwestern Pennsylvania, accounting for approximately \$5.5 billion in annual output, more than a quarter of the region's total output and more than twice the output of the next-largest sector. It is also the number one sector for employment in the region, employing more than 77,000 people. The average annual output growth rate for manufacturing over the past ten years has been 2.0%, slightly below the average of 2.6% for all industries within the region. However, manufacturing was more adversely affected by the recent recession than other industries. Manufacturing's output growth rate over the past three years was (2.9%), well below the region's average of 2.9%.

### Regional Output and Growth Rate by Industry

Industry	Employment	2003 Output	00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)	Industry Output as a % of Regional Output
<b>Manufacturing</b>	<b>77,292</b>	<b>\$ 5,489</b>	<b>-2.9%</b>	<b>-1.1%</b>	<b>2.0%</b>	<b>26.0%</b>
Public Administration	54,820	\$ 2,134	1.7%	0.7%	1.5%	10.1%
Retail Trade	45,675	\$ 2,004	2.4%	2.6%	4.0%	9.5%
Real Estate and Rental and Leasing	3,956	\$ 1,608	12.2%	7.7%	6.3%	7.6%
Health Care and Social Assistance	54,155	\$ 1,596	3.1%	1.3%	0.8%	7.6%
Finance and Insurance	11,037	\$ 1,132	12.4%	7.6%	3.3%	5.4%
Information	6,548	\$ 835	7.2%	8.4%	6.9%	4.0%
Transportation and Warehousing	10,965	\$ 788	17.6%	2.7%	1.8%	3.7%
Wholesale Trade	9,674	\$ 734	1.9%	1.0%	2.8%	3.5%
Other Services (except Public Administration)	23,855	\$ 675	5.7%	2.4%	2.2%	3.2%
Construction	11,840	\$ 665	-2.0%	-0.3%	0.0%	3.2%
Accommodation and Food Services	27,091	\$ 631	4.9%	3.2%	4.0%	3.0%
Administrative and Other Support Services	12,627	\$ 602	12.0%	6.7%	5.0%	2.9%
Agriculture, Forestry, Fishing and Hunting	1,719	\$ 545	21.5%	15.7%	9.2%	2.6%
Professional, Scientific, and Technical Services	7,597	\$ 468	4.8%	3.1%	2.0%	2.2%
Mining	2,800	\$ 448	7.7%	2.5%	4.7%	2.1%
Utilities	1,605	\$ 286	-10.7%	-3.6%	-2.0%	1.4%
Management of Companies and Enterprises	1,801	\$ 205	-7.6%	-4.3%	-1.0%	1.0%
Educational Services	8,852	\$ 194	2.8%	-0.7%	0.4%	0.9%
Arts, Entertainment, and Recreation	3,103	\$ 68	-1.4%	-2.0%	-0.6%	0.3%
	377,014	\$ 21,106	2.9%	1.9%	2.6%	

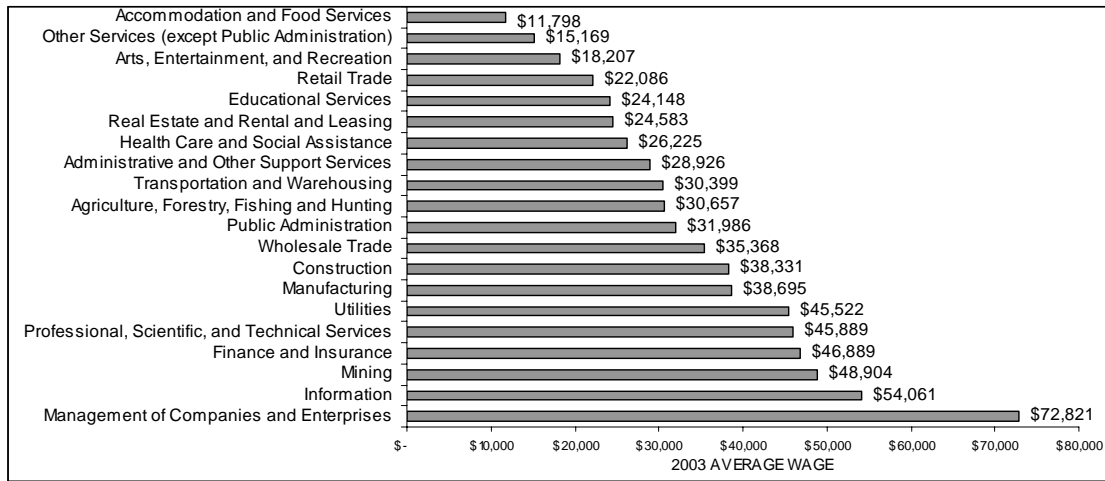
Source: Economy.com

## Personal Income

High wages in manufacturing help contribute to individual income and good standards of living for employees and their families. They are also a factor in attracting workers at all levels to an industry. In the NWIRC's service area, manufacturing wages are above average relative to other industries; there are six industries in the region with higher wages.

High wages may also be a double-edged sword if they reflect relative age and experience of the workforce or the potential burden of retirement benefits and pensions. Replacing workers who are retiring and managing pension costs associated with those workers may be a challenge.

**Regional Average Wages by Industry**

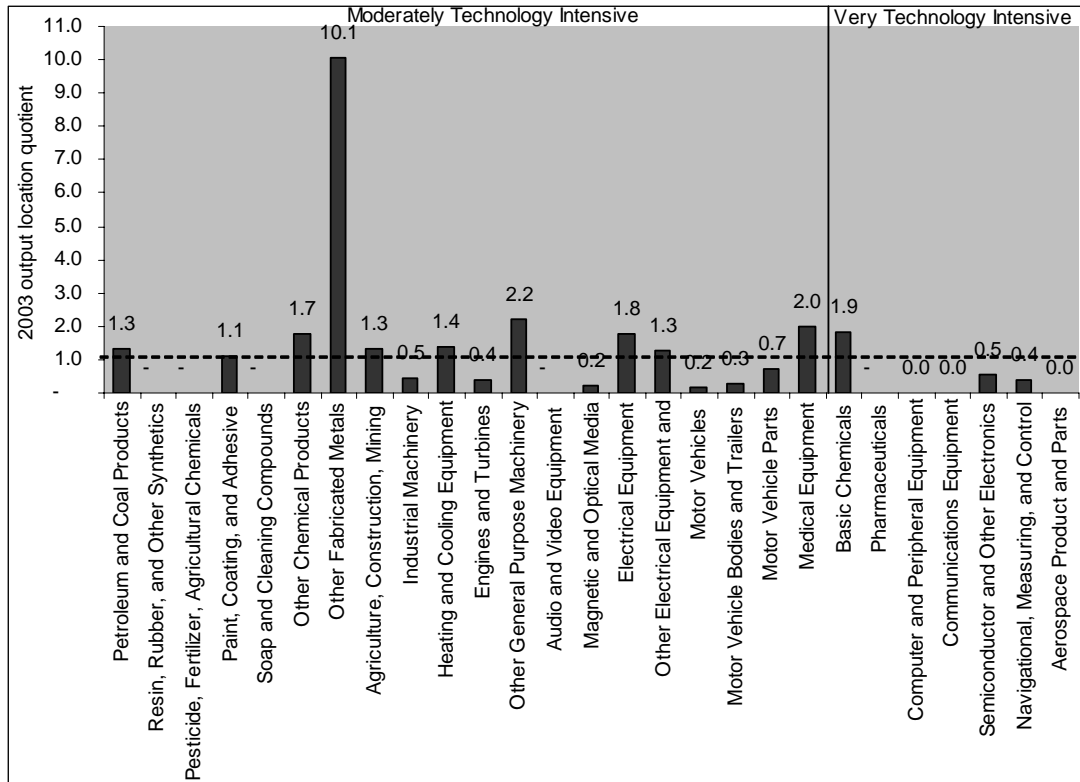


Source: Economy.com

## Technology Intensity

Northwestern Pennsylvania's specialization in moderately technology intensive manufacturing industries exceeds specialization in industries that are very technology intensive. The region is strong in several moderately intensive industries, most notably other fabricated metals, which has a location quotient of 10.1. Other moderately intensive industries in which the region shows higher than average specialization include machinery and medical equipment. The region also has a moderate degree of specialization in basic chemicals, a very technology intense industry.

**Regional Level of Specialization in Technology-Intensive Industries**



Source: Economy.com

Northwestern Pennsylvania is more developed than regional and national peers in many moderately technology-intensive industries, and relative levels of employment in those industries are also higher than average for this region. However, Northwestern Pennsylvania lags state, regional, and national peers in both specialization and employment in very technology intensive industries. Therefore, this region's total technology-intensive employment level is lower than average.

### Regional Employment in Technology-Intensive Industries

		NWIRC	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Employment in Private Sector		<b>7.8%</b>	<b>8.9%</b>	<b>10.9%</b>	<b>9.7%</b>
Moderate Technology Intensive	Manufacturing	5.5%	3.1%	4.4%	3.3%
	Services	0.7%	2.2%	2.6%	2.4%
Very Technology Intensive	Manufacturing	0.9%	1.8%	1.5%	2.0%
	Services	0.7%	1.7%	2.3%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

Source: Economy.com

## NWIRC Drivers (ranked by 2003 output dollars)

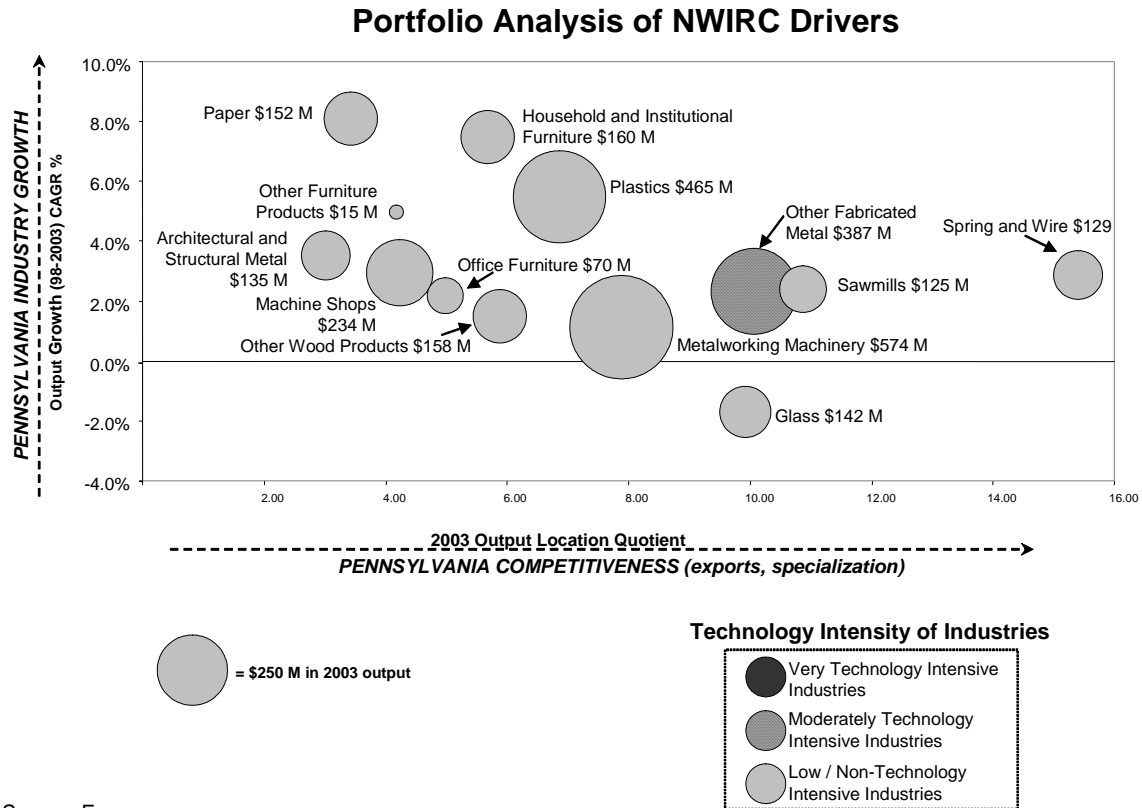
Industry	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)	1993-2003 Change in LQ	Number of Establishments
Metalworking Machinery	\$574	1.8%	1.1%	10.4%	7.89	2.08	205
Plastics	\$465	5.7%	5.5%	5.8%	6.87	2.55	91
Other Fabricated Metal	\$387	0.3%	2.3%	8.0%	10.07	5.47	50
Machine Shops, Screw, Nut, & Bolt Mfg.	\$234	5.1%	2.9%	9.0%	4.24	1.13	186
Household and Institutional Furniture	\$160	6.4%	7.5%	10.5%	5.70	4.03	39
Other Wood Products	\$158	0.6%	1.5%	4.4%	5.89	2.47	62
Glass	\$142	-1.4%	-1.7%	0.1%	9.94	1.12	5
Architectural and Structural Metals	\$135	0.0%	3.5%	-0.3%	3.02	(0.58)	76
Spring and Wire	\$129	-0.7%	2.8%	7.2%	15.42	8.14	11
Sawmills and Wood Preservation	\$125	4.4%	2.4%	3.7%	10.89	5.33	77
Office Furniture	\$70	3.3%	2.2%	1.7%	5.00	1.37	6
Other Furniture	\$15	2.7%	5.0%	10.1%	4.19	2.95	2
<b>Emerging Driver</b>							
Paper	\$152	12.1%	8.1%	15.1%	3.43	2.97	13

Source: Economy.com, Harris Infosource

The economic analysis yielded thirteen drivers and one emerging driver for Northwestern Pennsylvania.

Traditionally, this region has been driven by wood and metal products, plastics, and tooling and machining operations. Based on Deloitte's analysis, those industries and their subsegments all continue to be regional economic drivers. An entire value chain for wood products, from sawmills to furniture and wood product manufacturing, is represented in driver industries, indicating that the region is capturing value from its natural resources. Paper products, which Deloitte analysis identified as an emerging driver, are another link in the value-added end of that chain. A similar effect is shown in metal-related industries, which comprise five of the driver industries. For these wood and metal industries, it continues to be important to focus on value-added products in order to create economic value and, to the extent possible, to avoid the pitfalls of commoditization. Plastics are another important driver for this region, showing both a high location quotient and a consistently strong growth rate.

## Portfolio Analysis of NWIRC Drivers



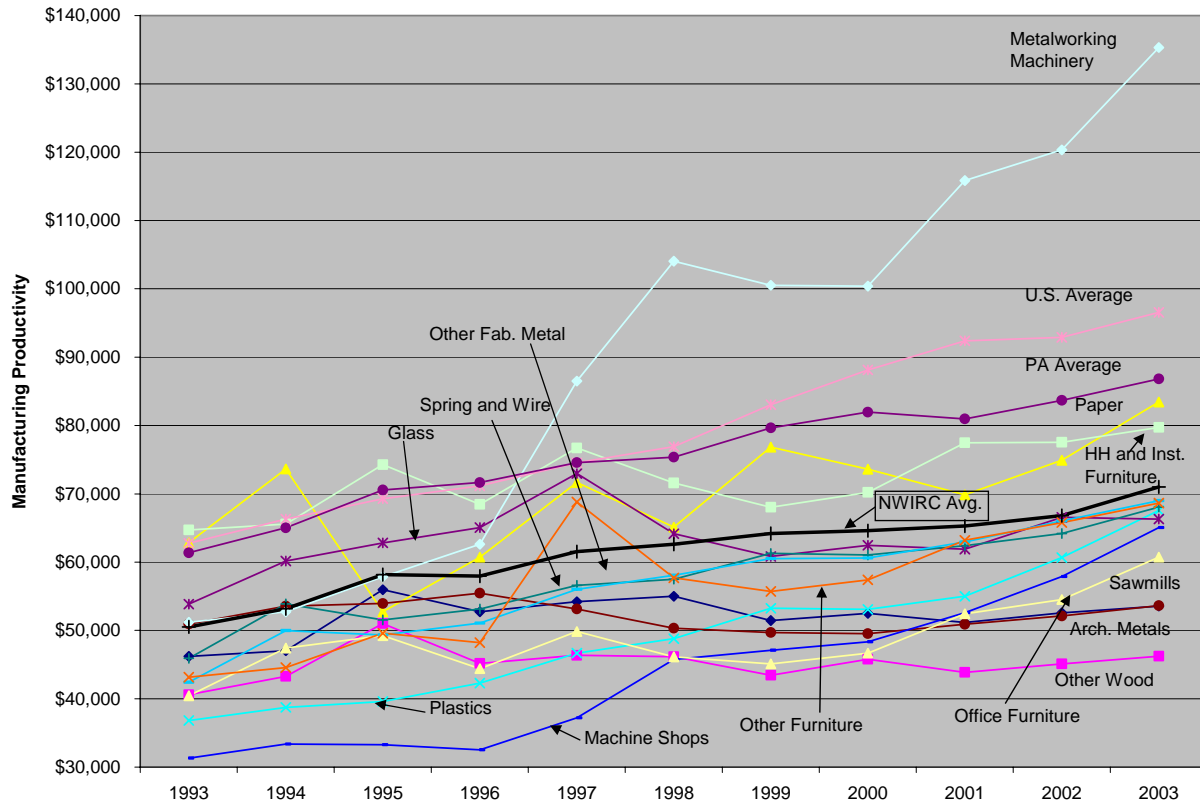
The portfolio analysis demonstrates two impressive facts about driver industries for Northwestern Pennsylvania. First, all of the region's driver industries except glass have shown positive average annual growth over the past five years, despite the recent national recession. Second, all of the NWIRC region's driver industries have location quotients over 3.0, indicating that this region has a high degree of regional industry competitiveness. On a less positive note, the portfolio analysis also makes it clear that only one of the industries driving this region's economy has moderate technology intensity and none have high technology intensity. While the previous section showed specialization in several technology-intensive industries for this region, only other fabricated metals is a regional economic driver.

The driver and portfolio analysis reveals a number of strong growth industries: two furniture-related industries, paper products, and plastics. As mentioned above, all driver industries have a strong level of competitiveness. There are opportunities for NWIRC to build on these strong industries by helping companies develop strategies to drive growth or further build regional specialization. There are also opportunities for the glass industry to increase its growth by innovating, moving up the value chain, and improving operations.



## Productivity in Driver Industries

### Productivity by Industry Productivity = Output per Employee



Source: Economy.com

In Northwestern Pennsylvania, average productivity for manufacturing is \$71,018, much lower than the Pennsylvania average of \$86,814 and the U.S. average of \$96,549. Trends in productivity changes for the region overall have closely mirrored Pennsylvania over the past ten years, with an average annual growth rate of 3.1%, but at a lower dollar level. Only one industry, metalworking machinery, has productivity greater than the U.S. and Pennsylvania average. With productivity of more than \$135,000 per employee and an average annual growth rate of 10%, metalworking machinery is the standout industry for this region in terms of productivity. Unfortunately, as seen in the portfolio analysis, this industry has not had a large increase in output during the past five years. If productivity has increased and output has decreased, it is likely that employment in this industry is declining.

Lower productivity industries that have seen only slight increases in output per employee over time include other wood products, sawmills, and architectural and structural metals. Possible explanations for the lagging performance of these industries could be the commoditization of their products, which leads to price competition and lower output values, or supply-demand imbalances which have forced firms to take temporary capacity shutdowns, which in turn can limit productivity.

### Average Productivity by Industry - NWIRC

	1993-2003		
	1993	2003	CAGR
Metalworking Machinery	\$ 51,195	\$ 135,312	9.2%
Paper	\$ 62,862	\$ 83,435	2.6%
Household and Institutional Furniture	\$ 64,712	\$ 79,717	1.9%
Other Fabricated Metal Product	\$ 42,412	\$ 68,994	4.5%
Other Furniture	\$ 43,157	\$ 68,631	4.3%
Spring and Wire	\$ 45,923	\$ 68,052	3.6%
Plastics Product	\$ 36,828	\$ 67,559	5.7%
Glass	\$ 53,844	\$ 66,294	1.9%
Machine Shops, Screw, Nut, & Bolt Mfg.	\$ 31,327	\$ 65,040	6.9%
Office Furniture	\$ 40,448	\$ 60,739	3.8%
Architectural and Structural Metals	\$ 50,939	\$ 53,635	0.5%
Sawmills and Wood Preservation	\$ 46,185	\$ 53,563	1.4%
Other Wood Products	\$ 40,598	\$ 46,218	1.2%
<b>U.S. Average</b>	<b>\$ 62,757</b>	<b>\$ 96,549</b>	<b>4.0%</b>
<b>PA Average</b>	<b>\$ 61,385</b>	<b>\$ 86,814</b>	<b>3.2%</b>
<b>NWIRC Region Mfg. Average</b>	<b>\$ 50,524</b>	<b>\$ 71,018</b>	<b>3.1%</b>

Source: Economy.com

## Conclusions

Northwestern Pennsylvania's manufacturing economy has been and continues to be driven by a number of highly competitive industries that capitalize on the region's natural resources, particularly wood. Many of these industries are made up of multiple SMEs that traditionally supplied larger firms that are no longer located within the region. Manufacturing remains critical to the region, accounting for 26% of the region's output. Wages in manufacturing remain competitive, offering workers a good standard of living. Specialization and employment in technology-intensive industries, which are also economic drivers, lags both regional and national peers, indicating that there may be an opportunity to drive employment and economic growth by investing to attract or build industries with moderate to high technology intensity. For all industries except metalworking machinery, productivity in this region is below both the U.S. and Pennsylvania averages.

To support the economic drivers of this region, it is important to understand the factors that are driving the high location quotients for driver industries and attempt to maintain those factors in order to support existing enterprises and attract new ones. It will also be important to help companies in wood, metal, plastic, paper, and glass industries develop strategies and innovative products and processes so that they can sustain growth and profitability and avoid commoditization.

Regional Issues (Based on workshops and Deloitte research):

- Decline in OEM and large manufacturing firms that had regional buy/sell relationships with SME firms (e.g., plastics, tool & die). This has caused significant local price pressure and margin decline
- Need for SMEs to look at new markets for customers as old markets decline
- Unskilled labor quality and availability – reported difficulty in finding basic unskilled workers with strong work ethic
- Eastern region transportation infrastructure needs improvement in terms of highway access
- Powdered metals industry consolidation threatens Eastern county growth industries

NWIRC opportunities:

- Help “traditional” manufacturing industries develop growth and innovation strategies that focus on moving up the value chain and avoiding the trap of commoditization
- Help all manufacturers with process improvements/lean manufacturing so that they can achieve or maintain profitability, especially in low-growth or competitive industries
- Agglomeration of SMEs from a supply perspective to build relationships and identify potential new markets

## MANTEC

### Region Analyzed

MANTEC serves SMEs in South Central Pennsylvania. This area has traditionally been a strong manufacturing region, supporting a diverse range of industries. The region is also a major center for public administration, since Harrisburg, the state capital, is located here.

Deloitte's analysis for MANTEC covered the following counties:

- Adams
- Cumberland
- Dauphin
- Fulton
- Franklin
- Lebanon
- Lancaster
- Perry
- York

## Importance of Manufacturing to the Region

South Central Pennsylvania has traditionally been a strong manufacturing region, supporting a diverse set of industries. Running through the region is the Susquehanna River, which goes all the way to Chesapeake Bay, providing early means of transit for East Coast trade. Lancaster County has more than 900 manufacturing establishments and York County is home to more than 700 manufacturing companies. The region also has a strong public sector presence, since it is home to the State Capitol in Harrisburg, and is the primary home for the Pennsylvania Dutch. Many food industries and companies are located here, taking advantage of local products from rich farmland and access to East Coast population centers. In addition, the region has developed new industries, such as Pharmaceuticals.

Manufacturing is the number one industry sector in South Central Pennsylvania, accounting for approximately \$10.9 billion in annual output, more than 19% of the region's total output in 2003. It is also the number one sector for employment in the region, employing more than 144,000 people. The average annual output growth rate for manufacturing over the past ten years has been 1.8%, below the average of 2.7% for all industries within the region. Manufacturing was more adversely affected by the recent recession than other industries. Manufacturing's output growth rate over the past three years was (3.0%), well below the region's average for all industries, which was 2.5%.

**Regional Output and Growth Rate by Industry**

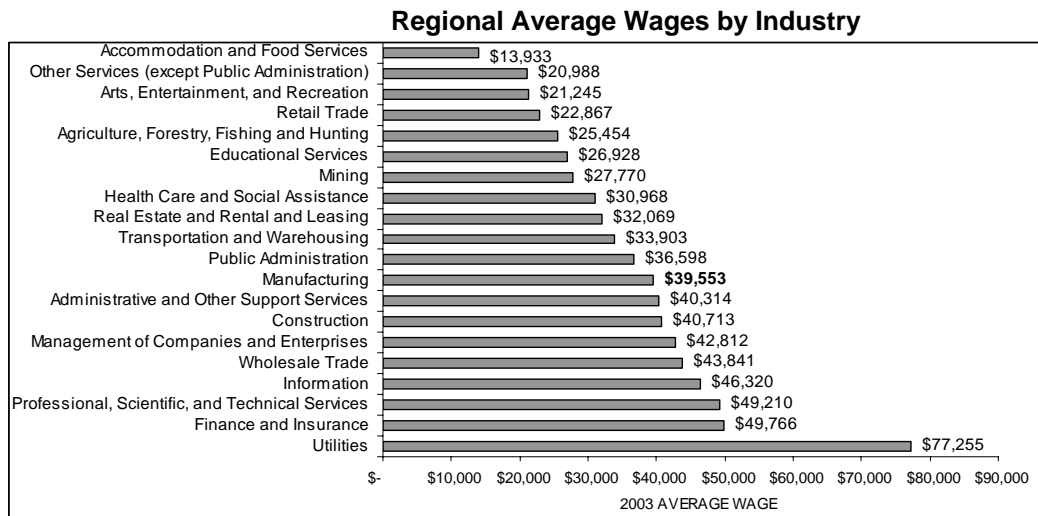
Industry	Employment	2003 Output	00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)	Industry Output as a % of Regional Output
<b>Manufacturing</b>	<b>144,447</b>	<b>\$ 10,874</b>	<b>-3.0%</b>	<b>-0.9%</b>	<b>1.8%</b>	<b>19.3%</b>
Public Administration	130,595	\$ 6,583	0.3%	0.0%	0.7%	11.7%
Real Estate and Rental and Leasing	9,219	\$ 4,825	9.6%	4.8%	4.3%	8.6%
Retail Trade	102,353	\$ 4,734	3.8%	3.4%	4.5%	8.4%
Transportation and Warehousing	36,844	\$ 3,652	20.4%	11.7%	8.4%	6.5%
Finance and Insurance	36,307	\$ 3,584	3.2%	1.9%	1.8%	6.4%
Health Care and Social Assistance	99,185	\$ 3,524	2.9%	2.1%	1.5%	6.3%
Wholesale Trade	37,486	\$ 3,503	3.0%	2.1%	5.0%	6.2%
Administrative and Other Support Services	34,590	\$ 2,565	10.6%	5.6%	5.8%	4.6%
Construction	44,171	\$ 2,505	-0.1%	0.5%	0.8%	4.4%
Professional, Scientific, and Technical Services	28,436	\$ 1,858	0.7%	2.0%	3.2%	3.3%
Other Services (except Public Administration)	44,654	\$ 1,784	4.6%	2.7%	2.5%	3.2%
Accommodation and Food Services	59,567	\$ 1,618	5.1%	3.4%	4.2%	2.9%
Information	16,326	\$ 1,572	2.2%	3.1%	4.0%	2.8%
Utilities	3,503	\$ 1,000	1.3%	1.6%	0.2%	1.8%
Agriculture, Forestry, Fishing and Hunting	4,535	\$ 716	-7.3%	0.6%	0.4%	1.3%
Management of Companies and Enterprises	8,913	\$ 594	-10.5%	-4.8%	-0.9%	1.1%
Educational Services	16,197	\$ 395	2.5%	-0.9%	1.2%	0.7%
Arts, Entertainment, and Recreation	12,559	\$ 323	3.3%	1.2%	2.6%	0.6%
Mining	2,629	\$ 162	5.0%	3.4%	10.5%	0.3%
	872,514	\$ 56,372	2.5%	2.0%	2.7%	

Source: Economy.com

## Personal Income

High wages in manufacturing help contribute to individual income and good standards of living for employees and their families. They are also a factor in attracting workers at all levels to an industry. In MANTEC's service area, manufacturing wages are slightly higher than average relative to other industries.

The fact that manufacturing wages are average relative to other industries may be a contributing factor to the region's challenges with attracting new highly skilled labor to the manufacturing sector. In other regions of Pennsylvania, manufacturing wages are above average relative to other industries.

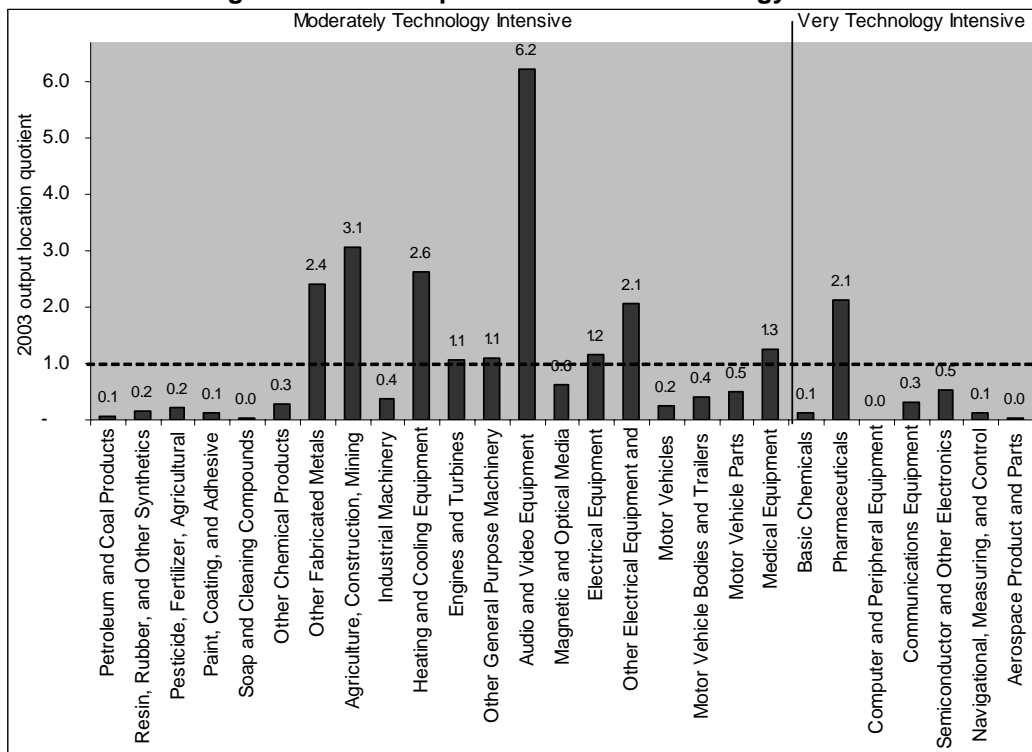


Source: Economy.com

## Technology Intensity

Overall, South Central Pennsylvania’s specialization in technology-intensive industries appears to be fairly healthy. The region’s specialization in moderately technology intensive manufacturing industries exceeds specialization in industries that are very technology intensive. The region is strong in several moderately intensive industries, most notably audio and video equipment, which has a location quotient of 6.2. Other moderately intensive industries in which the region shows some specialization are agriculture, construction, and mining machinery; air conditioning, heating, and ventilation equipment; other fabricated metals; and other electrical equipment. The region also has a relatively high degree of specialization in pharmaceuticals, a very technology intense industry. It has below average levels of specialization in all other very technology intensive industries.

**Regional Level of Specialization in Technology-Intensive Industries**



Source: Economy.com

South Central Pennsylvania is more developed than Pennsylvania and national peers in many moderately technology-intensive industries and relative levels of employment in those industries are also higher than average for this region. However, South Central Pennsylvania lags state, regional, and national peers in both specialization and employment in very technology intensive industries. In total this region’s technology-intensive employment level is lower than average.

### Regional Employment in Technology-Intensive Industries

		MANTEC	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Employment in Private Sector		<b>7.6%</b>	<b>8.9%</b>	<b>10.9%</b>	<b>9.7%</b>
Moderate Technology Intensive	Manufacturing	3.7%	3.1%	4.4%	3.3%
	Services	1.5%	2.2%	2.6%	2.4%
Very Technology Intensive	Manufacturing	1.1%	1.8%	1.5%	2.0%
	Services	1.3%	1.7%	2.3%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

Source: Economy.com



## MANTEC Drivers (ranked by 2003 output dollars)

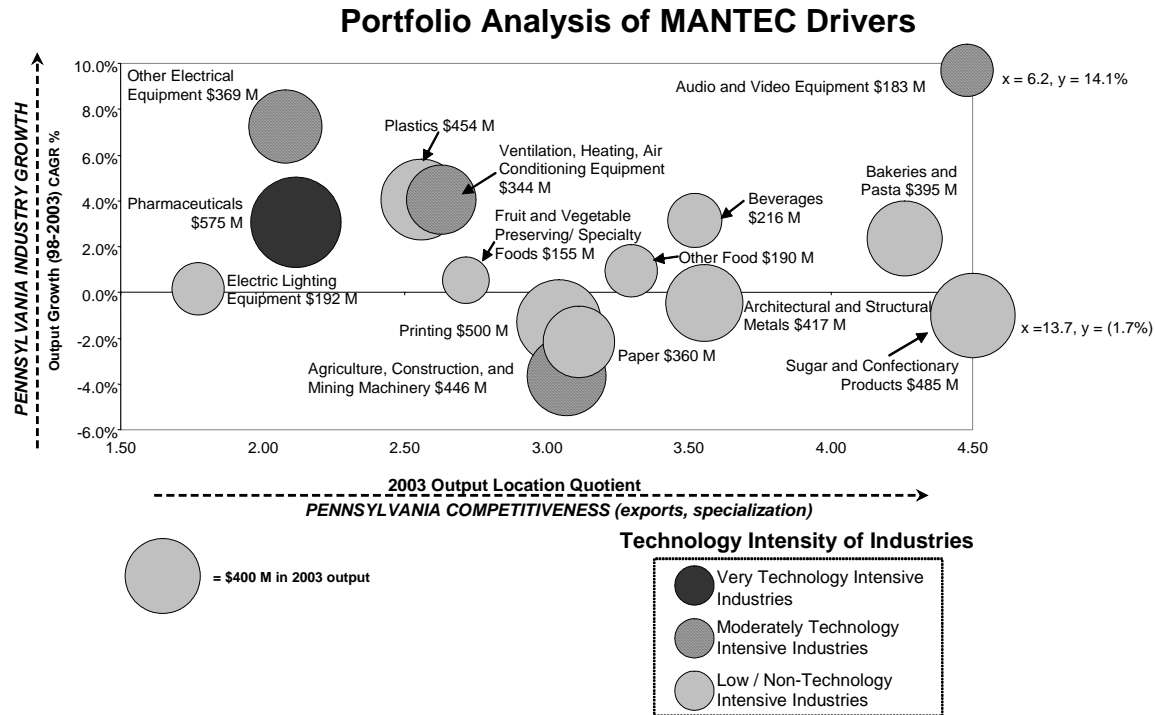
Industry	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)	1993-2003 Change in LQ	Number of Establishments
Pharmaceuticals	\$ 575	1.5%	3.0%	4.2%	2.12	(0.02)	14
Printing	\$ 500	-2.4%	-1.3%	-0.6%	3.04	0.93	345
Sugar and Confectionery Products	\$ 485	-2.7%	-1.7%	-0.2%	13.70	1.04	24
Plastics	\$ 454	2.8%	4.0%	7.8%	2.56	1.28	73
Agriculture, Construction, and Mining Machinery	\$ 446	-1.7%	-3.7%	3.9%	3.07	(1.50)	43
Architectural and Structural Metals	\$ 417	-2.2%	-0.5%	2.1%	3.56	0.35	140
Bakeries and Pasta	\$ 395	1.9%	2.3%	2.9%	4.26	1.70	30
Other Electrical Equipment and Components	\$ 369	7.6%	7.2%	9.4%	2.08	0.07	18
Paper	\$ 360	-4.2%	-2.2%	1.0%	3.12	1.36	65
Ventilation, Heating, Air-Conditioning, Refrigeration Equipment	\$ 344	3.5%	4.0%	11.6%	2.63	0.70	19
Beverages	\$ 216	-2.5%	3.1%	3.2%	3.52	1.18	25
Electric Lighting Equipment	\$ 192	0.7%	0.1%	6.2%	1.77	(1.88)	10
Other Food	\$ 190	-2.0%	0.9%	-0.3%	3.30	0.31	62
Fruit and Vegetable Preserving and Specialty Foods	\$ 155	0.0%	0.5%	1.1%	2.72	0.92	20
<b>Emerging Driver Industries</b>							
Audio and Video Equipment	\$ 183	3.5%	14.1%	22.0%	6.23	4.36	3

Source: Economy.com, Harris Infosource

The economic analysis yielded fourteen drivers and one emerging driver for South Central Pennsylvania.

Traditionally, this region has been home to a wide variety of manufacturing industries as the driver data shows. There is much diversity in the region's output: products ranging from plastics to metals to electrical equipment each contribute a relatively similar share of output. The historic presence of Hershey and many other food product manufacturers and access to agricultural resources and markets has made several food and beverage industries drivers. The pharmaceuticals industry has emerged as the region's largest driver and continues to show healthy growth. While automobile and other vehicles and parts manufacturing have traditionally been part of the economic base of this region, those industries have seen a decline over the past ten years as the overall auto industry has declined. Other industries, such as pharmaceuticals, have grown to fill the void left by the declining drivers.

## Portfolio Analysis of MANTEC Drivers

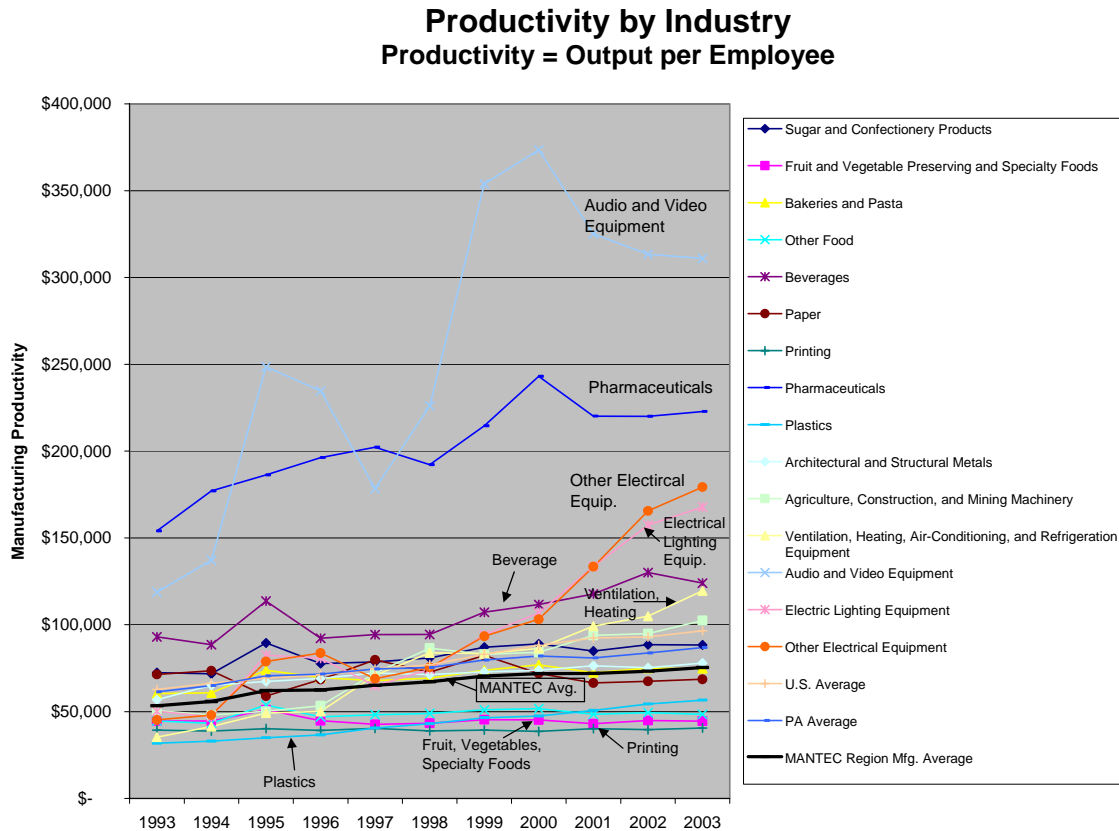


Source: Economy.com

The portfolio analysis shows that this region seems to have a number of fairly stable economic driver industries with moderate degrees of competitiveness. The fact that there are many drivers that contribute relatively similar levels of output means that South Central Pennsylvania's economy is diverse and not heavily dependent on any single manufacturing industry's success to drive the region's economic success.

Food manufacturing industries all have a good level of competitiveness; however, they are not currently high growth drivers and may require process improvement or product innovation in order to drive growth or sustain profitability. Audio and video equipment, identified in the Deloitte analysis as a potential emerging driver, is the region's only driver that has both a high growth rate and a high degree of competitiveness. It is also one of the few technology-intensive drivers for this region and is fairly small relative to other driver industries in this region. It may be important to understand the dynamics of this industry and identify ways to further develop and support it in the region, especially if other industries, such as motor vehicles and parts manufacturing, continue to decline. Architectural and structural metals, paper products, printing, and agriculture, construction, and mining equipment are all industries with moderate levels of competitiveness but negative growth rates. These industries might need to consider their strategic direction and try to move towards products that are specialized in order to capture higher profit margins, drive growth, and maintain regional competitiveness. Other electrical equipment; heating, air conditioning and ventilation equipment, and pharmaceuticals are all technology intensive industries with moderate growth rates in the region but less competitiveness than other South Central Pennsylvania driver industries. These industries need opportunities to continue their growth and improve their competitiveness to develop a stronger need for their continued location in the region.

## Productivity in Driver Industries



Source: Economy.com

In South Central Pennsylvania, average productivity for manufacturing is \$75,283, lower than the Pennsylvania average of \$86,814 and the U.S. average of \$96,549. Trends in productivity changes have closely mirrored Pennsylvania over the past ten years, with an overall average annual productivity growth rate for the region of 3.2%. Leading industries in terms of productivity are audio and video equipment and pharmaceuticals. Productivity in audio and video equipment increased more than 160% from \$118,732 output per employee in 1993 to \$310,913 in 2003. Productivity in pharmaceuticals has increased nearly 50% over the past ten years from \$154,013 to \$222,860. Other industries with very high levels of current productivity include other electrical equipment and electrical lighting equipment, both of which have also seen impressive increases in productivity over the past ten years. Ventilation equipment has also seen impressive growth, increasing from \$35,240 in 1993 to \$119,556 in 2003. Lower productivity industries that have seen slower increases in output per employee over the past ten years include printing, fruit and vegetable preserving, and other food.

### Average Productivity by Industry – MANTEC

	1993-2003		
	1993	2003	CAGR
Audio and Video Equipment	\$ 118,732	\$ 310,913	9.1%
Pharmaceuticals	\$ 154,013	\$ 222,860	3.4%
Other Electrical Equipment	\$ 45,119	\$ 179,298	13.4%
Electric Lighting Equipment	\$ 50,149	\$ 167,810	11.6%
Beverages	\$ 92,967	\$ 123,988	2.7%
Ventilation, Heating, Air-Conditioning, and Refrigeration Equipment	\$ 35,240	\$ 119,556	11.7%
Agriculture, Construction, and Mining Machinery	\$ 50,513	\$ 102,407	6.6%
Sugar and Confectionery Products	\$ 72,450	\$ 88,385	1.8%
Architectural and Structural Metals	\$ 56,796	\$ 77,929	2.9%
Bakeries and Pasta	\$ 60,322	\$ 74,719	2.0%
Paper	\$ 71,404	\$ 68,512	-0.4%
Plastics	\$ 31,762	\$ 56,608	5.4%
Other Food	\$ 44,565	\$ 48,463	0.8%
Fruit and Vegetable Preserving and Specialty Foods	\$ 44,615	\$ 44,446	0.0%
Printing	\$ 39,345	\$ 40,561	0.3%
U.S. Average	\$ 62,757	\$ 96,549	4.0%
PA Average	\$ 61,385	\$ 86,814	3.2%
MANTEC Region Mfg. Average	\$ 53,353	\$ 75,283	3.2%

Source: Economy.com

## Conclusions

Manufacturing is an important part of South Central Pennsylvania's economy, accounting for more than 19% of the region's total output in 2003. The region's manufacturing economy is driven by a diverse set of industries. This diversity is fairly unique to MANTEC's region of Pennsylvania. Many other regions in the Commonwealth are or have been heavily dependent on a specific industry, such as steel, and have felt the impact if that industry subsequently declines. MANTEC's manufacturing diversity should be healthy for the overall economy of the region over time, because the decline of any single industry should not have a devastating effect on the region.

The potential negative side of this diversity is that industries may be locating in this region based on convenient access to large population center markets, distribution (interstates, water, etc.), and less expensive labor, not because of any specific natural resources or other factors unique to the region. As such, there is a danger that firms or industries in the region would find it easy to relocate if economic factors (access to raw materials, less expensive labor, etc.) were more favorable elsewhere. There might be an opportunity for MANTEC to take a role in understanding the factors that make this region attractive to each industry and helping to develop or advocate infrastructure, public policy, and business environment that supports manufacturing and helps the region continue to attract businesses.

It may also be important to identify emerging drivers such as audio and video equipment, industries that are developing and growing in the region and that can grow and replace declining drivers.

An overarching issue that many manufacturers in this region raised was the dearth of highly skilled and management talent entering manufacturing industries. This region has a manufacturing workforce that is aging and rapidly nearing retirement, but there is a shortage of young, skilled talent to replace retiring workers. Those workers that do replace experienced, skilled talent require a significant amount of training before they reach the productivity levels of the workers they replace, and this training takes a considerable amount of time and money. While the region does have its fair share of universities and trade/vocational schools, moderate wages, a negative stigma attached to manufacturing, and a lack of excitement about lifestyle in the region have led to a drain of management-level talent. There appears to be a significant opportunity for MANTEC to help advocate manufacturing careers to young people and work with companies to help recruit, train, and retain management and highly skilled labor. One possible opportunity is to help develop better relationships between SMEs and local educational institutions through intern or apprenticeship programs.

Regional Issues (Based on workshops and Deloitte research):

- Attracting and retaining white collar skilled workers
- Challenges to core food processors to remain cost-competitive while developing new products
- Leveraging OEM and Tier 1 companies to create drivers in transportation manufacturing and other local industries, through developing stronger inter-regional buy/sell relationships with recent OEM investment.

MANTEC opportunities:

- Help develop a world-class workforce in South Central Pennsylvania by serving as a regional workforce development and education intermediary to improve connections among employers, job seekers, academic institutions, and workforce providers
- Help “traditional” manufacturing industries develop growth and innovation strategies that focus on moving up the value chain and avoiding the trap of commoditization
- Help all manufacturers with process improvements/lean manufacturing so that they can achieve or maintain profitability, especially in low-growth or competitive industries
- Help identify existing companies (including those that may need to move to new markets and products for survival) and/or attract new investment to the region to build out buy-sell clusters around key industries

## IMC

### Region Analyzed

IMC IRC serves SMEs in North Central Pennsylvania, which is an area that encompasses a diverse history of manufacturers. Many manufacturers are based there for access to the local natural resources such as wood and metals. This region covers areas ranging from traditional “railroad towns” to State College, the home of Penn State University.

Deloitte’s analysis for IMC covered the following counties:

- Blair
- Centre
- Clinton
- Huntington
- Juniata
- Lycoming
- Mifflin
- Montour
- Northumberland
- Snyder
- Union

## Importance of Manufacturing to the Region

Much of this region's manufacturing history has been built on its natural resources. For example, wood and wood products have been a base driver for the region as have fruit and vegetable preserving and metals manufacturing. The region also had a strong association with the railroad industry. As some of the traditional manufacturing industries have slowed or declined, other industries, such as pharmaceuticals, health-related services, and retail, have grown to replace them. Even with strong growth in services, manufacturing remains the biggest driver of this region.

Manufacturing is the number one industry sector in North Central Pennsylvania, accounting for approximately \$3.9 billion in annual output, 21.8% of the region's total output in 2003. It is the second largest sector for employment in the region, employing more than 66,000 people. The average annual output growth rate for manufacturing over the past ten years has been 2.7%, above the average of 2.2% for all industries within the region. Manufacturing was more adversely affected by the recent recession than other industries. Manufacturing's output growth rate over the past three years was (0.2%), well below the region's average of 2.2%.

**Regional Output and Growth Rate by Industry**

Industry	Employment	2003 Output	00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)	Industry Output as a % of Regional Output
<b>Manufacturing</b>	<b>66,087</b>	<b>\$ 3,926</b>	<b>-0.2%</b>	<b>1.5%</b>	<b>2.7%</b>	<b>21.8%</b>
Public Administration	69,655	\$ 3,230	-1.9%	-0.7%	0.7%	17.9%
Retail Trade	38,311	\$ 1,592	2.8%	2.3%	3.6%	8.8%
Health Care and Social Assistance	42,575	\$ 1,414	2.3%	0.3%	0.5%	7.8%
Real Estate and Rental and Leasing	2,348	\$ 1,147	7.0%	3.6%	4.8%	6.4%
Transportation and Warehousing	10,719	\$ 900	13.7%	6.0%	2.8%	5.0%
Finance and Insurance	8,513	\$ 794	5.0%	5.0%	1.9%	4.4%
Wholesale Trade	9,971	\$ 771	6.0%	3.2%	5.4%	4.3%
Construction	11,908	\$ 685	0.3%	0.3%	-0.3%	3.8%
Accommodation and Food Services	24,022	\$ 562	6.4%	3.9%	4.0%	3.1%
Agriculture, Forestry, Fishing and Hunting	1,505	\$ 478	4.9%	7.5%	4.4%	2.7%
Other Services (except Public Administration)	14,123	\$ 470	6.0%	2.3%	1.9%	2.6%
Administrative and Other Support Services	7,372	\$ 435	9.9%	2.7%	3.1%	2.4%
Professional, Scientific, and Technical Services	8,253	\$ 430	4.0%	2.5%	2.4%	2.4%
Information	5,382	\$ 413	0.6%	2.7%	2.7%	2.3%
Educational Services	8,891	\$ 267	14.4%	12.2%	4.6%	1.5%
Management of Companies and Enterprises	2,599	\$ 191	-6.6%	-2.5%	0.1%	1.1%
Utilities	1,040	\$ 174	-8.0%	-3.8%	-4.6%	1.0%
Mining	467	\$ 77	6.9%	5.2%	6.0%	0.4%
Arts, Entertainment, and Recreation	3,173	\$ 58	-0.1%	-2.3%	0.4%	0.3%
	336,913	\$ 18,014	2.2%	1.8%	2.2%	

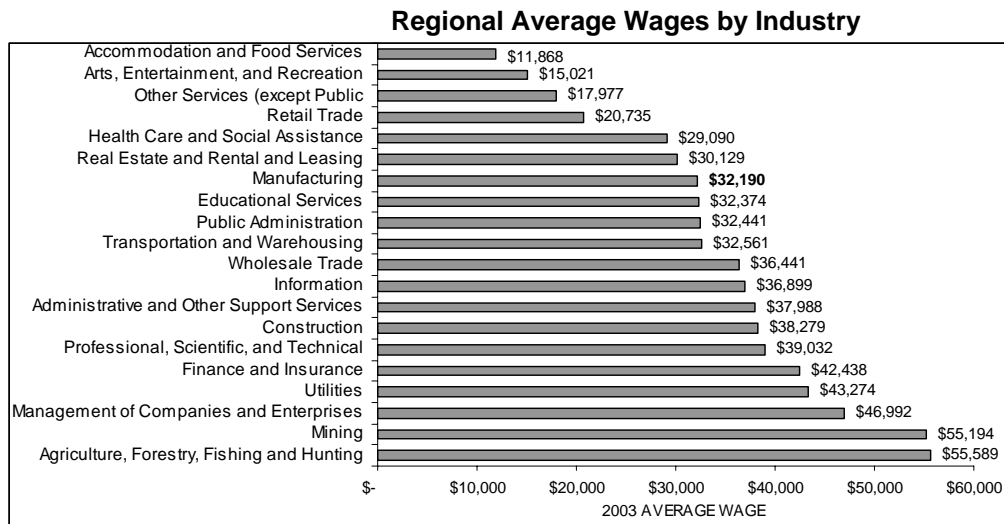
Source: Economy.com



## Personal Income

High wages in manufacturing help contribute to individual income and good standards of living for employees and their families. They are also a factor in attracting workers at all levels to an industry. In IMC's service area, manufacturing wages are slightly lower than average relative to other industries. For all industries, wages for this region tend to be lower than other areas in Pennsylvania and the country, making it an attractive location for businesses to locate and have access to a strong pool of talent.

The fact that manufacturing wages are lower than average relative to other industries may be a reflection of the fact that the region's workers tend to be at a low- to semi-skilled level or that they are not highly unionized. Lower wages may be a contributing factor to the region's challenges with attracting new highly skilled or management-level labor to the manufacturing sector. In other regions of Pennsylvania, manufacturing wages are above average relative to other industries, potentially making manufacturing a more appealing sector for workers.

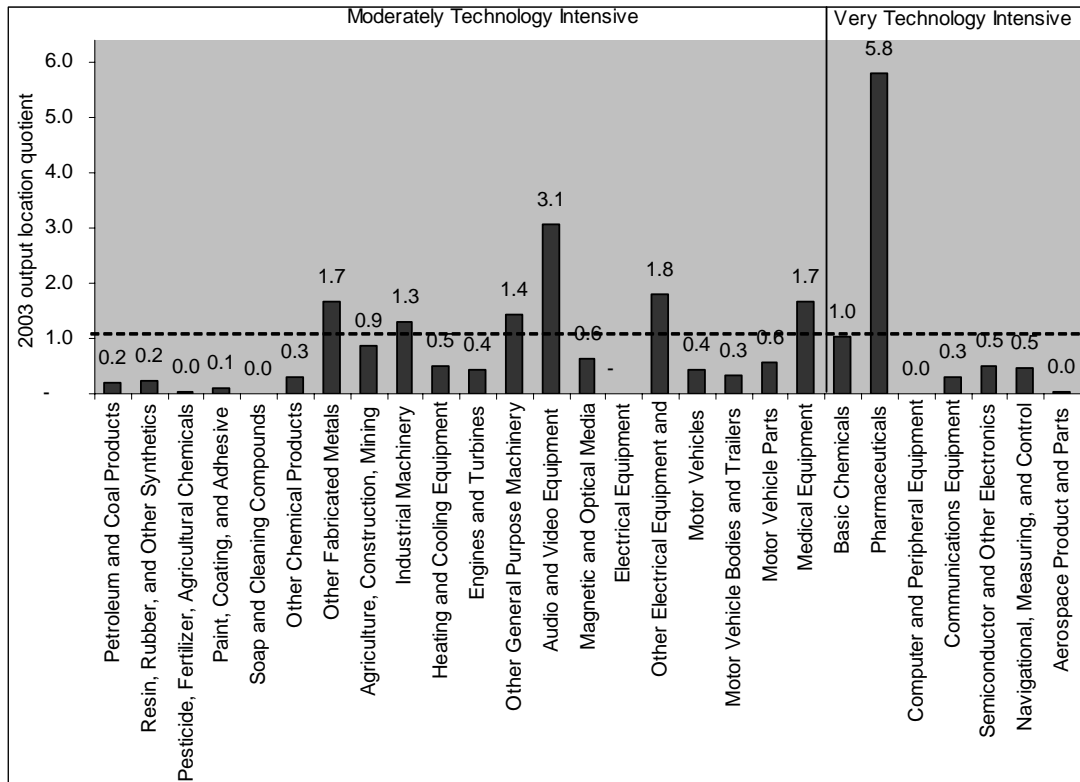


Source: Economy.com

## Technology Intensity

A chart showing North Central Pennsylvania's specialization in technology-intensive manufacturing industries yields some interesting findings. Specialization in pharmaceuticals, a very technology-intensive industry, is very strong for this region. With a location quotient of 5.8, it is much more regionally competitive than any other industry. Specialization in basic chemicals is about average with the rest of the country; this may reflect some "spillover" effect of pharmaceuticals involving the chemicals industry and raising its location quotient for the region. Levels of specialization in moderately technology-intensive industries are moderate, with audio and video equipment leading the pack.

**Regional Level of Specialization in Technology-Intensive Industries**



Source: Economy.com

North Central Pennsylvania is more developed than Pennsylvania and national peers in many moderately technology-intensive industries and one very technology-intensive industry (pharmaceuticals); relative levels of employment in those industries are also higher than average for this region. The pharmaceuticals industry employs more than 4,700 people in this region.

### Regional Employment in Technology-Intensive Industries

		IMC	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Employment in Private Sector		<b>10.4%</b>	<b>8.9%</b>	<b>10.9%</b>	<b>9.7%</b>
Moderate Technology Intensive	Manufacturing	3.9%	3.1%	4.4%	3.3%
	Services	1.2%	2.2%	2.6%	2.4%
Very Technology Intensive	Manufacturing	4.1%	1.8%	1.5%	2.0%
	Services	1.1%	1.7%	2.3%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

Source: Economy.com

## IMC Drivers (ranked by 2003 output dollars)

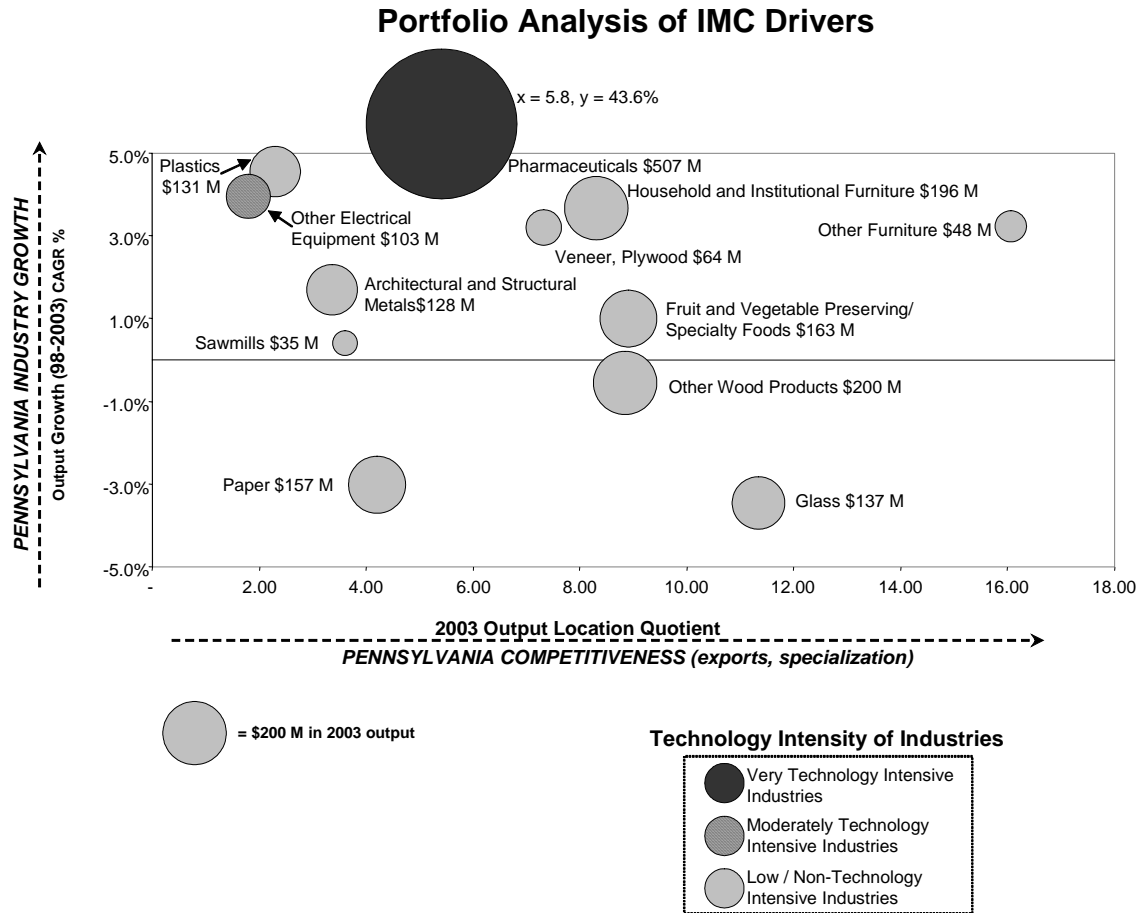
Industry	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)	1993-2003 Change in LQ	Number of Establishments
Other Wood Products	\$200	-1.9%	-0.6%	3.0%	8.85	3.19	70
Household and Institutional Furniture	\$196	2.8%	3.6%	5.0%	8.31	4.29	57
Fruit and Vegetable Preserving and Specialty Foods	\$163	-3.8%	1.0%	-0.2%	8.91	2.35	5
Paper	\$157	-5.1%	-3.0%	1.5%	4.22	2.05	30
Glass	\$137	-6.1%	-3.5%	0.7%	11.36	2.41	5
Plastics	\$131	3.2%	4.5%	6.2%	2.30	0.99	35
Architectural and Structural Metals	\$128	2.2%	1.7%	3.2%	3.38	0.77	47
Other Electrical Equipment and Components	\$103	0.8%	3.9%	9.2%	1.80	0.10	8
Veneer, Plywood, and Engineered Wood Products	\$64	2.6%	3.2%	5.2%	7.33	3.52	8
Other Furniture Related Products	\$48	2.8%	3.2%	7.2%	16.06	10.04	3
Sawmills and Wood Preservation	\$35	-1.0%	0.4%	4.5%	3.62	2.01	59
<b>Emerging Driver Industries</b>							
Pharmaceuticals	\$507	36.1%	43.6%	31.1%	5.81	5.36	6

The economic analysis yielded eleven drivers and one emerging driver for North Central Pennsylvania.

It is interesting to review the drivers for this region and see the changes that have taken place over the last ten years. Base economic industries, such as wood and wood products or fruit and vegetable products, which are based on local natural resources, continue to be economic drivers for the region. The entire value chain for wood, from sawmills to furniture and paper products, is represented in the region, indicating that the region is capturing value from its natural resources. Most of these traditional industries are similar in size, indicating a good level of diversity among traditional driver industries. Recent growth for these traditional industries has been moderate, with some industries' output decreasing in recent years, possibly due to product commoditization and customer pricing pressure, which may have reduced selling prices.

In contrast to these traditional industries, pharmaceuticals, which has emerged in the last ten years to become the region's largest driver, has more than two and a half times the output of the next largest driver industry. Despite the fact that it is so large, Deloitte analysis identified pharmaceuticals as an "emerging" driver because it has had high double-digit growth rates over the past ten years. It is exciting to see new drivers emerge to be so large so quickly, and it may be important for North Central Pennsylvania to develop new drivers to fill in gaps left by declining or departing driver industries. However, the region should be cautious not to become too dependent on the pharmaceuticals industry. Reliance on any single industry to drive the region's economy could lead to long-term problems if that industry declines or departs the region. Since the pharmaceuticals industry in the region appears to be concentrated into a small number of large firms, the departure of any one firm could have a major impact on the region.

## Portfolio Analysis of IMC Drivers



Source: Economy.com

The portfolio analysis shows that this region seems to have a number of fairly stable economic driver industries with strong degrees of competitiveness. In this region, nearly all of the driver industries have location quotients over 2.0 and five industries have location quotients over 8.0. Nearly all have seen some level of growth over the past five years, but growth has been moderate (less than 5%) for every industry except pharmaceuticals. The glass, paper, and other wood products industries have all had negative average growth over the past five years, possibly due to commoditization and pricing pressures. There is probably an opportunity to review the strategies and operations for firms within these and some of the lower-growth industries to develop ways to drive growth, develop differentiated products, and improve supply chain costs so that these industries can sustain their competitiveness and profitability and avoid the commoditization trap.

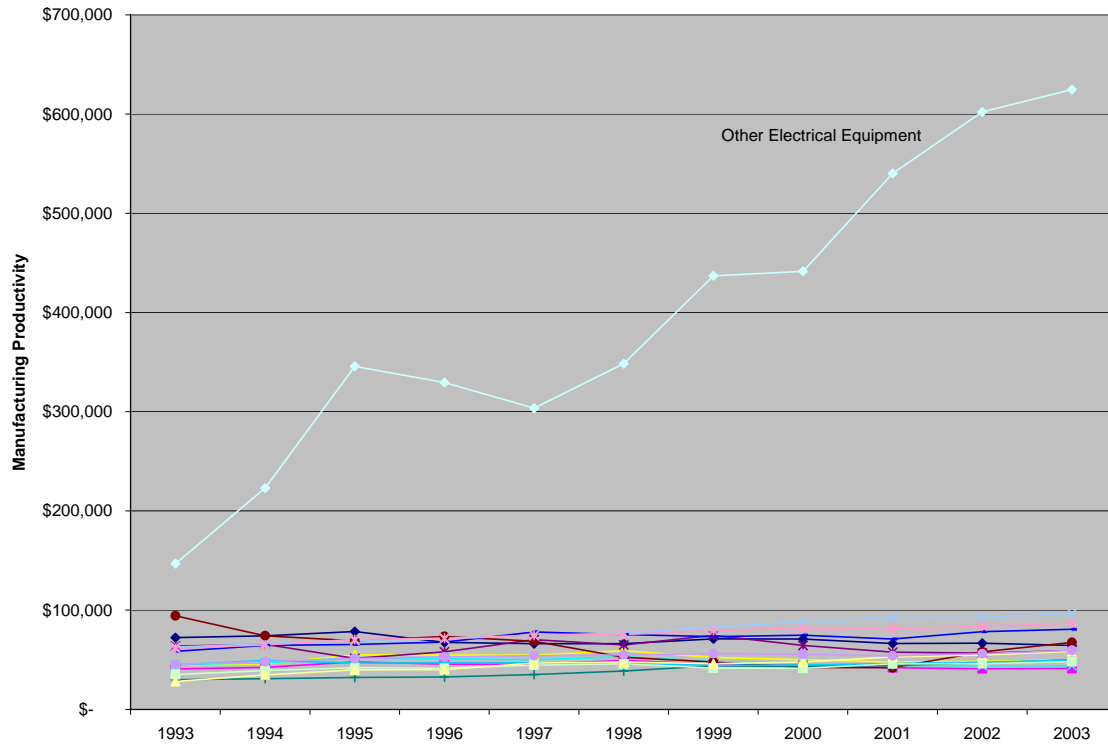
The fact that there are many drivers that contribute relatively similar levels of output indicates that North Central Pennsylvania's manufacturing economy has been fairly diverse and not heavily dependent on any single industry's success to drive the region's economic success. As mentioned above, the region is currently dominated by pharmaceuticals and while we applaud the cultivation and growth of this industry, caution should be taken that the region does not

focus on a single industry and neglect opportunities to develop and build other driver industries to maintain some diversity.

The portfolio chart also shows that only two of North Central Pennsylvania's driver industries, pharmaceuticals and other electrical equipment, have a moderate to high level of technology intensity. These two industries are also two of the highest-growth industries for the region over the past five years. There may be an opportunity to attract other technology-intensive industries to the region to help drive further growth.

## Productivity in Driver Industries

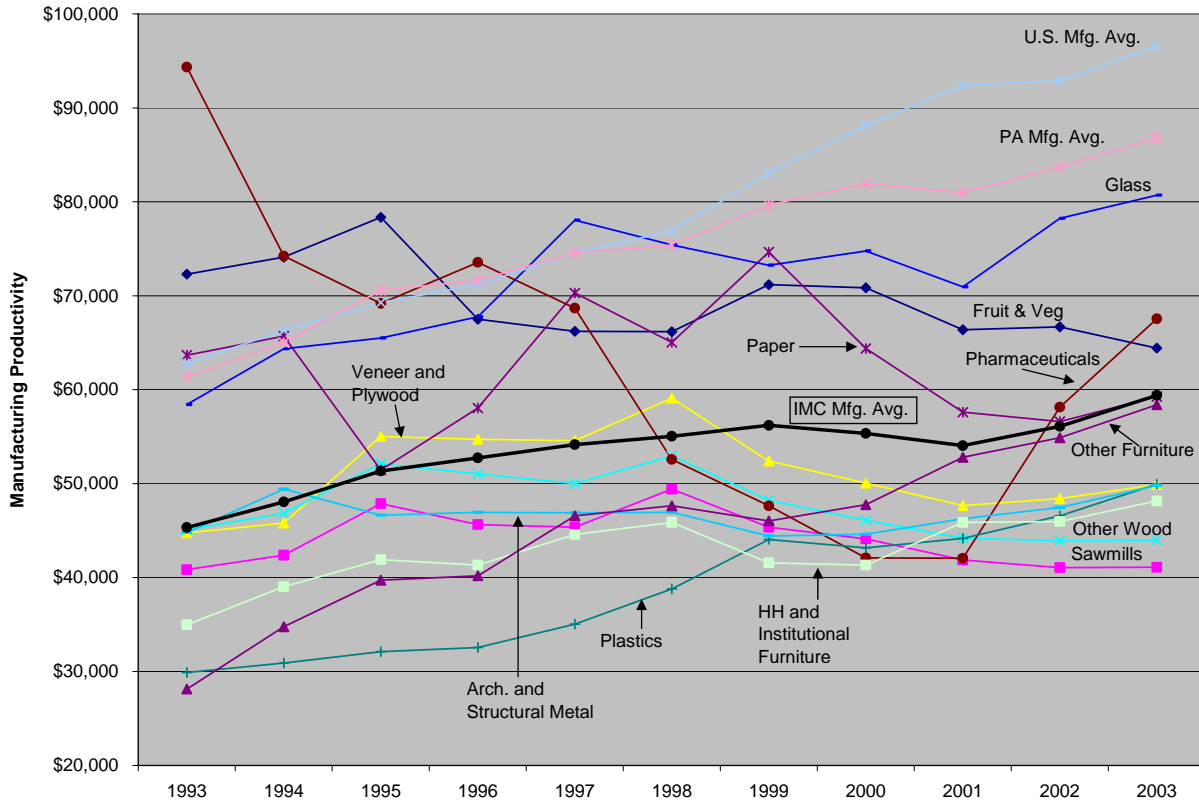
### Productivity by Industry Productivity = Output per Employee



Source: Economy.com

In North Central Pennsylvania, other electrical equipment dominates all other industries in terms of productivity. With output per worker at \$624,623, productivity in this industry is nearly eight times higher than any other industry in the region and has shown significant increases over the past ten years. Other electrical equipment is also the only industry in the region that has productivity that is higher than the Pennsylvania and U.S. averages.

**Productivity by Industry, Excluding Other Electrical Equipment  
Productivity = Output per Employee**



Source: Economy.com

Removing other electrical equipment from the graph shows the performance of the other industries in the region. The average productivity for manufacturing in North Central Pennsylvania is \$59,403, significantly lower than the Pennsylvania average of \$86,814 and the U.S. average of \$96,549. The average annual growth rate for productivity in the region (including the high-performing other electrical equipment industry) is 2.5%, which is below Pennsylvania (3.2%) and U.S. (4.0%) averages. There appears to be a big opportunity in this region to improve productivity in most industries.

The second highest performing industry is glass with productivity of \$80,701. The pharmaceuticals industry is also relatively strong for the region, but productivity in pharmaceuticals has decreased by nearly \$27,000 per employee since 1993. Industries with lower productivity in this region include sawmills, other wood products, and household and institutional furniture. Several industries in this region have seen declines in productivity over the past ten years. In addition to pharmaceuticals, food, paper, and other wood products have all declined.



### Average Productivity by Industry - IMC

	1993-2003		
	1993	2003	CAGR
Other Electrical Equipment	\$ 146,952	\$ 624,613	14.1%
Glass	\$ 58,426	\$ 80,701	3.0%
Pharmaceuticals	\$ 94,331	\$ 67,533	-3.0%
Fruit and Vegetable Preserving and Specialty			
Food	\$ 72,287	\$ 64,433	-1.0%
Paper	\$ 63,677	\$ 59,265	-0.7%
Other Furniture	\$ 28,120	\$ 58,394	6.9%
Plastics	\$ 29,906	\$ 49,935	4.8%
Veneer and Plywood	\$ 44,739	\$ 49,901	1.0%
Architectural and Structural Metals	\$ 44,792	\$ 49,805	1.0%
Household and Institutional Furniture	\$ 34,961	\$ 48,146	3.0%
Other Wood Products	\$ 45,091	\$ 43,991	-0.2%
Sawmills	\$ 40,838	\$ 41,085	0.1%
U.S. Average	\$ 62,757	\$ 96,549	4.0%
PA Average	\$ 61,385	\$ 86,814	3.2%
IMC Region Mfg. Average	\$ 45,321	\$ 59,403	2.5%

Source: Economy.com

## Conclusions

North Central Pennsylvania has a strong manufacturing economy, which provides more than one-fifth the total economic output for the region. Cost-competitive wages, a high-quality workforce, and proximity to major population centers make the region attractive to manufacturing companies.

An overarching issue that many manufacturers in this region raised was the scarcity of highly skilled and management talent entering manufacturing industries. Younger workers that companies do find to replace experienced, skilled talent require a significant amount of training before they reach the productivity levels of the workers they replace and this training takes a considerable amount of time and money. While the region has its fair share of universities and trade/vocational schools, moderate wages, a negative stigma attached to manufacturing, and a lack of excitement about lifestyle in the region have led to a lack of management-level talent. There appears to be a significant opportunity for IMC to help advocate manufacturing careers to young people and work with companies to help recruit, train, and retain management and highly skilled labor. One possible opportunity is to develop better relationships between SMEs and local educational institutions through management training, intern, or apprenticeship programs.

The economy for this region is transitioning from one based on natural resources and railroads to a more diverse set of core industries. While manufacturing industries such as forestry and wood products remain important to the region, new industries such as pharmaceuticals and other electrical equipment have developed a strong presence. There may be an opportunity to promote the region as a leader in health care services and use its strong talent pool in that field in order to attract more health and medical industries that are related to pharmaceuticals, such as medical equipment, clinical testing, or call centers. Building a set of related industries and developing a pool of skilled talent may develop a regional competitive advantage in health-care related industries and create more of a location factor for the pharmaceuticals industry. In the meantime, the region should be careful to balance its priorities between helping cultivate the booming pharmaceuticals industry, sustaining current manufacturing industries, and attracting new industries, particularly ones with higher technology intensity.

