

IN the Spotlight

High-Tech: A Product, a Process, or Both?

There is no universally accepted definition of “high-tech,” nor is there a standard list of industries considered to be high-tech. Today nearly every industry contains some element of technology, and even the most technologically intensive industry will include low-tech elements.

Nevertheless, several groups have developed lists of industries they consider high-tech using U.S. Standard Industrial Classifications (SIC). The breadth of these lists depends on two factors: 1) the goals of the organization and its customers and 2) whether the organization ascribes to the argument that only industries that *produce* technology can be considered high-tech or to the argument that industries that *use* advanced technology processes can also be categorized as high-tech.

Any industry-based definitions of high-tech will be imperfect, but none of the definitions discussed here should be considered incorrect. The important factor to consider is the

perspective from which any list is derived.

Most high-tech industry classifications have common elements, yet may vary significantly in scope. Let’s consider four classifications of high-tech industries developed by the following respected and often quoted organizations (see Table 1 on page 2): the American Electronics Association (AEA), RFA (formerly Regional Financial Associates), One Source Information Services Inc. (formerly Corp Tech) and the U.S. Bureau of Labor Statistics (BLS).

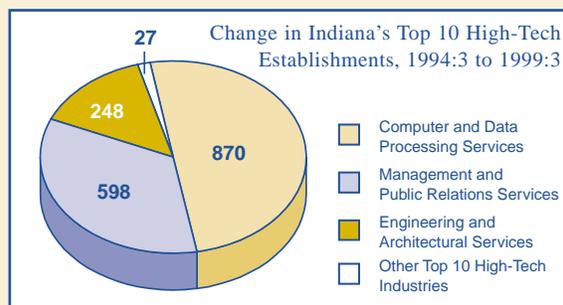
The different missions of these four organizations influence how they define high-tech. AEA is a trade association made up of mostly electronics and information technology companies. Its members generally produce technology and ascribe to the limited definition of high-tech based only on the nature of an industry’s product rather than its process. RFA is a national consulting firm. Its clients

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High-Tech Industries Are Highlighted in This Issue



Indiana
Unemployment Rate
for April 2000:
3.4%
Up Slightly from
2.9% in April 1999

Table 1: Four Definitions of High-Tech Industries

Sectors	AEA	RFA	One Source	BLS	Sectors	AEA	RFA	One Source	BLS
Industrial Inorganic Chemicals			x	x	Misc. Electrical Equipment and Supplies			x	
Plastics Materials and Synthetics				x	Motor Vehicles and Equipment			x	x
Drugs		x	x	x	Aircraft and Parts			x	x
Soap, Cleaners and Toilet Goods			x	x	Ship and Boat Building and Repairing			x	
Paints and Allied Products			x	x	Railroad Equipment			x	
Industrial Organic Chemicals				x	Guided Missiles, Space Vehicles and Parts			x	x
Agricultural Chemicals			x	x	Search and Navigation Equipment	x	x	x	x
Misc. Chemical Products			x	x	Measuring and Controlling Devices	x	x	x	x
Petroleum Refining				x	Medical Instruments and Supplies	x	x	x	x
Fabricated Structural Metal Products			x		Ophthalmic Goods			x	
Metal Forgings and Stampings			x		Photographic Equipment and Supplies	x	x	x	x
Ordnance and Accessories, NEC			x	x	Watches, Clocks, Watchcases and Parts			x	
Misc. Fabricated Metal Products			x		Telephone Communications	x		x	
Engines and Turbines			x	x	Telegraph and Other Communications			x	
Farm and Garden Machinery			x		Cable and Other Pay Television Services			x	
Construction and Related Machinery			x	x	Communications Services, NEC	x	x	x	
Metalworking Machinery			x		Electric Services			x	
Special Industry Machinery			x	x	Gas Production and Distribution			x	
General Industrial Machinery			x	x	Combination Utility Services			x	
Computer and Office Equipment	x	x	x	x	Water Supply			x	
Refrigeration and Service Machinery			x		Sanitary Services			x	
Misc. Industrial and Commercial Machinery			x		Misc. Wholesale Trade Durable Goods			x	
Electric Distribution Equipment				x	Computer and Data Processing Services	x	x	x	x
Electrical Industrial Apparatus				x	Medical and Dental Laboratories			x	
Household Audio and Video Equipment	x		x	x	Engineering and Architectural Services			x	x
Communications Equipment	x	x	x	x	Research and Testing Services		x	x	x
Electronic Components and Accessories	x	x	x	x	Management and Public Relations			x	x

Source: Compiled by the National Association of State Development Agencies and the Indiana Department of Commerce

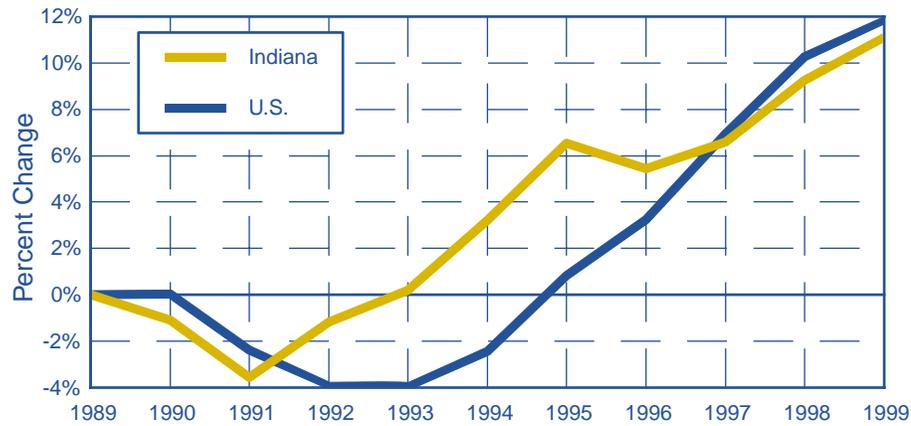
Table 2: Four Perspectives on High-Tech Employment, 1989 and 1999

