

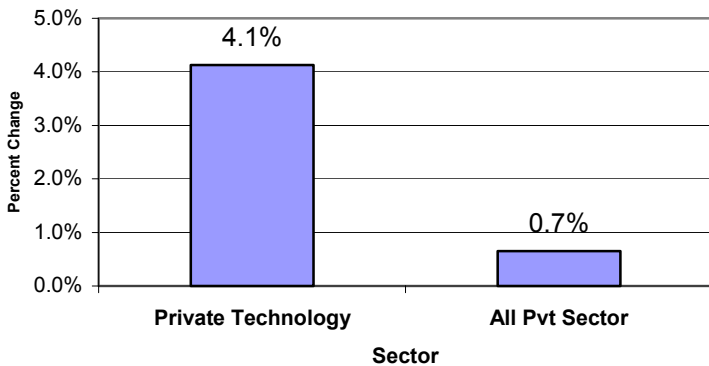
# Hawaii's Technology Sector in 2001

Department of Business Economic Development and Tourism

November 2002

Hawaii's private technology sector continued to grow faster than the rest of the economy in 2001, despite the more difficult economic conditions brought on by the 9/11 tragedy and the collapse of many *dot-com* companies on the Mainland. Paid employment in the technology sector as a whole registered a 4.1% increase in 2001 to more than 13,550 jobs. By comparison, all private sector wage and salary jobs increased by just 0.7%. (See Table 1 on page 6 for the full Technology sector data set.)

Figure 1. Growth in Jobs, 2001



This measure of technology activity includes the number of private sector operating units, wage and salary jobs, and payroll in a range of industries identified as technology-intensive. Due to data limitations the measure does not include self-employed proprietors in these industries or technology activity in government, educational institutions or medical facilities. (A more thorough discussion of the measure starts on page 4).

The measure includes a broad mix of technology activity going on throughout the state's economy. It provides a barometer for both the creation of new technology and the use of technology by the economy as a whole. It complements another measure of

technology; the survey of firms conducted periodically by the High Technology Development Corporation.

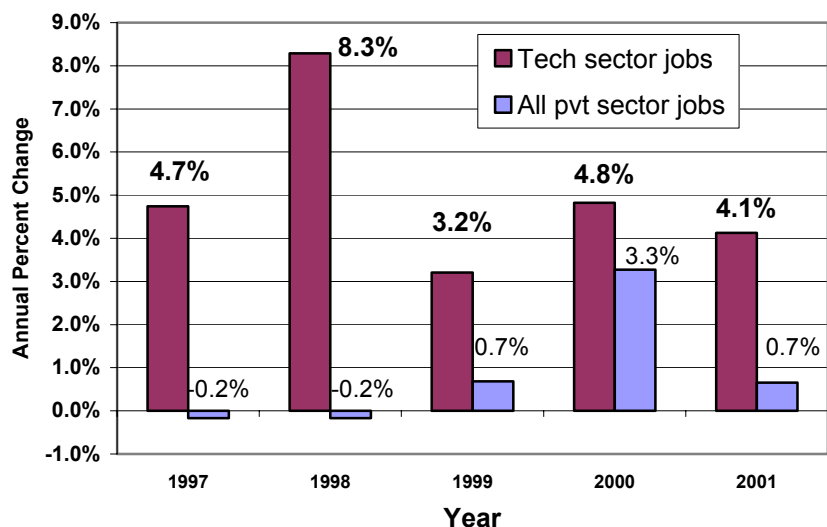
The number of operating units in Hawaii's technology sector grew faster than jobs in 2001, with a 9.1% increase. Operating units are either individual firms or branches of existing firms. The number of operating units has generally outpaced employment growth over the past few years. In 2001 there were more than 1,150 private operating units in the technology sector. Total wages and salaries in the technology sector also outpaced jobs growth with a 6.5% increase in 2001, reaching \$688 million. The average salary in the sector was nearly \$50,800 in 2001, 70% more than the private sector average.