Regional Issues (based on workshops and Deloitte research):

- Access to the region
- Retaining the value add investment within the region through building out the regional cluster relationships
- Attracting and retaining white collar skilled workers
- Attracting and retaining workers with technology skills

IMC opportunities:

- Assist with recruitment, development, and training of skilled talent. Build programs that link educational institutions with manufacturers to develop talent. Advocate manufacturing as an attractive career path and the region as one that offers a favorable quality of life
- Help “traditional” manufacturing industries develop growth and innovation strategies that focus on moving up the value chain and avoiding the trap of commoditization
- Help all manufacturers with process improvements/lean manufacturing so that they can achieve or maintain profitability, especially in low-growth or competitive industries

- Help identify and attract new industries to the region, including those that build on the strong health services skills already present and those that might increase the region's participation in technology-intensive industries.
- Continue to build and leverage Penn College

## **Manufacturers Resource Center (MRC)**

### **Region Analyzed**

MRC serves SMEs in the Greater Lehigh Valley Region. Originally a stronghold of the iron, steel, and coal industries, the region has shifted in recent times to support a diverse set of manufacturing and service industries. Proximity to major cities and easy transportation access have made this region an attractive place for firms to locate.

Deloitte's analysis for MRC covered the following counties:

- Berks
- Carbon
- Lehigh
- Northampton
- Schuylkill

## Importance of Manufacturing to the Region

The birthplace of America's Industrial Revolution, the Greater Lehigh Valley Region has long been a manufacturing-based economy. This region has also had a long history of adapting to changes in the economy by cultivating new industries as mature ones decline. With the opening of the Lehigh Canal and railroads in the 1800s, the region boomed with the iron, steel, and coal industries. As those industries declined, the region moved into textiles, and now has shifted to a diverse manufacturing economy, driven by companies with products ranging from trucks to candy, musical instruments, and crayons. Supported by research and development activities at local universities, the region has been actively courting biopharm industries and is now home to more than 20 biopharm companies. Although manufacturing remains the biggest sector of the economy, the region's economic diversity has now broadened to include many service industries.

Manufacturing is the number one industry sector in the Greater Lehigh Valley Region, accounting for approximately \$7 billion in annual output, which is 21.8% of the region's total output in 2003. It is also the largest sector for employment in the region employing more than 86,000 people. The average annual output growth rate for manufacturing over the past ten years has been 0.8%, below the average of 2.2% for all industries within the region. Manufacturing was more adversely affected by the recent recession than other industries. Manufacturing's output growth rate over the past three years was (4.2%), well below the region's average of 1.0%.

**Regional Output and Growth Rate by Industry**

Industry	Employment	2003 Output	00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)	Industry Output as a % of Regional Output
<b>Manufacturing</b>	<b>86,548</b>	<b>\$ 7,061</b>	<b>-4.2%</b>	<b>-0.7%</b>	<b>0.8%</b>	<b>21.8%</b>
Real Estate and Rental and Leasing	5,664	\$ 2,875	9.1%	5.3%	5.6%	8.9%
Public Administration	66,186	\$ 2,703	3.1%	2.0%	2.0%	8.3%
Retail Trade	61,063	\$ 2,669	2.0%	2.6%	3.6%	8.2%
Health Care and Social Assistance	66,884	\$ 2,399	2.6%	1.7%	1.1%	7.4%
Finance and Insurance	20,029	\$ 2,048	0.9%	2.0%	0.9%	6.3%
Administrative and Other Support Services	23,232	\$ 1,799	6.4%	4.8%	5.4%	5.5%
Wholesale Trade	17,075	\$ 1,711	1.9%	2.0%	4.5%	5.3%
Utilities	4,827	\$ 1,415	1.6%	3.2%	1.3%	4.4%
Construction	22,050	\$ 1,262	-1.7%	0.2%	0.5%	3.9%
Professional, Scientific, and Technical Services	17,032	\$ 1,169	1.2%	1.9%	2.7%	3.6%
Transportation and Warehousing	15,259	\$ 1,138	8.7%	4.1%	5.3%	3.5%
Other Services (except Public Administration)	27,274	\$ 1,085	4.5%	2.0%	2.0%	3.3%
Information	10,035	\$ 967	-1.9%	0.5%	2.9%	3.0%
Accommodation and Food Services	34,380	\$ 926	5.4%	3.5%	4.2%	2.9%
Management of Companies and Enterprises	6,989	\$ 375	-11.1%	-4.8%	-1.5%	1.2%
Educational Services	13,067	\$ 302	-1.8%	-2.7%	-0.2%	0.9%
Agriculture, Forestry, Fishing and Hunting	2,728	\$ 249	-9.4%	0.2%	1.0%	0.8%
Arts, Entertainment, and Recreation	7,432	\$ 191	-2.8%	-2.4%	0.4%	0.6%
Mining	583	\$ 102	0.9%	-1.6%	4.6%	0.3%
	508,337	\$ 32,446	1.0%	1.6%	2.2%	

Source: Economy.com

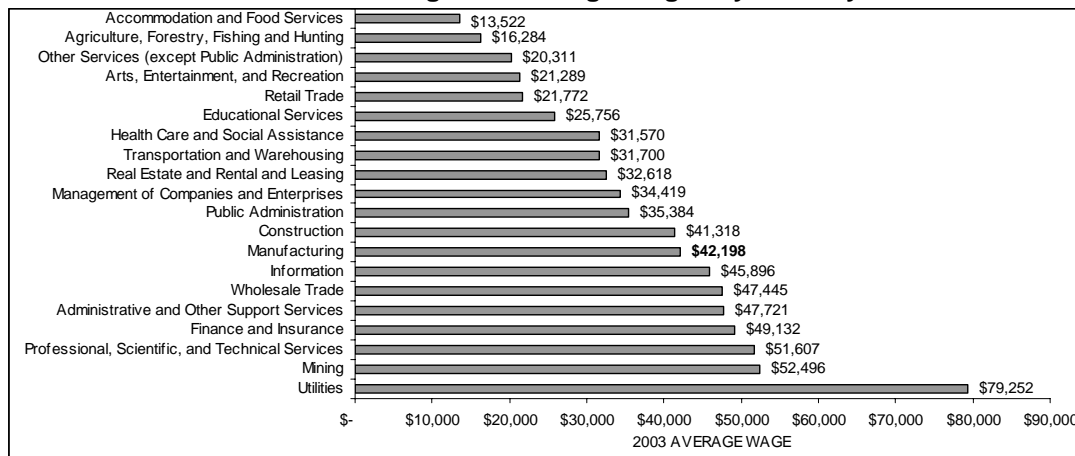
## Personal Income

High wages in manufacturing help contribute to individual income and good standards of living for employees and their families. They are also a factor in attracting workers at all levels to an industry. In MRC's service area, manufacturing wages are higher than most other industries. Seven industries have higher average wages than manufacturing.

The fact that manufacturing wages are lower than wages in some other industries may be a reflection of the fact that the region's workers tend to be at a lower skill level or that they are not highly unionized. Higher wages may be needed to attract new, highly skilled or management-level labor to the manufacturing sector, which has been a problem for this region.

Conversely, high wages may be a double-edged sword if they reflect relative age and experience of the workforce or the potential burden of retirement benefits and pensions. Replacing workers who are retiring and managing pension costs may be a challenge. This appears to be an especially large problem for the steel industry, which, with its unionized work force, has had heavy health care and pension burdens that seem to have severely impacted companies operating on thin margins in a commoditized business. Industry restructuring has allowed some companies to avoid these cost burdens and operate with a much lower cost structure, while others declare bankruptcy and the Pension Benefit Guaranty Corp. picks up the burden. Still others are trying to remain competitive under their old cost structure.

**Regional Average Wages by Industry**

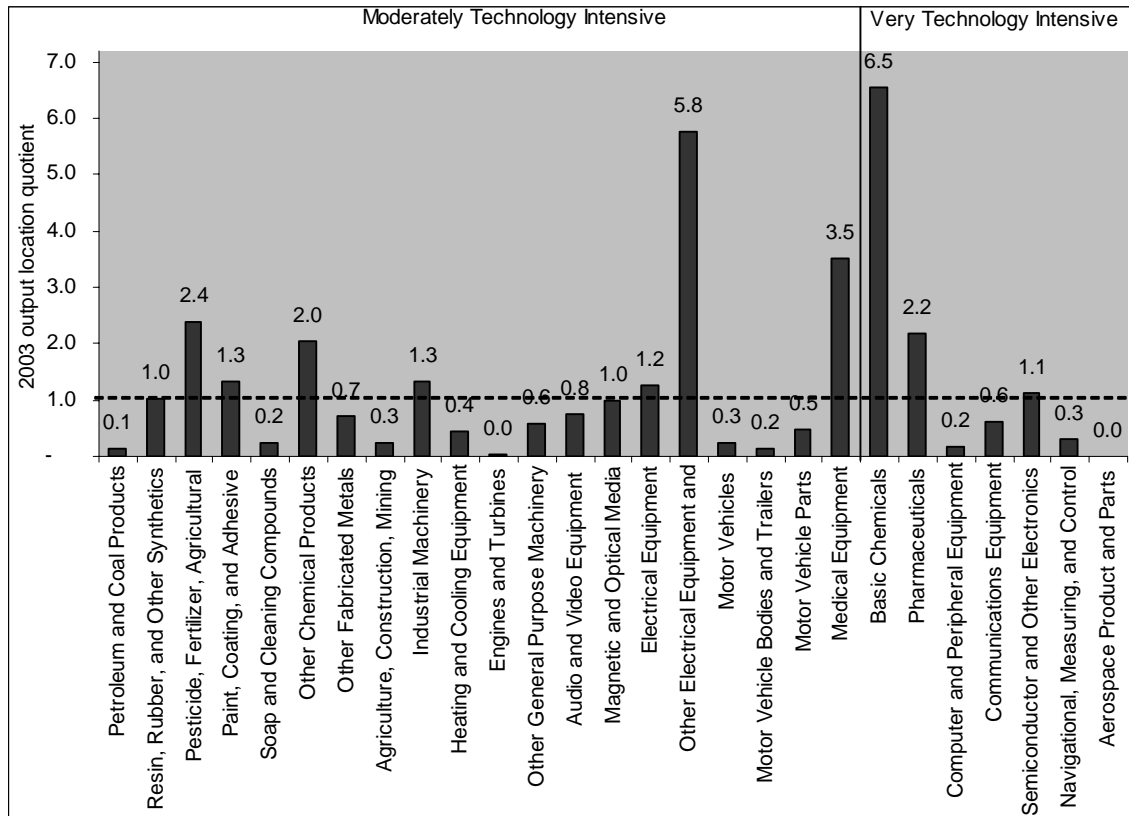


Source: Economy.com

## Technology Intensity

A chart showing the Greater Lehigh Valley Region's specialization in technology-intensive manufacturing illustrates that the Greater Lehigh Valley Region seems to have done a good job of attracting technology-intensive industries to the area. Competitiveness in basic chemicals, a very technology-intensive industry, is very strong for this region. With a location quotient of 6.5, it is much more regionally competitive than any other industry. Competitiveness in pharmaceuticals, another very technology-intensive industry, is also strong, with a location quotient of 2.2. The regional competitiveness of both of these industries is probably a result of the Greater Lehigh Valley Region's efforts to develop the biopharm sector. Levels of specialization in several moderately technology-intensive industries are also strong. Other electrical equipment, with a location quotient of 5.8, appears to be another highly competitive industry; medical equipment, which is often seen in areas where the pharmaceuticals industry is strong, also seems have some specialization in this region. Other industries in which the region has a good level of competitiveness are also chemical-related: Fertilizers/pesticide and other chemicals both have location quotients over 2.0.

**Regional Level of Specialization in Technology-Intensive Industries**



Source: Economy.com

The Greater Lehigh Valley Region is more developed than Pennsylvania and national peers in many technology-intensive industries; relative levels of employment in those industries are also higher than average for this region. Overall employment in technology-intensive industries slightly lags regional peers in nearby states, possibly because industries such as pharmaceuticals are so highly developed in states such as New Jersey.

### Regional Employment in Technology-Intensive Industries

		MRC	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Employment in Private Sector		<b>9.7%</b>	<b>8.9%</b>	<b>10.9%</b>	<b>9.7%</b>
Moderate Technology Intensive	Manufacturing	4.4%	3.1%	4.4%	3.3%
	Services	1.8%	2.2%	2.6%	2.4%
Very Technology Intensive	Manufacturing	2.7%	1.8%	1.5%	2.0%
	Services	0.8%	1.7%	2.3%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

Source: Economy.com



## MRC Drivers (ranked by 2003 output dollars)

Industry	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)	1993-2003 Change in LQ	Number of Establishments
Other Electrical Equipment and Components	\$ 609	8.8%	8.5%	10.3%	5.78	0.85	15
Basic Chemicals	\$ 586	-1.2%	0.9%	-0.5%	6.54	0.65	21
Plastics	\$ 411	1.2%	2.6%	5.6%	3.90	1.51	83
Pharmaceuticals	\$ 355	11.3%	11.5%	11.0%	2.20	1.12	9
Other Miscellaneous Manufacturing	\$ 243	3.5%	3.7%	1.9%	3.45	0.86	122
Printing	\$ 211	-4.4%	-3.1%	-2.3%	2.16	0.40	194
Machine Shops - Screw, Nut, & Bolt Manufacturing	\$ 188	0.7%	3.0%	10.1%	2.18	0.81	135
Cement and Concrete Products	\$ 145	-1.8%	0.3%	4.1%	3.52	0.82	59
Foundries	\$ 131	-12.2%	-4.6%	-1.7%	3.72	(0.32)	28
Sugar and Confectionery Products	\$ 129	-1.5%	1.0%	1.3%	6.11	1.47	15
<b>Emerging Driver Industries</b>							
Medical Equipment	\$ 126	7.1%	5.5%	4.8%	3.50	2.09	18
Electrical Equipment	\$ 125	11.4%	11.8%	8.6%	1.25	(0.13)	20

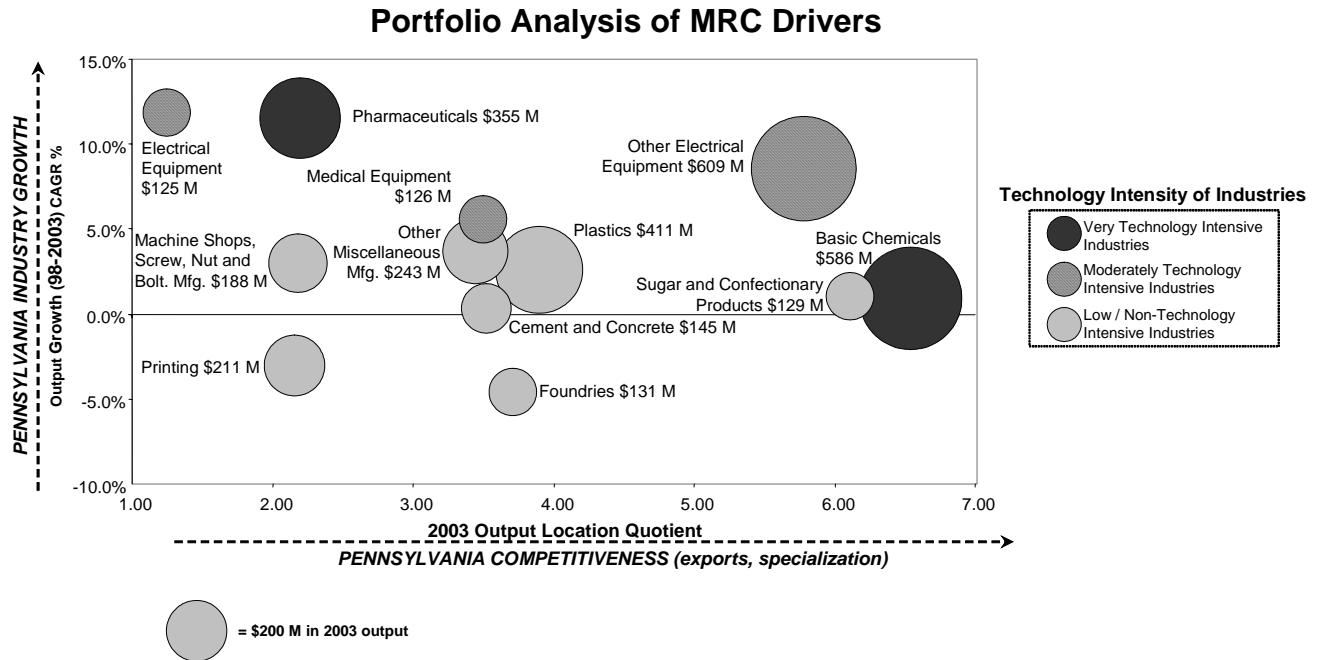
Source: Economy.com, Harris Infosource

The economic analysis yielded ten drivers and two emerging drivers for the Greater Lehigh Valley Region.

Industries that are economic drivers for this region are an interesting mix of traditional local industries, such as foundries, and newer industries, such as pharmaceuticals and other electrical equipment, which have grown over the past ten years to become two of the largest industries in the region. Steel mills and apparel manufacturing are considered declining drivers as output and employment decline and production moves elsewhere. It is encouraging to see other industries that are newer to the area fill the void left by the declining industries. The drivers that remain in the Greater Lehigh Valley Region are quite diverse, indicating that the region is no longer reliant on a single industry for its economic health.

While it is exciting to see new drivers emerge to be large so quickly, and it may be important for the Greater Lehigh Valley Region to develop additional new drivers to fill in gaps left by declining or departing driver industries, the region should be cautious not to become too dependent on any one industry or set of industries such as biopharm. Reliance on any single industry to drive the region's economy could lead to long-term problems if that industry declines or departs the region as was the case with steel and, more recently, optoelectronics. Since the pharmaceuticals industry in the region appears to be concentrated into a small number of large firms, the departure of any one firm could have a major impact on the region.

## Portfolio Analysis of MRC Drivers



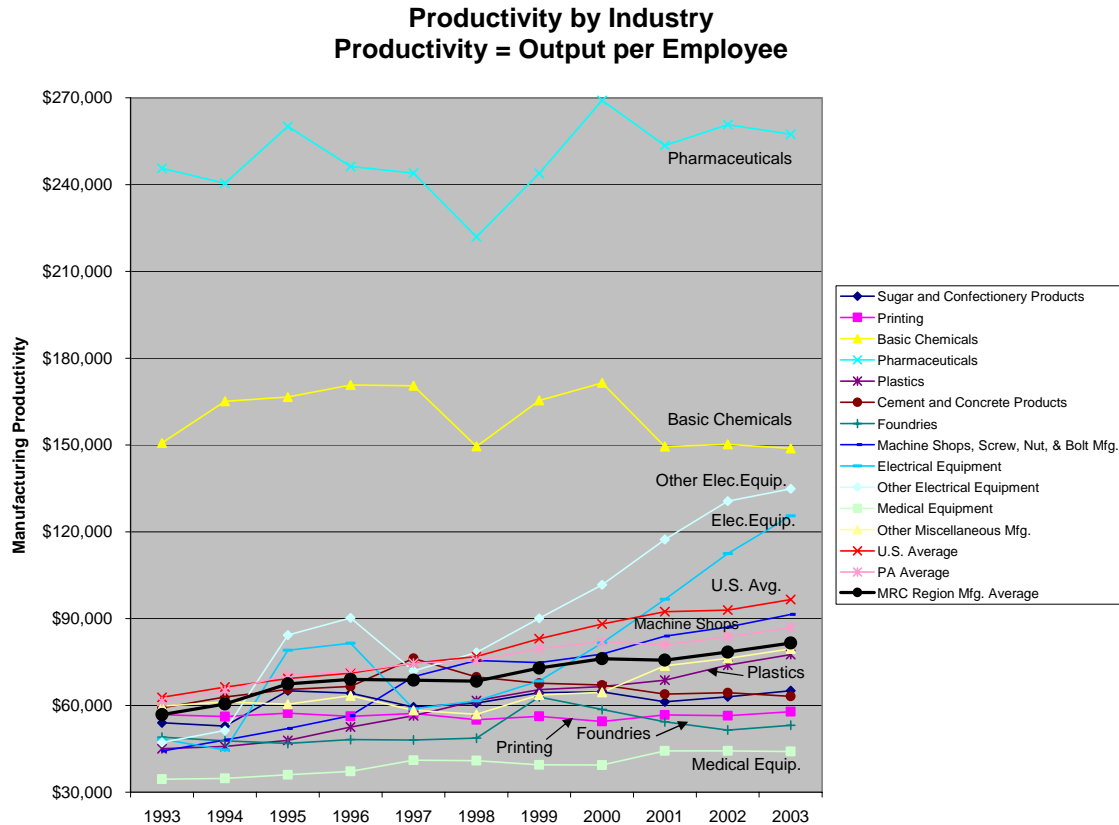
Source: Economy.com

The portfolio analysis shows that this region seems to have a number of fairly stable economic driver industries with strong degrees of competitiveness. In this region, nearly all of the driver industries have location quotients over 2.0 and three industries have location quotients over 5.0. Only two industries, printing and foundries, have shown negative average annual output growth over the past five years, although growth in most other industries has been moderate (less than 5%). There is probably an opportunity to review the strategies and operations for firms within some of the lower-growth industries to develop ways to drive growth, develop differentiated products, and improve supply chain costs so that these industries can sustain their competitiveness and profitability and avoid the commoditization trap.

Pharmaceuticals and other electrical equipment, two technology-intensive industries, have had significant growth in this region, but still have lower levels of competitiveness than many other local industries. It will probably be important to provide opportunities to sustain the growth and increase their competitiveness in the state in order to drive their long-term success in the region. These industries can also be important for economic development because the clusters of industries that support them (e.g., chemicals for pharmaceuticals, components for electrical equipment) may also begin to grow and develop in the region.

The fact that there are many drivers that contribute relatively similar levels of output indicates that Greater Lehigh Valley Region's economy is now fairly diverse and not heavily dependent on any single manufacturing industry's success to drive the region's economic success. As mentioned above, while we applaud the cultivation and growth of the biopharm industry, caution should be taken that the region does not focus on any single industry and neglect opportunities to develop and build other driver industries to maintain some diversity.

## Productivity in Driver Industries



Source: Economy.com

In the Greater Lehigh Valley Region, average productivity for manufacturing is \$81,581, lower than both the Pennsylvania average of \$86,814 and the U.S. average of \$96,549. Trends in productivity changes have closely mirrored Pennsylvania over the past ten years, with an overall average annual productivity growth rate for the region of 3.3%. The pharmaceuticals industry has the highest productivity of any industry in this region, with an average output of more than \$257,000 per employee. Basic chemicals and two electrical equipment industries are also high-productivity. While productivity has not increased much in pharmaceuticals and basic chemicals over the past ten years, electrical equipment and other electrical equipment have had strong increases, especially in the past few years. Lower-productivity industries for this region include medical equipment, foundries, and printing. While medical equipment has seen some moderate productivity increases in the past ten years, the other lower-productivity industries have not improved significantly.

### Average Productivity by Industry - MRC

	1993-2003		
	1993	2003	CAGR
Pharmaceuticals	\$ 245,644	\$ 257,362	0.4%
Basic Chemicals	\$ 150,715	\$ 148,843	-0.1%
Other Electrical Equipment	\$ 47,173	\$ 134,818	10.0%
Electrical Equipment	\$ 48,308	\$ 125,517	9.1%
Machine Shops, Screw, Nut, & Bolt Mfg.	\$ 44,209	\$ 91,384	6.8%
Other Miscellaneous Mfg.	\$ 59,776	\$ 79,557	2.6%
Plastics	\$ 45,001	\$ 77,566	5.1%
Sugar and Confectionery Products	\$ 53,940	\$ 65,032	1.7%
Cement and Concrete Products	\$ 59,152	\$ 63,117	0.6%
Printing	\$ 56,771	\$ 57,826	0.2%
Foundries	\$ 49,025	\$ 53,087	0.7%
Medical Equipment	\$ 34,442	\$ 44,048	2.3%
U.S. Average	\$ 62,757	\$ 96,549	4.0%
PA Average	\$ 61,385	\$ 86,814	3.2%
MRC Region Mfg. Average	\$ 56,800	\$ 81,581	3.3%

Source: Economy.com

## Conclusions

The Greater Lehigh Valley Region has a strong manufacturing economy, which provides more than one-fifth the total economic output for the region. Cost-competitive wages, a high-quality workforce, and proximity to major population centers make the region attractive to manufacturing companies.

An overarching issue that many manufacturers in this region raised was the absence of highly skilled and management talent. Those workers that do replace experienced, skilled talent require a significant amount of training before they reach the productivity levels of the workers they replace. This training can take time and investment to achieve. While the region has its fair share of universities and trade/vocational schools, moderate wages, a negative stigma attached to manufacturing, and a lack of excitement about lifestyle in the region have led to a lack of management-level talent. There appears to be a significant opportunity for MRC to help advocate manufacturing careers to young people and work with companies to help recruit, train, and retain management and highly skilled labor. One possible opportunity is to continue to develop better relationships between SMEs and local educational institutions through management training, intern, or apprenticeship programs.

The economy for this region has made more than one transition as the health of its major industries changed and new industries entered the region to replace the economic void. The region has been going through one such transition over the past ten years and now supports a more diverse set of core manufacturing and service industries. While manufacturing industries such as foundries remain important to the region, new industries such as pharmaceuticals and other electrical equipment have developed a strong presence. In particular, the region is promoting itself as an ideal location for biopharm companies and seems to have done a good job of attracting such industries. This development seems to have been successful thus far. It is important, however, that the region takes caution not focus so much on one industry or sector that the other, richly diverse industries in the region suffer or that the region becomes too dependent on any one industry. To manage further development, it will become increasingly important to improve the level of competitiveness for industries like pharmaceuticals and other electrical equipment in order to develop a regional competitive advantage; otherwise, there becomes a danger that these industries will exit the region.

Regional Issues (Based on workshops and Deloitte research):

- Transitional economy, shifting from historical base in metals production to advance manufacturing
- Regional SMEs need to move outside of traditional markets, services and products to maintain margin and promote growth
- Capturing regional clustering opportunities

MRC opportunities:

- Assist with recruitment, development, and training of skilled talent. Build programs that link educational institutions with manufacturers to develop talent. Advocate manufacturing as an attractive career path and the region as one that offers a favorable quality of life

- Help “traditional” manufacturing industries develop and execute growth and innovation strategies that focus on moving up the value chain and avoiding the trap of commoditization
- Help all manufacturers with process improvements/lean manufacturing so that they can achieve or maintain profitability, especially in low-growth or competitive industries
- Help identify and attract new industries to the region, especially those in the clusters that support biopharm or electrical equipment to build more of a local competitive advantage for those industries and capture more local value from them.

## Northeastern Pennsylvania IRC (NEPIRC)

### Region Analyzed

NEPIRC serves SMEs in eleven counties in Northeastern Pennsylvania.

Deloitte's analysis for NEPIRC covered the following counties:

- Bradford
- Columbia
- Lackawanna
- Luzerne
- Monroe
- Pike
- Sullivan
- Susquehanna
- Tioga
- Wayne
- Wyoming

## Importance of Manufacturing to the Region

Manufacturing is the number one industry sector in Northeastern Pennsylvania, accounting for approximately \$4.3 billion in annual output, nearly 19% of the region's total output in 2003. It is the second largest sector for employment in the region, employing more than 59,000 people. The average annual output growth rate for manufacturing over the past ten years has been 2.4%, slightly above the average of 2.3% for all industries within the region. Manufacturing was more adversely affected by the recent recession than other industries. Manufacturing's output growth rate over the past three years was (1.8%), well below the region's average of 2.0%.

### Regional Output and Growth Rate by Industry

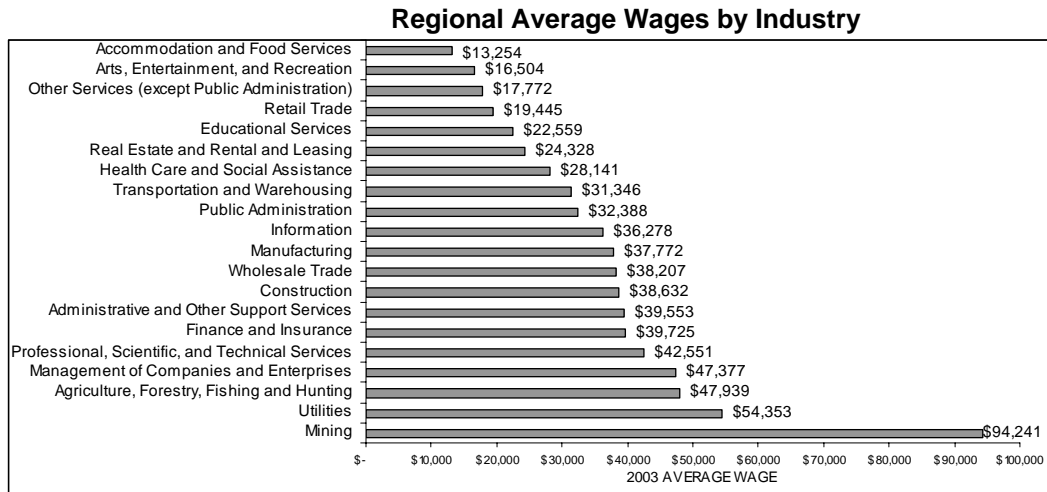
Industry	2003		00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)	Industry Output as a % of Regional Output
	Employment	2003 Output				
<b>Manufacturing</b>	<b>59,738</b>	<b>\$ 4,321</b>	<b>-1.8%</b>	<b>0.5%</b>	<b>2.4%</b>	<b>18.8%</b>
Public Administration	65,063	\$ 2,690	2.0%	1.3%	1.4%	11.7%
Retail Trade	55,221	\$ 2,184	3.0%	2.9%	3.9%	9.5%
Health Care and Social Assistance	56,525	\$ 1,838	1.9%	0.9%	0.6%	8.0%
Real Estate and Rental and Leasing	4,806	\$ 1,822	6.6%	4.3%	1.9%	7.9%
Finance and Insurance	15,473	\$ 1,416	3.4%	2.5%	2.3%	6.2%
Wholesale Trade	13,877	\$ 1,149	7.7%	4.5%	5.1%	5.0%
Transportation and Warehousing	16,374	\$ 1,133	6.8%	5.5%	4.0%	4.9%
Administrative and Other Support Services	15,516	\$ 932	5.6%	5.9%	6.2%	4.1%
Construction	15,751	\$ 896	-1.8%	-1.0%	0.2%	3.9%
Accommodation and Food Services	34,803	\$ 880	4.2%	2.7%	3.1%	3.8%
Information	10,218	\$ 736	1.1%	1.1%	2.3%	3.2%
Other Services (except Public Administration)	19,573	\$ 674	5.0%	2.8%	2.1%	2.9%
Utilities	3,041	\$ 628	-4.0%	0.2%	-0.2%	2.7%
Professional, Scientific, and Technical Services	9,365	\$ 543	-2.0%	1.8%	1.0%	2.4%
Agriculture, Forestry, Fishing and Hunting	1,176	\$ 467	15.5%	12.7%	5.8%	2.0%
Educational Services	10,173	\$ 211	0.1%	-2.0%	0.2%	0.9%
Management of Companies and Enterprises	2,568	\$ 193	-14.3%	-5.5%	-3.0%	0.8%
Mining	748	\$ 165	6.2%	7.8%	11.0%	0.7%
Arts, Entertainment, and Recreation	4,552	\$ 90	-2.9%	-0.5%	0.1%	0.4%
	414,561	\$ 22,969	2.0%	2.1%	2.3%	

Source: Economy.com



## Personal Income

High wages in manufacturing help contribute to individual income and good standards of living for employees and their families. They are also a factor in attracting workers at all levels to an industry. In NEPIRC's service area, manufacturing wages are about average with other industries.

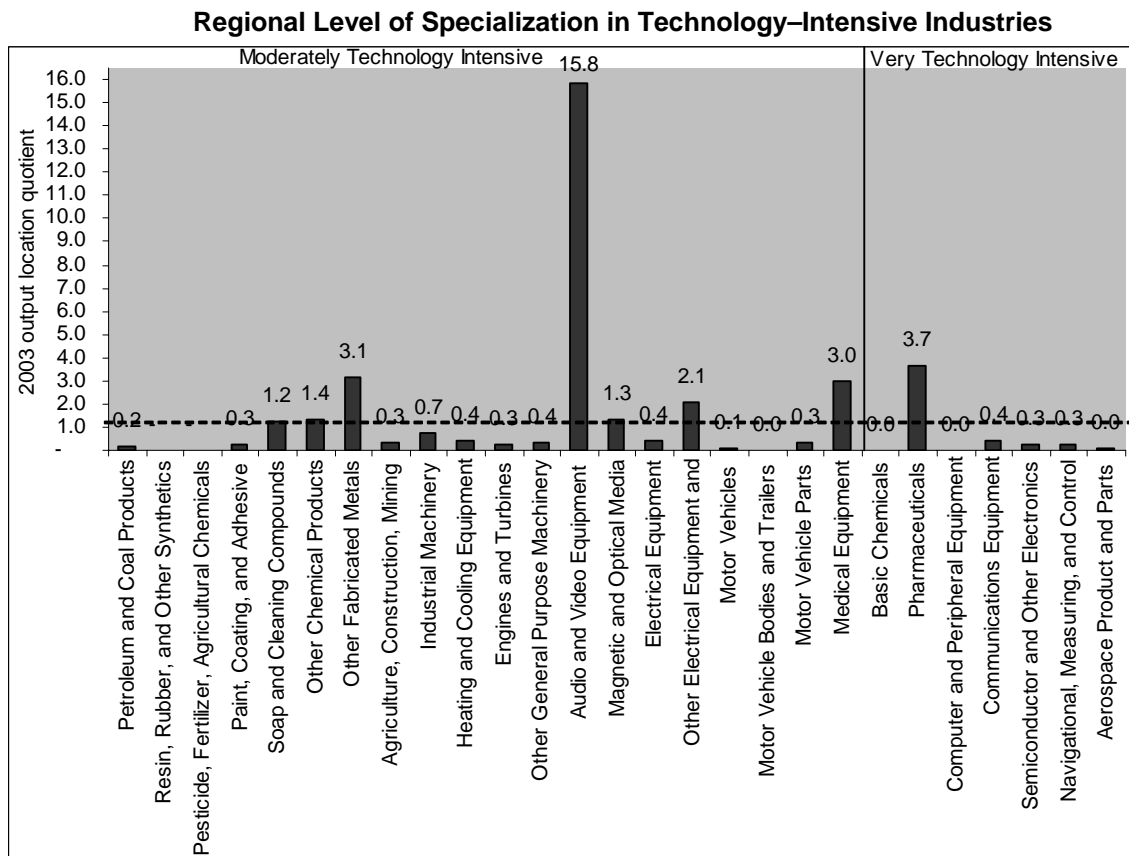


Source: Economy.com

## Technology Intensity

A chart showing Northeastern Pennsylvania's specialization in technology-intensive manufacturing illustrates that the region seems to have done a good job attracting technology-intensive industries, although development of moderately-intensive industries is stronger than very technology-intensive industries. Competitiveness in the audio and video equipment industry dominates this region, with a location quotient of 15.8. Competitiveness in pharmaceuticals, a very technology-intensive industry, is also strong, with a location quotient of 3.7. The region is below the average level of competitiveness for all other very technology-intensive industries. There may be an opportunity to try to attract or develop other very technology-intensive industries to Northeastern Pennsylvania, particularly those clustered with pharmaceuticals and audio and video equipment.

Other technology-intense industries in which the region has an above average level of competitiveness are other fabricated metal with a location quotient of 3.1, medical equipment with a location quotient of 3.0, and other electrical equipment with a location quotient of 2.1.



Source: Economy.com

Despite the strong levels of competitiveness shown in the chart above, Northeastern Pennsylvania employment in technology-intensive industries lags Pennsylvania, regional, and national peers. The gap between the level of competitiveness and employment levels in certain industries may be explained by the fact that some of the more technology-intensive industries are fairly small in this region and may not employ many workers. It may also be partly explained

by the high levels of productivity in several of the technology intensive industries for this region. For these industries with high output per employee, fewer employees are needed to produce fairly high levels of output.

### Regional Employment in Technology-Intensive Industries

		NEPIRC	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Employment in Private Sector		<b>6.1%</b>	<b>8.9%</b>	<b>10.9%</b>	<b>9.7%</b>
Moderate Technology Intensive	Manufacturing	2.9%	3.1%	4.4%	3.3%
	Services	1.2%	2.2%	2.6%	2.4%
Very Technology Intensive	Manufacturing	1.4%	1.8%	1.5%	2.0%
	Services	0.7%	1.7%	2.3%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

Source: Economy.com

## NEPIRC Drivers (ranked by 2003 output dollars)

Industry	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)	1993-2003 Change in LQ	Number of Establishments
Pharmaceuticals	\$ 418	40.5%	22.0%	19.4%	3.67	2.85	4
Plastics	\$ 406	3.5%	5.1%	7.3%	5.45	2.63	58
Paper	\$ 276	0.3%	0.3%	0.8%	5.69	2.48	39
Audio and Video Equipment	\$ 196	-14.3%	-2.9%	6.0%	15.81	(6.12)	3
Other Electrical Equipment and Components	\$ 155	-2.5%	1.7%	4.9%	2.09	(1.02)	7
Foundries	\$ 153	1.1%	3.8%	5.9%	6.12	3.16	10
Glass	\$ 146	-5.6%	-3.0%	3.3%	9.29	3.66	9
Sugar and Confectionery Products	\$ 95	3.2%	4.1%	6.6%	6.39	3.57	12

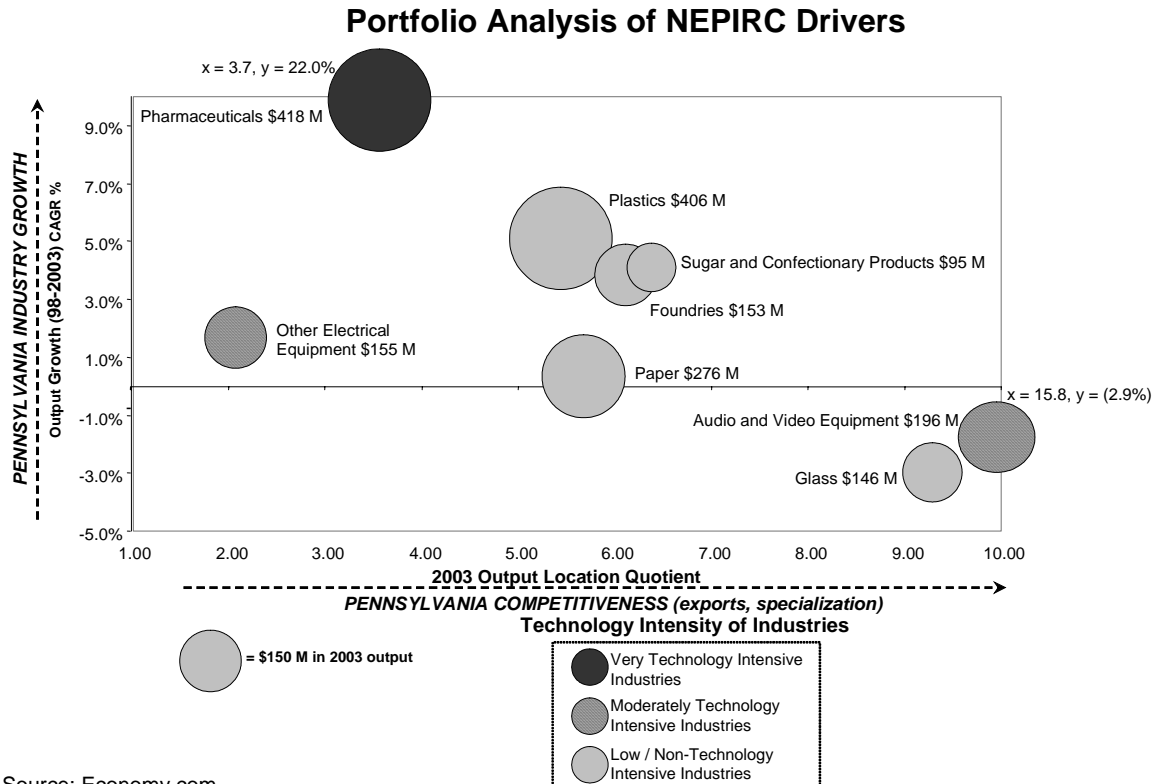
Source: Economy.com, Harris Infosource

The economic analysis yielded eight manufacturing industry drivers for Northeastern Pennsylvania.

Industries that are economic drivers for this region are an interesting mix of traditional regional industries, such as paper, and newer industries, such as pharmaceuticals and other electrical equipment, which have grown over the past ten years to become two of the largest industries in the region. Pharmaceuticals, in particular, has had impressive growth over the past decade. While older industries such as apparel manufacturing and animal slaughtering and processing remain important to the region, they are no longer economic drivers as their industries decline. It is encouraging to see other industries that are newer to the area begin to develop and fill voids left by declining industries. The drivers that remain in the Northeastern Pennsylvania are quite diverse, indicating that the region is not reliant on a single industry for its economic health. Many of these industries, such as plastics, paper, foundries, and glass, also take advantage of local natural resources that enable the region to create a high degree of local competitiveness and potentially create regional competitive advantages in those industries.

It is exciting to see new drivers emerge to become so large so quickly, and it may be important for Northeastern Pennsylvania to develop new drivers to fill in gaps left by declining or departing driver industries. However, the region should be cautious not to become too dependent on any one industry or set of industries such as pharmaceuticals or audio and video equipment. Reliance on any single industry to drive the region's economy could lead to long-term problems if that industry declines or departs the region. Since the both of these industries in the region appear to be concentrated into a small number of large firms, the departure of any one firm could have a major impact on the region.

## Portfolio Analysis of NEPIRC Drivers



The portfolio analysis shows that this region seems to have a number of fairly stable economic driver industries with strong degrees of competitiveness. In this region, all of the driver industries have location quotients over 2.0 and most industries have location quotients over 5.0.

Several of the traditional industries for this region cluster together in the middle of the graph. All have location quotients in the 5.0-6.5 range and most have seen moderate annual growth of 3-5% in the past five years. Only the paper industry has had flat output growth, possibly driven by commoditization of products and falling prices that have affected revenues in recent years. These industries have strong regional competitiveness, possibly driven by their historical presence in the area and access to raw materials. Given that they are industries in which products tend to be commodities, they most likely need assistance in continuing to drive growth and profitability, with focus on developing differentiation strategies and process improvement.

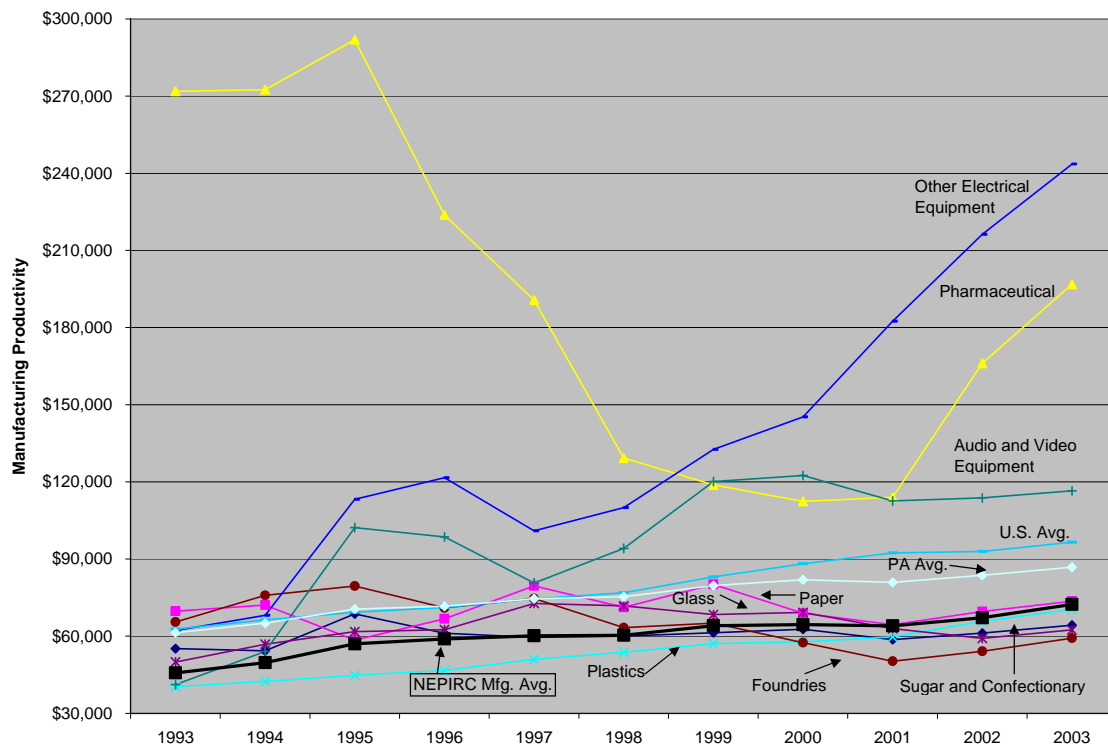
The two outliers on the graph are pharmaceuticals and audio and video equipment; both are technology-intensive industries. Pharmaceuticals has been a high-growth industry in this region, growing from \$59 million in output in 1993 to \$418 million in 2003 to become the region's largest manufacturing driver industry. The location quotient for pharmaceuticals is 3.67, making it regionally competitive, but less so than some of the region's more traditional industries. To sustain this industry, it will probably be important to continue to drive growth. Also, since there are only four pharmaceuticals establishments in this region right now, it might be helpful to attract other companies to the region and diversify the local industry or build clusters of related industries that will encourage the current companies to stay in the region and further build the

local economy. Audio and video equipment has a location quotient of 15.8, making it the most regionally competitive industry in the region. However, average annual growth for this industry has been negative over the past five years. It is also represented by only three establishments in the region. For this industry, it may be important again to try to attract new companies to capitalize on the high degree of local industry experience. It would probably also be helpful to current firms if they had access to resources to help them develop long-term strategies for success and processes to innovate and develop higher margin, high-growth products.

The fact that there are many drivers that contribute relatively similar levels of output indicates that Northeastern Pennsylvania's economy is now fairly diverse and not heavily dependent on any single manufacturing industry's success to drive the region's economic success. While the growth of the pharmaceuticals industry is a positive for this region's economy, caution should be taken that the region does not focus on any single industry and neglect opportunities to develop and sustain other driver industries to maintain economic diversity.

## Productivity in Driver Industries

Productivity by Industry  
Productivity = Output per Employee



Source: Economy.com

In Northeastern Pennsylvania, average productivity for manufacturing is \$72,324, significantly lower than both the Pennsylvania average of \$86,814 and the U.S. average of \$96,549. Trends in productivity changes have closely mirrored Pennsylvania over the past ten years, but the region has an overall average annual productivity growth rate of 4.3%, which is stronger than Pennsylvania's growth of 3.2%. Electrical equipment has the highest productivity of any industry in this region, with an average output of more than \$243,000. Productivity for this industry has grown rapidly since 1997. Since 1993, electrical equipment's productivity has nearly quadrupled. Pharmaceuticals is another high-productivity industry for this region. Although output per employee for that industry peaked in 1995 and then decreased significantly, it has now begun to recover. Lower productivity industries for this region include foundries and glass.

### Average Productivity by Industry – NEPIRC

	1993-2003		
	1993	2003	CAGR
Other Electrical Equipment	\$ 62,183	\$ 243,584	13.2%
Pharmaceuticals	\$ 271,877	\$ 196,844	-2.9%
Audio and Video Equipment	\$ 41,131	\$ 116,506	9.9%
Paper	\$ 69,752	\$ 73,629	0.5%
Plastics	\$ 40,341	\$ 70,363	5.2%
Sugar and Confectionery Products	\$ 55,153	\$ 64,223	1.4%
Glass	\$ 49,952	\$ 62,488	2.1%
Foundries	\$ 65,499	\$ 59,222	-0.9%
U.S. Average	\$ 62,757	\$ 96,549	4.0%
PA Average	\$ 61,385	\$ 86,814	3.2%
NEPIRC Region Mfg. Average	\$ 45,741	\$ 72,324	4.3%

Source: Economy.com



## Conclusions

Northeastern Pennsylvania has a strong manufacturing economy, which provides nearly 19% of the total economic output for the region. Cost-competitive wages, a high-quality workforce, and proximity to major population centers make the region attractive to manufacturing companies.

The region's manufacturing economy is driven by a mix of traditional and newer industries. While manufacturing industries such as plastics and glass remain important to the region, new industries such as pharmaceuticals have developed a strong presence. It is encouraging that new industries are developing to replace industries such as apparel that have declined in recent years. The region should take caution, however, not to focus so much on one industry or sector that the other, richly diverse industries in the region suffer or that the region becomes too dependent on any one industry. To manage further development, it will become increasingly important to improve the level of competitiveness for industries like pharmaceuticals and other electrical equipment in order to develop a regional competitive advantage; otherwise, there becomes a danger that these industries will exit the region

Regional Issues (Based on workshops and Deloitte research):

- Regional economy in transition from traditional manufacturing to advanced manufacturing
- The region has attractive qualities for new investment within the manufacturing endowment that should continue to be exploited and understood
- Some regional perception issues need to be addressed

NEPIRC opportunities:

- Assist with recruitment, development, and training of skilled talent. Build programs that link educational institutions with manufacturers to develop talent. Advocate manufacturing as an attractive career path and the region as one that offers a favorable quality of life
- Help "traditional" manufacturing industries develop growth and innovation strategies that focus on moving up the value chain and avoiding the trap of commoditization
- Help all manufacturers with process improvements/lean manufacturing so that they can achieve or maintain profitability, especially in low-growth or competitive industries
- Help identify and attract new industries to the region, especially those in the clusters that support pharmaceuticals or electrical equipment to build more of a local competitive advantage for those industries and capture more local value from them

## **Delaware Valley IRC (DVIRC)**

### **Region Analyzed**

DVIRC serves SMEs in the Philadelphia area in Southeastern Pennsylvania. In addition to being the original site of our nation's government, Philadelphia was also home to many of America's early manufacturing industries. Now the fifth largest city in the United States, Philadelphia is still driven by a large manufacturing presence but has also diversified into many strong service industries.

Deloitte's analysis for DVIRC covered the following counties:

- Bucks
- Burlington (NJ)
- Camden (NJ)
- Chester
- Delaware
- Gloucester (NJ)
- Montgomery
- Philadelphia
- Salem (NJ)

Deloitte included local New Jersey counties in our analysis due to the high degree of cross-border economic activity and worker movement.

## Importance of Manufacturing to the Region

Manufacturing has been an important part of the Philadelphia area's economy since Colonial times. Originally a busy maritime port, wood yards and ship building were important industries. Later, sugar refineries, machine shops, and iron and steel manufacturing developed in the region, as did chemicals plants and manufacturing for the new railroad systems. While some of these industries remain economic drivers today, others have declined or moved elsewhere and new industries, such as pharmaceuticals, have developed to replace them. The region's manufacturing roots have always been based in craftsmanship and the region is home to a large number of smaller manufacturers that make specialized products.

Philadelphia is centrally located near other major East Coast cities with convenient transportation access, which has always made the city a convenient one for doing business. The region is also home to several excellent educational institutions, including the University of Pennsylvania. Although manufacturing has always been strong in this region, growth has been almost flat for the past five years and negative for the past three years while service industry sectors, such as transportation, real estate, hospitality, and finance, have driven the region's economic growth. The region has also been a leader in service industries: With branches of the U.S. Mint and Federal Reserve Bank, it is no surprise to see finance as an important economic sector.

Manufacturing is the number two industry sector in Southeastern Pennsylvania, accounting for approximately \$23.6 billion in annual output, 12.4% of the region's total output in 2003. In output, only real estate surpasses manufacturing for this region. Manufacturing is the fourth largest sector for employment in the region, employing more than 216,000 people. The average annual output growth rate for manufacturing over the past ten years has been 0.6%, below the average of 2.2% for all industries within the region. Manufacturing was more adversely affected by the recent recession than other industries. Manufacturing's output growth rate over the past three years was (5.0 %), well below the region's average of 1.6%.

**Regional Output and Growth Rate by Industry**

Industry	Employment	2003 Output	00-03 CAGR (%)	98-03 CAGR (%)	93-03 CAGR (%)	Industry Output as a % of Regional Output
Real Estate and Rental and Leasing	34,962	\$ 24,360	5.9%	4.1%	2.8%	12.8%
<b>Manufacturing</b>	<b>216,839</b>	<b>\$ 23,680</b>	<b>-5.0%</b>	<b>-1.0%</b>	<b>0.6%</b>	<b>12.4%</b>
Finance and Insurance	142,370	\$ 19,395	3.5%	3.9%	2.8%	10.2%
Public Administration	331,607	\$ 16,785	1.6%	1.3%	0.6%	8.8%
Health Care and Social Assistance	344,935	\$ 14,703	0.2%	0.3%	0.3%	7.7%
Retail Trade	271,118	\$ 14,423	2.1%	2.6%	4.1%	7.6%
Wholesale Trade	118,382	\$ 14,355	4.0%	3.0%	4.8%	7.5%
Professional, Scientific, and Technical Services	168,654	\$ 13,653	0.3%	1.5%	2.4%	7.2%
Administrative and Other Support Services	139,433	\$ 9,135	2.0%	1.6%	3.5%	4.8%
Construction	99,936	\$ 7,738	-0.5%	0.2%	1.4%	4.1%
Transportation and Warehousing	60,965	\$ 7,464	16.7%	8.9%	8.0%	3.9%
Information	60,532	\$ 6,182	-1.8%	1.3%	2.0%	3.2%
Other Services (except Public Administration)	125,778	\$ 5,804	5.6%	3.1%	2.6%	3.0%
Accommodation and Food Services	148,849	\$ 4,739	4.5%	3.9%	5.0%	2.5%
Educational Services	105,164	\$ 3,099	1.1%	-1.1%	1.0%	1.6%
Utilities	7,476	\$ 2,077	-10.4%	-5.6%	-4.1%	1.1%
Management of Companies and Enterprises	22,194	\$ 1,924	0.4%	0.4%	1.8%	1.0%
Arts, Entertainment, and Recreation	31,378	\$ 1,065	0.8%	0.2%	1.3%	0.6%
Agriculture, Forestry, Fishing and Hunting	7,476	\$ 344	-18.1%	-5.2%	-0.2%	0.2%
Mining	-	\$ -	NA	NA	NA	0.0%
	2,438,049	\$ 190,924	1.6%	1.9%	2.2%	

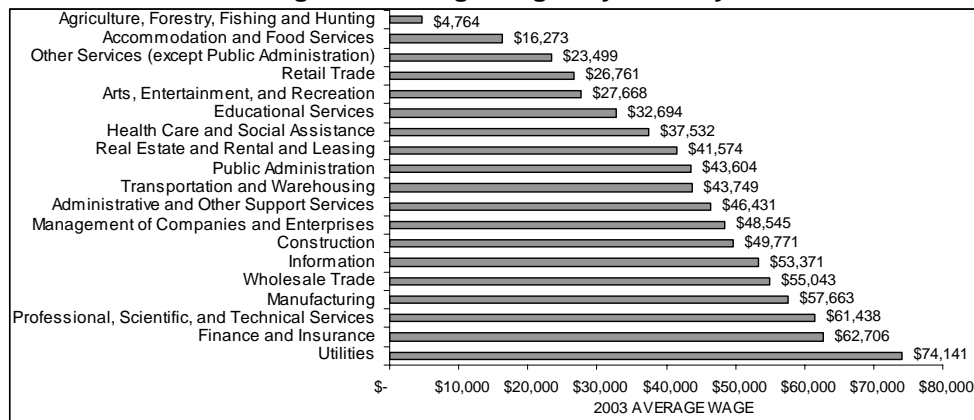
Source: Economy.com

## Personal Income

High wages in manufacturing help contribute to individual income and good standards of living for employees and their families. They are also a factor in attracting workers at all levels to an industry. The Philadelphia area has higher manufacturing wages than many other Pennsylvania regions, most likely reflecting the higher cost of living in the area. In addition, manufacturing wages are strong relative to other industries; there are only three industries in the region with higher wages.

High wages may also be a double-edged sword if they reflect relative age, skill level, and experience of the workforce or the potential burden of retirement benefits and pensions. Replacing highly skilled workers who are retiring and managing pension costs may be a challenge. This appears to be an especially large problem for the steel industry, which, with its unionized work force, has had heavy health care and pension burdens that seem to have severely impacted companies operating on thin margins in a commoditized business. Industry restructuring has allowed some companies to avoid these cost burdens and operate with a much lower cost structure, while others declare bankruptcy and the Pension Benefit Guaranty Corp. picks up the burden, and still others are trying to remain competitive under their old cost structure.

**Regional Average Wages by Industry**

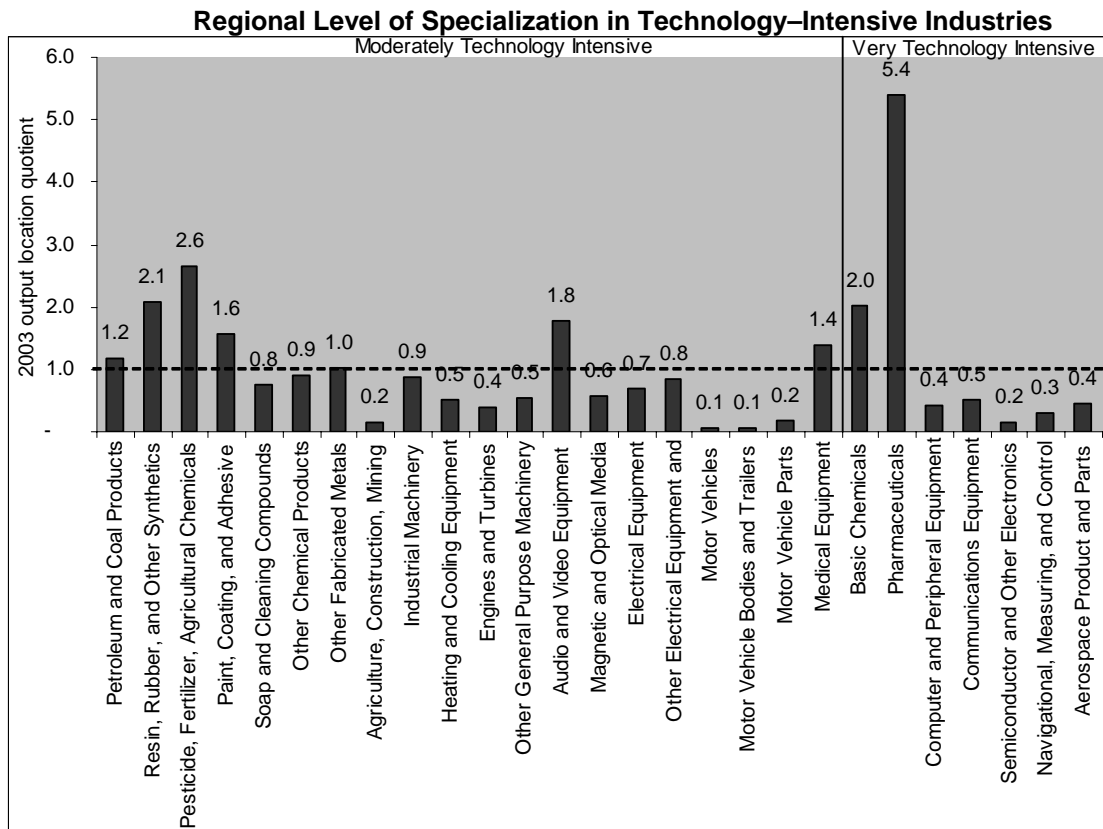


Source: Economy.com

## Technology Intensity

A chart showing the Philadelphia area's specialization in technology-intensive manufacturing illustrates that the region seems to have done a moderate job building competitiveness in technology-intensive industries. Competitiveness in pharmaceuticals, a very technology-intensive industry, is the strongest for this region, with a location quotient of 5.4. Competitiveness in the basic chemicals industry is also above average, with a location quotient of 2.0. Basic chemicals is one of the region's oldest industries and it appears that the region has managed to sustain its competitiveness over more than 100 years. There may be an opportunity to try to attract or develop other very technology-intensive industries to Philadelphia, possibly leveraging talent from The University of Pennsylvania or other regions to increase or improve R&D activities.

Other industries in which the region has an above average level of competitiveness are pesticides and fertilizers with a location quotient of 2.6; resin, synthetic rubber, and synthetic fibers, with a location quotient of 2.1; and audio and video equipment with a location quotient of 1.8.



Source: Economy.com

Overall, the DVIRC's region exceeds both Pennsylvania and national averages for employment in technology-intensive industries. In moderately intensive industries, this region lags all other regions for manufacturing, but exceeds all others in services. In very technology-intensive industries, this region exceeds peers both in manufacturing and services sectors.

		DVIRC	Pennsylvania	Regional Peers*	United States
Total Technology-Intensive Employment in Private Sector		<b>10.2%</b>	<b>8.9%</b>	<b>10.9%</b>	<b>9.7%</b>
Moderate Technology Intensive	Manufacturing	2.3%	3.1%	4.4%	3.3%
	Services	3.1%	2.2%	2.6%	2.4%
Very Technology Intensive	Manufacturing	2.2%	1.8%	1.5%	2.0%
	Services	2.6%	1.7%	2.3%	2.1%

\*The average of regional peers: IN, OH, MI, KY, MD, VA, NY, NJ

## DVIRC Drivers (ranked by 2003 output dollars)

Industry	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)	1993-2003 Change in LQ	Number of Establish- ments
Pharmaceuticals	\$ 5,115	-2.6%	3.0%	4.2%	5.39	0.14	38
Basic Chemicals	\$ 1,070	-4.5%	0.4%	0.1%	2.03	0.33	48
Printing	\$ 994	-4.4%	-2.6%	-2.2%	1.73	0.34	775
Paper	\$ 825	-2.6%	-1.9%	-1.2%	2.04	0.63	155
Resin, Rubber, and Synthetic Fibers	\$ 688	-4.9%	-1.0%	-1.6%	2.07	(0.30)	26
Machine Shops - Screw, Nut, & Bolt Mfg.	\$ 624	-1.7%	-0.5%	5.2%	1.23	(0.04)	418
Paint, Coating, and Adhesives	\$ 421	0.3%	3.7%	1.9%	1.56	0.03	52
<b>Emerging Driver Industries</b>							
Pesticide and Fertilizer	\$ 356	21.0%	21.4%	21.7%	2.64	2.31	10
Office Furniture	\$ 250	1.2%	1.8%	2.3%	1.94	0.68	56

Source: Economy.com, Harris Infosource

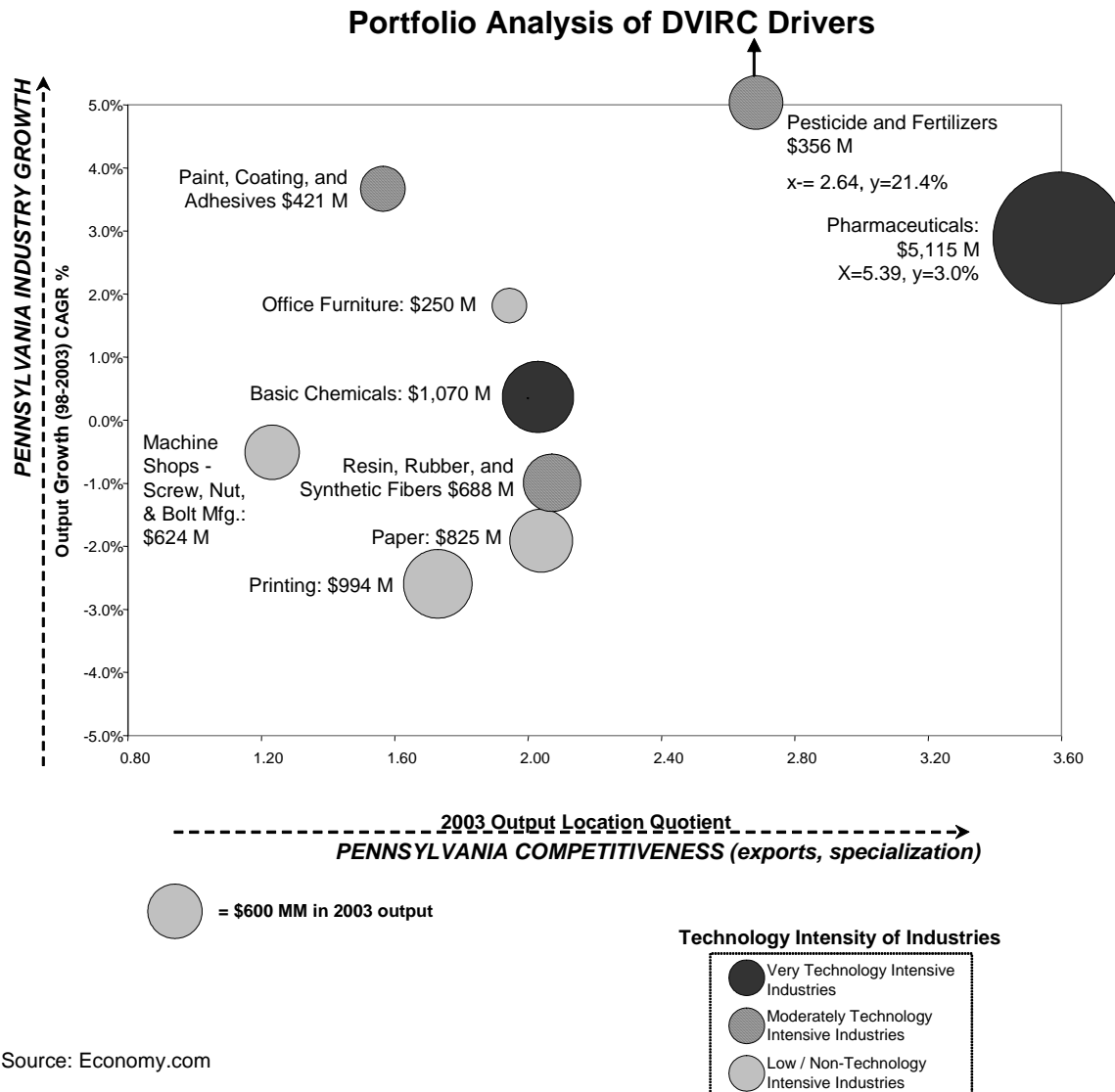
The economic analysis yielded seven manufacturing industry drivers and two emerging drivers for the Philadelphia area.

Industries that are economic drivers for this region are an interesting mix of traditional regional industries, such as basic chemicals, paper, and machine shops, and newer industries, such as pharmaceuticals. Pharmaceuticals dominates the manufacturing landscape of this region; its output is nearly five times larger than the next largest industry. Pharmaceuticals has also had moderate growth over the past five years. Industry growth for most other manufacturing drivers in this region has been slow or negative.

Deloitte's economic analysis identified pesticides and fertilizers and office furniture as potential emerging drivers for DVIRC's service area. Both of these industries have grown over the past ten years and their location quotients have risen in that time, indicating that they are becoming more competitive for the region.

While it is exciting to see drivers be so large, and it may be important for the Philadelphia area to develop new drivers to fill in gaps left by declining or departing driver industries, the region should be cautious not to become too dependent on any one industry or set of industries such as pharmaceuticals. Reliance on any single industry to drive the region's economy could lead to long-term problems if that industry declines or departs the region.

## Portfolio Analysis of DVIRC Drivers



The portfolio analysis shows that this region seems to have a number of economic driver industries with moderate degrees of competitiveness. The chart above shows many industries for this region clustered around a location quotient of about 2.0; most of these industries have negative or low growth rates. Firms in these industries most likely need assistance developing long-term strategies for growth and differentiation and process improvement assistance so that output declines do not create profitability problems. It may also be important to find ways to improve their local competitiveness so that there is more of a regional competitive advantage and less of a danger that these industries will move away from this region.

Pharmaceuticals, the dominant manufacturing industry in this region, has a strong location quotient and has demonstrated fairly consistent growth. The big question is whether to further develop this industry and build on its regional competitiveness or try to attract and develop

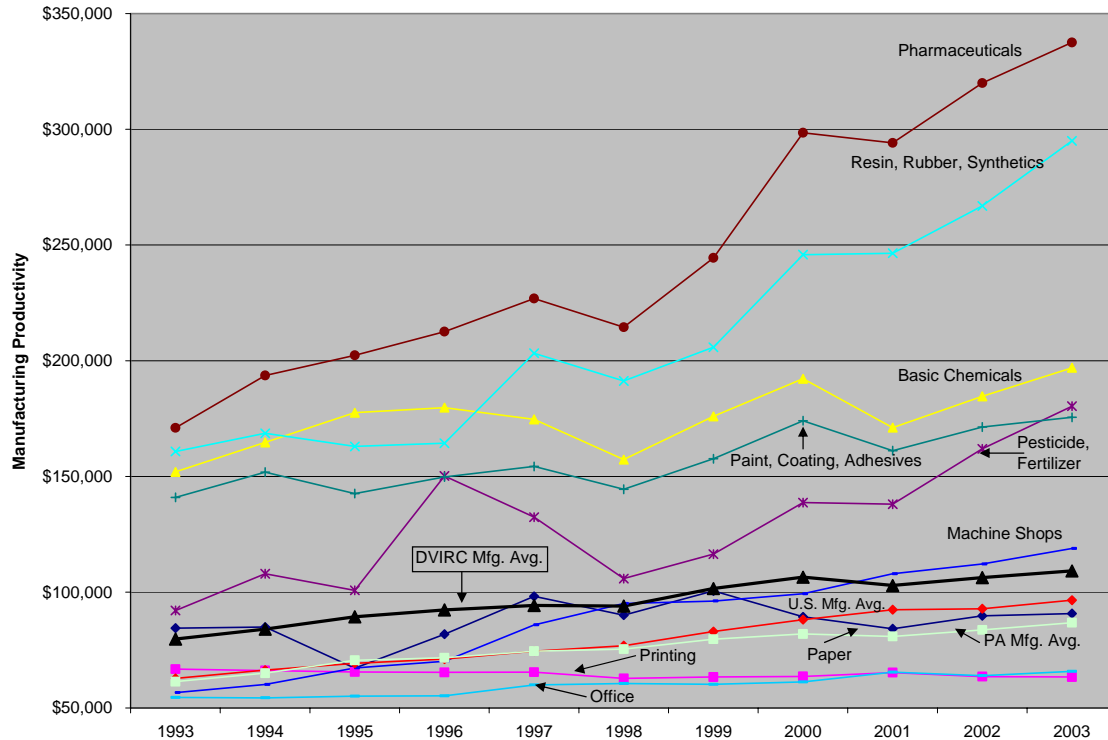


other, more diversified industries in the region in order to put some limit on Philadelphia's economic reliance on a single industry. Currently, pharmaceuticals accounts for more than one-fifth of the region's manufacturing output. Increased reliance on this industry could be a problem, especially if current trends of offshoring continue (see Section E of this report for more discussion on offshoring in this industry).

Pesticide and fertilizers and paint, coatings, and adhesives both appear to be promising industries that the region might want to develop further, as does office furniture. Each of these industries has shown consistent growth in the region even during the 2000-2003 recessionary period.

## DVIRC Productivity In Driver Industries

**Productivity by Industry**  
Productivity = Output per Employee



Source: Economy.com

In the Delaware Valley, average productivity for manufacturing is \$109,204, significantly higher than both the Pennsylvania average of \$86,814 and the U.S. average of \$96,549. Trends in productivity changes have closely mirrored Pennsylvania over the past ten years. The region has an overall average annual productivity growth rate of 2.9%, which is slightly lower than Pennsylvania's growth of 3.2%.

The region has a number of high-productivity industries, led by pharmaceuticals, with an average productivity level of \$337,516. Productivity for the pharmaceuticals industry in this region has been steadily increasing for the past ten years, nearly doubling from the \$171,020 level of 1993. Resins, rubber, and synthetic fibers is another high-productivity industry that has shown consistent growth over the past decade. Basic chemicals is another above average performer, but productivity increases over time have been more moderate. Many driver industries in the Delaware Valley have high productivity; there are seven industries whose average 2003 productivity is above the U.S. average level. There are no industries in this region with productivity below \$50,000.

### Average Productivity by Industry – DVIRC

	1993-2003		
	1993	2003	CAGR
Pharmaceuticals	\$ 171,020	\$ 337,516	6.4%
Resin, Synthetic Rubber and Fibers	\$ 160,775	\$ 295,032	5.7%
Basic Chemicals	\$ 151,948	\$ 196,939	2.4%
Pesticide, Fertilizer, and Other Agricultural Chemicals	\$ 92,098	\$ 180,364	6.3%
Paint, Coating, and Adhesives	\$ 140,991	\$ 175,558	2.0%
Machine Shops, and Screw, Nut, & Bolt Mfg.	\$ 56,659	\$ 118,870	7.0%
Paper	\$ 84,527	\$ 90,783	0.7%
Office Furniture	\$ 54,519	\$ 65,830	1.7%
Printing	\$ 66,773	\$ 63,363	-0.5%
<b>U.S. Average</b>	<b>\$ 62,757</b>	<b>\$ 96,549</b>	<b>4.0%</b>
<b>PA Average</b>	<b>\$ 61,385</b>	<b>\$ 86,814</b>	<b>3.2%</b>
<b>DVIRC</b>	<b>\$ 79,774</b>	<b>\$ 109,204</b>	<b>2.9%</b>

Source: Economy.com

## Conclusions

The Delaware Valley has a strong manufacturing economy, which provides nearly 13% of the total economic output for the region. Manufacturing has had growth that has been below average in the region for the past ten years, but cost-competitive wages, a high-quality workforce, higher than average productivity, and proximity to major population centers make the region attractive to manufacturing companies.