United States	AEA	RFA	One Source	BLS
1989 High-Tech Employment	4,049,398	3,830,998	13,033,440	9,029,400
1999 High-Tech Employment	5,008,666	4,817,666	14,834,912	10,416,100
Growth in High-Tech Employment 1989-99	24%	26%	14%	15%
Net Job Change 1989-99	959,268	986,668	1,801,472	1,386,700
Indiana	AEA	RFA	One Source	BLS
1989 High-Tech Employment	81,705	69,356	364,142	234,548
1999 High-Tech Employment	74,787	75,674	412,056	274,899
Growth in High-Tech Employment 1989-99	-8%	9%	13%	17%
Net Job Change 1989-99	-6,918	6,318	47,914	40,351

Source: U.S. Bureau of Labor Statistics

Figure 1: High-Tech Employment Growth since 1989

Data include high-tech industries from all lists (AEA, RFA, One Source, BLS)



Source: Compiled by the Indiana Department of Commerce using U.S. Bureau of Labor Statistics data

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(continued from page 1)

include builders and contractors, banks, insurance companies, financial services firms and government. The industries with the greatest growth potential and those reflective of their clients' interests are included in RFA's list of high-tech industries. While both AEA and RFA have narrowly defined high-tech, One Source and BLS use broader definitions that include industries with both high-tech products and processes.

One Source gathers and sells corporate information on technology firms for use in sales and marketing. As it has built its database of firms, One Source has expanded its list of what should be considered a high-tech industry. BLS is a federal agency responsible for collecting and analyzing data on the national labor force. It has defined those industries with the highest concentration of technology-based occupations, such as

scientists and engineers, as high-tech industries.

Combining these four definitions, Figure 1 compares high-technology employment growth in Indiana and the United States. Using 10 years of BLS data (1989 to 1999), we can illustrate how different definitions of high-tech can show vastly different results (see Table 2 and Figure 2). The data are sorted at the three-digit SIC level.

The Trade Association: AEA

AEA recently released *Cyberstates 4.0*, its annual report on technology employment, based on AEA's limited definition of high-tech industries, which fall into three categories: 1) computer, communication, and electrical equipment, 2) communication services and 3) computer related services.

AEA's list is the most restrictive of the four classifications. Absent from the list are areas such as drug manufacturing, robotics, and research and

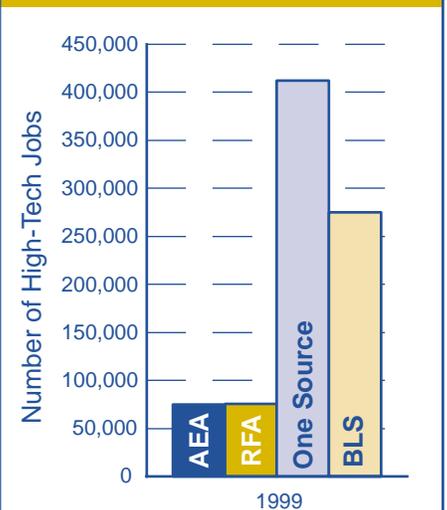
testing operations. Using the AEA classification, total U.S. high-tech employment grew 24% since 1989, while Indiana sustained a loss of 8% (approximately 7,000 jobs).

The AEA results for Indiana, however, clearly illustrate the vagaries of high-tech classifications. AEA's results are largely dictated by employment changes in Indiana's household audio and video equipment sector. This is in part due to global markets drawing plants to less-expensive labor markets. However, in Indiana, reclassification of companies had a much greater impact during the period being reported. The largest reclassification occurred in 1995 when Delphi Delco Electronics Systems in Kokomo was moved out of electronics and into motor vehicles by BLS. Delphi Delco-Kokomo produces the Electronic Powertrain Control Module, which incorporates state-of-the-art computer technology to

(continued on page 4)

Figure 2: High-Tech in Indiana, 1999

Four perspectives



Source: Compiled by the Indiana Department of Commerce using U.S. Bureau of Labor Statistics data

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measure and control the engine and automatic transmission. With this reclassification, the approximately 9,500 high-skill jobs designing and producing automotive electronics were no longer reflected in the AEA results. Without this reclassification, Indiana would have added 2,582 high-tech jobs for a growth rate of 3.2% versus the decline shown in the AEA study.

According to AEA, Indiana's strongest high-tech industry, in terms of growth, is computer and data processing services.

The Consulting Group: RFA

RFA's high-tech sectors are similar to those selected by AEA. However, RFA does not include household audio and video equipment or telephone communications, but adds drugs and research and testing services.

Under RFA's classification, Indiana's high-tech employment shows a net increase of more than 6,000 jobs since 1989, whereas AEA showed a net loss of approximately the same amount for the same time period. According to RFA, Indiana high-technology sector employment has increased every year except one since 1995. By changing just two industries, RFA data paint a far rosier picture of Indiana's high-tech economy than AEA data.

