

## **INTRODUCTION**

The Center for Economic Development completed its analysis on local high-tech industries in fall 2001. A report titled *High Tech Industrial Activity in Greater Cleveland, 1992-2000* was released in February 2002. It was widely distributed to economic development organizations, universities, government agencies, and private entrepreneurs who are pushing a high-tech agenda for Northeast Ohio.

In this briefing, the analysis is extended to include estimating percentages of technology-oriented workers in each high-tech industry that has a major presence in the Cleveland area. The objective is to identify a leading group of local industries that rank highest in technology-oriented occupation staffing, total employment, and per capita earnings.

## **DATA AND METHODOLOGY**

Occupational staffing data presented in this report was provided by the Bureau of Labor Market Information (LMI) of the Ohio Department of Jobs and Family Services. Total employment and earnings figures were derived from ES202 estimates. All data represents calendar year 2000.

Staffing patterns by occupation for 3-digit SIC industries are only available at the state level. In order to complete the subsequent analysis, it was assumed that Cleveland primary metropolitan statistical area (PMSA) staffing patterns reflect those across the state of Ohio. This assumption is supported by the following statistics: 20 percent of high-tech industrial employment is located in the six-county Cleveland PMSA; 20 percent of working age (18 to 65 years) Ohioans live in the local area; and Greater Cleveland represents about 22 percent of the state economy.

ES202 data are based on quarterly unemployment compensation reports collected by each state under federal mandate. Nearly all employers are required to file unemployment reports to their respective states. The data includes quarterly information on each company's name, address, zip code, county, industrial classification, employment, and earnings. Estimates for employment levels, total earnings, and number of establishments by zip code are developed from this data. One advantage of ES202 data is that it supplies records for each establishment operated by a company. This provides a clearer picture of a company's presence in a geographic area.

## ANALYSIS

### DEFINING HIGH-TECH

According to the Bureau of Labor Statistics (BLS)<sup>1</sup>, an industry is considered high-tech based on the proportion of its scientific, technical, and engineering personnel and on the proportion of the aforementioned personnel engaged specifically in research and development (R&D). Firms that employ significant numbers of these personnel typically design, develop, and introduce new products and innovative manufacturing processes through the systematic application of scientific and technical knowledge.

BLS concludes that industries are high-tech if employment in both R&D and in all technology-oriented occupations<sup>2</sup> account for a proportion of employment that is at least twice the average for all industries in the Occupational Employment Statistics Survey. High-tech industries must employ at least six R&D workers per thousand workers and 76 technology-oriented workers per thousand workers, or 7.6 percent. A subset of high-tech industries, those with ratios at least five times the average, is referred to as high-tech intensive industries. These industries have at least 15 R&D workers per thousand workers and 190 technology-oriented workers per thousand workers, or 19 percent.

In filing ES202 reports, many companies do not segregate their R&D facilities as an independent establishment, especially if it is located on the same property as a manufacturing or headquarters facility. The result is that the staffing information supplied by LMI often does not differentiate R&D employment from technology-oriented employment. Therefore, in this analysis only the 7.6 percent and 19 percent occupation criteria were applied.

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<sup>1</sup> Hecker, Daniel. "High Technology Employment: A Broader View," *Monthly Labor Review*. June 1999, pp. 18 – 28.

<sup>2</sup> Technology-oriented occupations include engineers, life and physical scientists, mathematical specialists, engineering and science technicians, computer specialists, and engineering, scientific, and computer managers.

### **TECHNOLOGY-ORIENTED EMPLOYMENT LEVELS**

Using national criteria, 23 high-tech industries were previously identified as having a major presence in Greater Cleveland.<sup>3</sup> Of this group, 18 meet the technology-oriented employment requirement.<sup>4</sup> Considering that Cleveland is reputed to lag the nation in high-tech employment, it's noteworthy that almost 80 percent of local high-tech industries exceed the national employment criteria.

As seen in Table 1, these 18 industries employed 84,000 workers whose earnings averaged \$51,400 annually in 2000. Aggregating across all industries shows that 19 percent of personnel work in technology-oriented jobs. This is significantly above the high-tech threshold established by the BLS. Especially notable are the top four technology employers: computer services, engineering and architecture, aircraft and parts, and measuring and controlling devices. Aggregating these industries shows that one out of every three workers are employed in a technology-oriented occupation.

Four of the 18 industries stand out in terms of regional employment share. In the chemical sector, paint products, organic chemicals, and miscellaneous chemicals employ 11,000 workers locally. This represents an employment share of 51 percent which is 2.5 times the region's share of working-age adults. In addition, more than one out of three workers in measuring and controlling devices are employed in the Greater Cleveland area.