The more rapid growth of the number of firms in the technology sector has reduced the average number of employees per each unit. In 2001, average technology sector employment was 11.8 employees per unit. This is down from 12.3 per unit in 2000 and 14.3 per unit in 1996. Still, the size of technology units is comparable to the 13.0 average for employees per unit in the private sector as a whole.

## Growth over Time

Jobs in the technology sector as a whole have consistently outperformed the rest of the economy since the 1996 base year for this technology sector measure. Technology sector jobs have increased nearly 28% compared with a 4% overall increase in private sector jobs over the period.

Figure 2. Private Sector Jobs Growth, Total & Technology Sector 1997 to 2001

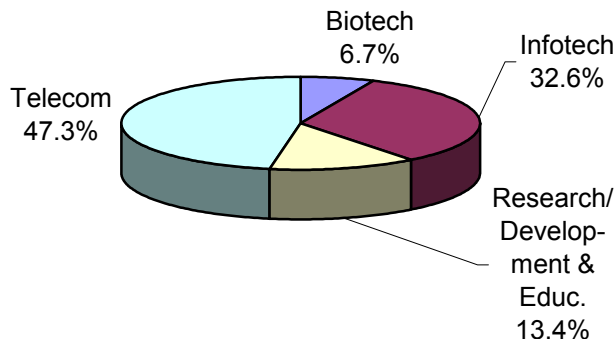


Likewise, the number of operating units in the technology sector increased 55% over the 1996-2001 period compared with 10% for all of the private sector. The total payroll for the technology sector increased 58% compared with 19% for the private sector as a whole.

**Types of Technology**

Technology activities can be grouped in a number of different ways. They may be grouped by the nature of the products produced (*biotechnology*, for instance), the markets served (as in the military-related, *dual use* technology), or by who produces the technology (private v. public sector). Often the breakdown must conform to the source of data. This particular measure of Hawaii's private technology sector draws on Federal and private sector definitions of information technology supplemented with research by DBEDT. The measure is divided into four major types of activity: *telecommunications*, *information technology*, *biotechnology* and *research/development and education*. Figure 3 shows the distribution of jobs by category.

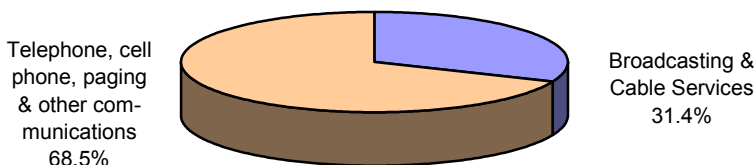
**Figure 3. Jobs by Type of Technology, 2001**  
(Total Jobs: 13,553)



In 2001 nearly half of the jobs in the technology sector were in Telecommunications. One third of the jobs were in Information Technology. Biotechnology in the private sector accounted for about 7% of jobs. The remainder of jobs fell into the Research/Development and Education category.

**Telecommunications** activity in Hawaii, based on Federal definition, is composed of two major components – telecommunications services and broadcasting (Figure 4). While the number of firms in Telecommunications activity has been increasing over the last few years, the number of jobs has been gradually declining since 1998. In 2001 telecommunications jobs declined by 2.0%. About 69% of the jobs in telecommunications are in the communications area with the other 31% in broadcasting.

**Figure 4. Telecommunications Sector Jobs, 2001**  
Total jobs: 6,405



The communications segment includes residential phone service, cell phone service, paging and other forms of two-way communications. Some internet providers fall into this category.

Broadcasting includes on-air television stations, cable television and transmission, and radio broadcasting.

Telecommunications is an important segment of the technology infrastructure. This is the most mature and established segment of the technology sector as well as the largest. Yet changes in technology and industry structure ranging from wireless and cable communications to phone service deregulation have impacted negatively on traditional communications services.

In fact more than 90% of the decline in jobs in this sector for 2001 occurred in traditional telephone service. This lack of growth probably reflects productivity gains as well as increased competition. Increases in cable channel offerings and upgrades to digital TV service can generally be accomplished without the addition of significantly more staff. The entire 2001 decline was in the communications segment. The broadcasting segment showed a slight gain in jobs for 2001.