Information Provider: One Source

Unlike the short lists compiled by AEA and RFA, the One Source list classifies 48 sectors as high-tech. Major additions include a number of manufacturing industries, such as metal products and transportation equipment, and several service industries.

Using a list with such a diverse collection of industries, high-tech in

Indiana takes on a much different appearance. Under the One Source definition, Indiana has a greater share of employment in high-tech sectors than the United States and an employment growth rate nearly equal to the U.S. rate. Indiana does best in the manufacturing sectors, showing gains in 22 of 33 sectors with a net increase of 31,287 jobs between 1989 and 1999. Motor vehicle and equipment employment represents the largest share of employment growth (includes firms previously coded under electronics).

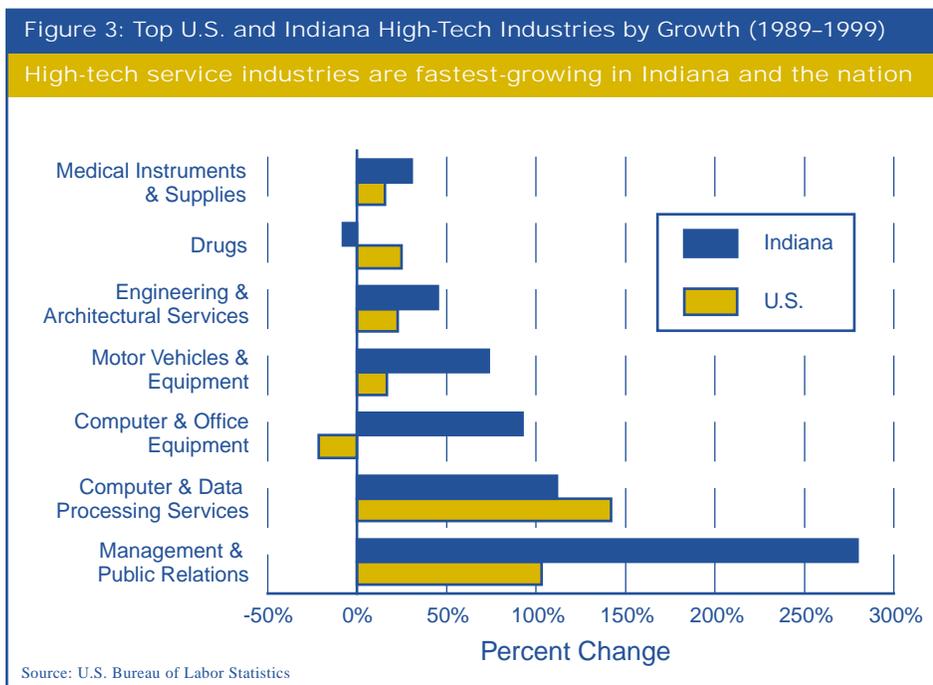
Even excluding manufacturing, Indiana still had a net gain of 15,364 jobs, mostly concentrated in computer and data processing services and business services. Both the engineering and architectural services and management and public relations sectors showed strong growth, gaining more than 11,500 jobs.

The Research Group: BLS

As with One Source, Indiana does quite well using the BLS sectors. Since 1989, Indiana has seen a net gain of more than 40,000 jobs and a growth rate of 17%, exceeding the U.S. rate of 15%. Indiana accounts for 2.6% of national employment for these sectors. High-tech service industries are fastest-growing in Indiana and the nation (see Figure 3).

BLS has further refined its high-tech industry definition by separating sectors into two groups. Those industries with a high concentration of research-oriented occupations are labeled *intensive*, while those with a lower concentration are considered *non-intensive*. This two-tiered structure

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April Rate Drop Could Indicate Slightly Slower Economic Growth

Indiana's unemployment rate fell to 3.4% in April, a decline of two-tenths of a percentage point. April normally sees a decline in the rate, as construction work begins to pick up for the approaching summer. The U.S. rate came down, too, from 4.3% in March to 3.7% in April.