The region's manufacturing economy is dominated by the pharmaceuticals industry, which is nearly five times as large as the next largest driver industry. Pharmaceuticals is a technology-intensive industry that appears to be very regionally specialized, possibly due to the region's proximity to New Jersey-based pharmaceuticals companies. Other industries that are drivers in the region include more historically traditional manufacturers such as basic chemicals, paper, and machine shops. It is encouraging that industries like Pharmaceuticals are developing to replace other industries that have declined in recent years. The region needs to take caution, however, not to focus so much on one industry or sector that the other, richly diverse industries in the region suffer or that the region becomes too dependent on any one industry. Pesticides, office furniture, and paint, coating and adhesives all appear to be growth industries, which the region may want to encourage to develop.

Regional Issues (Based on workshops and Deloitte research):

- Further analysis on the pharmaceuticals supply chain should be conducted to understand additional opportunities for SMEs to supply and service this industry.
- Challenges to the cost structures of SMEs in the form of increased labor costs (including benefits)
- For such a large regional economy it appears to have only a few key manufacturing drivers which could have a major on the region impact if industry consolidation occurs.

DVIRC Opportunities

- Work with SMEs within key clusters to increase regional linkages to large drivers
- Increase SME market penetration in process improvement
- Work with SMEs to develop innovative approaches to service regional and global market opportunities
- Continue to help SMEs develop and execute strategies for growth and innovation

# E. ISSUES BY INDUSTRY FOR DRIVERS

## Project Approach and Methodology



### Issues for Driver Industries

Once the driver industries for Pennsylvania were identified, an analysis was performed for each driver to identify industry-specific issues. Identifying and understanding the issues in each industry is critical for the IRCs to determine whether they can assist the manufacturers with these issues, and if so, the type of service that would have the greatest impact.

In essence, the driver empirical analysis provided the analytical framework to study the key issues impacting manufacturing. The drivers clarify which industries have the “root” economic influence, thus providing a framework to understand the importance or relative weight of each issue depending on the impact to the firm within the industry considered.

To begin identifying the issues, the Deloitte team determined the historic establishment and profile of the driver industries in Pennsylvania to understand why each industry had historically located in Pennsylvania and the division of SMEs versus large firms in each industry. This provided the historical context of each driver in Pennsylvania. Then, Porter’s Five Forces model was used to evaluate barriers to entry, threat of substitutes, buyer power, and supplier power to understand the dynamics of each industry. Economic analysis for each driver industry evaluated employment data and state output to determine Pennsylvania’s competitive position for those industries in relation to other states, identify buy-sell clusters for each industry, and identify any related issues. For a more in-depth look into the issues and the industries, trends and rationale for growth were studied to establish how critical the issues were to the success of the industry. Research information was gathered from trade publications, public filings, industry reports, and articles.

In addition to the secondary research, Deloitte team members conducted seven regional workshops run by the IRCs to gain more insight into regional and industry issues by conducting interviews with business leaders in each industry. Discussion during the workshops helped determine which issues appear to be of greatest concern and most urgent to Pennsylvania companies. Deloitte later consulted industry experts such as past clients and Deloitte employees who have worked in these particular industries to gain further insight into industry issues. The table below summarizes the tools Deloitte used in the issues analysis.

Analysis	Description	Relevance
Historical Establishment & Profile	Definition of the industry and sub-industry sets of firms; why the industry historically located in PA; the division of firms that are large and small in terms of total employment	Provides an understanding for the industry analysis
Porter's Five Forces	Assessing barriers to entry, buyer power, supplier power, and threat of substitutes for each industry	Presents an overview of the nature and dynamics of the industry
Economic Analysis	Analyze the state output and employment data in relation to other states as well as the industry nationally	Provides an understanding of Pennsylvania's relative competitive position
Trend Analysis	Analyze trends and rationale for industry growth	The recent trends in the industry are important to understand the criticality of the issues
Workshops	Firm-specific and industry-specific issues, as pertinent to small manufacturers, were discussed in seven workshops (one workshop in each IRC region)	Helps validate and provide deeper insight into real issues
Supply Chain	Leverage the buy and sell relationships created from the input-output tables to analyze issues facing suppliers and customers	Provides a framework to look at the industry and confirm that no major aspects of the industries are being left out
Value Chain	As assessment of the industry supply chain with an eye for the amount of value addition along the process	Provides an overview of what piece of the supply chain is the most value adding
Fantus CLF	Analyze Pennsylvania-specific location factors such as labor, access to capital, real estate, and logistics	Brings context for Pennsylvania for the issues
Key Theme Summary	Summarize and prioritize the key issues and themes identified in each analysis	Presents the industry issues in a logically classified manner which in turn helps develop recommendations.

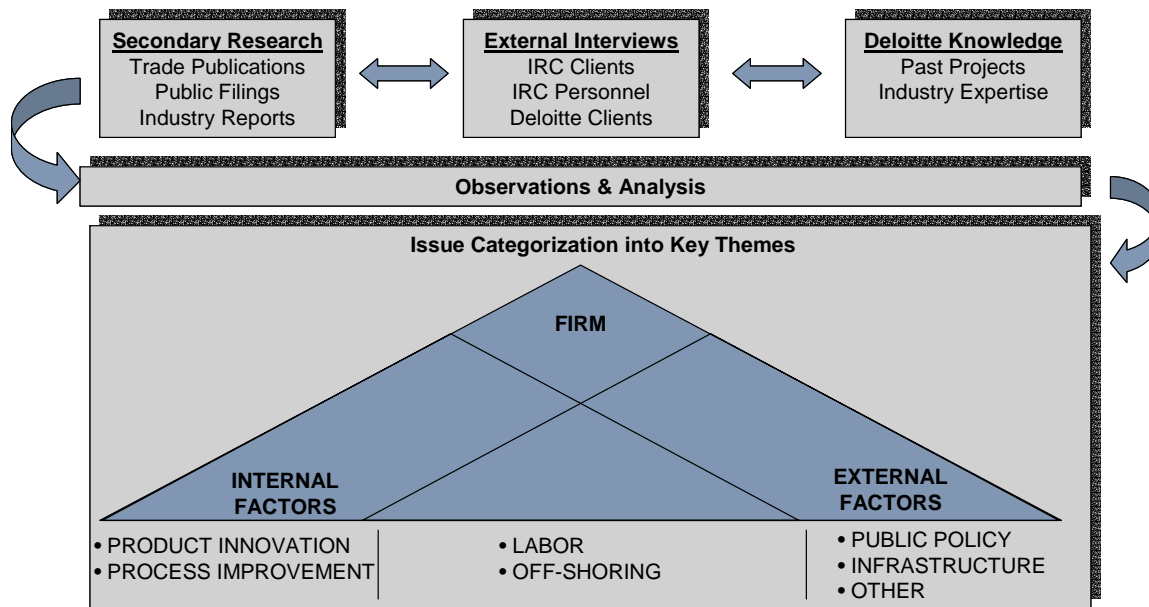
Following the workshops, the Deloitte team focused on the key issues of each industry, as determined by the secondary research incorporated with the main issues addressed in the workshops. Through this, the key issues themes were derived and categorized into internal, external, and hybrid issues.

- **Internal issues** are those which the firm can take action to influence or improve
- **External issues** are those that impact the firm but are typically influenced or solved via public policy
- **Hybrid issues** are those that both firms and public policy shape and influence

The industry supply and value chains were analyzed to determine where the industry could improve and add more value. Finally, the Deloitte team analyzed success factors such as labor, access to capital, real estate and logistics to examine issues specific to Pennsylvania.

The key macro issues will be leveraged and compared against the capabilities of the IRCs for the Gap Analysis section.

The picture below is a graphical representation on how the Deloitte team arrived at the key macro issues. Combining the knowledge gained from secondary resources, Deloitte knowledge, and external interviews, the Deloitte team observed the data and conducted an analysis to determine the primary issues and findings from this data. From there, the team was able to classify the key issues into three categories: Internal, external, and hybrid issues.



Below is a summary of each driver industry and the primary issues identified in each industry, which includes a description of the issue and the degree to which each issue affects the SMEs and large firms. More detailed information on each industry is included in the Appendix.

## **Section Outline – Industry Issue Summaries**

- I. Pharmaceuticals
- II. Electrical Equipment
- III. Plastics
- IV. Printing
- V. Food
- VI. Paper
- VII. Basic Chemicals
- VIII. Metalworking Machinery
- IX. Architectural and Structural Metals
- X. Machine Shops
- XI. Other Fabricated Metals
- XII. Wood Products
- XIII. Furniture
- XIV. Glass
- XV. Medical Equipment



## I. PHARMACEUTICALS INDUSTRY

### INDUSTRY DEFINITION:

The pharmaceuticals industry is comprised of establishments primarily engaged in manufacturing biological and medicinal products, processing (i.e., grading, grinding, and milling) botanical drugs and herbs, isolating active medicinal principles from botanical drugs and herbs, and manufacturing pharmaceutical products intended for internal and external consumption in such forms as ampoules, tablets, capsules, vials, ointments, powders, solutions, and suspensions.

### INDUSTRY DESCRIPTION:

Recently, the industry has experienced a slow down in growth. From 1998 to 2000, total domestic output increased by 31%; however, from 2000 to 2003, the growth rate was only 2%. This slowdown can be attributed to pricing pressure, expired patents, decrease in new product approvals, and a wave of over-the-counter substitutes for prescription drugs. Growth is expected to pick up again with the aging “baby boom” generation and the lengthening average age life expectancy. Profit margins are small due to the high R&D investment needed to create a new drug; many manufacturers never achieve enough commercial success to recoup this investment.

### PHARMACEUTICALS IN PENNSYLVANIA:

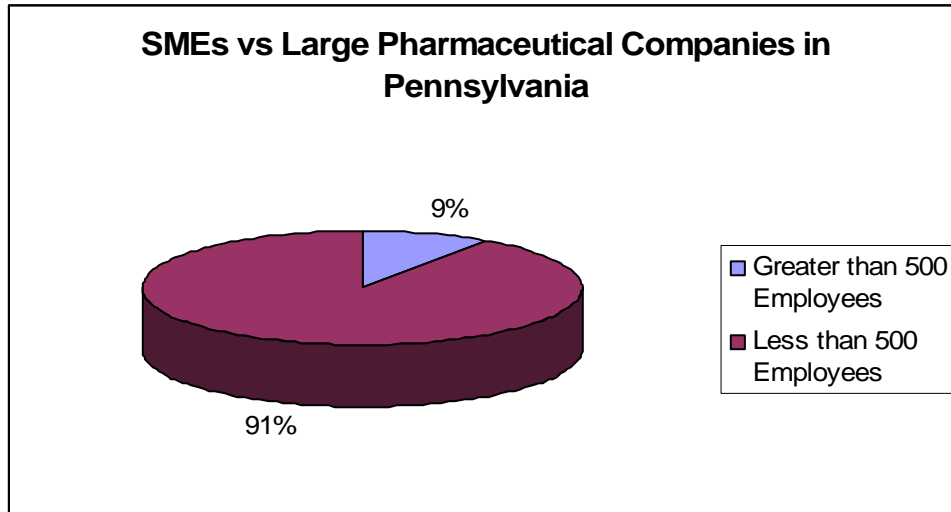
Pharmaceutical manufacturing has become a major driver in Pennsylvania due to its closeness to other related industries (i.e., medical equipment) and because many of the founders of pharmaceutical companies (i.e. Wyeth Pharmaceuticals) lived in Pennsylvania when their company was founded. Pennsylvania currently ranks 3<sup>rd</sup> in the United States by location quotient for pharmaceutical manufacturing behind New Jersey and California, which reflects the state’s competitive advantage in terms of access to markets. However, it has seen a slow down in growth compared to other growing industries. The largest company by number of employees is Wyeth Pharmaceuticals. Within the Pennsylvania commonwealth, Morris, Union and Montgomery counties have had the greatest output of pharmaceuticals in dollars ranging from \$1,500 to 5,000 M per year. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Top Right	Strong Economic Base
Opportunity		Driver is in Good Health
Key State Competition	State	Location Quotient
	Pennsylvania	3.44
	New Jersey	5.52
	Indiana	4.63
	North Carolina	3.38
	Connecticut	2.01
	West Virginia	1.60
	Illinois	1.39
	Massachusetts	1.18
	Nebraska	1.15
	California	1.11
	Missouri	1.09

**TOP 10 PENNSYLVANIA FIRMS:**

Company	Employees in PA
Wyeth Pharmaceuticals	7,000
Aventis Pasteur	1,500
Pfizer Global Manufacturing Inc	1,000
McNeil Consumer Healthcare Co	900
Centocor Inc	864
Wyeth Vaccines	650
GlaxoSmithKline	560
Aventis Behring LLC	400
Glaxosmithkline Consumer Healthcare	400
Bayer Corp	350

There are 74 pharmaceutical companies in Pennsylvania: 7 (9%) large and 67 (91%) SME.



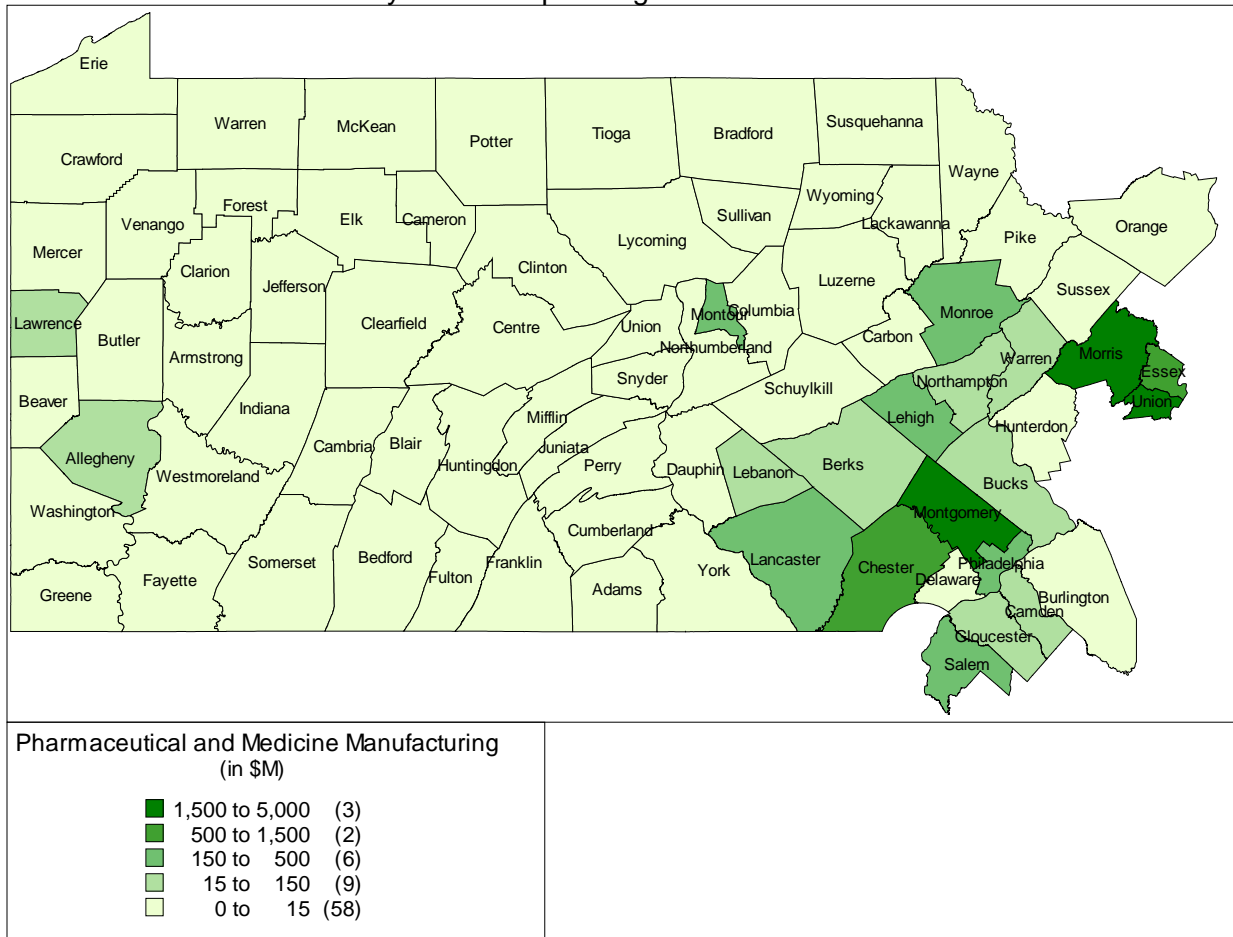
## PENNSYLVANIA'S COMPETITIVE POSITION:

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
New Jersey	\$ 5,569	\$ 6,814	\$ 10,897	\$ 9,670	-3.9%	6.0%	5.1%
California	\$ 3,141	\$ 3,685	\$ 6,734	\$ 7,241	2.4%	11.9%	7.9%
<b>Pennsylvania</b>	<b>\$ 3,841</b>	<b>\$ 5,109</b>	<b>\$ 6,553</b>	<b>\$ 6,684</b>	<b>0.7%</b>	<b>4.6%</b>	<b>5.2%</b>
North Carolina	\$ 2,402	\$ 3,264	\$ 3,924	\$ 4,259	2.8%	4.5%	5.3%
Indiana	\$ 2,131	\$ 3,598	\$ 3,814	\$ 4,208	3.3%	2.6%	6.4%
New York	\$ 2,364	\$ 2,574	\$ 3,221	\$ 3,982	7.3%	7.5%	4.9%
United States	\$ 28,960	\$ 35,736	\$ 46,708	\$ 47,748	0.7%	4.9%	4.7%

## LOCATION OF OUTPUT:

A thematic map of the concentration of pharmaceutical industry output in Pennsylvania is shown below. Please refer to the key for the output range.



**BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**









- Other Food Mfg.
- Converted Paper Product Mfg.
- Printing & Related Support Activities
- Petroleum & Coal Products Mfg.
- Basic Chemical Mfg.
- Resin, Synthetic Rubber, & Artificial Synthetic Fibers & Filaments Mfg.
- Paint, Coating, & Adhesive Mfg.
- Other Chemical Product & Preparation Mfg.
- Glass & Glass Product Mfg.
- Alumina & Aluminum Production & Processing
- Other Miscellaneous Mfg. (Signs & Advertising Displays)
- Newspaper, Periodical, Book, & Directory Publishers
- Specialized Design Services
- Other Professional, Scientific, & Technical Services
- Waste Treatment & Disposal
- Rail & Road Transportation

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products)**

- Animal Production
- Animal Food Mfg.
- Ambulatory Health Care Services
- Hospitals
- Nursing & Residential Care Facilities

**INDUSTRY ISSUES:**

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Pharmaceuticals	Technology	Manufacturers need to upgrade their systems to be CFR Part 11 compliant (FDA regulation that mandates life science companies to comply with certain requirements if they intend on using technology in any regulatory reporting such as batch records, training records, product documentation and other areas). This regulation has forced companies to carefully examine both technology and processes related to those systems producing electronic records in lieu of paper records and electronic signatures in lieu of handwritten signatures		
Pharmaceuticals	Public Policy	With Americans facing skyrocketing pharmacy bills, buying drugs in Canada has become a hot political issue and one that has many implications for drug manufacturers in Pennsylvania		
Pharmaceuticals	Product Innovation / Process Improvement	As large pharmaceutical companies return previously outsourced production (to contract manufacturers) in-house, contract manufacturers have been affected and are exploring opportunities in biotech manufacturing. Biotech is facing a shortage of capacity as bio-manufacturing processes differ markedly from pharmaceutical manufacturing. Further, the average biologic plant costs more than \$300 million to build - an expense that few companies are willing to cover		
Pharmaceuticals	Process Improvement	Pharmaceutical supply chain is very complex. A majority of the raw materials are being outsourced from China and India, and the shipping and customs logistics for these products are tedious once the raw materials enter the production process. As a result, companies are looking to streamline the supply chain to improve efficiency		

**RECOMMENDATIONS:**

- Assist SMEs in becoming CFR part 11 compliant
- Advocate legislation to curb and regulate drug importation
- Equip contract manufacturers in pharmaceuticals for biotech manufacturing
- Streamline the supply chain to improve efficiency
- Encourage investment in innovative technologies by providing assistance for SME companies to access capital to fund technology-driven equipment purchases
  - Assist with adoption of new technology and any necessary training
  - Identify opportunities for tax credits or other assistance to acquire and depreciate capital equipment
- Provide strategy and innovation support to help SMEs identify niches and opportunities for continued survival in an increasingly consolidating industry
  - Help identify value-added service opportunities
  - Help identify market niches

## II. ELECTRICAL EQUIPMENT

### INDUSTRY DEFINITION:

This industry is the combination of electrical lighting equipment manufacturing, electrical equipment manufacturing, and other electrical equipment and component manufacturing. Electrical lighting equipment involves establishments primarily engaged in manufacturing electric lamp bulbs, tubes, and fixtures. Electrical equipment is made up of establishments who manufacture equipment that generates and distributes electrical power. Other electrical equipment and component manufacturing involves manufacturing electrical power storage and transmission devices and accessories for carrying currents.

### INDUSTRY DESCRIPTION:

Employment in the industry has declined considerably. This has been attributed to the two things: First, the advent of China and other low-cost nations importing commodity electric equipment into the country. From 1995-2002, Chinese imports into the U.S. grew at over 12% per year. As a result, manufacturers in the U.S. have been forced to shift production to higher value equipment. At the same time, the level of automation in the industry has increased tremendously, thus augmenting overall productivity. For example packaging manufactured goods often required manual labor in the past however the automation of this process has replaced staff with electronic packing machines that carry out the same task

### ELECTRICAL EQUIPMENT IN PENNSYLVANIA:

This industry originally located in Pennsylvania due to the wealth of engine, turbine and power transmission manufacturing in the Great Lakes Region and a need to be close to industries such as metalworking machinery and semiconductors. In 1993, Pennsylvania supplied the United States with 7.5% of the total industry output, which amounted to approximately \$2 B in revenue. Although Pennsylvania is forecasted to produce \$4.6 B in revenue in this industry for 2003, this only equates to 5.8% of the total industry output for the United States.

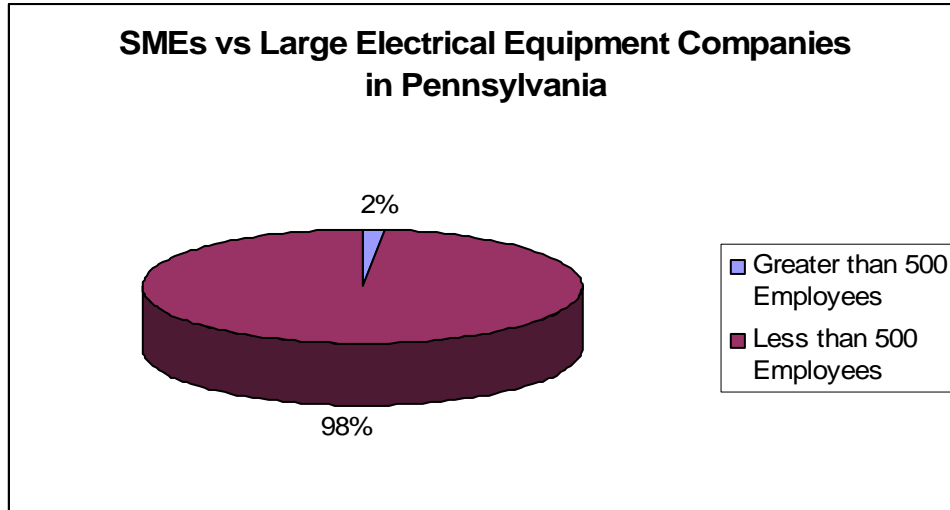
Pennsylvania's employment in this industry has declined over the past 10 years, which can be attributed to technological advances in making the process more automated. Within the Pennsylvania commonwealth, Montgomery, Berks and Allegheny counties have the greatest output of electrical equipment in dollars ranging from \$499 to 753 M per year. Pennsylvania currently ranks 18<sup>th</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Top Left	Growing Economic Base
Opportunity		Emerging industry segment in multiple locations
Key State Competition	State	Location Quotient
	Pennsylvania	1.42
	Iowa	2.20
	Idaho	2.13
	South Carolina	2.09
	Tennessee	1.96
	Ohio	1.56
	Illinois	1.40
	Kentucky	0.89
	Georgia	0.81
	Nebraska	0.78
	Maryland	0.74

#### TOP 10 PENNSYLVANIA FIRMS:

Company	Employees in PA
AK Steel Corp	4,000
East Penn Manufacturing Co Inc	3,100
Eaton Cutler-Hammer	1,210
Black Box Corp	600
Emerson Process Management	600
Shop Vac Corp	600
Hubbell-Columbia Lighting	579
Osram Sylvania Inc	500
Siemens Energy & Automation Inc	500
General Electric Co Inc	480

There are 470 electrical equipment companies in Pennsylvania: 8 (2%) large and 462 (98%) SME.



**PENNSYLVANIA'S COMPETITIVE POSITION:**

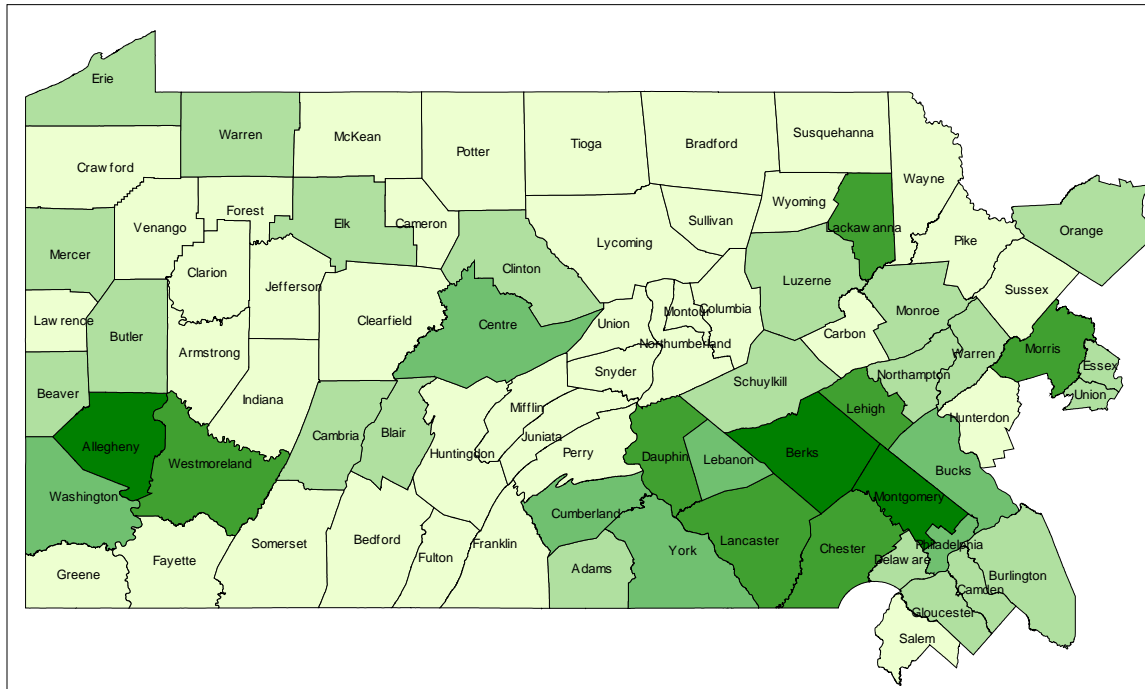
The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
Wisconsin	\$ 1,339	\$ 2,865	\$ 3,784	\$ 8,697	105.0%	69.2%	62.7%
North Carolina	\$ 1,737	\$ 4,034	\$ 6,122	\$ 7,003	14.1%	27.3%	39.7%
Illinois	\$ 1,741	\$ 3,077	\$ 4,585	\$ 5,291	14.5%	28.4%	31.7%
Arizona	\$ 753	\$ 2,789	\$ 4,320	\$ 4,674	9.6%	35.3%	60.7%
Ohio	\$ 1,696	\$ 2,660	\$ 3,429	\$ 4,629	32.3%	30.1%	29.5%
<b>Pennsylvania</b>	<b>\$ 1,994</b>	<b>\$ 3,273</b>	<b>\$ 4,031</b>	<b>\$ 4,612</b>	<b>12.9%</b>	<b>16.6%</b>	<b>23.6%</b>
United States	\$ 26,383	\$ 59,546	\$ 88,682	\$ 79,889	-9.6%	16.2%	33.4%



## LOCATION OF OUTPUT:

A thematic map of the concentration of electrical equipment industry output in Pennsylvania is shown below. The industry is concentrated in DVIRC, MANTEC, MRC and Catalyst Connection. Please refer to the key for the output range.



### Electrical Equipment Industry (NAICS 3351, 3353, 3359) (In \$M)

499 to 753	(3)
150 to 499	(7)
75 to 150	(7)
25 to 75	(22)
0 to 25	(39)

## BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):

- Other Wood Product Mfg.
- Converted Paper Product Mfg.
- Printing & Related Support Activities
- Petroleum & Coal Products Mfg.
- Basic Chemical Mfg.
- Resin, Synthetic Rubber, & Artificial Synthetic Fibers & Filaments Mfg.
- Glass & Glass Product Mfg.
- Nonferrous Metal (except Aluminum) Production & Processing
- Forging & Stamping
- Cutlery & Handtool Mfg.
- Other Fabricated Metal Product Mfg.
- Communications, Computer & Peripheral Equipment Mfg.
- Semiconductor & Other Electronic Component Mfg.







- Navigational, Measuring, Electromedical, & Control Instruments Mfg.

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products)**

- Iron & Steel Mills & Ferroalloy Mfg.
- Alumina & Aluminum Production & Processing
- Agriculture, Construction, & Mining Machinery Mfg.
- Metalworking Machinery Mfg.
- Other General Purpose Machinery Mfg.
- Navigational, Measuring, Electromedical, & Control Instruments Mfg.
- Other Wood Product Mfg.
- Petroleum & Coal Products Mfg.
- Basic Chemical Mfg
- Resin, Synthetic Rubber, & Artificial Synthetic Fibers & Filaments Mfg.
- Glass & Glass Product Mfg.
- Nonferrous Metal (except Aluminum) Production & Processing
- Forging & Stamping
- Cutlery & Handtool Mfg.
- Other Fabricated Metal Product Mfg.
- Communication, Computer & Peripheral Equipment Mfg.
- Semiconductor & Other Electronic Component Mfg.
- Navigational, Measuring, Electromedical, & Control Instruments Mfg.

**INDUSTRY ISSUES:**

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Electrical Equipment	Product Innovation	The electrical equipment industry is facing a serious overcapacity problem. This is caused in large part by offshore second- and third-tier suppliers (primarily Chinese) that are beginning to penetrate the U.S. marketplace due to their low prices even though they have no real infrastructure or demonstrable physical presence in the United States itself. As a result, prices for electrical equipment such as relays and switches have dropped between 5% and 10% over the past year, and more price reductions are expected. US manufacturers are increasingly considering product innovation and customization opportunities to retain customers		
Electrical Equipment	Strategy	Exploring new markets has become a major concern for small manufacturers. As the computing and telecommunications sectors have contracted, manufacturers are analyzing opportunities in newer markets such as automotive		
Electrical Equipment	Process Improvement	In order to survive the onslaught of China, manufacturers are increasingly considering offering value-added services in the areas of logistics and inventory management to achieve shorter lead times		

## **RECOMMENDATIONS:**

- Consolidate SMEs in order to decrease the risk and cost of exploring new markets and innovating products to decrease lead times
- Process improvement consulting to ensure that SMEs remain competitive in an industry that is consolidating and to identify opportunities for process or technology improvement
- Encourage investment in innovative technologies by providing assistance for SME companies to access capital to fund technology-driven equipment purchases
  - Assist with adoption of new technology and any necessary training
  - Identify opportunities for tax credits or other assistance to acquire and depreciate capital equipment
- Provide strategy and innovation support to help SMEs identify niches and opportunities for continued survival in an increasingly consolidating industry
  - Help identify value-added service opportunities
  - Help identify market niches

### III. PLASTICS INDUSTRY

#### INDUSTRY DEFINITION:

The plastics industry is comprised of establishments primarily engaged in processing new or spent (i.e., recycled) plastics resins into intermediate or final products, using such processes as compression molding, extrusion molding, injection molding, blow molding, and casting. Within these industries, a wide variety of products are made such as plastic pipes, pipe fittings, unsupported profile shape manufacturing (i.e. rods and plates), bottles, machine parts, etc. Deloitte's analysis focused on PVC, packaging, and molding.

#### INDUSTRY DESCRIPTION:

The industry as a whole is moving toward consolidation, which creates a make-up of a few major players with great industrial capabilities and greater supplier negotiating power. Consolidating has also helped to combat increasing foreign competition, which is driving down profit margins. The bottling and packaging market is one of the few growing segments. Currently, there has been an increased demand for new technology in packaging (e.g., hot-fill plastic).

#### PLASTICS IN PENNSYLVANIA:

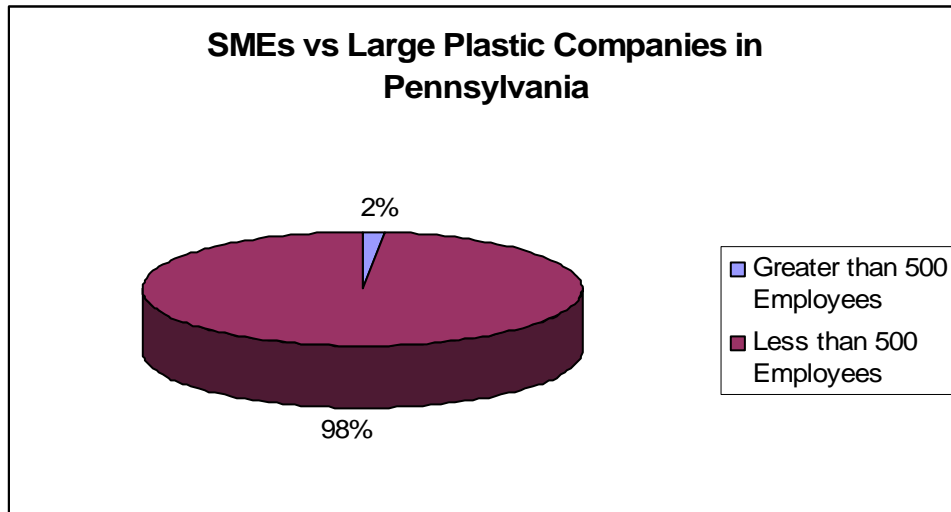
The plastics industry is present in Pennsylvania because it is used in several other industries in close proximity such as basic chemicals. Plastics are expensive to ship so Pennsylvania is an ideal manufacturing site due to its location on the manufacturing belt. PPG Industries INC is the largest plastic manufacturer in Pennsylvania. Within the Pennsylvania commonwealth, Erie County has the greatest output of plastic in dollars ranging from \$200-281 M per year. Pennsylvania currently ranks 3<sup>rd</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Top Right	Strong Economic Base
Opportunity		Driver is in Good Health
Key State Competition	State	Location Quotient
	Pennsylvania	2.22
	Wisconsin	3.12
	Indiana	2.34
	South Carolina	2.20
	Arkansas	2.02
	Ohio	1.91
	West Virginia	1.85
	Illinois	1.82
	Maine	1.79
	Mississippi	1.74
	Iowa	1.70

**TOP 10 PENNSYLVANIA FIRMS:**

Company	Employees in PA
PPG Industries Inc	1400
Graham Packaging Co LP	890
Sealed Air Corp	691
Key Plastics LLC	660
Advanced Glassfiber Yarns LLC	600
OMNOVA Solutions Inc	520
West Pharmaceutical Services Inc	520
Armstrong Holdings Inc	500
Bemis Co Inc	500
Jet Plastica Industries Inc	500

There are 602 plastics companies in Pennsylvania: 10 (2%) large and 592 (98%) SME.



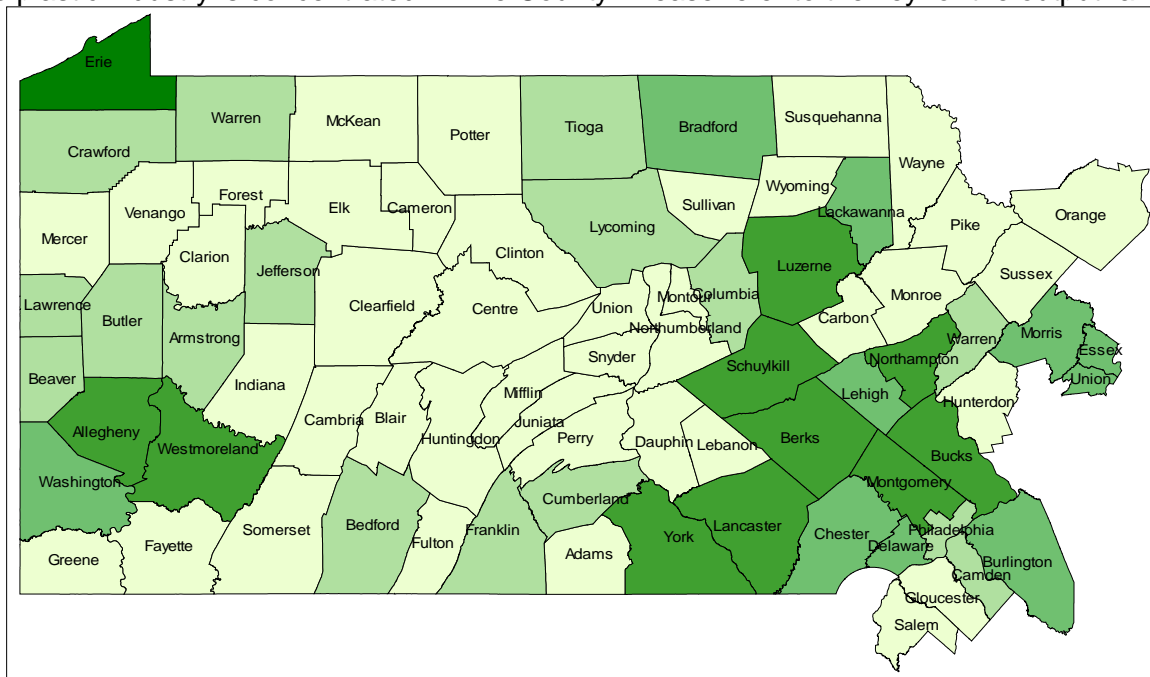
## PENNSYLVANIA'S COMPETITIVE POSITION:

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$2,198,940,000	\$3,234,010,000	\$3,481,550,000	\$3,115,090,000	-3.6%	-0.6%	3.2%
Pennsylvania	\$1,654,550,000	\$2,379,590,000	\$2,669,670,000	\$2,817,930,000	1.8%	2.9%	5.0%
Illinois	\$1,565,370,000	\$2,462,550,000	\$2,831,330,000	\$2,687,710,000	-1.7%	1.5%	5.0%
Texas	\$1,511,520,000	\$2,452,360,000	\$2,697,400,000	\$2,504,640,000	-2.4%	0.4%	4.7%
Ohio	\$1,742,060,000	\$2,451,440,000	\$2,660,870,000	\$2,212,750,000	-6.0%	-1.7%	2.2%
Wisconsin	\$1,091,440,000	\$1,480,110,000	\$1,763,050,000	\$1,738,440,000	-0.5%	2.7%	4.3%
United States	\$26,273,270,000	\$34,352,340,000	\$35,684,380,000	\$31,204,870,000	-4.4%	-1.6%	1.6%

## LOCATION OF OUTPUT:

A thematic map of the concentration of plastic industry output in Pennsylvania is shown below. The plastic industry is concentrated in Erie County. Please refer to the key for the output range.



Plastics Product Manufacturing (3261)  
(in \$M)

- 200 to 281 (1)
- 100 to 200 (10)
- 60 to 100 (10)
- 20 to 60 (16)
- 0 to 20 (41)

**BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**

- Basic Chemical Mfg.
- Converted Paper Product Mfg.
- Glass & Glass Product Mfg.
- Other Chemical Product & Preparation Mfg.
- Paint, Coating, & Adhesive Mfg.
- Petroleum & Coal Products Mfg.
- Resin, Synthetic Rubber, & Artificial Synthetic Fibers & Filaments Mfg.
- Support Activities for Rail & Road Transportation
- Warehousing & Storage

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products)**

- Food Mfg.
- Beverage & Tobacco Product Mfg.
- Wood Product & Paper Mfg.
- Textile & Textile Product Mills
- Nonmetallic Mineral Product Mfg.
- Primary Metal Mfg.
- Computer & Electronic Product Mfg.
- Transportation Equipment Mfg.
- Furniture & Related Product Mfg.
- Miscellaneous Mfg.

## INDUSTRY ISSUES:

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	Small
Plastic	Competitiveness	Many US plastic manufacturers are concerned with China's presence in the plastic market. China's cheap labor and undervalued currency is allowing them to sell plastic products at extremely low margins. There is suspicion of dumping due to the fact that small plastic toys imported from China are selling at prices comparable to the freight charges. There is also concern around the current trade deficit that the US faces with China and increasing foreign competition for exports. US traditionally exported raw materials to China to satisfy the 50% of local demand that Chinese manufacturers did not have the capacity to fulfill; however, recently, US exports have met competition from Japan, Korea, Taiwan, and Germany. China's accession to the WTO is expected to once again put US exports in favor. Government assistance is provided through tariffs that vary from 3-7% ad valorem tax for countries with normal trade relations (NTR) and 25-45% ad valorem tax for countries without normal trade relations; however, this has not served as a deterrent	●	◐
Plastic	Performance Improvement/New Product Development	Studies from 1999 show that plastic manufacturing is the 4th largest in the manufacturing industry. There were \$304 billion in shipment of plastics and 1.5 million jobs; however, profit margins have been driven down due to the competitive nature (increased by consolidation and foreign) of the industry. Firms need to stay alive by either driving down cost of production or creating new products to increase profit margins	●	●
Plastic	Public Policy	New legislation, which has taken effect in several states, requires new plastic containers to use certain amount (amount specified by state) of recycled PET plastic in its products. This is a costly task, and companies are looking for ways to decrease the cost of recycling PET plastics so that the unit cost of creating these products does not increase	●	●

## RECOMMENDATIONS:

- Supply strategy services to analyze opportunities to enter new markets in order to maintain or increase current level of sales
  - Help identify value-added service opportunities
  - Help identify market niches
- Lobby to enforce stricter dumping laws
- Provide supply chain and logistics/distribution services
- Consolidate SMEs to decrease the threat of competition and share technology and innovation



- Process improvement consulting to ensure that SMEs remain competitive and to identify opportunities for process or technology improvement

## **IV. PRINTING INDUSTRY**

### **INDUSTRY DEFINITION:**

Industries in the printing and related support activities sub sector print products, such as newspapers, books, periodicals, business forms, greeting cards, and other materials, and perform support activities, such as bookbinding, plate making services, and data imaging. The support activities included here are an integral part of the printing industry and a product (a printing plate, a bound book, or a computer disk or file) that is an integral part of the printing industry is almost always provided by these operations. The printing processes employed include, but are not limited to, lithographic, gravure, screen, flexographic, digital, and letterpress. A rapidly growing new technology uses a computer file to directly "drive" the printing mechanism to create the image and new electrostatic and other types of equipment (digital or non-impact printing). Publishing is not included.

### **INDUSTRY DESCRIPTION:**

The printing industry was adversely affected in 2001 by the economic slowdown. During this time, advertising expenditures were cut; demand for magazines, catalogues, inserts and books decreased; and there was a slow down in industrial production, which affected demand for labels and packaging-related printing. Firms began to consolidate, and major players sought to restructure and rationalize activities in an effort to reduce costs. More recently, there has been growth in the quick printing and digital printing segments. Competition is intense due to the over-capacity in the commercial printing market and advancement in the substitute technologies (i.e., Internet, photo copy equipment, and office computer equipment).

### **PRINTING IN PENNSYLVANIA:**

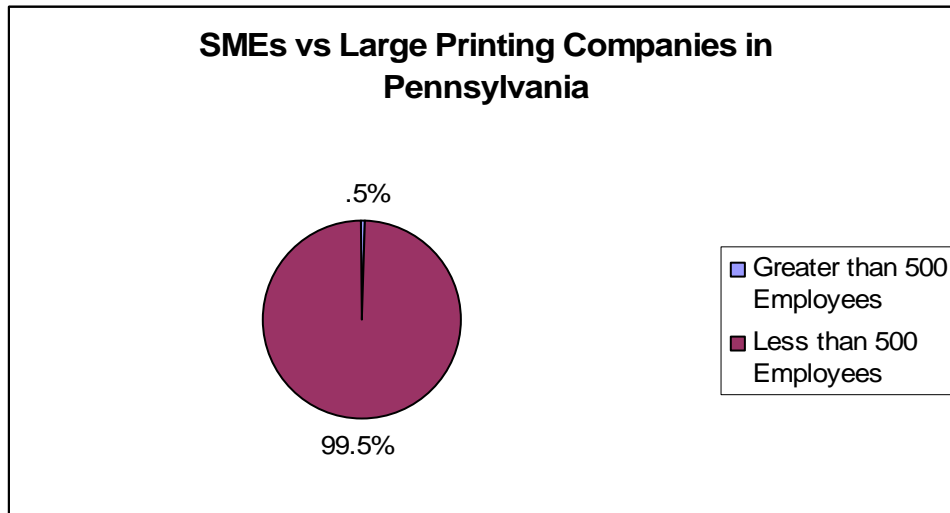
Pennsylvania attracted the printing industry due to its concentration of population, and its activity in the advertising and publishing industries. Within the Pennsylvania commonwealth, Allegheny, Lancaster, Montgomery and Philadelphia counties have the greatest output of print manufacturing in dollars ranging from \$200-416 M per year. Pennsylvania currently ranks 4<sup>th</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Bottom Left	Important Economic Base
Opportunity		Driver needs a revolution to be competitive
Key State Competition	State	Location Quotient
	Pennsylvania	1.95
	Wisconsin	3.20
	Minnesota	2.87
	Kansas	2.53
	Utah	1.76
	Illinois	1.72
	Ohio	1.43
	Tennessee	1.34
	Maryland	1.32
	Kentucky	1.30
	Vermont	1.27

#### TOP 10 PENNSYLVANIA FIRMS:

Company	Employees in PA
R R Donnelley	4163
Day-Timers Inc	800
Offset Paperback Mfrs Inc	750
Regency Thermographers	728
Brown Printing Co Inc	650
Vertis Direct Marketing	600
Maple Press Co	595
Haddon Craftsmen Inc	530
Quebecor World/Fairfield	500
Sharp Corp	500

There are 2197 printing companies in Pennsylvania: 10 (.5%) large and 2187 (99.5%) SME.



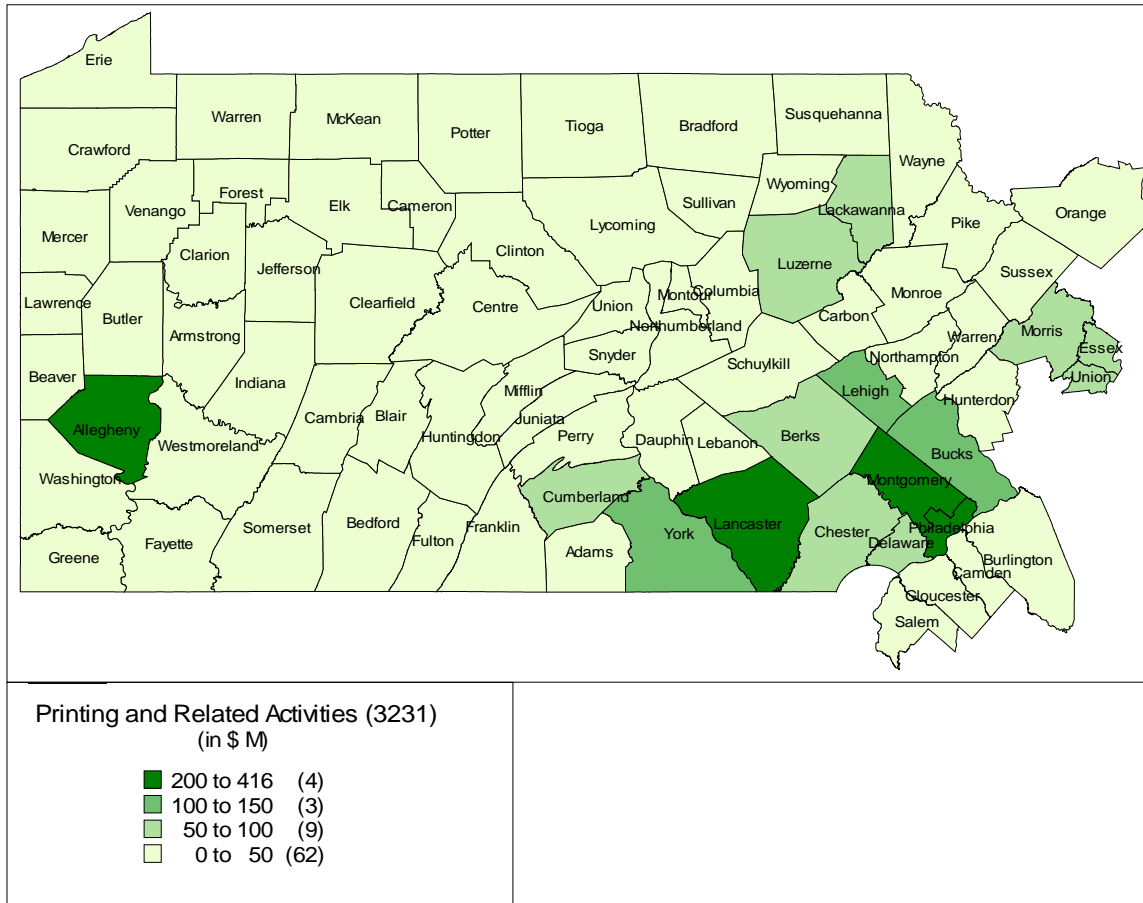
### PENNSYLVANIA'S COMPETITIVE POSITION

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

Printing and Related Support Activities

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$ 4,675	\$ 5,029	\$ 5,027	\$ 3,519	-11.2%	-5.8%	-2.5%
Illinois	\$ 3,181	\$ 3,050	\$ 2,913	\$ 2,355	-6.8%	-4.2%	-2.7%
<b>Pennsylvania</b>	<b>\$ 2,556</b>	<b>\$ 2,494</b>	<b>\$ 2,445</b>	<b>\$ 2,287</b>	<b>-2.2%</b>	<b>-1.4%</b>	<b>-1.0%</b>
Texas	\$ 2,083	\$ 2,373	\$ 2,298	\$ 2,142	-2.3%	-1.7%	0.3%
New York	\$ 4,305	\$ 3,876	\$ 3,937	\$ 1,874	-21.9%	-11.4%	-7.3%
Wisconsin	\$ 1,361	\$ 1,412	\$ 1,421	\$ 1,653	5.2%	2.7%	1.8%
Minnesota	\$ 1,361	\$ 1,434	\$ 1,514	\$ 1,548	0.7%	1.3%	1.2%
United States	\$ 42,710	\$ 39,993	\$ 39,206	\$ 28,917	-9.6%	-5.3%	-3.5%

## LOCATION OF OUTPUT:



## BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):

- Repair & Maintenance
- Converted Paper Product Mfg.
- Petroleum & Coal Products Mfg.
- Paint, Coating, & Adhesive Mfg.
- Other Chemical Product & Preparation Mfg.
- Industrial Machinery Mfg.
- Commercial & Service Industry Machinery Mfg.
- Newspaper, Periodical, Book, & Directory Publishers
- Radio & Television Broadcasting
- Road Transportation







## SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products)

- Animal Food Mfg.
- Grain & Oilseed Milling
- Sugar & Confectionery Product Mfg.
- Fruit & Vegetable Preserving & Specialty Food Mfg.

- Bakeries & Tortilla Mfg.
- Beverage & Other Food Mfg.
- Tobacco Mfg.
- Other Textile Product Mills
- Apparel Accessories & Other Apparel Mfg.
- Printing & Related Support Activities
- Soap, Cleaning Compound, & Toilet Preparation Mfg.
- Motor Vehicle Parts Mfg.
- Medical Equipment & Supplies Mfg.
- Other Miscellaneous Mfg.
- Newspaper, Periodical, Book, & Directory Publishers
- Sound Recording Industries
- Grantmaking & Giving Services.

### INDUSTRY ISSUES:

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Printing	Competitiveness	In an industry with many large competitors who often compete on price, it is critical for SMEs to shift from being "job shops" to providing customers with value-added services. Many of these services may require adding new skills or technology		
Printing	Technology	Technological advancements in printing industry equipment and materials have led to increased product innovation and diversification along with improvements in productive efficiency in labor and capital costs, product quality, production time and volumes		
Printing	Labor	The printing industry is labor-intensive; labor market conditions are tight for people with the newly needed combination of traditional graphic arts and new technology-based skills		

### RECOMMENDATIONS:

- Help SMEs develop recruiting and training programs to attract and skilled labor and to keep skilled labor "up to date" on latest skills and technologies
  - Establish apprenticeship programs
  - Provide links between industry and educational institutions
- Process improvement consulting to ensure that SMEs remain competitive in an industry that is consolidating and to identify opportunities for process or technology improvement
- Encourage investment in innovative technologies by providing assistance for SME companies to access capital to fund technology-driven equipment purchases
  - Assist with adoption of new technology and any necessary training

- Identify opportunities for tax credits or other assistance to acquire and depreciate capital equipment
- Provide strategy and innovation support to help SMEs identify niches and opportunities for continued survival in an increasingly consolidating industry
  - Help identify value-added service opportunities
  - Help identify market niches
  - Help identify opportunities for acquiring government or homeland security business

## V. FOOD

### **INDUSTRY DEFINITION:**

Industries in the food manufacturing sub sector transform livestock and agricultural products into products for intermediate or final consumption. The industry groups are distinguished by the raw materials (generally of animal or vegetable origin) processed into food products. The food products manufactured in these establishments are typically sold to wholesalers or retailers for distribution to consumers; establishments primarily engaged in retailing bakery and candy products made on the premises not for immediate consumption are included.

For Pennsylvania, the major sectors that are drivers are:

### **Sugar and Confectionary Product Manufacturing (NAICS 3113)**

This industry group comprises establishments primarily engaged in manufacturing sugar and confectionery products.

### **Bakeries and Pasta Manufacturing (NAICS 3118)**

This industry group comprises establishments primarily engaged in manufacturing baked goods. Establishments primarily engaged in manufacturing bakery products, for retail sale but not for immediate consumption, are included. Products included in the group include: bread, crackers, cookies, pasta, and tortillas.

### **INDUSTRY DESCRIPTION:**

The food industry has experienced a flux in growth over the past few years ranging from -5% to 5%. Overall the industry is mature, and a decline in growth is expected. Commodity products such as pastas and canned fruits and vegetables face the most competition due to the presence of private labels, and consequently receive a low profit margin. Specialty and custom made foods, however, still enjoy a high profit margin due to the lack of substitutes for the products.

### **FOOD IN PENNSYLVANIA:**

Pennsylvania originally attracted the food industry because of its abundance of raw materials and ease of access to distribution markets. For example, Hershey Foods located in Pennsylvania near the dairy industry so that it could obtain the milk products needed to make chocolate. Currently, the largest food manufacturer by number of employees is Hershey Foods. Within the Pennsylvania commonwealth, Dauphin, Lancaster and Philadelphia counties have the greatest output of food in dollars ranging from \$251-400 M per year. Pennsylvania currently ranks 2<sup>nd</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.



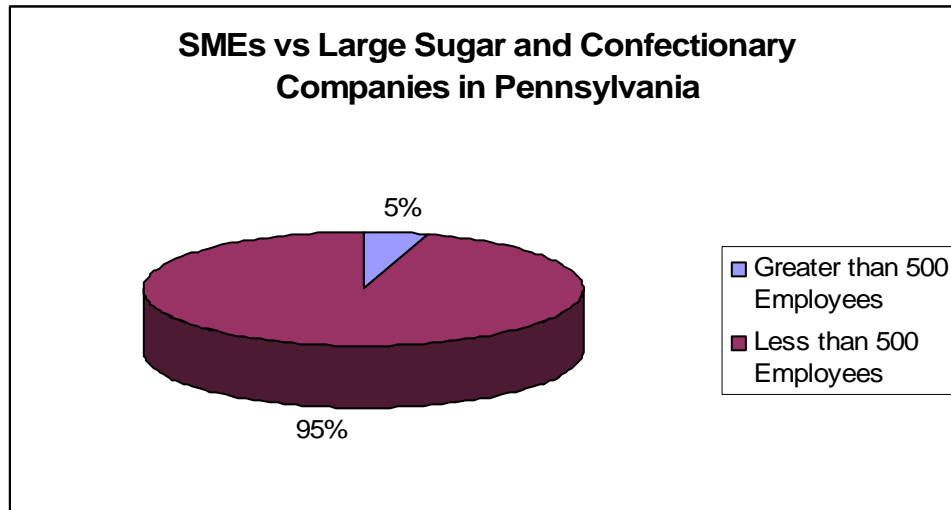
Industry Position		
Industry Quadrant	Bottom Right	Traditionally Competitive
Opportunity		Driver with a Challenged Strategy and Will Need to Refocus Efforts
Key State Competition	State	Location Quotient
	Pennsylvania	2.35
	Tennessee	2.57
	Georgia	1.99
	Illinois	1.98
	North Dakota	1.79
	Utah	1.60
	Iowa	1.48
	Missouri	1.46
	Louisiana	1.43
	South Dakota	1.36
	Arkansas	1.33

#### TOP 10 PENNSYLVANIA FIRMS:

##### Sugar and Confectionary Products (3113)

Company	Employees in PA
Hershey Foods Corp	21,496
R M Palmer Co	1,040
H B Reese Candy Co	1,017
Y & S Candies Inc	650
Gertrude Hawk Chocolate Inc	600
Swell Confections	500
Just Born Inc	460
Wilbur Chocolate Co Inc	450
Luden's	430
Master Foods USA	400

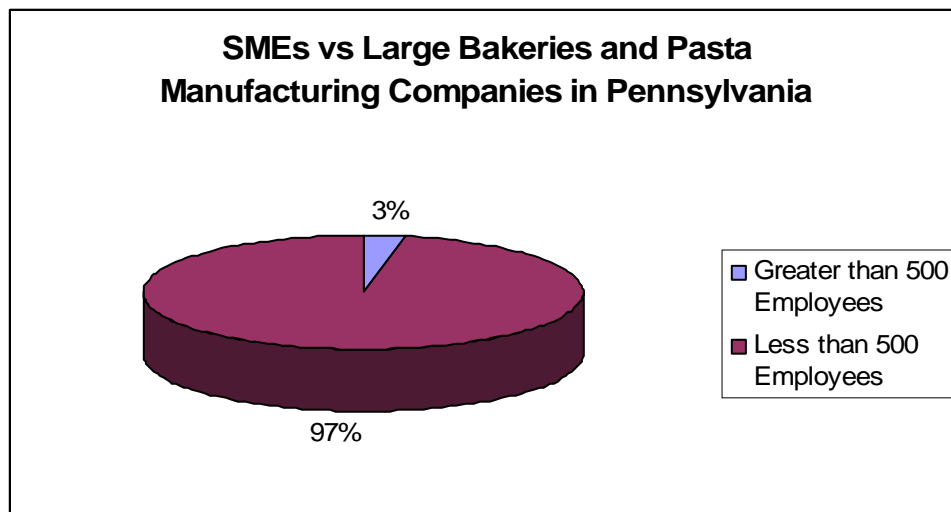
There are 125 sugar and confectionary companies in Pennsylvania: 6 (5%) large and 119 (95%) SME.



Bakeries and Pasta Manufacturing (3118)

Company	Employees in PA
Stroehmann Bakeries	1,612
Tasty Baking	1,179
Kraft Foods Inc	1,000
Pepperidge Farm Inc	900
D F Stauffer Biscuit Co Inc	550
Interstate Brands Corp	512
Amoroso's Baking Corp	450
Kellogg Co	337
Bake-Line Inc	300
Maple Donuts Inc	272

There are 220 bakeries and pasta manufacturing companies in Pennsylvania: 7 (5%) large and 213 (95%) small.



## PENNSYLVANIA'S COMPETITIVE POSITION:

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

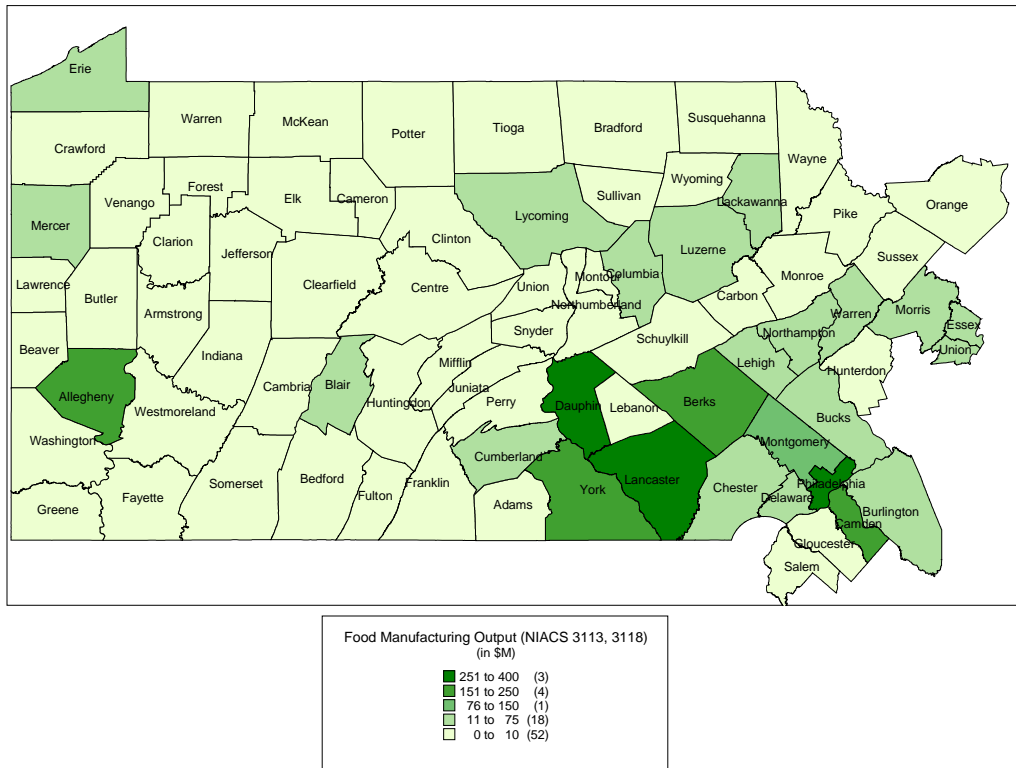
### Sugar and Confectionery Product Manufacturing

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
<b>Pennsylvania</b>	<b>\$ 874</b>	<b>\$ 933</b>	<b>\$ 968</b>	<b>\$ 962</b>	<b>-0.2%</b>	<b>0.5%</b>	<b>0.9%</b>
California	\$ 853	\$ 774	\$ 847	\$ 828	-0.7%	1.1%	-0.3%
Illinois	\$ 1,041	\$ 901	\$ 820	\$ 709	-4.7%	-3.9%	-3.4%
Florida	\$ 272	\$ 302	\$ 326	\$ 346	2.0%	2.3%	2.2%
Texas	\$ 292	\$ 285	\$ 276	\$ 282	0.7%	-0.2%	-0.3%
Tennessee	\$ 227	\$ 248	\$ 231	\$ 267	4.9%	1.2%	1.5%
New York	\$ 329	\$ 310	\$ 299	\$ 260	-4.7%	-2.9%	-2.1%
United States	\$ 6,658	\$ 6,507	\$ 6,672	\$ 6,232	-2.2%	-0.7%	-0.6%

### Bakeries and Pasta Manufacturing

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$ 2,236	\$ 2,133	\$ 2,192	\$ 1,946	-3.9%	-1.5%	-1.3%
Illinois	\$ 1,277	\$ 1,345	\$ 1,436	\$ 1,402	-0.8%	0.7%	0.9%
<b>Pennsylvania</b>	<b>\$ 1,197</b>	<b>\$ 1,244</b>	<b>\$ 1,295</b>	<b>\$ 1,187</b>	<b>-2.9%</b>	<b>-0.8%</b>	<b>-0.1%</b>
New York	\$ 1,628	\$ 1,371	\$ 1,326	\$ 1,177	-3.9%	-2.5%	-2.9%
Texas	\$ 1,001	\$ 1,031	\$ 1,064	\$ 1,082	0.5%	0.8%	0.7%
Georgia	\$ 810	\$ 1,010	\$ 1,053	\$ 1,073	0.6%	1.0%	2.6%
Ohio	\$ 842	\$ 854	\$ 935	\$ 973	1.4%	2.2%	1.3%
United States	\$ 19,160	\$ 17,865	\$ 18,336	\$ 16,296	-3.9%	-1.5%	-1.5%

## LOCATION OF OUTPUT:



## BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):









- Repair and Maintenance
- Dairy Product Manufacturing
- Animal Production
- Oilseed & Grain Farming
- Sugar & Confectionery Product Mfg.
- Converted Paper Product Manufacturing
- Glass and Glass Product Manufacturing
- Boiler, Tank, and Shipping Container Manufacturing
- Printing and Related Support Activities
- Petroleum & Coal Products Manufacturing
- Newspaper, Periodical, Book, & Directory Publishers
- Radio & Television Broadcasting
- Rail & Road Transportation

## SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products)

- Fruit and Vegetable Preserving and Specialty Food Manufacturing
- Dairy Product Manufacturing
- Other Food Manufacturing

## INDUSTRY ISSUES:

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Food	Product Innovation	While food manufacturers develop a large number of new products every year, only a small percentage of those products are successful in the marketplace. In a mature industry where many products are commoditized, successful new products are critical to drive growth		
Food	Performance Improvement	Because revenue growth is low in the food industry, manufacturers are increasingly looking for cost savings in order to improve their profit. The overall supply chain (plan, source, make, distribute) and the associated costs represent the highest area of potential for cost reduction		
Food	Competitiveness	In an industry with many large retail customers that have strong buying power and many large competitors who often compete on price, it is critical for each SME to establish a product or market niche in which it can thrive. In addition, SMEs often need resources or creative solutions to develop distribution channels		
Food - confectionary	Off Shoring	Many confectionary companies are moving production offshore due to lower ingredient (i.e., sugar), labor, and utility costs		

## RECOMMENDATIONS:

- Identify and “incubate” new product ideas to help drive manufacturer growth
- Help develop value-added products (e.g., convenience) that will allow commoditized food categories to differentiate and improve financial performance
- IRC service line to help manufacturers develop and implement the product development process, from identifying opportunities for products and markets to developing products and testing their performance with consumers
- Continue to identify process improvement and cost savings ideas. Look beyond functional or single-process opportunities to enterprise cost savings opportunities and opportunities to optimize the total supply chain
- Identify opportunities to give incentive to larger processing companies such as Hershey to use more inputs (ingredients, capital equipment, etc.) from Pennsylvania
- Help smaller manufacturers with sales process
  - how to get retail distribution
  - how to bring value to retailers
- Identify potential incentives to lure more food manufacturers to the state – focus on benefits of central shipping location near major population centers
- Identify opportunities to influence manufacturer decision to remain in Pennsylvania and not relocate operations offshore, especially in the confectionary industry

## VI. WOOD, WOOD PRODUCTS, AND CONVERTED PAPER INDUSTRIES

### INDUSTRY DEFINITION:

The wood products manufacturing sub sector includes establishments that make wood products from logs and bolts that are sawed and shaped, and establishments that purchase sawed lumber and make wood products. With the exception of sawmills and wood preservation establishments, the establishments are grouped into industries mainly based on the specific products manufactured.

### Sawmills and Wood Preservation (NAICS 3211)

This industry group comprises establishments whose primary production process begins with logs or bolts that are transformed into boards, dimension lumber, beams, timbers, poles, ties, shingles, shakes, siding, and wood chips. Establishments that cut and treat round wood and/or treat wood products made in other establishments to prevent rotting by impregnation with creosote or other chemical compounds are also included in this industry group.

### Converted Paper Product Manufacturing (NAICS 3222)

This industry group comprises establishments primarily engaged in manufacturing paper products from purchased paper and paperboard.

### Veneer, Plywood, and Engineered Wood Product Manufacturing (NAICS 3212)

This industry comprises establishments primarily engaged in one or more of the following: (1) manufacturing veneer and/or plywood; (2) manufacturing engineered wood members; and (3) manufacturing reconstituted wood products. This industry includes manufacturing plywood from veneer made in the same establishment or from veneer made in other establishments, and manufacturing plywood faced with non-wood materials, such as plastics or metal.

### Other Wood Product Manufacturing (NAICS 3219)

This industry group comprises establishments primarily engaged in manufacturing wood products (except establishments operating sawmills and wood preservation facilities and establishments manufacturing veneer, plywood, or engineered wood products).

### INDUSTRY DESCRIPTION:

In recent years, the wood, wood products, and paper industry has struggled due to excess supply, decreasing paper prices, increase of imports and a decline of exports. Specifically, imports from Canada have significantly increased the pricing pressure. As a result, the industry has not grown and there has been a move toward consolidation. The industry relies on traditional construction for revenue; however, there has been a move toward wood substitutes in construction.

### WOOD AND WOOD PRODUCTS IN PENNSYLVANIA:

Manufacturing wood, wood products, and paper is a natural industry for Pennsylvania to be involved in because 59% of its total land area is forested. In the Pennsylvania commonwealth, Snyder and Lancaster counties have the greatest output of wood and wood products in dollars ranging from \$100-135 M per year. Converted paper products industry has the greatest amount of output in York, Chester, Philadelphia, and Bucks in dollars ranging from \$150-200 M per year. Pennsylvania currently ranks 21<sup>st</sup> among the United States by location quotient for wood and wood products and 3<sup>rd</sup> for converted paper products, which reflects the state's competitive

advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

### Wood and Wood Products

Industry Position		
Industry Quadrant	Bottom Left	Important Economic Base
Opportunity		Driver needs a revolution to become competitive
Key State Competition	State	Location Quotient
	Pennsylvania	1.97
	Alabama	2.97
	Wisconsin	2.28
	Oklahoma	2.27
	Arkansas	2.14
	South Dakota	2.13
	Minnesota	1.96
	Texas	1.78
	Mississippi	1.68
	Indiana	1.64
	Utah	1.43

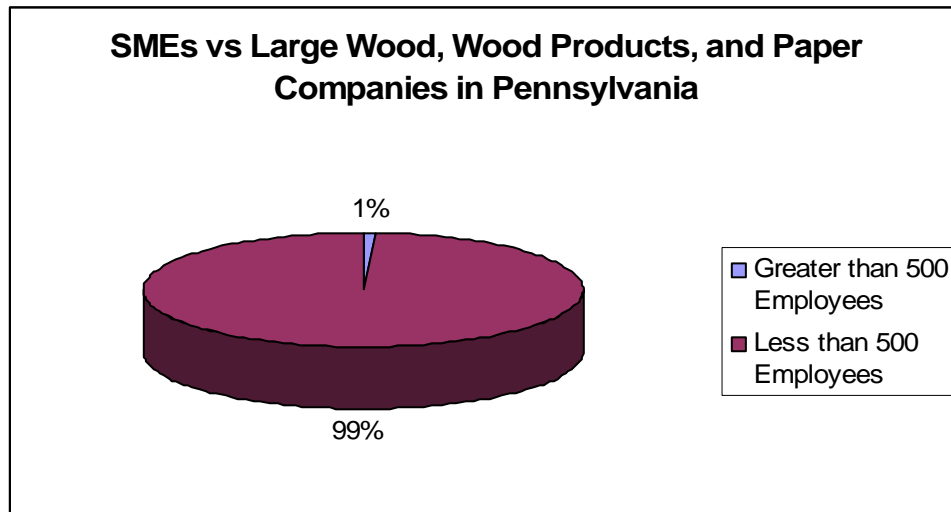
### Converted Paper Products

Industry Position		
Industry Quadrant	Bottom Right	Traditionally Competitive
Opportunity		Driver with a Challenged Strategy and Will Need to Refocus Efforts
Key State Competition	State	Location Quotient
	Pennsylvania	2.55
	Wisconsin	3.60
	South Carolina	3.02
	Delaware	2.46
	Georgia	2.45
	Maine	2.23
	Utah	2.13
	Arkansas	1.92
	Mississippi	1.84
	Kentucky	1.70
	Delaware	2.46

## TOP 10 PENNSYLVANIA FIRMS

Company	Employees in PA
Procter & Gamble Paper Products Co	3150
Dart Container Corp Of Pennsylvania	1200
Smurfit-Stone Container Corp	1123
Tyco Healthcare Retail Group	1050
Kimberly-Clark Corp	1000
Weyerhaeuser Co	950
Conestoga Wood Specialties Corp	800
Williamhouse	800
Cascades Tissue Group	700
MeadWestvaco Corp	575

There are 1341 wood, wood products, and paper companies in Pennsylvania: 13 (1%) large and 1328 (99%) SME.



