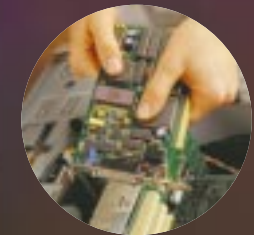
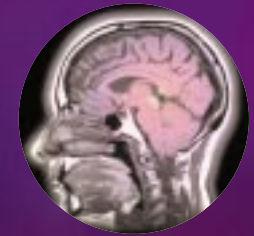


INDEX OF
INNOVATION &
TECHNOLOGY

Washington State

2 0 0 1



June 2001

To Our Washington Colleagues:

Over the past year, our technology industries have been in the news almost daily. The exciting successes for many and the tough financial situation for others only represent the surface of the innovation and technology base of our state's economy. By looking at our state through the lens of these 30 or more indicators, we see companies with great potential, entrepreneurs with exciting new ideas, opportunities for all our state's residents and even a challenge or two.

This is Washington Technology Center's second Index of Innovation and Technology for Washington State. It represents an update to last year's inaugural release. Some of the indicators reinforce the trends outlined last year. Some of the indicators show acceleration in those trends.

As with the 2000 Index, this report paints a picture of Washington, a state that is:

- well-known for its dominant industries—agriculture, aircraft, forest products, and software.*
- extremely entrepreneurial—a state where more ideas are being turned into companies than anywhere else.*
- increasing its leadership position as an exporting state, especially in technology products like aircraft and software.*
- struggling with the downside of growth—uneven benefits across the state as well as transportation and housing issues in its most urban areas.*

We trust that you will find these data interesting, engaging and enlightening.

Once again, welcome to Washington's 2001 Index of Innovation and Technology.



Terry Byington, Chair
Washington Technology Center



Lee Cheatham, Executive Director
Washington Technology Center

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INTRODUCTION

Innovation and technology are key drivers of today's—and tomorrow's—economy. But understanding the relationship between economic prosperity and these drivers is difficult. This report provides a set of indicators outlining the relationship between the prosperity and vitality of Washington State, its residents and the innovation and technology drivers.

Summary Findings

Washington's innovation and entrepreneurial economy is thriving. This report presents quantitative information about more than 30 key indicators, or measures. From these indicators, several conclusions can be drawn.

- Most importantly, we find that Washington's young and growing companies continue to provide much of the growth in the state's economy, as reported in last year's Index. In 2000, these startup companies in Washington represented a larger share of the employment growth in the state compared to every other state except one (Utah).

Several trends reported last year are reinforced in this report:

- Capital investment in Washington companies is growing, but at a rate much slower than in other regions of the country. Overall during the past two years, growth in venture investment has grown at slightly more than half the rate of the other major regions.
- Workforce issues remain challenging for companies. However, the extreme difficulty in filling technology job openings has decreased over the past two years.

Trends that remain valid from last year include:

- Most of Washington's technology employment is found in the central Puget Sound Region, especially the western portion of King County. Employment in technology industries is increasing in most other regions of the state, but still remains a minority share overall.
- Washington's economy continues to rely heavily on trade. Washington has the highest per-capita trade sector of any of the major exporting states. Almost 3/4 of this trade is related to technology products—aircraft and software.
- Washington's higher education institutions are producing, in aggregate, fewer graduates in science and engineering than a few years ago. This, in spite of the fact that the demand for these graduates is rapidly increasing.
- Overall, Washington's quality of life continues to be an attractive feature of the state. Transportation issues are the biggest threat.

Indicator Areas

Key indicators in six major areas are presented in this report. Summary findings are presented on these six elements, which are vital to Washington's economy.

INNOVATION

Washington continues to be an extremely innovative state. New ideas are implemented by companies at a higher rate than anywhere else in the country.

Research and development, an extremely important component of innovation, is currently mixed in Washington. Industrial R&D is declining. Since this industrial component represents the largest portion, the result is a decline in the state's overall R&D investment. However, university and federally funded private research are increasing.

COMPETITIVENESS

Washington remains very competitive. Trade is increasing in importance to the state, especially in the technology sectors of aircraft and software.

Washington's technology industries continue to be focused in the King County region. Most other areas of the state are increasing employment in the technology sectors, but this represents only a minority share of the technology employment.

GROWTH

Startup companies are an important element in Washington's employment picture. With the exception of Utah, Washington is the state with the highest percentage of employment from young companies.

Employment in technology industries has remained fairly constant over the past decade. It currently represents slightly less than 10% of overall employment. The non-aircraft employment, however, has continued to increase dramatically during this period.

FINANCIAL CAPACITY

Investment in Washington companies is growing, but much more slowly than in other major regions of the country. Over the past two years, venture investment in Washington has grown at a 6% rate while overall investment in the largest 12 regions has grown by 11.7%. In the long term, this reduced rate will affect the viability of Washington's technology sectors.

HUMAN POTENTIAL

Washington residents and students continue to lead the nation in academic achievement. Washington still ranks first in the percentage of residents with high school degrees. Washington students consistently exceed the national average in math and verbal SAT scores.

Washington's four-year higher education institutions produced fewer graduates in science and engineering in 1999 than in 1997. This decline comes at a time when the demand for these degrees is significantly increasing.

QUALITY OF LIFE

Washington residents continue to enjoy a quality of life with abundant recreational and arts amenities. Issues of transportation congestion and high housing prices threaten parts of Western Washington.

I n n o v a t i o n is the generation of new ideas and the translation of these ideas into commercially successful products and services.

Indicators:

Primary indicators of innovation relate to idea creation, business activity, and patent and research activity:

- Innovation capacity
- New company creation
- Company closings
- Business churn
- Patent generation
- Top technology patent areas
- Research and development expenditure

Why is innovation important?

It can be argued that this single area is the differentiator between a technology-based economy and a traditional resource-based economy. A technology economy survives on its ability to produce and market products that are based on new ideas.

As we become more and more reliant on innovation and technology, all sectors of our economy will be significantly affected by innovation. It no longer will be enough just to provide products from natural or manufactured resources. Competition from other companies, areas and countries as well as scarcity of resources will require that innovation and new technology become a significant part of every company's product and operational portfolio.

Innovation is the novel and effective translation of an idea into a product. It is critical to all companies. Innovation success also requires an educated workforce to ensure that research is conducted and the resulting new ideas are quickly translated into products.

What does it mean for Washington?

Washington ranks high among all states for innovation capacity. Patent activity continues to grow, although slowing in the most recently reported year. R&D expenditure increased significantly in almost all sectors except industrial research, where it declined. All of these indicators point to a strong base of innovation with some caution for the future outlook.

The one area where Washington seems to be unique is in the high level of business starts and closures—or business churn. As reported in last year's Index, Washington ranks first in both of these measures. Washington's manufacturing sectors, for example, seem to have a very low churn rate. Retail, construction and services sectors have high rates. Deeper investigation reveals that there is little shift in relative sizes of the sectors as a result of this churn. The retail/wholesale sector as a percentage of Washington's business establishments is declining slightly and the business services sector is growing slightly. Both of these trends are in line with an overall move to a more innovation- and technology-driven economy.

How do these measures relate?

Overall, innovation is key to long-term competitiveness. Both integrated (innovation index) and specific (patent production, distribution) measures gauge the innovation content of Washington's economy.

The rate of business change as gauged by openings, closings and churn-rate differences among sectors defines long-term trends in the state's economy. This is measured by new company creation, company closings and business churn.

INNOVATION CAPACITY [I-1]

Why is this indicator important?

Innovation capacity provides a single measure of the overall effectiveness of a state's companies to translate good ideas into economic activity. It is an aggregate measure based on relative shares of high-tech jobs, scientists and engineers in the workplace, number of patents generated, industry research and development, and venture capital.

What does it mean for Washington?

Relative to other states, Washington's capacity for innovation is high—ranking 8th. Because this is an aggregate measure, Washington is, on balance, strong in most elements important to innovation. These elements range from generating new ideas to accessing the capital necessary to translate those ideas into products.

Source: Progressive Policy Institute

NEW COMPANY CREATION [I-2]

Why is this indicator important?

Economic growth results from creation of new jobs. Many of these new jobs are created in startup and small companies. Thus, as more new companies are created, the economy grows and becomes more robust.

What does it mean for Washington?

Washington's rate of new company creation (normalized by the size of its workforce) is more than 20% higher than the state next most effective at creating new companies—California. Washington's rate is more than double the median rate for all states.

Source: Corporation for Enterprise Development

COMPANY CLOSINGS [I-3]

Why is this indicator important?

As companies close, both positive and negative effects result. On the negative side, there is distress in the workforce. People are out of work and investments are lost without prospect of repayment. On the positive side, talented people are free to pursue other ideas and opportunities. When measuring business closings, it is best to also examine the number of new enterprises being formed and which of the sectors are experiencing these changes.

What does it mean for Washington?

Washington ranks highest of all states. When adjusted for the size of the workforce, more companies cease operations each year in Washington than in any other state. Taken with the company creation measure above, it is clear that Washington's young companies are continuously "in play," with new ideas continually being examined and attempted.

Source: Corporation for Enterprise Development

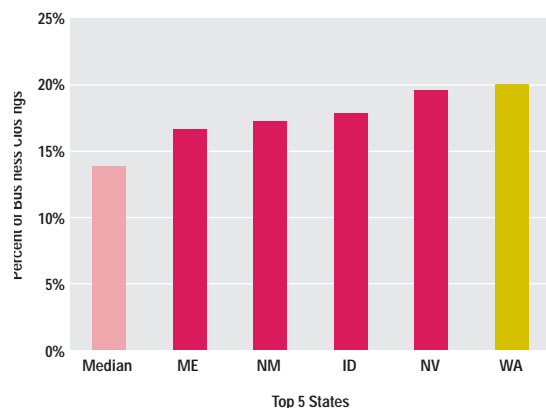
I-1 Washington ranks 8th of all states in innovation capacity



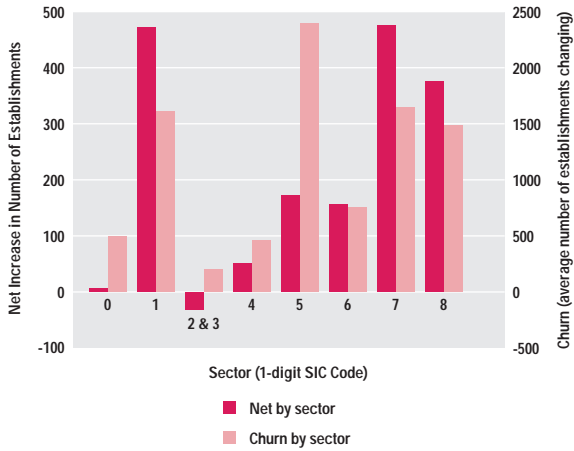
I-2 Washington ranks 1st of all states in the creation of new companies



I-3 20% of Washington businesses cease operations each year



I-4 Washington's technology sectors account for the net number of new businesses created each year



BUSINESS CHURN [I-4]

Why is this indicator important?