**Information Technology** is the second largest category in the technology measure. This Federally defined cluster contained 33% of technology sector jobs in 2001. This was the also the second fastest growing major category of the technology sector in 2001 with a 9.7% increase in jobs over 2000.

The largest segment of infotech activity and the driving force over the last half-decade has been software development. Software accounted for 49% of the Information Technology jobs in 2001, up sharply from 45% the year before. Software development employed about 2,200 paid workers at 375 sites around the state in 2001. The growth in software development jobs has been impressive -- 286% from 1996 to 2001.

Another large area of information technology is information services, which accounted for about 33% of the jobs in infotech in 2001. Information services include such activities as information and retrieval systems (which includes a good deal of Hawaii's internet providers), data processing, and computer systems management, maintenance and repair. Jobs in infotech services increased 6.0% from 2000 to 2001.

Infotech sales and service accounted for 17% of infotech jobs in 1999. This segment includes retailers specializing in computer hardware and software. Many of these stores provide computer repair services. Specialty stores play an important role in transferring computer technology to consumers and small business. As well as providing hardware and software, they act as consultants in assessing customer needs for computing and networking technology. However, since 1998 paid employment in infotech sales has been in decline. This period has been marked by turbulence in the computer sales market with the entry national retail chains such as CompUSA and Circuit City into the Hawaii market. From 2000 to 2001 the jobs loss was 3.4%. Nevertheless, the number of operating units in sales and service has been slowly increasing since 1998. In 2001 there were 102 specialty stores around the state, up more than 5% from 2000.

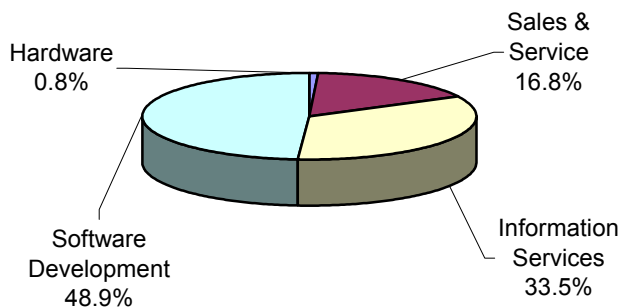
Infotech-related Hardware assembly accounted for 1% of Hawaii's infotech employment base. Jobs in this small segment have been declining every year since 1996, when it accounted for 2% of Infotech jobs.

**Biotechnology** in Hawaii's private sector is dominated by the growing of sophisticated varieties of seed corn produced for export from Hawaii. Biotechnology is the smallest and yet the fastest growing activity in the private technology sector, increasing 57% in the 2000 to 2001 period

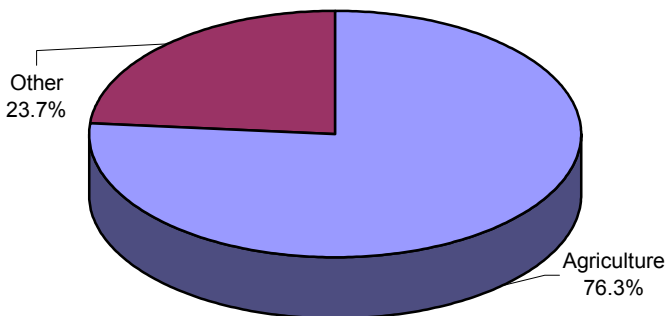
alone. About three quarters of the jobs in this category were in exotic agricultural activity including seed corn development, food crops grown under cover and animal aquaculture. *Other* biotech activity includes the production of medicinals and botanicals, pharmaceuticals and diagnostic substances. Due to the limitations of the source of data, the biotech research and development occurring at the University of Hawaii and in some private hospitals, which could be significant, is not captured in this measure. Thus, the measure understates the scope and amount of biotechnology actually being conducted.