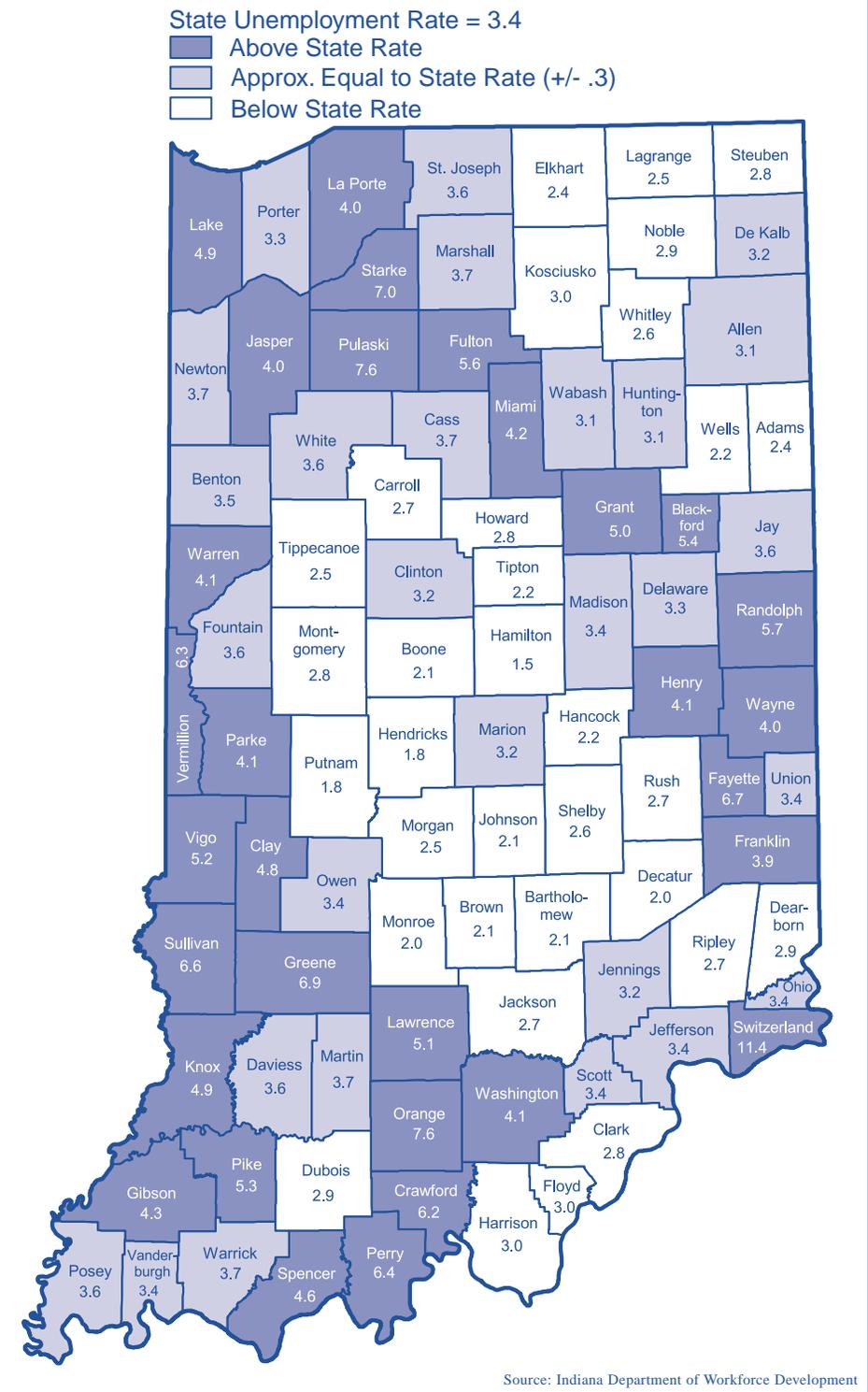
The drop in Indiana's rate, however, was less than in prior years. In 1999, the rate declined four-tenths of a percentage point from March to April, and in April 1998 the rate tumbled half a point.

The fact that the rate did not decline as much this year may not be significant. The difference from previous years is not large. But it's also true that Indiana's unemployment rate was slightly higher this March than in March 1998 and 1999. The total number of unemployed workers stayed at 104,800 in April, higher than April in either of the last two years.

The path of the state's unemployment rate over the next two months will reveal whether the federal government's efforts to slow the U.S. economy are starting to have an effect. On the other hand, we may find no statistically significant change. The low unemployment rates of recent years may not really have changed.

Figure 1: April Unemployment Rates by County

The national unemployment rate for April was 3.7%



Personal Income Growth Accelerated During 1999

Quarterly personal income figures released by the U.S. Department of Commerce show Indiana's economy advanced at a torrid 7.5% annual rate in the last quarter of 1999. The nation grew by 5.1% in the same period. Indiana's growth was 12th among the 50 states (see Figure 1).

In the 40 quarters that made up the 1990s, Indiana had 35 periods of positive growth compared with 36 positive quarters for the nation. Utah,

Oregon, New Mexico and Nevada led the nation with only one down quarter in the entire decade. Hawaii and North Dakota, by contrast, had only 25 positive quarters.

Over the entire decade, Indiana averaged a 2.95% growth rate compared with the nation's 3.02% average increase. This record put the Hoosier state in 27th place among the 50 states, just behind Illinois and Delaware and just ahead of Virginia