Business starts and closings do not tell the whole story. It also is important to examine the areas of the economy where those new businesses are formed and existing businesses cease operation. The differential rates of this churn define the long-term structural changes in the state's economy.

What does this mean for Washington?

Overall, more new business establishments open than close each year in Washington. Only in the manufacturing sector is the net number of businesses declining—and then only slightly. Large increases are seen in the Mining and Construction sector and the Business Services sector. This latter sector is where most of Washington's computer, software and internet companies are classified.

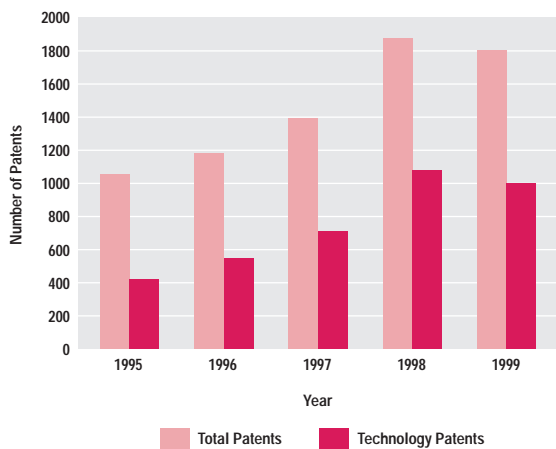
Washington's largest sector (by number of establishments) is Retail/Wholesale. There is a proportionally smaller number of net new establishments in this sector, pointing to its relative stability.

In general, the structure of Washington's economy isn't changing much. There is a slight move towards more business service companies, but in general, the impact of technology will be felt across all of the industry sectors.

Note: See References for full description of SIC Code Divisions.

Source: Washington State Employment Security Department

I-5 The number of patents by Washington inventors increased by 72% from 1995 to 1999



PATENT GENERATION [I-5]

Why is this indicator important?

Number of patents generated by Washington companies, universities and laboratories is a good indication of how active the new idea creation process is within the state. These new ideas can be the basis for future products and companies, as well as a protection mechanism against competitors. Without a sufficient number of these new ideas, business growth will slow down.

What does this mean for Washington?

The number of patents granted to Washington inventors has risen for the past five years, but has slowed in the last year reported. The total number of patents granted to Washington companies and inventors has increased by more than 70% during the period from 1995 through 1999. About half of all these patents are in technology areas.

Source: U.S. Patent and Trade Office

TOP TECHNOLOGY PATENT AREAS [I-6]

Why is this indicator important?

As important as the number of ideas is the breadth of issues and problems in which those ideas are conceived. Examining the range of technology areas in which patents are generated gives an example of the breadth and diversity of the growth potential for the state's technology economy.

What does it mean for Washington?

Patents granted to Washington companies and inventors are well distributed across high-technology areas—from computing and information technologies to medicine to instrumentation.

Source: U.S. Patent and Trade Office

RESEARCH AND DEVELOPMENT EXPENDITURE [I-7]

Why is this indicator important?

Research activity leads to new ideas on which companies and products are formed. Therefore, research investment is an important element to continued future economic growth.

What does it mean for Washington?

Overall, Washington ranks 16th for all states in R&D expenditure. Significant gains were made for 1997–1998 in R&D expenditure at Washington's universities and non-profit organizations as well as in Federally Funded Research and Development Centers. However, industry research dropped significantly. Since the industry component is significant in the state's volume of research, Washington's overall ranking thus declined from 8th to 16th.

Source: National Science Foundation

I-6 Technology patents constitute 9 of the top 14 patent areas

Technology Patent Area	Total Patents 1995–1999
Computer graphics, operator interface	321
Molecular biology and microbiology	307
Database and file management	242
Drug, bio-affecting and body treating (514)	153
Computers and digital processing systems	148
Drug, bio affecting and body treating (424)	134
Aeronautics	113
Electronic measuring and testing	103
Measuring and testing	102

I-7 Washington ranks 16th overall for R&D expenditures, down from 8th in 1997

Type of Funding	1997 Rank	1998 Rank
FFRDC/Nonprofits	3	1
Other Nonprofits	6	8
Universities	22	10
State/Local Government	14	14
Intramural	24	17
Industrial Firms	6	17
FFRDC/Independent	50	22
FFRD/University	50	22
TOTAL	8	16

C o m p e t i t i v e n e s s measures how Washington compares with other states and regions in attracting and keeping technology-based industries.

Indicators:

Industry dominance, employment distribution and exports all play a part in assessing Washington's competitiveness.

Indicators used in this report include:

- Industry dominance
- Technology employment by region
- Technology employment by industry sector
- Growth by sector
- Exports by sector
- Export value and ranking
- Tax burden

Why is competitiveness important?

States and regions that are competitive are able to attract highly qualified people as well as new businesses and capital investment. Continued economic growth depends on how well the state competes to renew and expand its talent and new resources.

What does this mean for Washington?

Washington is dominated by several key industries: agriculture, forestry and wood products, food processing, and aircraft manufacturing. Of these, only aircraft is included in our definition of technology sectors.

Within the state, the technology employment is very localized in the central Puget Sound area, specifically in western King County. Because of the employment in the aircraft industry, Snohomish County has the second highest density. Other areas with significant technology clustering include TriCities, Spokane and Vancouver.

Overall, Washington's technology employment levels are near the national averages. Washington companies such as Microsoft, RealNetworks and Amazon.com provide leadership in the software and internet sectors.

Exporting is a key to Washington's economy. It's increasingly important as Washington's share of U.S. trade increases. Currently, Washington is ranked first among major exporting states for per-capita export value.

Aircraft and software are the two largest exporting sectors.

How do these measures relate?

In assessing the impact of technology on the state's economy, the nature of the industries, their dominance and the distribution of employment are key. Regional technology employment and technology sector employment are useful measures.

The distribution (by industry) and the overall size of Washington's export market are major factors in the state's economy. State export profile, exports per capita and ranking are good measures of the export activity.

INDUSTRY DOMINANCE [C-1]

Why is this indicator important?

Strong and competitive industry sectors are measured by their size (employment) and dominance. Very dominant industry sectors provide economic benefit to their states and residents because they are the basis for growth of new companies within the industry and its supporting industries.

What does it mean for Washington?

Washington is best known for its most dominant industry—aircraft. This chart quantifies how dominant this industry is in Washington. It also shows the decline in aircraft employment between 1998 and 1999. Forestry and Wood Products is Washington’s second most dominant industry, but employment is fairly small, resulting in a much smaller economic impact.

Computer and Data Processing Services represents a large employment base in Washington and is also a dominant center of activity in the U.S., as shown by its dominance factor of nearly 1.5. Another notable industry in this chart is Research and Testing Services. Its dominance increased significantly in this two-year period.

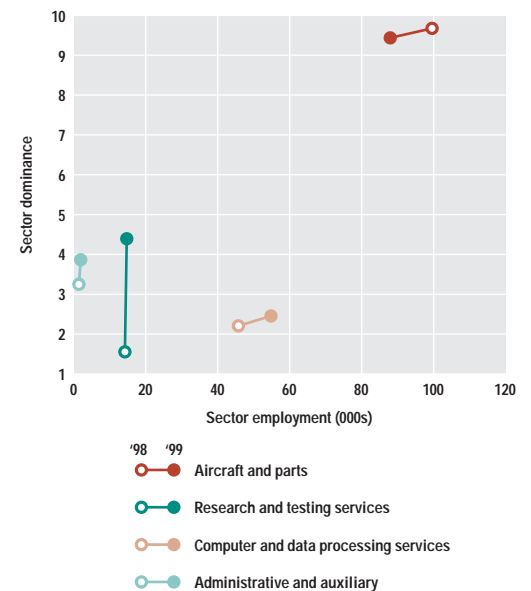
This chart compares the overall size (employment) of several of Washington’s industries with the dominance factor for those industries for two years. Note that while Washington’s aircraft sector is declining slightly in dominance because of workforce reductions, other sectors like Research and Testing Services are becoming much more dominant.

Note: the dominance factor used in this report is the same as the location quotient defined by regional scientists. The line of “Dominance =1” reflects those industries where Washington State reflects the national average.

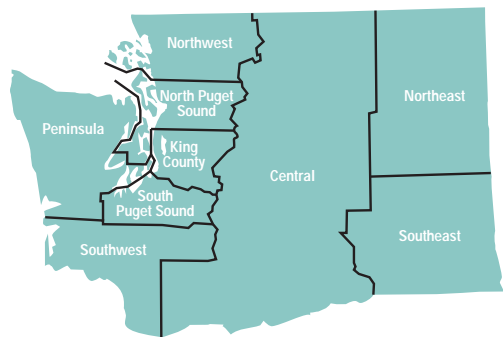
Source: Washington State Employment Security Department

C-1 Washington’s most dominant industries are aircraft, forestry and wood products, research and testing services

Sector	Sector Dominance		Sector Employment (in 000s)	
	1999	1998	1999	1998
Aircraft and parts	8.66	9.29	88.0	100.1
Forestry and wood products	4.29	4.13	2.4	2.2
Research and testing services	2.40	1.15	15.2	14.4
Administrative and auxiliary	2.10	1.79	2.2	1.9
Ship and boat building and repairing	2.05	2.06	7.1	7.0
Computer and data processing services	1.47	1.39	55.2	45.7
Engineering and architectural services	1.21	1.25	23.5	23.3
Medical and dental laboratories	1.11	1.06	4.6	4.3
Telephone communication	1.04	1.01	22.6	20.8
Medical instruments and supplies	1.00	0.99	5.8	5.7
Household audio and video equipment	0.96	0.95	1.6	1.6
Measuring and controlling devices	0.91	0.99	5.5	6.2
Computer and office equipment	0.88	0.97	6.5	7.6



C-2 Technology employment is very localized—mostly within King County



TECHNOLOGY EMPLOYMENT BY REGION [C-2]

Why is this indicator important?