## PENNSYLVANIA'S COMPETITIVE POSITION

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

### Sawmills and Wood Preservation

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
Oregon	\$ 844	\$ 553	\$ 648	\$ 453	-11.3%	-3.3%	-5.5%
California	\$ 592	\$ 473	\$ 507	\$ 425	-5.7%	-1.8%	-3.0%
Washington	\$ 546	\$ 480	\$ 618	\$ 392	-14.1%	-3.3%	-3.0%
Arkansas	\$ 323	\$ 323	\$ 398	\$ 335	-5.5%	0.6%	0.3%
North Carolina	\$ 380	\$ 398	\$ 396	\$ 316	-7.3%	-3.8%	-1.7%
Georgia	\$ 284	\$ 299	\$ 367	\$ 300	-6.5%	0.0%	0.5%
Mississippi	\$ 409	\$ 336	\$ 393	\$ 281	-10.6%	-2.9%	-3.4%
<b>Pennsylvania</b>	<b>\$ 191</b>	<b>\$ 259</b>	<b>\$ 264</b>	<b>\$ 266</b>	<b>0.2%</b>	<b>0.5%</b>	<b>3.1%</b>
United States	\$ 6,820	\$ 6,301	\$ 6,726	\$ 5,298	-7.6%	-2.8%	-2.3%



Veneer, Plywood, and Engineered Wood Product Manufacturing

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$ 333	\$ 409	\$ 475	\$ 461	-1.0%	2.0%	3.0%
Wisconsin	\$ 262	\$ 306	\$ 315	\$ 331	1.7%	1.4%	2.2%
Georgia	\$ 191	\$ 266	\$ 332	\$ 305	-2.8%	2.3%	4.4%
Oregon	\$ 584	\$ 384	\$ 416	\$ 288	-11.5%	-4.7%	-6.2%
Minnesota	\$ 305	\$ 324	\$ 330	\$ 287	-4.5%	-2.0%	-0.5%
Florida	\$ 171	\$ 184	\$ 208	\$ 253	6.8%	5.5%	3.6%
Texas	\$ 278	\$ 339	\$ 380	\$ 234	-14.9%	-6.0%	-1.6%
Ohio	\$ 190	\$ 238	\$ 271	\$ 229	-5.5%	-0.7%	1.7%
<b>Pennsylvania</b>	<b>\$ 171</b>	<b>\$ 227</b>	<b>\$ 234</b>	<b>\$ 224</b>	<b>-1.4%</b>	<b>-0.2%</b>	<b>2.5%</b>
United States	\$ 4,877	\$ 5,363	\$ 5,854	\$ 4,770	-6.6%	-1.9%	-0.2%

Other Wood Product Manufacturing

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$ 1,059	\$ 1,161	\$ 1,322	\$ 1,180	-3.7%	0.3%	1.0%
Georgia	\$ 717	\$ 1,138	\$ 1,239	\$ 1,051	-5.4%	-1.3%	3.5%
Texas	\$ 733	\$ 1,121	\$ 1,176	\$ 840	-10.6%	-4.7%	1.2%
<b>Pennsylvania</b>	<b>\$ 635</b>	<b>\$ 855</b>	<b>\$ 865</b>	<b>\$ 812</b>	<b>-2.1%</b>	<b>-0.9%</b>	<b>2.3%</b>
Wisconsin	\$ 607	\$ 684	\$ 737	\$ 783	2.0%	2.3%	2.3%
North Carolina	\$ 698	\$ 931	\$ 905	\$ 725	-7.1%	-4.1%	0.3%
United States	\$ 13,062	\$ 14,650	\$ 15,314	\$ 12,396	-6.8%	-2.7%	-0.5%

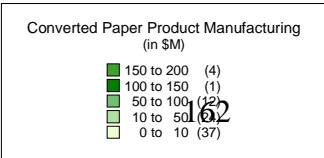
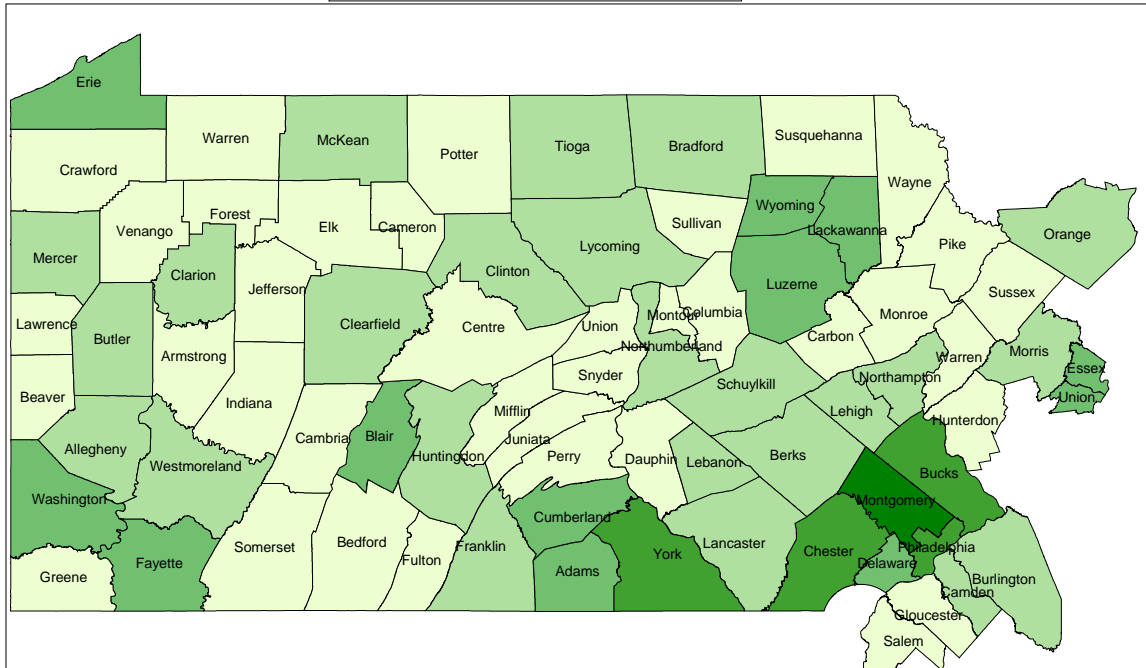
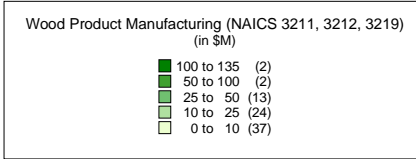
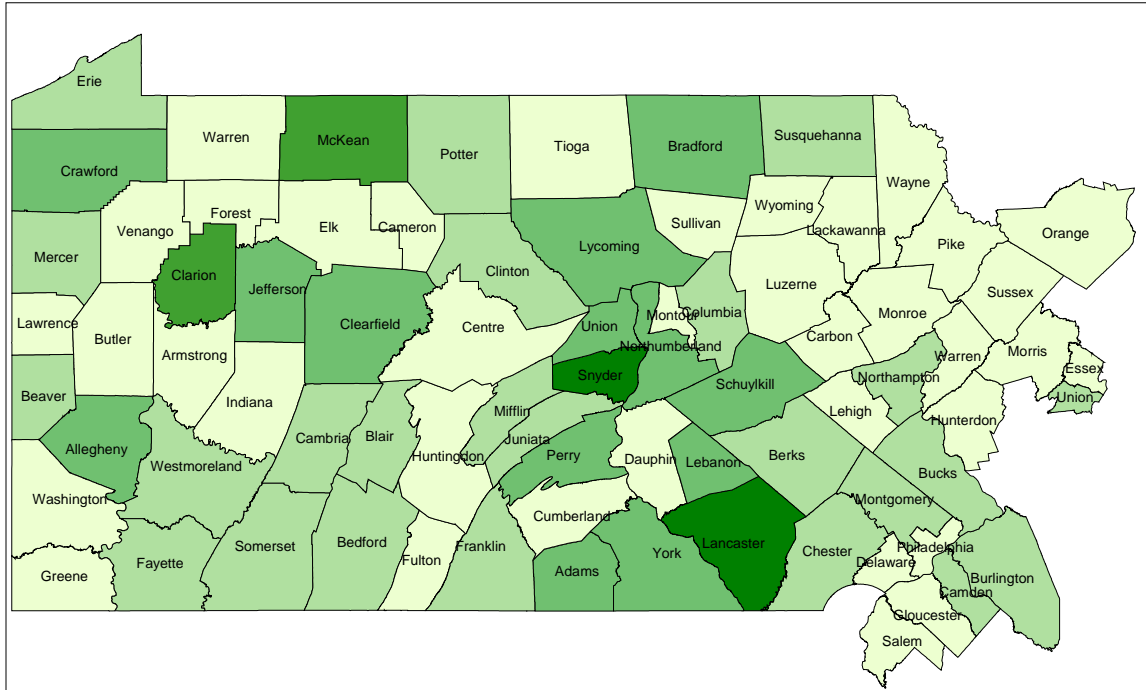
All WOOD

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$ 1,985	\$ 2,043	\$ 2,304	\$ 2,066	-10.4%	0.5%	1.0%
Georgia	\$ 1,192	\$ 1,703	\$ 1,938	\$ 1,656	-14.6%	1.0%	8.4%
Oregon	\$ 2,740	\$ 1,846	\$ 2,041	\$ 1,446	-33.1%	-12.1%	-17.2%
<b>Pennsylvania</b>	<b>\$ 996</b>	<b>\$ 1,341</b>	<b>\$ 1,363</b>	<b>\$ 1,302</b>	<b>-3.2%</b>	<b>-0.6%</b>	<b>7.8%</b>
Wisconsin	\$ 1,005	\$ 1,143	\$ 1,222	\$ 1,302	7.0%	7.1%	7.5%
North Carolina	\$ 1,254	\$ 1,532	\$ 1,512	\$ 1,211	-21.3%	-10.7%	-1.6%
Texas	\$ 1,222	\$ 1,630	\$ 1,743	\$ 1,189	-40.6%	-17.0%	-5.7%
United States	\$ 24,760	\$ 26,314	\$ 27,894	\$ 22,464	-21.0%	-7.5%	-2.9%

Converted Paper Product Manufacturing

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
<b>Pennsylvania</b>	<b>\$ 2,018</b>	<b>\$ 2,251</b>	<b>\$ 2,226</b>	<b>\$ 2,109</b>	<b>-1.8%</b>	<b>-1.1%</b>	<b>0.4%</b>
Texas	\$ 1,337	\$ 1,823	\$ 1,614	\$ 1,638	0.5%	-1.8%	1.9%
Georgia	\$ 1,596	\$ 1,726	\$ 1,559	\$ 1,471	-1.9%	-2.6%	-0.7%
California	\$ 2,400	\$ 2,117	\$ 1,876	\$ 1,386	-9.6%	-6.8%	-4.9%
Wisconsin	\$ 1,602	\$ 1,440	\$ 1,445	\$ 1,307	-3.3%	-1.6%	-1.8%
Illinois	\$ 2,198	\$ 1,749	\$ 1,400	\$ 1,131	-6.9%	-7.0%	-5.9%
United States	\$ 31,354	\$ 29,122	\$ 25,912	\$ 20,354	-7.7%	-5.8%	-3.9%

# LOCATION OF OUTPUT:



**Sawmill BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**

- Forestry & Logging
- Repair & Maintenance
- Petroleum & Coal Products Mfg.
- Basic Chemical Mfg.
- Support Activities for Rail & Road Transportation
- Warehousing & Storage

**Sawmill SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products)**

- Veneer, Plywood, & Engineered Wood Product Mfg.
- Other Wood Product Mfg.
- Household & Institutional Furniture & Kitchen Cabinet Mfg.
- Other Miscellaneous Mfg.

**Wood Product BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**

- Sawmills & Wood Preservation
- Veneer, Plywood, & Engineered Wood Product Mfg.
- Other Wood Product Mfg.
- Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing
- Converted Paper Product Mfg.
- Petroleum and Coal Products Manufacturing
- Glass & Glass Product Mfg.
- Paint, Coating, and Adhesive Manufacturing
- Automotive Repair and Maintenance
- Maintenance and Repair Other Facilities
- Rail and Road Transportation
- Motor Vehicle Parts Mfg.
- Household & Institutional Furniture & Kitchen Cabinet Mfg.
- Other Miscellaneous Mfg.

**Wood Product SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- New Residential Structures
- New Farm Structures
- Repair and Maintenance
- Residential Building Construction
- Nonresidential Building Construction
- Sawmills & Wood Preservation
- Other Wood Product Mfg. (Pallets, Wood Containers, Prefab Wood Buildings)
- Household and Institutional Furniture and Kitchen Cabinet Manufacturing
- Veneer, Plywood, and Engineered Wood Product Manufacturing
- Office Furniture (including Fixtures) Manufacturing
- Other Wood Product Manufacturing
- Audio and Video Equipment Manufacturing

- Motor Vehicle Manufacturing
- Motor Vehicle Body and Trailer Manufacturing
- Ship and Boat Building
- Other Transportation Equipment Manufacturing
- Office Furniture (including Fixtures) Manufacturing
- Other Miscellaneous Manufacturing
- Personal and Household Goods Repair and Maintenance

**Paper BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**













- Petroleum & Coal Products Mfg.
- Repair & Maintenance
- Resin, Synthetic Rubber, & Artificial Synthetic Fibers & Filaments Mfg.
- Paint, Coating, & Adhesive Mfg.
- Other Chemical Product & Preparation Mfg.
- Rail & Road Transportation

**Paper SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Grain & Oilseed Milling
- Sugar & Confectionery Product Mfg.
- Fruit & Vegetable Preserving & Specialty Food Mfg.
- Dairy Product Mfg.
- Bakeries & Tortilla Mfg.
- Other Food Mfg.
- Tobacco Mfg.
- Glass & Glass Product Mfg.
- Household & Institutional Furniture & Kitchen Cabinet Mfg.

## INDUSTRY ISSUES:

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Wood and Wood Products	Strategy	Firms need to decide whether to offer focused vs diversified product lines and whether or not they want to vertically integrate to gain access to low cost materials		
Wood and Wood Products	Product Innovation	In an industry with many large competitors (U.S. and foreign) who often compete on price, it is critical for each SME to move away from producing commodity products as a "job shop" and establish a value-added product or market niche in which it can thrive		
Wood and Wood Products	Labor	Pennsylvania has a comparative advantage for some wood production because it is a source for some high end hardwoods. Unfortunately, much of the harvested wood is exported to low cost labor countries for value-add processing, which is exporting jobs		
Wood and Wood Products	Process/Cost Improvement	Business is cyclical and industry performance is often determined by macroeconomic factors outside manufacturer's control. Manufacturers must be able to financially weather both up and down cycles; this is especially difficult for SME's who do not have the financial resources that some of the larger players have		
Wood and Wood Products	Public Policy	Environmental regulations are creating the need for major processing changes to meet compliance requirements. Changes are often difficult and costly to implement, especially for firms in the Paper Products industry (compliance with Cluster Rules)		
Paper	Public Policy	Environmental regulations on both logging and pulp production have begun to limit the supply of raw materials for the industry		

## RECOMMENDATIONS:

- Strategy/Innovation:
  - Help companies identify and target profitable market niches
  - Assist companies in developing corporate strategies – diversification versus focus
  - Identify ways for companies to forecast and manage manufacturing capacity and demand cyclicity
  - Help companies develop strategies for raw materials sourcing and innovations that use alternative materials
- Strategy consulting:
  - Identify and develop business case for desirable level of vertical integration

- Identify and develop business case for degree of product diversification
- Innovation:
  - Develop a process for new product development
  - For smaller firms, identify opportunities to move into higher value-added products or markets and assist in the new product development process
  - For all firms, use key industry trends (timber availability, growth of OSB and other replacement products) to identify new opportunities for growth
- Process improvement
  - Continue to identify ways in which companies can improve their performance and manage resources in a cyclical business
  - Assist companies in complying with NSR and other environmental regulations – both by identifying process improvement opportunities and by identifying opportunities to ameliorate the financial burden that compliance often demands

## VII. Basic Chemicals Industry

### INDUSTRY DEFINITION:

The basic chemicals industry is primarily engaged in manufacturing chemicals using the basic process (i.e., thermal cracking and distillation). The chemicals that are manufactured in this industry are typically separate chemical elements or separate chemically-defined compounds.

### INDUSTRY DESCRIPTION:

Consolidation is a major trend in the basic chemicals industry because it helps to decrease overhead, selling and manufacturing costs. Although there is a great need for innovation, the market is mature, and the only reported growth is through acquisitions.

Profitability in the industry is determined by product mix, raw material cost, capacity utilization and operating efficiency. Since natural gas and oil are the main raw materials for many basic chemicals, the price fluctuation in these goods affects the industry.

### BASIC CHEMICALS IN PENNSYLVANIA:

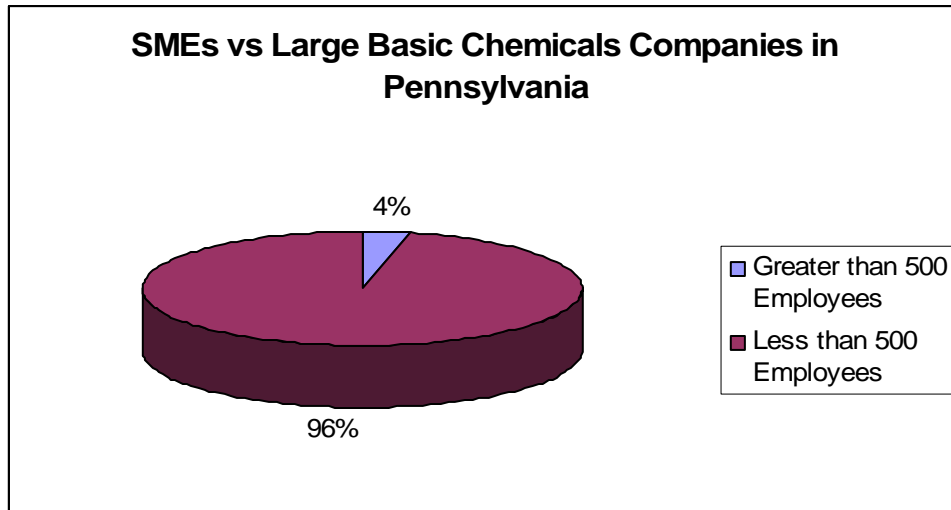
The basic chemicals industry has a strong presence in Pennsylvania due to its access to raw materials and its proximity to many of the other industrial markets located in the northeast United States. The largest basic chemical manufacturer in Pennsylvania determined by number of employees is Air Products and Chemicals INC. Within the Pennsylvania commonwealth, Lehigh County has the greatest output of basic chemicals in dollars ranging from \$400-475 M per year. Pennsylvania currently ranks 9<sup>th</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Top Left	Growing Economic Base
Opportunity		Emerging industry segment in multiple locations
Key State Competition	State	Location Quotient
	Pennsylvania	1.80
	Wyoming	11.40
	West Virginia	9.81
	Louisiana	7.62
	Texas	2.81
	Tennessee	2.07
	North Carolina	1.93
	Mississippi	1.84
	New Jersey	1.81
	Kentucky	1.72
	Alabama	1.48

**TOP 10 PENNSYLVANIA FIRMS:**

Company	Employees in PA
Air Products & Chemicals Inc	5480
Westinghouse Electric Co LLC	1200
Rohm & Haas Co	1110
Osram Sylvania Inc	990
AmeriGas Inc	369
Ferro Corp	300
Silberline Manufacturing Co	240
Penn Color Inc	225
PQ Corp	210
Lonza Inc	180

There are 110 basic chemicals companies in Pennsylvania: 4 (4%) large and 106 (96%) SME.





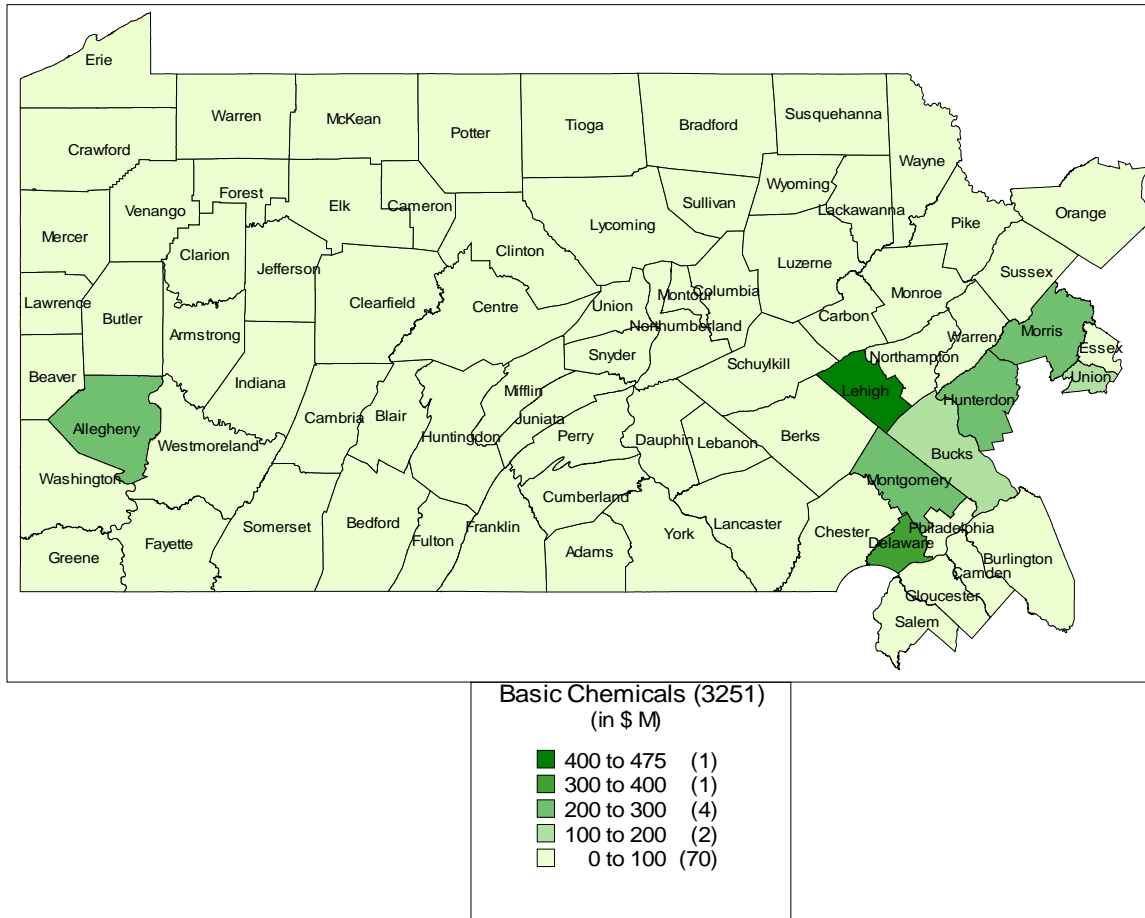
### PENNSYLVANIA'S COMPETITIVE POSITION:

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
Texas	\$4,846,810,000	\$6,933,090,000	\$6,566,790,000	\$5,554,090,000	-5.4%	-3.6%	1.2%
Louisiana	\$3,002,050,000	\$2,925,090,000	\$3,105,900,000	\$2,723,930,000	-4.3%	-1.2%	-0.9%
Pennsylvania	\$2,092,530,000	\$1,928,840,000	\$2,163,900,000	\$1,944,080,000	-3.5%	0.1%	-0.7%
New Jersey	\$2,118,700,000	\$2,360,130,000	\$2,535,780,000	\$1,755,070,000	11.5%	-4.8%	-1.7%
North Carolina	\$1,010,230,000	\$1,346,320,000	\$1,340,180,000	\$1,350,370,000	0.3%	0.1%	2.7%
New York	\$930,420,000	\$1,065,070,000	\$1,094,840,000	\$1,241,430,000	4.3%	2.6%	2.7%
United States	\$29,262,130,000	\$31,773,810,000	\$33,406,070,000	\$26,507,690,000	-7.4%	-3.0%	-0.9%

## LOCATION OF OUTPUT:

A thematic map of the concentration of the basic chemical industry output in Pennsylvania is shown below. The basic chemical industry is concentrated in Lehigh County. Please refer to the key for the output range.



## BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):

- Other Food Mfg.
- Sawmills & Wood Preservation
- Other Wood Product Mfg.
- Pulp, Paper, & Paperboard Mills
- Converted Paper Product Mfg.
- Petroleum & Coal Products Mfg.
- Resin, Synthetic Rubber, & Artificial Synthetic Fibers & Filaments Mfg.
- Paint, Coating, & Adhesive Mfg.
- Other Chemical Product & Preparation Mfg.
- Alumina & Aluminum Production & Processing
- Waste Treatment & Disposal
- Rail & Road Transportation

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Grain & Oilseed Milling
- Leather & Hide Tanning & Finishing
- Pulp, Paper, & Paperboard Mills
- Resin, Synthetic Rubber, & Artificial Synthetic Fibers & Filaments Mfg.
- Pesticide, Fertilizer, & Other Agricultural Chemical Mfg.
- Paint, Coating, & Adhesive Mfg.
- Soap, Cleaning Compound, & Toilet Preparation Mfg.
- Other Chemical Product & Preparation Mfg.
- Rubber Product Mfg.
- Coating, Engraving, Heat Treating, & Allied Activities
- Other General Purpose Machinery Mfg.

## INDUSTRY ISSUES:

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Basic Chemicals	Waste	Millions of pounds of pollutants and waste are released into the environment of Pennsylvania each year causing communities with a high concentration of pollutants severe health problems including cancer, kidney failure, reproduction and respiratory problems, liver disease, etc. As a result, communities where chemical plants are located are protesting the presence of the companies. A reduced amount of waste emission is possible; however, it is costly and involves large amounts of R&D. Chemists need to find the most cost effective, environmentally acceptable way to add value to products in order to combat against pressures from the community	●	●
Basic Chemicals	Product Innovation and Technology	There is a challenge in the industry to continue to innovate. The current trend of innovation is in highly specialized technology (i.e. nanotechnology) and firms of all sizes are finding they do not have the personnel or resources to keep up with current demand. Even when the products are developed, companies are finding it increasingly difficult to "scale up" these products (to provide the production for products developed in their labs)	●	●
Basic Chemicals	Off Shoring	Many U.S. companies are establishing themselves in developing countries (India and China) due to the increased demand for basic chemicals and the reduced cost of labor in these areas. There should be an increased incentive for firms to stay in the US	●	◐

## RECOMMENDATIONS:

- **Spill and Leak Prevention** - Spill and leak prevention is first and foremost among pollution prevention techniques in the sector. The emphasis on spill and leak prevention has been widespread for more than a decade as a result of early safety and environmental regulations. Most facilities within the sector are required to have a Spill Prevention, Control, and Countermeasures (SPCC) plan.
- **Inventory Control** - A frequent source of waste is expired or contaminated raw materials. Many materials have a limited shelf life and raw materials are often lost when contaminated or improperly stored. Coordinating the purchasing and consumption of raw materials will help eliminate material spoilage. Good housekeeping, material handling procedures, and container selection can significantly reduce waste from contamination and container damage. In addition, it is a way to reduce costs.
- **Process Optimization / Quality Control** - Process optimization reduces waste through higher yields. Many facilities reduce waste indirectly through their optimization and quality control efforts. Statistical process control is frequently used to optimize processes through the identification of special causes of wastes which can then be targeted for improvement. Process optimization can be achieved with the use of automated process

control devices. Reviewing operating procedures and employee training can also increase yields.

- Production Scheduling - Production scheduling for the batch processing of chemicals was used as a means to reduce cleaning. Optimization of production scheduling can reduce the number of times it is necessary to clean equipment, and in doing so increase plant productivity. This can be accomplished by scheduling the production of the same or similar products in succession so that cleaning the tanks between batches is not necessary.
- In-Process Recycling - In-process recycling is the direct reuse of waste materials in the process to make the originally intended product. This method is particularly effective in processes where quality constraints are not too demanding. In batch processes, equipment cleaning is a significant cause of waste generation, since a solvent or aqueous rinsate is used. Frequently, the rinsate can be collected and used in making a future batch of the same product.<sup>16</sup>
- Consolidate with other firms to share the risk of producing highly specialized products and know-how. Form joint ventures that involve one firm making the research investment and the other the development investment and share the profits
- There is little that the IRCs can do about regulations; however, communities can lobby for tax incentives to incent companies to stay in the US and for tariffs on imports

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<sup>16</sup> Source: [www.state.ga.us](http://www.state.ga.us)

## VIII. Metalworking Machinery

### INDUSTRY DEFINITION:

The metalworking machinery industry is made up of manufacturing establishments involved in metal cutting and metal forming machine tools; cutting tools; and accessories for metalworking machinery; special dies, tools, jigs, and fixtures; industrial molds; rolling mill machinery; assembly machinery; coil handling, conversion, or straightening equipment; and wire drawing and fabricating machines.

### INDUSTRY DESCRIPTION:

The industry is largely affected by fluctuations in the economy. In 1998, the downturn of the economy resulted in a decrease in sales revenue for the industry from \$32,546 to \$20,394. Sales revenue in the industry has continued to fluctuate with the economy, and in 2002, the industry saw another decrease in sales revenue of 10%. Economic conditions have been difficult on the industry; and projections for 2003 are for another 10% decrease.

### METALWORKING MACHINERY IN PENNSYLVANIA:

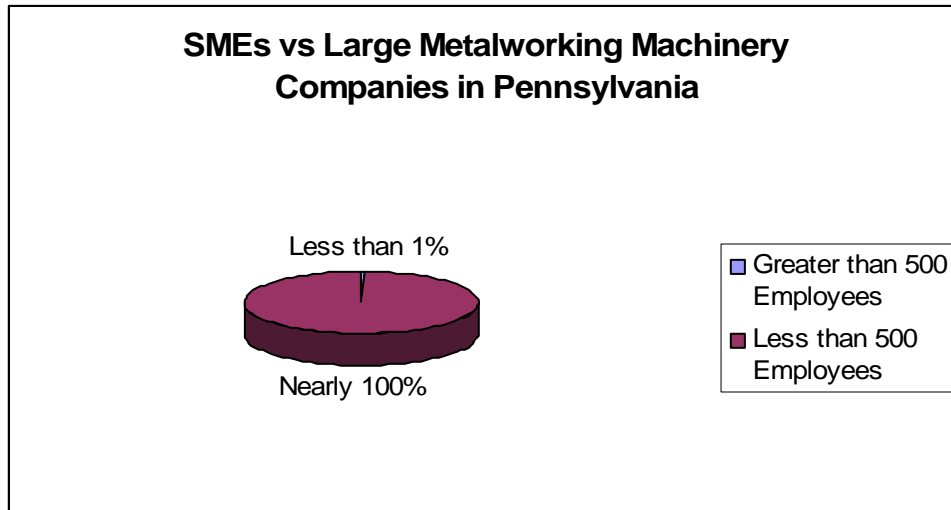
Due to the central location of Pennsylvania in the industrial belt and the high cost of transportation, the metalworking machinery industry has a strong presence in Pennsylvania. Erie, Crawford, Washington, Allegheny, Westmoreland, York, Franklin and Morris are the leading counties for metalworking machinery in Pennsylvania with \$89-286 M in output per year. Pennsylvania currently ranks 14<sup>th</sup> by location quotient in the United States, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below:

Industry Position		
Industry Quadrant	Bottom Left	Important Economic Base
Opportunity		Driver needs a revolution to become competitive
Key State Competition	State	Location Quotient
	Pennsylvania	1.35
	Tennessee	1.84
	Connecticut	1.83
	South Carolina	1.66
	New Hampshire	1.55
	Arkansas	1.42
	Missouri	1.24
	Iowa	1.23
	North Dakota	1.03
	Kentucky	0.89
	Minnesota	0.77

**TOP 10 PENNSYLVANIA FIRMS:**

Company	Employees in PA
Kennametal Inc	580
Oberg Industries Inc	535
Penn United Technology Inc	500
Brenner Tool & Die Inc	380
C & J Industries Inc	375
Greenleaf Corp	311
Brubaker Tool Corp	296
Park Corp	260
Ross Mould Inc	250
Saegertown Manufacturing Corp	250

There are 628 metalworking machinery companies in Pennsylvania: 3 (less than 1%) large and 625 (nearly 100%) SME.

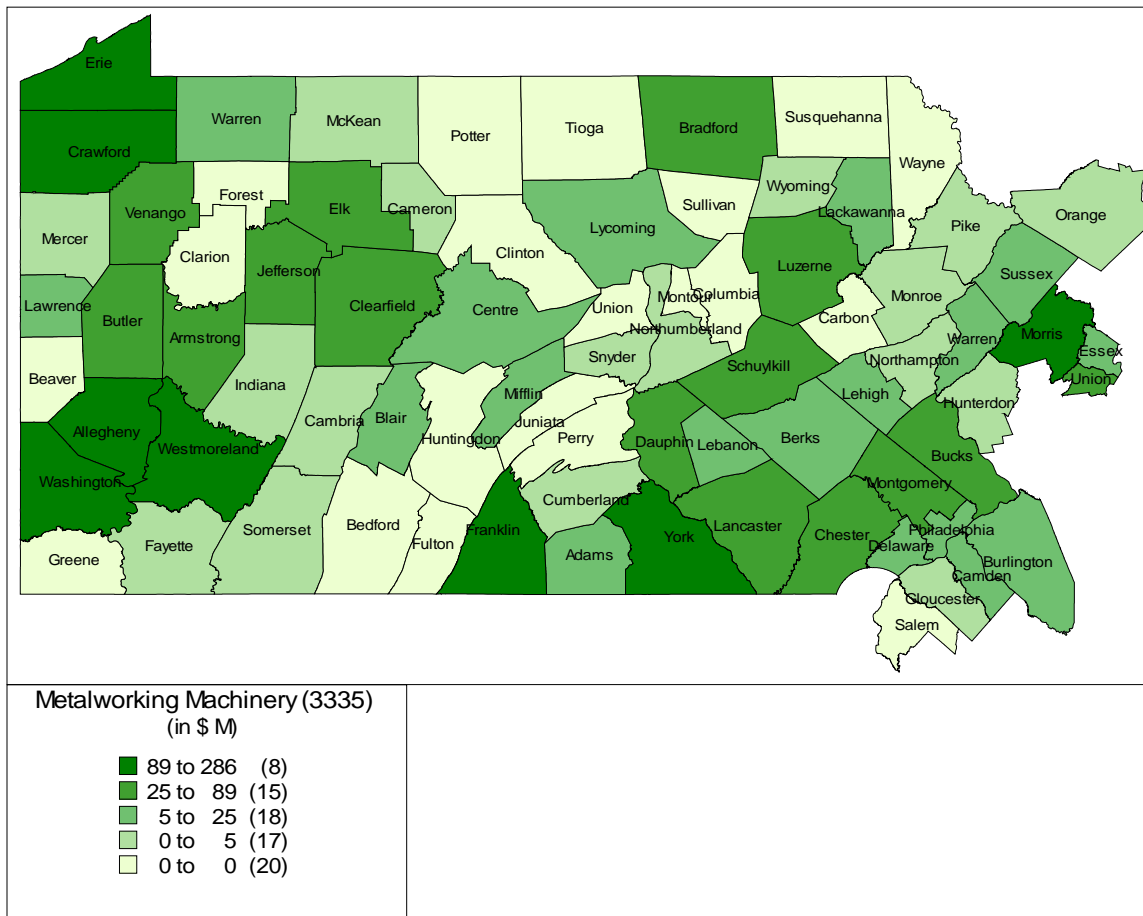


## PENNSYLVANIA'S COMPETITIVE POSITION:

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
Michigan	\$ 3,083,110,000	\$ 5,939,670,000	\$ 6,273,560,000	\$ 5,556,160,000	-4.0%	-1.1%	5.5%
Ohio	\$ 1,983,270,000	\$ 4,088,420,000	\$ 3,803,770,000	\$ 3,625,700,000	-1.6%	-2.0%	5.6%
Illinois	\$ 1,567,070,000	\$ 3,436,930,000	\$ 3,120,790,000	\$ 3,020,020,000	-1.1%	-2.1%	6.1%
California	\$ 809,950,000	\$ 1,925,040,000	\$ 3,612,200,000	\$ 2,561,500,000	-10.8%	4.9%	11.0%
Pennsylvania	\$ 810,730,000	\$ 1,864,550,000	\$ 1,805,190,000	\$ 1,842,090,000	0.7%	-0.2%	7.7%
Wisconsin	\$ 651,040,000	\$ 1,562,010,000	\$ 1,609,590,000	\$ 1,816,520,000	4.1%	2.5%	9.8%
United States	\$15,047,900,000	\$29,853,740,000	\$33,305,300,000	\$33,562,310,000	0.3%	2.0%	7.6%

## LOCATION OF OUTPUT:





**BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**

- Repair & Maintenance
- Other Wood Product Mfg.
- Petroleum & Coal Products Mfg.
- Iron & Steel Mills & Ferroalloy Mfg.
- Forging & Stamping
- Cutlery & Handtool Mfg.
- Other Fabricated Metal Product Mfg.
- Electrical Equipment Mfg.
- Other Electrical Equipment & Component Mfg.
- Support Activities for Rail & Road Transportation
- Warehousing & Storage

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Glass & Glass Product Mfg.
- Steel Product Mfg. from Purchased Steel
- Nonferrous Metal (except Aluminum) Production & Processing
- Foundries, Forging & Stamping
- Cutlery & Handtool Mfg.
- Spring & Wire Product Mfg.
- Machine Shops; Turned Product; & Screw, Nut, & Bolt Mfg.
- Other General Purpose Machinery Mfg.
- Motor Vehicle Parts Mfg.
- Aerospace Product & Parts Mfg.

## INDUSTRY ISSUES:

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	Small
Metalworking Industry	Labor	Employment and wages levels have decreased between the years 1995 and 2002. Employment declined by 3 % per year in this time, while wages contracted by less than 5 % in the same period. In addition, the metalworking machinery industry needs a specially skilled labor force. There has actually been an increase in the amount of skill necessary for the job due to new computer aided processes; however, there has been a large decline in the number of people entering into this labor pool. The industry needs to find a way to attract skilled workers	●	●
Metalworking Industry	Technology	The increasing complexity and precision required in stamped metal components, such as automobile body and appliance parts, coupled with the large variety of such components necessary to meet consumer preferences, have required manufacturers to increase the flexibility and efficiency of the machinery used in manufacturing processes. Also, goods and services must accommodate rapid changes in production schedules and produce profitable batch runs of varying sizes. Therefore, equipment such as that made by metalworking machinery manufacturing firms is important to meet the needs of the downstream customers. Firms must spend large amounts of capital to keep up with this trend, which has been difficult due to economic fluctuations	◐	◐

## RECOMMENDATIONS:

- Help SMEs develop recruiting and training programs to attract and retain skilled labor and to keep skilled labor “up to date” on latest skills and technologies
  - Establish apprenticeship programs
  - Provide links between industry and educational institutions
- Process improvement consulting to ensure that SMEs remain competitive in an industry that is consolidating and to identify opportunities for process or technology improvement
- Encourage investment in innovative technologies by providing assistance for SME companies to access capital to fund technology-driven equipment purchases
  - Assist with adoption of new technology and any necessary training
  - Identify opportunities for tax credits or other assistance to acquire and depreciate capital equipment
- Provide strategy and innovation support to help SMEs identify niches and opportunities for continued survival in an increasingly consolidating industry
  - Help identify value-added service opportunities
  - Help identify market niches

- Help identify opportunities for acquiring government or homeland security business

## IX. Architectural and Structural Metals Industry

### INDUSTRY DEFINITION:

The architectural and structural metals industry primarily manufacturers fabricated structural metal products (e.g., metal carports, dwelling, farm buildings, greenhouses, homes, silos, utility buildings, and warehouses), prefabricated metal products (e.g., barge, boat, bridge, highway bridge sections, railway bridge sections, ship sections, radio and TV towers), metal plate work products (e.g., airlocks, baffles, bins, breechings, casings, chutes, covers, culvers, cyclones, ducting, flumes, hoppers, liners, pipe, smoke stacks, sterilizing chambers, truss plants, and tunnel lining), metal doors and metal framed windows, sheet metal products (e.g., canopies, concrete forms, ducts, eaves flooring, flues, furnace castings, gutters, guardrails, louvers, machine guards, and roofing), and other ornamental and architectural metal products.

### INDUSTRY DESCRIPTION:

Growth and revenue for this industry is heavily dependant on construction and building demand and the economy. Competition is based on service attributes, product quality, delivery, brand awareness and product price. There has also been an increase in imports and a decrease in exports, which has intensified competition over the past few years. Since much of the market involves highly specialized, custom-made products, the profit margins are high; however, imports, especially from China, have eroded some of the profit margins in the more generic products.

### ARCHITECTURAL AND STRUCTURAL METALS IN PENNSYLVANIA:

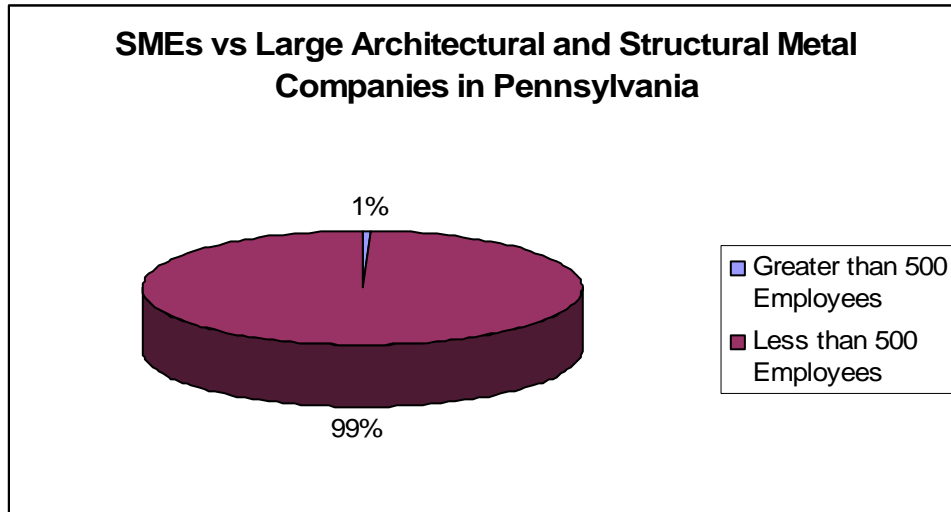
Manufacturers have historically located near either suppliers or customers; many came to Pennsylvania because of the steel mills. TRACO currently employs the most people in the architectural and structural metals industry in the state. Within the Pennsylvania commonwealth, Allegheny and Lancaster counties have the greatest output of architectural and structural metals in dollars ranging from \$147-211 M per year. Pennsylvania currently ranks 6<sup>th</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Top Left	Growing Economic Base
Opportunity		Emerging industry segment in multiple locations
Key State Competition	State	Location Quotient
	Pennsylvania	1.97
	Alabama	2.97
	Wisconsin	2.28
	Oklahoma	2.27
	Arkansas	2.14
	South Dakota	2.13
	Minnesota	1.96
	Texas	1.78
	Mississippi	1.68
	Indiana	1.64
	Utah	1.43

**TOP 10 PENNSYLVANIA FIRMS**

Company	Employees in PA
TRACO	1,500
Werner Co Inc	1,000
Alcoa Mill Products	900
Overhead Door Corp	605
United States Steel Corp	500
Rightscreen	481
Williard	475
Kawneer Co Inc	375
Conewago Enterprises Inc	340
SSM Industries Inc	340

There are 959 basic chemicals companies in Pennsylvania: 5 (1%) large and 954 (99%) SME.



**PENNSYLVANIA’S COMPETITIVE POSITION**

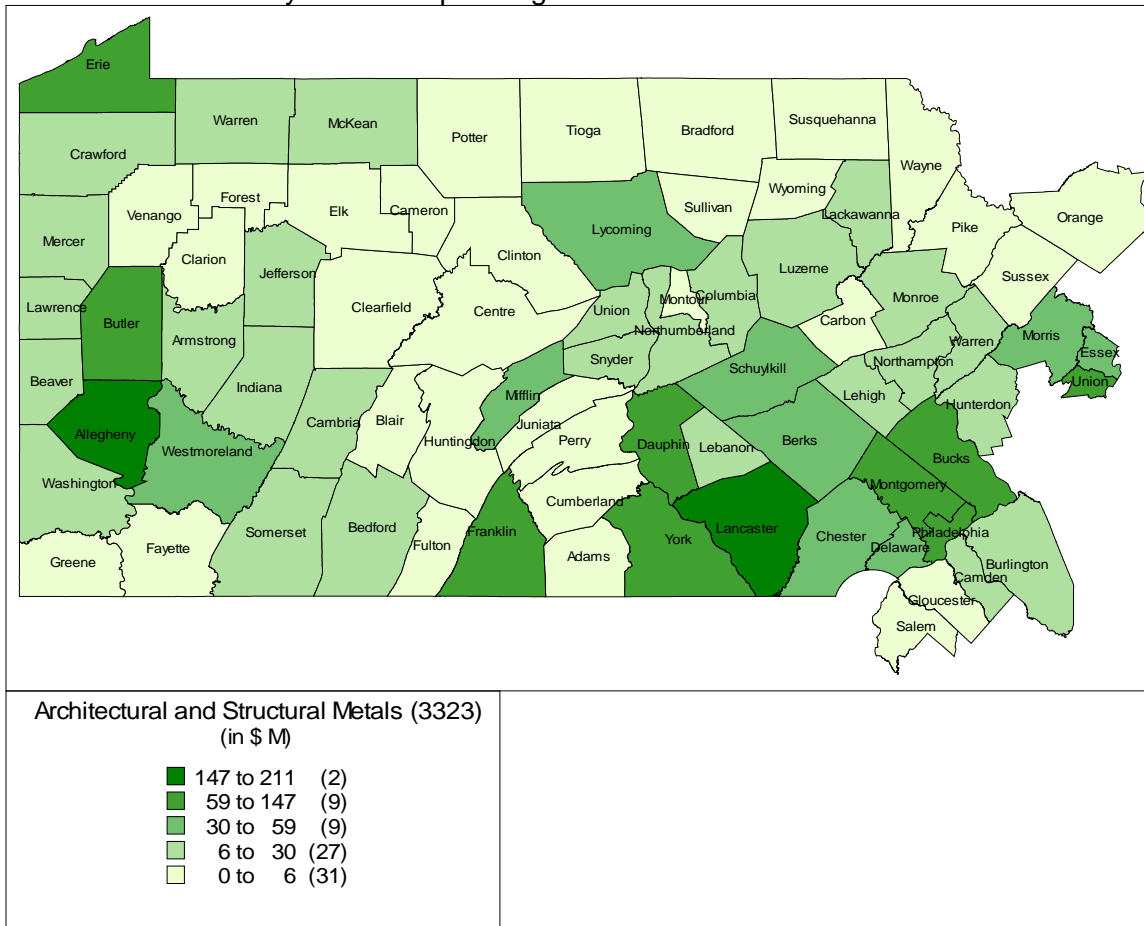
The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

### Architectural and Structural Metals Manufacturing

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
Texas	\$ 1,638	\$ 2,998	\$ 2,984	\$ 2,737	-2.8%	-1.5%	4.8%
California	\$ 1,432	\$ 1,993	\$ 2,623	\$ 2,646	0.3%	4.8%	5.7%
<b>Pennsylvania</b>	<b>\$ 1,289</b>	<b>\$ 1,611</b>	<b>\$ 1,708</b>	<b>\$ 1,653</b>	<b>-1.1%</b>	<b>0.4%</b>	<b>2.3%</b>
New York	\$ 914	\$ 1,235	\$ 1,167	\$ 1,045	-3.6%	-2.8%	1.2%
Ohio	\$ 1,010	\$ 1,167	\$ 1,329	\$ 931	-11.2%	-3.7%	-0.7%
Illinois	\$ 792	\$ 1,030	\$ 1,108	\$ 930	-5.7%	-1.7%	1.5%
United States	\$ 17,627	\$ 23,561	\$ 24,599	\$ 20,644	-5.7%	-2.2%	1.4%

### IV. LOCATION OF OUTPUT

A thematic map of the concentration of output for this industry in Pennsylvania is shown below. Please refer to the key for the output range.



### BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):

- Converted Paper Product Mfg.
- Petroleum and Coal Products Mfg.











- Basic Chemical Mfg.
- Paint, Coating, and Adhesive Mfg.
- Other Chemical Product and Preparation Mfg.
- Glass and Glass Product Mfg.
- Iron and Steel Mills and Ferroalloy Mfg.
- Steel Product Mfg. from Purchased Steel
- Coating, Engraving, Heat Treating, and Allied Activities
- Maintenance
- Rail and Road Transportation

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Veneer, Plywood, and Engineered Wood Product Mfg.
- Other Wood Product Mfg.
- Forging and Stamping
- Agriculture, Construction, and Mining Machinery Mfg.
- Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Mfg.
- Other General Purpose Machinery Mfg.
- Semiconductor and Other Electronic Component Mfg.
- Medical Equipment and Supplies Mfg.
- New Residential Structures
- New Commercial, Manufacturing, and Institutional Structures
- New Highways and Streets

**INDUSTRY ISSUES:**

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Architectural and Structural Metals	Competitiveness	Within this industry, products range from commodity to highly customized. The industry has relied on regional supply chains to offset foreign competition due to the cost of shipment; however, this strategy is beginning to erode. To retain competitive advantage and profitability, especially as imports from China increase, companies need to identify value-added products and services that they can offer. The shift from standard product offerings to more design and customization also requires a shift in the types and skills of labor that companies need		
Architectural and Structural Metals	Product Innovation	In addition to strategic changes, companies within the industry need a disciplined approach to the market and new product development. Innovation and movement up the value chain are likely to mitigate the commoditization of the product and low cost imports within the industry		
Architectural and Structural Metals	Process Improvement	Customization should be balanced with the need for efficient production and some level of economies of scale in order to achieve strong levels of customer service and profitability		
Architectural and Structural Metals	Process Improvement/ Product Innovation-- Quality	Industry groups have established consistent, nationwide quality standards for which companies can be certified. As structural standards within the A/E/C industry have continued to increase, it is important for companies to have quality measures		
Architectural and Structural Metals	Labor	This industry is more labor intense than most other manufacturing industries, requires employees with specific skills for which they are typically certified, and has a history of high turnover. While employment is expected to decline in the near future, the 10-year employment forecast shows many employment opportunities as experienced, skilled Baby Boomers begin to retire		

**RECOMMENDATIONS:**

- Human Resources
  - Develop and implement training and certification programs for skilled workers
  - Help companies attract and retain skilled labor
- Help companies with the product customization process
  - Better understand customer needs
  - Develop a diversified product/service line to fulfill customer needs
  - Streamline the product development process
  - Identify opportunities for developing higher value-added products
- Assist companies with the quality certification process
- Help SMEs identify affordable technologies that can help improve efficiency
- Customer/Channel strategy
  - Identifying customers or segments with the highest current or potential profitability
  - Helping SMEs identify and target a diverse customer base so that they are not reliant on a single customer or industry



## X. Machine Shops

### INDUSTRY DEFINITION:

Machine shops are engaged in machining metal parts on a job or order basis. Generally machine shop jobs are low-volume, using machine tools, such as lathes (including computer numerically controlled), automatic screw machines and machines for boring, grinding, and milling.

### INDUSTRY DESCRIPTION:

The industry is unique in the fact that it is highly fragmented, with many highly specialized firms. Growth in the industry is dependant on the number of customers and expansion in the size of the market. Factors that are critical to the success of the industry are cost control, quality control, sales service, access to technology, and the ability to vary the service offering to suit customer needs. The industry is also extremely labor intensive, and there is little opportunity to replace capital with labor.

### MACHINE SHOPS IN PENNSYLVANIA:

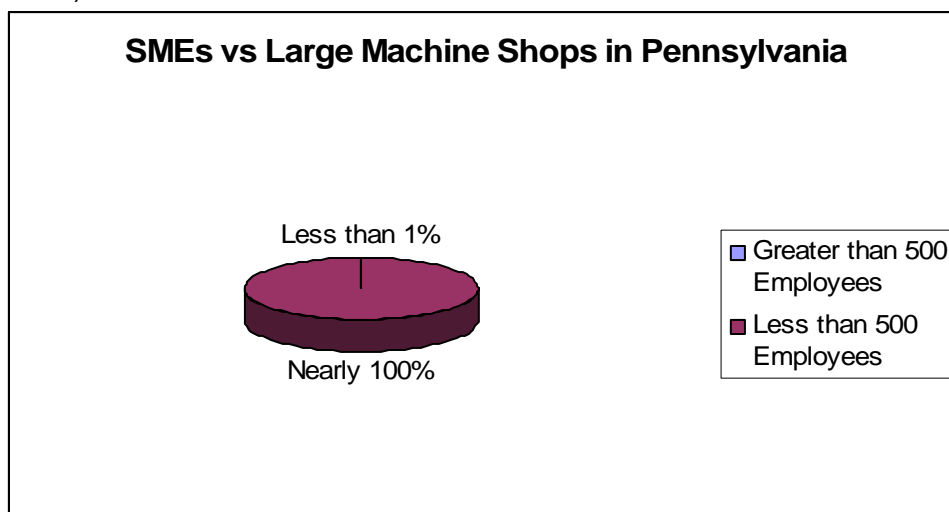
Pennsylvania is a prime location for machine shops because many of the industry's customers are located there. SPS Technologies is currently the largest machine shop employer in the state of Pennsylvania. Within the Pennsylvania Commonwealth, Montgomery County has the greatest output of furniture in dollars ranging from \$100-277 M per year. Pennsylvania currently ranks 11<sup>th</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Bottom Left	Important Economic Base
Opportunity		Driver needs a revolution to become competitive
Key State Competition	State	Location Quotient
	Pennsylvania	1.56
	Connecticut	2.05
	Ohio	1.75
	Massachusetts	1.75
	Indiana	1.74
	New Hampshire	1.61
	Alabama	1.44
	South Dakota	1.37
	North Carolina	1.31
West Virginia	1.20	
Texas	1.14	

## TOP 10 PENNSYLVANIA FIRMS

Company	Employees in PA
SPS Technologies Inc	975
Pem Fastening Systems	710
Southco Inc	380
S F S Intec Inc	350
Bonney Forge Corp	295
Millcraft Products Inc	250
B & G Manufacturing Co Inc	240
Miller Welding & Machine Co	230
Tyco Electronics Corp	215
Bissinger & Stein Inc	200

There are 1531 machine shops in Pennsylvania: 2 (Less than 1%) large and 1529 (Nearly 100%) SME.

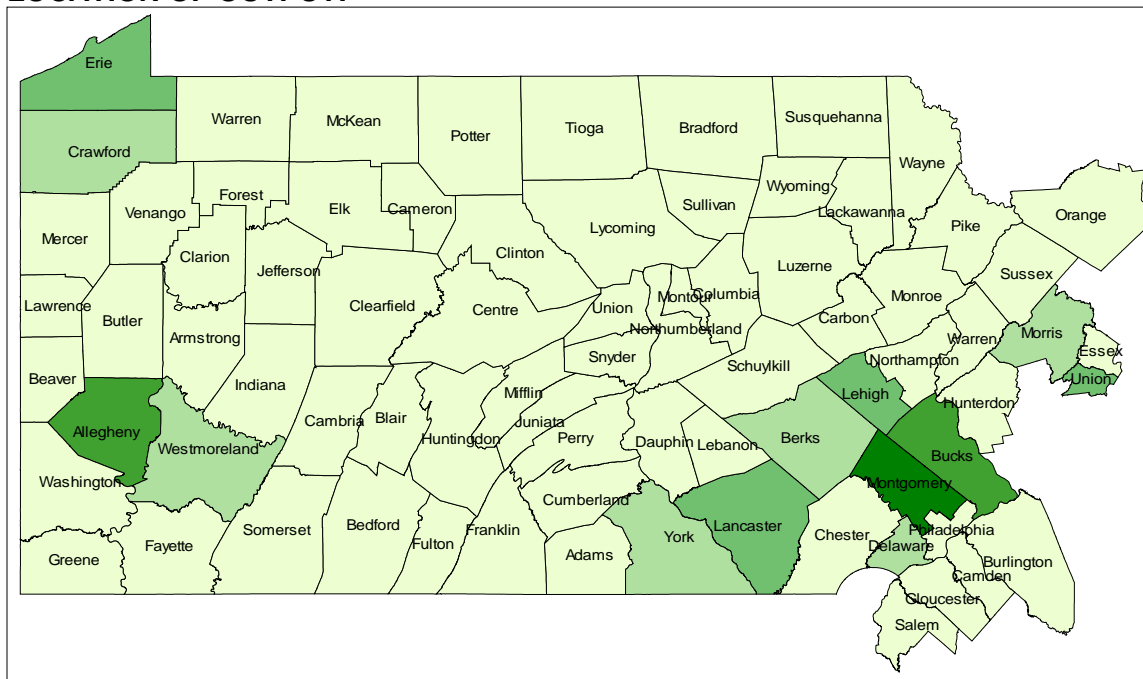


## PENNSYLVANIA'S COMPETITIVE POSITION:

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$ 1,674,290,000	\$ 4,433,750,000	\$ 7,049,650,000	\$ 7,541,340,000	2.3%	9.3%	14.7%
Illinois	\$ 1,593,960,000	\$ 2,896,760,000	\$ 3,036,010,000	\$ 2,844,930,000	-2.1%	-0.3%	5.4%
Texas	\$ 744,250,000	\$ 1,939,740,000	\$ 1,954,960,000	\$ 2,158,440,000	3.4%	1.8%	10.2%
Ohio	\$ 1,088,550,000	\$ 1,962,490,000	\$ 2,041,790,000	\$ 1,660,760,000	-6.7%	-2.7%	3.9%
Pennsylvania	\$ 808,860,000	\$ 1,505,300,000	\$ 1,569,460,000	\$ 1,614,460,000	0.9%	1.2%	6.5%
United States	\$13,153,960,000	\$24,486,200,000	\$27,233,850,000	\$25,469,520,000	-2.2%	0.7%	6.2%

**LOCATION OF OUTPUT:**



**BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**

- Repair & Maintenance
- Iron & Steel Mills & Ferroalloy Mfg.
- Metalworking Machinery Mfg.
- Support Activities for Road Transportation
- Warehousing & Storage

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Boiler, Tank, & Shipping Container Mfg.
- Hardware Mfg.
- Spring & Wire Product Mfg.
- Other Fabricated Metal Product Mfg.
- Industrial Machinery Mfg.
- Commercial & Service Industry Machinery Mfg.
- HVAC & Commercial Refrigeration Equipment Mfg.

- Engine, Turbine, & Power Transmission Equipment Mfg.
- Other General Purpose Machinery Mfg.
- Navigational, Measuring, Electromedical, & Control Instruments Mfg.
- Motor Vehicle Parts Mfg.

**INDUSTRY ISSUES:**

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	Small
Machine Shops	Labor	The majority of the skilled workers in the machine shop industry are approaching retirement. Specialized machinery requires a highly trained staff, and the number of workers available with these skills do not meet the current demand	●	●
Machine Shops	Labor	It is difficult to determine whether or not new applicants into the industry have the correct skill set required to work in the machine shops since there is no standard set of qualifications tied to a title (i.e., one machinist may have a variety of skills that are not consistent with another machinist). Money is being wasted on hiring unqualified workers	●	●

**RECOMMENDATIONS:**

- Human Resources
  - Develop and implement training and certification programs for skilled workers
  - Help companies attract and retain skilled labor
- Help SMEs develop recruiting and training programs to attract and skilled labor and to keep skilled labor “up to date” on latest skills and technologies
  - Establish apprenticeship programs
  - Provide links between industry and educational institutions

## **XI. Other Fabricated Metals**

### **INDUSTRY DEFINITION:**

The other fabricated metals industry primarily manufactures metal valves (e.g., industrial valves, fire hydrants, lawn hose nozzles), ball and roller bearings, fabricated pipe and pipe fittings, ammunition, small arms, enameled iron and metal sanitary ware, portable ladders, steel wool and other fabricated metal products. These products are sold to a variety of industries including automotive manufacturers; industrial, construction, and agricultural equipment and machinery manufacturers; producers of commercial and military aerospace, chemical and petrochemical manufacturers, water and sewage, power generation, and oil and gas production. The government is the biggest purchaser of small arms, ammunition, and ordnance.

### **INDUSTRY DESCRIPTION:**

Growth and revenue for this industry is dependant on expenditures on equipment manufacturing and general business activity for customer industries. Valve demand is also driven by construction and building activity. Competition is based on price for most segments of this industry, especially for metal valves and ball bearings, which are fairly standardized, commodity products. Product quality also influences competitiveness. Imports for these products account for 25-30% of domestic demand and are growing, with less expensive imports from China increasing rapidly over the past two years. The combination of cheaper imports and price competition has led to an erosion of revenue growth and profitability in the industry. Many companies are consolidating or producing or sourcing from overseas.

Technology and process improvements are important to this industry, as companies try to produce high quality products better and faster. Innovation is also becoming increasingly important, as companies search for new products that are not commoditized and use new technologies to improve design and efficiency. Innovation seems to require a substantial investment and creates increased requirements for employee skills.

### **OTHER FABRICATED METALS IN PENNSYLVANIA:**

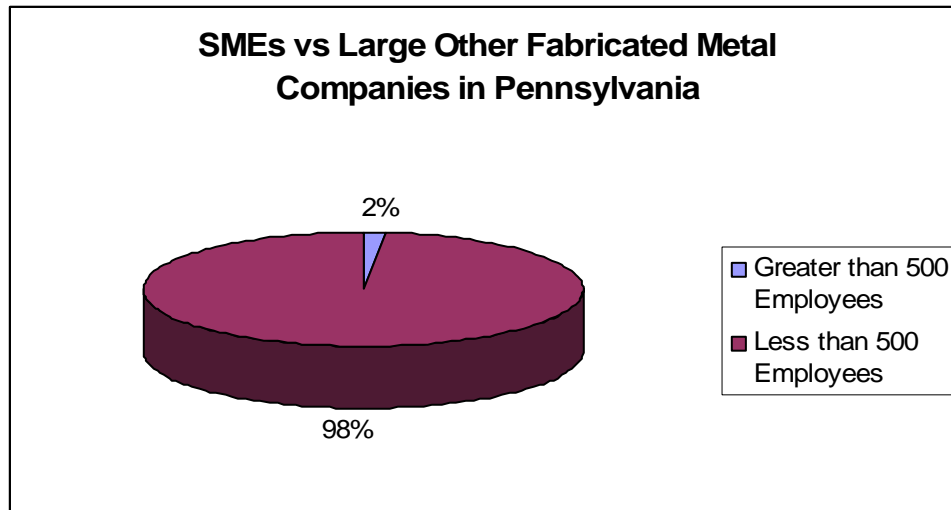
This industry has historically been located in Pennsylvania due to the ample local supply of raw materials and proximity of customer industries. Allegheny Ludlum Corp currently employs the most people in the other fabricated metals industry in the Pennsylvania. Within the commonwealth, Elk, Lancaster and Montgomery counties have the greatest output of other fabricated metals in dollars ranging from \$100-152 M per year. Pennsylvania currently ranks 8<sup>th</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Bottom Left	Important Economic Base
Opportunity		Driver needs a revolution to become competitive
Key State Competition	State	Location Quotient
	Pennsylvania	1.94
	South Carolina	3.43
	Wisconsin	3.07
	Arkansas	2.61
	Connecticut	2.21
	Minnesota	2.15
	Vermont	2.09
	New Hampshire	2.00
	South Dakota	1.94
	Indiana	1.90
	Illinois	1.82

#### TOP PENNSYLVANIA FIRMS:

Company	Employees in PA
Allegheny Technologies Inc	2400
Victaulic Company of America Inc	1400
SKF USA Inc	690
Wheatland Tube Co	600
Magnetics	500
NTN-BCA Corp	400
MCS Industries Inc	375
U T I Corp	350
General Dynamics Ordnance & Tactical System	300
ITT Industries Inc	300
Kane Magnetics International Inc	300
Superior Tube Co	300
Worthington Armstrong Venture	300

There are 370 other fabricated metal companies in Pennsylvania: 6 (2%) large and 364 (98%) SME.

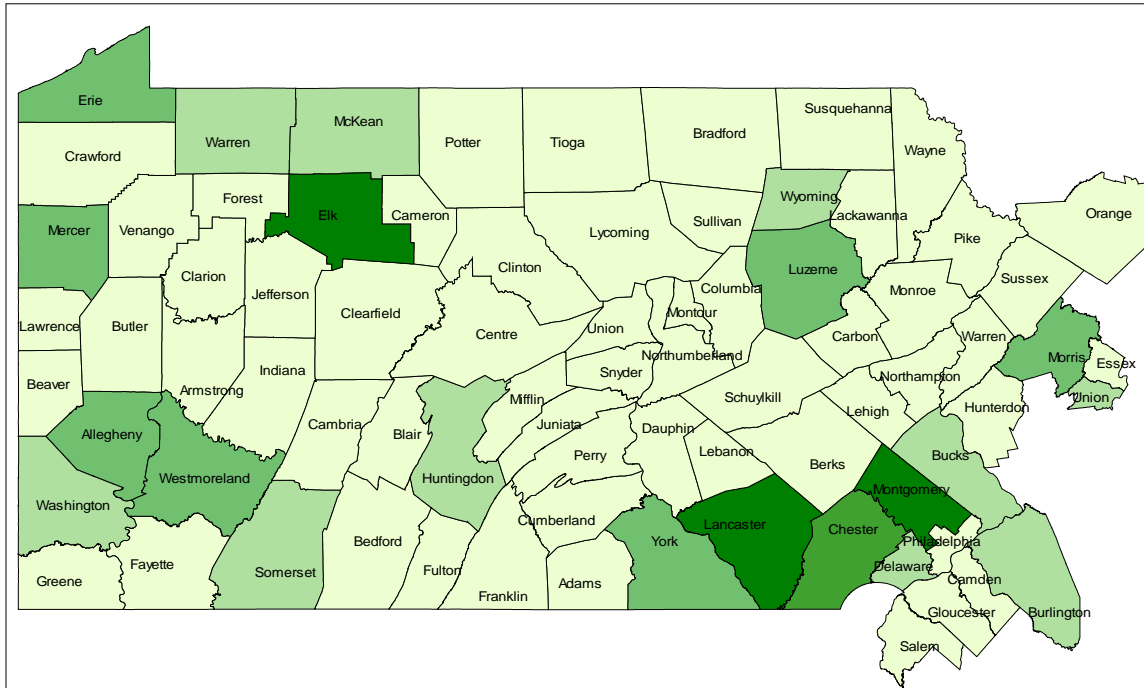


**PENNSYLVANIA'S COMPETITIVE POSITION:**

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$ 1,231,340,000	\$ 1,694,670,000	\$ 2,305,010,000	\$ 2,267,500,000	-0.5%	5.0%	5.7%
Illinois	\$ 1,157,650,000	\$ 1,648,010,000	\$ 1,697,380,000	\$ 1,525,150,000	-3.5%	-1.3%	2.5%
Texas	\$ 1,211,560,000	\$ 1,768,090,000	\$ 1,707,120,000	\$ 1,507,340,000	-4.1%	-2.6%	2.0%
Pennsylvania	\$ 1,080,180,000	\$ 1,502,480,000	\$ 1,477,420,000	\$ 1,397,770,000	-1.8%	-1.2%	2.4%
Ohio	\$ 1,163,730,000	\$ 1,526,750,000	\$ 1,503,080,000	\$ 1,091,530,000	-10.1%	-5.4%	-0.6%
Wisconsin	\$ 846,610,000	\$ 934,690,000	\$ 1,013,240,000	\$ 970,120,000	-1.4%	0.6%	1.2%
United States	\$16,385,690,000	\$20,512,480,000	\$20,856,100,000	\$17,721,660,000	-5.3%	-2.4%	0.7%

**LOCATION OF OUTPUT:**



Other Fabricated Metals (3329)  
(in \$ M)

100 to 152	(3)
75 to 100	(1)
50 to 75	(7)
25 to 50	(10)
0 to 25	(57)

**BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**

- Sawmills and Wood Preservation
- Other Wood Product Manufacturing
- Converted Paper Product Manufacturing
- Petroleum and Coal Products Manufacturing
- Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing
- Iron and Steel Mills and Ferroalloy Manufacturing
- Forging and Stamping
- Cutlery and Handtool Manufacturing
- Boiler, Tank, and Shipping Container Manufacturing
- Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing
- Metalworking Machinery Manufacturing
- Semiconductor and Other Electronic Component Manufacturing
- Rail and Road Transportation











**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Forging and Stamping
- Boiler, Tank, and Shipping Container Manufacturing
- Other Fabricated Metal Product Manufacturing (Plumbing Fixtures, Pipes)
- Commercial and Service Industry Machinery Manufacturing
- Metalworking Machinery Manufacturing
- Engine, Turbine, and Power Transmission Equipment Manufacturing
- Other General Purpose Machinery Manufacturing
- Other Electrical Equipment and Component Manufacturing
- Office Furniture (including Fixtures) Manufacturing

**INDUSTRY ISSUES:**

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	Small
Other Fabricated Metals	Performance Improvement	Because revenue growth is low in this industry, manufacturers are increasingly looking for better, faster, cheaper ways to manufacture their products. The overall supply chain (plan, source, make, distribute) represents the highest area of potential for cost reduction and performance improvement.		
Other Fabricated Metals	Strategy	Within the Other Fabricated Metals industry, products range from commodity to highly customized. The industry has relied on regional supply chains to offset foreign competition due to the cost of shipment, however this strategy is beginning to erode. To retain competitive advantage and profitability, especially as cheaper imports from China increase, companies need to identify value-added products and services that they can offer.		
Other Fabricated Metals	Innovation	Developing new products requires investment in R&D and technology. Many SMEs may not have the resources or processes to innovate to the extent that is required. Helping SMEs access affordable resources and establish market-focused new product development processes can help improve their chances of innovation success.		
Other Fabricated Metals	Labor	Increasing use of technology such as CAD and the need to develop new, specialized products has changed the type and level of skills needed in this industry. Recruiting, training, and retaining workers with the necessary skills is important.		

**RECOMMENDATIONS:**

- Help SMEs develop strategies for developing innovative, proprietary products that do not have to compete on price
- Help SMEs recruit, train, and retain workers with the technological skills needed in today's enterprises

- Help SMEs improve processes and efficiency so that they can be cost-competitive and weather economic downturns
- Find innovative ways to partner SMEs with R&D and technology resources
- Help small arms, ammunition, and ordnance manufacturers find opportunities for generating new business with government entities such as the Department of Defense and Department of Homeland Security

## **XII. Furniture Industry**

### **INDUSTRY DEFINITION:**

The furniture industry comprises establishments primarily engaged in the design and manufacturing of furniture and related products. The manufacturing processes used in the manufacturing of furniture are standard methods of forming materials and assembling components, including cutting, molding and laminating. Design services may be performed by the furniture establishment's own work force or may be purchased from industrial designers. Furniture is classified based on the application for which it is designed. It is also classified according to the component material from which it is made. Furniture may be produced on a stock or custom basis and may be shipped assembled or unassembled (knockdown). Establishments primarily engaged in manufacturing furniture frames and parts are included.

### **INDUSTRY DESCRIPTION:**

The furniture industry is segmented into home and office furnishings. Currently, home furniture is growing moderately at 3.8%; however, office furniture declined by 19% in 2002. The industry is rebounding in low to mid priced segments; however, high-end items are still in decline. There has also been increased competition from imports, which have driven many large manufacturers to establish overseas operations and outsourcing contracts. Intense price competition and promotions on price have significantly reduced profit margins.

For Pennsylvania, sectors of this industry that are drivers include:

#### **Household and Institutional Furniture and Kitchen Cabinet Manufacturing (NAICS 3371)**

This industry group comprises establishments manufacturing household-type furniture, such as living room, kitchen and bedroom furniture and institutional (i.e., public building) furniture, such as furniture for schools, theaters, and churches.

#### **Office Furniture (Including Fixtures) Manufacturing (NAICS 3372)**

This industry group comprises establishments primarily engaged in manufacturing furniture designed for office use, such as office chairs and desks; and office and store fixtures, such as showcases. Establishments primarily engaged in manufacturing furniture parts and frames, for all types of furniture, are also included.

### **FURNITURE IN PENNSYLVANIA:**

Pennsylvania attracted the furniture industry due to its abundance of raw materials and skilled artisans. The industry has since grown, and currently, manufacturers have set up regional distribution centers in Pennsylvania that distribute to a cluster of stores. The largest office furniture manufacturer by number of employees in Pennsylvania is Knoll Inc and Wood-Mode Inc. for household and institutional furniture. Within the Pennsylvania commonwealth, Montgomery County has the greatest output of office furniture in dollars ranging from \$100-156 M per year, and Lancaster has the greatest output of household and institutional furniture with \$80-94 M per year. Pennsylvania currently ranks 13<sup>th</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Top Left	Growing Economic Base
Opportunity		Emerging industry segment in multiple locations
Key State Competition	State	Location Quotient
	Pennsylvania	1.61
	Wisconsin	2.00
	Vermont	1.88
	Arkansas	1.82
	Georgia	1.74
	South Dakota	1.67
	Tennessee	1.41
	Virginia	1.40
	Ohio	1.39
	Missouri	1.29
	Utah	1.27

## TOP 10 PENNSYLVANIA FIRMS:

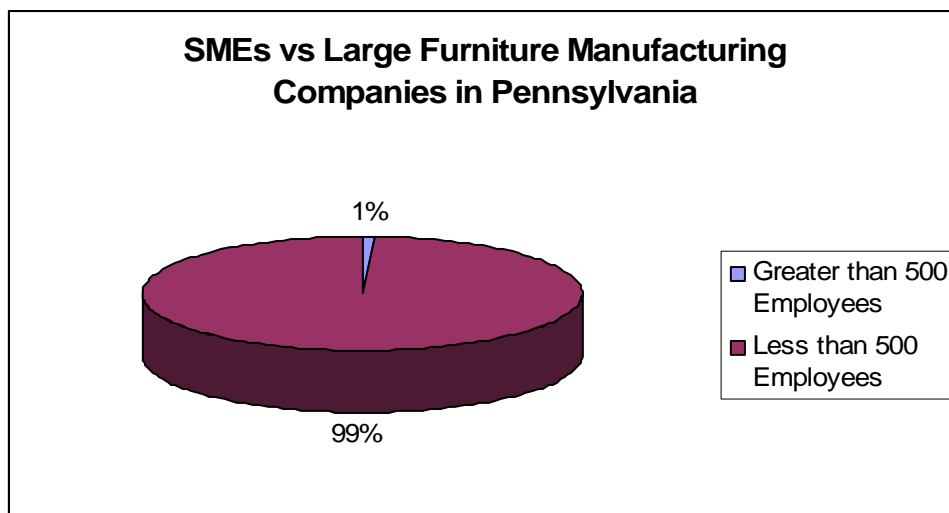
### Household and Institutional Furniture

Company	Employees in PA
Wood-Mode Inc	1,800
Brodart Co	1,180
Yorktowne Inc	1,050
Pennsylvania House	700
MasterBrand Cabinets Inc	590
Graco Children's Products Inc	500
Armstrong Cabinet Products	461
PENCO Products Inc	330
Rutt Handcrafted Cabinetry LLC	300
Schnadig Corp	300

### Office Furniture

Company	Employees in PA
Knoll Inc	1,350
Trion Industries Inc	410
Stanley Works Inc	287
Ridg-U-Rak Inc	275
Lozier Corp	230
HON Co	220
Container Research Corp	200
Innovative Office Products Inc	200
Marlton Technologies Inc	195
Brodart Furniture	180

There are 786 other fabricated metal companies in Pennsylvania: 7 (1%) large and 779 (99%) SME.