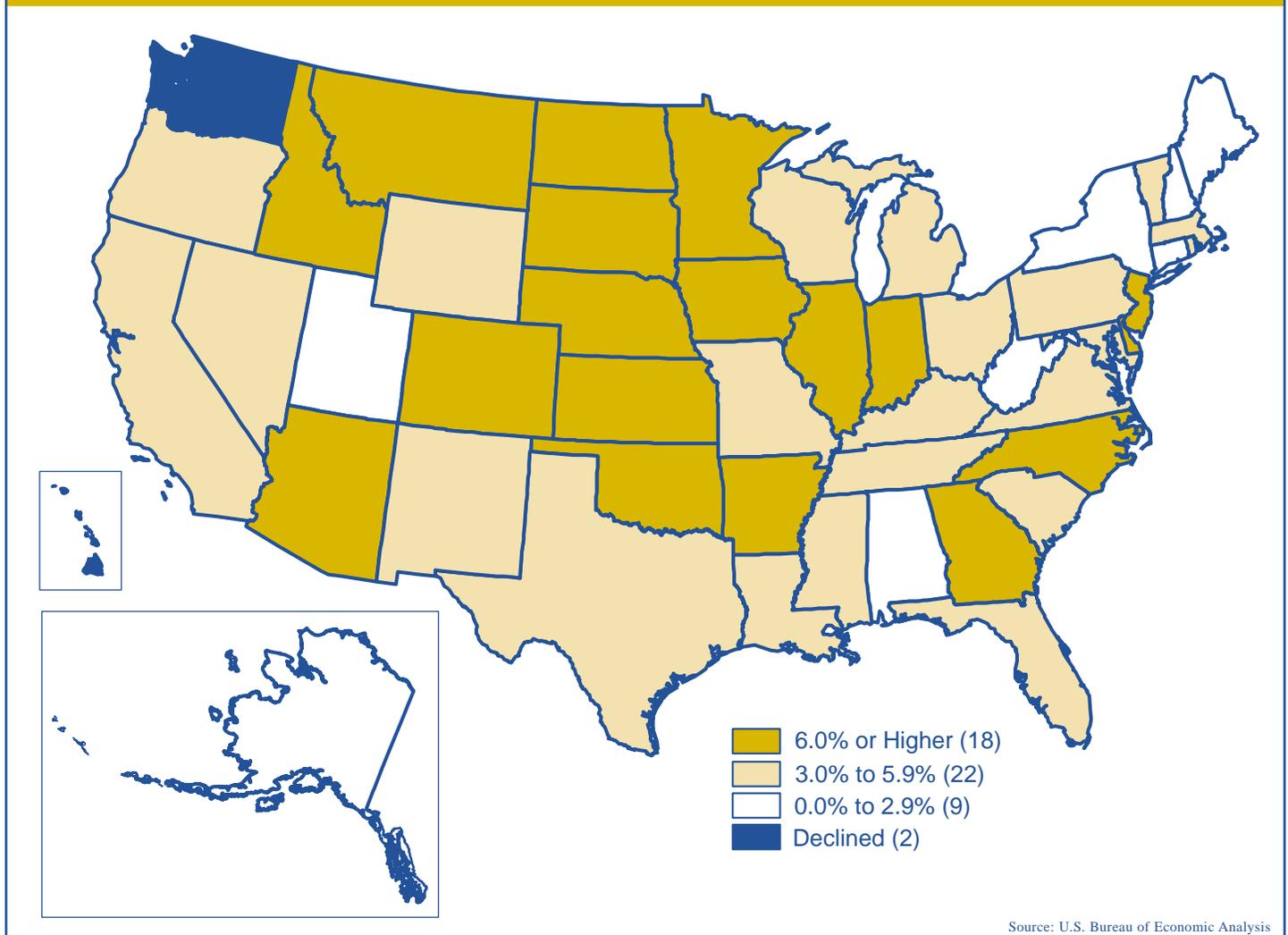
and Massachusetts.

Perhaps the most volatile component of personal income is farm proprietors' earnings. This residual tends to reflect swings in market conditions as well as the irregular patterns of federal government subsidy payments. When nonfarm earnings alone are considered, the story of Indiana's 1999 economy is somewhat different.

Figure 2 shows that total real personal income in the Indiana

Figure 1: Percent Change in Real Total Personal Income

Fourth quarter 1999 at annual rate



Source: U.S. Bureau of Economic Analysis

economy (that is, adjusted for inflation and including the farm sector) was flat in the first quarter but came on strongly during the year to surpass the nation in the fourth quarter. But when the farm sector – which accounts for less than 1% of the total – is excluded, the results are very different.

In Figure 3, nonfarm personal income is more stable at both the state and national levels. But here Indiana's weak quarter is the second of the year, when the nation shows a slowdown in its growth rate. As the nation resumed a higher growth path in the last half of 1999, Indiana's economy responded with performance that approached and then exceeded the nation's.

This pattern of economic change is driven by the importance of durable-goods manufacturing in Indiana's economy. At the close of 1999, 22% of the income earned by Hoosiers (either through self-employment or working for others) originated in manufacturing of durable goods; nationally 10% of earnings are derived from that sector. Although durable-goods manufacturing did not lead Indiana's earnings growth (that honor went to agricultural services), it did provide Indiana's competitive advantage for 1999.

Figure 4 shows that the greatest positive difference between earnings growth in Indiana and in the nation was in the manufacture of durable goods. The largest negative difference (the bottom of the chart) was in farming. A careful examination of Figure 4 shows that, aside from mining, which had a decline in earnings, durable goods manufacturing provided Indiana with earnings growth greater than the national rate.