Industries often cluster together geographically to maximize the exchange of ideas, build business relationships, and take advantage of specialized services and infrastructure. Strong clustering helps technology industries grow rapidly. On the other hand, the benefits of the growth of these clustered industries are not available statewide. The regional imbalance can become a concern to public policymakers.

What does it mean for Washington?

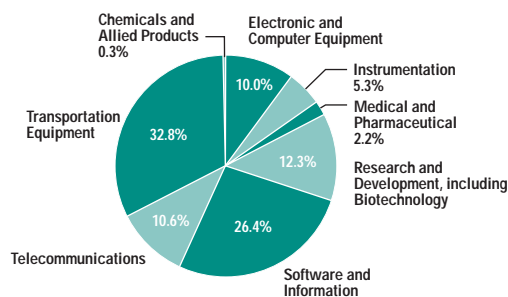
Technology jobs in Washington remain tightly clustered in King County, where about 65% of the technology jobs in the state reside. King County also continues to have the highest density of technology jobs—almost 1 in 10 workers in King County is employed in a technology sector. King County's density is 2 to 20 times higher than the other regions of the state.

Most other regions experienced higher growth rates for technology employment than the central Puget Sound area. The Central region of the state experienced a nearly 5-fold increase in the employment in technology industries over the two-year period reported. This certainly is evidence that all regions of Washington can host technology-based companies.

Sources: Washington State Employment Security Department; U.S. Census Bureau

Region	Total Tech Employment (2Q 2000)	% Change in Employment (1998-2000)	Technology jobs per 1000 population
King County	167,044	10.7%	99.1
North Puget Sound	45,547	2.9%	50.7
Southwest	12,041	38.6%	22.5
Northeast	9,074	48.7%	18.8
Central	8,839	565.6%	13.2
Northwest	3,315	12.8%	11.9
South Puget Sound	8,570	92.8%	9.4
Southeast	1,282	-81.5%	9.3
Peninsula	787	136%	3.7

C-3 Transportation equipment is Washington's largest technology sector, followed by software and information



TECHNOLOGY EMPLOYMENT BY INDUSTRY SECTOR [C-3]

Why is this indicator important?

A diversity of prominent technology sectors provides a more stable state economy than if only a few sectors are dominant. Thus, tracking the relative size and growth of these sectors is important.

What does it mean for Washington?

Transportation equipment continues to dominate Washington's technology sectors, with aircraft being the largest part of that sector. Its share of the technology industries in Washington, however, declined from 40% to about 33%. As in past years, the other major elements of the state's technology sectors are software & information, R&D (including biotechnology), telecommunications, and electronic and computer equipment.

This trend toward increasing the size of the non-aircraft technology industries continues to provide a more robust state economy for the future.

Source: Washington State Employment Security Department

GROWTH BY SECTOR [C-4]

Why is this indicator important?

In addition to the overall distribution of the individual sectors among the technology industries, the growth in each of these sectors is important. Because each of the sectors grow at different rates, the structure of the state's technology economy changes. Movement towards a more diversified and balanced set of technology sectors provides economic stability.

What does it mean for Washington?

Changes in employment in the technology sectors reflect the movement in Washington's economy toward the software, telecommunications and research-related sectors like biotechnology. Declines occurred in the mature technology sectors—aircraft and instrumentation.

The growth in the software and information sectors is positive for Washington because those sectors have demonstrated the ability to take root and grow in many of the regions around the state. Thus, the state appears to be moving toward a technology structure that could support more broadly based employment throughout the state.

Source: Washington State Employment Security Department

EXPORTS BY SECTOR [C-5]

Why is this indicator important?

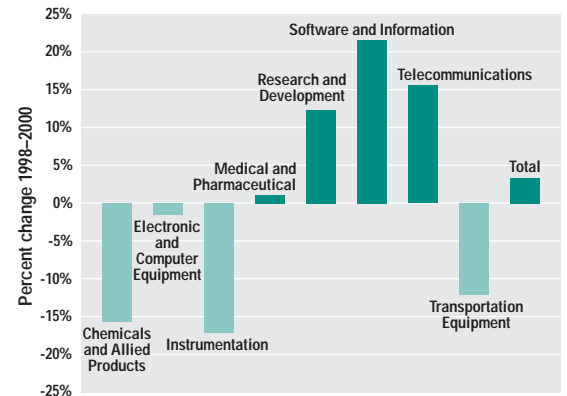
Due to Washington's location near Asia and other Pacific Rim trading partners, exports are important. Washington's technology product companies can take advantage of this proximity and the experience in the state related to conducting business overseas to gain competitive advantage in their markets.

What does it mean for Washington?

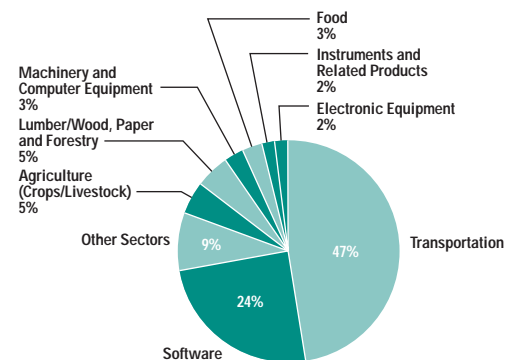
Aircraft and software make up 70% of Washington's exports. This is a reflection of the dominance of these major industries. Future growth in these industries can leverage this international trade advantage.

Sources: Massachusetts Institute for Social and Economic Research, University of Massachusetts; Washington State Office of Trade and Economic Development

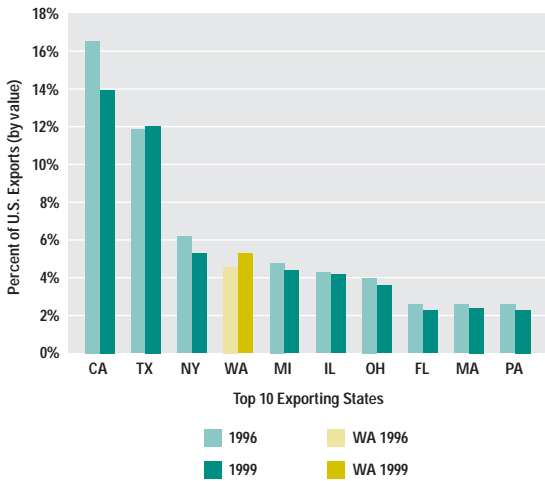
C-4 Software and information technologies had the largest percent increase in employment, followed by telecommunications



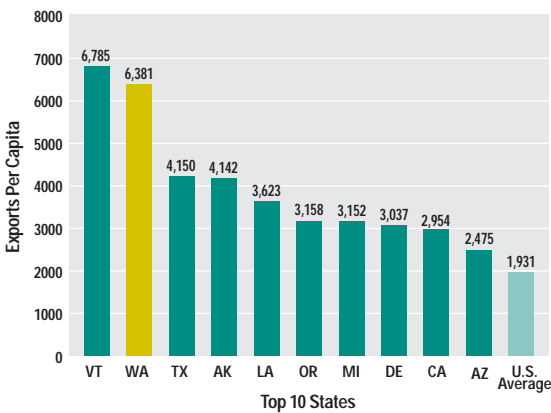
C-5 Transportation and software make up 70% of Washington exports



C-6 Washington ranks 4th in the value of exports



C-7 Washington is 2nd in exports per capita



C-8 Washington ranks 4th in business tax burden and 45th in household tax burden

State	Share of Business Taxes (Rank)	Share of Household Taxes (Rank)
Alaska	1	50
Wyoming	2	49
Texas	3	47
Washington	4	45
Florida	5	46
North Dakota	6	44
Illinois	7	39
Montana	8	40
Indiana	9	36
Louisiana	10	42

EXPORT VALUE AND RANKING [C-6 & C-7]

Why is this indicator important?

Comparing Washington's export value with other states allows evaluation of the competitiveness of Washington's exporting industries.

What does it mean for Washington?

Washington is a major exporting state. As a corollary, exports play an extremely important part in Washington's economy. The current trend indicates that exports are becoming increasingly important to the state's economy.

The state accounts for slightly more than 5% of all U.S. exported goods—ranking 4th of all states. Of the top 10 exporting states, only Washington and Texas experienced a growth in the share of U.S. exports between 1996 and 1999.

On a per-capita basis, Washington ranks 2nd in the value of exports and ranks 1st of the top exporting states. Texas, the next highest per-capita state, exports at a rate only 65% that of Washington.

Sources: Massachusetts Institute for Social and Economic Research, University of Massachusetts; U.S. Census Bureau

TAX BURDEN [C-8]

Why is this indicator important?

Competitiveness of a region or state can be examined in two ways. The first is to examine the benefits and assets in the region. Second is to examine the cost of living and doing business in the state. As measures of these costs, tax burdens for personal income and business operations are good indicators.

Low taxes certainly make a state attractive for business as well as its residents. High business taxes make it more difficult for businesses to operate and expand. Similarly, high personal tax rates make it difficult to recruit employees, especially experienced and therefore highly compensated employees.

What does it mean for Washington?

Washington assesses a larger portion of the overall tax burden on its businesses, and therefore a smaller portion on its residents, than do other states.

Washington ranks 4th highest in the share of taxes paid by businesses and ranks 45th in the share paid by households. Alaska, Wyoming and Texas have higher business tax portions—all states with large natural resource revenues.

Source: Institute on Taxation and Economic Policy

G r o w t h of Washington's economy is measured using both the increase in available jobs for Washington's residents and the increased vitality of Washington's individual companies.

Indicators:

The following employment indicators are related to growth:

- Employment growth
- Employment in startup companies
- Advertised technology positions
- Employment in gazelle companies
- Average technology job wage

Why is growth important?

Most industries are cyclic, following a pattern based on factors in the local and global economy. However, different industries react differently to these same economic factors. For example, technology industries such as biotechnology, software, and telecommunications tend to react somewhat differently than the resource-based industries of agriculture, forestry, and food processing. Thus, achieving a state economy that is diverse in its makeup is important to achieving stability and long-term health.

What does this mean for Washington?

Growth of the technology sector is an important part of the diversification of Washington's economy. Currently, these technology sectors represent about 10% of Washington's overall employment. Because the multiplier effect—increased employment demand on other sectors due to employment in the technology sectors—is about 2.36, more than one-third of Washington's employment can be attributed to technology.