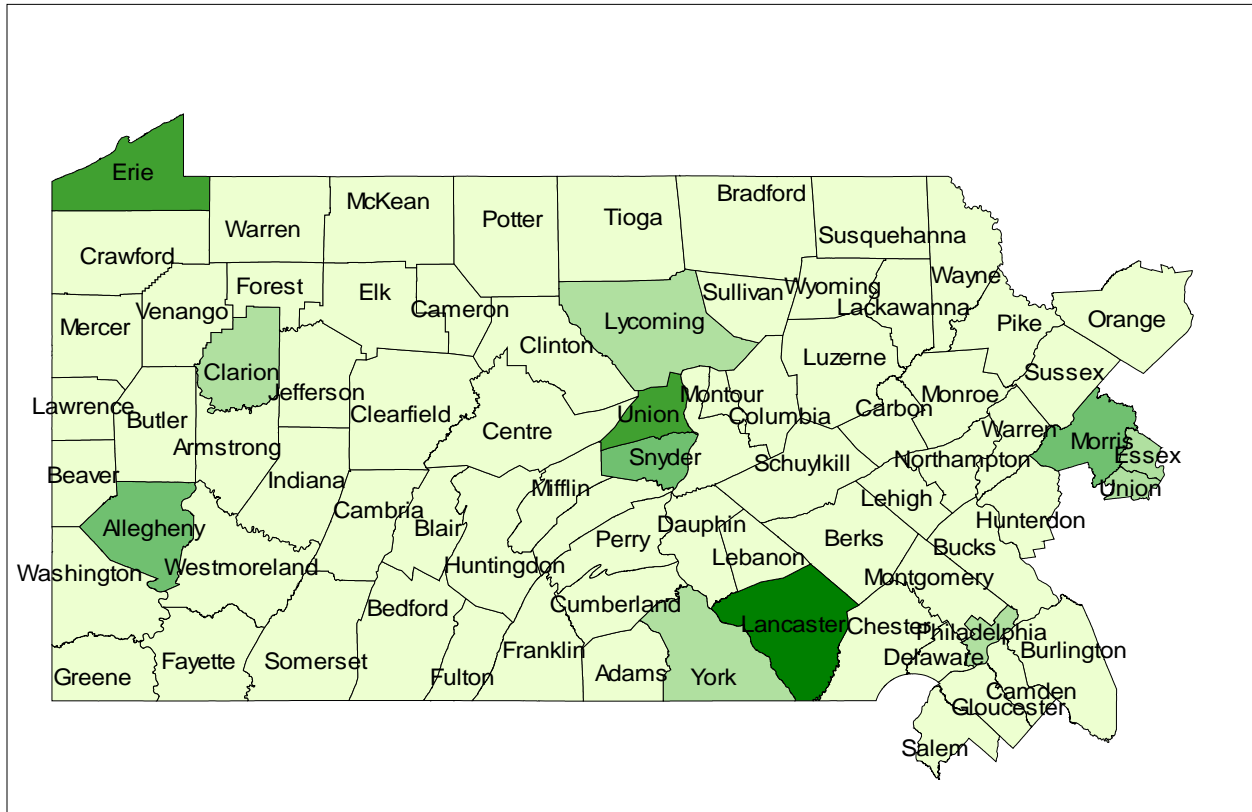


**PENNSYLVANIA'S COMPETITIVE POSITION:**

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

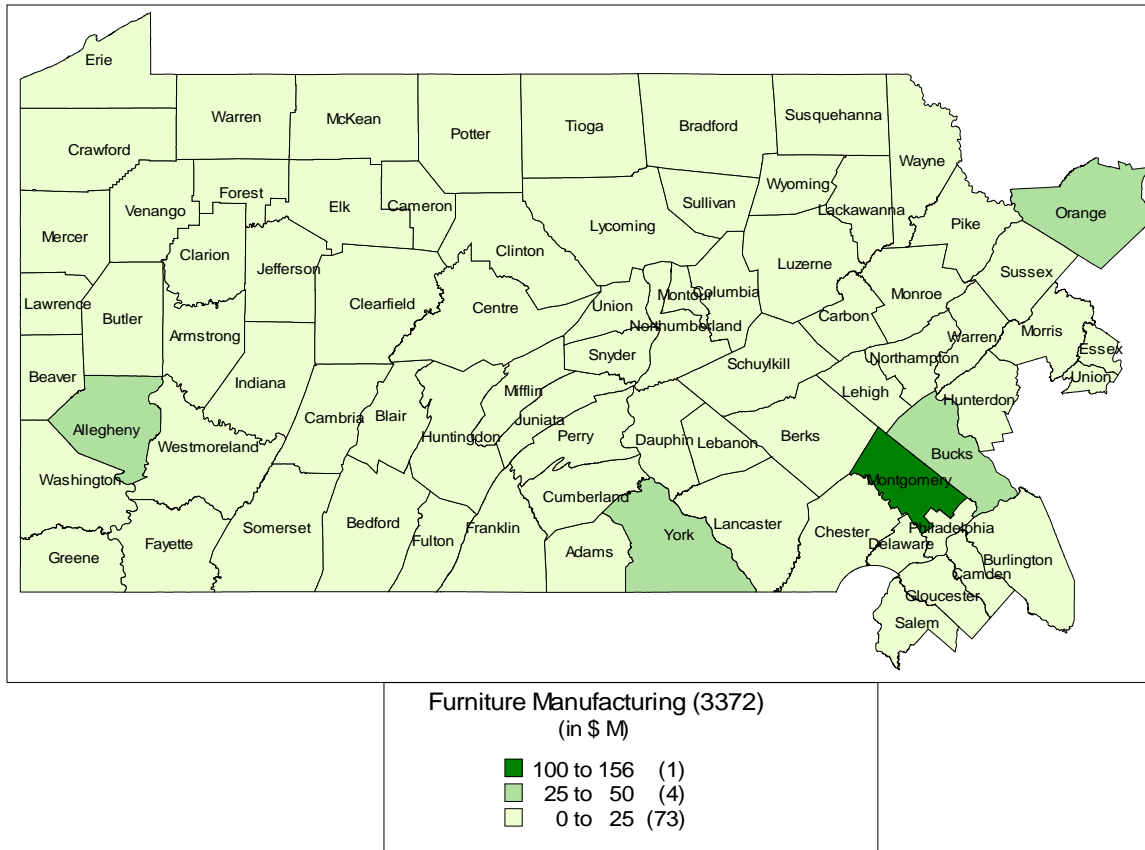
State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
California	\$1,450,510,000	\$1,805,140,000	\$2,099,030,000	\$2,070,700,000	-0.5%	2.3%	3.3%
North Carolina	\$2,186,840,000	\$2,375,850,000	\$2,345,480,000	\$1,974,200,000	-5.6%	-3.0%	-0.9%
Texas	\$626,640,000	\$840,820,000	\$985,040,000	\$1,027,480,000	1.4%	3.4%	4.6%
Pennsylvania	\$529,350,000	\$680,740,000	\$738,690,000	\$769,630,000	1.4%	2.1%	3.5%
Mississippi	\$834,290,000	\$794,380,000	\$891,600,000	\$737,780,000	-6.1%	-1.2%	-1.1%
Ohio	\$538,600,000	\$696,620,000	\$777,310,000	\$727,810,000	-2.2%	0.7%	2.8%
United States	\$14,530,040,000	\$15,892,090,000	\$16,527,590,000	\$12,942,540,000	-7.8%	-3.4%	-1.0%

**LOCATION OF OUTPUT:**



Household and Institutional Furniture (3371)  
(in \$ M)

- 80 to 94 (1)
- 60 to 80 (2)
- 40 to 60 (3)
- 20 to 40 (6)
- 0 to 20 (66)



**BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):**

- Fabric Mills
- Textile and Fabric Finishing and Fabric Coating Mills
- Sawmills and Wood Preservation
- Veneer, Plywood, and Engineered Wood Product Mfg.
- Other Wood Product Mfg.
- Converted Paper Product Mfg.
- Petroleum and Coal Products Mfg.
- Iron and Steel Mills and Ferroalloy Mfg.
- Forging and Stamping
- Cutlery and Handtool Mfg.
- Boiler, Tank, and Shipping Container Mfg.
- Other Fabricated Metal Product Mfg.
- Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg.
- Glass and Glass Product Mfg.

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Residential Building Construction
- Nonresidential Building Construction
- Other Wood Product Mfg.

- Audio and Video Equipment Mfg.
- Motor Vehicle Mfg.
- Motor Vehicle Body and Trailer Mfg.
- Ship and Boat Building
- Other Transportation Equipment Mfg.
- Household and Institutional Furniture and Kitchen Cabinet Mfg.
- Office Furniture (including Fixtures) Mfg.
- Other Miscellaneous Mfg.
- Personal and Household Goods Repair and Maintenance

## INDUSTRY ISSUES:

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Furniture	Consolidation and Off Shoring	Heavily discounted pricing has led to profit margin erosion and bankruptcy for many players. Remaining players have turned to acquisitions and off shoring (as much as 30% of their production) to improve economies of scale and margins due to the maturity of the industry. As a result, many U.S. production facilities have shut down	●	●
Furniture	Off Shoring	Furniture imports have increased 13 % per year for the last 5 years as U.S. furniture makers have outsourced production and foreign companies have imported cheaper products. In 2003, imports from China were expected to increase by 24%	●	●
Furniture	Labor and Innovation	To retain competitive advantage and profitability companies need to identify value-added products and shift from standard product offerings to more design and customization. This will require a shift in the skills of the employees	◐	●
Furniture	Product Innovation	Companies within the industry need a disciplined approach to market and new product development. Innovation and movement along the value chain are likely to mitigate the commoditization of the products and low cost imports within the industry	◐	◑
Furniture	Process Improvement	Price competition from imports and pricing pressure from retailers as they discount to increase sales has led to increased pressure on margins. Cost cutting and restructuring can help manufacturers weather the margin pressure	◑	◑



**RECOMMENDATIONS:**

- Help SMEs continue to be cost-effective and price-competitive by focusing on lean manufacturing and other process improvement activities
- Help SMEs identify a strategy for adapting to the increased rate of imports either by establishing offshoring capabilities or agreements or by moving up the value chain to create products that serve customer needs and do not have to compete on price.
  - Help SMEs recruit, train, and retain skilled employees that can provide value-added services such as design and customization
- Provide advocacy or other support against dumping of product from China
- Support suppliers to this industry by helping them move away from commodity products into value-added products or services
- Help SMEs identify opportunities for product and technology innovation

### XIII. Glass Industry

#### INDUSTRY DEFINITION:

The glass industry is primarily involved with manufacturing glass and glass products. The industry is mainly divided into four segments: manufacturing flat glass and/or laminated glass, other pressed or blown glass and glassware, glass container manufacturing, and glass product manufacturing. These products are then sold to window manufacturers, automobile manufacturers, food manufacturers, etc.

#### INDUSTRY DESCRIPTION:

The industry has experienced slight growth of 2-3.5% each year, which is more than its projected growth and the growth United States Gross Domestic Product. There will always be a strong demand for flat glass since there is no perfect substitute for flat glass; however, glass containers have met fierce competition from the plastic bottling industry. There has also been an increase in foreign competition. The overall competitiveness of the industry and cyclical decline in downstream building has driven down profit margins.

#### GLASS IN PENNSYLVANIA:

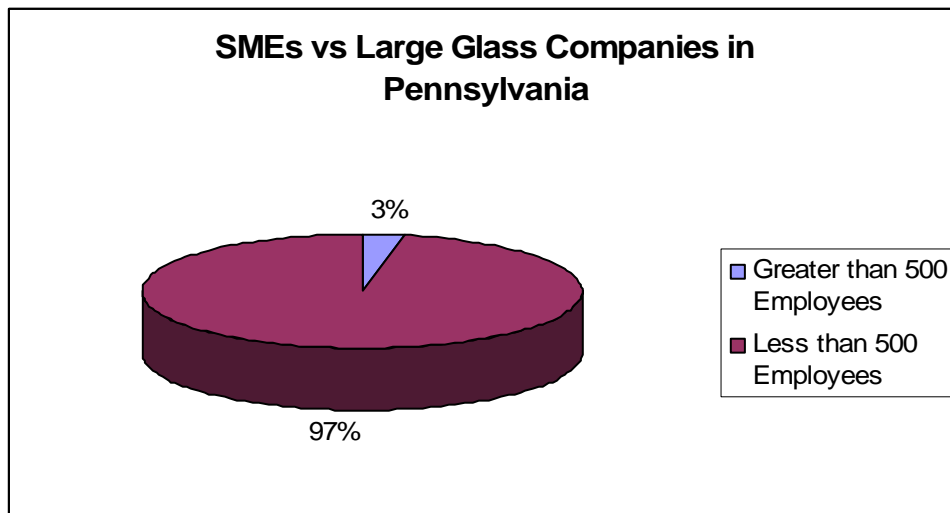
The glass industry in Pennsylvania is present due to the abundance of raw materials (sand, lime, crushed stone) and the proximity to auto manufacturers that have a high demand for flat glass for windows and windshields. Techneglas INC employs the largest number of Pennsylvania workers; however, PPG is considered Pennsylvania's largest glass manufacturer. Within the Pennsylvania commonwealth, Allegheny County has the greatest output of glass and glass products in dollars ranging from \$200-238 M per year. Pennsylvania currently ranks 1<sup>st</sup> among the United States by location quotient for this industry, which reflects the state's competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Bottom Right	Traditionally Competitive
Opportunity		Driver with a Challenged Strategy and Will Need to Refocus Efforts
Key State Competition	State	Location Quotient
	Pennsylvania	3.50
	South Carolina	3.40
	West Virginia	3.17
	North Carolina	2.97
	Tennessee	2.92
	Ohio	2.42
	New Jersey	2.29
	Oklahoma	2.27
	Indiana	2.01
	Wisconsin	1.63
	Michigan	1.50

**TOP 10 PENNSYLVANIA FIRMS:**

Company	Employees in PA
Techneglas Inc	1800
PPG Industries Inc	1527
Corning Asahi	1000
Anchor Hocking Corp	550
Pittsburgh Corning Corp	455
American Video Glass Co	450
World Kitchen Inc	425
Owens-Brockway Glass Container Inc	400
Saint Gobain-Container Inc	400
Anchor Glass Container Corp	350

There are 131 glass companies in Pennsylvania: 4 (3%) large and 127 (97%) SME.



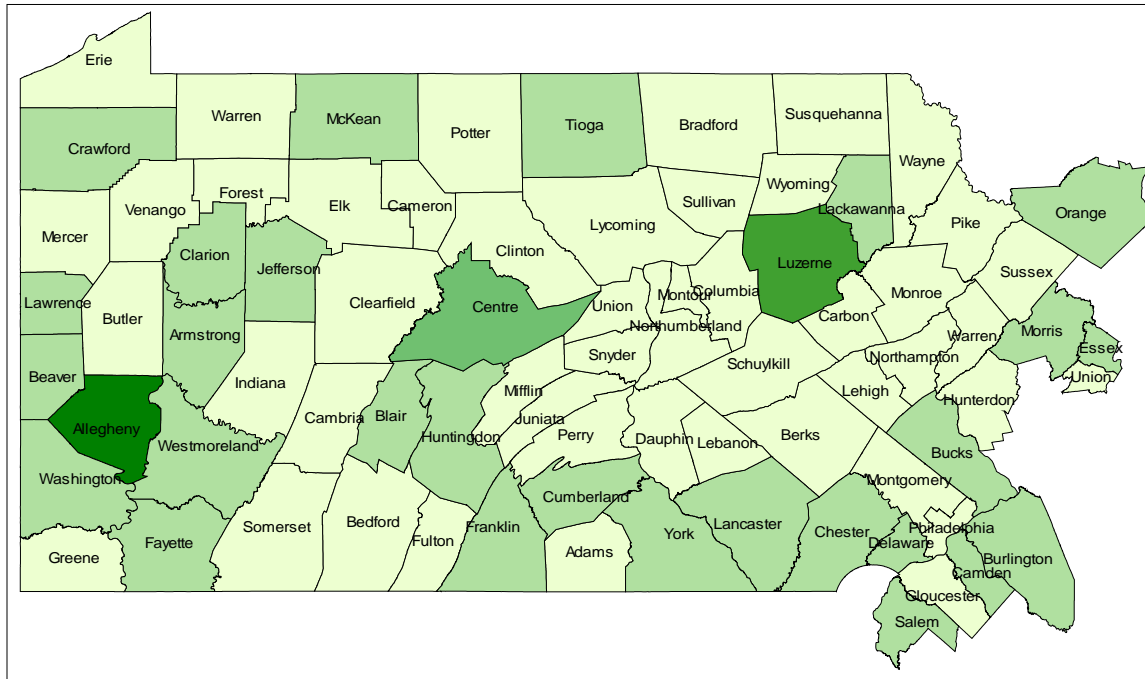
**PENNSYLVANIA'S COMPETITIVE POSITION**

The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
Pennsylvania	\$888,970,000	\$1,173,460,000	\$1,106,000,000	\$937,990,000	-5.3%	-3.7%	0.5%
California	\$671,410,000	\$816,230,000	\$858,590,000	\$855,160,000	-0.1%	0.8%	2.2%
Ohio	\$705,710,000	\$726,430,000	\$742,430,000	\$593,490,000	-7.2%	-3.3%	-1.6%
Texas	\$369,970,000	\$459,540,000	\$538,160,000	\$564,840,000	1.6%	3.5%	3.9%
New Jersey	\$406,410,000	\$462,450,000	\$521,690,000	\$553,510,000	2.0%	3.0%	2.8%
New York	\$420,710,000	\$498,830,000	\$652,170,000	\$526,420,000	-6.9%	0.9%	2.1%
United States	\$7,233,330,000	\$8,133,440,000	\$7,986,820,000	\$6,593,190,000	-6.2%	-3.4%	-0.8%

## LOCATION OF OUTPUT

A thematic map of the concentration of the glass industry output in Pennsylvania is shown below. The glass industry is concentrated in Allegheny County. Please refer to the key for the output range.



Glass and Glass Product Manufacturing (3272)  
(in \$ M)

■	200 to 238	(1)
■	120 to 200	(1)
■	60 to 120	(1)
■	5 to 60	(27)
■	0 to 5	(48)

## BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):







- Repair & Maintenance
- Oil & Gas Extraction
- Natural Gas Distribution
- Other Wood Product Mfg.
- Converted Paper Product Mfg.
- Petroleum & Coal Products Mfg.
- Basic Chemical Mfg.
- Metalworking Machinery Mfg.
- Support Activities for Rail & Road Transportation
- Warehousing & Storage

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Fruit & Vegetable Preserving & Specialty Food Mfg.
- Beverage & Other Food Mfg.
- Fabric Mills
- Textile & Fabric Finishing & Fabric Coating Mills
- Other Wood Product Mfg.
- Petroleum & Coal Products Mfg.
- Soap, Cleaning Compound, & Toilet Preparation Mfg.
- Other Nonmetallic Mineral Product Mfg.
- Nonferrous Metal Production & Processing
- Medical Equipment & Supplies Mfg.
- Architectural & Structural Metals Mfg.
- Commercial & Service Industry Machinery Mfg.
- Semiconductor & Other Electronic Component Mfg.
- Navigational, Measuring, Electromedical, & Control Instruments Mfg.
- Electric Lighting Equipment Mfg.
- Other Electrical Equipment & Component Mfg.
- Motor Vehicle Parts Mfg.
- Ship & Boat Building
- Household & Institutional Furniture & Kitchen Cabinet Mfg.

## INDUSTRY ISSUES:

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	Small
Glass	Product Innovation/ Technology	Increasing pressure from environmentalists to become more energy efficient and to decrease amount of water/emissions that occur during glass production. By 2020, the glass industry would like to be operating with 20% less emissions and to make all glass 100% recyclable. To meet these standards, a significant amount of R&D and capital will be necessary. With narrowing profit margins, this will be difficult for small and medium sized firms to afford		
Glass	Competitiveness	Narrowing profit margin due to the cyclical decline in downstream building and ongoing price constraints resulting from import competition and product substitution. In the glass bottling industry, plastic is the main competitor for glass. Many beverage companies are favoring plastic due to the durability and lighter weight. Glass needs to exploit the market perception that it represents quality, innovate, and show why glass is superior to substitutes to increase profit margins		
Glass	Labor	Many of the employees involved in the glass industry are represented by unions with a great deal of clout. Unresolved issues may result in a worker strike. This can be very costly to the company due to lack of production, resolving the issues and resuming operations		

## RECOMMENDATIONS:

- Process improvement consulting to ensure that SMEs remain competitive and to identify opportunities for process or technology improvement
- Help to develop the Human Resource department to be aware of the workers needs and desires to prevent strikes
- Provide strategy and innovation support to help SMEs identify niches and opportunities that are environmentally friendly and meet emissions standards for continued survival in the industry
  - Help identify value-added service opportunities
  - Help identify market niches

## XIV. Medical Equipment Industry

### INDUSTRY DEFINITION:

The medical equipment industry is primarily engaged in manufacturing medical equipment and supplies. Examples of products made by these manufacturers are laboratory apparatus and furniture, surgical and medical instruments, surgical appliances and supplies, dental equipment and supplies, orthodontic goods, dentures, and orthodontic appliances. Participants in this industry supply to wholesalers as well as direct to hospitals, private practices and laboratories.

### INDUSTRY DESCRIPTION:

This industry is currently growing at a rate of 7% per year due to consumer demand, improved regulatory conditions, and opportunities to produce new products required for medical advances. The increasing demand can also be attributed to the aging “baby boomer” population. The industry is highly competitive. Many of the newer products are highly specialized and have high margins. Being a first mover is crucial to earning high margins on products due to patent laws; however, being a first mover also entails a great deal of risk: Products often become obsolete before the investment made to develop the product is recouped.

### MEDICAL EQUIPMENT IN PENNSYLVANIA:

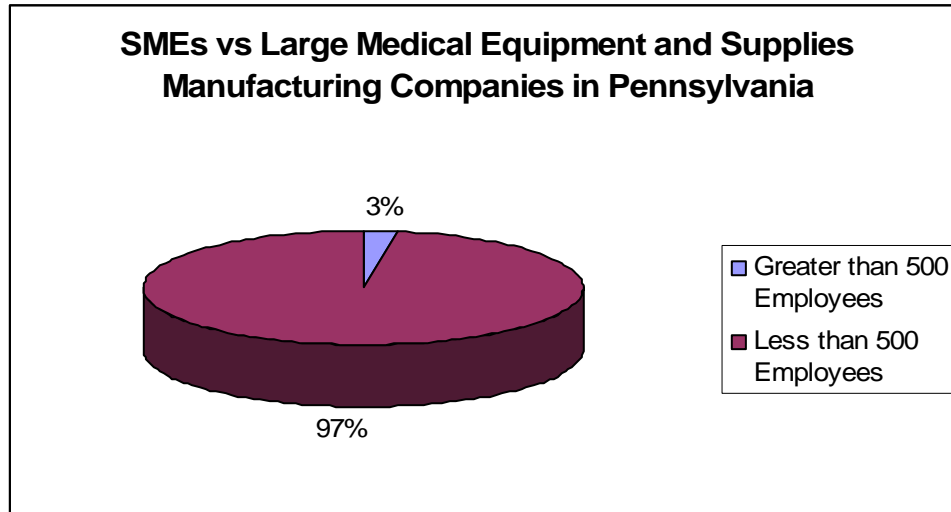
Medical equipment manufacturers typically choose to locate in Pennsylvania due to the proximity to other related industries (e.g., pharmaceuticals). Pennsylvania is also a centralized location for distribution to this industry’s customers. The largest Pennsylvania manufacturer of medical equipment, as ranked by number of employees, is Medrad INC. Within the Pennsylvania Commonwealth, Montgomery and Indiana counties have had the greatest output of medical equipment in dollars ranging from \$80-116 M per year. Pennsylvania currently ranks 7<sup>th</sup> among the United States by location quotient for this industry, which reflects the state’s competitive advantage in terms of access to markets. More information around the industry in Pennsylvania is in the table below.

Industry Position		
Industry Quadrant	Top Left	Growing Economic Base
Opportunity		Emerging industry segment in multiple locations
Key State Competition	State	Location Quotient
	Pennsylvania	1.97
	Nebraska	6.95
	Indiana	4.32
	Minnesota	2.57
	Florida	2.14
	Massachusetts	2.13
	Wisconsin	2.03
	Connecticut	1.95
	Delaware	1.91
	North Carolina	1.81
	Utah	1.79

**TOP 10 PENNSYLVANIA FIRMS:**

Company	Employees in PA
Medrad Inc	1200
B Braun Medical Inc	1100
Dentsply International Inc	850
Mine Safety Appliances Co Inc	741
Draeger Medical Inc	550
Fisher Scientific Co LLC	520
Alcon Laboratories Inc	500
Gentex Corp	415
Lake Region Medical Inc	350
Synthes USA	350

There are 277 glass companies in Pennsylvania: 7 (3%) large and 270 (97%) SME.



**PENNSYLVANIA'S COMPETITIVE POSITION:**

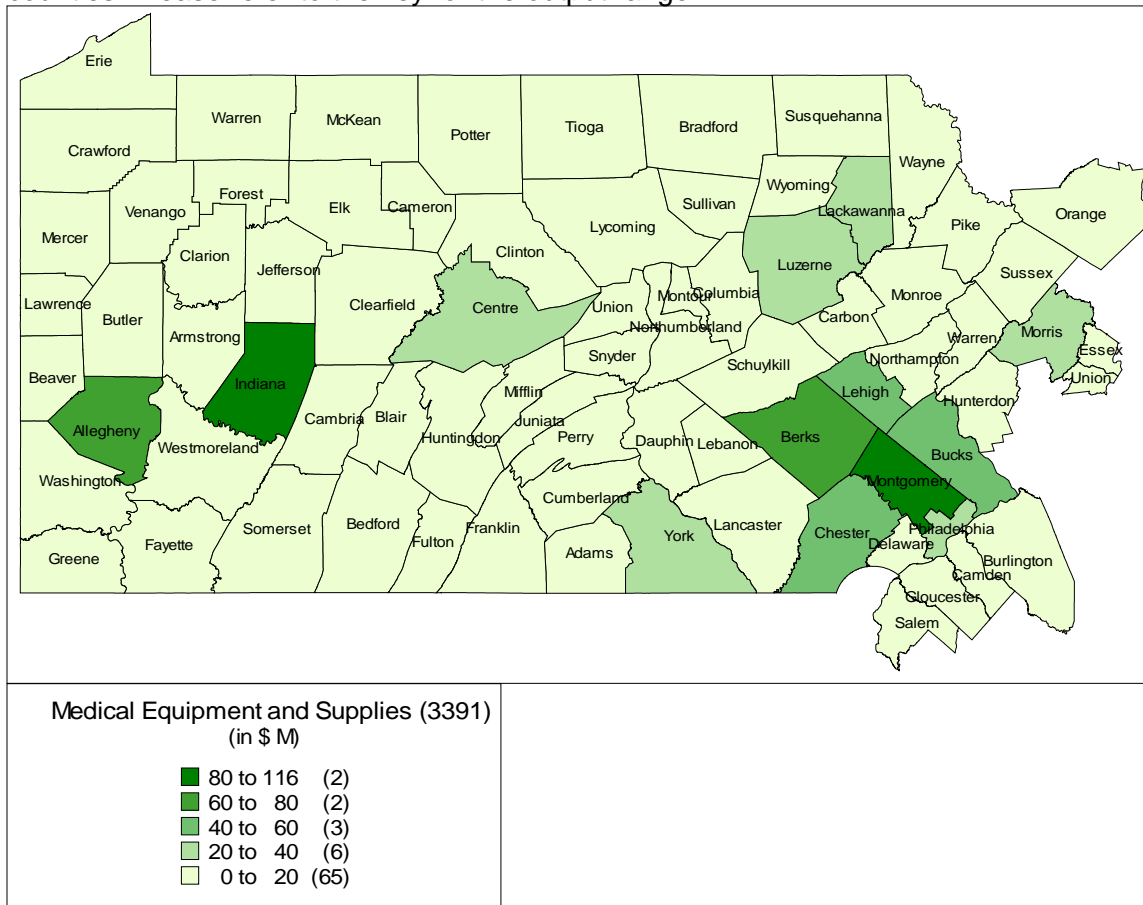
The table below shows where Pennsylvania ranks versus other states in terms of output. States are ranked on 2003 output for this industry.

State	1993	1998	2000	2003	2000-2003 CAGR	1998-2003 CAGR	1993-2003 CAGR
United States	\$14,872,810,000	\$13,412,580,000	\$13,452,460,000	\$10,695,060,000	-7.4%	-3.7%	-3.0%
California	\$ 2,676,880,000	\$ 2,901,620,000	\$ 3,418,330,000	\$ 1,746,910,000	-20.0%	-8.1%	-3.8%
Florida	\$ 724,310,000	\$ 699,120,000	\$ 733,460,000	\$ 1,121,880,000	15.2%	8.2%	4.1%
Indiana	\$ 596,560,000	\$ 572,060,000	\$ 737,710,000	\$ 879,990,000	6.1%	7.4%	3.6%
Pennsylvania	\$ 659,370,000	\$ 684,240,000	\$ 723,580,000	\$ 855,210,000	5.7%	3.8%	2.4%
Texas	\$ 783,790,000	\$ 910,060,000	\$ 714,980,000	\$ 683,050,000	-1.5%	-4.7%	-1.2%
Massachusetts	\$ 772,680,000	\$ 799,640,000	\$ 855,380,000	\$ 640,850,000	-9.2%	-3.6%	-1.7%



## LOCATION OF OUTPUT

A thematic map of the concentration of the medical equipment industry output in Pennsylvania is shown below. The medical equipment industry is concentrated in Montgomery and Indiana counties. Please refer to the key for the output range.









## BUY RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries from which companies in this industry purchase materials or supplies):

- Converted Paper Product Mfg.
- Printing and Related Support Activities
- Petroleum and Coal Products Mfg.
- Basic Chemical Mfg.
- Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg.
- Glass and Glass Product Mfg.
- Forging and Stamping
- Cutlery and Handtool Mfg.
- Computer and Peripheral Equipment Mfg.
- Communications Equipment Mfg.
- Semiconductor and Other Electronic Component Mfg.
- Navigational, Measuring, Electromedical, and Control Instruments Mfg.
- Electrical Equipment Mfg.

**SELL RELATIONSHIPS IN PENNSYLVANIA (Manufacturing industries to whom manufacturers in this industry sell their products):**

- Ambulatory Health Care Services
- Hospitals
- Death Care Services

The following table is a description of the primary issues that the industry is currently facing and how each issue affects firms of different sizes.

	Issue	Description	Importance by firm size	
			Large	SME
Medical Equipment	Economies of Scale	Cost of medical technology is decreasing by .8% per year due to economies of scale that large firms can reach. The lower unit cost due to the economies of scale grant these large firms bargaining power with suppliers and a less expensive end-product. SMEs are having trouble achieving these economies of scale due to the high volume of production required to see this benefit. In turn, they can not compete with large firms in cost and lack the bargaining power needed to get their supplies at a lower cost		
Medical Equipment	Product Innovation	Declining level of reimbursements has served as a deterrent for innovation (especially for SMEs). Revenue to innovate comes from the sale of medical equipment to health care professionals and hospitals. Medical professionals create revenue for themselves largely through reimbursements from insurance and government programs. Medical professionals are reluctant to buy products that are not reimbursable through government and insurance due to the large investment in research, capital and development		
Medical Equipment	Technology	Due to the rapid innovation of technology in the industry, it is difficult for SMEs to produce highly specialized products due to the capital investment and risk of obsolescence. In addition, it is difficult to compete with the large firms in this area due to the lack of production capacity. Most specialized products are developed by larger firms who have the scale and capacity to take on development cost and risk. Unfortunately, SMEs typically cannot take on the risk and compete in this high-margin niche		

**RECOMMENDATIONS:**

- Many of the large firms are unable to handle the full amount of capacity that is needed to handle the demand for specialized products. Smaller firms that are struggling and have excess capacity could partner with the larger firms and form an alliance to handle the additional demand. This would cause less conflict than an acquisition
- Smaller firms could consolidate to share technology, risk in producing products with higher margins, and to increase production capacities to achieve economies of scale and increase bargaining power
- Smaller firms who are unable to produce at a high enough volume to achieve the economies of scale can partner with another small firm for that product

- Seek government grants to offset the cost of production at obtainable level
- Control inventory and minimize transportation costs to drive down costs and increase margins
- Firms could form joint ventures for technology sharing purposes in order to share the cost of the research and development of the equipment. Small firms could consolidate in order to make the development of the new product less risky. Manufacturers could work with the insurance companies to ensure that their will be reimbursements available for the product
- IRC could help to join firms with existing complimentary technologies in order to save on the cost of investing research and capital. Smaller firms could consolidate to become more competitive with the larger firms
- Smaller firms could become design houses, help with production capabilities, consolidate, or form an affiliation with a university to increase R&D resources

## F. MACRO ISSUES

In addition to regional- and industry-specific issues, three issues dramatically affect Pennsylvania manufacturers:

- China/Offshoring
- Innovation
- Labor

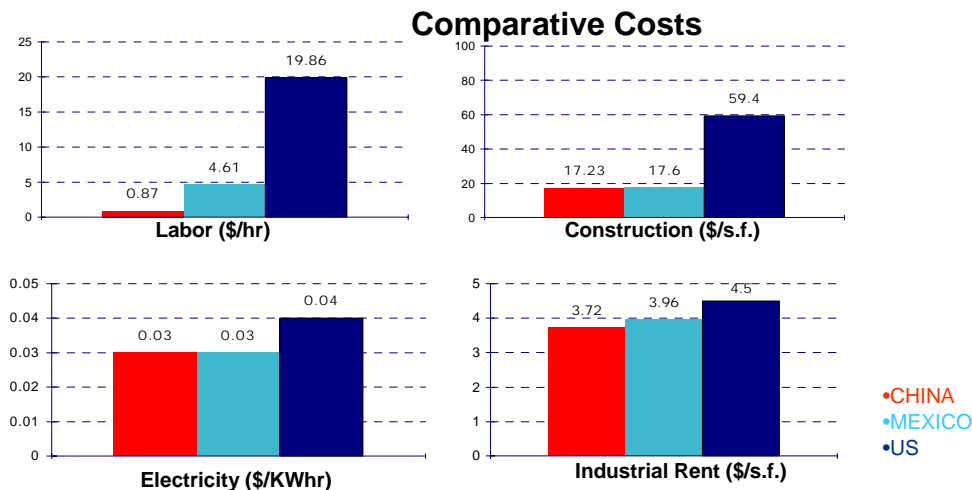
The globalization of manufacturing economies and the offshoring and globalization of supply chains continues to increase, especially as China becomes an ever larger player in the manufacturing world. As manufacturing of many goods moves overseas and as products become increasingly commoditized, the need for innovation so that domestic companies can remain competitive has become essential so that the American quality of life can be maintained. As innovation and technology change the way that manufacturers do business, labor with specific skills becomes essential to company performance. Combined with a significant demographic shift as Baby Boomers begin to retire and a somewhat negative stigma associated with manufacturing careers, the need for new skills creates challenges for attracting, training, and retaining talent.

These three issues are interrelated and, from Deloitte's research, appear to be impacting SMEs across industries, geographies, and company sizes. It is important to understand the challenges that each of these issues presents and strategies that companies and the IRCs can take to overcome the challenges.

## China/Offshoring

Offshoring is not a new phenomenon. In recent times, it began with NAFTA and it continues today with many manufacturing activities moving to China. In the long term, offshoring has many benefits for the origin country making the investment, including improved productivity, increased standard of living, and lower prices for consumers. However, the short-term impacts of offshoring are significant and are painful for many who are affected. It is important, therefore, where possible, to be able to capture the benefits and minimize, or offset, the negative impacts of offshoring.

Over past few years, the focus of offshoring activities has shifted first from Japan to Korea and Taiwan, then briefly from Taiwan and Korea to Mexico, and now from Mexico to China. Why is offshoring happening and why is a large volume of production moving to China? The simple answer is that U.S. production costs have become too high to be competitive in an increasingly global economy. As the graphs below show, labor, construction, electricity, and real estate costs are all much lower in countries like Mexico and China than they are in the U.S. The most significant differential is in labor costs, where China's labor cost per hour is 95% lower than that of the U.S. With such a large differential, it makes business sense to move labor-intensive manufacturing processes to China. In fact, labor cost differentials frequently offset the increased shipping charges that offshoring creates. Exacerbating the situation with China is the undervaluation of China's currency. Revaluation, which China is reluctant to undertake, would only provide a short-term reprieve to the U.S. economy; it is not a silver bullet. Deloitte expects that the most likely scenario is a revaluation within the next two to four years, but possibly sooner.



Source: Deloitte Fantus

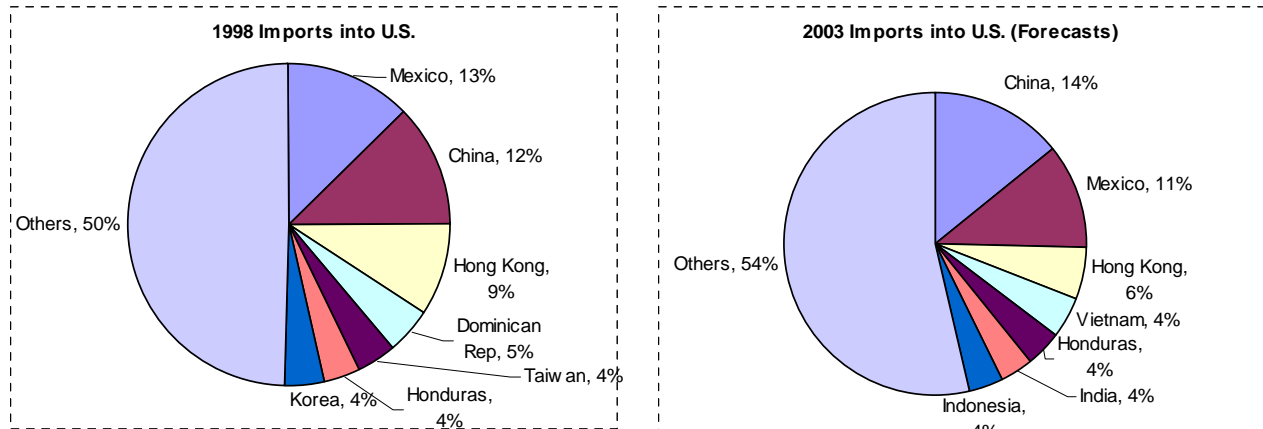
Another reason for offshoring is that China has a huge population base and a growing middle class, both of which contribute to increased markets for goods. Many manufacturers or industries have shifted or added production capacity overseas in order to serve growing markets such as China. For example, currently, China is importing U.S. produced steel; even with

dramatic capacity increases in domestic Chinese steel production capacity there is still a need for additional steel to satisfy domestic China market demand.

Based on Deloitte's analysis, there are several Pennsylvania industries that appear to have been hardest hit by offshoring since 1998. Those which Deloitte identified are: Cut and sew apparel; electric lighting, equipment and component manufacturing; semiconductors, and computer and peripheral equipment manufacturing. Each of these industries is discussed on the following pages.

## Cut and Sew Apparel Manufacturing

Apparel manufacturing has been the hardest hit industry in Pennsylvania from offshoring. Imports of apparel to the U.S. have grown phenomenally over the last decade. In the past 5 years alone, apparel imports have grown at over 4% a year. Imports from China have grown at 6.6% per year.



Source: United States International Trade Commission (<http://dataweb.usitc.gov>)

Imports into U.S. (\$M)		
	China	Total
1998	\$ 5,991	\$ 48,799
2003*	\$ 8,780	\$ 62,069
CAGR	6.6%	4.1%

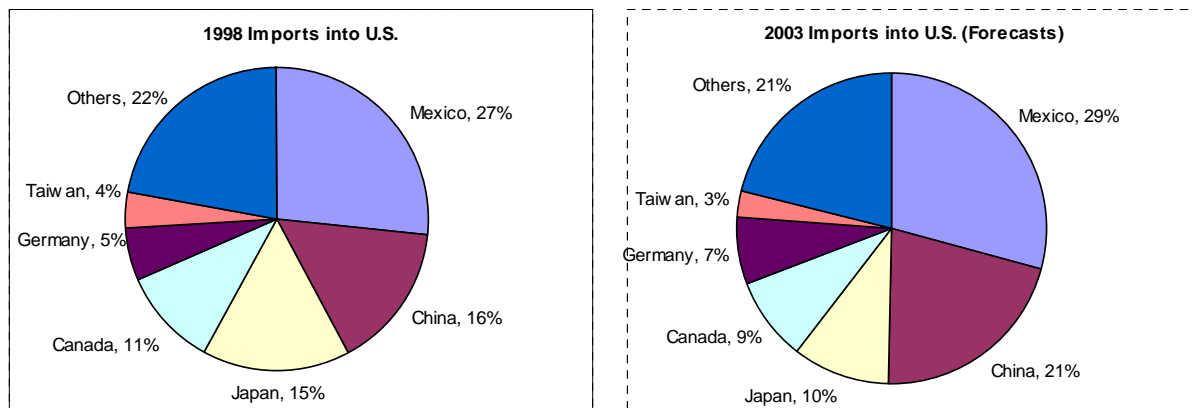
Traditionally, Pennsylvania has had a strong apparel base. In 1993, Pennsylvania produced over a \$1 billion in apparel output and employed close to 50,000 people. In 2003, the apparel output is \$440 million and the industry employs only about 13,000 people. The industry has lost 27,000 jobs in the past decade. The job losses since 1998 alone have been a little over 16,000 people.

Cut and Sew Apparel Manufacturing Pennsylvania Employment and Output			
	1998	2003	CAGR
Employment	29,660	13,330	-12%
Output	\$ 923.7	\$ 446.3	-11%

Source: Economy.com

## Electric Lighting, Equipment and Component Manufacturing

This is an industry where China has grown phenomenally. Chinese imports in the U.S. have grown at over 9% per year since 1998. In 2003, China is expected to account for 21% of all electrical equipment imports in the U.S., up from 16% in 1998. Overall imports of electrical equipment into the U.S. have also grown strongly – at 4% per year since 1998.



Source: United States International Trade Commission (<http://dataweb.usitc.gov>)

Imports into U.S. (\$M)		
	China	Total
1998	\$ 3,660	\$ 23,422
2003*	\$ 6,236	\$ 29,554
CAGR	9.3%	4.0%

Pennsylvania manufacturers of electrical equipment are feeling the weight of China. Although overall output has increased, Pennsylvania has lost approximately 10,000 jobs in this industry since 1998 – an average decrease of 5% per year.

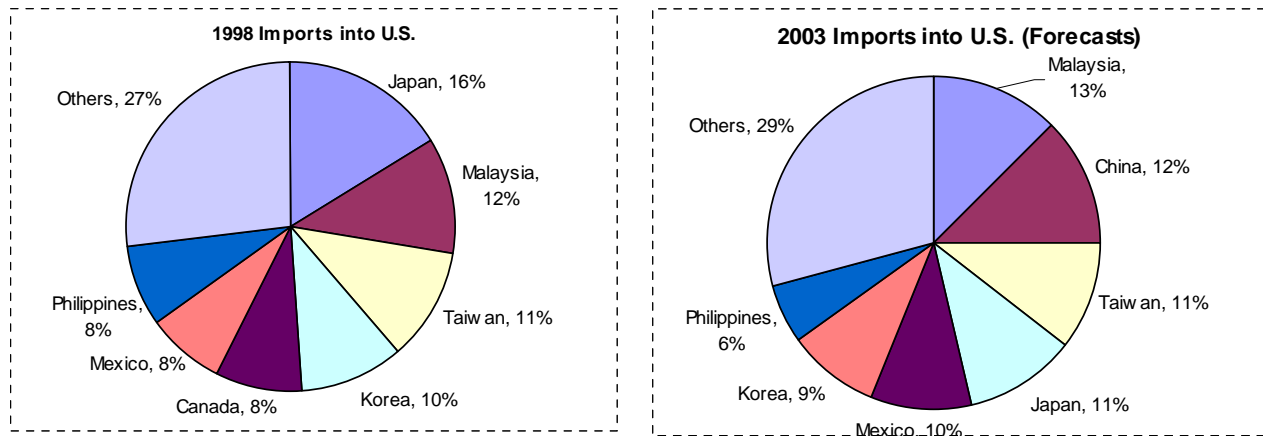
Electric Lighting, Equipment and Component Mfg Pennsylvania Employment and Output			
	1998	2003	CAGR
Employment	34,310	24,550	-5%
Output	\$ 3,273.1	\$ 4,611.9	6%

Source: Economy.com



## Semiconductors

The semiconductors industry in the U.S. and globally has faced a severe contraction due to the recessionary decline in computer sales. Overall imports of semiconductors to U.S. have declined at 3.5% per year since 1998. Similarly, Pennsylvania output in the industry has also declined at a compounded rate of 3% per year since 1998. However, in the midst of this downturn, China has managed to capture an increasingly large portion of semiconductors imports into the U.S. Since 1998, Chinese imports have grown at over 12% per year. China now accounts for 12% of all semiconductor imports to the U.S., a considerable increase from 5% in 1998.



Source: United States International Trade Commission (<http://dataweb.usitc.gov>)

Imports into U.S. (\$M)		
	China	Total
1998	\$ 3,389	\$ 68,400
2003*	\$ 6,772	\$ 55,096
CAGR	12.2%	-3.5%

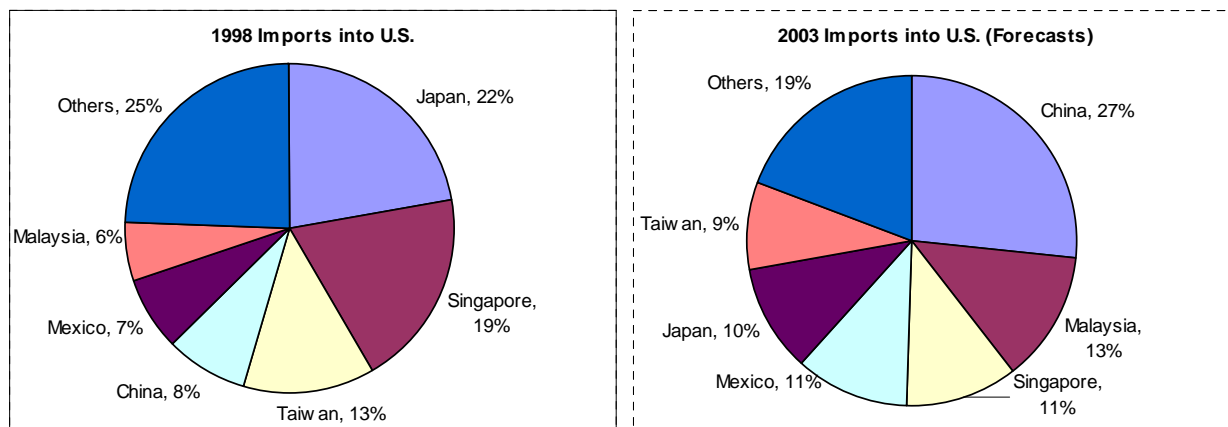
Pennsylvania has lost close to 7,000 jobs in the industry since 1998. The Chinese capture of the semiconductors market in the U.S. indicates that job losses in the semiconductors industry which may originally have been a result of the downfall in the economy may now be permanent.

Semiconductors Pennsylvania Employment and Output			
	1998	2003	CAGR
Employment	24,210	17,450	-5%
Output	\$ 2,423.6	\$ 2,038.5	-3%

Source: Economy.com

## Computer and Peripheral Equipment Manufacturing

The story in the computer and peripheral manufacturing industry is a more dramatic version of the story in the semiconductor industry. The contraction in the economy has led to stagnation in the demand for computers and peripherals. While overall imports of computer equipment to the U.S. have grown at 1.6% per year, Chinese imports have grown at 24.3% per year. Imports from China have replaced Japanese imports in this industry. In 1998, Japan's share was 22%, while China accounted for 8%. In 2003, China is expected to account for 27% of all imports in this industry, while Japan's share has fallen to 10%.



Source: United States International Trade Commission (<http://dataweb.usitc.gov>)

Imports into U.S. (\$M)		
	China	Total
1998	\$ 4,404	\$ 55,017
2003*	\$ 16,217	\$ 60,563
CAGR	24.3%	1.6%

Historically, Pennsylvania has not been a front-runner in the computer manufacturing industry. In 1998, it accounted for only \$630 million in output. However, this small output has been cut in half. In 2003, Pennsylvania was expected to produce only \$325 million worth of computer equipment – a decline of 10% per year since 1998. The jobs losses have been as severe: Pennsylvania has lost close to 2,500 jobs in the industry since 1998.

Computer and Peripheral Manufacturing Pennsylvania Employment and Output			
	1998	2003	CAGR
Employment	7,100	4,610	-7%
Output	\$ 630.7	\$ 325.6	-10%

Source: Economy.com

The impact of offshoring does not stop with the four industries discussed. Many other industries have been affected by the surge of imports, particularly from China. Moreover, it is important to note that each of the industries that are directly affected by international competition support domestic supply networks that reach throughout the Commonwealth. The goods being imported from China and other low-cost nations are not only finished goods, but also include components. Most often it is the second, third, and fourth tier domestic component supplier that suffer sales losses. Thus, the negative effects from international production platforms ripple throughout Pennsylvania's economy.

### **Surviving the Pain of Offshoring**

As some of Pennsylvania's driver industries become more affected by offshoring, leading to job and output losses, the question becomes what to do about the situation. Protectionism is not the answer. For long-term survival, an industry must be able to produce goods at globally competitive prices or cheaper imported goods will always be a threat. Protectionism may simply prolong the life of an industry that needs a fundamental or strategic change. Companies do not, and should not, have to rely on the government to adapt to the new reality of offshoring and globalization. There are actions that companies can take that can be supported by government or by intermediaries that are close to the market and have credibility with business, but a firm-level solution should drive the approach.

Many larger firms are taking advantage of cheaper production in China, Mexico, and other nations by moving production overseas. For SMEs, this could be challenging because they may simply not have the resources to take such an action. A more realistic opportunity for SMEs is to source products or components from overseas, which is still challenging, but this strategy can be executed with less resource investment than building or buying a manufacturing operation. Two major caveats to any overseas sourcing are the lack of product/component standards, making clear specifications and quality monitoring essential, and poor intellectual property protection, making confidentiality and other agreements crucial. Legal, reporting, and tax systems may also be less developed elsewhere than in the U.S. and could present navigational challenges.

Another opportunity that globalization presents is the chance to enter new markets, perhaps European markets or other places in which U.S. goods are desirable or relatively inexpensive. In the regional workshops, SMEs who had lost sales due to competition from China discussed how they had offset some of the losses by entering markets, such as Europe and other parts of the U.S., such as New York, where they are competitive. In addition, the growing Chinese middle class presents a huge market for finished goods that current Chinese industry may not be able to fulfill.

A third way of adapting to globalization is to shift product strategy away from commodity products by offering more specialized, high-value products which may not face foreign competition. Companies will also need to have efficient, lean manufacturing processes that can respond quickly to customer needs and produce at competitive prices. Making this shift requires investment in innovation and strategy development. It will most likely also require workers to have different, or higher-level, skills. The benefit is that these jobs will probably also have higher wages and more opportunity for growth than those jobs which are transferred out of the country. In short, it can be a winning strategy that can protect or develop jobs, but will require significant changes to execute. This solution is plausible for large firms, but for SMEs

this strategy will require significant assistance (in areas of process and product innovation). There is an opportunity for Pennsylvania's IRCs to help SMEs develop company strategies, product innovation capabilities, and training and development programs to help support taking this kind of action.

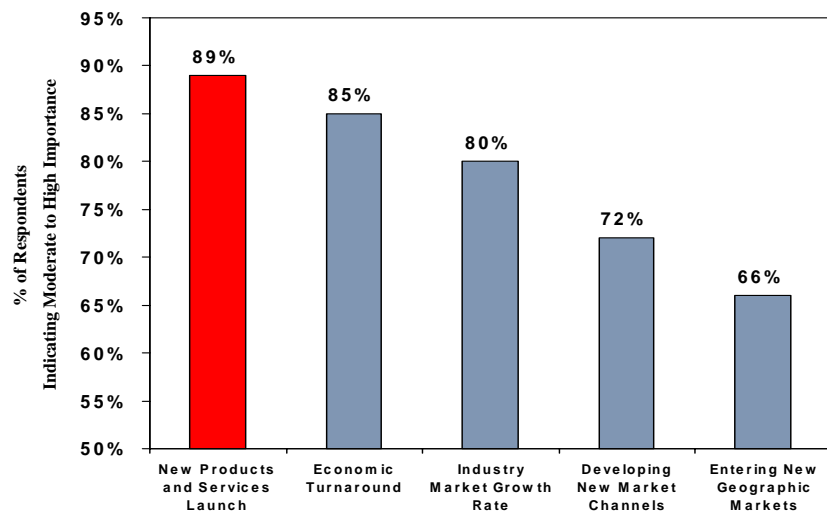
Offshoring is painful in the short run, but it can also bring benefits. It forces domestic producers to be more productive in order to remain competitive with goods produced in "cheaper" nations. Less expensive goods imported from elsewhere put downward pressure on consumer prices and bring more value to consumers. The combination of higher productivity and lower costs of goods creates a higher standard of living. While offshoring can lead to local job and output losses, there are actions that manufacturers can take to better position themselves in an increasingly global economy, including moving operations offshore, sourcing goods or components offshore, or shifting strategy to create differentiated goods that do not have to compete with commoditized imported goods. The IRCs have an opportunity to work with manufacturers to further develop these options and choose those that best suit each company or industry.

## Innovation

Innovation, the development of new products, services, and business or production processes, is important for companies to survive and grow. Once a company's core business has matured, it is essential to pursue new opportunities to drive growth. Unfortunately, it is also inherently risky to pursue new growth platforms. Investment is required, but success is not guaranteed and too much innovation can cause a company's capital and operating cost structures to mushroom. A failed innovation attempt that taps company resources and dilutes strategic focus can leave a company worse off than if it had not pursued growth at all.

Despite the inherent risk in innovation, many companies, especially manufacturers, are pursuing innovation as the cornerstone of their competitive strategy. In a 2003 Deloitte survey of over 500 manufacturing companies in 19 countries, "launching new products and services" ranked highest of any factors that companies expect to drive growth over the next three years. The chart below shows that more than 89% of respondents ranked product innovation as moderately to highly important for growth. Entering new channels and geographic markets were other critical factors. To satisfy new channels and markets, companies will most likely need to develop new products or find new ways to bring existing products to market.

**Top Reported Revenue Growth Drivers  
For the Next Three Years**



Source: Deloitte Global Manufacturing Benchmarking Study, 2003

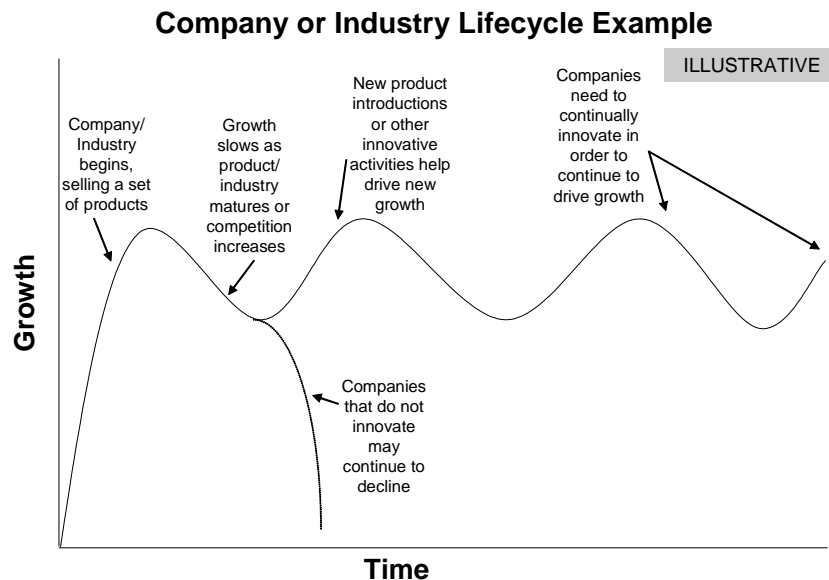
What is driving this push toward innovation? There are four main forces pushing companies or industries toward innovation:

- **Market Forces** – Reacting to supply chain changes or new competition. Two major factors that appear to be present in Pennsylvania manufacturing are the increasing commoditization of products in traditional industries and increasing offshoring or competition from Chinese imports or imports from other nations. Both of these factors appear to have had a negative impact on Pennsylvania manufacturers. Innovation to

either create differentiated products that do not need to directly compete with cheaper competition or to improve efficiency to maintain profit margins is becoming an increasingly important strategy for manufacturers to maintain competitiveness

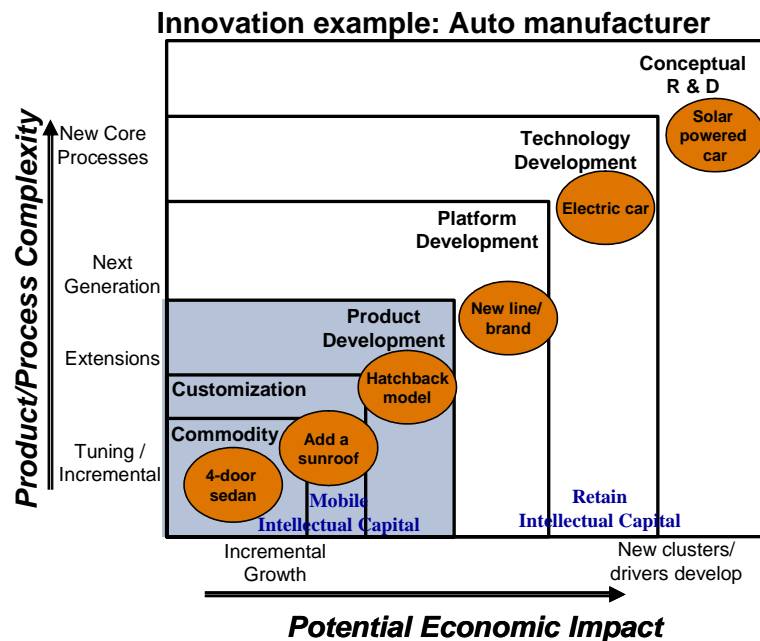
- **Market Opportunity** – Identification of new applications of existing products or modification of existing products to enter new markets. As mentioned above, another significant planned growth strategy that manufacturers report is entering new markets or distribution channels. Typically, some innovation is required to adapt products or go-to-market strategies to better fit new markets
- **Demand for Growth from Shareholders or Owners** - Stakeholders, especially financial markets, are typically looking for future growth to drive shareholder value and continued prosperity. This demand for growth puts pressure on company management to deliver innovative, profitable, new offerings. For many SMEs that are not publicly held and those that are family owned, there may be less of this demand for change. In fact, owners may even resist major changes and risk-taking.
- **New Technology or R&D Available to an Industry or Company** - New information and tools can help improve current operations or identify new opportunities. Companies need tools and processes to both capture new information and effectively translate it into new products or processes that will help drive growth and create a competitive edge

The chart below shows the lifecycle that a company or industry may go through as it develops and matures. Once an industry has reached maturity, as many of Pennsylvania’s manufacturing industries have, growth may level off or begin to decline as consumption of its products slows or new competition (additional companies or overseas competitors) enters the market. Without innovations, the company or industry may decline. With innovations, however, the company can build a new competitive advantage and drive new growth. The cycle is continuous; the competition will also begin to adopt the new products or processes, so the need for innovation is permanent for companies to stay “ahead of the curve”.



Product innovation can be classified into a typology of levels of action as companies move from commodity to futuristic concepts. The chart below shows each category of innovation conceptually and offers examples of innovation at each level for an automobile manufacturer.

- **Customization** – Tuning and enhancement of current products. For an auto manufacturer, this might be the addition of a feature such as a sunroof that appeals to certain consumers
- **Product Development** – Extensions of core product driven by product families. For an auto manufacturer, this might be a new model within a particular make, such as using a sedan base to create a station wagon or hatchback
- **Platform Development** – Next generation. For the auto manufacturer, this might be an entire new make that includes several different models but still leverages the current equity and branding of the manufacturer
- **Technology Development & Concept R&D** (including disruptive technology) – Non-core, technology transfer, true innovation. For our auto manufacturer, this is a technological leap into solar powered cars or other technologies that require a significant transformation from current products and processes to “disruptive” new products and processes that change the market. This type of innovation is long-term, often requiring a number of years to achieve, but it is important for companies to think in terms of disruptive innovation in order to develop truly significant innovations



To maintain long-term competitiveness, it is important for all companies to be thinking in terms of disruptive innovations that create competitive advantage. Unfortunately, the “higher” levels of innovation are usually driven by large corporations and universities who have the resources to support research. Most SMEs focus on “lower”, less costly, levels of innovation, such as growing existing product families or improving customer service. The areas in which SMEs typically focus are highlighted in blue in the auto industry example above. Most SMEs also do not have an organized process or resources for innovation. While the activities that SMEs are undertaking are meaningful, it is becoming increasingly important for companies to develop the resources and processes that can help them drive better and more sustainable growth and remain competitive.

Innovation is an important component of a sustainable competitive strategy and one of the driving forces for creating growth. Because innovation involves investment and success is not guaranteed, risk is involved. For SMEs, the risk can be especially high, since most companies do not have either the financial or human resources to invest in innovation and most do not have standard methodologies or processes for the new product development process. Without the proper resources, organization, or support, risk of failure increases. For Pennsylvania manufacturers, especially SMEs, the ability to innovate is for their survival as products in many industries become commoditized and competition from countries like China and Mexico increases. There is an opportunity for IRCs to take a leadership role in helping companies innovate by helping SMEs develop market-focused innovation strategies; helping SMEs establish new product development methodologies and processes; enabling access to resources, including financing, and R&D or technology talent; increasing cooperation with the Ben Franklin Centers or, prospectively, with the “Keystone Innovation Centers” championed by the Rendell Administration; helping to develop and train current workers in new skills or technologies that are driven by innovation; and helping guide the innovation process from start to finish.



## **Labor**

The impact of the recent recession and resulting loss of more than two million manufacturing jobs nationally over the past three years has been highly publicized. However, at the same time, a report released by the National Association of Manufacturers and Deloitte in April, 2003, identified a growing shortage of skilled talent (i.e., engineers, R&D professionals, skilled production workers, and plant managers) in the manufacturing sector. This talent shortage was also a concern raised by manufacturers in many IRC regions. Is it possible that both stories can be true? Can there be a shortage of talent in a sector that has had so many job losses over the past several years? A look behind the numbers helps explain this apparent contradiction.

First, an analysis of the losses. Because of rapidly increasing productivity, manufacturing has sustained its overall share of total U.S. output over time by growing but requiring the same absolute number of workers. This is great news for the industry and potentially profitable, but it does mean that employment in the sector has not grown. There is also a downside: Manufacturing tends to be cyclical, suffering recessions earlier and recovering from them later than other industries. The most recent recession, combined with the effects of increased offshoring, led to a loss of approximately 2 million manufacturing jobs. This combination of non-growth and job losses due to the recession has, theoretically, led to an excess of talent available to manufacturing companies.

So, in a sector with two million potentially available workers, how is it possible that there could be a talent shortage? Three main factors are at play: the aging of the manufacturing workforce, the increasing levels of complexity and technology involved in manufacturing that require a more highly skilled workforce, and the negative perception of manufacturing as a career.

The first factor, the aging of the workforce, impacts manufacturing significantly. As Baby Boomers age, an estimated 76 million workers are expected to retire over the next two decades and only 46 million “Gen Xers” are available to replace them. The sheer difference between these numbers could lead to a significant shortage of workers. Productivity increases and immigration can help fill some of the gaps, but a shortage of workers in the millions may still result. The numbers don’t tell the whole story, however. Manufacturing employees who have been on the job for decades have developed a high level of skill and experience that it will take younger workers time to similarly develop. This will most likely increase the need for effective industry-led, skill-based programs (both academic and on-the-job training). It may also lead to productivity declines as less skilled people climb the learning curve to reach the skill level of the experienced workers they replace.

Manufacturing productivity has increased in recent years primarily due to increased development and use of advanced technologies that support increased quality and complexity of products. This increase in complexity and technology has led to a need for highly-skilled, technology savvy employees. Manufacturing workers must now be well-versed in both the traditional know-how and craftsmanship for making a particular product and new technologies that help design or build that product more efficiently. For example, a printing employee now needs the traditional skills of design and layout but must also understand how to use the computer programs that improve the efficiency of these functions. Other product designers need their traditional craftsman skills but must also understand CAD systems and other

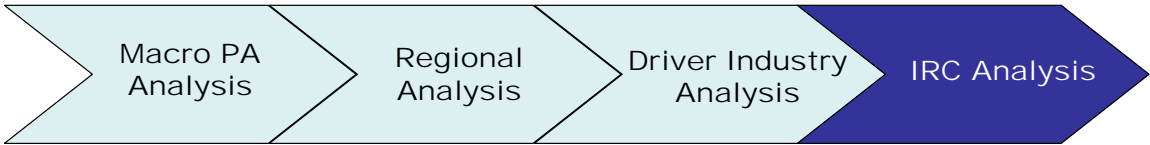
technology now used to improve the design process. It is this combination of deep trade skills and technical savvy that is essential to future productivity in manufacturing but is in short supply in the current manufacturing talent pool. There is a particular shortage in talent in engineering, R&D, and management skills. In fact, a recent Center for Workforce Success study found that 80% of large and small manufacturers polled reported a “moderate to serious” shortage of qualified job applicants. This shortage of skilled workers particularly hampered smaller firms. Some reported that they could not schedule needed second or third shifts for the same reason. Others reported that they had advertised extensively for employees with specific skills such as welders or electricians and could not find acceptable candidates, or they hired entry-level workers whose skills were barely adequate.

Compounding the skills shortage is a prevalent perception among young people today that manufacturing is not an attractive career option. American youth are “turned off” by manufacturing. There is major disconnect between perception of manufacturing careers and desired career characteristics. The manufacturing sector’s image is heavily loaded with negatively connotations and tied to an old stereotype of the “assembly line”. Manufacturing is perceived to be in the old economy and in decline: “Things are not made in America anymore. Manufacturing is not going to be around for too long.” Manufacturing is not identified with high technology or innovation and is professed as a cookie-cutter job. The desired career characteristics of American youth are opportunities that are creative and interesting; having ample opportunities for growth and advancement; and in a stable, high growth sector. In addition, the U.S. education and training system does not seem to be focused on developing the craft and technical skills and programs that young people need to prepare for manufacturing careers, nor does it promote careers in manufacturing as an exciting employment opportunity.

As the economy recovers, manufacturers will once again expand their business and seek skilled workers to help them attain their business goals. While some of the job losses from the recession may be permanent, new jobs will also be created in a cyclical recovery. Thus, manufacturers face a lack of well-qualified employees with specific educational background and skills, not just a lack of employees. As many labor-intensive jobs move offshore, the jobs that remain in the U.S. will be more highly skilled ones or those in certain professions such as R&D, engineering, and management. These jobs should become more attractive and desirable than the perceived “assembly line” careers that young people are aware of today.

The opportunity, then, is for entities like the IRCs to advocate manufacturing to young people as a career by stressing the attractiveness of many manufacturing related jobs, including strong wages and variety of highly skilled professional opportunities. There is an opportunity to work closely with educational institutions not only to promote career options in manufacturing but also to establish training or apprenticeship programs that can develop the skills that companies need and enable young people to get the experience they need. Yet another opportunity is to align manufacturing organizations, especially SMEs, with educational or other institutions to establish relationships that give manufacturers access to resources for needed skills such as R&D and engineering. Regionally, IRCs may want to help SMEs benchmark salaries, quality of life, and other factors that might help attract more workers to manufacturing careers. In addition, IRCs can help SMEs develop and deliver training programs to help current and new workers develop the skills they need, especially as the skills needed in manufacturing industries evolve and involve both craft and technology. In order to become more effective in this role, IRCs could increasingly position themselves as the essential intermediaries between SME workforce needs and the capabilities and performance of the Pennsylvania educational and training system.

# G. ANALYSIS OF IRC CAPABILITIES



## IRC Capabilities

Once the key issues and needs were identified for each region, Deloitte analyzed how each IRC could address regional manufacturers' needs. Deloitte gathered information on the history of each IRC, including the current and planned capabilities available. This analysis provided a high-level qualitative assessment to compare against industry and regional issues to determine potential service "gaps" and opportunities for IRC investment. Recommendations to close these "gaps" can be found in the Gap Analysis & Recommendations section of this report.

To better understand IRC capabilities, Deloitte also researched the NIST MEP (National Institute of Standards and Technology's Manufacturing Extension Partnership), which assists many of the regional IRCs by providing them with additional resources such as funding and expertise. The MEP is a government agency with centers that serve all 50 states and Puerto Rico. Currently, the MEP has 400 locations nationwide that are linked together through the Department of Commerce's National Institute of Standards and Technology. Centers are funded by federal, state, local and private resources.

## Northwest Industrial Resource Center

The NWIRC (Northwest Industrial Resource Center) was established by the Pennsylvania's IRC program in 1988. It is one of seven IRCs in the Pennsylvania Commonwealth that helps SME manufacturing companies become more competitive. In addition, it seeks partnerships with organizations that strive to help SMEs at affordable costs. It is an affiliate of the NIST MEP, which provides NWIRC with additional resources and funding to assist its clients. NWIRC operates in 13 Northwest Pennsylvania counties serving nearly 1,800 manufacturing firms that employ over 91,000 people.

NWIRC once considered itself a broker for local and regional private sector consultants. It helped manufacturers identify and pre-qualify external consultants in order to help those manufacturers grow and thrive in their market. Later, NWIRC moved toward a Direct Provider Model or "balanced broker". In addition to linking SMEs with local and regional consultants, it also began offering services in ISO/QS and merged with NWIRC Operations.

Currently, NWIRC is focused on moving away from the brokering, "point solutions" model to a more holistic, "enterprise-wide approach" consulting model using a balanced scorecard approach to make sure concepts become actions. NWIRC does, however, stay true to its non-competitive roots in never offering a service that would directly compete with a local or regional consulting firm and is avoiding duplication of efforts among the 7 regional IRCs. The idea behind this change is to help SMEs, who are dedicated to productivity and quality, find areas for improvement and opportunity and meet their current challenges.

Currently, NWIRC offers general assistance/assessments, project identification, potential consultants for selection to work on projects, project cost share or loans, other assistance and reviews, e-business consultation services, manufacturing strategy and productivity improvements, technological improvements, facility layout assistance, computerized design and control, quality improvement, human resources assistance, TQM development and implementation, ISO 9000 certification, marketing and business planning, including export development, e-business, education and training, executive/management training, workforce development, manufacturing seminars, e-business and Pennsylvania School-To-Work program. The number of projects closed by service line for the fiscal year 2002-2003 is as follows:

<b>Service Line</b>	<b># of Projects Closed</b>
CAD/CAM/CAE	3
EDI/Communications/LAN	1
Business Systems and Management	67
Environmental	9
Quality	128
Plant Layout	2
Market Development	8
Material Engineering	1
Process Improvement	37
Product Development	2
Human Resources	65
<b>Total</b>	<b>323</b>

To continue moving towards to more holistic model, the NWIRC has adopted the NIST MEP 360vu brand. This brand allows access to branded products, staff training, PBA training and support (Professional Business Advisor initiative development program that will train individuals in NWIRC who will in turn assist SMEs with their new found knowledge), access to knowledge network, a national marketing effort, participation in developing new products, and part of a truly integrated network that will help NWIRC. The adoption of this plan will also assist their clients in focusing on the transformation to world-class manufacturing, granting access to a broader range of expertise, developing trusted relationships, and participating in supply chain improvement programs. Overall, the goal of using this plan is to deliver higher value-added services to achieve an even-higher level of credibility with its clients.

NWIRC has set several goals in their strategic plan for 2001-2004 to achieve or begin working on by 2004. First, they want to focus on generating increased economic impact. To do this, they will partner key clusters and common technologies, work on building capabilities and measure and communicate the impact of these improvements, develop long-term relationships to increase trust, meet the needs of clusters by forming councils to provide advice, and measure and communicate the impact of their actions by improving capabilities.

Secondly, they want to focus workforce development on the 5 key clusters and on targeted technologies within those clusters. To do this, they will align training with impact strategies and design strategies to further along partnering key clusters. Next, they want to work to ensure the long-term stability of NWIRC. Strengthening the leadership structure (i.e., development of succession plans), improving operational effectiveness by pushing to achieve performance excellence and maintaining focus on continued improvement will help to achieve this goal. Finally, NWIRC would like to maximize mutual benefits of select partnerships by getting them aligned and using a balanced scorecard to make sure concepts become actions.

To stay successful and to meet these goals, NWIRC functions in two types of teams. The operating teams are divided into service delivery, marketing/communications, and program administration that are headed by team coaches. These sub teams create ideas and share them between each other to generate ideas to make NWIRC successful. The enterprise team is made up of NWIRC executive directors and team coaches. This team works to foster change and encourage improvement. The teams are committed to making NWIRC a collaborative group that works to avoid duplication of efforts, improving professional development by increasing their knowledge and transferring knowledge, and fostering fiscal stewardship by properly managing public funds.

In addition, they are using eBusiness to drive growth. Through eBRN (eBusiness Resource Network), NWIRC is able to provide manufacturers with unbiased advice to help them survive. They have also identified 5 strategic thrusts: generate a maximum economic impact, ensure workforce skill transfer, strengthen long-term stability growth, maximize mutual benefits, and provide unique services to the IRC network. To combat against the challenge of the lack of skilled workers due to aging population of skilled tradesmen, they are working to target incoming high school and trade school graduates, incumbent unskilled workers with the ability to be taught, and the current unemployed skilled workers. Finally, NWIRC must offer high-end engineering services because they are critical to the success of manufacturing firms trying to compete.