Figure 2: Real Personal Income, 1999

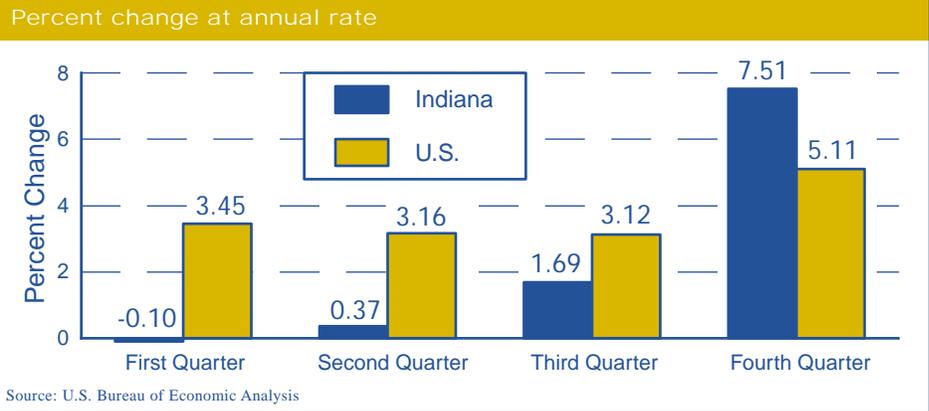


Figure 3: Real Nonfarm Personal Income, 1999

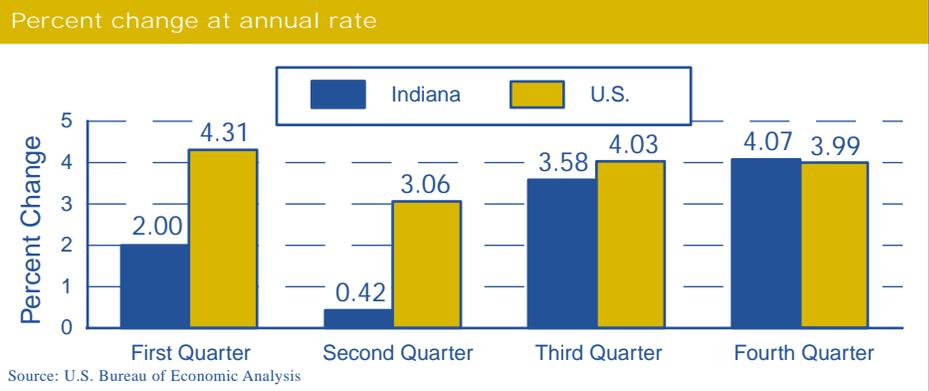
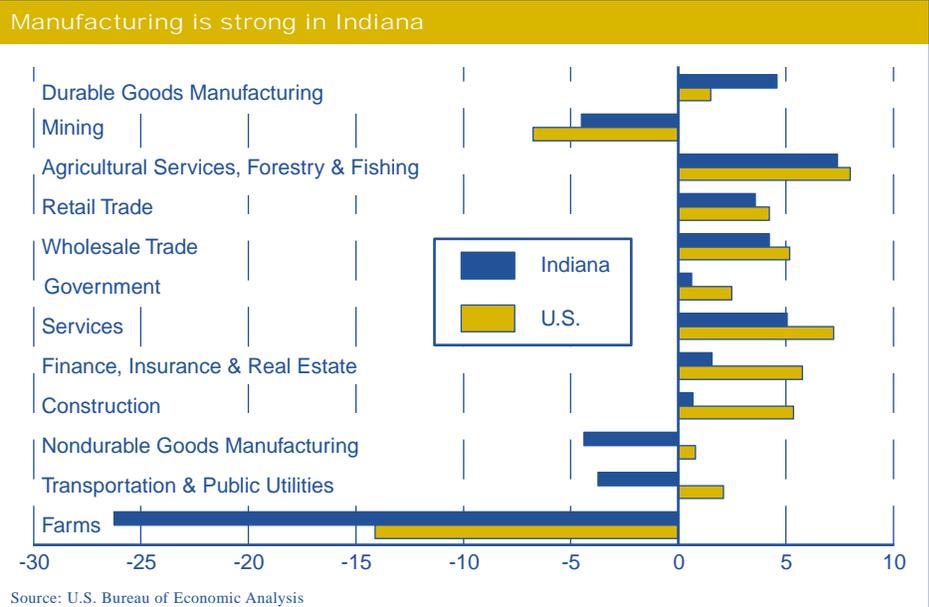


Figure 4: Percent Change in Earnings, 1998:4 to 1999:4



More Jobs in Services Lead to Record April Employment

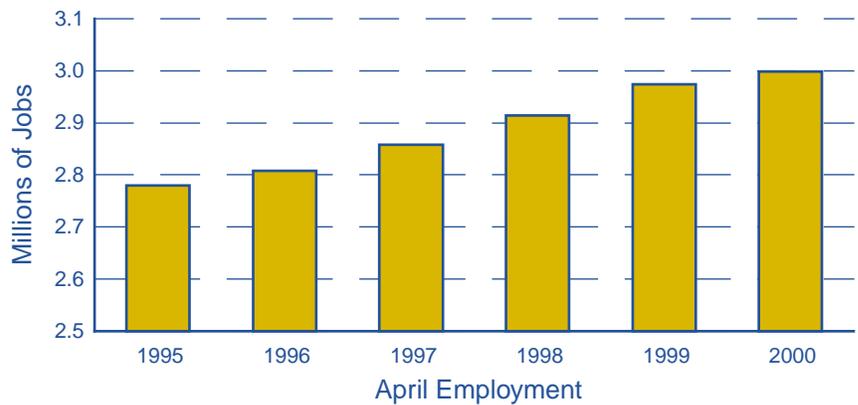
Employment in Indiana rose to 3 million jobs in April, a new record for the month. Non-farm employment was up 1% from April 1999 (see Figure 1).

The year-to-year increase occurred mainly in two sectors: services and

manufacturing. Employment in services industries increased by 10,500 jobs, counting part-time positions. The category known as business services, which includes computer software companies as well as building maintenance firms, added 3,400 jobs.