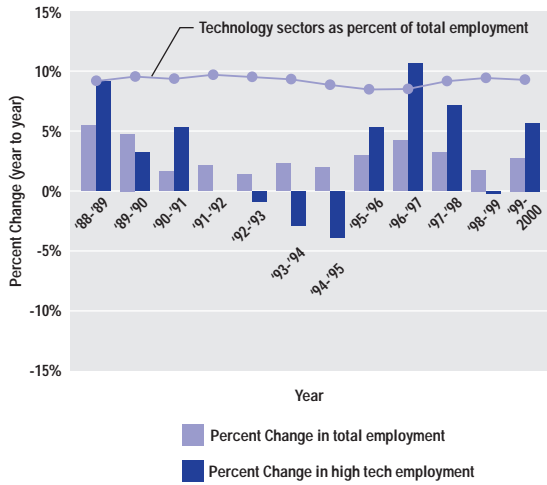
Employment growth in the technology sector was strong between 1999 and 2000, showing an increase of more than 5%. However, the portion of the state's workforce attributed to technology has remained fairly constant because of similar growth in the other sectors.

Several other facts are particularly impressive. Washington continues to lead all states for the highest annual wages paid to technology workers. In addition, Washington's startup companies provide the second highest employment growth rate in the U.S.—33% over five years.

How do these measures relate?

A significant number of jobs in Washington State are technology-based and that number is growing, especially for the state's startup companies. Each of the measures in this section support this integrated view of Washington's technology-based economy.

G-1 Technology industries account directly for 9.4% of Washington's total employment



EMPLOYMENT GROWTH [G-1 & G-2]

Why is this indicator important?

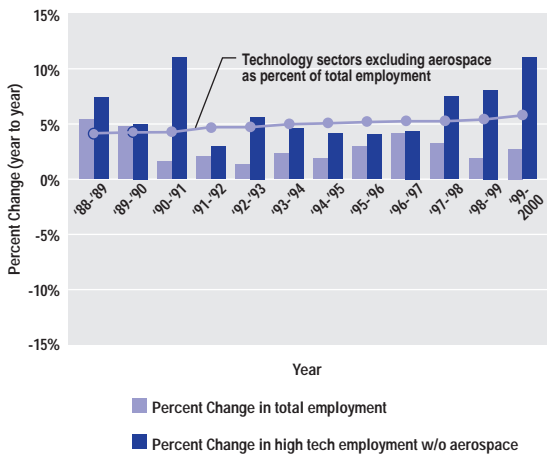
Employment in Washington's technology industries is the key indicator of the size and health of these industries. Growth in these technology sectors will enhance the stability of the state's economy by providing a more diverse base.

This indicator has two components. First, the overall technology sector employment and increases by year are shown [G-1]. Next, the same data are shown but the aircraft sector is excluded [G-2]. This second chart helps to illuminate the trends in the non-aircraft sector that are masked because of the large size of aircraft employment, and thus the commanding effect that employment changes in aircraft represent on the overall trend.

What does it mean for Washington?

Overall, technology employment in Washington represents just below 10% of the total employment. This number has been relatively steady over the past decade. Some fluctuation occurs following the employment trends in the aircraft industry. Growth of employment in the non-aircraft technology sectors has steadily increased. It currently represents more than 5% of the total employment.

G-2 Technology industries (excluding aerospace) directly account for 6.3% of Washington's total employment



The two charts show a marked difference between trends in the overall technology sector when aircraft employment is included or excluded. The non-aircraft sectors have grown steadily in employment over the past 10 years. That growth rate has varied from a few percent to over 10% each year. When the aircraft sector is added, we see a more cyclic trend exhibiting both increases and decreases in employment.

This increasing portion of non-aircraft technology employment will continue to stabilize employment in Washington State.

For a complete description of the industry sectors included in this definition of technology sectors, see the References section of this report.

Source: Washington State Employment Security Department

EMPLOYMENT IN STARTUP COMPANIES [G-3]

Why is this indicator important?

Small companies have the potential to provide a majority of job growth. Rapid job growth in startup companies can significantly affect the overall increase in employment for the state. This measure also reflects the extent to which local entrepreneurs have an affect on the overall economy.

What does it mean for Washington?

Washington ranks second in the U.S., behind Utah, in employment growth rate for startup companies. This rate (33%) has increased over last year's reported rate of 22.4%, thus increasing the state's ranking from 6th to 2nd. It is also significantly higher than the national average of 19.3%.

The increase in this job creation rate shows that many of Washington's startup companies have entered their high-growth periods. To the extent that additional startup companies are formed and can survive through their early years, this employment growth rate will continue to remain high.

Source: Corporation for Economic Development

EMPLOYMENT IN GAZELLE COMPANIES [G-4]

Why is this indicator important?

Small and growing companies provide much of the employment growth in the U.S. In addition, those startup companies that grow rapidly offer the highest potential for job growth. These are referred to as "gazelle" companies because of this rapid growth.

Measuring the percentage of jobs in gazelle companies reflects the total number of these gazelle companies, their growth rate and the percentage gazelle companies represent of the overall number of companies in the state. Therefore, a higher ranking indicates relatively more small, growing companies in the state. A lower ranking reflects a small number of startups relative to the overall company mix in the state and/or startup companies growing at a slower rate.

What does it mean for Washington?

Washington ranks low in this measure (in the bottom quartile of all states). Combining this fact with the indicator showing that Washington ranks high in the startup company growth rate (2nd in the U.S.), we conclude two things. First, many of Washington's startup companies terminate operation early (as demonstrated by the high closure rate) and therefore are not counted in the startup growth rate. Second, Washington has a fairly significant portion of its employment in more mature (non-startup) companies, and therefore the percentage of employment in potential gazelle companies is small.

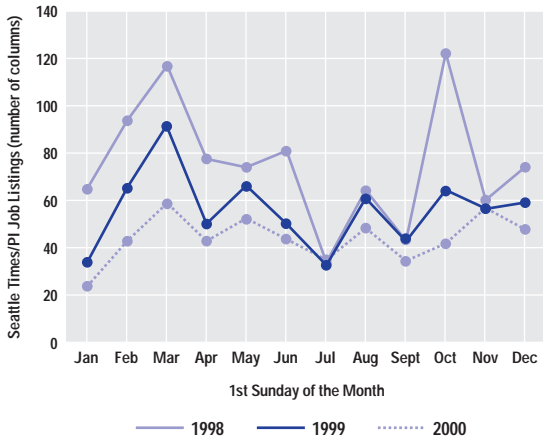
Source: Progressive Policy Institute

G-3 Washington State has the 2nd highest growth rate for employment in startup companies

Top 10 States	5 Year Growth Rate (93-98)	Rank Last Year (92-97)
1) Utah	33.8%	2
2) Washington	33.3%	6
3) Idaho	30.0%	12
4) Kentucky	28.9%	35
5) Arizona	28.1%	3
6) Colorado	27.6%	26
7) California	26.6%	13
8) Florida	25.6%	10
9) Nevada	25.2%	16
10) Missouri	25.0%	28
U.S. Average	19.3%	

Washington ranks in the bottom quartile in the percentage of jobs in gazelle companies with 12.6% (the U.S. average is 14.3%)

G-5 Number of unfilled technology positions declined between 1998 and 2000



ADVERTISED TECHNOLOGY POSITIONS [G-5]

Why is this indicator important?

A company's growth can be severely limited by lack of qualified workers to meet business demands. Therefore, difficulty in finding employees for open positions can limit economic growth. The number of open, advertised technology positions is an indicator of the number of unfilled company positions.

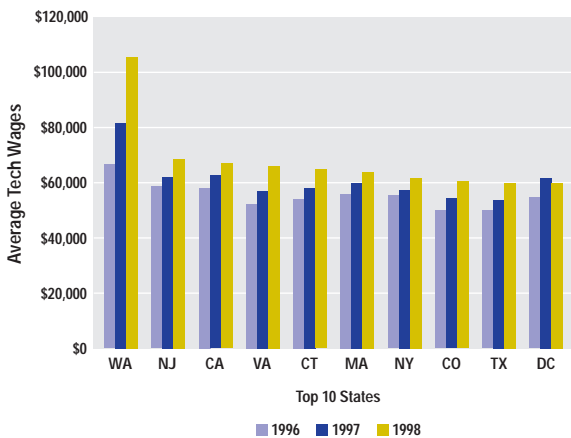
What does it mean for Washington?

This year, the trend continues downward for the number of open positions advertised. This is a reflection of the easing in the technology company markets and equity funding experienced in 2000.

A demand still exists for additional employees. Companies in Washington are searching for qualified workers. This indicator seems to best reflect the future expectations for hiring.

Source: Employment listings, Sunday Seattle Times/Post-Intelligencer

G-6 Washington State ranks 1st for average technology job wages (1996–1998)



AVERAGE TECHNOLOGY JOB WAGE [G-6]

Why is this indicator important?

Given the high demand for qualified and experienced technology workers at all levels, compensation level is one tool companies use to attract and retain those workers.

What does it mean for Washington?

Washington continues to top the list of all states in the average wage for technology workers over the period 1996–1998. Part of this value certainly is due to equity-based compensation granted to employees in technology-based companies.

Source: American Electronics Association

F i n a n c i a l C a p a c i t y determines the ability of companies in Washington to grow by attracting local capital investment.

Indicators:

Both private and public sources of technology capital are examined in the indicators that gauge financial capacity:

- Venture investment by region
- Growth in venture investment by region
- Initial public offerings
- Distribution of Northwest capital investment
- Small Business Innovative Research program awards
- Advanced Technology Program awards

Why is financial capacity important?

Ready access to capital is one of the most important success factors for growing companies—especially when investments in technology are required. Strong capital backing is needed to ensure that the technology investment can effectively and quickly be translated into new products or can significantly improve the company's business and manufacturing processes.

Because there is such a strong tie between the investors and the management of a company, locally available capital is important. Having qualified and willing investors and investment institutions near the entrepreneurs is therefore key to growth in entrepreneurial companies.

What does this mean for Washington?

Findings in this report are similar to those of last year. Washington companies have attracted an increasing investment; however, Washington's growth rate is smaller than that of most other regions of the U.S. This trend suggests that other regions will move ahead of Washington in their impact on major industry sectors.

The big capital story in 2000, both nationally and in Washington, was the significant downturn in the rate of investment to technology sectors, especially internet-based enterprises. Downturn may be a slightly misleading term. Venture-backed capital investment returned to a level between the 1999 and 2000 rates. Capital investment is still growing, just not at the exceptional rate of early 2000.

Still, private capital is more readily accessible to Washington companies than even just a few years ago. Many of the larger investment banks and venture funds have opened offices within the state. In addition, investors within Washington are becoming more active with the state's companies.