**Research, Development and Education (R/D&E)** activity represents about 13% of the private sector technology sector by employment (Figure 7). It includes a number of relatively small technology-oriented activities (for Hawaii, that is) that could not be appropriately assigned to the other major categories of infotech, telecom or biotechnology. Research and development activities are an eclectic mix of specialties such as testing

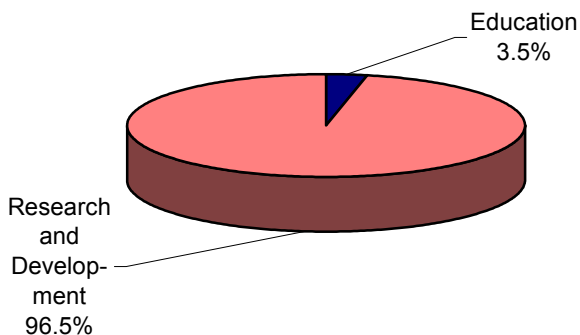
**Figure 5. Information Technology Sector Jobs, 2001**  
Total Jobs: 4,416



**Figure 6. Biotechnology Sector Jobs, 2001**  
Total Jobs: 913



**Figure 7. Research/Development & Education, 2001:  
Total Jobs: 1,819**



laboratories, commercial and noncommercial research, and some hardware assembly such as x-ray apparatus and measurement devices. The education component consists of private data processing schools.

Paid jobs in the R/D&E segment grew 1.1% in 2001. This is more than the private sector average but well below average growth for the technology sector as a whole. Jobs in R/D&E declined between 1996 and 1998, but since 1998 have increased 14%.

In contrast to the jobs count, total wages paid in R/D&E increased 12.3% in 2001, double the average for the technology sector and more than four times the increase for the private sector as a whole.

Most research/development and technology related education is probably conducted in Hawaii's public sector or within private, general educational institutions. Thus, a relatively limited amount of the total R/D&E activity in Hawaii is captured by this measurement. Nevertheless, as Hawaii's commercial technology base expands, we would expect to see this category show continued growth in the future.

Table 1 summarizes the size and growth of Hawaii's private technology sector from 1996 to 2001 along with a total private sector comparison.

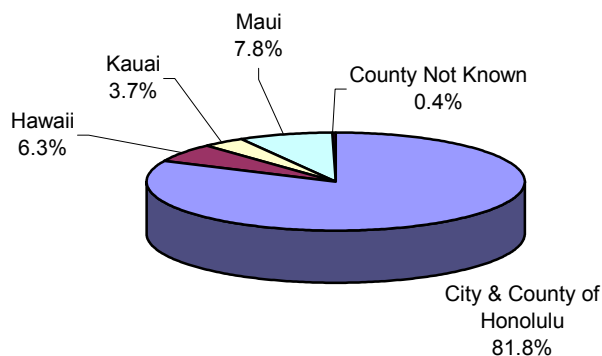
### Technology and the Counties

Not surprisingly, the City and County of Honolulu accounts for majority of the state's technology workforce -- about 82% of the state total (Figure 8). Maui County follows at 8%, Hawaii County has 6% of the state total and Kauai County has 4%.

The growth of technology varied considerably by county in 2001. Maui led the statewide increase in technology sector job growth for 2001 with a 14.5% increase. The next highest growth for technology jobs occurred on Oahu with a 7.1 percent increase.

More information on the Technology sector profiles for the Neighbor Islands is planned for a future e-report.

**Figure 8. Share of Technology Sector Jobs by County, 2001**



### About the DBEDT Technology Sector Measure

There is no broadly agreed upon measure of a "technology industry" or sector in the economy. This is mainly because technology activity is so broad, ranging all the way from a new invention in the laboratory to the computer on our desktop. Some definitions that have been developed focus only on what is important to a particular state or industry. For instance, Michigan counts automobile manufacturing in high tech. The American Electronics Association counts only activity related to its constituency. Hawaii has targeted several specialty areas of technology including *Ocean R&D* and military related, *Dual Use* technology. Some measures define technology activity as any industry in which the proportion of R&D and technology-oriented occupations exceeds the average of all industries by some amount -- from simply above average to as much as double the average for all industries.