Overall, NWIRC needs to continue improving itself by partnering with organizations with the same goals and follow their strategic plan. They also must focus on helping SMEs innovate and seek out ways to fund these improvements. They need to continue to assess the market to identify new challenges and develop resolutions. In doing this, NWIRC will be able to continue to assist SMEs who are dedicated to productivity and quality to become more competitive.

## Catalyst Connection

Catalyst Connection (formerly SPIRC (Southwestern Pennsylvania Industrial Resource Center)) was established with funding from the IRC program in 1988 as an affiliated organization of the Pittsburgh Technology Council (PTC). In 1994, after six years of support from the Commonwealth of Pennsylvania and private sources, Catalyst Connection was designated a manufacturing extension center under the national NIST/MEP program and focused their core business on technical consulting services. This designation gave Catalyst Connection additional federal support, which allowed them to help their clients with greater tools, methods, and capabilities.

This designation has continued to the present, and currently, Catalyst Connection partners with the Urban Redevelopment Authority of Pittsburgh, the City of Pittsburgh/Allegheny County, Allegheny-Pittsburgh Business Development Corporation, Industrial Development Corporations (IDC), Innovation Works, Inc., University Related Organizations, and the Software Engineering Institute/Carnegie Mellon University. These partnerships help Catalyst Connection to achieve their goals and meet challenges that they face such as issues related to workforce, innovation, and development.

Catalyst Connection operates in 13 counties that contain 4,200 manufacturing companies employing 185,000 people. They function under the same principle as the NWIRC in that they seek to help SMEs that are dedicated to quality and productivity to become more competitive, and to grow. Catalyst Connection offers services in nine practice areas: market development, web enhancement, product development, lean manufacturing, quality systems, information technology, workforce development, computer based training, financial assistance, and SBIR funding assistance. The total number of projects closed for each service line for the fiscal year 2002-2003 is:

<b>Service Line</b>	<b># of Projects Closed</b>
Market Development	29
Web enhancement	20
Product Development	2
Lean Manufacturing	58
Quality Systems	50
Information Technology	12
Workforce Development	35
Financial Assistance	13
Computer Based Training	6
SBIR	7
<b>Total</b>	<b>232</b>

Catalyst Connection recently hit an important milestone in serving over 1000 customers since inception in 1988. Catalyst Connection has been successful due to their ability to identify the needs of their clients. For example, Catalyst Connection recognized that a key component to SMEs success in marketing is an effective Website. Many potential clients search the Web for new clients, and SMEs would be missing a large segment of their target market without a Website. Catalyst Connection is helping SMEs to keep up with the latest technologies to stay on top of this marketing technique.

Catalyst Connection has also enabled SMEs to develop by providing them with the necessary resources (such as data collection, processes for developing new products and increasing efficiency and value in current processes, new system implementation and knowledge, and linking SMEs to sources of funding to support their businesses) that SMEs struggle to provide for themselves.

To continue meeting SMEs needs and to increase their credibility, Catalyst Connection has also adopted the 360vu brand and has set several goals that they are hoping to achieve in order to continue growing. The first goal is client satisfaction. Catalyst Connection measures their success on feedback from client satisfaction surveys submitted by clients a few weeks after a project is completed and from the results they get from a survey contained under the NIST impact survey collected by a third party survey house. On a scale from 1-5, with 5 being the highest, Catalyst Connection has set a target point of 4.4 for the 2003-2004 year for the NIST Impact and Internal Catalyst Connection Survey. Catalyst Connection also has a goal of an 80% survey completion rate. Overall, this helps them to improve on quality of service and to focus on client needs, impact and deliverables. In its most recent fiscal year, Catalyst achieved a 4.6 average satisfaction rating.

Next, Catalyst Connection has set a goal of \$22.1 million value-added impact for clients for 2003-2004. This is determined by the following equation:

$$\text{value-added} = 0.15 * (\text{sales increase} + \text{sales retained}) + \text{cost savings} + \text{capital investments avoided} + \text{savings on investment}$$

This number helps Catalyst Connection clients identify a monetary amount that their efforts have created and serves as another measure of success.

In addition, Catalyst Connection has set a goal of increasing income from fees by 13.6% for 2003-2004. This will be a difficult task considering the current economic conditions and the projection of a 7% decrease in gross fee income from the prior year for 2002-2003. The income from these fees in addition to \$200,000 received in private funds represents 25% of the core operating budget.

The next goal is based on the required to the 15% cash match required by the Commonwealth of Pennsylvania to receive their grant, which is equivalent to \$339,325. The total match for the Commonwealth is 1:1 while it is 2:1 for the Federal Contracts. Catalyst Connection must meet this goal in order to maintain grant funding.

Other goals for the organization include servicing very small (less than 10 employees) manufacturing companies, increasing market awareness to 45% for 2003-2004 (a 13% increase from 2002-2003), a 25% fee income generation from new services, and an internal measurement of workplace strength that will be put into place for 2003-2004. All of these goals will help Catalyst Connection grow and provide continued service in the region.

To achieve these goals and to ensure its survival, Catalyst Connection is run by a 27 person board of directors, with 14 regional manufacturing executives and representatives from local financial institutions, universities, consulting firms, labor unions and economic development organizations. The organization also has 26.5 full time staff committed to its core business of technical services consulting with another staff of 4.0 FTEs committed to the Workforce Education Program, a program that manages training and education initiatives to support



technology, manufacturing, and biomedical employers in western Pennsylvania. (The Workforce Education Program is not supported by NIST/MEP funding).

Catalyst Connection has an Operations Department, and a Support Services department. The Catalyst Operations group is comprised of the service delivery staff, the business development staff, marketing, events coordination and data administration. The service delivery staff provides technical services to clients, manages the efforts of third party subcontractors, monitors the progress that clients are making with implementation and are ultimately responsible for the impact that clients realize as a result of their projects. The business development staff is responsible for, building and maintaining relationships with firms, identifying needs, developing proposals and monitoring impacts for each engagement. The marketing and events coordination staff provide education and awareness opportunities to clients, while data administration assists with data collection, analysis and reporting.

The second department is Support Services and Administration. Due to its affiliation with the Pittsburgh Technology Council, Catalyst Connection shares with them information systems, finance and accounting, administration, human resources and marketing communications.

Catalyst Connection has received a \$1.5 million congressional earmark to form the “Doyle Center for Manufacturing Technology”. This will be an extension of the TIDE (Technology Insertion Demonstration and Evaluation program that does market research on SEI process around computer maturity model integration, tests systems and encourages technology development) research around supply chain. This center will provide small manufacturers with a link to the Department of Defense supply chain in order to increase their competitive ability and reach. Other regional initiatives include the Advanced Manufacturing Network (AMN-a network dedicated to leading regional manufacturers committed to the best technologies, equipment, management, human resources and leadership to improve their company’s performance.)

To date with 36 full-time employees and an annual operating budget of \$6 million, Catalyst Connection is achieving its vision of being recognized by manufacturing firms in the region as the principal resource and gateway for assistance, expertise and information. And, as a forward-thinking organization, Catalyst Connection continuously adds new programs that allow the organization to better serve the marketplace and develop outreach initiatives that position the group’s advisors as experts in their fields.

## Manufacturing Resource Center

The Manufacturing Resource Center (MRC) is a state and federally funded extension center that is a non-profit subsidiary of Lehigh University serving 5 counties on the east side of Pennsylvania. Like the other regional centers, it is dedicated to helping small- and medium-sized manufacturing firms and related businesses become more productive and competitive. The MRC plans to do this by providing these firms with strategic partnering, consulting and education. The manufacturers that benefit most from the MRC are those that are not taking full advantage of available technologies, processes or management techniques that could be very beneficial to helping them survive and thrive in a competitive environment. The MRC has been a part of the IRC since 1988 and has been affiliated with the NIST/MEP program since 1994. The MRC also acts as a team member in a variety of state and federal programs like Team Pennsylvania, the Ben Franklin Technology Partners of Northeastern Pennsylvania, work force development programs, regional development agencies, and coordination with private sector to enhance the community.

The MRC plans on expanding their efforts in order to encourage economic growth through a strong Manufacturing base regionally and nationally, to provide manufacturers with the skills (business and technical) necessary to remain competitive and grow, to give an avenue for firms to adopt current and advanced technologies, to improve production capabilities, quality and efficiency, to develop the workforce, to link manufacturers with regional, state and national assistance programs, and to support the IRC network initiatives. In addition to meeting these objectives, the MRC has set several goals that it would like to achieve in the upcoming years.

First, the MRC would like to assist companies through consulting and training in supply chain management, plant layout, Manufacturing cells, lean Manufacturing, operations assessments, material engineering, health and safety, energy efficiency, quality management, technology, human resources, and business planning and market development. To do this, it plans on assisting in quality management by teaching and implementing ISO awareness, TQM planning, quality inspection, current good Manufacturing practices and Six Sigma. Next, the MRC plans on improving technology with eBusiness and website development, ERP/MRP implementation, LAN communications and CAD/CAM/CAE. In addition, the human resource function can be improved with technical training, computer-based training, team building and problem solving, supervisory-level training, HR systems consulting and training Consortia Management. Finally, the MRC projects being able to assist in business planning and market development through eBusiness and marketing, business plan development, strategic planning, market analysis and development, product development and design, export assistance and financial systems, assistance and literacy.

In addition to these goals of assisting manufacturers through the business functions, the MRC wants to continue to leverage their staff and resources to increase the reach of their assistance. In addition, they want to continue to improve on client services and internal processes through Internal Quality Plan based on Malcolm Baldrige criteria. The MRC would like to maintain a full-time technical staff and access to expertise in the Manufacturing areas such as information and quality systems and human resource development.

Finally, the MRC must meet the following goals to receive funding from the IRC and MEP:

Item	IRC	MEP
Projects Completed	220	150
Number of Companies	100	70
Fee Income	20	15
Cash Match	1,343,340	1,176,006
Number of Firms Reporting Impact	80	60
Value Added	15,000,000	15,000,000
Average Customer Satisfaction	4.2	4.2

The MRC is headed up by a board of directors who develop policy, strategic direction, legal, financial and contractual oversight. The board has 18 directors, which are made up of 10 people from the Manufacturing/private sector, 2 Lehigh University representatives, and 6 others who tend to financial, other educational, other state/federal, economic development and community affairs. The goals are set in the Strategic/Operating/Sales/Incentive Plan process so that everyone is responsible for the success in achieving each goal; however, there are several teams that are given individual responsibility for goals. To enable their staff to meet these goals and to meet or exceed customer expectations, training and development is necessary and budgeted in annually. The MRC encourages agents to become professionally certified in their areas of expertise, and new agents are nationally trained in Manufacturing extension practices and sales/consulting techniques. The MRC has also applied to NIST for 360vu certification and is putting one of their field agents through Professional Business Advisor Training and two field agents are updated on the latest Lean training.

The MRC penetrates their market with a broad stroke while continuing to seek a target market. They continue to develop their skills, and they are currently focusing on technology applications with a focus on Lean Manufacturing, Six Sigma and IT applications, workforce development, quality with emphasis on meeting the demand for ISO/QS 9000 and ISO 14000, information technology and eBusiness and environmental health and safety. They plan on presenting and achieving success with these services with a One-on-One delivery that will help to develop relationships with the firms for repeat business, which is essential for the overall success for the region. For fiscal year 2002-2003, the total number of projects for each service line was closed:

<b>Service Line</b>	<b># of Hours in Delivery</b>
CAD/CAM/CAE	2
EDI/Communications/LAN	17
Business Systems/Management	70
Environmental	3
Quality	69
Plant Layout	3
Automation/Robotics	1
Control Systems	3
Market Development	20
Process Improvement	28
Product Development	7
Human Resources	101
Other	2
General	2
Financial	1
<b>Total</b>	<b>329</b>

The MRC is doing very well recognizing the needs of their clients. They are partnering with several firms and developing skills within their organization that will help the firms overcome their challenges. However, to better bridge the gap between their capabilities and the demands of the market, they should better leverage their relationships with partners such as the Ben Franklin Technology Partners of Northeast Pennsylvania to address the crucial issue of technology development. The MRC's focus is quite broad, and to meet the immediate needs of the manufacturers, they will need to prioritize their issues to narrow their focus and meet those challenges.

## Northeastern Pennsylvania Industrial Resource Center

NEPIRC was founded in 1988 as a non-profit corporation by a variety of manufacturers, higher education institutes and local economic development agencies. The goal of NEPIRC was to provide financial and technical assistance to regional manufacturers with fewer than 500 employees in order to increase productivity and competitiveness. NEPIRC has become much more developed and narrowed its focus and is now an ISO 9001:2000 registered Manufacturing Extension Partnership and is the first of its kind in the nation. NEPIRC is in the first stage of the application process for 360vu branding, and staff members have attended Professional Business Advisor training to support this initiative. Due to the nature of the grants received by federal, state and local entities, NEPIRC is obligated to continue to center their efforts on helping SMEs. NEPIRC serves 11 counties in northeastern Pennsylvania with over 1,500 manufacturers (most with 20 or fewer employees).

The NEPIRC provides a variety of services to manufacturers in the northeast region: Lean Manufacturing, technical and engineering assistance, human resources and workforce development, quality improvement and ISO assistance, information technology services and strategic services. However, the Pennsylvania Department of Community and Economic Development discourages NEPIRC to offer activities that overlap with Ben Franklin in new product development, product testing or product advertising assistance to clients. NEPIRC is, however, allowed to present workshops on how to develop new products. For fiscal year 2002-2003, the total number of projects by service line was closed:

<b>Service Line</b>	<b># of Projects Closed</b>
Business Systems/Management	20
Environmental	17
Quality	42
Plant Layout	8
Control Systems	2
Market Development	12
Process Improvement	20
Product Development	4
Human Resources	110
Other	1
Financial	1
<b>Total</b>	<b>237</b>

NEPIRC is governed by a 27 member board made up of 18 private sector professionals, 6 representatives from institutions of higher education and 3 members from local development agencies. The Board of Directors currently has 5 active subcommittees: Executive Committee, Compensation Committee, Audit Committee, Nominating Committee and the Revolving Loan Fund Committee. NEPIRC aims to make the Board and subcommittees instrumental in the strategic direction, goals, initiatives and developments.

There have been many new developments made in the organization over the past few years. They created a Business Development Function in January of 2000 to serve new clients, foster long-term relationships with existing, key clients, engage in long-lasting, high-impact projects with innovative clients and decrease the amount of time spent on sales efforts. In addition, 3 Departmental Director Positions were created: Director of Manufacturing, Director of Business

Development and Director of Finance and Administration. These positions were created to reduce the amount of time spent by the Executive Director in overseeing day-to-day operations of the Center, which allows more time to be spent on more strategic issues, helps to continue growth of NEPIRC, provides room for staff advancement and establishes a succession plan for the Executive Director.

The NEPIRC has also increased its market stratification by grouping its key clients into subsets based on industry, acceptance of innovation, willingness to deal with NEPIRC, readiness to change and financial strength. They also track their current clients on the level of repeat business; time lapsed between projects with NEPIRC and satisfaction survey responses. They also determine the present and future needs of the regional manufacturers by surveys and questionnaires given to manufacturers in the region, client feed back and by obtaining information from industry and economic development groups. This has lead to an increase in repeat business from clients over the last 2 years because they can better service the needs of their clients. Finally, there has been an increase in internal reporting done within NEPIRC. The creation of the additional director positions has enabled those departments to work together to track metrics that were not able to be efficiently tracked in the past. Now, management can track the number of outstanding proposals, proposal acceptance rate by Field Agent and overall, the average dollar value of each proposal and acceptance rate and appointments with key clients. This change has allowed NEPIRC to run more smoothly and efficiently.

NEPIRC also identified strengths, opportunities and challenges that they currently have. It believes its strengths lie with its integrity with clients, abundance or resources for clients, strong relationship with granting agencies, extensive expertise, strong reputation for quality and a team approach to serving clients. It sees opportunities in its strong likelihood of continued grant funding, active participating in 360vu branding that will increase client awareness, opportunity to capitalize on regional workforce needs, high market penetration rate and name recognition among clients and capability to expand Lean Manufacturing and HR services. NEPIRC identifies its challenges as the perception among some clients that it is strictly a government funding source, the need to specialize services and obtain expertise in certain fields while remaining flexible, the need to build long-term relationships with current clients and secure new clients, ever-changing market conditions and client needs, field staff still currently sell and deliver their own services, leading to peaks and valleys between sales efforts and consulting services, the need to integrate Business Development and Manufacturing Service areas and growing pains of increasing internal staff and need for more clearly-defined staff roles.

In response to these strengths, opportunities and challenges, NEPIRC has set the following goals and objectives: To establish a better balance between projects performed directly using internal staff and projects performed with a 3<sup>rd</sup> party, to increase NEPIRC's non-grant income to maintain its current level of fiscal health, to launch two new service offerings annually that generate a minimum of \$20,000 of yearly revenue, initiate a focused and proactive public relations campaign designed to favorably impact stakeholders and enhance NEPIRC's public image and increase market penetration among Manufacturing companies with 100 or fewer employees at an annual rate of 10%.

To ensure the success of these goals, the NEPIRC has assigned individuals to action items to keep development in motion. The accomplishment of these goals will help NEPIRC and its clients to survive in this current economy and grant them continued success; however, NEPIRC must recognize that achieving these goals is not a small, short-term task. Manufacturers need

help now as well, and NEPIRC needs to create and leverage partnerships to help out in the short-term before they are fully capable of providing assistance in each service line in the future.

## MANTEC

Incorporated as a private, non-profit firm in 1988 by the governor of Pennsylvania, MANTEC, Inc. serves 9 counties with 2,800 manufacturers in the south central region of Pennsylvania. Like the other 6 IRCs, its mission is to engage South Central Pennsylvania manufacturers in continuously improving their productivity, competitiveness and contribution to the economic prosperity of their region. In December 1995, MANTEC collaborated with the Industrial Modernization Center (IMC) to form an alliance called the Mid-Pennsylvania Manufacturing Extension Partnership (MEP). Through the Mid-Pennsylvania MEP, MANTEC has become an affiliate of the Manufacturing Extension Partnership. In addition, MANTEC acquired the York County International Network (YCIN) in 1996 and expanded its focus from one county to the entire region. The Network has since been reorganized to be an independent affiliate of MANTEC with its own Board of Directors, funding and initiatives and renamed to SPIN (Southcentral Pennsylvania International Network) to reflect its mission. In 2001, SPIN became the World Trade Center-Harrisburg.

MANTEC currently offers manufacturers who are willing to commit to improvement customized solutions in streamline production processes, optimizing company financial performance, improving product quality, maximizing workforce potential, assistance in regulatory compliance and expanding market opportunities. More specifically they offer lean training, automation, material handling and robotics, business systems and management, CAD/CAM/CAE, EDI/IT/e-Commerce, energy demand/utility cost reduction, environmental, health and safety, Human Resources, ISO/Quality systems, market development, plant layout, process improvement and training and development. MANTEC will evaluate its client and match it with one of these services, a consultant or a product to ensure customer satisfaction. For fiscal year 2002-2003, MANTEC closed the following number of projects on each service line:

<b>Service Line</b>	<b># of Hours in Delivery</b>
CAD/CAM/CAE	1
Business Systems/Management	64
Environmental	26
Quality	23
Plant Layout	10
Automation/Robotics	2
Market Development	18
Process Improvement	33
Product Development	3
Human Resources	77
Other	2
Financial	1
<b>Total</b>	<b>260</b>

For the fiscal year 2002-2003, MANTEC closed 260 projects with 122 projects being for companies with 101-250 employees. In addition, the majority of the projects were in Lancaster County in Business Systems/Business Management category. For 2002, client satisfaction surveys reflected an increase of sales of \$18,486,600, retention of sales of \$43,055,000, a cost savings of \$7,688,065, 512 retained jobs and 112 jobs created.



MANTEC does, however, recognize that there is vast room for improvement, and they need to understand its market better. Market analysis is critical to identifying the current needs of the regional manufacturers and to tailoring their efforts to meet those needs. MANTEC can do this through market surveys and partnerships.

In addition, they recognize the need to better market their service offerings. This will help MANTEC to develop long-term relationships with clients in addition to attracting new clients. MANTEC does not have to overcome this challenge independently. They should seek out partnerships with local organizations that can help spread the word about their services due to their anti-competitive nature, which is one of the most successful ways to generate knowledge around services. This would also help them to meet their goal of extending beyond their current 24% market penetration, and these partnerships could also be an additional source of funds for MANTEC and their clients for investments and technology.

## Delaware Valley Industrial Research Center

The Delaware Valley Industrial Research Center (DVIRC) was established in 1988 by the Pennsylvania Department of Commerce. Its founding sponsors were the Greater Philadelphia Chamber of Commerce, the Philadelphia Industrial Development Corporation and the University City Science Center. Currently, the DVIRC receives one-third of its funding from the IRC, Department of Community and Economic Development (DCED) and NIST MEP. Like the other IRCs, the DVIRC is dedicated to helping small- and medium-sized firms become more productive and more competitive, and they are dedicated to driving economic development in the region. The DVIRC strives to develop long-term relationships with its clients in order to maximize the value-added to its customers through its services, which is how the DVIRC measures its success. In 2002, DVIRC customers documented value-add from DVIRC help at \$50 million in cost savings and product improvement.

DVIRC is currently affiliated with the NIST/MEP, Team Pennsylvania, and has adopted the 360vu brand. Through its affiliation with Team PA, the DVIRC manages the “Stay Invent the Future” initiative and the nation’s first dual-degree, dual enrollment program. This helps to overcome the challenge of attracting new skilled workers to the manufacturing industry.

Initially, the DVIRC focused on Total Quality, MIS and CAD projects; however, as the center developed, internal management and technical expertise advanced, and they implemented a world-class Manufacturing philosophy. Today, the DVIRC service offerings include consulting services, education and training, and regional initiatives. More specifically, they offer business and marketing, strategic planning and growth programs, Lean Manufacturing, quality management programs, financial analysis, human resources, E-business, web solutions, Information Technology, systems and software, sales and customer service, Institute for World Class Manufacturing, custom training programs, public workshops, plant tours, current issues seminars, guest speaker events, workforce and economic development, government affairs, state and federal communications and regional education and training programs and partnerships. To help manufacturers determine the best line of service, the DVIRC evaluates each client to determine their business goals, develops a plan to achieve them, and implements and measures the results. For fiscal year 2002-2003, the DVIRC closed the following number of projects by each service line:

<b>Service Line</b>	<b># of Projects Closed</b>
CAD/CAM/CAE	8
EDI/Communications/LAN	5
Business Systems and Management	59
Environmental	2
Quality	9
Plant Layout	42
Market Development	12
Process Improvement	11
Product Development	39
Human Resources	45
Other	4
<b>Total</b>	<b>236</b>

The DVIRC is governed by a Board of Directors made up of executives from small- and medium-sized manufacturers and representatives from banking, economic development, and the academic community. In their Operating Plan for Fiscal Year 2003-2004, they identified the following goals:

<b>DVIRC One-on-One Program Goals—FY03-04</b>	<b>02-03</b>	<b>03-04</b>
<b>Customer Satisfaction—Project Completion</b>	4.5	4.5
Customer Satisfaction—NIST Survey	4.5	4.5
Number of Engagements	250	175
Number Companies Assisted	150	130
Number New Companies	50	40
Number Companies Reporting Value-Added	80	85
Total Aggregate Value-Added	\$28M	\$44M
Total Fee Income	\$2M	\$3M

Although the DVIRC goals for the next fiscal year will help the center to generate more value-added and revenue, they are not surveying the market to adapt services to the changing needs of their clients. Ongoing market research is critical to the success of adding value to clients in order to generate more revenue by having a more tailored approach to helping clients.

## Industrial Modernization Center

The Industrial Modernization Center (IMC) was established in 1988 as 1 of the 7 IRCs with the goal of making small- and medium-sized firms become more productive and competitive by providing services and results that are affordable. The Center seeks partnerships with other organizations in order to add more value to its clients. Its partnerships include MANTEC (another IRC), PennTAP, SEDA-COG, Southern Allegheny Planning and Development Commission (SAPDC), and the Workforce Development and Continuing Education Center at Penn College. The MANTEC partnership provides the IMC with access to the mid-Penn Workforce Performance Center and mid-Penn Works—an online training guide for its clients. PennTAP helps to improve its clients' competitiveness. SEDA-COG and SAPDC assist with export development and governmental sales, and the Technology Transfer Center offers non-credit courses for upgrading, training and development opportunities.

The IMC is presently affiliated with the U.S. Department of Commerce and NIST/MEP and is supported through the Pennsylvania Department of Community and Economic Development. The support that they receive from these affiliations allows the IMC to offer services at reasonable costs. The IMC services 12 counties in central Pennsylvania. The IMC service offerings include information technologies, quality management and strategic business services. If there is something that a manufacturer needs that the DVIRC can't provide, they connect the manufacturer with 3<sup>rd</sup> party consultants so that they can receive help.

The IMC current offerings include information technology services, IT systems assessments and planning, Local Area Network (LAN) designs, LAN upgrades and installations, Manufacturing software selection assistance, CAD/CAM/CNC, barcoding, strategic management services, strategic redirection and planning, new product development, business acquisition services, e-Business resource center, e-Business assessments, competitor website analysis, vendor selection and project management, IMC web grant program, Manufacturing process improvements, Manufacturing operations review, Lean Manufacturing, production planning/control, process improvement, cellular Manufacturing, environmental management/ISO 14001, workforce skills assessments and training plans, performance improvement and quality systems, performance improvement services, employee morale and motivation, quality management systems, ISO 9000, manufacturers' workforce development network, and workshops and training. Last year, the IMC closed the following number of projects by each service line:

<b>Service Line</b>	<b># of Projects Closed</b>
CAD/CAM/CAE	3
EDI/Communications/LAN	21
Business Systems/Management	9
Environmental	6
Quality	21
Plant Layout	1
Market Development	29
Process Improvement	15
Product Development	1
Human Resources	12
Other	6
General	1
Financial	1
<b>Total</b>	<b>126</b>

The IMC recognizes areas where they must improve in order to satisfy their clients; they identified them in their Strategic Plan for 2002-2004. According to the IMC, they must market their brand and services pro-actively; build strong sales skills and improve prospect development; know their markets better through substantial market analysis; develop a customer relationship management strategy and marketing plan; define a subsidy strategy to support key IMC performance measures; build a larger pool of consultants with skills and services to serve the region; construct an electronic client tracking and information management system; develop new products and services; and establish an internal quality system.

Achieving these goals would help the IMC to bridge the gap between their capabilities and the current needs of their clients; however, recognizing these needs is only the first step toward achieving these goals. They also need to find the most efficient way to meet these goals. To do this, they can continue to hire workers skilled in the areas where manufacturers are being met with their greatest difficulties or outsource efforts for clients. In addition, they must continue to educate their current staff to keep up with the latest advances in their specialties. The IMC is on the right track; however, they need to take the next step.

## H. IMPACT OF IRCs ON CLIENTS

### Summary

Deloitte finds that Pennsylvania's IRC Network has sustained the strong positive impact on the Commonwealth's economy that has been documented in previous studies and that the impact estimates arrived at by NEXUS Associate in their 1999 evaluation remain valid.<sup>17</sup> Deloitte reached this conclusion by determining statistically that the Pennsylvania IRC Network has remained true to its mission and that the characteristics of the business establishments served have not changed from the 1999 evaluation. Therefore, quantitative impacts that have been recently measured persist.

Regular evaluations produced by the NIST/MEP consistently place Pennsylvania's IRCs among the highest performing centers in the nation in terms of client impact and satisfaction. Information provided by more than 70 IRC client establishments in seven regional workshops indicate that the IRC Network has adjusted services to meet changes in market demand and has significant, positive impacts, on those businesses. Those impacts ranged from increasing productivity to helping with top line revenue growth, with an emphasis on the IRCs' traditional mission of improving productivity.

The result is that the competitive position of assisted business establishments has been improved and jobs preserved by helping companies survive a difficult economic climate during the early years of the new millennium. In short, while the economy was weak in the early years of the current decade there are no data that indicate that previously registered economic impacts have changed.

A formal quantitative impact evaluation of the IRCs could not be conducted because the data used in those studies could not be accessed, due to a change in policy by the federal government. A second best solution to this problem had to be arrived at and this was to use the logic of the "theory of change" literature<sup>18</sup>. This theory holds that a rigorous causal sequence of events should lead to predictable outcomes. If the sequence of these causal factors is observed then it is highly likely that the expected change has been initiated, can be expected to occur, or is highly likely to occur. In the case of Pennsylvania's IRCs Deloitte used the counterfactual version of a theory of change.

Deloitte hypothesized that if a program has demonstrated positive impact, if there is no evidence of change in mission or in the delivery of services, and if the observed impact was

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<sup>17</sup> The Pennsylvania Industrial Resource Centers: Assessing the Record and Charting the Future (NEXUS Associates, October 1999).

<sup>18</sup> There is no one concise definition of the theory of change. The theory evolved from work at the Harvard Business School on change management and quickly spread to three very different groups of practitioners--human resource managers, foundations, and school reform advocates. The common denominator among the three is that all were required to make investments and place bets on how to change complex organizations in environments where outcomes take a long time to observe or where data to evaluate outcomes is difficult to obtain. The evaluation community has been especially active in thinking about how logic models lie behind theories of change.

recently observed, then the impact persists. The previous evaluation conducted by NEXUS Associates covered the time period from 1989 to 1999. Deloitte was asked to evaluate the performance of the program from 2000 to 2003. Were there major changes over this three year period that would indicate program deterioration?

- Deloitte looked for evidence that the IRCs changed their customer mix. They did not.
- Deloitte looked for evidence of increased customer dissatisfaction with either the mix of programs or in the quality of programs from 1999 to the present. None could be found.
- Deloitte looked for evidence of degradation in the performance of the IRCs as measured by their federal funding agency. The national NIST/MEP assessments show that that the IRCs have consistently performed well in terms of the impact they have had on client firms when compared to all centers in the MEP network. The IRCs have maintained their positions as high performers when compared to their national peer institutions.
- Deloitte looked for a major change in the economic operating environment. Here there was change. There was a downturn in the state's economy during the first three quarters of 2001 as measured by quarterly gross state product. A shallow recovery began in the fourth quarter of 2001. However, this recovery in Gross State Product was unaccompanied by an improvement in the state's employment situation. Therefore, Deloitte concluded that most of the impact of the IRCs would be observed in the improved probability that establishments served by the IRCs would survive the downturn and experience lower rates of employment loss and the preservation of the economic base of the Commonwealth.

Therefore, Deloitte concludes that the findings released by NEXUS Associates are very likely to hold true over the three years that followed the release of their work.

Research by NEXUS Associates demonstrates in rigorous fashion that intervention by the IRCs has dramatic positive impacts on the client firms and on the economy of the Commonwealth. The 1999 NEXUS Study<sup>19</sup> had five major findings:

1. IRC clients increased labor productivity by 3.6 to 5.0 percentage points per year more than had they not received IRC assistance.
2. IRC clients increased output by 1.9 to 4.1 percentage points per year above the increase of comparison firms.
3. IRC clients increased Pennsylvania's Gross State Product (GSP) by an inflation adjusted \$1.9 billion from 1988 to 1997.
4. There was a return of \$22 GSP gain for every \$1 of state public funding invested in the program
5. Between 1988 and 1997, the state realized more than \$120 million (nominal) or \$110 million (real \$1992) in additional state tax receipts as a result of the IRC program.

The first four of the five findings continued through the early years of the current decade.

The change in the economic environment from the late 1990s to the early years of the current decade makes it impossible to estimate the state tax impact of the IRC network on the Commonwealth of Pennsylvania without access to the original federal database that NEXUS Associates used in their analysis. Many of the taxes referred to by NEXUS Associates are income tax payments. While the recession of 2001 was short in terms of the decline in gross state product it had long-lasting impacts on employment and income flows to the state's workers. This means that tax revenues most likely declined from

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<sup>19</sup> The Pennsylvania Industrial Resource Centers: Assessing the Record and Charting the Future (NEXUS Associates, October 1999).

manufacturing workers, as they did for most people in the state's workforce. Because of this change in the economic environment Deloitte cannot simply extrapolate NEXUS' fifth finding. However, Deloitte is confident that in the absence of the IRC Network the failure rate of establishments would have been higher during the recession than was observed and the flow of tax payments over the past three years would have been lower than observed.

NEXUS was able to replicate economic impacts found in numerous studies that show that assistance provided by Manufacturing Extension Centers (MECs)<sup>20</sup> throughout the country have a positive impact on the performance of client firms and the economy in which they are located. For example, in an analysis of manufacturing firms from two states, Ronald Jarmin found that value added per worker at plants that received assistance from a MEC "grew between 3.4 and 4.5 percent faster" than it did at firms that did not receive assistance.<sup>21</sup> Jarmin also found that assisted firms had an increase in productivity of between 3.4 to 16.0 percent<sup>22</sup>. Such findings suggest positive implications about the performance of the program in Pennsylvania and are in the range as those found by NEXUS. These two sets of results give Deloitte further confidence that the findings are robust and were carried over for three additional years.

## Introduction

Deloitte's assessment of the impact of Pennsylvania's IRC Network was performed using multiple methods. The foundation of the assessment came from a statistical analysis of establishment-level data from the *Harris Selectory Database* for all manufacturing establishments in the Commonwealth of Pennsylvania coupled with activity data for the Pennsylvania IRCs obtained from the NIST/MEP centralized database. This baseline statistical analysis was augmented with qualitative information drawn from workshops that were held in each of the seven IRC service areas, in which approximately 70 IRC clients participated.

Research on the impacts of Pennsylvania's program has been generated by both the NIST/MEP and NEXUS Associates. These evaluations have shown that the IRCs have important and significantly positive impacts on the economy of the Commonwealth. In addition, analyses of the national MEP program have consistently shown that assistance from IRCs and other Manufacturing Extension Centers (MECs) around the country help to increase the productivity, survival rates, and the competitiveness of manufacturing firms. This improved firm performance then directly and positively impacts the state and local economy where the firm operates.

The Deloitte research adds to this base of empirical results by showing qualitatively that these positive impacts persist and by demonstrating quantitatively that the IRCs are working with firms that know they are challenged and seek assistance. The Deloitte research asks if Pennsylvania's Industrial Resource Centers are fulfilling their mission.

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<sup>20</sup> Manufacturing Extension Center, or MEC, is a generic term used to refer to any center operated in conjunction with the Manufacturing Extension Partnership. The PA IRCs would also be considered MECs.

<sup>21</sup> Jarmin, Ronald S. 1999. "Evaluating the Impact of Manufacturing Extension on Productivity Growth." *Journal of Policy Analysis and Management*. Vol. 18, number 9: pp 99-119.

<sup>22</sup> Jarmin uses several different statistical models in his analysis that result in a range of outcomes from 3.4 to 16 percent. The results are increases above that found at non-client firms.



The IRCs are charged to work with small and mid-sized manufacturers in a broad range of industries. The rationale for public intervention in the operations of these firms is that private markets fail to meet the needs of small and mid-sized manufacturing establishments (SMEs) in some basic ways. If markets operate perfectly it is expected that the private sector will provide the services of the IRCs and that the targeted clients for IRC services would select private vendors. Another way of posing this question is to ask if the IRCs are substituting for services that private firms should be providing. Deloitte answered this question using a three stage statistical analysis with the addition of a fourth qualitative step.

Some form of selection is required in a world of limited budgets and Deloitte expects that the IRCs and the companies that work with the IRCs will self-select. It is economically desirable if the selection is based on the culture of the client establishments: determining whether the establishments are ready, willing and able to undertake fundamental change. It is economically undesirable if the selection is made purely on the financial characteristics of the establishments — that the IRCs only work with the most credit worthy companies.

Credit scores are a neutral and efficient way of measuring the economic viability of firms and do not suffer from the vagaries of measures of accounting profit, especially for small firms where the reported financial condition is frequently intertwined with the owners' personal financial condition. The 2003 *Harris Selectory Database* reports the current Dun & Bradstreet credit rating of each listed manufacturing establishment on a five-point scale: 1 indicates low risk, 2 moderate risk, 3 average risk, 4 significant risk, and 5 high risk. Therefore, as the credit score increases, the firm's expected economic viability decreases. If the risk characteristics (as summed in the mean credit score) of the establishments that work with the IRCs are significantly superior to the risk characteristics of establishments that have not worked with the IRCs then the IRCs are achieving their impressive results partially through "creaming," or working with firms that are at lower economic risk than the universe of firms. If the IRCs achieve their results with firms that display credit risks that are on a par with their matched establishments or have credit scores that are inferior to their matched establishments then they are achieving their noted results and clearly meeting their mission. Deloitte does not expect that the IRCs work with a random cross-section of the small and mid-sized manufacturing base of the Commonwealth; they work with those that are ready and willing to change their operating practices and have the cultural predisposition to make investments in productivity enhancing improvements.

Deloitte determined that the IRCs are on mission and working with manufacturing firms that are challenged but are also ready, willing and able to initiate change. This determination was made in a three step statistical process with an added fourth qualitative step. First, Deloitte determined whether the IRCs are working with SMEs. Then the Deloitte team matched the record of each establishment that worked with an IRC (based on records contained in the national MEP database) to the 2003 *Harris Selectory Database*. Each establishment was then matched to an establishment in the *Harris Selectory Database* that was not in the MEP database. The matched non-client establishments then served as a quasi-experimental control group for the IRC client firms. The credit scores of the client establishments were compared with the credit scores of the matched, non-client establishments using a matched pair t-test<sup>23</sup> to test whether or not the mean credit scores of each sample were equivalent.

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<sup>23</sup> Matched pair t-tests compare two sets of observations to determine if the difference in the means of two groups is statistically different from some number. The first test discussed above was constructed to test if the difference

In the third part of the analysis, multinomial logistic regression models were run to determine whether there was an increased probability of the IRC's clients having higher credit ratings than the population of manufacturing firms, controlling for the characteristics of the establishment. Finally, qualitative information from the workshops was used to better understand the impact of the program on client establishments. Each of these research steps is discussed in turn.

## Does the IRC Network Meet the Size Mandate of the MEP Program?

The IRCs work with SMEs, but not to the exclusion of other establishments. The very smallest companies are under-represented when compared to the universe of establishments in the Commonwealth if measured by sales (for those establishments that report sales data) or by employment.

**Sales Range, 2003**

	Client Firms		Non-Client Firms		All Firms	
	Total	Percent	Total	Percent	Total	Percent
<b>Under \$500K</b>	34	2.1%	4,357	25.1%	4,391	23.1%
<b>\$500-\$999K</b>	76	4.7%	2,882	16.6%	2,958	15.6%
<b>\$1MM-\$4.9MM</b>	529	32.7%	6,387	36.8%	6,916	36.4%
<b>\$5MM-\$9.9MM</b>	323	19.9%	1,596	9.2%	1,919	10.1%
<b>\$10MM-\$24.9MM</b>	369	22.8%	1,263	7.3%	1,632	8.6%
<b>\$25MM-\$49.9MM</b>	171	10.6%	493	2.8%	664	3.5%
<b>\$50MM-\$99.9MM</b>	81	5.0%	244	1.4%	325	1.7%
<b>\$100MM-\$499.9MM</b>	36	2.2%	126	0.7%	162	0.9%
<b>\$500MM-\$999.9MM</b>	1	0.1%	13	0.1%	14	0.1%
<b>\$1B-\$9.9B</b>	0	0.0%	5	0.0%	5	0.0%

between the two means was zero (e.g. the two means were the same), while the second test was constructed to determine if the credit rating for the IRC clients was superior to the control group. The test is a matched pair design because the treatment group--in this case the IRC clients--are matched as closely as possible to a comparison group, also known as a quasi-experimental control group. The control group is considered to be quasi-experimental because potential IRC clients were not randomly assigned either to the client set or to the non-client control set. Instead, the characteristics of the IRC clients that were in the Harris database were noted and then the database was searched to find another establishment that shared as many of these characteristics as possible. The match proceeded using the order of characteristics as they are discussed in the main body of the paper. The test uses the student t-distribution, which is a robust approximation of a normal distribution so that the test not only compares the difference between the means of the two groups but also the shape, or spread, of the distribution by using the standard deviation.

## Employment, 2003

	Client Firms		Non-Client Firms		All Firms		
	Total	Percent	Total	Percent	Total	Percent	
<b>Employment Size</b>	< 10	140	7.1%	8,802	46.6%	8,942	42.9%
	10-19	236	12.0%	3,365	17.8%	3,601	17.3%
	20-49	518	26.4%	3,533	18.7%	4,051	19.4%
	50-99	345	17.6%	1,254	6.6%	1,599	7.7%
	100-249	493	25.2%	1,342	7.1%	1,835	8.8%
	250-499	168	8.6%	357	1.9%	525	2.5%
	500 or more	59	3.0%	220	1.2%	279	1.3%

The tables for sales range and employment show that client firms tend to be moderate in size. The IRCs tend not to work with the very smallest firms nor do they work often with the very large firms.<sup>24</sup>

### Do the IRCs Cream for Better Credit Risks?

If the IRCs earn their results by creaming, then Deloitte expects that the average credit score for the IRC clients would be better than that of the matched firms that serve as the quasi-experimental control group. The five-point credit scale used in the *Harris Selectory Database* is inverted—superior credit is indicated by a lower number and inferior credit by a higher number. The matched-pair t-tests indicate that the IRCs do not cream. One version of the test indicates that the credit profile of the IRC's client firms is statistically indistinguishable from the profile of the quasi-experimental control group. A second, more stringent test determined that the credit profile of the IRC client firms was *not superior* to that of the control group with a 91% probability.

The matched firms were selected using four characteristics that Deloitte determined to be the most important, limited by the data elements that were contained in the *Harris Selectory Database*.<sup>25</sup> The first matching characteristic was the five-digit North American Industry Classification System (NAICS) number that was assigned to the establishments' product.<sup>26</sup> This was followed by the establishment's size as indicated by its sales range,<sup>27</sup> location, and then a series of six variables that measured the establishments' ownership structure.<sup>28</sup>

<sup>24</sup> When only single location firms are included, the larger client firms (in terms of sales or employment) are greatly reduced in number. This suggests that some of the sales and employment figures for branch plants or headquarter locations may include data from multiple sites rather than for the single plant location.

<sup>25</sup> The matches were generated by the statistical package STATA.

<sup>26</sup> The new NAICS is the successor to the more familiar SIC.

<sup>27</sup> Employment was not used because it was missing in many and there is greater incentive for firms to report their sales figures accurately to credit rating agencies than it is to report employment size.

<sup>28</sup> All establishments were placed into one of six categories: Headquarters location of a privately held company, Headquarters location of a publicly traded company, single location of a privately held company, single location of a publicly traded company, branch plant of a privately held company, and branch plant of a publicly traded company.

The mean credit rating of an IRC client firm was 2.92 (close to average risk) but it was also marginally inferior to the mean credit risk of the control group mean of 2.81.<sup>29</sup> The descriptive statistics are shown in the table below.

### Credit Ratings of IRC Client Firms and of the Control Group

	IRC Clients	Control Group
Mean	2.92	2.81
Standard Deviation	1.28	1.31
95% Confidence Interval	Lower Bound	2.70
	Upper Bound	2.93

Deloitte then subjected the two groups to two matched pair difference of means tests. The first test tested the null hypothesis that the mean of the IRC group was statistically the same as the mean for the control group. This hypothesis could not be rejected—meaning that the means are statistically the same.<sup>30</sup> A second test was performed that is stricter and is a direct test of the creaming hypothesis. The null hypothesis was that the IRC client group had better credit scores than the control group. This hypothesis was rejected and is a strong indication that creaming does not take place based on the credit worthiness of the establishment.<sup>31</sup>

## A Multinomial Approach to Testing the Creaming Hypothesis

The matched pair statistical design roughly controls for the characteristics of the firm but it does so somewhat crudely. The next section reports on the results from a multinomial logistic regression analysis. This analysis is similar to any regression analysis in that it holds constant all of the characteristics that are listed on the right hand side of the equation but the results are interpreted as a probability—there is higher or lower probability that the condition captured by the dependent variable will occur. This allows the sign of the IRC dummy variable to be interpreted as to whether or not working with the IRC increases or decreases the probability of being associated with a particular credit class. We do not interpret these results as being “causal.” That is, working with the IRC program “causes” the resulting credit condition to occur. (Deloitte would need before and after credit scoring to allow for this interpretation and these types of data do not exist).

A multinomial logistic regression differs from a simple logistic regression in that the dependent variable is made up of multiple categories. In this case, there are five possible credit scores: 1

<sup>29</sup> The standard deviation of the IRC client group was smaller than that of the control group.

<sup>30</sup> The t-test resulted in a t-statistic of 1.36 with the probability that the difference is statistically meaningful of 0.18, far below the 0.90 probability required in most statistical tests.

<sup>31</sup> The value of the t-statistic remained at 1.36 but because the null was framed as a one-tailed test the confidence bands shift. The null was rejected with a 0.91 probability which is customarily considered to be statistically valid.

is the lowest credit risk and 5 is high risk. The results of the multinomial regression appear as four separate simple logistic regressions: one for each credit score except one.<sup>32</sup>

Two separate multinomial logistic regressions were run. The first was simply to run the credit score against the IRC dummy variable without controlling for other firm characteristics. The second, and more important, regression controlled for the size of firm (measured by the firm's sales range), age, 3-digit NAICS code, location (urban versus non-urban), and ownership structure.

In the first set of regressions (see table below), the coefficient for the IRC client variable is negative and significant for credit scores 1, 2, and 4 (category 3 was omitted). The coefficient for a credit score of 5 was positive. However, it was not significant and could not be interpreted statistically. These results suggest that there is a lower probability of IRC clients having superior credit scores than non-client firms and reinforces the results found using the matched pair t-test. The fact that the result for category 4 was negative and significant and the result for category 5 was not significant suggests that IRC client firms have average credit scores (i.e., there is a greater probability that clients have a credit score of three).

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<sup>32</sup> In a multinomial logistic regression, the categorical dependent variable is treated similar to that of a categorical independent variable in any standard regression analysis in that one category is omitted. Failing to do so would result in perfect collinearity. In all results shown here, category 3 (average risk) has been omitted.

**Multinomial Logistic Regression Results**  
**(Credit Score = constant + IRC Client)**

Number of Observations	18,037
LR Chi Square	60.47
Probability > Chi Square	0.0000
Log Likelihood	(28,718.06)
Pseudo R Square	0.0011

Credit Score (category 3: Average Risk omitted)	Coefficient	z-Score	P >  z	95% Confidence Interval	
				Lower Bound	Upper Bound
				<b>1. Low Risk</b>	
IRC Client	(0.47)	(5.84)	0.0000	(0.63)	(0.31)
Constant	(0.56)	(23.98)	0.0000	(0.61)	(0.52)
<b>2. Moderate Risk</b>					
IRC Client	(0.32)	(4.70)	0.0000	(0.45)	(0.19)
Constant	(0.21)	(9.89)	0.0000	(0.25)	(0.17)
<b>4. Significant Risk</b>					
IRC Client	(0.16)	(1.96)	0.0490	(0.33)	(0.00)
Constant	(0.93)	(35.09)	0.0000	(0.98)	(0.88)
<b>5. High Risk</b>					
IRC Client	0.06	0.86	0.3880	(0.08)	0.21
Constant	(0.77)	(30.66)	0.0000	(0.82)	(0.72)

The second set of regressions (see table below) is more rigorous in that it controls for other characteristics of the firm that may impact its competitiveness and, therefore, its credit score. The results of this second multinomial regression are similar to those of the first in that there is a lower probability that client firms have superior credit scores to non-client firms. This further supports the notion that the IRCs are not “creaming” but rather are providing assistance to those firms that need and seek of it.

**Multinomial Logistic Regression Results**  
**(Credit Score = constant + IRC Client + Sales Range + Age**  
**+ NAICS + Urban + Ownership Characteristics)**

Number of Observations	18,023
LR Chi Square	1,934.93
Probability > Chi Square	0.0000
Log Likelihood	(26,945.94)
Pseudo R Square	0.0347

					95% Confidence Interval	
		Coefficient	z-Score	P >  z	Lower	Upper
					Bound	Bound
Credit Score (category 3: Average Risk omitted)	<b>1. Low Risk</b>					
	IRC Client	(0.38)	(4.36)	0.0000	(0.54)	(0.21)
	Sales Range			(Too numerous to display)		
	Age	(0.00)	(0.47)	0.6390	(0.00)	0.00
	NAICS			(Too numerous to display)		
	Urban	(0.36)	(5.99)	0.0000	(0.47)	(0.24)
	Branch/Public	(1.14)	(4.98)	0.0000	(1.58)	(0.69)
	Single Location/Private	0.64	7.54	0.0000	0.47	0.81
	Single Location/Public	1.35	2.19	0.0280	0.14	2.55
	Headquarter/Private	0.62	2.34	0.0190	0.10	1.13
	Headquarter/Public	(0.62)	(1.25)	0.2110	(1.60)	0.35
	Constant	(24.43)	(16.65)	0.0000	(27.31)	(21.56)
	Credit Score (category 3: Average Risk omitted)	<b>2. Moderate Risk</b>				
IRC Client		(0.13)	(1.78)	0.0750	(0.27)	0.01
Sales Range				(Too numerous to display)		
Age		(0.00)	(1.44)	0.1500	(0.00)	0.00
NAICS				(Too numerous to display)		
Urban		(0.10)	(1.80)	0.0710	(0.21)	0.01
Branch/Public		(0.64)	(4.04)	0.0000	(0.95)	(0.33)
Single Location/Private		0.58	7.71	0.0000	0.43	0.73
Single Location/Public		0.64	1.06	0.2890	(0.54)	1.82
Headquarter/Private		(0.09)	(0.44)	0.6630	(0.49)	0.31
Headquarter/Public		(0.69)	(1.99)	0.0470	(1.37)	(0.01)
Constant		(0.32)	(0.22)	0.8220	(3.12)	2.47
Credit Score (category 3: Average Risk omitted)		<b>4. Significant Risk</b>				
	IRC Client	(0.20)	(2.20)	0.0280	(0.37)	(0.02)
	Sales Range			(Too numerous to display)		
	Age	0.00	0.87	0.3820	(0.00)	0.00
	NAICS			(Too numerous to display)		
	Urban	0.12	1.61	0.1080	(0.03)	0.26
	Branch/Public	0.43	3.56	0.0000	0.19	0.66
	Single Location/Private	(0.09)	(1.12)	0.2650	(0.26)	0.07
	Single Location/Public	(0.97)	(0.90)	0.3670	(3.09)	1.14
	Headquarter/Private	(0.36)	(1.44)	0.1500	(0.84)	0.13
	Headquarter/Public	0.64	2.09	0.0360	0.04	1.23
	Constant	(24.86)	(17.17)	0.0000	(27.70)	(22.03)
	Credit Score (category 3: Average Risk omitted)	<b>5. High Risk</b>				
IRC Client		(0.02)	(0.26)	0.7960	(0.17)	0.13
Sales Range				(Too numerous to display)		
Age		0.00	1.08	0.2790	(0.00)	0.00
NAICS				(Too numerous to display)		
Urban		0.24	3.31	0.0010	0.10	0.38
Branch/Public		0.85	7.16	0.0000	0.61	1.08
Single Location/Private		0.37	4.37	0.0000	0.21	0.54
Single Location/Public		0.83	1.36	0.1750	(0.37)	2.02
Headquarter/Private		0.39	1.57	0.1160	(0.10)	0.87
Headquarter/Public		1.08	3.48	0.0000	0.47	1.68
Constant		(0.40)	(0.28)	0.7760	(3.18)	2.38

## Qualitative Review of IRC Impact

Given the potential challenges with quantitative analysis, the final phase of Deloitte's analysis of IRC impact was to conduct qualitative discussions with more than 70 clients during the seven regional workshops. Combined with the statistical analyses already discussed, the information from the focus groups further supports the conclusion that IRC clients both benefit from the assistance provided by the IRC and were in need of the assistance due to some market imperfection in the private sector that meant the type of assistance the firms needed was not available from other sources.

Manufacturers that benefit most from IRC services are SMEs that are not yet taking full advantage of available technologies, processes or management techniques that could be beneficial to helping them survive and thrive in a competitive environment. As a result, the IRCs are serving the correct clients based on the mission of the IRC network, but selection bias for clients may lean toward currently underperforming companies with substantial prospects for improvement.

As shown in the table below, IRC services historically were principally concentrated on process improvement, quality, business systems and management, and human resources. While all of these services are important to client establishments and have resulted in demonstrable productivity improvements, they are all focused on cost-cutting and bottom-line performance improvement, not revenue-building and top line improvement. In recent years, the IRCs have begun to address topline growth opportunities. Quantitative analysis can measure productivity improvements.

**Top Three Services Offered by Each IRC  
Measured by Number of Projects Closed in 2002**

Service	CC	NWIRC	MRC	NEPIRC	MANTEC	DVIRC	IMC
Human Resources/ Workforce Development	3	3	1	1	1	2	
Business Systems and Management		2	2	3 (tie)	2	1	2
Quality	2	1	3	2			3
Process Improvement/ Plant Layout				3 (tie)	3	3	
Lean Manufacturing	1						
Market Development							1

Anecdotal findings include:

- Issues such as meeting quality certification, process improvement, and lean manufacturing remain top-of-mind for many SMEs. The skills and services that IRCs can bring in these areas are recognized by SMEs, who are very complimentary about the services they have received from the IRCs
- There are SME "success stories" for individual companies in every region.
  - A medium-sized manufacturer of high tech air curtains that responded to a challenge from China with swift development of a superior product



- A metals company that shifted from being a job shop to offering more engineered and proprietary product offerings that better serve customer needs. The company also added designers and engineers to its staff to become more value-added and help customers solve problems
- A medical equipment supplier that developed new products to take advantage of a growing industry sector
- An equipment manufacturer that positions itself as the premium producer and generates 30% of sales from products that have been in the market for less than 24 months
- A bakery that acquired a nearly bankrupt competitor, focused its product lines, and is now improving company profit performance

## Summary & Conclusions

Previous research on the impact of the IRCs demonstrated that they have a positive and significant impact on clients as well as the economy of the Commonwealth. Deloitte finds that these impacts continued from 2000 to 2003. Analysis by Deloitte proved that the IRCs are meeting their mandate to work with small to mid-sized manufacturers. It has been determined that the IRC are not creaming – i.e. they are not selectively working with firms that are at lower economic risk than the universe of firms that are part of their mission. However, some form of selection is required in a world of limited budgets and Deloitte expects that the IRCs and the companies that work with the IRCs will self-select. It is economically desirable if the selection is based on the culture of the client establishments: determining whether the establishments are ready, willing and able to undertake fundamental change and the evidence indicates that these words describe the IRCs client firms. These business establishments are ready and willing to undertake fundamental changes in their operating practices and they have the cultural predisposition to make investments in productivity enhancing improvements.

# I. GAP ANALYSIS & RECOMMENDATIONS

Deloitte used a qualitative “gap analysis” to focus on the differences that exist between services currently offered by the IRCs and services that are either demanded by potential clients or services that local businesses are only vaguely aware that they may need, but will respond to foreseeable changes in market conditions. The gap analysis is based on information from the industry issues analysis, the regional workshops, and the IRC capabilities analysis. The primary function of the gap analysis is to look at the need for specific services that can address the business and public policy challenges that were identified. This demand profile was then compared to the current capabilities of the IRCs to develop recommendations for how IRCs can close the gaps.

The chart that follows provides an overview of the recommendations, which are discussed in more detail below. Five service gaps exist: (1) resources so that SMEs can define and change their business strategies in response to the globalization of their markets and increased market competition, (2) facilities that can aid and assist SMEs to develop new products as part of a consistent effort to stimulate top line revenue growth, (3) Continued provision of process enhancement services, (4) develop capabilities to respond to workforce needs as an intermediary for the workforce training system and SMEs to ensure that training efforts are based on industry-developed skill standards, and (5) deeper capacity to advocate for small and mid-sized manufacturers in public policy arenas.

## IRC Gap Analysis

Key Macro Issues	IRC Capability	Potential Impact on...			Action required
		SME Needs	PA Economy	IRC Model	
Strategy	Currently this capability is drawn from a few IRC staff or outsourced to a variety of independent consultancies. There is also a pilot PBA program	✓	✓	✓	1. Develop a robust strategy and planning capability or resource specializing in SME strategy.
New Product Development	Two IRCs offer skills and services on a modest scale for new product development. There is no organized capability in funding, market strategy or technical design	✓	✓	✓	2. Develop an IRC network or regional capability offering cradle-to-grave new product development assistance
Process Improvement	The IRC network specializes in process improvement for SME. It has significant strength in Lean Manufacturing at the shop floor and supply chain levels	✓	✓	✓	3. Continue to support and build out consistent process improvement capabilities across the network
Workforce Development	Currently, IRCs offer services at the Firm level. There is some activity to serve as an intermediary to bring organizations and educational institutions together	✓	✓	✓	4. Develop an IRC Network capability to support SMEs in attracting, developing, and retaining workers with the skills needed for future success
Strategic Advocacy	Currently, IRCs offer services at the Firm level. There is no organized capability to advocate the importance of, or address key issues for, SME manufacturing across industries	✓	✓	✓	5. Develop an IRC Network capability to provide SME-focused research and analysis on key issues and strategic thought leadership for manufacturing across industries

KEY: Moderate Significant

## 1. SME Strategy Capability

<p><b>Description:</b> Develop a business strategy service that is capable of delivering world class business planning, marketing, thought leadership and innovation consulting services tailored to the specific needs of SMEs</p> <p>A potential model for facilitating the development and execution of this service is an outsourcing arrangement with a global strategy service firm. The arrangement would include a full-time Program Management Office (PMO) that would draw on consulting firm experts and experienced resources with specific methods and approach to provide consistency and continuity to IRC-qualified and managed projects for IRC clients</p>	<p><b>Pros:</b></p> <ul style="list-style-type: none"> <li>✓ Fills a significant gap that was identified in the workshops</li> <li>✓ Provides an opportunity to grow and develop small firms creating a competitive advantage for business retention and economic development</li> </ul>
	<p><b>Cons:</b></p> <ul style="list-style-type: none"> <li>✓ Need to confirm market demand.</li> <li>✓ Critical to demonstrate a translation of strategy methodology from large firm to small firm.</li> <li>✓ Clients could not find meaningful value in the service if done inappropriately.</li> <li>✓ Proposed model requires significant investment</li> </ul>
<p><b>Performance Measures:</b> Deal flow, customer satisfaction, firm level metrics within 3 years of implementing the strategy, including impact on revenue, profit, and growth</p>	

All manufacturers have a definite, significant, and growing need for consulting services in the area of business strategy. The global nature of competition and rapid technological innovations present new and ever-changing threats that firms need to react to. A well developed strategy capability would have the ability to work with SMEs in a variety of industries to develop innovative strategies to deal with multiple issues that are confronting each firm. This gap in strategic services threatens the economic base of the state of Pennsylvania.

There is also a clear link between business strategy and new product development. New product development is the likely to be stimulated as enterprises look strategically at their markets and capabilities to shape a prosperous future.

## 2. Product Innovation

<p><b>Description:</b> Develop a regional or inter-network new product development capability that would incorporate cradle-to-grave new product development services including: Investment capital, product strategy and market identification, intellectual property licensing, design, engineering and manufacturing support</p> <p>A potential model for this service could be a manufacturing innovation “incubator” that would provide new product development services and partially fund its operations by taking an equity stake in the new product. For project-related expenses, this operation would look to existing private and public venture funds</p>	<p><b>Pros:</b></p> <ul style="list-style-type: none"> <li>✓ Fills a significant gap that was identified through the workshops</li> <li>✓ Direct firm level impact for innovation at the small firm level</li> <li>✓ Self-funding model</li> <li>✓ Revitalization of manufacturing based on innovation</li> </ul>
<p><b>Performance Measures:</b> Deal Flow, revenue generated by new products, success in building a new industry</p>	<p><b>Cons:</b></p> <ul style="list-style-type: none"> <li>✓ Need to confirm market demand</li> <li>✓ Potential failure of new products that are introduced</li> <li>✓ Misunderstood by the marketplace</li> <li>✓ Difficulty in attracting and maintaining talent for proposed model</li> </ul>

A product innovation service could work at the shop floor level of a company, assisting in the product development process from defining the business case for the investment to design of the product and financing its introduction. Through this seamless service, innovation could become a reality.

### 3. Performance Improvement

<p><b>Description:</b> The IRCs should continue to actively penetrate the market with existing and new performance improvement services including:</p> <ul style="list-style-type: none"> <li>-Lean manufacturing initiatives</li> <li>-Supply chain cost reduction</li> <li>-Information technology strategy and selection</li> <li>-Quality control programs</li> <li>-SG&amp;A and accounting process improvement</li> <li>-Sourcing and logistics</li> </ul>	<p><b>Pros:</b></p> <ul style="list-style-type: none"> <li>✓ Builds from a program strength, expanding an existing IRC core competency</li> <li>✓ Addresses a market demand from companies which the IRC has yet to penetrate or with which the IRC will look to expand relationships</li> <li>✓ Requires minimal capital to expand, though it would require additional hires</li> </ul>
	<p><b>Cons:</b></p> <ul style="list-style-type: none"> <li>✓ <i>Market demand needs to be confirmed</i></li> <li>✓ Potential to become to “thin” in diverse services and loose focus</li> <li>✓ Clients could not find meaningful value in the service if done inappropriately.</li> <li>✓ Additional task of management of new hires, should they be network wide resources or individual IRC</li> </ul>
<p><b>Investment:</b> Market survey to validate investment and demand – \$30,000</p>	
<p><b>Performance Measures:</b> Deal flow, customer satisfaction, firm level metrics associated with cost reduction ( Profit, Growth)</p>	

It is critical that the IRCs continue to expand through additional services and increased market penetration in performance improvement services.

#### 4. SME Workforce Development

<p><b>Description:</b> Develop, attract, and retain a world class manufacturing workforce for SMEs in Pennsylvania by serving as a regional workforce development and education intermediary that works directly with employers, job seekers, academic institutions, and workforce providers to drive towards specific outcomes.</p> <p>Strategy could be determined on a statewide basis, but specific services should be regionally focused. Services could include:</p> <ul style="list-style-type: none"> <li>• Aggregating market demand to inform supply side</li> <li>• Business outreach to increase participation in career development and educational programs</li> <li>• Managing the creation of a “pipeline” of workers trained in the specific skills for specific jobs</li> <li>• Career awareness, job development, &amp; planning services; recruiting and placement services for graduates</li> <li>• Customized job training and skills upgrades for incumbent workers</li> <li>• Advocacy to help shape state/federal policy</li> </ul>	<p><b>Opportunities:</b></p> <ul style="list-style-type: none"> <li>✓ Fills a significant gap that was identified in the workshops.</li> <li>✓ Direct firm level impact</li> <li>✓ Improved institutional relations</li> <li>✓ Helps SMEs leverage available Pennsylvania and Federal resources</li> </ul>
<p><b>Performance Measures:</b> ROI on workforce development programs implemented</p>	<p><b>Challenges:</b></p> <ul style="list-style-type: none"> <li>✓ Attracting and maintaining talent, especially in less urban areas</li> <li>✓ Determining the proper balance and focus between incumbent worker training and filling the pipeline with properly educated/trained workers</li> <li>✓ Role requires tact, diplomacy, perseverance, and resources</li> </ul>

SME workforce development will help SMEs develop a manufacturing workforce that can handle the new challenges of increasing technology, changes in business and manufacturing processes, and the increased need for innovation. Many workforce development resources are available in Pennsylvania. The role of the IRCs can be as an intermediary to help SMEs access these resources, and to help SMEs with specific firm-level projects to attract, train and develop, and retain workers with the mix of skills each company needs.

## 5. SME Strategic Advocacy & Research

<b>Description:</b> Develop a capability or resource to provide SME-focused research and analysis on key issues and strategic thought leadership for manufacturing across industries. Develop and structure regional leadership that provides a clear forum to address SME needs	<b>Pros:</b> <ul style="list-style-type: none"> <li>✓ Addresses a significant issue mentioned throughout all of the workshops</li> <li>✓ Clearly shows the IRC as a regional asset and advocate for SME manufacturers</li> <li>✓ Provides a unified perspective on local, state, and national industry issues</li> <li>✓ Should not require significant additional costs for development</li> </ul>
	<b>Cons:</b> <ul style="list-style-type: none"> <li>✓ Will require significant time and effort on the leadership's part</li> <li>✓ Positions the IRC as a political entity</li> </ul>
<b>Performance Measures:</b> Customer satisfaction; Increase in regional location quotient	

SME research and advocacy will be necessary to grow the knowledge base for companies seeking to innovate or change market direction. While thought leadership in manufacturing is available through multiple sources, there appears to be limited research conducted specifically for the size and scale of the typical SME.

## **J. APPENDIX**

1. Macro Analysis
  - a. Wealth Creation Index
  - b. Technology Intensive Industries
2. Workshop Participants
3. Drivers and Clusters
4. Industry Issues
5. Limitations and Assumptions
6. Theory of Change



## 1. Macro Analysis

### THE WEALTH CREATION INDEX

The Wealth Creation Index (WCI) is instituted based on four variables:

- Average Output per Employee
- Average Real Wages
- Capital Expenditures
- Shareholder Value

#### Average Output per Employee

Factors	Calculations
Value Factor	<p>Average Output per Employee (1993-2001)</p> <p>For the purposes of this analysis, calculations are as follows:</p> <ul style="list-style-type: none"> <li>▪ Output per Employee in Industry i at Time t = <math display="block">\frac{\text{Total Output in Industry i at Time t}}{\text{Total Employment in Industry i at Time t}}</math></li> <li>▪ The average of Output per Employee is calculated from 1993-2001</li> </ul>
Weight Factor	<p>Industry's Share of Output as a % of Pennsylvania GSP (2001)</p> <p>For the purposes of this analysis, calculations are as follows:</p> <ul style="list-style-type: none"> <li>▪ Industry's Share of GSP in Industry i at Time t = <math display="block">\frac{\text{Total Output in Industry i at Time t}}{\text{Total Output in Pennsylvania at Time t}}</math></li> </ul>
Output per Employee Score (Value*Weight)	Average Output per Employee * Industry's Share of Output as a % of Pennsylvania GSP
Z-SCORE	Z-SCORE is calculated based on the Output per Employee Score. Mathematically: Z-score = (value-mean)/standard deviation
Data Sources:	Economy.com
Notes:	Public Administration has been excluded from all analyses – Add in Why

## Average Real Wages

Factors	Calculations
Value Factor	<p>Average Real Wages (1993-2001)</p> <p>For the purposes of this analysis, calculations are as follows:</p> <ul style="list-style-type: none"> <li>Real Wage per Job in Industry i at Time t = <math display="block">\frac{\text{Total Wages \&amp; Salaries in Industry i at Time t}}{\text{Total Employment in Industry i at Time t}}</math></li> <li>The average of real wages is calculated from 1993-2001</li> </ul>
Weight Factor	<p>Industry's Share of Wages &amp; Salaries as a % of Pennsylvania's Wages &amp; Salaries (2001)</p> <p>For the purposes of this analysis, calculations are as follows:</p> <ul style="list-style-type: none"> <li>Industry's Share of Wages &amp; Salaries in Industry i at Time t = <math display="block">\frac{\text{Total Wages \&amp; Salaries in Industry i at Time t}}{\text{Total Wages \&amp; Salaries in Pennsylvania at Time t}}</math></li> </ul>
Avg. Real Wages Score (Value*Weight)	Average Real Wages * Industry's Share of Wages & Salaries as a % of Pennsylvania's Wages & Salaries
Z-SCORE	Z-SCORE is calculated based on the Avg Real Wage Score. Mathematically: Z-score = (value-mean)/standard deviation
Data Sources:	Economy.com
Notes:	Public Administration was excluded from the analysis because it is not an export industry

## Capital Expenditures

Factors	Calculations
Value Factor	<p>Industry Capital Expenditures as a % of Industry Output (U.S. 2001)</p> <p>For the purposes of this analysis, calculations are as follows:</p> <ul style="list-style-type: none"> <li>Industry's Share of Capital Expenditure in Industry i at Time t = <math display="block">\frac{\text{Total Capital Expenditures in Industry i at Time t}}{\text{Total Output in Industry i at Time t}}</math></li> </ul>
Weight Factor	<p>Estimated Industry Capital Expenditures in Pennsylvania as a % of Total Capital Expenditures in Pennsylvania (2001)</p> <p>The capital expenditures by industry for Pennsylvania are approximated using U.S. figures as a proxy. Let the resulting equation be A.  <math>A = \text{U.S. capital expenditure as a \% of GDP} * \text{Industry output for Pennsylvania}</math></p> <p>Industry capital expenditures for Pennsylvania as a % of total capital expenditures for Pennsylvania. Let the resulting equation be B.  <math>B = \frac{\text{Capital Expenditures in Industry i (equation A for each Industry)}}{\text{Total Pennsylvania Capital Expenditures (Sum of all A's)}}</math></p> <p>Weight Factor = A*B</p>
Capital Expenditure Score (Value*Weight)	Industry Capital Expenditures as a % of Industry Output*Weight Factor
Z-SCORE	Z-SCORE is calculated based on the Capital Expenditure Score. Mathematically: Z-score = (value-mean)/standard deviation
Data Sources:	Economy.com; Annual Capital Expenditures 2001 Report by US Census Bureau
Notes:	Public Administration has been excluded from all analyses; U.S. 2001 Capital Expenditures has been adjusted to 1996 chained dollars

## Shareholder Value

Factors	Calculations
Value Factor	CAGR by Company for Public Companies Listed in Pennsylvania (1984-2002)
Weight Factor	Market Value for Company as a % of Total Industry Market Value (2002)
Weighted CAGR Score (Value*Weight)	Score for Each Company = CAGR by Company for Public Companies Listed in Pennsylvania * Market Value for Company as a % of Total Industry Market Value  Total Score for Industry i = SUM of all company scores in Industry i
Z-SCORE	Z-SCORE is calculated based on the Capital Expenditure Score. Mathematically: Z-score = (value-mean)/standard deviation
Data Sources:	Compustat Data
Notes:	Public Administration has been excluded from all analyses; Industries that did not have at least 15 companies or a market value of \$5B were excluded from this analysis.

## Final Results

The final ranking of the Wealth Creation Index (WCI) is based on the average of the individual variable z-score.

$$\text{Average of Z-SCORES} = \frac{\text{Sum of All Z-SCORES}}{\text{Number of Variables}}$$

## Methodology for Shift-Share Analysis

### Analysis for the Commonwealth of Pennsylvania

#### Introduction

Shift-Share analysis is a common method of analyzing regional economic growth and change. This method of analysis benefits from the fact that it is relatively simple to perform and easy to understand. There are no black boxes here.

There are several different techniques that are built on the traditional shift-share method. These techniques are arguably more accurate and may provide better insight into changes that have occurred in a region's economy. The technique used for this analysis is referred to as a dynamic shift share analysis (Barff & Knight, 1989). This approach differs from the traditional approach only in that all initial calculations are based on annual changes or growth rates. In contrast, the traditional approach is based on growth rates over a multi-year period (usually 5 to 10 years). Both approaches are discussed below.

#### Shift-Share

Shift-share analysis breaks down a region's growth into three components or effects: national growth effect, industry mix effect, and competitive effect. The analysis is based on the simple identity:

$$g_{ir} \equiv g_n + (g_{in} - g_n) + (g_{ir} - g_{in})$$

where:  $g_{ir}$  = growth rate in industry  $i$  in region  $r$ ;

$g_{in}$  = growth rate in industry  $i$  in the nation; and

$g_n$  = national growth rate.

In the traditional approach, growth rates are measured over the entire time period being studied, usually 5 to 10 years. The dynamic approach simply calculates all changes on an annual basis. The results are later summed across the entire time period.

Breaking down a region's growth rate by industry into these three different rates allows the three 'effects' to be calculated. When summed across all industries, these effects show what share of the total regional growth can be accounted for by growth in the national economy as a whole (national growth effect), by growth in specific industries (industry mix effect) or by some other factor that makes certain local industries more competitive (competitive effect). Each effect is discussed below.

#### National Growth Effect

The national growth effect shows what the region's growth in employment by industry (or gross output by industry) would have been had it grown at the same rate as the nation as a whole.

The national growth effect is calculated as:

$$N = \sum E_{ir} g_n$$

where  $E_{ir}$  is the region's employment in industry  $i$  in the base year.

### **Industry Mix Effect**

The industry effect shows whether the region has a concentration of fast (or slow) growth industries. That is, do the types of industries that are located in the region tend to grow faster or slower than the average of all industries in the nation (e.g., the national average growth rate)? The industrial mix effect is calculated as:

$$I = \sum E_{ir} (g_{in} - g_n)$$

### **Competitive Effect**

Finally, the competitive effect shows whether or not the industries located within the region are growing faster than the same industries are throughout the nation as a whole. If an industry located in the region is growing at a rate greater than the industry's average national growth rate, then that region is said to have a competitive advantage over other regions for that industry.

$$C = \sum E_{ir} (g_{ir} - g_{in})$$

Of the three components or effects, the competitive effect is the most interesting and most problematic. While several different interpretations of the competitive effect have been suggested by researchers, most tend to suggest that the competitive effect does measure something that is different about the region that allows certain industries grow faster than they do in other places (even though the specific factor or factors are not known).