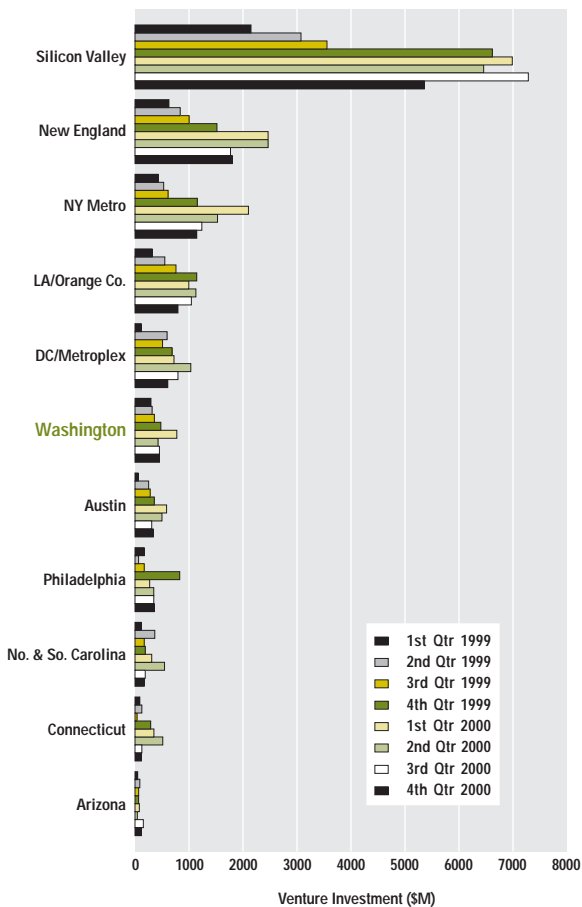
Capital investment is available to companies in many forms. This year, we begin reporting capital raised from Initial Public Offerings (IPOs) in addition to venture-backed financing and federally available technology development financing. IPOs provide companies with access to a fairly large capital infusion and signify, for those successful offerings, that the public capital markets believe the company's business prospects are long term.

To complete the private financing picture, we must remember that small private investors—the "angels"—are becoming a much larger part of the investment picture. However, angel investment indicators are not included because no easy method exists for gathering appropriate information.

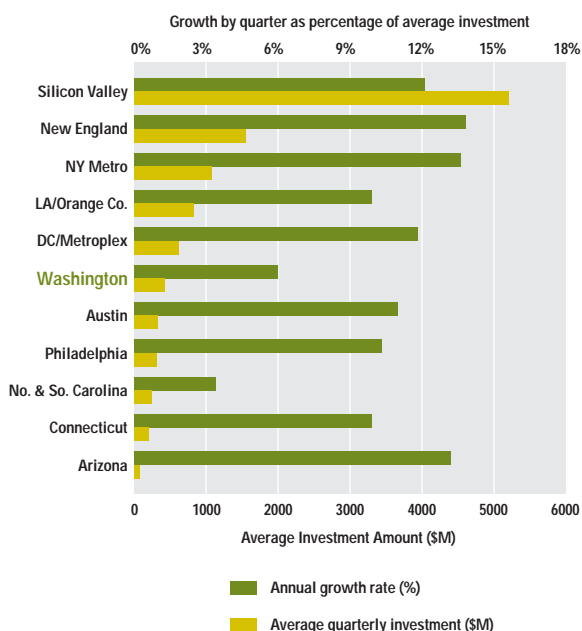
How do these measures relate?

Companies require capital to start and expand operations. This capital tends to be somewhat localized. Measures such as regional distribution of venture investment, growth of that investment, the industries in which it is invested, and the public sources of financing are included.

FC-1 Washington ranks 6th of 11 regions for venture investment



FC-2 Washington ranks 10th out of 11 regions for average quarterly venture investment growth during the past 2 years



VENTURE INVESTMENT BY REGION [FC-1]

Why is this indicator important?

In order for companies to grow, they require investment capital. The total size of the investment in Northwest companies reflects two things. First, it is an indicator of the size of Washington's technology economy. Second, it reflects the strength and commercial potential of ideas in Northwest companies as compared to other regions.

What does it mean for Washington?

Two major conclusions should be drawn from this indicator. First, Washington is among the top regions in the country for venture investment, ranking 6th overall in these 11 large capital markets. The first five regions each represent large metropolitan areas. Washington leads the group of "smaller large metropolitan areas."

Second, the percentage of investment going to companies in Silicon Valley continues to be exceptionally large. Over the two years represented in this chart, Silicon Valley attracted 48% of the funding for these 11 regions. Second place (New England, primarily Boston) attracted 14% of the total; Washington attracted 4%.

Source: PricewaterhouseCoopers

GROWTH IN VENTURE INVESTMENT BY REGION [FC-2]

Why is this indicator important?

In addition to the overall amount of venture investment, the growth rate of venture investment can be used both to gauge the relative vitality of business concepts in a region and to project future impact. Those regions experiencing growth in investment at or above the average will maintain or increase their impact. Those growing more slowly will eventually lose impact.

What does it mean for Washington?

Investment in Washington companies continues to grow, but not at the rate of late 1999 and early 2000. The total investment in the first quarter of 2000 was 2.6 times that of first quarter 1999—just one year earlier. However, that rate was sustained only a short time. Overall growth in the eight quarters of 1999 and 2000 was just 6%.

However, for the 11 areas reported, Washington ranked 10th, having the second lowest growth rate. The average growth rate of these areas exceeded 10% and total growth of the 11 areas combined was nearly 12%.

For the reasons given above, this slower growth in venture investment raises concern for the long-term impact of Washington in the future technology-based economy.

Source: PricewaterhouseCoopers

INITIAL PUBLIC OFFERINGS [FC-3]

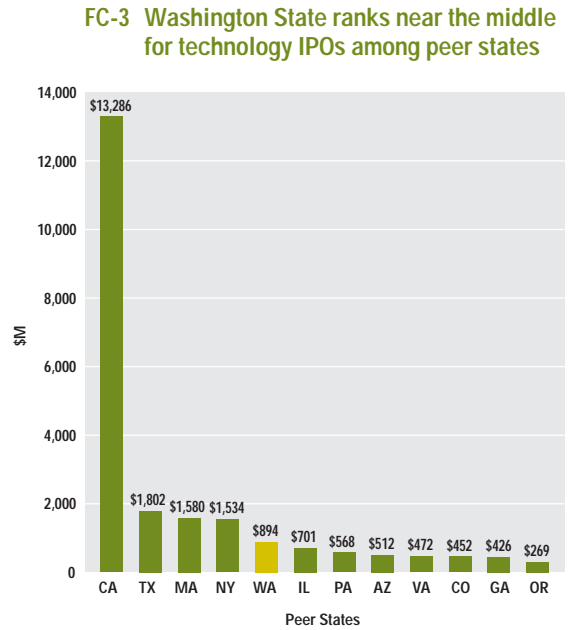
Why is this indicator important?

The initial offering of equity to investors through the publicly traded exchanges is one measure of the expected long-term viability of a company. Both the number of companies that “go public” and the total market value of those companies can be used to gauge this expectation. In this measure, we use total market capitalization at the time of the offering to compare Washington to other states.

What does it mean for Washington?

Based on these IPO data, Washington is clearly a leader in creating an environment for companies to start, grow and establish a long-term presence. At a total market value of \$894M, Washington ranks 5th behind California, Texas, Massachusetts, and New York.

Source: IPO.com



DISTRIBUTION OF NORTHWEST CAPITAL INVESTMENT [FC-4]

Why is this indicator important?

The Northwest’s distribution of venture investment across sectors can be related to the national and global trends in economic growth (e.g., investment in information technology and communications) using this measure. It portrays the makeup of our region’s technology economy.

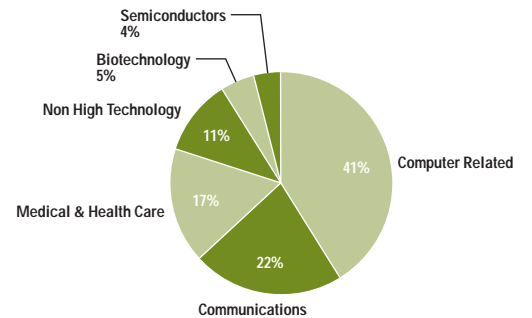
What does it mean for Washington?

The majority of investment in Washington companies was in telecommunications and computer-related companies. These two sectors totaled 63% of the investment—increasing from last year’s 58% share.

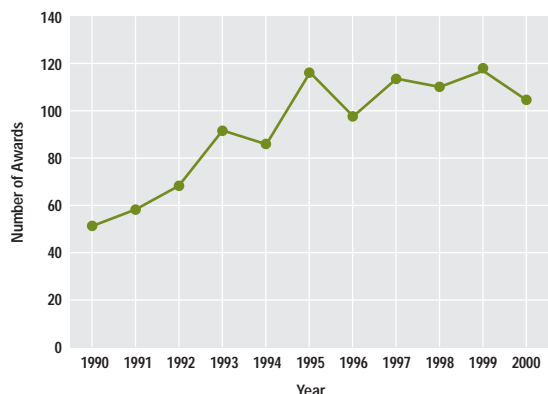
Based on the significant increase in overall investment, most sectors experienced a larger investment in 2000 than in 1999. Only biotechnology received a slightly smaller investment.

Source: Northwest Venture Associates

FC-4 Computer related products dominate Northwest capital investment



FC-5 SBIR investments in Washington State have begun to level off over the past 5 years



SMALL BUSINESS INNOVATIVE RESEARCH PROGRAM AWARDS [FC-5]

Why is this indicator important?

The Small Business Innovative Research (SBIR) program offers an opportunity for Washington companies to find investment from federal sources to assist with growth of their company. This program is specifically targeted to small business with new ideas and limited capital to explore those ideas.

What does it mean for Washington?

Washington companies have been successful over the past decade in attracting SBIR program awards. The rapidly increasing trend of the early to mid-90s has ended; the number of awards is relatively flat for the past five years. Washington ranks 12th for SBIR Phase I and 13th for Phase II awards in 2000. This is down from ranking 10th in both categories in 1999.

Source: State Science and Technology Institute

FC-6 Companies in Washington State have received few ATP awards (8)

ADVANCED TECHNOLOGY PROGRAM AWARDS [FC-6]

Why is this indicator important?

Like the SBIR program, the Advanced Technology Program (ATP) is a federal resource for technology development. It is intended for companies to explore and develop new, promising and high-risk technologies that are too early for private investment. The number of ATP awards reflects a combination of the quality of the new technology idea and the company's willingness to invest in the fairly intensive application process.