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<sup>3</sup> R. Sadowski. *High-Tech Industrial Activity In Greater Cleveland 1992 – 2000*. Maxine Goodman Levin College of Urban Affairs, Cleveland State University. February 1, 2002.

<sup>4</sup> Industries not meeting the occupational requirements are plastic materials and synthetics (SIC 282), soaps and cleaners (SIC 284), electrical industrial apparatus (SIC 362), electronic components (SIC 367), and medical equipment and instruments (SIC 384).

## *Technology-Oriented Employment*

**Table 1. High-Tech Industries in the Cleveland PMSA**

<b>SIC</b>	<b>Description</b>	<b>Total Emp</b>	<b>% State Emp</b>	<b>Tech Emp</b>	<b>% Tech Emp</b>	<b>Earnings</b>
737	Computer & Data Processing Services	11,779	17.9%	4,764	40.4%	\$57,778
871	Engineering & Architecture	8,085	23.5%	2,770	34.3%	\$48,187
372	Aircraft & Parts	3,524	18.5%	894	25.4%	\$49,528
382	Measuring & Controlling Devices	6,332	37.5%	1,434	22.6%	\$51,428
366	Communications Equipment	1,958	24.6%	413	21.1%	\$57,424
873	Research & Development	2,870	14.1%	579	20.2%	\$44,581
356	General Industrial Machinery	3,045	13.3%	530	17.4%	\$44,434
281	Industrial Inorganic Chemicals	2,160	26.8%	339	15.7%	\$54,454
285	Paint Products	4,268	73.1%	535	12.5%	\$50,787
355	Special Industrial Machinery	2,580	18.0%	308	11.9%	\$43,825
283	Drugs	758	18.0%	85	11.2%	\$37,903
361	Electrical Distribution Equipment	445	13.2%	47	10.6%	\$34,839
286	Industrial Organic Chemicals	2,148	36.3%	215	10.0%	\$58,264
371	Motor Vehicles & Equipment	18,166	15.7%	1,584	8.7%	\$58,489
874	Management & Public Relations	8,599	21.6%	683	7.9%	\$60,106
289	Miscellaneous Chemicals	4,495	47.1%	347	7.7%	\$46,454
353	Construction Machinery	2,534	19.4%	193	7.6%	\$42,226
357	Computer & Office Equipment	497	7.5%	38	7.6%	\$42,143
<b>Aggregated Total</b>		<b>84,243</b>	<b>20.4%</b>	<b>15,758</b>	<b>18.7%</b>	<b>\$51,400</b>

Notes

Total Emp: Total industry employment in the Cleveland PMSA.

% State Emp: Percentage of industry employment across the State of Ohio that is located in the Cleveland PMSA.

Tech Emp: Total technology-oriented employment in the Cleveland PMSA for the respective industry.

% Tech Emp: Percentage of technology-oriented employees in the Cleveland PMSA for the respective industry.

**LEADING HIGH-TECH INDUSTRIES**

Of the industries listed in Table 1, a group of 10 stand out in terms of total employment, technology staffing, and earnings. In order to be included in this leading group, an industry had to meet at least two of the following criteria: 1) the industry’s total workforce must be greater than the aggregated median value of 2,958 employees; 2) the industry’s technology staffing must be greater than the aggregated median value of 12.2 percent; and 3) per capita earnings must be at or above the aggregated average of \$51,400. Computer and data processing services (SIC 737) and measuring and controlling devices (SIC 382) were the only two industries that met all three criteria (see Table 2).

Within the leading group, representative industry sectors include durable manufacturing (SICs 382, 372, 371, 366, and 356), services (SICs 874, 871, and 737), and non-durable manufacturing (SICs 285 and 281). In addition, half of the leading group has been previously identified as belonging to a Northeast Ohio industry cluster.<sup>5</sup> Motor vehicles, paint products, and inorganic chemicals are classified as driver industries in that they fuel the regional economy and its growth due to the quantity of exports out of the region, employment concentration, and other factors. Computer and data processing and measuring and controlling devices are classified as emerging industries in that they offer substantial growth opportunities based on the existing companies and resources in the region, as well as global industry growth.

**Table 2. Leading High-Tech Industries in Greater Cleveland**

SIC	Description	Total Emp	Tech Emp	% Tech Emp	Earnings
737	Computer & Data Processing Services	11,779	4,764	40.4%	\$57,778
382	Measuring & Controlling Devices	6,332	1,434	22.6%	\$51,428
874	Management & Public Relations	8,599	683	7.9%	\$60,106
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371	Motor Vehicles & Equipment	18,166	1,584	8.7%	\$58,489
366	Communications Equipment	1,958	413	21.1%	\$57,424
356	General Industrial Machinery	3,045	530	17.4%	\$44,434
285	Paint Products	4,268	535	12.5%	\$50,787

<sup>5</sup> Northeast Ohio Regional Economic Development Strategies Initiative, Clusters Project, June 1998.