## **Technology Intensive Industries**

Below is a complete list of moderately technology intensive and very technology intensive industries:

### **Moderately Technology-Intensive Industries**

- 5418 Advertising and Related Svs
- 5416 Management, Scientific, and Technical Consulting Svs
- 5414 Specialized Design Svs
- 5413 Architectural, Engineering, and Related Svs
- 3391 Medical Equipment and Supplies Mfg
- 3363 Motor Vehicle Parts Mfg
- 3362 Motor Vehicle Body and Trailer Mfg
- 3361 Motor Vehicle Mfg
- 3359 Other Electrical Equipment and Component Mfg
- 3353 Electrical Equipment Mfg
- 3346 Mfg and Reproducing Magnetic and Optical Media
- 3343 Audio and Video Equipment Mfg
- 3339 Other General Purpose Machinery Mfg
- 3336 Engine, Turbine, and Power Transmission Equipment Mfg
- 3334 Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment
- 3332 Industrial Machinery Mfg
- 3331 Agriculture, Construction, and Mining Machinery Mfg
- 3329 Other Fabricated Metal Product Mfg
- 3259 Other Chemical Product and Preparation Mfg
- 3256 Soap, Cleaning Compound, and Toilet Preparation Mfg
- 3255 Paint, Coating, and Adhesive Mfg
- 3253 Pesticide, Fertilizer, and Other Agricultural Chemical Mfg
- 3252 Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg
- 3241 Petroleum and Coal Products Mfg

### **Very Technology-Intensive Industries**

- 3251 Basic Chemical Mfg
- 3254 Pharmaceutical and Medicine Mfg
- 3341 Computer and Peripheral Equipment Mfg
- 3342 Communications Equipment Mfg
- 3344 Semiconductor and Other Electronic Component Mfg
- 3345 Navigational, Measuring, Electromedical, and Control Instruments Mfg
- 3364 Aerospace Product and Parts Mfg
- 5112 Software Publishers
- 5415 Computer Systems Design and Related Svs
- 5417 Scientific Research and Development Svs
- 5419 Other Professional, Scientific, and Technical Svs

## 2. Workshop Participants

### Catalyst Connection

Georgia Berner, President, Berner International Corporation  
Robert A. Clark, Vice President, Clark Metal Products Co.  
Nils Swann, President, CMC  
John A. Skiavo, President and Chief Executive Officer, Economic Growth Connection of Westmoreland  
Charles Gray, Chief Operating Officer, Frontier Electronic Systems Corp.  
Brian M. Kelley, Director, Economic Opportunity Programs Heinz Endowments  
John A. Ross, CFA, Chief Financial Officer, Kurt J. Lesker Company  
David Zirnsak, Plant Manager, McKesson Automation, Inc  
Russell E. Finsness, President, MetPlas, Inc.  
James Sumner, President, PA Cold Drawn LLC  
Donald E. Klessner, Vice President, Continuous Improvement, PTC Alliance  
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John Gregor, Vice President, Packaging Horizons Corporation  
Scott Gruber, Executive Vice President, National Penn Bank  
Charles Hamburg, President, Effort Foundry Inc.  
Vincent Horvath, President, Alstom T&D Bitronics, Inc.  
Ed Katchur, V. P. Administration, Schuylkill Products Inc .  
Dan Loikits, Owner, Dynalene  
Michael Lubas, Managing Director, Shalmet Corp (Hq)  
Lisa Jane Scheller, President & CEO, Silberline Manufacturing Co.  
Bill Wydra, Jr., President, Ashland Technologies, Inc.  
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### NWIRC

Doug Bolton, President, The Homerwood Corp.  
Gary Clark, Vice President, Snap-Tite, Inc.  
Bill Clyde, President, North Coast Plastics, Inc.  
Bill Muck, President, Merit Tool Co., Inc.  
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Sandy McLauchlin, Plant Manager, Air Products  
Jim Barerra, President, Wilkes Pools  
Russ Lindermath, Plant Manager, Wilkes Pools  
John Graham, President, Comfort Designs  
Rudy Singh, Dir. of Manufacturing, Berwick Offray  
William Cockerill, Community Liaison, AFL-CIO

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Rick Hoover, Hoover Consulting  
Dennis Beck, L-3 Communications  
Marvin Kuzo, Lonza  
Mike Wolf, Lycoming Engines  
Rob Postal, Mifflin County Industrial Development Corp.  
Don Alsted, PMF Industries, Inc.  
Bob Walker, PRIMUS Technologies Corp.  
Jim Dent, Springs Window Fashions  
Rod Datt, Supelco  
JoAnn Williams, Supelco

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Mr. Rick Merluzzi, Edlon, Inc.  
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Mr. Peter Clayton, EFE Laboratories  
Ms. Denise Urbans, Res Kem Corporation  
Mr. Walt Reinman, Fredericks Company



### 3. Drivers and Clusters

#### Defining Regions, Concepts, and Variables

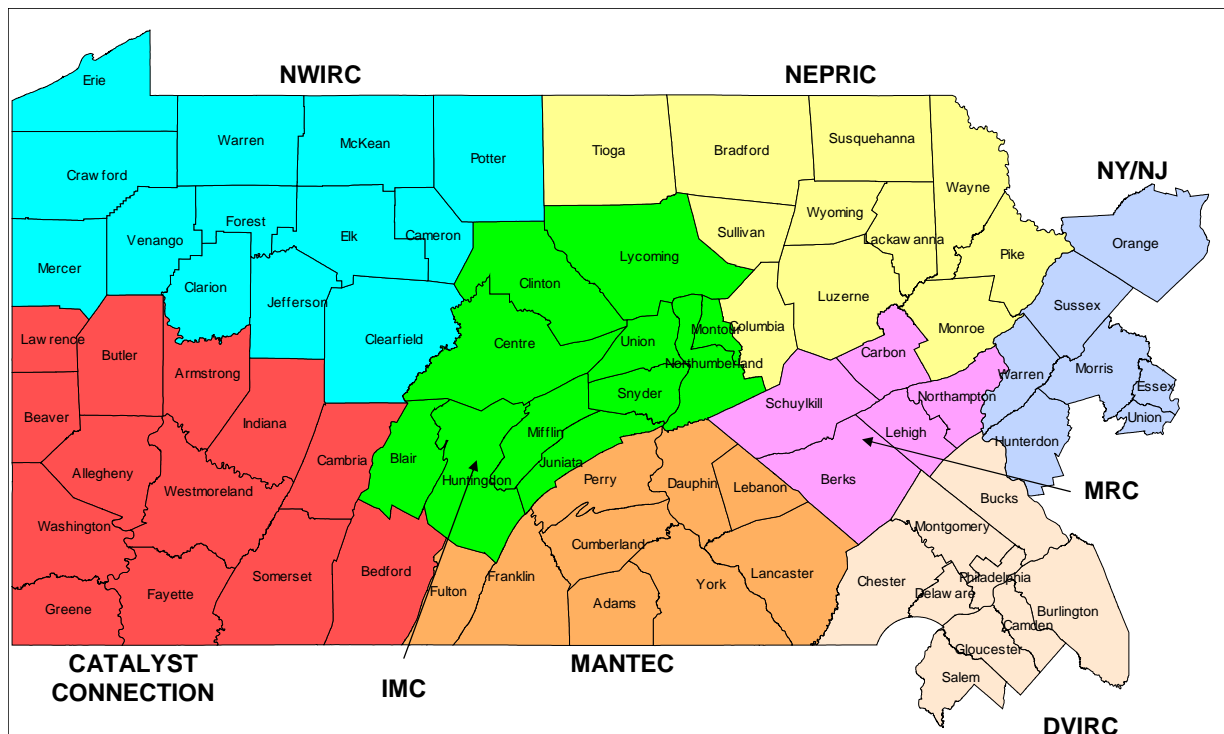
##### Geographic Area of Study

The analysis was conducted for 8 regions, as well as for the state as a whole. The geographic areas used are based primarily on the regional boundaries of the PA IRCs. There are, however, 2 exceptions:

1. The DVIRC region includes those New Jersey counties that are a part of the Philadelphia Metropolitan Area (Burlington, Camden, Gloucester, and Salem counties).
2. An 8<sup>th</sup> region is added in order to consider the possible linkages that the PA IRC have with the New Jersey and New York counties located to the east of the Pennsylvania border. These counties include: Hunterdon, Warren, Morris, Essex, Union, and Sussex counties, NJ and Orange county, NY.

A map of the geographic areas is contained in Figure 1.

Figure 1: Geographic Areas of Study

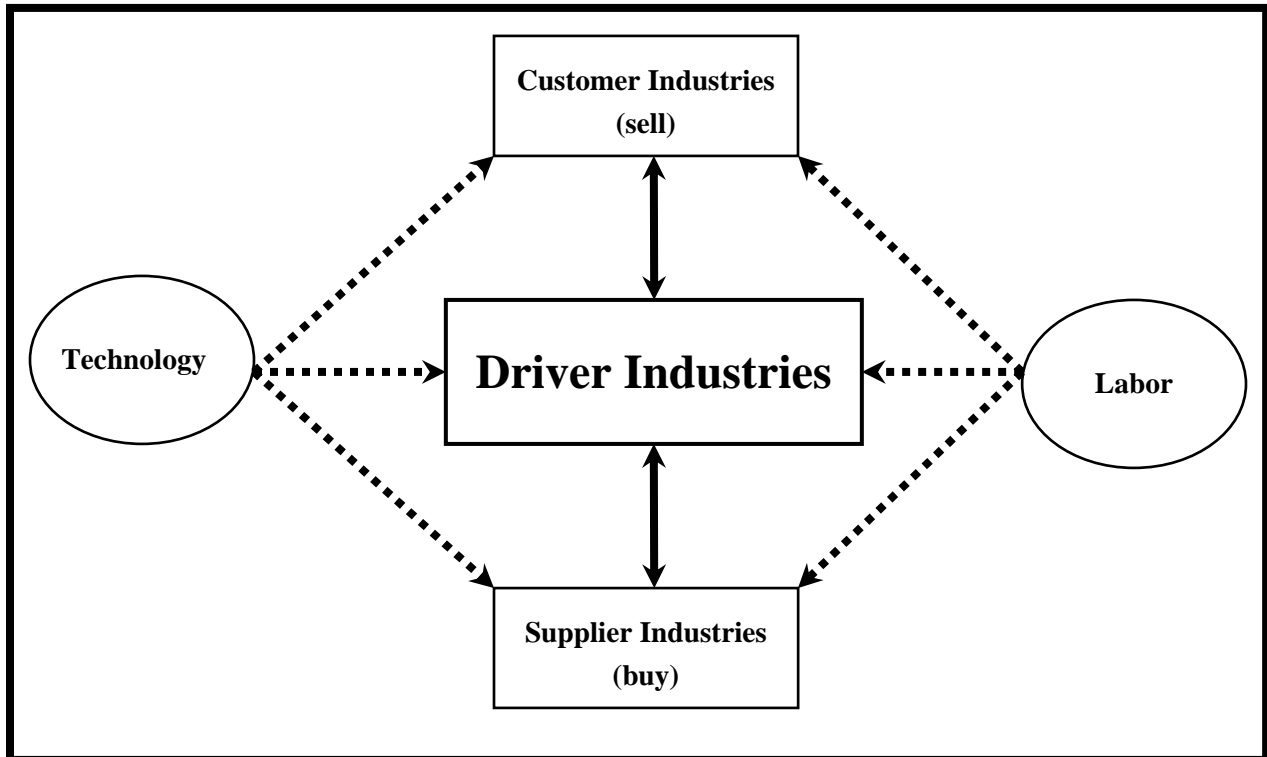


## Defining Drivers and Clusters

For the purposes of this analysis, the following definitions and/or concepts are used:

1. **Drivers:** Drivers or Driver Industries are those “industries in which the region has its greatest competitive advantage,” (Hill & Brennan, 2000). These industries form the heart of the Industrial Cluster.
2. **Clusters:** Clusters or Competitive Industrial Clusters are a “geographic concentration of competitive firms or establishments in the same industry that have close buy-sell relationships with other industries in the region, use common technologies, or share a specialized labor pool that provides firms with a competitive advantage over the same industry in other places. This four-part definition requires that the first part, as a necessary condition (a geographic concentration of competitive firms or establishments in the driver industry or industries), be combined with at least one of the other three parts before a group of industries can be considered an industrial cluster.” (Hill & Brennan, 2000). These concepts are depicted graphically in Figure 1.

Figure 2: Structure of a Cluster (from Hill & Brennan, 2000)



## Variable Definitions

Twelve key variables were used to identify industry clusters and driver industries. Seven of the variables identify the competitiveness of an industry while the remaining five identifies the export

orientation of the industry (e.g., identifies whether or not the industry exports its product outside of the region). Each variable is listed below<sup>33</sup>.

## 1. Competitiveness

- Productivity
  - Total Worker Productivity (Real Output per Worker) (2001)
  - Change in Worker Productivity (1993-2001)
- Share of National Industry Output
  - Current Regional Share of National Industry Output (2001)
  - Change in the Industry's Share of National Output (1993-2001)
- Relative Average Earnings
  - Industry's Current Relative Earnings (regional industry relative to national industry) (2001)
  - Change in Industry's Relative Earnings (1993-2001)
  - Industry's Current Regional Relative Earnings (regional industry relative to all regional industries) (2001)

## 2. Exports

- Output Specialization
  - Current Output Location Quotient (2001)<sup>34</sup>
  - Change in Output Location Quotient (LQ) (1993-2001)

## 3. Employment Specialization

- Current Employment Location Quotient (LQ) (2001)

## 4. Centrality

- Industry's Current Share of Total Regional Output (2001)
- Change in Industry's Share of Total Regional Output (1993-2001)

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<sup>33</sup> A diagram depicting how each of these variables is interpreted within the analysis is included at the end of this appendix and is discussed in detail later in this discussion.

<sup>34</sup> The location quotient (LQ) technique is the calculated ratio between the local economy and the economy of some reference unit – in our case the national economy. The formula for Current Output Location Quotient is:

$$LQ_{ir}^t = \frac{\text{regional output in industry } i \text{ for year } t / \text{total regional output for year } t}{\text{national output in industry } i \text{ for year } t / \text{total national output for year } t}$$

$$= \frac{Y_{ir}^t / Y_r^t}{Y_{iN}^t / Y_N^t}$$

A location quotient greater than one suggests that there is a concentration or specialization of an industry within a region, while a location quotient less than one suggests an industry is not concentrated in the region. The concentration of an industry in a region suggests that the industry is an exporter while the lack of concentration of an industry suggests that the existing industry produces primarily for local consumption and/or that the region must import products produced by the industry.

## Identifying Industry Clusters and Drivers

Two separate quantitative analyses were used to identify industry clusters and driver industries, a mathematical cluster analysis and a discriminant analysis. These analyses were conducted for each region, as well as for the state as a whole.

Throughout this discussion, the actual analysis for the State of Pennsylvania is used as an example. All tables that are referred to in this discussion are for the State of Pennsylvania. Tables for each of the regional analyses are included as separate appendices.

### Mathematical Cluster Analysis

A mathematical or hierarchical cluster analysis is used to identify similar groups of industries based on the twelve variables described earlier. This analysis is conducted in order to identify a “candidate solution” of the number of clusters in a regional economy. The number of clusters in the candidate solution is then used in the discriminant analysis that will be discussed in the next section.

Since this analysis is mathematical and not statistical, the grouping of industries is made based on the relative value of each variable for each industry and/or group of industries and not on the distribution or variances of the variables across industries.

The mathematical cluster analysis starts with each of the 288 industries separated into 288 separate groups. At each stage of the analysis, two groups are combined into a single group. The algorithm used to combine each group selects the two groups based on the relative homogeneity of the two groups. The analysis continues to combine industries or groups of industries until all industries are contained in a single group (i.e., 287 stages).

Select characteristics of each stage of the analysis are contained in an agglomeration schedule. The agglomeration schedule shows which industries or groups of industries are combined and the distance coefficient for each stage of the analysis. The distance coefficient is a measure of the differences between the two groups that are combined at each stage.<sup>35</sup> A portion of the agglomeration schedule produced by the analysis for the State of Pennsylvania is attached at the end of this appendix. The schedule shows the first two and last twenty stages of the analysis.

Since the distance coefficient is a measure of differences or dissimilarity between industries or groups of industries, it is used to identify stages at which two heterogeneous groups of industries are combined. Again, the objective of this analysis is to identify candidate solutions that can then be used in the discriminant analysis. A candidate solution is characterized as being a case in which all industries are combined into 20 or fewer groups that are relatively homogeneous.

Candidate solutions are determined by identifying significant changes in the distance coefficient. To make this determination, two additional variables are calculated for each stage of the analysis, the slope and acceleration of the distance coefficient. These two variables are then evaluated to determine stages at which heterogeneous groups of industries are combined. Using percentiles to determine threshold values for both the slope and acceleration variables,

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<sup>35</sup> The distance coefficient measures the difference in the values of the twelve variables for each of the two industries or groups of industries combined at each stage. The distance measure used is the squared Euclidean distance or sum of the squared differences between the values for each group.

significant changes in the distance coefficient are identified. These stages are identified by “\*\*\*” in the columns labeled significant change in d slope or acc. The candidate solution, as shown in the last column of the table, is the stage prior to the stage at which the heterogeneous groups are combined.

From this analysis, three candidate solutions were selected for use in the discriminant analysis. Each of these candidate solutions had fewer than 20 groups of industries and at least two had greater than 5 groups.

## Discriminant Analysis

A discriminant analysis is used to determine what caused the mathematical cluster groupings to form. Unlike the mathematical cluster analysis, a discriminant analysis is statistical. The results from this analysis allow the grouping of industries to be described statistically and the groups of industries to be interpreted in economic terms.

The discriminant analysis is used to predict which group each of the 288 industries belongs to based on the characteristics of the twelve variables used in the analysis. The number of groups that the analysis will use was determined from the candidate solution described in the previous section. The basis for assigning industries to any particular group is through the use of discriminant functions that are calculated from statistical relationships in the entire dataset (all industries and all variables). The functions are generated in order to ensure the greatest discrimination between each group of industries or, in other words, to ensure heterogeneity across groups and homogeneity within groups.

The first step in interpreting the results of the discriminant analysis is to compare the grouping of industries obtained from the mathematical cluster analysis with that obtained from the discriminant analysis. A table showing how these results compare for the state level analyses is included at the end of this appendix. In order to ensure the internal validity of each of the analyses, approximately 90% of the industries should be “correctly classified.” That is, the two analyses should result in the vast majority of industries being included in the same group as the other analysis did.

The second step in interpreting the results from the discriminant analysis is to describe, in economic terms, the characteristics of each discriminant function. Attached at the end of this appendix is a table showing the structural characteristics of the discriminant analysis. The table is actually a structure matrix that shows correlation of each of the twelve variables with each of the discriminating functions generated by the analysis.<sup>36</sup>

As shown in the attached table, the first three functions show the following correlations:

- Function 1 is correlated with:
  - Increasing real earnings (drws9301 = 0.63)
  - High real earnings (rws01 = 0.56)
- Function 2 is correlated with:

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<sup>36</sup> It is important to note that the number of functions generated by the analysis may differ by region and by the number of groups created by the analysis. The total number of functions generated is dependent upon the number of functions that are necessary for combining all industries into the specified number of groups, not on any other factor.

- Increasing real earnings (drws9301 = 0.42)
- Large share of national industry output (share01 = 0.76)
- Large output location quotient (lqy01 = 0.76)
- Large labor location quotient (lql01 = 0.47)
- Function 3 is correlated with:
  - Decreasing real earnings (drws9301 = -0.48)
  - High Real Earnings (rws01 = 0.48).

It is important to note that both the absolute value and direction (positive or negative values) of the correlation coefficients matter. For variables measured over time, a large positive (negative) correlation coefficient means that the variable is increasing (decreasing) for that particular function. For static variables, a large positive (negative) correlation coefficient means that the variable is large or high (small or low) for that particular function.

Based on these correlations, each function can be interpreted in economic terms. To help better understand how each variable is interpreted, a “logic diagram” is attached to this appendix.<sup>37</sup> For each of the twelve variables, there are 3 possible results. Variables measured over time are increasing, stable, or decreasing, while static variables are high (large), moderate, or low (small).

In terms of the structure matrix, the value of a variable within a function is shown by the value of the correlation coefficient. If the correlation coefficient for a variable is high or increasing, it suggests that the function will group together industries that all have relatively large values for that particular variable. Therefore, if a correlation coefficient is high (increasing), then the economic interpretation is that the function is correlated with driver (expanding driver or emerging) industries. Similarly, if a correlation coefficient is low (decreasing), the interpretation is that the function is correlated with non-basic (retiring/declining) industries.

To apply these interpretations to each of the functions within the structure matrix, the variables with the greatest correlation with that function must be identified (as shown earlier). Then all of these variables must be interpreted at the same time in order to arrive at an interpretation for the function as a whole.

In the case of the state level example, Function 2 is correlated with increasing real earnings, large share of national industry output, large output location quotient, and large labor location quotient. Each is individually interpreted to identify driver industries or expanding or emerging industries. Taken together, Function 2 is interpreted as grouping together driver industries.

The final step in interpreting the results from the discriminant analysis is to identify the relationships between each function and each of the groups of industries. The final table attached to this appendix is a table titled “Functional Characteristics of Industry Groupings (Clusters)”. The table shows the z-score for each function/group combination.

Since Function 2 was interpreted as grouping together driver industries, each group of industries that has a positive and significant relationship (z-score) with Function 2 potentially contains driver industries. For the state level analysis, this includes groups 3, 7, 10, 12, 15, and 16.

For each of these groups, the relationships with each of the other functions must be evaluated in order to more fully understand each group of industries. In the case of group 3, while it has a

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<sup>37</sup> This is the diagram that was referred to in the “Variable Definitions” section.

positive and significant relationship to Function 3, it also has a positive and significant relationship with Function 4. Function 4 can be interpreted as grouping together industries that are retiring or declining. Combining this with the interpretation of Function 3 suggests that the industries in group 3 are likely to be important industries for the state's economic base but are declining or retiring.

### **Filtering Process for Drivers**

The drivers identified by the discriminant analysis (i.e. the model) were scrutinized for their viability, primarily based on output size and output growth. If the model identified industries as drivers which were extremely small in size, they were filtered. Further, given that the model was based on data until 2001, industries which have experienced a severe decline from 2001-2003 needed a second look.

Similarly, if there were industries that were significantly large in output and had a high location quotient but were not captured by the model as drivers, then they were classified drivers.

Please refer to the end of the document for the results of the filtering process by each region.

### **Identifying Industry Clusters and Drivers**

#### **Define Clusters**

The process of identifying clusters has multiple steps:

1. **State Input/Output Tables (I/O):** The state input/output tables were examined to identify buy/sell relationship of the driver industries with other industries. These buy-sell relationships along with the driver industry formed the clusters.
  - The use of the input/output tables was only used as an initial phase in the identification of these regional industries because these tables are based on SIC codes and not NAICS codes
  - Measures of backward (supply-chain) and forward (customer-chain) linkages are obtained from the I/O tables and used to identify industries that are linked to driver industries
2. **Deloitte & Touche Industry Knowledge:** Industry knowledge and expertise, especially which related to each industry's supply-chain, was used to further refine the identification of the regional driver industries.

#### **References**

Hill, E., & Brennan, J. (2000). A Methodology for Identifying the Drivers of Industrial Clusters: The Foundation of Regional Competitive Advantage. *Economic Development Quarterly*, 14, 65-96.

## 4. Industry Issues

### Pennsylvania Drivers

Driver Industries	2003 Output (in \$M)	2000-03 Output CAGR (%)	1998-2003 Output CAGR (%)	1993-2003 Output CAGR (%)	2003 Output Location Quotient (LQ)
Pharmaceuticals	\$6,684	0.7%	4.6%	5.2%	3.44
Electrical Equipment	\$4,612	4.6%	5.9%	7.9%	1.42
Plastics	\$2,818	1.8%	2.9%	5.0%	2.22
Printing*	\$2,287	(2.2%)	(1.4%)	(1.0%)	1.95
Food**	\$2,149	(1.7%)	(0.2%)	0.3%	2.35
Paper	\$2,109	(1.8%)	(1.1%)	0.4%	2.55
Basic Chemicals	\$1,944	(3.5%)	0.1%	(0.7%)	1.80
Metalworking Machinery	\$1,842	0.7%	(0.2%)	7.7%	1.35
Architectural and Structural Metals	\$1,653	(1.1%)	0.4%	2.3%	1.97
Machine Shops - Screw, Nut, Bolt Mfg	\$1,614	0.9%	1.2%	6.5%	1.56
Other Fabricated Metals	\$1,398	(1.8%)	(1.2%)	2.4%	1.94
Wood Products	\$1,302	(1.5%)	(0.5%)	2.5%	1.43
Furniture	\$1,271	1.0%	1.7%	2.8%	1.61
Resin, Rubber and Fibers	\$1,248	(3.6%)	0.2%	0.7%	1.84
Glass	\$ 938	(5.3%)	(3.7%)	0.5%	3.50
Medical Equipment	\$ 855	5.7%	3.8%	2.4%	1.97

Driver Industry Analysis—This section will provide additional information to each driver; however, the same information may not be available for each industry.

1. Basic Chemicals
2. Glass
3. Medical Equipment
4. Pharmaceuticals
5. Plastics
6. Architectural and Structural Metals
7. Electrical Equipment
8. Printing
9. Food Manufacturing
10. Wood Products
11. Converted Paper Products
12. Machine Shops
13. Metalworking
14. Other Fabricated Metals
15. Furniture



## 1. Basic Chemicals

### I. INDUSTRY DEFINITION

This industry group comprises establishments primarily engaged in manufacturing chemicals using basic processes, such as thermal cracking and distillation. Chemicals manufactured in this industry group are usually separate chemical elements or separate chemically-defined compounds

### II. NATURE OF THE INDUSTRY

#### Historic Location Rationale

Many chemical companies chose to locate in Pennsylvania due to the proximity of the industrial markets in the Northeast. In addition, Pennsylvania is a great source of the raw materials (mainly oils and natural gas) that go into basic chemicals.

#### Global Investment Patterns

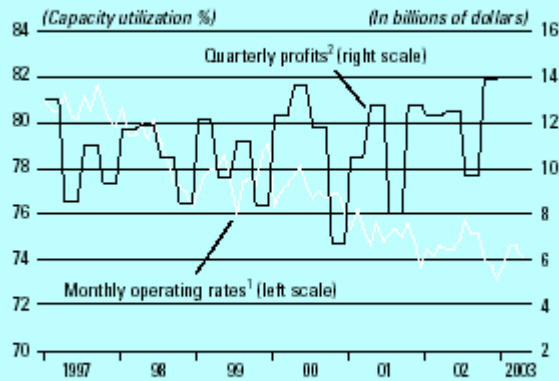
Historically, the U.S. has had a trade surplus, which peaked at \$20.2 Billion in 1995. Recently, the US has been functioning in a trade deficit measured at \$5.0 Billion in 2002. Growth in developing countries is creating a greater demand for exports and foreign direct investments to satisfy the need for basic chemicals. This should move the U.S. back towards a trade balance if not back to a surplus

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"><li>• Consolidation is an ongoing trend in the industry. Consolidation is helping companies to decrease overhead, selling and manufacturing costs</li><li>• The market is mature, and for a company to see any significant growth, companies would have to acquire small businesses in the segments</li></ul>
Competitiveness	<ul style="list-style-type: none"><li>• Main competitors are metals, glass, wood, and paper</li><li>• Compete with other suppliers on price and performance</li></ul>

Profitability

**CHEMICAL OPERATING RATES & PROFITS**



Sources: <sup>1</sup>Federal Reserve Board. <sup>2</sup>Commerce Department

- Profitability is highly dependant upon price of raw materials (natural gas and oil)
- OPEC has decided to limit production of oil to drive prices above \$25. This increases the cost of production for basic chemicals that have oil as a raw material

**CHEMICAL INDUSTRY REVENUES & INCOME**

(In billions of dollars)

	BASIC CHEMICALS, RESINS & SYNTHETICS		
	2000	2001R	2002
Revenues	170.9	158.8	147.5
Depreciation & amortization	9.4	9.9	9.5
Other operating costs & expenses	151.1	148.4	131.7
Income (or loss) from operations	10.4	0.5	6.3
Nonoperating income	7.0	8.0	4.1
Income before taxes	9.6	1.3	3.6
Income taxes	1.1	0.1	0.3
Income after taxes	8.5	1.2	3.4
Taxes as a % of pre-tax income	11.7	6.6	7.1

- Profits are driven by product mix, raw material cost, capacity utilization and operating efficiency
- Increasing demand (up to 5.4% by 2007) for germicides and disinfectants will increase demand for basic chemicals; however, due to the intense competition, there will be little profit gains in the industry

Fragmentation

- Du Pont 3-5%


Consumers

- Major consumers:
- Manufacturing
- Automotives
- Agriculture
- Housing

Life-cycle	<ul style="list-style-type: none"> <li>• Mature Product Market; however, due to developing countries, there should be growth in exports and foreign investment</li> </ul>
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#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>• There is constant need for innovation to develop new syntheses and processes for existing products in order to increase their value</li> <li>• Chemists need to find the most cost effective, environmentally acceptable way to add value to products in order to combat against pressures from the community</li> <li>• Chemical companies are finding it increasingly difficult to "scale up" their products--that is, to provide the production for products developed in their labs</li> <li>• Currently, the industry is struggling to innovate</li> <li>• The current trend of innovation is in highly specialized technology (i.e. nanotechnology) and firms of all sizes are finding they do not have the personnel or resources to keep up with current demand</li> </ul>
Labor	<ul style="list-style-type: none"> <li>• Highly capital extensive due to the health hazards and processes</li> <li>• Average spending of \$31.1 Billion per year</li> </ul>
Offshoring	<ul style="list-style-type: none"> <li>• Many U.S. companies are establishing themselves in developing countries (India and China) due to the increased demand for basic chemicals and the reduced cost of labor in these areas</li> <li>• US firms are able to fund these offshore facilities with entrepreneurial funds (US ranks 11<sup>th</sup> in the world in entrepreneurial activity)</li> <li>• There must be an increased incentive for firms to stay in the U.S.</li> </ul>
Public Policy	<ul style="list-style-type: none"> <li>• Heavily regulated by the state and federal government in areas such as public safety, worker safety, and environmental protection</li> </ul>

Technology	<ul style="list-style-type: none"> <li>• Reduce waste in order gain community support, decrease incidence of health issues related to chemical waste, and decrease number of law suits related to emission of waste and pollutants</li> <li>• Map shows that Pennsylvania has extremely high amounts of pollution due to chemical waste</li> </ul>  <ul style="list-style-type: none"> <li>• 5.5 billion pounds of toxic chemicals and 75 million recognizable carcinogens are injected into the U.S. environment each year</li> <li>• Pennsylvania ranks 5<sup>th</sup> in US for health risks from air pollutants; 8<sup>th</sup> in types of hazardous air pollutants released in the environment; 9<sup>th</sup> in the amount of air pollutants released into the environment; and 12<sup>th</sup> in amount of chemical waste released into the environment (120 million pounds per year)</li> <li>• Increasing concern over health effects such as cancer, kidney failure, liver disease, reproduction and respiratory issues, etc.</li> <li>• Increasing resistance from communities where chemical plants are located due to the health issues associated with these chemicals</li> <li>• Chemists need to find the most cost effective, environmentally acceptable way to add value to products in order to combat against pressures from the community</li> <li>• Firms need help in producing this technology and building innovative processes</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Transportation costs tend to be 5-6% of the total value of shipments</li> <li>• Industry relies on demand from the corporate sector, and recent lack of demand from the manufacturing industry has resulted in chemical companies decreasing their amount of spending and focusing their efforts on internal processes to improve efficiency</li> </ul>

## **2. Glass Industry**

### **I. INDUSTRY DEFINITION:**

This industry comprises establishments primarily engaged in manufacturing glass or glass products by melting silica sand or cullet. The industry is comprised of four segments: Flat Glass Manufacturing (NAICS 327211) which comprises establishments primarily engaged in (1) manufacturing flat glass or (2) manufacturing both flat glass and laminated glass; Other Pressed or Blown Glass and Glassware (NAICS 327212) which comprises establishments primarily engaged in manufacturing pressed, blown, or shaped glass or glassware (except glass packaging containers); Glass Container Manufacturing (NAICS 327213) which comprises establishments primarily engaged in manufacturing glass packaging containers (e.g. bottles and jars); and Glass Product Manufacturing Made of Purchased Glass (NAICS 327215) which comprises establishments primarily engaged in remelting, pressing, blowing, or shaping purchased glass

### **II. NATURE OF THE INDUSTRY**

#### **Historic Location Rationale**

The wealth of natural resources and riverside location made Pittsburgh an ideal spot for glassmaking. The coal and lumber that were so readily available in Western Pennsylvania provided some of the necessary supplies. The Monongahela, Ohio, and Allegheny Rivers made for easy trade and helped establish Pittsburgh as the hub of the glassmaking industry for much of the nineteenth and twentieth centuries.

The first two Pittsburgh glassmaking factories, New Geneva Glassworks and Pittsburgh Glassworks had been established by 1797. A hundred years later there were fifty factories in Western Pennsylvania and they were responsible for thirty percent of the glass produced in the United States. Western Pennsylvania continued to be a major force in the glassmaking industry until the mid-twentieth century. By the nineteen sixties production had begun to fade (Source: [www.pitt.edu](http://www.pitt.edu))

The major glass manufacturer in Pennsylvania now is PPG, which has been located in Pittsburgh since 1883. Currently, PPG's largest clients are involved in the auto manufacturing industry. The Pittsburgh location is ideal to serve their auto manufacturing clients due to close proximity to several of the auto plants and accessibility to the natural resources (soda ash, lime stone, titanium)

#### **Global Investment Patterns**

This industry has a significant level of globalization with between 15 to 25 % of industry activity generated by international trade. Foreign ownership is evident amongst several of the major players and several of the larger U.S.-based firms have considerable production capacity in other countries

Several of the global leaders in this industry, notably Asahi Glass and Compagnie de Saint-Gobain, are majority owned outside the U.S. but have considerable manufacturing interests in America. Saint-Gobain alone is estimated to account for around 13 % of the US glass market

Owens-Illinois generates 38 % of its sales revenue outside the U.S. (e.g. Europe, Australia), Visteon Corporation generates 30 % of its revenue outside the U.S. (e.g. Brazil, Japan, and Europe) and PPG Industries generates 33 % of revenue outside the U.S. (e.g. Europe)

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"> <li>• Slight growth—2-3.5% per year expected growth, which slightly exceeds the industries expected growth and GDP</li> <li>• Glass containers are seeing a slight surge due to increased demand from malt beverage producers and their choice to use glass bottling</li> <li>• There is no exact substitute for windows due to the transparency that it provides; therefore, there is a direct correlation between demand for construction and automotives and demand for flat glass</li> <li>• Demand for value-added products is growing at a faster rate than demand for basic glass</li> </ul>
Competitiveness	<ul style="list-style-type: none"> <li>• Driven by price. Competes highly with plastic (especially in containers and bottling). Flat glass (windows) is the only segment that is virtually free from competition</li> <li>• Narrowing profit margin due to the cyclical decline in downstream building and ongoing price constraints resulting from import competition and product substitution</li> <li>• In the glass bottling industry, plastic is the main competitor for glass. Many beverage companies are favoring plastic due to the durability and weight. The glass industry needs to exploit the market perception that glass represents quality and show why glass is superior to substitutes to increase profit margins</li> </ul>
Profitability	<ul style="list-style-type: none"> <li>• Narrowing profit margins due to the cyclical decline in downstream building and ongoing price constraints resulting from import competition and product substitution</li> </ul>
Fragmentation	<ul style="list-style-type: none"> <li>• Major Players:</li> <li>• Owens-Illinois 9-11%</li> <li>• Guardian Industries 7-8%</li> <li>• Asahi Glass Company 5-6%</li> <li>• PPG 5-6%</li> <li>• Visteon 2-3%</li> <li>• Apogee 1-2%</li> </ul>
Consumers	<ul style="list-style-type: none"> <li>• Construction companies, automotive manufacturers, telecommunications, hospitality, and household markets</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>• Mature—Unlikely to record significant growth due to the establishment of major players</li> <li>• New players would have to enter into a niche market, which would not significantly impact the overall growth of the industry</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• There is a trade balance between exports and imports</li> </ul>

#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>• High need for technology to ward off competition. To stay competitive in the container and bottling industry, there has been development to make glass more light-weight and durable; however, consumer preference is still favoring plastic</li> <li>• Continue to innovate glass containers to keep up with demand and compete with plastic innovation</li> <li>• Increasing pressure from environmentalists to become more energy efficient and to decrease amount of water emissions that occur during the glass production. By 2020, the glass industry would like to be operating with 20% fewer emissions and to make all glass 100% recyclable. To meet these standards, a significant amount of R&amp;D and capital will be necessary. With narrowing profit margins, this will be difficult for small and medium sized firms</li> </ul>
Labor	<ul style="list-style-type: none"> <li>• Capital intensive—Technology has given rise to increased productivity</li> <li>• Several of the employees involved in the glass industry are represented by unions with a great deal of clout. Unresolved issues around worker related issues may result in a strike by the workers, which is very costly to the company due to lack of production and the time spent resolving the issue and resuming operations</li> </ul>
Offshoring	<ul style="list-style-type: none"> <li>• There is a high amount of international trade; however, due to a slow down in international demand for automotive glass, export numbers have dropped</li> </ul>
Public Policy	<ul style="list-style-type: none"> <li>• The industry is highly regulated across federal, state, and local government jurisdiction around safety, environment, minerals used to create glass, zoning, and land</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>• Many of the older facilities have environmental issues—specifically arsenic</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Need to create stronger, more durable glass to compete in the construction industry</li> </ul>

### **3. Medical Equipment Industry**

#### **I. INDUSTRY DEFINITION:**

This industry comprises establishments primarily engaged in manufacturing medical equipment and supplies. Examples of products made by these establishments are laboratory apparatus and furniture, surgical and medical instruments, surgical appliances and supplies, dental equipment and supplies, orthodontic goods, dentures, and orthodontic appliances. Participants in this industry supply to wholesalers as well as direct to hospitals, private practices and laboratories. This industry does not manufacture laboratory instruments, X-ray apparatus, electromedical apparatus (including hearing aids), and thermometers (except medical)

#### **II. NATURE OF THE INDUSTRY**

##### **Historic Location Rationale**

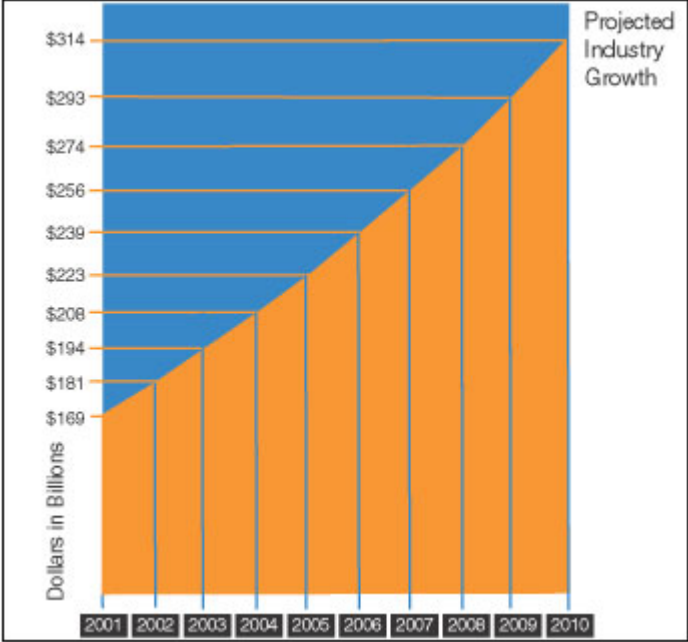
Location rationale is based on the proximity of related industries (i.e. Pharma) and central distribution area for the region

##### **Global Investment Patterns**

Currently the U.S. enjoys a trade surplus of \$7 Billion and supplies 47% of the world's total equipment



### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

<p>Growth/ Consolidation</p>	 <p>The chart displays industry growth in billions of dollars from 2001 to 2010. The values are: 2001 (\$169), 2002 (\$181), 2003 (\$194), 2004 (\$208), 2005 (\$223), 2006 (\$239), 2007 (\$256), 2008 (\$274), 2009 (\$293), and 2010 (\$314). The 2010 value is marked as 'Projected Industry Growth'.</p> <ul style="list-style-type: none"> <li>• The industry is currently growing at approximately 7% per year</li> <li>• Growth can be attributed to increased consumer demand, improved regulatory conditions, and new treatment opportunities</li> <li>• Consumer demand is rapidly increasing due to the aging “baby boomer” population and the push towards home health care</li> <li>• Consolidation in the industry could pose legal questions around licensing rights and patents—specifically surrounding the transferability of rights</li> </ul>
<p>Competitiveness</p>	<ul style="list-style-type: none"> <li>• Industry is highly competitive</li> <li>• Manufacturers compete with each other as well as other industries and technologies (i.e. medication may be a more successful treatment than a procedure)</li> </ul>
<p>Profitability</p>	<ul style="list-style-type: none"> <li>• The medical industry has a high rate of return, which signals profitability; however, many of the products with the high margins have patents or are so specialized that only large companies can take of the risk of developing it</li> </ul>
<p>Fragmentation</p>	<ul style="list-style-type: none"> <li>• Major Players:</li> <li>• General Electric 14.2-14.7%</li> <li>• Baxter Int. 12.2-13.3%</li> <li>• Tyco Int. 10.5-13.0%</li> <li>• Johnson &amp; Johnson 12.0-12.8%</li> <li>• Medtronic 9.7-10.0%</li> </ul>
<p>Consumers</p>	<ul style="list-style-type: none"> <li>• Health care professionals, health care facilities, drug stores, etc.</li> </ul>

Life-cycle	<ul style="list-style-type: none"> <li>• Mature—although the market is growing</li> </ul>
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#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>• Need for constant innovation to keep up with the advances in healthcare and to keep Medicare disability claims in a state of decline (current rate of innovation are driving claims down by 1.5% per year due to decreased about of defects, improved quality of products, new products, etc.)</li> <li>• Due to the need to keep health care costs down, there is an increased pressure by the government and consumers to produce state-of-the-art medical equipment in the most cost effective manner possible</li> <li>• Both of these involve costly research and development investments</li> </ul>
Labor	<ul style="list-style-type: none"> <li>• Industry spends high amount of capital on both labor and capital—both is required</li> </ul>
Offshoring	<ul style="list-style-type: none"> <li>• Many manufacturers are dumping medical equipment on countries where requirements and regulations are not strictly enforced—this is creating outrage from the US communities and resistance from the countries that are being dumped on (India)</li> <li>• Little deterrence through tariffs</li> <li>• Imports are subject to the same regulations as domestically produced goods</li> <li>• Firms who import finished goods to only in turn export them, must seek marketing clearance from the FDA</li> <li>• There is a high risk associated with offshoring due to the fact that the manufacturer will face political, economical, and regulatory risks from the host country that might off set the lower cost of production</li> <li>• Face the risk of fluctuations in currency</li> </ul>

Public Policy	<ul style="list-style-type: none"> <li>• Highly regulated industry that must meet several requirements and regulations that increase the cost of the products</li> <li>• Industry is regulated in the U.S. by FDA, Health Care Financial Administration, Occupational Safety and Health Administration, Environmental Protection Agency and the U.S. Department of Agriculture</li> <li>• Internationally regulated by the Global Harmonization Task Force</li> <li>• Medical Device Manufacturing Association (MDMA) was created in 1992 to help prevent unfair regulations against the industry</li> <li>• Declining level of reimbursements has served as a deterrent for innovation (especially for smaller firms). Revenue to innovate comes from the sale of medical equipment to health care professionals and hospitals. Medical professionals create revenue for themselves largely through reimbursements from insurance and government programs. Medical professionals are reluctant to buy products that are not reimbursable through government and insurance--Reimbursements are playing an increasing roll in the growth of the industry due to the question on what Medicare and Medicaid will cover. In order to receive payment on products, products must be considered by the Council for Medicare and Medicaid necessary and reasonable. Manufacturers are reluctant to develop a product that is not going to be reimbursable due to the large amount of research, development, and capital that will be dumped into the product</li> <li>• Reimbursements are going to continually decline in the upcoming years due to the cuts in health care funding, which will slow the rate of research and development</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Due to the rapid innovation of technology in the industry, it is difficult for SMEs to produce highly specialized products due to the capital investment and risk of obsolescence. In addition, it is difficult to compete with the large firms in this area due to the production capacity</li> <li>• Cost of medical technology is decreasing by .8% per year due to economies of scale that large firms can reach. The lower unit cost from the economies of scale gives these large firms bargaining power with suppliers and a less expensive end-product. Small firms are having trouble achieving these economies of scale due to the high volume of production required to see this benefit. In turn, they can not compete with large firms in cost, and they lack the bargaining power needed to get their supplies at a lower cost</li> <li>• Many of the specialized, high margin products have patents</li> </ul>

Other Comments	<ul style="list-style-type: none"><li>• Due to regulations and competition, there is limited price flexibility in the industry—especially for small firms</li><li>• Products that may make it into the market can be pulled off at any time if the product is deemed unsafe and ineffective even if it previously passed all of the requirements and regulations to get into a market</li><li>• Large firms have an additional advantage in technology due to the fact that they can attract better scientists and are more likely to gain regulatory approval than smaller firms</li><li>• Increasing concern over reprocessing single use devices—question stands on whether manufacturers can be held liable for single use devices that medical professionals are reusing</li><li>• Lines can be blurred between regulations for pharmaceuticals and medical equipment due to the way that the pharmaceuticals are distributed through medical devices</li></ul>
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## **4. Pharmaceutical and Medicine Manufacturing**

### **I. INDUSTRY DEFINITION:**

This industry comprises of establishments primarily engaged in one or more of the following:

- Manufacturing biological and medicinal products
- Processing (i.e., grading, grinding, and milling) botanical drugs and herbs
- Isolating active medicinal principals from botanical drugs and herbs
- Manufacturing pharmaceutical products intended for internal and external consumption in such forms as ampoules, tablets, capsules, vials, ointments, powders, solutions, and suspensions

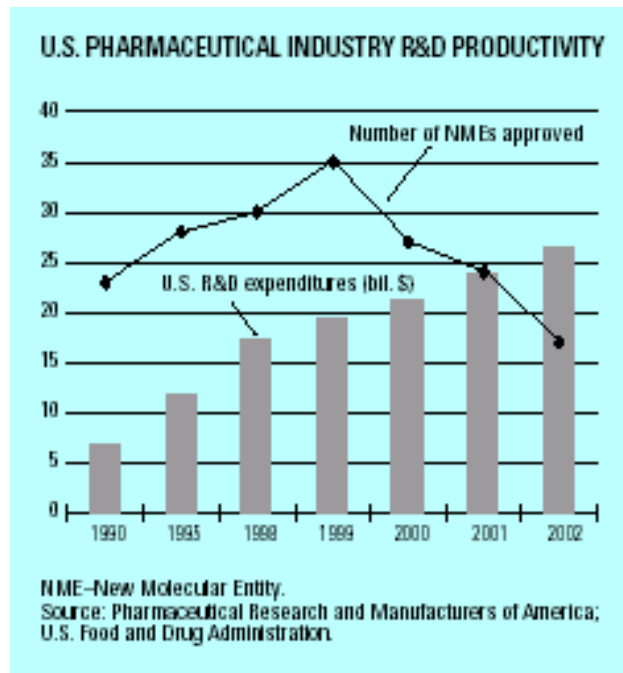
## II. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

<p><b>Growth</b></p>	<ul style="list-style-type: none"> <li>• The pharmaceutical industry has experience little growth in recent years. Between 1998 and 2000, total domestic output grew by 31%. The figure between 2000 and 2003 was 2%. The slowdown in growth is largely in due to pricing pressure in branded pharmaceuticals stemming from: <ul style="list-style-type: none"> <li>-Patent expirations on several key drugs that have rapidly lost market share to cheaper generic copies</li> <li>-A relative dearth in new product approvals</li> <li>-Pricing pressures from both government and managed care programs</li> <li>-A recent wave of over-the-counter versions of some prescription drugs</li> </ul> </li> <li>• However, growth for branded drugs is expected to pick up in 2004. The industry will receive some respite from patent expirations as the patents on the majority of the blockbusters drugs have already expired. Further, R&amp;D investments are still on the rise and the industry has a robust pipeline that holds 1100 drugs</li> <li>• The fundamentals of the generic pharmaceuticals industry have been exceptionally strong and have been driving overall growth in the industry. It is facing a growth in volumes and an increased market share – generics now represent 53% of total U.S. prescription volume after being stuck below 50% market share for some time. This is primarily due to: <ul style="list-style-type: none"> <li>-Positive pricing – With demand for generic surging, the industry has undergone a pricing rationalization including actual price increases</li> <li>-Large number of patent expirations for branded drugs, which have helped boost generic sales</li> <li>-The accelerating number of patent challenges posed to branded drug patents. While the generics industry has experienced periods of strong volumes and patent expirations in the past, it has never successfully challenged so many patents</li> </ul> </li> <li>• Long term growth factors for the overall pharmaceutical industry are strong. The primary growth factors include the aging of the baby boom generation and the lengthening of the average life expectancy</li> </ul>
<p><b>Profitability</b></p>	<ul style="list-style-type: none"> <li>• Profit margins for the major pharmaceutical manufacturers are very steep, as is the odds against making a profit. Less than a third of marketed drugs actually achieve enough commercial success to recoup their R&amp;D investment. However, when a drug maker launches a new compound that is widely accepted in the marketplace, the economic rewards can be immense</li> </ul>
<p><b>Fragmentation</b></p>	<ul style="list-style-type: none"> <li>• The outsourced sector of manufacturing in the life science industry is highly fragmented, being made up of numerous contract manufacturing organizations (CMOs). A few of these CMOs are big players but most are small companies. Many appear to be over-dependent on a small client base</li> </ul>

### III. KEY INDUSTRY ISSUES

#### Product Innovation

- R&D is the lifeblood of the pharmaceutical industry. Given the limited patent lives of pharmaceuticals, cultivating new drugs is crucial to survival in this business. Drug makers have consistently spent large sums on research and development. However, drug manufacturing is a high-risk business; for every 5,000 compounds discovered, only one ever reaches the pharmacist's shelf. In spite of this, the immense rewards have encouraged companies to boost R&D investments year-after-year. R&D investment in the U.S. was estimated to be \$26.4 billion in 2002. While investments in R&D keep increasing every year, the number of drugs approved by the FDA has declined considerably. Only 17 new breakthrough drugs (defined as new molecular entities) were approved by the U.S. Food and Drug Administration (FDA) in 2002, the lowest level since 1983. Over the past 3 years, R&D productivity has declined significantly



<p><b>Process Improvement</b></p>	<p><b>Supply Chain Complexity</b></p> <ul style="list-style-type: none"> <li>• Pharmaceutical supply chain is becoming very complex. A majority of the raw materials are beginning to be outsourced from China and India and the shipping and customs logistics for these products are tedious. As a result, manufacturers are beginning to place orders in advance of up to two months. However, once the raw materials enter the production process, they have to pass through it quickly as companies have to deal with outdating. Outdating refers to the maximum length of time from when a product begins one stage of production until it must begin the next stage of production. Though most of the outdating allows a product to exist for 2-4 weeks in between stages, the outdating differs from product-to-product, and from phase-to-phase. In addition to these constraints, there is very little flexibility in the production process. When a pharmaceutical manufacturer is licensed by the FDA to manufacture a product, the company is held to the BOM that is declared in the filing. For example, if a filing states that a product is to be made with a 50-cubic foot blender, a manufacturer is unable to use a 25 or 100 ft. blender. As a result, companies are increasingly looking at streamlining the supply chain to improve efficiency</li> <li>• Another issue facing manufacturers is the upgrade of systems to be CFR Part 11 compliant. CFR (Code of Federal Regulations) Part 11 is an FDA regulation that mandates life science companies to comply with certain requirements if they intend on using technology in any regulatory reporting (such as batch records, training records, product documentation and other areas). This regulation has forced companies to carefully examine both technology and processes related to those systems producing electronic records in lieu of paper records and electronic signatures in lieu of handwritten signatures</li> </ul>
<p><b>Offshoring</b></p>	<ul style="list-style-type: none"> <li>• Intermediates and early-stage intermediates markets are very tough and companies from India, China, and other countries are coming into this area. However, this is not a very critical issue in the light of other concerns</li> </ul>



**Public Policy****Importation of Drugs**

- With Americans facing skyrocketing pharmacy bills, buying drugs in Canada has become a hot political issue and one that has back-breaking implications for drug manufacturers in Pennsylvania. The Associated Press surveyed comparable U.S. and Canadian prices for 10 popular drugs and found the Canadian prices were 33 percent to 80 percent cheaper
- Whether to allow Americans to import drugs from Canada and other countries where governments have imposed price controls is among the outstanding issues as lawmakers race to come up with a bill before the end of the year to create a prescription drug benefit for seniors. Allowing this provision would create a \$40 billion savings in what the government dispenses
- Bringing prescription drugs into this country from abroad is now illegal. But the federal government has not tried to block individuals from doing so
- The Food and Drug Administration has said it is especially concerned about the safety drug sales from Canada but it will not utilize resources to measure the safety
- A solid majority of Americans say they want Congress to legalize the importation of lower-priced medicines from Canada and Europe and would be willing to pay higher taxes to provide prescription drug benefits to senior citizens. A survey by Harris Interactive shows that for 53% of patients with drug costs over \$1000 would be willing to purchase drugs from another country. The percentage of patients overall is 48%

<b>Percentage of Patients Willing to Purchase Drugs from Another Country Based on Current Prescription Spend</b>					
	Total	Out-of-Pocket Amounts Spent on Rx Drugs in the Last 12 Months			
		\$0	\$1-\$200	\$201-1,000	Over \$1,000
Nov'02	40%	44%	36%	43%	44%
Sep'03	48%	53%	45%	47%	53%
<i>Source: Harris Interactive Healthcare Poll</i>					

<p><b>Technology</b></p>	<p><b>Pharmaceutical Manufacturing Capabilities</b></p> <ul style="list-style-type: none"> <li>• The sluggish growth in branded pharmaceuticals has led to a problem of excessive capacity. Pharmaceutical companies have been returning previously outsourced production (to contract manufacturers) in-house to boost asset utilization. As a result, contract manufacturers are increasing exploring opportunities in biotech manufacturing, which is facing a shortage of capacity</li> <li>• Fewer molecules are being produced by the drug companies' pipelines, and the remaining candidates are more complex, requiring custom synthesis suppliers to have more sophisticated toolkits</li> </ul> <p><b>Biotech Manufacturing Capabilities</b></p> <ul style="list-style-type: none"> <li>• An important trend has been an increasing focus on biotechnology as pharmaceutical companies look to replenish their depleted product by signing deals with innovative biotechs. In 2002, sales of biotech drugs rose 23% to \$20 billion, and they are expected to jump 25% in 2003. There are about 300 public U.S. biotechnology companies. However, more than half do not have revenue produced from the sale of commercial products. Their revenue streams tend to be earned from collaborative arrangements with large pharmaceutical partners. This is primarily because of the capacity crunch facing biotech manufacturing. It is estimated that right now there is only about a quarter of the manufacturing capacity needed for all the experimental products on lab benches or heading into some phase of clinical trial</li> <li>• This is because biotechnology poses a challenge to the modern pharmaceutical contract manufacturer. While there are issues in dosage form development, clinical trial supplies manufacturing and secondary manufacturing that are common to pharmaceuticals and biopharmaceutical, at a primary level, bio-manufacturing processes differ markedly from pharmaceutical manufacturing. Unlike traditional medicines, which are pure chemical concoctions, biotech drugs are complicated protein-based molecules. They're often grown in live mammalian or yeast cells in networks of costly equipment, such as fermentation tanks. The average biologic plant costs more than \$300 million to build - an expense that few companies are willing to swallow. As a result, there will be a substantial shortage of quality contract manufacturing facilities available to companies that have biological products in development and wish to scale-up manufacturing. Forecasts estimate that by 2005 there could be a four-fold gap between supply and demand</li> </ul>
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## 5. Plastic Industry

### I. INDUSTRY DEFINITION:

This industry group comprises establishments primarily engaged in processing new or spent (i.e., recycled) plastics resins into intermediate or final products, using such processes as compression molding; extrusion molding; injection molding; blow molding; and casting. Within most of these industries, the production process is such that a wide variety of products can be made such as plastic pipes, pipe fittings, unsupported profile shape manufacturing (i.e. rods and plates), bottles, machine parts, etc. For our analysis we will focus on PVC, packaging, and molding.

### II. NATURE OF THE INDUSTRY

#### Historic Location Rationale

- 1935-first plastic press in Pennsylvania set up in Erie and several plants were established over the years
- Plant employees began opening their own businesses, which gave rise to mold-making industry in the area
- In 1984, industry leaders were concerned with the decreasing amount of skilled labor in the plastic industry
- Leaders negotiated with Penn State (Erie) to create a Plastic Engineering degree in turn for equipment donated from local factories, a \$1.2 million endowment

#### Global Investment Patterns

- Government assistance is provided through tariffs that vary from 3.1-7.1% ad valorem tax for countries with normal trade relations (NTR) and 25-45% ad valorem tax for countries without normal trade relations
- As a result, there has been very little globalization of the industry and a low level of U.S. ownership of foreign establishments

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

<p>Growth/ Consolidation</p>	<ul style="list-style-type: none"> <li>• Industry as a whole is moving toward consolidation. Since 1993, there have been 6,124 global plastic merger and acquisition transactions announced with 2,455 disclosing values aggregating \$282.4 billion. In the U.S., there have been 1,849 transactions announced, 765 disclosing values aggregating \$103.1 billion</li> <li>• The consolidation will result in fewer competitors who are large, greater industrial capabilities, greater supplier negotiating power and a more global focus</li> <li>• Consolidation is driven by: 1) Increased outsourcing of plastics product manufacturing, 2) increased importance of scale and efficiency, 3) increased desire for end market diversification, 4) increased customer demand for comprehensive services and solutions, 5) increased foreign competition, 6) increased importance of foreign manufacturing capabilities, 7) industry cyclicalities and over capacity, 8) decrease in product lifecycles and 9) new manufacturing processes and technology</li> <li>• Exception: Packaging is the only segment of the plastic industry still growing—new technology (increased durability, style, decreased weight, etc.) has rejuvenated the segment, and there is an increased consumer demand for flexible packaging and technology</li> </ul>
<p>Competitiveness</p>	<ul style="list-style-type: none"> <li>• Increasing foreign competition for exports. U.S. traditionally exported raw materials to China to satisfy the 50% of local demand that Chinese manufacturers could not fulfill; however, recently, U.S. exports have met competition from Japan, Korea, Taiwan, and Germany. China's accession to the WTO is expected to once again put U.S. exports in favor</li> <li>• Consolidation has resulted in fewer competitors within the industry</li> <li>• Plastic manufacturers also compete with metal, clay, concrete, glass, etc. Competition with other industries are regional due to shipping cost of materials</li> </ul>
<p>Profitability</p>	<ul style="list-style-type: none"> <li>• 1999 studies show that plastic manufacturing is the 4<sup>th</sup> largest in the manufacturing industry. There were \$304 billion in shipment of plastics and 1.5 million jobs; however, profit margins have been driven down due to the competitive nature (increased by consolidation) of the industry</li> <li>• Margins should improve slightly due to the low energy prices (raw materials)</li> <li>• Pipes and Fittings—Dependant on demand for construction, government expenditure on infrastructure, and interest rates</li> <li>• Bottles—Based on availability of substitutes, technology, and demand</li> </ul>

Fragmentation	<ul style="list-style-type: none"> <li>• Major Players:</li> <li>• Pipes and Fittings—General Electric-10.0%, Nibco-2.4%, PW Eagle-2.3%, and The Lamson and Sessions Co.-1.0%</li> <li>• Bottles—Blackstone-7.5%, Owens-Illinois-7.0%, Dean Foods-6.5%, Plastipak-5.0%, Ball Corp.-4.0%, and Constar Int.-4.0%</li> </ul>
Consumers	<ul style="list-style-type: none"> <li>• Seven Primary Markets: Packaging, building and construction; consumer and institutional, transportation, industrial machinery, electrical and electronics; furniture and furnishings</li> <li>• Smaller Segments:</li> <li>• Pipes and Fittings—Plumbers, farmers, and miners</li> <li>• Bottles—Liquid (Beverages, Detergent, etc.) and Food Manufacturers</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>• Pipes and Fittings—Mature: Industry Value Added (IVA) growth is slightly less than GDP growth, low value adding opportunity, and trend toward consolidation</li> <li>• Bottles—Growth due to the increased demand for packaging and technology</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Increasing cost of the raw materials, such as plastic resin used in PVC piping, may effect sales in the long run due to the necessity of the product and the small number of firms that manufacture it</li> </ul>

#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>• New innovations (i.e. hot-fill plastic) have not caught on for some products it has been applied to (i.e. Plastic Beer Bottles) due to consumer preference for glass bottles and aluminum cans</li> <li>• Research and Development costs are extremely high but innovation is necessary to stay profitable in the industry</li> </ul>
Process Improvement	<ul style="list-style-type: none"> <li>• Looking for ways to decrease the process time to increase productivity and output—currently the cooling of the plastic is the bottleneck in the process. Methods are being developed to use nitrogen gas to increase the rate it takes to cool the product</li> <li>• Looking for ways to decrease the cost of recycling PET plastics used in bottles—new legislation, which has taken effect in several states, requires new plastic containers to use certain amount (amount specified by state) of recycled PET plastic</li> </ul>
Labor	<ul style="list-style-type: none"> <li>• Labor cost is high relative to other manufacturing industries. This poses a greater threat for imports</li> <li>• Capital intensive—Entire lines can be committed to a single product</li> </ul>
Offshoring	<ul style="list-style-type: none"> <li>• Government assistance is provided through tariffs that vary from 3.1-7.1% ad valorem tax for countries with normal trade relations (NTR) and 25-45% ad valorem tax for countries without normal trade relations</li> <li>• As a result, there has been very little globalization of the industry and a low level of US ownership of foreign establishments</li> <li>• Many US plastic manufacturers are concerned with China's presence in the plastic market. China's cheap labor and undervalued currency is allowing them to sell plastic products at extremely low margins. There is suspicion of dumping due to the fact that small plastic toys imported from China are selling at prices comparable to the freight charges. There is also concern around the current trade deficit that the US faces with China</li> </ul>
Public Policy	<ul style="list-style-type: none"> <li>• Must meet Federal, State, and Emission requirements for safety purposes</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>• Market has excessive machinery and manufacturing space available in Pennsylvania</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Expensive and necessary due to the rapid need for change and competition</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Manufacturers that are not currently producing in the states with the recycling legislation are still under pressure from environmentalists to use recycled plastics. The public image of these manufacturers are at stake if they do not make an effort to use recycled materials</li> </ul>

## 6. Architectural and Structural Metals Manufacturing (NAICS 3323)

### I. INDUSTRY DEFINITION:

This industry comprises establishments primarily engaged in manufacturing one or more of the following:

- Fabricated structural metal products including: metal carports, dwelling, farm buildings, greenhouses, homes, silos, utility buildings, and warehouses
- Prefabricated metal products including: barge, boat, bridge, highway bridge sections, railway bridge sections, ship sections, radio and TV towers
- Metal plate work products including: airlocks, baffles, bins, breechings, casings, chutes, covers, culverts, cyclones, ducting, flumes, hoppers, liners, pipe, smoke stacks, sterilizing chambers, truss plants, and tunnel lining
- Metal doors and metal framed windows (typically using purchased glass)
- Sheet metal products including: canopies, concrete forms, ducts, eaves, flooring, flues, furnace castings, gutters, guardrails, louvers, machine guards, and roofing
- Other ornamental and architectural metal products including: balcony railings, banisters, chain ladders, elevator guide rails, fire escapes, grill and grill work, ladders, railings, scaffolding and stairs and staircases

### II. NATURE OF THE INDUSTRY

#### Historic Location Rationale

- Manufacturers in this industry historically have located near either suppliers (e.g., steel mills) or customers. Traditional centers of manufacturing within this industry have declined as a source of advantage due to transport and technological developments. This appears to have encouraged continued multi-state regional expansion of the industry--smaller firms servicing more local markets and customers
- The distribution of firms corresponds to the historical development, and current distribution of major U.S. fabricated structural metal manufacturing centers

#### Global Investment Patterns

- For plate work and prefabricated structural products, the level of foreign ownership in this industry is low (foreign operators account for less than 25% of domestic demand)
- Despite the low level of globalization in this industry, there are increasing levels of foreign competitors entering the domestic and international markets. Major players such as Harsco Corporation and Alcoa have international operations; Butler Manufacturing Company Sanswa Shutter Corporation, Masonite International and Griffon Corporation have operations in both the United States and foreign countries

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"> <li>• Because construction and building drive more than half the demand in this industry, revenue growth is heavily influenced by the economy and residential, non-residential and infrastructure construction demand</li> <li>• This industry has been growing at a comparable rate to GDP for the five years to 2001</li> <li>• Revenue growth over the last two years has been low, as the economy weathers a downturn and commercial construction slows</li> </ul>
Competitiveness	<ul style="list-style-type: none"> <li>• Industry competition is typically based on service attributes, product quality, delivery, brand awareness and product price.</li> <li>• Increasing imports, lower exports, and higher domestic demand, have intensified competition in the metal building systems market over recent years.</li> <li>• A local and/or regional presence has been important factor of competitive success because business and market development efforts are at the local and regional level.</li> <li>• Substitute products include other methods and materials for building construction such as wood</li> </ul>
Profitability	<ul style="list-style-type: none"> <li>• Because ornamental metal is often a customized or specialty product, it is a highly profitable market segment - margins may be as much as 2-3 times higher than those on commodity metal products</li> <li>• Foreign competition, mainly from China, has entered the U.S. reducing margins on some products but leaving many other specialty designs to continue to command high prices and margins</li> </ul>



Fragmentation	<ul style="list-style-type: none"> <li>• While there are some major players in this industry, the industry remains fairly fragmented due to localized demand: <ul style="list-style-type: none"> <li>○ The top four firms generate less than 10% of total industry revenues</li> <li>○ 83% of firms employ less than 50 people and the average number of employees per firm is 30-35</li> </ul> </li> <li>• The number of enterprises within the plate work and fabricated structural products industry has declined by 3 % per annum over the five years to 2001. From 4,929 enterprises in 1996, there are now 4,565 enterprises operating in the U.S.</li> <li>• Low barriers to entry allow smaller firms to enter and exit the industry <ul style="list-style-type: none"> <li>○ Moderate to high capital investment required</li> <li>○ Access to raw materials and distribution channels</li> <li>○ Economies of scale to ensure low-cost production</li> </ul> </li> <li>• Experts expect this industry to consolidate further, driven by the need of manufacturers to increase manufacturing capacity, achieve greater process integration, and add geographic diversity to meet customers' product and delivery needs, improve production efficiency, and manage costs</li> </ul>
Consumers	<ul style="list-style-type: none"> <li>• The major users for these metal products are the residential and commercial construction industries. These industries are: <ul style="list-style-type: none"> <li>○ Seasonal</li> <li>○ Highly sensitivity to national and regional economic conditions</li> </ul> </li> <li>• The biggest product segments in this industry are fabricated structural metal products (\$18 billion industry revenues), sheet metal products (\$19 billion), and metal windows and doors (\$12 billion)</li> <li>• Because of the large number of customers that are small and medium sized businesses, the manufacturers and/or suppliers of products have stronger pricing power in most situations</li> <li>• Manufacturing firms in the industry are selling to customers who are highly knowledgeable about product and service attributes</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>• Mature <ul style="list-style-type: none"> <li>○ Customers of this industry have repeat buying patterns</li> <li>○ Goods and services are segmented along the lines of market</li> <li>○ Price competition between firms is widespread</li> <li>○ Products have saturated the market</li> <li>○ There are relatively less rapid product and technology changes</li> <li>○ There is a mass market for the goods and services manufactured within this industry</li> <li>○ Consolidation of industry participants</li> <li>○ There is a wholehearted acceptance of goods and services manufactured within this industry</li> </ul> </li> </ul>

Other Comments	<ul style="list-style-type: none"> <li>• Low productivity may be contributed to the number of small firms in the industry</li> </ul>
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#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>• Although there are some products that are standardized, there is a diverse range of products, many of which require product and service customization to user requirements. As such, the design, development and manufacturing of products often requires a great deal of user-manufacturer interface</li> </ul>
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Labor	<ul style="list-style-type: none"> <li>• Labor intensity is higher than most manufacturing industries and productivity increases have been smaller in this industry than in other manufacturing industries</li> <li>• Those segments where products are customer-engineered to customer specifications are especially labor-intensive</li> <li>• Technology, such as computer-controlled machine tools and robots, has reduced labor costs due to the capital intensity of the projects. Computer-controlled equipment allows operators to simultaneously tend a greater number of machines and often makes setup easier, thereby reducing the amount of time setup workers spend on each machine.</li> <li>• Employment forecasts vary among the skilled labor occupations <ul style="list-style-type: none"> <li>○ A decline in employment is projected for many machine tool operators</li> <li>○ A large number of jobs will also become available due to a surge in retirements by baby boomers</li> <li>○ Opportunities are expected to be strong for sheet metal workers. Prospects are expected to be better for sheet metal workers in construction than for manufacturing as construction grows more quickly</li> </ul> </li> <li>• Labor turnover rates are typically higher in this industry than in all other manufacturing industries. These higher revenue rates have had the effect of slowing productivity growth, and they have also exacerbated the safety and health problems associated with new workers</li> <li>• Training and Certification <ul style="list-style-type: none"> <li>○ The National Institute for Metalworking Skills has developed uniform national standards and a process to certify metalworking-machine operators to formally recognize them as competent in a specific machining operation or field</li> <li>○ Apprenticeship programs consist of shop training supervised by an experienced machinist and related classroom instruction on topics including math, physics, blueprint reading, mechanical drawing, and quality and safety practices</li> </ul> </li> <li>• In addition, classroom and on-the-job training in the operation and programming of computer-controlled machine tools are increasing in importance. Workers often take additional training provided by the union or by their employer to improve existing skills or to acquire new ones</li> </ul>
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Offshoring	<ul style="list-style-type: none"> <li>• Export levels are low and decreasing, primarily going to Canada and Mexico</li> <li>• Import levels are low but increasing and are primarily sourced from Canada, Mexico, and China</li> <li>• Larger integrated metal corporations have expanded to international markets and invested in global operations <ul style="list-style-type: none"> <li>○ Smaller metal products producers may be undercut by imported finished goods from China but may also have access to lower-cost imported metal for use in fabrication</li> </ul> </li> </ul>
Public Policy	<ul style="list-style-type: none"> <li>• Import tariffs on these products are relatively low (0.6%-5.7%)</li> <li>• Environmental: Facilities are subject to extensive environmental legislation and regulations affecting the discharge of waste, including the Clean Air Act and the Clean Water Act</li> <li>• Firms are also subject to a variety of non-environmental matters. Included in these are occupational health and safety, wage, overtime, and other employment matters and dealings with state and federal government agencies</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• New technologies have enabled firms to improve productivity and begin to reduce labor intensity. They also raise the level of minimum skills requires for workers entering the industry and increase the need for both classroom and on-the-job training <ul style="list-style-type: none"> <li>○ Computer-controlled machine tools and robots help reduce labor intensity in some parts of this industry</li> <li>○ The use of CAD and CAM has lead firms to greater efficiency as well as contribute to the product design process</li> <li>○ In many sheet metal shops, computerized metalworking equipment enables workers to experiment with different layouts and to select the one that results in the least waste. They cut or form parts with computer-controlled saws, lasers, shears, and presses</li> <li>○ Automated welding is run by computer control, which increases productivity and reduces the number of product defects. Fewer defects mean less rework</li> </ul> </li> <li>• Approximately 75-80 % of total capital expenditures are on the purchase of new manufacturing equipment. In comparison, approximately 15 % of expenditures are on new buildings and structures</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Quality certification: Bodies such as the American National Standards Institute and the International Organization for standardization provide national industry quality standards. Quality certification is important to receive work from major downstream companies because of their reliance upon continuous, high quality standards</li> </ul>

## **7. Electrical Equipment Manufacturing (NAICS 3351, 3353, 3359)**

### **I. INDUSTRY DEFINITION:**

This industry is the combination of the following NAICS codes:

- Electric Lighting Equipment Manufacturing (3351): This industry group comprises establishments primarily engaged in manufacturing electric lamp bulbs and tubes and lighting fixtures
- Electrical Equipment Manufacturing (3353): This industry group comprises establishments primarily engaged in manufacturing equipment that generates and distributes electrical power
- Other Electrical Equipment and Component Manufacturing (3359): This industry group comprises establishments, not classified to any other industry group, primarily engaged in manufacturing electrical power storage and transmission devices and accessories for carrying current

Household Appliance Manufacturing (NAICS 3352) was excluded from this group as Pennsylvania has an extremely small output for this industry.

### **II. Historical Location Rationale**

The electrical equipment industry has been traditionally located in proximity to complementary and secondary manufacturing facilities, such as the engine, turbine and power transmission equipment manufacturing industry, the automotive industry, and construction machinery manufacturing. The above industries are all concentrated in the Great Lakes region. As a result, this region has traditionally dominated the electrical equipment industry.