What does it mean for Washington?

No new ATP awards were made to Washington companies in 2000. This program continues to be a completely untapped resource for the state's companies.

Source: National Institute of Science and Technology

Year	Number of Awards-WA	ATP Award Amount	Number of Awards-U.S.	ATP Award Amount
1990	-		10	\$35,400,000
1991	1	\$900,000	28	\$93,000,000
1992	-		20	\$46,300,000
1993	1	\$300,000	27	\$56,200,000
1994	-		78	\$256,600,000
1995	4	\$5,100,000	92	\$375,800,000
1996	-		6	\$14,400,000
1997	-		62	\$157,300,000
1998	2	\$3,100,000	76	\$229,600,000
1999	-		37	\$109,900,000
2000	-		54	\$148,000,000

The *H u m a n P o t e n t i a l* represented by Washington residents is a key resource for the continued growth and well-being of the state's economy.

Indicators:

To discover the potential of Washington residents to participate in the technology economy, we examine indicators relating to an educated, technology-literate workforce:

- Educational attainment
- Science and technology degrees granted
- SAT scores
- Standardized math test scores

Why is human potential important?

Technology industries—and all companies adopting new innovations and technology improvements—rely heavily on an educated and skilled workforce. With these new ideas, there is a premium on workers that can both understand new concepts and also extend and integrate those new concepts with other ideas. Thus, education is a key component for the future competitiveness of Washington's companies.

What does this mean for Washington?

Washington residents are well prepared for the innovations and technology they will see in the coming decades when compared to residents in other states. A vast majority have completed secondary education, and many have higher education degrees.

Unfortunately, many of Washington's scientists and engineers must be educated outside the state because of the small number of degrees granted by Washington institutions each year.

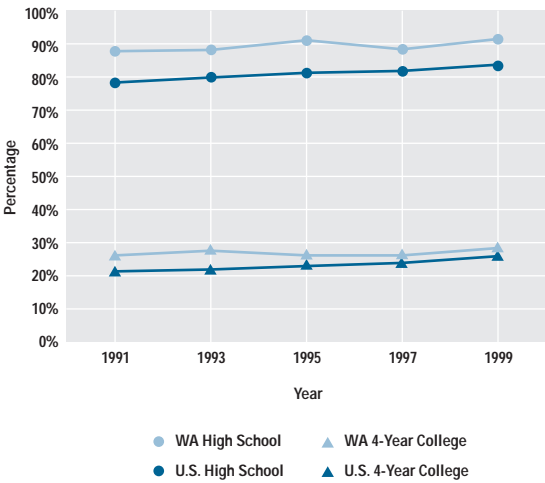
Note: As in last year's report, this Index does not address the size of the need for technology workers. That need remains large, even after the business slowdown in the technology sectors. Again, other organizations have characterized the size of that gap, so it is not repeated here.

How do these measures relate?

Basic education of the workforce, especially in science and mathematics, is required for workers to successfully deal with new innovations and technologies. Competence on standardized testing (SAT, mathematics) demonstrates meeting this requirement.

Companies require a technology workforce with higher levels of education, specifically with strong science, engineering and technology backgrounds. Educational attainment and science and technology degrees granted gauge this need.

HP-1 Washington ranks 1st in percentage of residents with a high school diploma and 12th in percentage of residents with a 4-year college degree



EDUCATIONAL ATTAINMENT [HP-1]

Why is this indicator important?

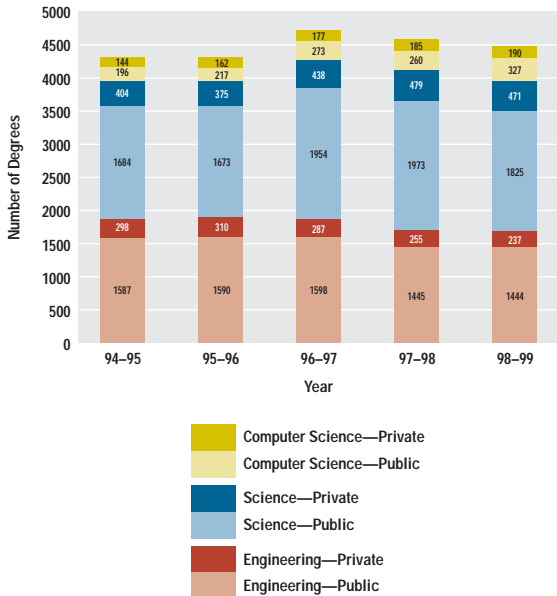
Companies infusing technology into their operations or products require an educated workforce. High school education is required for most of these positions, but for many is not enough. Availability of a workforce with higher education experience and accomplishment is required in many cases for companies to realize the full potential of new innovations and technologies.

What does it mean for Washington?

More than 90% of Washington residents have completed their secondary education. Washington also ranks in the top 25% of states for residents having completed higher education degrees. Both of these percentages increased from 1997 to 1999, a trend that must continue if Washington is to remain competitive.

Source: U.S. Census Bureau

HP-2 Washington's 4-year institutions grant roughly 4,500 science and technology degrees each year



SCIENCE AND TECHNOLOGY DEGREES GRANTED [HP-2]

Why is this indicator important?

Companies relying on innovation and new technology for their future must attract a workforce having 4-year and advanced university degrees. Many of those people must be educated within the state's system of public and private universities and colleges.

What does this mean for Washington?

The number of science and technology degrees granted by Washington's 4-year higher education institutions actually declined between 1996 and 1999. This decline was driven by a reduction in the number of Bachelors-level science and engineering graduates from Washington's public universities.

Source: Washington State Higher Education Coordinating Board

SAT SCORES [HP-3]

Why is this indicator important?

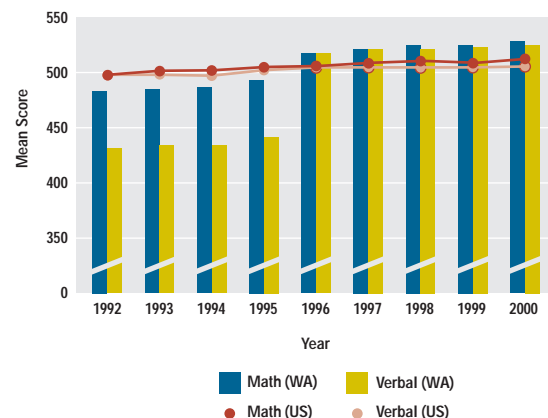
Standardized Achievement Test (SAT) scores have long been an important measure of a student's readiness for continuing on toward higher education. High SAT scores indicate that the state's young people are well prepared for the post-secondary education required by the state's entrepreneurial and technology companies.

What does this mean for Washington?

Washington students' SAT scores have continued to increase over the past decade. They continue to exceed the national mean test scores in both math and verbal skills. From these scores, we can assume that many of Washington's high school students will be able to successfully complete their higher education programs.

Source: The College Board

HP-3 Washington students have exceeded the national average for math and verbal SAT scores over the past 5 years



STANDARDIZED MATH TEST SCORES [HP-4]

Why is this indicator important?

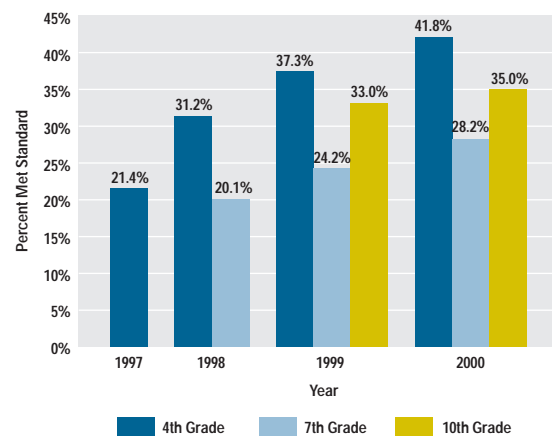
Proficiency in mathematics is a core requirement for anyone to successfully work in the technology economy. Basic math skills must begin with elementary school education and continue throughout secondary school education.

What does this mean for Washington?

Overall, scores on Washington's mathematics proficiency examinations have increased since 1997. The increases in these scores over the past several years is very promising. However, the relatively low percentage of elementary and secondary students passing the test as well as the slow rate of increase is troubling. At the current rate, several decades may be required until all of Washington's students gain the necessary mathematics proficiency.

Source: Washington State Superintendent of Public Instruction

HP-4 Washington's primary and secondary students are increasing their proficiency in math and science



A state's *Q u a l i t y o f L i f e* is key to attracting qualified workers to the state and keeping them.

Indicators:

To gauge Washington's quality of life, we attempt to quantify those non-economic factors that make life enjoyable for Washington residents. These indicators reflect several areas important to supporting a technology workforce:

- State park use
- Traffic congestion
- Urban area housing affordability
- Statewide housing affordability
- Crime index
- Arts and sports organizations

Why is quality of life important?

Opportunities for interaction, recreation and learning (not related to their job) are key to technology workers' satisfaction. These factors are extremely important in both attracting and retaining qualified technology workers.

What does this mean for Washington?

Overall, Washington provides its residents with a lifestyle that offers many diverse experiences. Geographic amenities and diversity are obvious—from the Puget Sound region to the mountains of north and central Washington to the desert-like environment of eastern Washington. Washington also offers a range of communities. It is possible to find urban, city living in the Seattle area or a rural setting in both the farming areas of the east and the timber country of the Olympic Peninsula. Quantifying those amenities that are important to technology workers is difficult, partly due to this diversity. Some regions of the state offer cosmopolitan living along with the attendant problems—traffic congestion and higher home prices, for example. Midsize and smaller communities in other parts of the state offer the opportunity to avoid these problems.

How do these measures relate?

These measures have been selected to highlight a few of the important aspects of living in Washington. These measures are not intended to be either comprehensive or complete, but to reflect those topics most referenced during background work for this report.

STATE PARK USE [QL-1]

Why is this indicator important?

Access to outdoor recreational settings for hiking, picnicking, boating, and other activities is an important part of life in the Northwest. Washington's state park system reflects the public investment in those activities.

What does it mean for Washington?

Washington residents use their state parks more than three times as often (on average) as do most U.S. residents. Only three states rank higher in this usage. Clearly, outdoor activities are an important part of the Washington—and Northwest—lifestyle.

Source: Washington State Office of Forecast Council

TRAFFIC CONGESTION [QL-2]

Why is this indicator important?