Figure 1: Indiana Nonfarm Employment, April 1995–2000

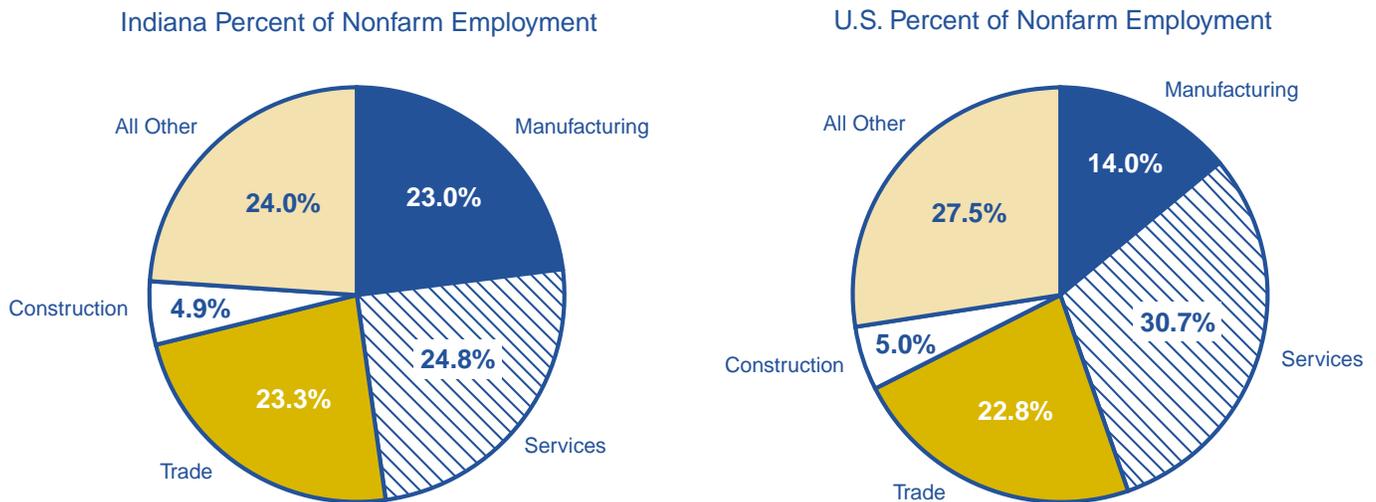
April 2000 was the highest April on record



Source: Indiana Department of Workforce Development

Figure 2: Mix of Nonfarm Employment, April 2000

Indiana has a higher proportion of manufacturing jobs than the U.S. average



Source: Indiana Department of Workforce Development

Health services were up by nearly 2,000. (All data are non-seasonally adjusted.)

Manufacturing employment continued to be strong in Indiana. Compared to the same month a year ago, there were 3,000 more manufacturing jobs in the state. Transportation equipment manufacturing expanded 4%, representing a net increase of 4,800 jobs. The chemicals industry added 1,000 jobs. Other manufacturing sectors showed slight declines. Primary metal industries accounted for 1,700 fewer jobs this year, and jobs in industrial machinery manufacturing were down by 1,000.

Retail and wholesale trade employment rose by 2,800 jobs, mostly in durable goods wholesaling. Restaurant jobs, on the other hand, were down almost 4,000 after peaking last year. Still, restaurant employment was 1.1% higher than two years ago.

Employment with the federal government jumped by 6,000 jobs

from April of last year. Much of that increase is attributable to the hiring of temporary workers for the census.

Indiana's Different Mix

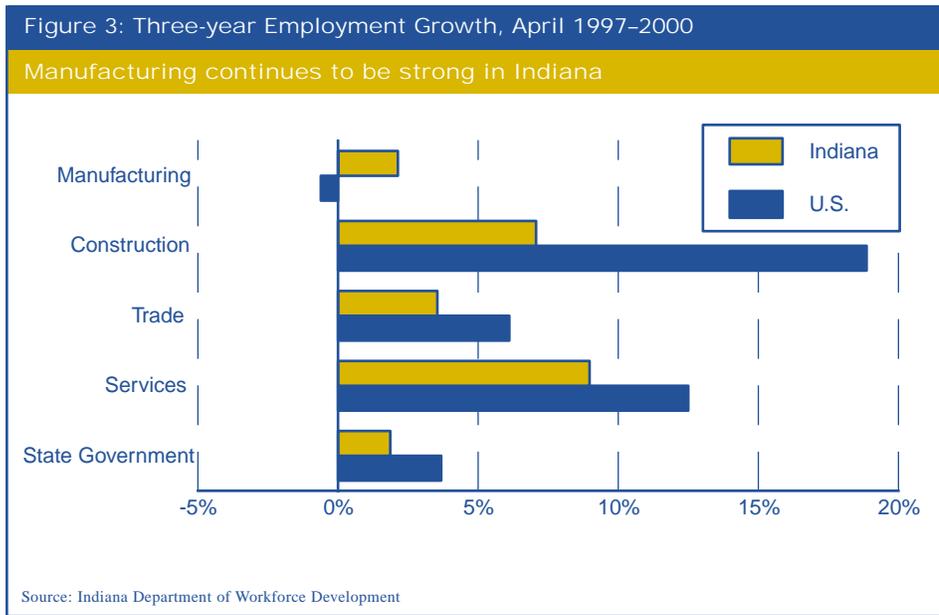
The steady increases in manufacturing employment have given Indiana a different economic mix from the U.S. average (see Figure 2). The nation as a whole is heavier in the services industries, while Indiana is heavier in manufacturing. This distinction holds true for most sub-categories of services and manufacturing, although the share of employment in health services is the same in Indiana as in the rest of the country.

As with most states in the Midwest, Indiana has been near full employment and has therefore had slower job

The steady increases in manufacturing employment have given Indiana a different economic mix from the U.S. average. The nation as a whole is heavier in the services industries, while Indiana is heavier in manufacturing.

growth than the nation over the past three years. Indiana's employment was up 4.9%, while the nation's employment grew 7.7%. Indiana outpaced the national average, though, in manufacturing growth (see Figure 3). The number of manufacturing jobs in Indiana increased 2.1% in the three years, while the nation registered a small decline.