Apart from the problem of defining technology there is the problem of finding data to measure whatever definition is established. Established data series on the economy tend to use some sort of industry classification system to count economic activity. The Federal government has a wealth of data series for the national and state levels based on the Standard Industrial Classification (SIC) system. This is being replaced by a production

based system called the North American Industrial Classification System (NAICS). These data series break most economic activity down to very detailed industry groups. This industry data is plentiful and available at no cost. However, it will only support definitions that use SIC and NAICS categories. For instance there is no SIC or NAICS industry for *tourism*, or *Ocean* industries. Hawaii has had to construct those itself.

Definitions of technology that do not fit into the SIC or NAICS scheme need to find data elsewhere. This usually means conducting special surveys of firms in the region that fit the definition. This can provide valuable information about very targeted technology activity. However, the trade-off is that survey programs can be costly, are time consuming and the results cannot be compared with other regions or the nation as a whole unless the survey is conducted nationally. Another problem is that surveys tend to have low rates of participation by those being surveyed. As a result, some estimating method must be used to adjust the results of the survey to reflect non-participants.

A long-standing program to measure the high technology industry in Hawaii has been pursued by DBEDT's affiliated agency, the High Technology Development Corporation (HTDC). The HTDC periodically surveys firms and agencies in Hawaii's technology unique clusters such as ocean related, dual use, energy related and medical technology. The HTDC survey, available at ([http://www.htdc.org/Business\\_Survey/2001](http://www.htdc.org/Business_Survey/2001)), develops information on the number of organizations, employees and revenues in these clusters.

The DBEDT Technology Sector Measure is meant to augment the firm-based HTDC survey measure with information that focuses on the broader role of technology activity in the economy. The importance of technology to the economy goes well beyond technology activity that creates new products for export. While that activity is important, technology's most significant value for the economy occurs when new technology is transferred into traditional and emerging industries to raise productivity and make these industries more competitive in national and global markets. The transfer of technology is difficult to measure directly. By measuring growth in the broader scope of technology activity that supports the application of technology in business and households, the process can be benchmarked and better monitored. The measure encompasses more jobs than just the researchers and computer programmers who develop new technology. However, by doing this it captures a better scope of the activities serving Hawaii's technology needs.

Taking into consideration the various definitions created for technology activity and the availability of data, DBEDT opted to use definitions that took advantage of existing industry based data produced by the Federal government. The definition adopted reflect elements of several measures of the private technology. The *Information Technology* and *Telecommunications* segments are based on U.S. Department of Commerce definition for Information and Communications. This measure identifies manufacturing and services associated with computers, data processing activity, software development and telecommunications in the economy at the four-digit SIC level. This is the most detailed level for industry classification in the SIC system. The value of the Commerce Dept. measure is its focus on the technical goods and services that have the most impact on the productivity and competitiveness of the business community. The measure uses data on operating units, paid jobs and total wages generated by the covered employment and wage program. The Federal report containing the definition is available on line at <http://www.esa.doc.gov/508/esa/TheEmergingDigitalEconomyII.htm> (see Appendix to Chapter II). The Commerce Dept. defined measure encompasses about 80% of the employment in Hawaii's private technology sector.

The current definition for a good deal of *Biotech* and *Research/Development and Education* includes elements of a more comprehensive definition of the technology sector produced by the Milken Institute <http://www.milkeninstitute.org/><sup>1</sup>. This definition includes most of the telecom and infotech activity in the Commerce Department definition but at a less detailed, three-digit level. Additional elements, including seed corn growing, which involves genetic research, were added by DBEDT for their relevance to Hawaii.

There are limitations to this measure of the technology sector, which should be kept in mind. First, due to the limits of the data source, it excludes technology activity occurring in government, which may be considerable. Examples of this are the cloning and other technology research being conducted through the University of Hawaii, data processing and information technology activities of government, and research and development activity conducted by the Federal government, such as the missile launches and testing at the Pacific Missile Range on Kauai.

Second, the measure also excludes the engineering and medical industries in Hawaii. This is because the source data are not detailed enough to separate high technology activity from the large amount of standard, non-technology activity occurring in these industries. Third, since the source data are for firms with payroll, the

<sup>1</sup> Publications/Research Reports, *America's High-Tech Economy: Growth Development, and Risks for Metropolitan Areas*

measure does not include the operations of sole proprietors and independent contractors performing technology work.