Most of Washington's residents live in areas where commuting to work and traveling to shopping and entertainment by car is required. The time required and the ease of this commute is an important aspect of the quality of life.

What does this mean for Washington?

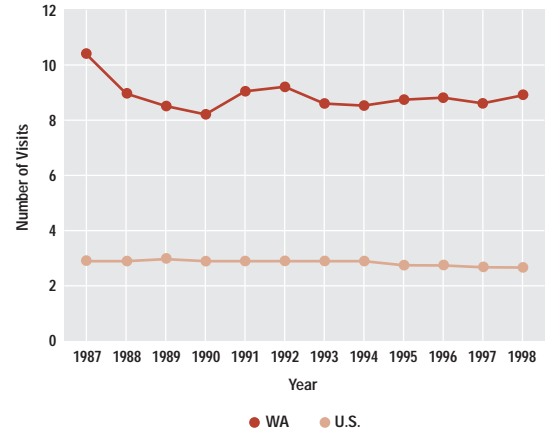
Traffic congestion is high in the Seattle area, but most other areas of the state experience relatively easy commutes. Combining the congestion problem with continued strong growth in the Seattle area points to an ongoing problem.

At the other extreme, Spokane continues to have little congestion among the 68 urban areas surveyed.

Finally, the cost associated with this lost time and extra transportation expense in the four Washington urban areas (including Portland) exceeds \$3B per year. The Seattle-Everett area accounts for \$1.8B in cost.

Source: Texas Transportation Institute

QL-1 Washington ranks 4th in state park visits per capita, more than 3 times the national average



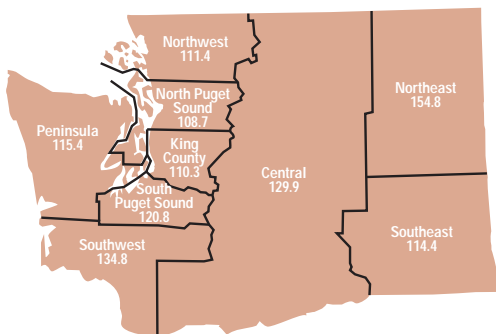
QL-2 The Seattle area is one of the worst areas in the nation for traffic as measured by delay

Rank	Urban Areas	Travel Rate Index	Annual Delay (person-hours per driver)
1	Los Angeles, CA	2.06	56
2	Seattle-Everett, WA	1.81	53
3	San Francisco-Oakland, CA	1.77	42
4	Washington, DC-MD-VA	1.71	46
6	New York-Northeastern NJ	1.70	34
8	Portland-Vancouver, OR-WA	1.65	34
	Urban Area Average	1.58	36
24	Tacoma, WA	1.46	27
59	Spokane, WA	1.12	10

QL-3 Houses in Washington urban areas tend to be more expensive than houses in other urban areas

Metro area	Share of Affordable for Median Income	Rank of Affordable Homes
Springfield, IL	89.6	1
Davenport–Moline–Rock Island, IA–IL	87.6	2
Elkhart–Goshen, IN	86.0	3
Rockford, IL	85.8	4
Mansfield, OH	85.5	5
Seattle-Bellevue-Everett, WA	44.5	144
Tacoma, WA	43.1	148
Portland–Vancouver, OR-WA	27.6	168
Eugene–Springfield, OR	23.8	170
Salinas, CA	13.0	174
San Jose, CA	13.0	175
Santa Cruz–Watsonville, CA	8.7	176
San Francisco, CA	5.7	177

QL-4 Housing is most affordable in the Southwest and Northwest regions of Washington



Note: Higher numbers indicate more affordable housing (100 being the balance point between ability to pay and cost of housing).

URBAN AREA HOUSING AFFORDABILITY [QL-3]

Why is this indicator important?

Home ownership is important to most people—and technology workers are no exception. For most people, the ease of purchasing a home is an important measure of the quality of living in an area. The affordability indicator shown here is determined as a percentage of the housing affordable to a person or family making the average wage in that metropolitan area.

What does this mean for Washington?

Washington's largest metropolitan areas have housing that is fairly expensive. Of the three areas included in this analysis, Portland/Vancouver has the smallest percentage of its housing available to people at the median income.

Seattle-Everett and Tacoma regions fall near the midpoint between the regions having the largest and smallest portions of their housing affordable. However, with the relatively high average income in the Puget Sound region, it's clear that housing is expensive. For first time homeowners or people moving from other regions, buying in these markets can be quite a challenge.

Source: National Association of Home Builders

STATEWIDE HOUSING AFFORDABILITY [QL-4]

Why is this indicator important?

This measure examines the relative affordability of housing in the regions of Washington State. Again, this indicator is adjusted for wages in the region, resulting in a housing affordability index.

What does this mean for Washington?

Northeast and Southwest Washington offer the most affordable housing (compared to wages) in the state. As expected, the King County region is the most expensive. Because of the relatively lower wages in the Northwest and Peninsula regions, housing in those areas is in the mid-range for the state.

Source: Washington Center for Real Estate Research

CRIME INDEX [QL-5]

Why is this indicator important?

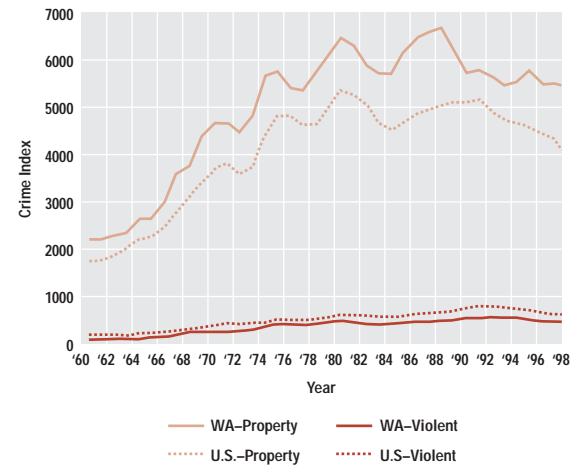
To attract and retain workers and residents to Washington, those people must believe that they will be safe in their homes and at work. This crime index is an aggregate measure of the overall crime exposure.

What does this mean for Washington?

Since 1960 the overall crime rate has increased in Washington, but in the past decade has steadily declined. The mix of crime in Washington is different from the U.S. average. Washington experiences a higher percentage of property crime, but a lower percentage of violent crime.

Source: The Disaster Center, Federal Bureau of Investigation

QL-5 Washington residents experience fewer violent crimes but more property crimes when compared to the U.S. average



ARTS AND SPORTS ORGANIZATIONS [QL-6]

Why is this indicator important?

To create a balanced atmosphere for a technology workforce, easy access to arts organizations, performances and exhibits as well as to professional sporting events is important.

Exact measurement of arts and sporting events is both impractical and unnecessary. This indicator provides a qualitative review of the breadth of opportunities and the distribution of those activities across the state.

What does this mean for Washington?

Washington residents and visitors have good access to arts and sports events. As reported last year, the Washington State Arts Commission provided support to 786 organizations and individuals all across the state. Most of these were for performing arts organizations.

Similarly, professional sports teams make their home in each of Washington's major cities. The state's three major league teams call Seattle their home. Minor league teams can be found in six of Washington's cities.

Sources: Washington State Arts Commission; individual professional sports leagues

QL-6 Washingtonians have access to arts and sporting events throughout the state

Type of Arts Organization		Number of Organizations
Theatres or theatre companies		18
Symphony orchestras		13
Opera companies		4
Ballet companies		3

Sport	League	Location of Teams
Football	NFL	Seattle
Basketball	NBA	Seattle
	WNBA	Seattle
Baseball	CBA	Yakima
	MLB	Seattle
	Northwest League	Everett, Spokane, Yakima
	Pacific Coast League	Tacoma
	Western Baseball League	TriCities
Soccer	USL-A	Seattle
	USL-Premier	Spokane, Seattle, Yakima
Hockey	WHL	Seattle, Spokane, TriCities

Table 1. List of Technology Occupations

- Physicians
- Physicists & Astronomers
- Biological Scientists
- Medical Scientists
- Life Scientists, NEC
- Mathematical Scientist, NEC
- Operations Research Analysts
- Engineer, Math, Natural Science Mgrs
- Aeronautical & Astro Engineers
- Metallurgists & Rel Engineers
- Mining Engineers, Incl Safety
- Petroleum Engineers
- Chemical Engineers
- Nuclear Engineers
- Civil Engineers, including Traffic
- Agricultural Engineers
- Electrical & Electronic Engineer
- Computer Engineers
- Industrial Engineers, Ex Safety
- Safety Engineers, Except Mining
- Mechanical Engineers
- Marine Engineers
- Engineers, NEC
- Chemists
- Meteorologists
- Geologists, Geophysicists, Ocean
- Physical Scientists, NEC
- Systems Analysts
- Data Base Administrators
- Computer Support Specialists
- Computer Programmers
- All Other Computer Scientists
- Statisticians
- Medical and Clinical Laboratory Technologists
- Technical Writers
- Civil Engineering Technicians and Technologists
- Electrical and Electronic Engineering Technicians and Technologists
- Industrial Engineering Technicians and Technologists
- Mechanical Engineering Technicians and Technologists
- All Other Engineering and Related Technicians and Technologists
- Biological, Agricultural, and Food Technicians and Technologists, Except Health
- Chemical Technicians and Technologists, Except Health
- Nuclear Technicians and Technologists
- Petroleum Technicians and Technologists
- All Other Physical and Life Science Technicians and Technologists
- Mathematical Technicians

DEFINITION OF TECHNOLOGY INDUSTRY

Technology industries are those which employ the majority of science, engineering, and technology occupations in the state. These occupations are listed in Table 1.

Several of the indicators for this report are based on a subset of Washington's economy referred to as the "technology industries" or "technology sectors." Several definitions for these technology sectors have been used recently in various reports and public discussions regarding technology. For this report, we developed a definition of technology sectors based on the occupations listed in Table 1 and the industries that employ a large percentage of these positions.

This rationale is based on the fact that technology-based products and services require employees with technology skills to develop, manufacture, sell, and maintain them.

Method Used for Selecting Industry Segments

We selected the SIC (standard industry classification) codes to include in this definition of technology industries using a two-step process:

1. Any SIC code having 7% or more of its employment in the technology occupations listed in Table 1 was included. By choosing the 7% limit, we were able to account for approximately 2/3 of all technology positions in Table 1. Adding industries with less than 7% of technology workers would have added too many non-technology workers to the total and exaggerated the figures.
2. Each of these potential technology SIC sectors was then examined for the individual companies included. This company-by-company scan allowed pruning of the list for those segments that had high percentages of technology occupations but really represented delivery of routine services based on a technology. Examples of sectors we excluded based on this second criterion are 7378-Computer maintenance and repair, 8734-Testing laboratories, and 874-Management and public relations services.