281	Industrial Inorganic Chemicals	2,160	339	15.7%	\$54,454
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**TECHNOLOGY-ORIENTED OCCUPATIONS**

Table 1 shows that approximately 16,000 employees work in technology-oriented occupations. These occupations can be broken out into eight general categories: technology management, computer specialists, engineers, engineering technicians, physical scientists, science technicians, healthcare, and sales. As seen in Table 3, engineers and engineering technicians account for over half of the employees. Computer specialists account for another 28 percent.

Although engineering-related professionals are found working in all 18 high-tech industries, the majority work in durable manufacturing and the service sector. The largest industry employers are engineering and architecture (2,191 employees), motor vehicles (1,518 employees), measuring and controlling devices (1,085 employees), and aircraft and parts (844 employees).

In contrast, computer-related employment is concentrated in a small group of high-tech industries. Computer and data processing accounts for 88 percent of the employees. Engineering and architecture and measuring and controlling devices also employ a relatively large number of computer specialists.

**Table 3. Technology-Oriented Occupations**

SOC	Description	Emp Level	% Tech Emp
<b>Technology Management</b>			
11-3021	Computer & Information System Managers	418	
11-9041	Engineering Managers	575	
	<b>Total</b>	<b>993</b>	<b>6.3%</b>
<b>Computer Specialists</b>			
15-1011	Computer and Information Scientists	24	
15-1021	Computer Programmers	1,497	
15-1032	Computer Software Engineers	518	
15-1041	Computer Support Specialists	1,081	
15-1051	Computer Systems Analysts	719	
15-1081	Network Systems & Data Communication Analysts	285	
15-1099	Computer Specialists, All Other	338	
	<b>Total</b>	<b>4,462</b>	<b>28.3%</b>

## *Technology-Oriented Employment*

**Table 3. Technology-Oriented Occupations (Continued)**

SOC	Description	Emp Level	% Tech Emp
<b>Engineers</b>			
17-2000	Engineers	3,061	
17-2011	Aerospace Engineers	33	
17-2041	Chemical Engineers	56	
17-2051	Civil Engineers	754	
17-2061	Computer Hardware Engineers	47	
17-2071	Electrical Engineers	488	
17-2072	Electronics Engineers	190	
17-2081	Environmental Engineers	157	
17-2112	Industrial Engineers	478	
17-2131	Materials Engineers	19	
17-2141	Mechanical Engineers	1,102	
	<b>Total</b>	<b>6,385</b>	<b>40.5%</b>
<b>Engineering Technicians</b>			
17-3021	Aerospace Engineering Technicians	22	
17-3022	Civil Engineering Technicians	300	
17-3023	Electrical Engineering Technicians	470	
17-3025	Environmental Engineering Technicians	67	
17-3026	Industrial Engineering Technicians	55	
17-3027	Mechanical Engineering Technicians	153	
17-3099	Engineering Technicians, All Other	1,144	
	<b>Total</b>	<b>2,211</b>	<b>14.0%</b>
<b>Physical Scientists</b>			
19-2031	Chemists	518	
19-2041	Environmental Scientists	84	
	<b>Total</b>	<b>602</b>	<b>3.8%</b>
<b>Science Technicians</b>			
19-4031	Chemical Technicians	620	
19-4091	Environmental Science Technicians	33	
19-4099	Life & Physical Science Technicians, All Other	44	
	<b>Total</b>	<b>697</b>	<b>4.4%</b>
<b>Healthcare</b>			
29-1111	Registered Nurses	138	
29-9199	Health Technicians, All Other	52	
	<b>Total</b>	<b>190</b>	<b>1.2%</b>
<b>Sales</b>			
41-9031	Sales Engineers	218	
	<b>Total</b>	<b>218</b>	<b>1.4%</b>

**Notes**

SOC: Standard Occupational Classification Codes, U.S. Department of Labor, Bureau of Labor Statistics.

To be included in an industry-specific LMI staffing pattern table, the occupation required a minimum employment level of 100. In many industries, a specific engineering discipline had less than the required level. In this case LMI combined all those engineering disciplines under a generic SOC code: 17-2000 Engineers.

Many SOC codes in Table 3 show less than 100 employees. These figures represent employment estimates at the PMSA level. The LMI employment rule reflects employment figures at the state level.