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

<p><b>Growth</b></p>	<ul style="list-style-type: none"> <li>• Pennsylvania was once a major state for manufacturing electrical equipment. In 1993, Pennsylvania produced \$2 billion in electrical equipment output – a staggering 7.5% of the total industry output in the United States. In 2003, Pennsylvania is forecasted to produce \$4.6 billion in electrical equipment output – although more than double in value from 1993 – it will account for 5.8% of the total industry output. Electrical equipment has grown significantly in the United States. It has tripled in output – from \$26 billion in 1993 to \$80 billion in 2003. Although the industry has grown strongly in Pennsylvania as well, the Commonwealth has captured less than its fair share of the growth</li> <li>• At the same time, employment in the industry has declined considerably. In 1993, the electrical equipment industry in Pennsylvania employed over 35,000 people. The employment in 2003 is forecasted to be less than 25,000. This is primarily due to 2 reasons:</li> <li>• The advent of China and other low-cost nations importing commodity electric equipment into the county. From 1995-2002, Chinese imports into the U.S. grew at over 12% per year. As a result, manufacturers in the U.S. have been forced to shift production to higher value equipment</li> <li>• At the same time, the level of automation in the industry has increased tremendously, thus augmenting overall productivity. For example packaging manufactured goods often required manual labor in the past however the automation of this process has replaced staff with electronic packing machines that carry out the same task</li> </ul>
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#### IV. KEY INDUSTRY ISSUES

<b>Product Innovation</b>	<ul style="list-style-type: none"><li>▪ The need for constant innovation is probably the most critical issue facing electrical equipment manufacturers. As commodity manufacturing moves to low cost countries, manufacturers are increasingly looking to explore higher value equipment. The need to understand “what to innovate” is a major concern for small manufacturers. They need help with assessing other competitors on the innovation front and where they are in the supply chain</li><li>▪ Some recent trends in innovation are:<ul style="list-style-type: none"><li>○ In the industrial controls market, some product innovation has occurred in recent years, with new products offering added features, more modular and simplified designs, greater miniaturization and programmability, and increased durability and ruggedness. With motor-driven equipment accounting for approximately two-thirds of electricity used in the industrial sector, there is also pressure on control manufacturers to improve the energy efficiency of their products</li><li>○ Switch makers have turned to customization and, in many cases, are offering modified standard products to ensure they remain on their customers' lists</li></ul></li><li>▪ The need for innovation is even more important as the expectation of technological innovation makes the long term prospects of the electronics industry look brighter. To a limited extent, the industry can create demand by providing newer and better equipment. Increased automation is in demand for industrial machinery and miniaturization continues to be in demand for consumer goods</li></ul>
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<p><b>Process Improvement</b></p>	<ul style="list-style-type: none"> <li>▪ In order to survive the onslaught of China, manufacturers are increasingly considering offering value-added services in the areas of logistics and inventory management to achieve shorter lead times. Manufacturers have shrunk the lead times for equipment such as relays from 20 to 25 days to 2 to 3 days to capture additional business and help distributors win more orders. Given the increase in uncertainty in demand, customers have been less willing to place orders in advance. Manufacturers have also increased the amount of inventory they keep on hand for popular product lines</li> <li>▪ Large companies have also made significant efforts to automate several processes. At one manufacturing facility, “computer-controlled trolleys move the motors-in-progress through the assembly line and robots wind the copper wire around the rotors and assemble and weld the finished motor”. The process has slashed production time by more than 90%. They think they have one-tenth of the number of people running these lines compared with rivals in Mexico or China. The challenge is to bring this automation to small manufacturers</li> </ul>
<p><b>Offshoring</b></p>	<ul style="list-style-type: none"> <li>▪ The electrical equipment industry is facing a serious overcapacity problem. This is caused in large part by offshore second- and third-tier suppliers, primarily Chinese, which are beginning to penetrate the U.S. marketplace even though they have no real infrastructure or demonstrable physical presence in the United States itself. But they offer rock-bottom prices. As a result, prices for electrical equipment, such as relays and switches, have dropped between 5% and 10% over the past year, and more price reductions are expected. As a result, U.S. manufacturers are increasingly considering product innovation and customization opportunities to retain customers</li> </ul>
<p><b>Other</b></p>	<ul style="list-style-type: none"> <li>▪ Exploring new markets have become a major concern for small manufacturers. As the computing and telecommunications sectors have contracted, manufacturers are analyzing opportunities in the automotive and industrial markets</li> </ul>



## 8. Printing and Related Support Activities

### I. INDUSTRY DEFINITION:

Industries in the printing and related support activities print products, such as newspapers, books, periodicals, business forms, greeting cards, and other materials and perform support activities, such as bookbinding, platemaking services, and data imaging. The support activities included here are an integral part of the printing industry and a product (a printing plate, a bound book, or a computer disk or file) that is an integral part of the printing industry is almost always provided by these operations.

The printing processes employed include, but are not limited to, lithographic, gravure, screen, flexographic, digital, and letterpress. A rapidly growing new technology uses a computer file to directly "drive" the printing mechanism to create the image and new electrostatic and other types of equipment (digital or nonimpact printing).

This subsection does NOT include publishing.

### II. NATURE OF THE INDUSTRY

#### Historic Location Rationale

- Factors influencing the location of this industry's activities include the distribution and concentration of the population and activity in the economy generally and the advertising and publishing industries in particular
- Customers in most segments tend to use printing services that are relatively close in proximity. The ready availability and low cost of printing equipment, the jobbing nature of most work, and the need for close contact with clients are some factors that tend to keep this industry localized
- The major states in the overall Printing industry in 2001 were California (10.1 percent of industry employment nationally), Illinois (6.7 percent), Pennsylvania (6.1 percent) and New York (5.8 percent)

#### Global Investment Patterns

- The industry has a low level of globalization with a large number of small establishments catering to localized markets or niche markets
- The ready availability and low cost of printing equipment, the jobbing nature of most work, and the need for close contact with clients are some factors that tend to keep globalization low

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"> <li>• The main factor affecting industry performance is the level of economic activity. The printing industry was adversely affected in 2001 by the economic slowdown             <ul style="list-style-type: none"> <li>○ Economy-wide advertising expenditures, which are sensitive to economic conditions, fell and this was reflected in lower demand for magazine, catalogues, inserts and books</li> <li>○ A decline in industrial production adversely affected demand for labels and packaging-related printing</li> <li>○ The decline in sales volumes and strong competition saw profit margins fall</li> <li>○ Recent low real growth in the value of industry shipments reflects a loss of sales in some segments to substitutes (e.g., loss of business forms business to e-commerce and photocopying) and an overall decline in real prices</li> <li>○ Industry consolidation through acquisitions, which was significant up to 2000, slowed appreciably as industry players sought to restructure and rationalize activities in an effort to reduce costs</li> </ul> </li> <li>• There has been strong growth in the quick printing and digital printing segments, which benefited from growth in outsourcing and in the growth of computer penetration in the United States</li> <li>• Developments in substitute technologies (i.e., photocopying equipment, office computer equipment and the Internet) dampened demand for traditional commercial and job printing activities, such as pre-printed invoices and order forms</li> </ul>
Competitiveness	<ul style="list-style-type: none"> <li>• Industry analysts believe that there is over-capacity in most commercial printing markets. Therefore, competition is intense</li> </ul>

Fragmentation	<ul style="list-style-type: none"> <li>• This industry is highly localized and fragmented</li> <li>• With over 30,000 establishments in the U.S. and an average of 24.7 employees per establishment, this industry is dominated by SMEs</li> <li>• In 2002, the largest 4 companies accounted for an estimated 12 % of industry revenues</li> <li>• Since 1997, there has been an increase in industry concentration among large players due to a large number of acquisitions <ul style="list-style-type: none"> <li>○ In 1999, the second and third largest printing companies in the U.S. merged to become the largest printing company in the United States (Quebecor World)</li> <li>○ In May 2003, Moore Corporation Ltd merged with Wallace Computer Services Inc to create a company, named Moore Wallace Inc, with around \$3.6 billion in consolidated annual revenues</li> <li>○ In November 2003, Moore Wallace announced its intention to merge with RR Donnelley</li> </ul> </li> <li>• Larger operators can accrue economies of scale and are able to provide more diverse and value-added services. This should provide larger operators with competitive advantages in the many markets. In the longer term, consolidation may see a rationalization of production capacity with flow-on favorable effects on industry profit margins</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>• The life cycle stage is mature <ul style="list-style-type: none"> <li>○ While volume growth has been strong, falling profit margins has kept down growth in the value of industry shipments, profits, and value added</li> <li>○ Technology in this industry tends to be influenced by suppliers (e.g., equipment manufacturers)</li> <li>○ There has been some consolidation among larger companies</li> <li>○ There is generally market saturation in some industries that represent major market segments, such as magazines and catalog advertising</li> </ul> </li> </ul>

#### IV. KEY INDUSTRY ISSUES

<p>Product Innovation</p>	<ul style="list-style-type: none"> <li>• Technological advancements in printing industry equipment and materials have produced new markets             <ul style="list-style-type: none"> <li>○ Color offset printing has driven demand for color inserts in newspapers</li> <li>○ On-line printing will provide convenience to some customers, drive demand, and potentially lower prices</li> <li>○ Computer technologies provide opportunities for printers to provide additional value added services (e.g., data management)</li> <li>○ New technologies affecting customers and end-markets can also affect demand for some printing services (e.g. decrease in use of bank checks due to new payment systems)</li> </ul> </li> <li>• The pace of innovation is a challenge facing the commercial printing industry. Companies must continually re-invest in new computer-based hardware and software as last year's technology becomes obsolete. To deploy the new technology, the companies must also reinvest in employee training</li> <li>• There will be a trend among printers to seek out value-added markets with higher profit margins, positioning themselves as value-added enablers of knowledge, advising customers on effective and efficient approaches to meet needs for presenting, organizing and deriving value from creative content, information and data. Potential high-value services include: customized printing, convenient quick print, electronic ordering, web page design, CD authoring and printing using specialized substrates, digital printing facilities management, photo CD capture and database management, data asset management, fulfillment and inventory management, design services, e-commerce services, and direct mail</li> <li>• Printers will need to ensure compatibility with customers' systems. They will need to develop closer relationships with customers and take on customers' in-house printing activities; manage customers stocks and providing warehousing of stock, supplies, and data; manage image and information databases; and become a one-stop shop. Printers need to continually improve their productivity to ensure that profit margins do not continue to decline</li> </ul>
<p>Process Improvement</p>	<ul style="list-style-type: none"> <li>• From 1997 to 2002, input costs rose due to an increased demand for more creativity and personalization, more extensive use of color, and faster turnaround. Increased investments were required in state-of-the-art equipment. Competitive pressures saw industry players introduce equipment that provided greater efficiency and utility</li> </ul>

Labor	<ul style="list-style-type: none"> <li>• Labor intensive industry</li> <li>• In 2001, the printing industry's payroll costs represented 26.1 % of the value of shipments, compared to the average for all manufacturing industries of 14.9 %</li> <li>• Because printing occupations are being affected by rapid technological change, skilled labor market conditions are tight. Many people in these occupations may need retraining or upgrading if they are to continue to find employment in the industry</li> <li>• Highly-qualified people in the commercial printing industry today have both traditional graphic arts skills and knowledge and experience in relevant information technologies such as computer-aided typesetting, graphic design software, computer-to-plate technologies and computer-based high speed multi-color press controls</li> <li>• Individuals typically acquire skills via a combination of work-based learning and academic education, usually at the high school and college level</li> </ul>
Offshoring	<ul style="list-style-type: none"> <li>• Import levels for this industry are low (4.8% of domestic demand) but increasing</li> <li>• Export levels are also low (5.1% of industry shipments) and declining slightly</li> <li>• However, the total import competition in this industry may be higher than it appears as imports of final products (e.g., printed books, etc.) are represented in the book and other publishing industries, rather than printing. Hence, while only a small proportion of domestic demand for printing is reflected in imports, the true level of import competition is significantly higher</li> </ul>
Public Policy	<ul style="list-style-type: none"> <li>• Regulatory levels for this industry are low</li> <li>• Industry players are subject to federal, state and local environmental laws</li> <li>• Printers need to be wary of copyright infringements and take measures to prevent copyright issues</li> </ul>

Technology	<ul style="list-style-type: none"> <li>• Technological advancements in printing industry equipment and materials lead to increased product innovation and diversification along with improvements in productive efficiency in labor and capital costs, product quality, production time, and volumes of production</li> <li>• The major technological developments have mainly been focused on printing equipment and printing technologies. Advances in computer-based technology: <ul style="list-style-type: none"> <li>○ Allow for faster and more precise manipulation of images and text prior to printing</li> <li>○ Greatly increased the quality of the final image</li> <li>○ Economically print large production runs (e.g., magazines), thus replacing imports and gravure printing processes</li> <li>○ Integrate value-added services (such as collators, folders, binders and laminating equipment) with printing machinery</li> <li>○ Enable printers to create a document in one location, transfer it via the Internet and then print it at another location, which has reduced storage and transport costs and made more timely delivery possible</li> </ul> </li> <li>• These advances have increased the capital requirements for maintaining technologically advanced equipment <ul style="list-style-type: none"> <li>○ In some segments, the cost of technologically efficient equipment is high</li> <li>○ However, in some segments, such as quick and digital printing, the barriers appear to be lower</li> </ul> </li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• In the major industry segments, contracts between suppliers and customers are long-term and can create a barrier to competition</li> </ul>

## 9. Food Manufacturing (NAICS 311)

### I. INDUSTRY DEFINITION

Industries in the food manufacturing sub sector transform livestock and agricultural products into products for intermediate or final consumption. The industry groups are distinguished by the raw materials (generally of animal or vegetable origin) processed into food products. The food products manufactured in these establishments are typically sold to wholesalers or retailers for distribution to consumers, but establishments primarily engaged in retailing bakery and candy products made on the premises not for immediate consumption are included.

For Pennsylvania, the major sectors that are drivers are:

#### **Sugar and Confectionary Product Manufacturing (NAICS 3113)**

This industry group comprises establishments primarily engaged in manufacturing sugar and confectionery products.

#### **Bakeries and Pasta Manufacturing (NAICS 3118)**

This industry group comprises establishments primarily engaged in manufacturing baked goods. Establishments primarily engaged in manufacturing bakery products, for retail sale but not for immediate consumption, are included. Products included in the group include: bread, crackers, cookies, pasta, and tortillas.

### II. NATURE OF THE INDUSTRY

#### **Historic Location Rationale**

- Manufacturing facilities for food processing tend to cluster near either the raw ingredients (typically farms or grain mills), locations from which distribution markets are easily accessible, or both
- Sugar and confectionery has been a long-term stalwart of the Pennsylvania economy since the founding of Hershey Foods in the early 1900s. While sugar and cacao beans are typically imported from other locations, Hershey was located near the dairy industry, which provided milk products for chocolate

#### **Global Investment Patterns**

- Given low prices, risk of foods perishing, and a number of federal tariffs, there is some level of barrier to entry for foreign products. As a result, imports as a percent of total industry shipments are quite low (typically less than 10%) and food product imports tend to come primarily from Canada or Mexico
- An exception to this general rule is the confectionary products industry, in which labor and sugar pricing differentials between countries are creating incentives for manufacturers to move production offshore
- Global investment patterns due to the nature of the food supply chain have grown through acquisition and agglomeration of multiple regional production and distribution points

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"> <li>• Food industry growth overall has been slow (annual rate of -5 to +5%) in recent years</li> <li>• Mature/declining industry</li> </ul>
Competitiveness	<ul style="list-style-type: none"> <li>• Food product competition varies by category, with national brands competing against private label or store brands in many cases. Competition is highest for commodity categories such as pasta or canned fruits and vegetables</li> <li>• Fairly low barriers to entry on a small scale but high capital investment needed to be a major player</li> </ul>
Profitability	<ul style="list-style-type: none"> <li>• Varies by category and brand – Commodity products have a much lower profit margin than high-end prepared foods</li> </ul>
Fragmentation	<ul style="list-style-type: none"> <li>• Although the biggest firms have clout (the top 10 firms make up 23% of industry sales), the food industry remains fairly fragmented</li> <li>• Food industry overall is consolidating through mergers and acquisitions in an effort to improve economies of scale and create high-margin, growth businesses</li> <li>• Retail customer base is also consolidating and is led by Wal-Mart shifting power from manufacturers to retailers</li> <li>• Many firms practice some level of vertical integration; for example, firms may own and develop crops, which may be grown outside the U.S. Linkages to suppliers, either via ownership or through contracts, ensure raw materials are available at an inexpensive rate</li> </ul>
Consumers	<ul style="list-style-type: none"> <li>• Aging demographics and busy lifestyles have led to a stronger focus on “better for you” foods and easy to prepare “convenience foods”. Consumers seem to be willing to trade up to higher price points for foods that provide health and convenience</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>• Most food products are quite mature and rely on product innovation to drive new growth</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Wal-Mart has become the largest grocer in the U.S. and has strict demands on value, distribution, and new methods, such as RFID, which manufacturers must respond to</li> <li>• Other retailers have also been consolidating</li> </ul>



#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>• Most food products are quite mature and many are commoditized, creating fierce competition and driving down prices</li> <li>• Food manufacturers rely on product innovation to drive new growth. Food companies pour a significant amount of money into new product launches, but only a small percentage of those new products succeed</li> </ul>												
Process Improvement	<ul style="list-style-type: none"> <li>• Industry is looking to improve logistics and supply chain costs to improve profits even as revenues slow</li> </ul>												
Labor	<ul style="list-style-type: none"> <li>• For food products in general, the USDA says that labor is the largest component of food production costs, accounting for 38% of every consumer dollar spent for food</li> </ul>												
Offshoring	<ul style="list-style-type: none"> <li>• An estimated 20-25% of all sugar candy sold in the U.S. is now made outside the country and imported. Industry watchers attribute the shift to other countries to cheaper sugar, lower wages, lower health care costs, and lower utility costs</li> <li>• For most food products, regulation and the need for proximity to ingredients and/or customers due to product spoilage prohibit imports from becoming a major threat</li> </ul> <p><b>Top Export Destinations: 2002:</b></p> <table> <tr> <td>Canada</td> <td>\$2,679</td> </tr> <tr> <td>Japan</td> <td>\$2,075</td> </tr> <tr> <td>Mexico</td> <td>\$1,847</td> </tr> </table> <p><b>Top Import Sources: 2002:</b></p> <table> <tr> <td>Canada</td> <td>\$3,482</td> </tr> <tr> <td>Mexico</td> <td>\$751</td> </tr> <tr> <td>New Zealand</td> <td>\$615</td> </tr> </table>	Canada	\$2,679	Japan	\$2,075	Mexico	\$1,847	Canada	\$3,482	Mexico	\$751	New Zealand	\$615
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Public Policy	<ul style="list-style-type: none"> <li>• U.S. government tariffs on foreign sugar and subsidies on U.S. sugar production create domestic prices that are significantly higher (2-3x) than outside of the U.S.</li> <li>• Tariffs on incoming fruits and vegetables tend to be high to protect local farming</li> <li>• Food industry is highly regulated by the FDA (labeling laws)</li> <li>• Country of Origin and food safety laws are affecting the food industry as are environmental regulations (EPA)</li> </ul>												
Infrastructure	<ul style="list-style-type: none"> <li>• Any research on capital investment, new M&amp;E requirements that would increase productivity, FDA requirements, Homeland security</li> <li>• Water/Wastewater requirements and impact on local wastewater systems that are likely to be old in need of repair causing impact fees to be passed through to the company</li> </ul>												

Technology	<ul style="list-style-type: none"> <li>• Industry is not a technology leader. While technology has improved over time, it has not altered dramatically</li> <li>• Chocolate-making process is fairly high-technology</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Health concerns and an increased level of publicity around childhood obesity could have a negative influence on candy and snack industries</li> <li>• The main growth strategies for the industry are acquisitions, expanding distribution channels or consumer use, and entering international markets</li> <li>• Low volatility in business cycle</li> <li>• Branding and product positioning is a key method used by food manufacturers to differentiate their products from their competitors. The industry is placing greater emphasis on promotion and advertising as it places greater focus on consumer values. This coincides with the increasing range of new products entering the marketplace</li> </ul>

## **10. Wood Product Manufacturing (NAICS 321)**

### **I. INDUSTRY DEFINITION**

The wood product manufacturing sub sector includes establishments that make wood products from logs and bolts that are sawed and shaped and establishments that purchase sawed lumber and make wood products. With the exception of sawmills and wood preservation establishments, the establishments are grouped into industries mainly based on the specific products manufactured.

**For Pennsylvania, driver industries include:**

#### **Sawmills and Wood Preservation (NAICS 3211)**

This industry group comprises establishments whose primary production process begins with logs or bolts that are transformed into boards, dimension lumber, beams, timbers, poles, ties, shingles, shakes, siding, and wood chips. Establishments that cut and treat round wood and/or treat wood products made in other establishments to prevent rotting by impregnation with creosote or other chemical compounds are also included in this industry group.

#### **Veneer, Plywood, and Engineered Wood Product Manufacturing (NAICS 3212)**

This industry comprises establishments primarily engaged in one or more of the following: (1) manufacturing veneer and/or plywood; (2) manufacturing engineered wood members; and (3) manufacturing reconstituted wood products. This industry includes manufacturing plywood from veneer made in the same establishment or from veneer made in other establishments, and manufacturing plywood faced with non-wood materials, such as plastics or metal.

#### **Other Wood Product Manufacturing (NAICS 3219)**

This industry group comprises establishments primarily engaged in manufacturing wood products (except establishments operating sawmills and wood preservation facilities and establishments manufacturing veneer, plywood, or engineered wood products).

### **II. NATURE OF THE INDUSTRY**

#### **Historic Location Rationale**

- Since 59% of Pennsylvania's total land area is forested, forest products industries are a natural component of the state's manufacturing economy
- Proximity to end users or supply chain trading partners is a distinct advantage

#### **Global Investment Patterns**

- Imports of wood and wood products comprise about 20% of total industry revenue

- The ITC has ruled that softwood imports from Canada have injured the U.S. lumber industry. Canadian imports are now subject to a 27% countervailing and anti-dumping duty
- While Canada dominates softwood lumber imports, other countries of origin include Brazil, Germany, Chile, New Zealand, and Sweden
- Russia has about 50% of the world's softwood forests and holds the largest timber reserves of any country. Russia is becoming an increasing source of imports to the U.S. and to China, traditionally one of the U.S.'s largest export markets
- Some of the larger, vertically integrated companies (e.g., Georgia-Pacific, Boise-Cascade, International Paper) have global operations
- Operations for value-added wood products are typically centralized and regional, so overseas operations are rare
- PA exporting approximately 95% of logs outside of the state and 40% to China (from workshop discussion)

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"> <li>• The forest products industry has not grown in recent years as oversupply and lower lumber and paper prices limit revenue growth</li> <li>• Plywood and Oriented Strand Board (OSB) markets remain strong as housing construction remains healthy</li> <li>• Some firms have been divesting or downsizing, as they change strategy from diversification to focus on core businesses</li> <li>• The wood products sector has seen consolidation over the past few years as companies try to boost market share, increase timber acreage, or acquire low-cost production facilities. Thus acquisitions, rather than capital investments, have been the primary growth strategy for wood products companies</li> <li>• Boise Cascade recently acquired Office Max, shifting Boise's focus from commodity paper and wood products markets to the retail market. Other notable transactions include Weyerhaeuser/Willamette and Mead/Westvaco</li> <li>• The industry is not making significant sales to any new market segments, rather it still relies on traditional construction industries while its export sales are falling</li> <li>• The domestic market has displayed very modest growth over the five years between 1997 and 2002, but increased import competition has stagnated growth for local producers</li> </ul>
Competitiveness	<ul style="list-style-type: none"> <li>• Increasing penetration of substitute products has reduced the use of wood in building applications; in addition, imports from Canada and use of substitutes has put price pressure on the industry</li> </ul>

Profitability	<ul style="list-style-type: none"> <li>• The wood and wood products industries continue to suffer from oversupply, lowering prices and limiting companies' profitability. Companies are temporarily reducing capacity in order to better match supply with demand</li> <li>• Higher energy costs have also impacted forest product company profitability in the past two years</li> <li>• The major disadvantage of the wood products industry's cost structure is the fact that purchasing and labor costs are very high in relation to the revenues received. This could only be overcome by 1) investing in the most modern plant and equipment available while closing down inefficient facilities, and 2) integrating operations upstream to logging and/or sawmilling</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>• Mature</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Variations on President Bush's Healthy Forests Initiative have recently passed both houses of Congress</li> </ul>

#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>• Degree of product focus – should firms focus on core products or diversify?</li> <li>• Most wood products are commodities, making pricing volatile with supply and demand changes. Because of this, smaller firms with limited financial resources may not be able to compete</li> <li>• Value-added wood products generally have smaller markets and are, therefore, impractical for larger manufacturers to produce. Smaller companies can develop a profitable niche by offering some of these high value-add specialty products</li> <li>• Due to supply constraints and other factors, the market is shifting from old-growth timber to newer or manufactured wood products</li> <li>• New product introductions have been minimal and sales are heavily reliant on traditional customers (i.e. the housing construction and furniture building industry)</li> <li>• Competition to establish supply contracts with major home, office, shop, factory and other building companies is high. Therefore, a successful manufacturer must supply a good range of products at a competitive price while employing a skilful sales force to negotiate these contracts</li> </ul>
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Process Improvement	<ul style="list-style-type: none"> <li>• Traditionally, this industry has relied heavily on labor; however, greater emphasis on automation over the past five years has prompted more investment in plant and equipment but only by major players</li> <li>• Despite this, reliance on labor is still very high for most producers due to the nature of the products made and a lack of funds available by small producers to invest in automated equipment</li> </ul>																											
Labor	<ul style="list-style-type: none"> <li>• Business expertise of operators - Extensive management skills and an in depth knowledge of the industry is necessary for success since the market for these products is small so all competitive advantages need to be exploited</li> <li>• For millwork, access to good design skills and ability to apply specifications to products is critical to the ensuring manufacture of quality end products</li> </ul>																											
Offshoring	<ul style="list-style-type: none"> <li>• Industry experts expect increasing competition from imports, while exports are threatened by increasing local capacity in traditional export markets</li> </ul> <p><b>For Softwood Lumber:</b></p> <table> <tr> <td>Top Import Sources: 2002:</td> <td>Canada</td> <td>18,076</td> </tr> <tr> <td>(in thousands of cubic meters)</td> <td>Germany</td> <td>961</td> </tr> <tr> <td></td> <td>Brazil</td> <td>703</td> </tr> </table> <p><b>For Veneer, Plywood, and Engineered Wood (% of total value):</b></p> <table> <tr> <td>Top Import Sources: 2002:</td> <td>Canada</td> <td>62%</td> </tr> <tr> <td>(in thousands of cubic meters)</td> <td>Brazil</td> <td>6%</td> </tr> <tr> <td></td> <td>Indonesia</td> <td>5%</td> </tr> </table> <table> <tr> <td>Top Export Destinations: 2002:</td> <td>Canada</td> <td>40%</td> </tr> <tr> <td>(in thousands of cubic meters)</td> <td>Mexico</td> <td>16%</td> </tr> <tr> <td></td> <td>Germany</td> <td>5%</td> </tr> </table>	Top Import Sources: 2002:	Canada	18,076	(in thousands of cubic meters)	Germany	961		Brazil	703	Top Import Sources: 2002:	Canada	62%	(in thousands of cubic meters)	Brazil	6%		Indonesia	5%	Top Export Destinations: 2002:	Canada	40%	(in thousands of cubic meters)	Mexico	16%		Germany	5%
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Public Policy	<ul style="list-style-type: none"> <li>• Increasingly stringent environmental regulations are reducing access to timber resources creating major shifts from plywood and traditional lumber to engineered products</li> <li>• Restrictions of old growth timber harvests in the West have shifted the forest product industry to the South</li> <li>• Other environmental actions affect access to raw materials – Roadless Area Conservation Rule</li> <li>• Bush’s Healthy Forests Initiative likely to increase the wood fiber supply</li> <li>• ITC has imposed duties protecting wood dumping from Canada</li> <li>• NSR clean air rules creating need for major processing changes to meet compliance requirements</li> </ul>																											

Technology	<ul style="list-style-type: none"> <li>• While this is not a high-technology industry, companies using more technologically advanced systems and processes are able to produce higher-quality products at reasonable prices</li> <li>• Technological change has occurred within this industry with a significant level of capital investment. Some plant modernization and increased computerization has taken place</li> <li>• The millwork industry is characterized by poor production techniques and limited equipment availability. The type of machinery used varies substantially between establishments of different age and scale <ul style="list-style-type: none"> <li>○ The large-scale establishments have state-of-the-art equipment to maintain high volumes of output to justify this higher level of capitalization. This new technology requires fewer skilled workers to operate</li> <li>○ The small and medium-scale establishments, which account for approximately 90% of industry revenue, tend to use older equipment and rely largely on the input of skilled labor to complement their operations</li> </ul> </li> <li>• The major technological developments have included: <ul style="list-style-type: none"> <li>○ Some computerization of operations</li> <li>○ Standardizing and simplifying the manufacturing process</li> <li>○ Modular designs that are easier to make as well as being pleasing to the customer</li> <li>○ Some efforts have been made to introduce Just-in-Time inventory control systems</li> <li>○ Regulation and control of noise pollution, solid waste emissions and treatment</li> </ul> </li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Availability of old-growth timber is dwindling</li> <li>• Industry is very sensitive to supply and demand balance</li> <li>• Currently, overcapacity is leading to lower prices and decisions regarding manufacturing capacity</li> <li>• Industry consolidation</li> <li>• Recycling influencing amount and type of raw materials used</li> </ul>

## 11. Converted Paper Product Manufacturing

### I. INDUSTRY DEFINITION

This industry group comprises establishments primarily engaged in manufacturing paper products from purchased paper and paperboard.

### II. NATURE OF THE INDUSTRY

#### Historic Location Rationale

- Since 59% of Pennsylvania's total land area is forested, forest products industries are a natural component of the state's manufacturing economy
- The Mid East region of the U.S. is home to 14.2% of paperboard manufacturing establishments, which is concentrated in New York, Pennsylvania and New Jersey. There has, however, been a shift out of this region since 1997 into the south of the country to be closer to raw materials and alternative markets

#### Global Investment Patterns

- Globalization of the paperboard industry is increasing. The U.S., Canada, Europe, Japan and Australia all have world-class paper producers; several of whom (International Paper, Georgia-Pacific, Stora Enso) have operations within the U.S.
- The majority of other producers are U.S. owned firms and concentrate their business on the local market. Exports and imports are both very low and constant because it is more cost effective for a firm to establish a manufacturing plant overseas than to transport low-value products to distant places

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"><li>• Demand is cyclical and depends on a number of factors: The overall economy, advertising spending, the growth rate of nondurable manufactured goods, inventory levels, and pricing</li><li>• Industry performance is driven mainly by the interaction of supply and demand. Because the sector is so dependent on factors such as global economic health and the industry capacity situation, demand and supply are frequently out of balance</li><li>• For the past two years, revenues in the U.S. have dipped. Paper prices fell, reflecting oversupply and reduced demand due to economic recession, decreases in advertising, and postal increases</li><li>• Manufacturers try to keep supply from greatly exceeding demand by limiting capacity expansion or taking downtime, halting production to allow supply and demand to balance out or to conduct scheduled or unscheduled maintenance</li><li>• Pulp prices rising in the first nine months of 2003, but weak demand meant that paper processors could not pass price increases along to customers</li></ul>
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Competitiveness	<ul style="list-style-type: none"> <li>• Most products in this industry are commodities, and prices are established by the intersection of supply and demand</li> <li>• Smaller firms may lack the financial weight to thrive as major players in commodity markets; many have sought to differentiate their products by offering value-added grades. The smaller markets for value-added products make this avenue less accessible to the larger firms</li> <li>• Major competition comes from substitute products (such as plastics, and polyurethane)</li> <li>• The major barriers to potential entry into paperboard making depend on the size and complexity of the enterprise. It may be fairly easy for a firm to enter the market on a small scale, but the following are barriers to entry: <ul style="list-style-type: none"> <li>○ Sunk capital costs and long lead times required to establish world-class manufacturing facilities at a price-competitive scale (as much as \$300 million for a large paper machine and \$1 billion to build a large integrated pulp and paper facility)</li> <li>○ Large fixed cost base encourages producers to run facilities at high levels to reduce capital cost per ton and generate cash. This creates pricing and earnings pressures for all industry players during times of excess capacity</li> <li>○ Access to distribution channels and low priced wood pulp</li> <li>○ In depth market and standards knowledge</li> <li>○ Stringent environmental protection guidelines</li> <li>○ Limited supply of natural resources</li> </ul> </li> </ul>
Profitability	<ul style="list-style-type: none"> <li>• The industry has remained profitable despite poor market conditions throughout 2001, which improved a little in 2002. Improved returns during the five years to 2002 are due principally to lower raw material and labor costs, especially since 1999. However, profit returns remain constrained by the cost of OCC, fuels and electricity</li> <li>• Paper and forest products are cyclical businesses in which pricing is largely outside of manufacturers' control; therefore, it is crucial for companies to manage their cost structures to remain competitive. Key cost drivers include fiber, energy, and labor, age and efficiency of equipment, operating rates, relative cost of capital, environmental compliance costs, and mill locations</li> <li>• Companies with a greater degree of vertical integration typically have lower cost positions relative to their less integrated peers, which generally translates into higher profitability. A paper and forest products company is vertically integrated if it owns its own timberlands, has energy cogeneration abilities, adds value through additional processing (e.g., converting containerboard into corrugated boxes), and/or controls its distribution channels</li> </ul>

Fragmentation	<ul style="list-style-type: none"> <li>• Compared with other capital-intensive industries, the North American paper industry remains highly fragmented. International Paper, by far the largest paper company in the United States, controls only about 11% of the nation's paper, paperboard, and pulp capacity, and less than 4.0% of global capacity. Thus, while the major players wield some market power, the industry is very competitive overall</li> <li>• In recent years, paper companies have consolidated in order to realign product mix, raise market share, and cut costs by replacing older, less efficient capacity with newer, low-cost operations. By acquiring existing, lower-cost mills rather than constructing "greenfield" mills (new mills built where none existed before), a company increases its own capacity but not that of the industry overall, to the benefit of pricing levels</li> </ul>
Consumers	<ul style="list-style-type: none"> <li>• Major domestic customers include businesses, publishing companies, and consumers</li> <li>• The domestic industry's share of the worldwide market is more than 25%. Most domestic forest products firms derive the majority of their revenues from U.S. sales, with only a portion derived from the export market</li> <li>• Since the mid-1990s, total paper and paperboard exports have accounted for about 10% of the total U.S. paper and paperboard production, up from about 8.0% in 1990. Foreign markets provide the U.S. paper industry with attractive opportunities as a result of reduced trade barriers and strong demographics. Attractive markets include China and Russia</li> <li>• Some of the U.S. industry's key trade partners, particularly those in the Far East and Western Europe, have begun making significant investments in their own world-class production facilities. Therefore, many foreign markets are now reducing their imports of certain paper grades from the United States</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>• The paper industry is mature</li> <li>• Downstream demand has waned due to slowing business activity</li> <li>• The market has become saturated by products and producers</li> <li>• The geographic spread of sales has remained domestically focused in the past five years, although the industry itself has made a significant shift out of the Mid East and New England regions into the south and west of the country to be closer to raw materials and alternative markets</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• With annual shipments of more than \$200 billion, the paper and forest products industry is one of the 10 largest U.S. industries. The paper and paperboard segment typically accounts for about 85% of industry revenues, with wood products representing the remainder</li> </ul>

#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>• The product range made by this industry is very large and new products are often introduced, usually for a specific purpose for a major client</li> <li>• The industry has undertaken some downsizing initiatives as companies shift away from a strategy of offering a diversified array of product offerings toward a low-cost producer strategy, believing that a focused market-share presence in a few highlighted grades leads to a better profit picture</li> <li>• Paper and forest products companies typically maintain a R&amp;D department to focus on identifying innovations and improvements to both processes and products</li> </ul>
Process Improvement	<ul style="list-style-type: none"> <li>• The paper industry has a high level of capital intensity. As the industry tries to maintain its competitive edge against overseas producers, they try to use the most modern technology possible. The results of this capital investment have already had an impact on the industry over the past five years, with labor productivity rising substantially</li> <li>• The industry's cyclical nature makes increasing production capacity challenging; expansion programs are undertaken in the midst of strong industry conditions, but the lengthy construction periods mean that the new capacity typically starts up just as industry conditions begin slowing. When supplies of a paper grade increase just as demand slows, prices tend to decline dramatically</li> </ul>
Labor	<ul style="list-style-type: none"> <li>• The industry directly employs an estimated 1.2 million people in the United States. It has traditionally been fairly labor-intensive; although, labor productivity is increasing as technology improves</li> </ul>
Offshoring	<ul style="list-style-type: none"> <li>• Globalization of the paperboard industry is increasing. The U.S., Canada, Europe, Japan and Australia all have world-class paper producers, several of whom (International Paper, Georgia-Pacific, Stora Enso) have operations within the U.S.</li> <li>• The majority of other paper products producers are U.S. owned firms and concentrate their businesses on the local markets. Exports and imports are both very low and constant because it is more cost effective for a firm to establish a manufacturing plant overseas than to transport low value products to distant places             <ul style="list-style-type: none"> <li>○ Trade in paperboard products is principally within North America. During 2002, imports and exports were mainly exchanged with Canada and Mexico</li> </ul> </li> </ul>

Public Policy	<ul style="list-style-type: none"> <li>• The industry is subject to a variety of federal, state, and local environmental and pollution control laws and regulations <ul style="list-style-type: none"> <li>○ Raw material sourcing has taken on greater complexity in recent years, as timber supply from federal lands has been increasingly curtailed by environmental regulations such as the Endangered Species Act and Roadless Area Conservation Rule. Water, spent chemicals, and other waste from the pulping process must undergo biological and other waste elimination treatment to meet stringent federal (and sometimes state) environmental regulations such as the Clean Water Act and the Cluster Rule</li> <li>○ The Cluster Rule has spawned a considerable amount of capital spending in the paper industry. Environmental spending as a percent of capital outlays made by the US paper industry: <ul style="list-style-type: none"> <li>▪ 14% since the 1980s</li> <li>▪ 21% in 2001</li> <li>▪ 4.2% in 2002 – drop attributable to absence of Cluster Rule deadlines in 2002, expected to rise again as more deadlines approach</li> </ul> </li> <li>○ Industry guidelines: Companies in the paper and forest products industry also operate in accordance with industry guidelines such as the environmental, health, and safety guidelines of the AF&amp;PA</li> </ul> </li> <li>• The protection provided by the U.S. government to paperboard manufacturers is a medium level but very broad in scope since it covers most products produced by the industry. Tariff rates range from 0-1.1% per kg for imported goods</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>• Rising energy costs in recent years have hurt paper industry profitability, as utilities comprise a significant proportion (10%) of the industry's cost structure</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Technology is advanced and is regularly being upgraded by the industry, especially to reduce marginal costs and to improve product quality</li> <li>• These developments have allowed the industry to respond better to changing client packaging needs as their products also evolve over time. They have also reduced labor intensity and raised the overall mechanization across the industry</li> </ul>

Other Comments	<ul style="list-style-type: none"><li>• In coming years, several factors are likely to continue to shape trends on the paper side of the industry. These include:<ul style="list-style-type: none"><li>○ Corporate decisions on manufacturing capacity</li><li>○ Industry consolidation</li><li>○ The choice between an extensive and a narrowly focused product roster</li><li>○ A growing dependence on recycled materials</li><li>○ Increasingly stringent environmental regulations</li><li>○ Changing international marketplaces. The paper sector will battle increased levels of foreign competition, with export markets likely to account for a growing share of revenues</li></ul></li></ul>
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## 12. Machine Shops Industry

### I. INDUSTRY DEFINITION

Machine shops are engaged in machining metal parts on a job or order basis. Generally machine shop jobs are low volume using machine tools, such as lathes (including computer numerically controlled), automatic screw machines and machines for boring, grinding, and milling.

### II. NATURE OF THE INDUSTRY

#### Historic Location Rationale

The machine shop industry is located in Pennsylvania due to the close proximity to related industries such as metalworking and automotives.

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"><li>The industry grew 5.5% in revenue and contributed 6.7% more than the previous year to the Gross Domestic Product from 2001-2002; however, it still is not growing as quickly as the GDP and therefore considered mature</li></ul>
Competitiveness/ Profitability	<ul style="list-style-type: none"><li>Extremely competitive industry. To obtain customers in the machine shop industry, it is necessary for companies to compete on price to win contracts. This drives profit margins way down</li></ul>
Consumers	<ul style="list-style-type: none"><li>Consumers include food processing, packaging, defence, aerospace, pharmaceutical, pulp and paper, oil services, and electronics industries</li></ul>
Life-cycle	<ul style="list-style-type: none"><li>The industry is in the mature stage of its life-cycle due to the fact that it is not growing as fast as the GDP. The number of firms in this industry in the United States has slightly declined over the past 5 years from 23,195 to 23,107</li></ul>
Other Comments	<ul style="list-style-type: none"><li>83 % of the companies in this industry employ less than 20 people, 14 % employ between 20 and 100 people, and 3 % employ more than 100</li></ul>

#### IV. KEY INDUSTRY ISSUES

Product Innovation/ Process Improvement	<ul style="list-style-type: none"> <li>• Due to the competitiveness of the industry, it is essential to the survival of the companies to find ways to machine parts better, faster and cheaper, and to remain competitive, they also need to continually improve its efficiency. Many companies do this through investments such as automation hardware, labor-saving systems and devices, and machines that do more in one setup. All of this can be very expensive</li> </ul>
Labor	<ul style="list-style-type: none"> <li>• The majority of the skilled workers in the machine shop industry are approaching retirement. Specialized machinery requires a highly trained staff, and the number of workers available with these necessary skills, do not meet the current demand. There is little opportunity to replace labor with capital</li> <li>• It is difficult to determine whether or not new applicants into the industry have the correct skill set required to work in the machine shops since there is no standard set of qualifications tied to a title (i.e., a machinist may have a variety of skills that are not consistent with another machinist). Money is being wasted on hiring unqualified workers</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Demand for machine shop services is heavily dependant on the demand for the industries that it supplies (automotive, agriculture, aerospace, etc.); much of the demand for these industries is driven by the economy. When there is a downturn in the economy, interest rates, and financial expectations, the demand for machine shops will be impacted</li> </ul>

## 13. Metalworking Industry

### I. INDUSTRY DEFINITION

The metalworking machinery industry is made up of manufacturing establishments involved in metal cutting and metal forming machine tools; cutting tools; and accessories for metalworking machinery; special dies, tools, jigs, and fixtures; industrial molds; rolling mill machinery; assembly machinery; coil handling, conversion, or straightening equipment; and wire drawing and fabricating machines.

### II. NATURE OF THE INDUSTRY

#### Historic Location Rationale

Pennsylvania is located in the industrial belt of the United States and is centrally located by several industries such as car manufacturers, glass, and plastic. The metalworking machinery industry supplies these industries with molds and equipment. Several suppliers to this industry are also located in this area, and good supplier relationships and a close proximity due to the cost of transportation are essential.

Brand name, reputation and relationships are also important to survival in the industry. Several of the Pennsylvania metalworking machine shops have a long history in the state and to leave the area would be detrimental to the company.

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Competitiveness	<ul style="list-style-type: none"> <li>The competitiveness within the metalworking industry is intense. The industry is comprised of small firms that compete rigorously for customers. This is necessary for survival due to the industry trend of repeat business by customers. To obtain customers, the companies must produce high levels of quality products</li> </ul>
Fragmentation	<ul style="list-style-type: none"> <li>Major Players: <ul style="list-style-type: none"> <li>Kennametal Inc. 5.00% - 5.80%</li> <li>Milacron Inc. 4.00% - 4.50%</li> <li>Lincoln Electric Holdings, Inc. 3.00% - 3.50%</li> </ul> </li> <li>The industry is fragmented into the following service lines: <ul style="list-style-type: none"> <li>Rolling Mill Machinery and Equipment 1.7</li> <li>Machine Tools (Metal Forming Types) 7.2</li> <li>Other Metal Working Machinery 12.2</li> <li>Machine Tools (Metal Cutting Types) 14.6</li> <li>Cutting Tool &amp; Machine Tool Accessories 18.2</li> <li>Industrial Molds 18.3</li> <li>Special Die &amp; Tools, Die Sets, Jigs, &amp; Fixtures 27.6</li> </ul> </li> </ul>
Consumers	<ul style="list-style-type: none"> <li>Car, glass, plastic, cutlery and metal manufacturers</li> </ul>



Life-cycle	<p>The life cycle stage is mature:</p> <ul style="list-style-type: none"> <li>• Customers are sophisticated buyers of goods and services produced</li> <li>• Customers have repeat buying habits</li> <li>• Industry analysis suggests that the industry group is cyclical</li> <li>• Manufacturers provide customers with broad product and service lines</li> <li>• Markets are segmented on the basis of product and services attributes</li> <li>• There are mass selling and distribution channels for goods and services produced</li> <li>• There is production overcapacity within this industry group</li> </ul>
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#### IV. KEY INDUSTRY ISSUES

Labor	<ul style="list-style-type: none"> <li>• Employment and wages levels have decreased between the years 1995 and 2002. Employment declined by 3.3 % per year in this time, while wages contracted by less than 5 % in the same period. Recent years have shown more stability, and from 1997 to 2002, productivity has increased on a per worker basis by 5.3% per year; however, the labor force is still lagging</li> <li>• The metalworking machinery industry needs a specially skilled labor force. There has actually been an increase in the amount of skill necessary for the job due to new computer aided processes; however, there has been a large decline in the number of people entering into this labor pool</li> <li>• Over 50% of the costs of labor are incurred on the manufacturing end of the industry, and they are continuing to increase</li> <li>• On average, \$.14 is spent on capital for every dollar spent on labor</li> </ul>
Offshoring	<ul style="list-style-type: none"> <li>• There has been an increase in globalization; however, due to the high cost of shipping and transportation, firms that are going global are maintaining their local presence but also locating overseas in order to serve the international markets</li> <li>• Less than 25% of domestic demand is satisfied by foreign producers</li> </ul>

Public Policy	<ul style="list-style-type: none"> <li>• Companies within this industry are required to comply with environmental laws and regulations concerning the environment such as discharge of waste, the Clean Air Act, which requires companies to meet air quality standards and gives power to the EPA to establish and enforce the limits on the emission of pollutants such as sulfur and nitrogen oxides, ozone emissions and other toxic materials; and the Clean Water Act, which regulates the discharge of pollutants into the surface water</li> <li>• Firms are also subject to a variety of non-environmental matters such as occupational health and safety, wage, overtime, and dealings with state and federal government agencies</li> <li>• Quality certification is important to receive work from major downstream companies because of their reliance upon continuous, high quality standards in all phases of company operations and customer service</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• The increasing complexity and precision required in stamped metal components, such as automobile body and appliance parts, coupled with the large variety of such components necessary to meet consumer preferences, has required manufacturers to increase the flexibility and efficiency of the machinery used in manufacturing processes</li> <li>• Goods and services must accommodate rapid changes in production schedules and produce profitable batch runs of varying sizes. Therefore, equipment, such as that made by metalworking machinery manufacturing firms, is important to meet the needs of the downstream customers</li> <li>• It is generally considered that firms within this industry group maintain manufacturing facilities with computerized, numerically controlled machining centers, grinding, welding, painting and assembly capabilities</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>• Large cost of capital</li> <li>• The industry is largely affected by fluctuations in the economy. The year of 1998 showed a huge decrease in sales revenue from \$32,546 to \$20,394 that was attributed to the lagging economy. 2002 saw another decrease of 10% of sales. The current economic conditions have been difficult on the industry; and projects for 2003 are for another 10% decrease</li> </ul>

## 14. Other Fabricated Metals

### I. INDUSTRY DEFINITION

This industry comprises establishments primarily engaged in:

- Casting and machining metal valves used to regulate the flow of fluids, liquids and gases, and related fixtures and fittings
- Manufacturing hydraulic and pneumatic pipe and tube assemblies
- Manufacturing ball and roller bearings, and parts, such as bearing races
- Fabricating other miscellaneous metal products

Some of the products made by enterprises in this industry classification are:

- Industrial valves(e.g., gate, globe, check, pop safety, relief)
- Fluid power valves and fittings
- Plumbing fixture fittings and trim
- Aerosol valves
- Plumbing and heating valves
- Hose and tube assemblies (i.e., fluid power, hydraulic and pneumatic)
- Tire valves and parts
- Hose nozzles and couplings
- Ball bearings and parts (including mounted)
- Pillow block units for ball or roller bearings
- Needle bearings and parts
- Races, ball and roller bearing
- Roller bearings and parts (including mounted)
- Fabricated pipe and pipe fittings made from purchased metal pipe
- Ammunition
- Military ordnance and accessories
- Badges
- Pallets
- Chests, fire or burglary resistive
- Industrial patterns
- Firearms and parts
- Safes
- Fireplace equipment
- Metal and enameled metal sanitary ware including sinks, bathtubs, drinking fountains, lavatories, etc.
- Flexible metallic tubing and hose
- Shower rods
- Foil containers (e.g., for bakery goods and frozen foods), made from purchased metal foil
- Soap-impregnated steel wool pads
- Flexible metallic hose and tubing
- Steel wool
- Portable metal ladders
- Trophies (except precious metal)

Metal valves make up about 45% of this industry's revenues. Ball and roller bearings comprise about 10% and pipes and pipe fitting account for 9%. All other products make up the remaining 36% of the industry.

## II. NATURE OF THE INDUSTRY

### Global Investment Patterns

- Both imports and exports are increasing in this industry. Imports from China increased by 35% from 2001-2002 in valves and 22% in other products. Other primary trading partners are Canada, Mexico, and Japan
- Many firms in the valve industry sell globally through exporting, wholly-owned foreign subsidiaries, or licensees
- Firms in many countries manufacture bearings, but North America, Western Europe, and Asia (especially Japan) are the most technically proficient

## III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

Growth/ Consolidation	<ul style="list-style-type: none"> <li>• Revenue declined from 1998 to 2002, probably due to cyclical activity</li> <li>• Demand is driven by capital expenditure on equipment manufacturing, construction, and general business activity. Since this industry sells to other manufacturing and construction businesses, the cyclical activity of those industries directly affects demand for this industry</li> </ul>
Competitiveness	<ul style="list-style-type: none"> <li>• In many metal valve and ball and roller bearing segments, products are highly standardized to fit specifications and competition is primarily price-based. The intense price competition has held down growth in the value of revenues</li> <li>• For other product segments, competition is based on product quality, product performance, and pricing</li> </ul>
Profitability	<ul style="list-style-type: none"> <li>• Because products are standardized and competition is often price-based, profit margins for this industry are generally in the single digits</li> </ul>
Fragmentation	<ul style="list-style-type: none"> <li>• Fragmented - the top four firms account for about 15% of industry revenue</li> <li>• 90-95% of the firms in this industry employ less than 100 people</li> <li>• The bearings segment has gone through extensive restructuring and consolidation over the past decade</li> </ul>

Customers	<ul style="list-style-type: none"> <li>Valves – Major customer segments are typically industrial and include: Chemical and petrochemical, water and sewerage, power generation, oil and gas production, automobile and aerospace manufacturers, and construction</li> <li>Other Products – Customers include automotive, industrial equipment and machinery, aerospace, agricultural machinery, and construction equipment manufacturers</li> <li>Many of these customer industries (e.g. Auto) are currently in decline; the impact of the decline is multiplied to affect this industry as a supplier</li> <li>The government is the largest purchaser of small arms, ammunition, and ordnance. With increased defense spending in recent years, demand for these products has grown. Many countries will only purchase these products from domestic firms</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>Mature:</li> <li>Standardized products, multiple manufacturers, pricing competition, mass market, little innovation, no industry growth over the past 5-6 years</li> </ul>

#### IV. KEY INDUSTRY ISSUES

Product Innovation	<ul style="list-style-type: none"> <li>Operating conditions for most commodity-type products in this industry are very specific, prompting producers to constantly upgrade product designs and production processes while developing superior materials</li> <li>Products are mostly commoditized and compete on price. There are niche or specialization opportunities that can create proprietary expertise and competitive advantage; these opportunities require more highly skilled labor</li> <li>Valves – Developing new products is very important. To innovate, firms are increasing their expenditures on research, development, and technology</li> <li>Products in the small arms, ammunition, and ordnance segments have a high degree of change and development. Technical excellence is an important competitive attribute in this segment</li> </ul>
Process Improvement	<ul style="list-style-type: none"> <li>Customer markets push and challenge valve manufacturers to upgrade and improve product capabilities; the more sophisticated customer requirements become, the greater the need becomes for advanced engineering and machining capabilities</li> <li>Because many products in this industry are highly commoditized, firms are continually aiming to improve product quality and produce better, faster, and cheaper. Improving productivity is essential for firms to remain competitive</li> </ul>

Labor	<ul style="list-style-type: none"> <li>Although the introduction of CAD and other computer aided technologies has reduced the amount of labor required, the industry continues to be labor-intensive. The increased use of computer technology has increased minimum skill levels needed for workers entering the industry</li> </ul>
Offshoring	<ul style="list-style-type: none"> <li>Increasing globalization of valves manufacturing. Imports account for 25% of domestic demand and exports account for 18% of revenue</li> <li>Imports from China increased by 35% from 2001-2002 in valves and 22% in other products. Other primary trading partners are Canada, Mexico, and Japan</li> <li>Many firms in the valve industry sell globally through exporting, wholly-owned foreign subsidiaries, or licensees</li> <li>Firms in many countries manufacture bearings, but North America, Western Europe, and Asia (especially Japan) are the most technically proficient</li> </ul>
Public Policy	<ul style="list-style-type: none"> <li>For countries with which the U.S. has normal trade relations, tariffs are in the 2-5% range</li> <li>Arms and ammunition are taxed at 10% unless they are subject to the National Firearms Act or sold to the U.S. Department of Defense or U.S. Coast Guard. These products may also have high import tariffs and are heavily regulated in terms of sales and use</li> </ul>
Technology	<ul style="list-style-type: none"> <li>Firms are generally emphasizing R&amp;D and CAD</li> <li>Technological change is high because of the complexity of design and the rapidity with which product lines become obsolete due to changing specifications and technological advances</li> <li>The bearings segment is technologically advanced and sophisticated with state of the art production facilities and a wide variety of product offerings. Achieving economies of scale is important for companies with heavy technological investment</li> </ul>
Other Comments	<ul style="list-style-type: none"> <li>Supplier industry to other manufacturers and construction, so their fortunes rise and fall with cyclicalities in those industries</li> <li>Valves and Bearings – Several organizations establish industry-specific or national standards for valve design and performance specs. Valve manufacturers must produce products that meet these specs</li> </ul>

## 15. Furniture Industry

### I. INDUSTRY DEFINITION

This sub sector comprises establishments primarily engaged in the design and manufacturing furniture and related products. The manufacturing processes used in the manufacture of furniture are standard methods of forming materials and assembling components, including cutting, molding and laminating. Design services may be performed by the furniture establishment's own work force or may be purchased from industrial designers. Furniture is classified based on the application for which it is designed. It is also classified according to the component material from which it is made. Furniture may be produced on a stock or custom basis and may be shipped assembled or unassembled (knockdown). Establishments primarily engaged in manufacturing furniture frames and parts are included.

**For Pennsylvania, sectors of this industry that are drivers include:**

#### **Household and Institutional Furniture and Kitchen Cabinet Manufacturing (NAICS 3371)**

This industry group comprises establishments manufacturing household-type furniture, such as living room, kitchen and bedroom furniture and institutional (i.e., public building) furniture, such as furniture for schools, theaters, and churches.

#### **Office Furniture (Including Fixtures) Manufacturing (NAICS 3372)**

This industry group comprises establishments primarily engaged in manufacturing furniture designed for office use, such as office chairs and desks; and office and store fixtures, such as showcases. Establishments primarily engaged in manufacturing furniture parts and frames, for all types of furniture, are also included.

### II. NATURE OF THE INDUSTRY

#### **Historic Location Rationale**

Case goods (wood furniture) manufacturing facilities have traditionally been located near sources of raw materials and skilled artisans. Upholstered furniture facilities are more geographically scattered to be near final users or convenient shipping locations.

Most major manufacturers have regional distribution centers located near clusters of stores, allowing them to deliver promptly, keep products in stock, undertake more efficient production runs, and reduce in-store inventory requirements.

#### **Global Investment Patterns**

Between 1997 and 2002, U.S. furniture imports grew by more than 93%, and the trend isn't slowing: forecast growth for 2003 is 13%. Exports from the U.S. are declining – down 10% in 2002. Strong price competition from imported products has driven many larger manufacturers to establish overseas operations or outsourcing contracts. For example, 25% of Furniture Brands International's sales are from imported products and Furniture Brands has closed more than 16 U.S. plants since 2001 as capacity is outsourced to Asia. Most contracts are set up in dollars or stable currencies, minimizing the impact of currency fluctuations on domestic

manufacturers. Some manufacturers cannot afford the price competition and have been driven out of business.

### III. CURRENT INDUSTRY ENVIRONMENT/ PROFILE

<p>Growth/ Consolidation</p>	<ul style="list-style-type: none"> <li>• Home furniture sales growth at the wholesale level was about 3.8% in 2002. By segment, upholstered furniture was +9.3%, wood +0.1%, and metal and other -2.3%. These numbers reflect improvement after an industry downturn in 2000-2001, driven by a general economic downturn.</li> <li>• The downturn hit the office furniture market harder, with revenues down 19% in 2002 after a 17% decline in 2001.</li> <li>• For 2003, furniture shipments are expected to decrease 2-5%</li> <li>• The low and mid-priced segments of the furniture market are rebounding from the downturn more quickly than high-end items.</li> <li>• The home furnishing business is cyclical. Factors affecting growth include: levels of homeownership, home remodeling and the average size of the home, which drive both new and replacement purchases; interest rates, which affect both housing purchases and financing of furniture purchases; disposable personal income, and consumer confidence levels. Most home furnishings are big-ticket items that are discretionary purchases – consumers usually need to have an optimistic view of the economy and their disposable income before making a purchase.</li> <li>• The office furnishings market is also cyclical, driven by levels of new business formation, nonresidential construction spending, employment levels for office-based work, changes in business expenditures and budgets, and competition, including used furniture which may become more prevalent in a downturn when businesses fail and create a glut of used furniture.</li> </ul>
<p>Competitiveness</p>	<ul style="list-style-type: none"> <li>• Furniture makers compete on product styling and quality, personal service, prompt delivery, price, and product and credit availability. Strong brands and practical or fashionable designs are another effective sales tool.</li> <li>• Strong price competition from imported products has driven many larger manufacturers to establish overseas operations or outsourcing contracts</li> <li>• The wood furniture market is highly diversified, with goods distinguished in terms of types of wood, style, price, and end use.</li> <li>• There are numerous suppliers for most of the raw materials used in this industry, so long-term contracts are not necessary and competitive pricing is the rule. Short-term price increases may have an impact on manufacturers' margins. Because most raw materials are commodities, suppliers to this industry have little leverage and must compete on price.</li> </ul>



Profitability	<ul style="list-style-type: none"> <li>• Net margins for this industry are in the high single digits. An individual company's performance depends on the level of consumer demand, the intensity of its competition, and the degree of cost-cutting the company may have accomplished</li> <li>• Due to the capital intensity of manufacturing operations, companies that have paid off start-up expenses and achieved production economies of scale have a significant cost-per-unit advantage.</li> <li>• Larger retailers have been aggressively promoting on price recently to gain market share, a practice which has penalized profit margins across the industry.</li> </ul>										
Fragmentation	<ul style="list-style-type: none"> <li>• The home furniture <b>manufacturing</b> market is highly fragmented; the top four manufacturers account for about 17% of industry sales in 2002.</li> <li>• In 2002, more than 60% of companies employed less than 10 employees and 86% employed less than 50 employees.</li> </ul> <table border="1"> <thead> <tr> <th>Manufacturer</th> <th>2002 Market Share</th> </tr> </thead> <tbody> <tr> <td>Furniture Brands International</td> <td>6.9%</td> </tr> <tr> <td>LA-Z-Boy</td> <td>6.2</td> </tr> <tr> <td>Ethan Allen</td> <td>2.8</td> </tr> <tr> <td>Bassett Furniture</td> <td>1.2</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>• A number of home furniture manufacturers have exited the business or slimmed down operations in recent years; however, some of the larger manufacturers have consolidated by making acquisitions. As an example, Furniture Brands International acquired Henredon Furniture Industries, Drexel Heritage Furnishings, and Maitland-Smith from LifeStyle Furnishings in 2002, making Furniture Brands the #1 player in home furnishings and helping the financially struggling LifeStyle to exit its operations.</li> <li>• The home furniture <b>retail</b> market is also fragmented, with the top 10 retailers selling only about 14% of total industry revenues.</li> <li>• The office furniture market is much more concentrated, with the six leading companies accounting for more than 70% of the market.</li> <li>• Downsizing has impacted Pennsylvania, as companies such as Hon and Ethan Allen announced Pennsylvania plant closures in 2003.</li> </ul>	Manufacturer	2002 Market Share	Furniture Brands International	6.9%	LA-Z-Boy	6.2	Ethan Allen	2.8	Bassett Furniture	1.2
Manufacturer	2002 Market Share										
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Customers	<ul style="list-style-type: none"> <li>• Channels through which home furniture manufacturers sell are dominated by full-service department stores and multibrand furniture stores. However, single-vendor furniture stores and other nontraditional channels such as warehouse stores are growing. Wal-Mart is now the world's largest furniture retailer</li> <li>• A similar dynamic is happening in office furniture, where retailer consolidation and the growth of office products superstores has shifted channels somewhat and increased competition among manufacturers.</li> <li>• Many of the largest furniture manufacturers either wholly own or maintain some control over their retail distribution (e.g. Ethan Allen both manufactures and has its own brand-exclusive stores). Vertical integration gives these manufacturers the ability to more tightly control costs, quality and service.</li> </ul>
Life-cycle	<ul style="list-style-type: none"> <li>• Mature <ul style="list-style-type: none"> <li>○ Consolidation has begun in the industry</li> <li>○ Industry growth has been lower than GDP growth in recent years</li> <li>○ Innovations tend to be in styling, not entirely new products</li> <li>○ Intense industry competition</li> </ul> </li> </ul>

**IV. KEY INDUSTRY ISSUES**

Product Innovation	<ul style="list-style-type: none"> <li>• Innovation tends to be focused on product variations and styles. While it is unlikely that innovation revolutions will develop products to replace beds or tables, modifications or new products may be developed due to consumers' changing needs. For example, with home computers becoming more prevalent, an increased need for desks or tables to hold computers and peripherals has arisen over the past several years.</li> <li>• As U.S. firms lose the pricing battle to less expensive imported products, U.S. companies may focus more on technological innovation to differentiate themselves from competitors.</li> <li>• Furniture items are often made to measure and it is important for manufacturers to be able to adjust standard products to suit individual requirements.</li> </ul>
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<p>Process Improvement</p>	<ul style="list-style-type: none"> <li>• As larger players have consolidated operations, they have increased their economies of scale also to improve production and business efficiency and reduce costs.</li> <li>• As market size decreases in the office furniture market, competition for market share is increasing. Manufacturers face a buyer's market where price and service are major considerations of the customer. Cost containment and operating efficiencies become even more important factors in meeting increased price competition if a manufacturer is to remain profitable.</li> <li>• In recent years, many manufacturers have emphasized quality by monitoring the entire production process from selection of raw materials to construction and finishing</li> <li>• Most manufacturers are struggling with overcapacity issues, especially as more production moves overseas</li> <li>• The manufacturing process for furniture is capital-intensive, but usually requires short production runs in order to accommodate the great variety of product colors and styles</li> <li>• Manufacturers that have some control over retail distribution often gain competitive advantage</li> </ul>
<p>Labor</p>	<ul style="list-style-type: none"> <li>• Employment in this industry declined 10.5% in 2001 and 4.7% in 2002. From a peak of 683,500 U.S. employees in 2000, employment by the end of 2002 was down to 571,000. Employment declines have been driven by bankruptcies of several manufacturers, improved manufacturing efficiency, and increased offshoring of manufacturing.</li> <li>• Generally, the smaller the establishment, the higher the labor intensity and the lower the capital intensity. Also, higher quality furniture tends to be more labor-intensive</li> </ul>

Off-Shoring	<ul style="list-style-type: none"> <li>The most significant trend in the furniture industry over the last several years has been increased competition from lower cost imported products that have seriously impacted the domestic manufacturing environment, especially for wood furniture products. Top companies have aggressively shifted to a more balanced mix of imported and domestically produced household furniture to take advantage of the savings from lower wage rates in other countries. This production shift has created import growth of more than 13% per year, pushed pricing pressure, forced the closure of many large U.S. plants, and reduced domestic employment for the industry.</li> <li>Although it is usually cheaper and easier to design and produce for local tastes and preferences, more production is being moved outside the United States.</li> <li>Products made in the U.S. are typically sold domestically. While imports account for an estimated 29% of home furnishing sales and more than 15% of office furniture, exports make up only about 3-4% of U.S. manufacturers' sales.</li> <li>Imports of wood furniture from China increased by 25% in 2002. Costs are lower and quality is improving for Chinese products, leading industry analysts to predict that the trend will continue, absent any public policy intervention.</li> </ul> <p><b>For Wood Furniture</b></p> <table> <tr> <td>Top Export Destinations: 2002:</td> <td>Canada</td> <td>\$159</td> </tr> <tr> <td></td> <td>Mexico</td> <td>\$157</td> </tr> <tr> <td></td> <td>U.K.</td> <td>\$19</td> </tr> <tr> <td>Top Import Sources: 2002:</td> <td>China</td> <td>\$1,682</td> </tr> <tr> <td></td> <td>Canada</td> <td>\$598</td> </tr> <tr> <td></td> <td>Italy</td> <td>\$231</td> </tr> </table>	Top Export Destinations: 2002:	Canada	\$159		Mexico	\$157		U.K.	\$19	Top Import Sources: 2002:	China	\$1,682		Canada	\$598		Italy	\$231
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Public Policy	<ul style="list-style-type: none"> <li>Furniture makers are pressing government officials for duties as high as 2.5x wholesale price on wood furniture, hoping to stop what they consider to be dumping of product from China.</li> <li>A proposed new federal emissions standard may require the installation of expensive controls on wood-fired boilers. Compliance with this proposed rule could create significant cost burdens for manufacturers and could have the impact of moving even more production overseas.</li> </ul>																		
Technology	<ul style="list-style-type: none"> <li>Generally in this industry, the larger players benefit from technology advanced equipment as the SMEs may not have the scale to justify the capital expenditure</li> </ul>																		

## **References for Driver Industry Analysis**

IBIS World Reports

S&P Industry Reports

U.S. Census Department

U.S. Department of Commerce

The Freedonia Group

American Furniture Manufacturers Association

Economy.com

Harris Infosource

One Source Site

### **The Websites of:**

State of Pennsylvania

GMIC

Energy Solutions Center

Microsoft

Pilkington

University of Pittsburgh

State of Georgia

BASF

Cannon Communications

Airproducts

Alcoa

Hershey Foods

Expecting The Unexpected -- Passives makers try to peek around the corner as sales, prices, and capacity utilization remain in flux. EBN <http://www.ebnonline.com/>, 26 May 2003.

China's suppliers moving up technology curve to solid-state, EBN <http://www.ebnonline.com/>, 23 June 2003

As prices continue to sink, struggling electromechanical switch and relay vendors seek ways to stay afloat. EBN <http://www.ebnonline.com/>

THE FLEXIBLE FACTORY: Leaning heavily on technology, some U.S. plants stay competitive with offshore rivals, *Business Week*, 5 May 2003

## 5. LIMITATIONS & ASSUMPTIONS

- While all efforts were made to “clean” and test the base data from economy.com, the base data for this analysis is still subject to potential inaccuracies associated with economic projections and aggregations of the Census dataset from which they were derived
- Based on the aggressive time frame of this work, LRD data was not available to conduct the IRC Impact Analysis
- Further investigation and confirmation should be conducted prior to implementation of the recommendations or observations within this report

### A Note on the Gross Product Data

The gross product data that Deloitte used in the Pennsylvania project were obtained from Economy.com. At this point in time they are the only vendor that can deliver gross product data at the county level using the North American Industrial Classification System (NAICS). Framing the research in terms of the NAICS rather than the older, and more familiar, SIC is due to the improved industry definition that occurs with the new system. Additionally, the U.S. economic statistical machinery is rapidly shifting to the NAICS and using this framework makes the report forward looking rather than backward gazing. The cost that is being experienced at the state and regional level by this shift from the SIC to the NAICS is that statistical history is being lost because the federal government is backcasting very little of this data and when they do it is for short time periods. Economy.com is filling the data void by providing the backcasted data.<sup>38</sup>

Questions have been raised about the data Deloitte reported based on the close inspection by the IRCs and their members. In particular, questions arise when the reported data appear to be smaller than expected based on their experience.

This note is intended to offer a better understanding of the data’s uses and limits and to discuss six reasons why reported data can depart from local expectations. Do these six sources of potential error mean that the data are “bad?” No. These are the best data available—in fact, they are the only data available. Because the data are derived from data collected for other purposes and are estimates they will depart from what local experts expect to see.

Six issues relating to the Economy.com gross product data are addressed: (1) the reported data are in 1996 constant dollars, (2) the gross product data are measure of value added—not gross sales, (3) the gross product data are stepped-down estimates from state and metropolitan level data, (4) the gross product data are interpolated by Economy.com from U.S. Bureau of Economic Analysis data based on two digit SIC categories to four-digit NAICS data, (5) the 2002 and 2003 data are projections derived from Economy.com’s regional macroeconomic models, and (6) Multi-establishment firms can have different NAICS classifications for their establishments. Each is a potential source of error or confusion, and are discussed briefly.

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<sup>38</sup> A backcast is a reverse forecast. Because the NAICS did not exist before 2002 all historical data provided are estimates based in part on cross-walk (or conversion) tables that the federal government has, and continues to, develop and in part from statistical information on how SIC industries are divided between several NAICS industries. Aggregation helps accuracy in these conversions so that the backcasts for aggregated NAICS industries are more accurate than for the disaggregated four to six digit NAICS categories.

## **1996 Constant Dollars**

The data are reported in 1996 constant dollars. This is done in economic analysis so that real changes in values can be observed and analyzed, rather than to attribute increases in dollar values due to inflation as being “real.” Therefore, those who think about their business results in current year dollars will see data reported in 1996 inflation-adjusted real dollars and think that they are too small.

## **Value Added**

The gross product data are similar to measures of value added. This would be gross sales, less intermediate purchased goods and services and labor costs. Gross product also differs from reported profits. Since labor costs are typically 70 to 80 percent of gross product costs reported gross product will be much lower than gross sales.

## **Stepped-down Estimates**

Data on value added or gross product are not collected at the county or state level. Even the state gross product data released by the U.S. Bureau of Economic Analysis are estimates produced from national data. Major sources of these data are IRS filings and wage data that are collected by the U.S. Bureau of Economic Analysis. The Bureau of Economic Analysis (BEA) currently reports the state gross product estimates at the two digit level of the SIC. The BEA is expected to produce the first NAICS-based estimates of state gross product during the summer of 2004.

The state gross product estimates are typically stepped down to smaller units of geography, such as a metropolitan area or county, based on that unit of geography’s share of state wage payments in the particular industry. The estimates depend greatly on aggregation bias for their accuracy. The smaller the economy in the unit of geography and the smaller the industry the greater is the probability of error. A third source of error occurs when the local establishment is not typical of the average establishment in the state. It is expected that observed variances between what is reported and what is expected will be the smallest in the largest regional economies. Conversely, the observed variances are expected to be greatest in the smallest geography and in the smallest industries. An additional caution is that because the estimation, or allocation, method typically uses the state data as control totals overestimates in one unit of geography must be accompanied by underestimates in other units of geography in the state.

## **From SIC to NAICS**

As was mentioned above the original gross product data that Economy.com worked with were based on two-digit SIC industries. Economy.com cross-walked the SIC estimates down to four-digit NAICS industries. (The four-digit level of the NAICS is roughly equivalent to the three digit level of the SIC.) The combination of cross-walking the data between SCI and NAICS and then stepping down these estimates to the four digit level of the NAICS are both potential sources of error. The accuracy of these estimates will improve in the summer of 2004 when the U.S. Bureau of Economic Analysis issues its state estimates based on the NAICS.



## **2002 and 2003 Are Based on Projections**

The project used a combination of historical data and econometric projections, all provided by Economy.Com. The data from 1983 to 2001 are all derived from data released by the federal government. While these data are subjected to benchmarking and correction, they all come from statistical reports and are “real.” The data that Deloitte used for 2002 and 2003 are projections that Economy.com makes with their regional econometric models. The models captured the 2001 recession and its slow recovery in the industrial northeast.

## **Multiple Products or Activities within a Company**

Each establishment operated by a company selects its primary NAICS code for reporting, usually based on the largest value of its production or activity at that establishment. Therefore, within a multi-establishment company, each establishment can have separate 4-digit NAICS codes that either represents the product that is made at the facility or the part of the production process that takes place at the facility (such as headquarters, wholesale, transportation, or physical production). Thus, a multi-product, multi-establishment firm’s output is typically split between several different 4-digit NAICS codes; not captured under a single NAICS code. This splitting of a company’s product between NAICS industries can explain why some companies or industries appear smaller in a particular NAICS industry than one might expect.

An example is PPG Industries. PPG’s business activities are recorded as NAICS 3255 (paint, coating, adhesives), 3261 (plastics), and 3272 (glass). PPG’s total output is split between those NAICS, so Deloitte’s analysis of industries by 4-digit NAICS codes would capture that piece of PPG’s output reported for each NAICS. If PPG’s total annual revenue is \$8 billion, but only \$6 billion is reported in NAICS 3261, a reader looking at the report for plastics might think that PPG is under-represented. However, Deloitte’s analysis of plastics only includes the gross product specifically reported as NAICS 3261 and does not include product from PPG’s other businesses.

## 6. THEORY OF CHANGE

An excellent overview of the theory of change is provided by the Program Development and Evaluation website maintained by the Cooperative Extension Program at the University of Wisconsin.

Logic Models are displayed, along with a template, at:  
<http://www.uwex.edu/ces/pdande/evaluation/evallogicmodel.html>

The literature on logic models and the theory of change is listed at:  
<http://www.uwex.edu/ces/pdande/evaluation/evallogicbiblio.html>

Examples of the use of the theory of change exist on websites maintained by several foundations. Otis White produced a short paper titled "A Good Simple Theory for Change" where he attempts to formalize the theory of change for Civic Strategies, an Atlanta based consultancy that works in urban revitalization with foundations:  
<http://www.civic-strategies.com/library/change.pdf>

The Annie E. Casey Foundation has been a leader in the use of change theories in its philanthropic investments. Its theories are outlined in its online publication "Eye of the Storm: Ten years on the front lines of new futures."  
<http://www.aecf.org/publications/eyeofstorm/newfutures.htm>

Carol Hirschon Weiss, "Nothing as Practical as Good Theory: Exploring Theory-Based Evaluation for Comprehensive Community Initiatives," *New Approaches to Evaluating Community Initiatives*, Aspen Institute's Roundtable on Comprehensive Community Initiatives, 1995, p. 65-92.

Michael Quinn Patton, 1997, Chapter 10, "The Program's Theory of Action: Conceptualizing Causal Linkages," pp. 215-238, in *Utilization-Focused Evaluation*, Third Edition, Sage Publications.