Transportation equipment manufacturing contributed much of the difference, growing by 15.3% in Indiana but by only 2.2% nationwide. Chemical production employment rose by 6.7% in Indiana and fell slightly in the United States. Indiana took a different path in construction employment too, as that industry grew 7.1% in this state but jumped 18.9% nationally. State government employment marched up 3.7% in the country as a whole but increased only moderately in Indiana (1.9%). In most other industries, Indiana's employment mix is very similar to the U.S. average.



Trends in High-Tech: Workers, Wages and Establishments

Employment in high-technology industries in Indiana grew from 243,860 in third quarter 1994 to 277,313 in third quarter 1999, according to covered employment and wage data from the Indiana Department of Workforce Development. This represents an employment increase of 33,453, or 13.7%, during the five-year period, compared with overall employment growth of 9.4% for the state.

This article uses the BLS definition of high-tech industries. See “IN the Spotlight” for more details on high-tech classification. The figures in this article do not correspond exactly with the figures in “IN the Spotlight” because each article uses a different data set within a different time frame.

High-tech industries accounted for larger shares of the state’s total employment and wages in third quarter

1999 (9.5% and 15.4%, respectively) than they did five years earlier (9.1% and 14.2%). Table 1 lists the state’s top 10 high-tech industries (by employment) in third quarter 1999.

Average weekly wages for all high-tech industries in the state were higher than the state average of \$564 for third quarter 1999. The drugs industry led with average wages that were almost 2.5 times the state average. Together, the 10 top high-tech industries paid, on average, \$935 per week — more than 1.6 times the state figure.

The state experienced total employment growth of 52,020 in 17 high-tech industries and an employment decline of 18,567 in 14 high-tech industries for net employment growth of 33,453

over the five-year period. Motor vehicles and equipment accounted for 52% of the employment growth, while household audio and video equipment accounted for 66% of the employment decline in the high-tech industries. Household audio and video equipment, which had been the second-largest high-tech employer in the state in 1994, dropped out of the top 10 by 1999 to 12th place, as employment in the industry fell from 19,135 in 1994 to 6,808 in 1999.

Changes in employment between third quarter 1994 and third quarter 1999 for the current top 10 high-tech employers in the state are shown in Table 1. The largest employment growth was in motor vehicles and

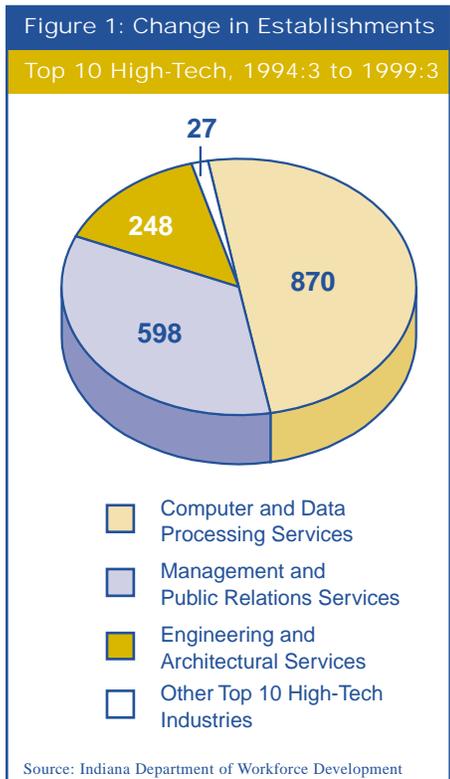


Table 1: Indiana’s Top 10 High-Tech Industries, Third Quarter 1999

INDUSTRIES	ESTABLISHMENTS		EMPLOYMENT	
	Number as of 1999:3	Change from 1994:3	Number as of 1999:3	Change from 1994:3
Motor Vehicles & Equipment	351	3	103,035	27,010
Computer & Data Processing Services	1,760	870	17,773	7,606
Drugs	39	-3	16,564	1,044
Engineering & Architectural Services	1,308	248	15,022	4,026
General Industrial Machinery	155	1	13,527	-480
Engines & Turbines	22	1	11,607	370
Medical Instruments & Supplies	88	11	11,012	1,161
Electronic Components & Accessories	107	8	10,968	-556
Management & Public Relations Services	1,681	598	9,901	5,102
Aircraft & Parts	41	6	8,884	1,904
Top 10 Industry Totals	5,552	1,743	218,293	47,187
All High-Tech Industry Totals	6,533	1,762	277,313	33,453
State Totals	138,163	6,456	2,916,650	250,864

Source: Indiana Department of Workforce Development

INCONTEXT

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illustrates Indiana's strength in industries using high-tech processes over those producing high technology. Like Indiana, the nation has grown faster in non-intensive industries (18%), but has also performed well in the intensive sectors (13%) since 1989. In Indiana, the motor vehicle industry is the powerhouse of the non-intensive category, while computer and data

processing services are the strongest intensive high-tech industries.

The differences shown here illustrate why knowing how data are defined is essential to understanding what the data mean. Once again, those wishing for a simple answer will be frustrated. It is not the data that have failed them, but the reality of a complex system (the economy) and the human factor that must determine how to best reflect that system using data.

IN Depth:

For all the latest state and county figures and complete time series data sets related to the Indiana economy, visit the following Internet sites:

- www.ibrc.indiana.edu/incontext
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