Finally, even though the industry statistics used are as detailed as possible the measure unavoidably includes some firms and employment that would not otherwise be considered strictly high technology. However, it is expected that the growth rate over time in these selected industries will reflect the fortunes of the more numerous technology firms.

This current compilation is an update and refinement of data presented in DBEDT's January 2000 report, *Hawaii's Emerging Technology Industry*. That report, which takes a close look at the scope of technology in Hawaii is available on the DBEDT web site at <http://www.hawaii.gov/dbedt/hecon/he1-00/index.html>.

While not a complete compilation of technology activity in the state, the DBEDT measure has identified the key components of that sector outside of government. Its main value will be in providing a consistent benchmark for growth in Hawaii tech sector over time in enough detail to examine the sources of that growth.

The following table shows data for the various elements of the technology sector from 1996 to 2001 with comparable data for the private sector as a whole.

<b>Table 1. Private Technology Sector, 1996 to 2001</b>						
	All Private Sector	Private Technology Sector				
		Technology Sector Total	Bio-technology	Information Technology	Research, Development & Tech Education	Telecommunications
<b>Operating Units</b>						
1996	31,253	<b>741</b>	19	415	140	167
1997	31,182	<b>756</b>	20	441	138	157
1998	31,253	<b>806</b>	24	469	149	164
1999	31,257	<b>881</b>	27	527	146	181
2000	33,554	<b>1,056</b>	31	664	167	194
2001	34,288	<b>1,152</b>	37	733	173	209
%change 2000-2001	2.2%	<b>9.1%</b>	19.4%	10.4%	3.6%	7.7%
<b>Ave. Paid Employment</b>						
1996	427,676	<b>10,607</b>	140	2,372	1,772	6,323
1997	426,968	<b>11,110</b>	206	2,650	1,693	6,561
1998	426,255	<b>12,031</b>	509	3,200	1,596	6,727
1999	429,179	<b>12,417</b>	601	3,584	1,636	6,598
2000	443,220	<b>13,016</b>	656	4,026	1,800	6,534
2001	446,107	<b>13,553</b>	913	4,416	1,819	6,405
%change 2000-2001	0.7%	<b>4.1%</b>	39.2%	9.7%	1.1%	-2.0%
<b>Total Wages (\$millions)</b>						
1996	\$11,208	<b>\$435.1</b>	\$4.2	\$97.3	\$63.5	\$270.0
1997	\$11,516	<b>\$285.4</b>	\$5.9	\$122.4	\$61.7	\$285.4
1998	\$11,791	<b>\$534.4</b>	\$13.1	\$160.8	\$67.2	\$293.2
1999	\$12,084	<b>\$581.7</b>	\$15.6	\$188.4	\$69.6	\$308.1
2000	\$12,933	<b>\$646.2</b>	\$22.5	\$221.9	\$80.8	\$321.1
2001	\$13,293	<b>\$688.0</b>	\$27.1	\$247.8	\$90.7	\$322.3
%change 2000-2001	2.8%	<b>6.5%</b>	20.7%	11.7%	12.3%	0.4%
<b>Average Annual Wages</b>						
1996	\$26,207	<b>\$41,019</b>	\$31,161	\$41,034	\$35,839	\$42,705
1997	\$26,973	<b>\$42,758</b>	\$28,455	\$46,190	\$36,445	\$43,497
1998	\$27,661	<b>\$44,414</b>	\$25,733	\$50,254	\$42,133	\$43,589
1999	\$28,155	<b>\$46,893</b>	\$27,148	\$52,565	\$42,540	\$46,700
2000	\$29,179	<b>\$49,649</b>	\$34,258	\$55,104	\$44,882	\$49,146
2001	\$29,797	<b>\$50,762</b>	\$29,713	\$56,121	\$49,876	\$50,319
%change 2000-2001	2.1%	<b>2.2%</b>	-13.3%	1.8%	11.1%	2.4%