Table 2 represents the resulting set of technology sectors used in our definition of high technology. In this table, we also show how our definition compares with those used by other organizations in recent studies. While none of these is exactly the same, there is a great deal of similarity among the definitions.

Table 3 is a description of the top-level SIC codes.

Table 2. Technology Industry SIC Codes

SIC Code for Industry Sector	IITW	PSRC	Beyers	Milken	AEA
281 Industrial inorganic chemicals					
2812 Alkalines and chlorine					
2813 Industrial gases					
2816 Inorganic pigments					
2819 Industrial inorganic chemicals NEC					
282 Plastics, rubber and fibers					
2821 Plastics material synthetic resins and nonvulcanizable elastomers					
2822 Synthetic rubber					
2823 Cellulosic manmade fibers					
2824 Manmade organic fibers, except cellulose					
283 Drug manufacturing					
2833 Medicinal chemicals and botanical products					
2834 Pharmaceutical preparations					
2835 In vitro and in-vivo diagnostic substances					
2836 Biological products, except diagnostic substances					
286 Organic chemicals					
2865 Cyclic crudes and intermediates, organic dyes					
2869 Chemicals, industrial organics NEC					
287 Agricultural chemicals					
289 Misc chemicals and chemical preparations					
2891 Adhesives and sealants					
2899 Chemicals and chemical preparations NEC					
291 Petroleum refining					
351 Engines and turbines					
353 Construction and related machinery					
355 Special industrial machinery					
354 Industrial tools					
3545 Tools, cutting and precision, and machine tool accessories					
357 Computers and office equipment					
3571 Electronic computers					
3572 Computer storage devices					
3575 Computer terminals					
3577 Computer peripheral equipment NEC					
3578 Calculating and accounting machines, except electronic computers					
3579 Office machines NEC					
361 Electrical distribution equipment					
3612 Power, distribution and specialty transformers					
3613 Switchgear and switchboard apparatus					
362 Electrical industrial apparatus					
3621 Motors and generators					
3624 Carbon and graphite products					
3625 Relays and industrial controls					
3629 Electrical industrial apparatus NEC					
363 Household equipment					
3634 Electric housewares and fans					
364 Electric wiring and lighting					
3643 Wiring devices, current-carrying					
3644 Wiring devices, noncurrent-carrying					
365 Household audio visual equipment					
3651 Household audio and video equipment					
3652 Phonograph records and prerecorded audio tapes and disks					
366 Communications equipment					
3661 Telephone and telegraph apparatus					
3663 Radio and television broadcasting and communication equipment					
3669 Communications equipment NEC					
367 Electronic components and accessories					
3671 Electron tubes					
3672 Printed circuit boards					
3674 Semiconductors and related devices					
3675 Electronic capacitors					
3676 Electronic resistors					
3677 Electronic coils, transformers and other inductors					
3678 Electronic connectors					
3679 Electronic components NEC					
369 Misc electrical equipment and supplies					
3691 Batteries, storage					
3692 Batteries, primary, dry & wet					
3694 Engines, internal combustion, electrical equipment					
3695 Magnetic and optical recording media					
3699 Electrical machinery, equipment and supplies NEC					
371 Motor vehicles and equipment					
3711 Motor vehicles and car bodies					
3713 Truck & bus bodies					
3714 Motor vehicle parts & accessories					

SIC Code for Industry Sector	IITW	PSRC	Beyers	Milken	AEA
3716 Motor homes and van conversions					
372 Aircraft and parts					
3721 Aircraft					
3724 Aircraft engines and engine parts					
3728 Aircraft parts & auxiliary equipment NEC					
375 Motorcycles, Bicycles and Parts					
3751 Motorcycles, Bicycles and Parts					
376 Guided missiles, space vehicles and parts					
3761 Aerospace, guided missiles & space vehicles					
3764 Aerospace, propulsion units and propulsion parts					
3769 Aerospace, guided missiles & space vehicles parts & equip NEC					
381 Search and navigation equipment					
3812 Search, detection, navigation, guidance, aeronautical and nautical systems and instruments					
382 Measuring and controlling devices					
3821 Laboratory apparatus and furniture					
3822 Automatic controls for regulating residential and commercial environments and appliances					
3823 Industrial instruments for measurement, display and control of process variables					
3824 Totalizing fluid meters and counting devices					
3825 Instruments for measuring and testing of electricity and electrical signals					
3826 Laboratory analytical instruments					
3827 Optical instruments and lenses					
3829 Measuring and controlling devices NEC					
384 Medical equipment, instruments and supplies					
3841 Surgical and medical instruments and apparatus					
3842 Orthopedic, prosthetic and surgical appliances and supplies					
3843 Dental equipment and supplies					
3844 X-ray apparatus and tubes and related irradiation apparatus					
3845 Electromedical and electrotherapeutic apparatus					
385 Ophthalmic goods					
3851 Ophthalmic goods					
386 Photographic equipment and supplies					
3861 Photographic equipment and supplies					
481 Telephone communications services					
4812 Radiotelephone communications					
4813 Telephone communications, except radiotelephone					
482 Telegraph and other message communications					
4822 Telegraph and other message communications					
484 Cable and other pay television services					
4841 Cable and other pay television services					
489 Misc communications services					
4899 Communications services NEC					
504 Wholesale office and computer equipment					
5045 Computers and computer peripheral equipment and software					
506 Wholesale electrical equipment, parts and appliances					
5065 Electronic parts and equipment NEC					
737 Computer and data processing services					
7371 Computer programming services					
7372 Prepackaged software					
7373 Computer integrated systems design					
7374 Computer processing and data preparation and processing services					
7375 Information retrieval services					
7376 Computer facilities management services					
7377 Computer rental and leasing					
7378 Computer maintenance and repair					
7379 Computer related services NEC					
781 Motion picture production					
807 Medical and dental laboratories					
8071 Medical laboratories					
871 Engineering and architectural services					
8711 Engineering services					
8712 Architectural services					
8713 Surveying services					
873 Research and testing services					
8731 Commercial physical and biological research					
8732 Commercial economic, sociological and educational research					
8733 Noncommercial research organizations					
8734 Testing laboratories					
874 Management and public relations services					

Study references:

IITW—Index of Innovation and Technology in Washington State (this report). PSRC—Puget Sound Regional Council (report to be released). Beyers—WB Beyers, PB Nelson, The Economic Impact of Technology-Based Industries in Washington State in 1997, prepared for the Technology Alliance, Seattle, WA, November, 1998. Milken—RC DeVol,

America's High Tech Economy, The Milken Institute, July 1999. AEA—MD Platzer, CyberStates V3.0, American Electronics Association, 1999.

Table 3. SIC Definitions

For those indicators using the 1-digit SIC code, the following definitions apply.

Title	SIC Code Groups	Description
Ag, Forestry, Fishing	01-09	Agricultural production, livestock and services; forestry; fishing, hunting and trapping
Mining & Construction	10-17	All mining, oil & gas extraction; building and heavy construction; special contractors
Manufacturing	20-39	Food procession, textile & apparel; wood, furniture, paper; chemical & petroleum; leather; stone; metal products and machinery; electronics; transportation equipment; measurement devices
Trans, Comms & Utilities	40-49	All transportation and services; pipelines; communications; electric, gas and sanitary services
Trade	50-59	Wholesale and retail trade
FIRE	60-69	Finance, Insurance and Real Estate
Business Services	70-79	Hotels; personal services; business services; automotive; motion pictures; amusement and recreation
Professional Services	80-89	Health; legal; educational; social; engineering, accounting, research, management services; museums
Public Admin	90-99	Government; justice and safety; Government program administration; national security

Source: Occupational Safety & Health Administration, www.osha.gov

REFERENCES

Those indicators for which additional information is needed are described below as well as electronic links to data (or links to sources for data).

INNOVATION

Chart I-1: Progressive Policy Institute (PPI), *State New Economy Index*, July 1999. The PPI index is derived from five factors: 1) share of jobs in high-tech industries; 2) share of scientists and engineers in the workforce; 3) patents generated relative to workforce size; 4) industry R&D as a share of gross state product; and 5) venture capital as a share of gross state product; www.neweconomyindex.org/states/part5.html

Charts I-2 & I-3: Corporation for Enterprise Development, *2000 Development Report Card for the States*, <http://drc.cfed.org>

Chart I-4: Washington State Employment Security Department, www.wa.gov/esd/

Charts I-5 & I-6: U.S. Patent and Trade Office, Office for Patent and Trademark Information, Technology Assessment and Forecast Branch, www.uspto.gov/web/offices/ac/ido/oeip/taf/clsstc/regions.htm

Chart I-7: National Science Foundation, Division of Science Resources Studies, *Federal Funds for Research and Development*, Fiscal Years 1998, 1999 and 2000, www.nsf.gov/sbe/srs/pubdata.htm

COMPETITIVENESS

Chart C-1: Washington State Employment Security Department, www.wa.gov/esd/

Chart C-2: Derived from employment data by the officers. Data supplied by the Washington State Employment Security Department, www.wa.gov/esd/

Charts C-3 & C-4: Washington State Employment Security Department, www.wa.gov/esd/

Chart C-5: Sector numbers from Massachusetts Institute for Social and Economic Research (MISER), University of Massachusetts; software figures from Washington State Office of Trade and Economic Development, www.oted.wa.gov/

Charts C-6 & C-7: State export numbers from MISER, www1.miser.umass.edu/trade/stjun.html; state population numbers from U.S. Census Bureau, www.census.gov/

Chart C-8: Institute on Taxation and Economic Policy, www.ctj.org/itep/

GROWTH

Charts G-1 & G-2: Washington State Employment Security Department, www.wa.gov/esd/

Chart G-3: Corporation for Enterprise Development, *2000 Development Report Card for the States*, <http://drc.cfed.org>

Chart G-4: Progressive Policy Institute, www.ppionline.org/

Chart G-5: Sunday *Seattle Times/Seattle Post-Intelligencer*. <http://seattletimes.nwsourc.com/>, <http://seattlep-i.nwsourc.com/>. The space dedicated to technology classified advertisements was measured on the first Sunday of each month in 1998, 1999 and 2000. The number of newspaper columns dedicated to these ads is the unit of this indicator. In the Sunday paper, a full page has 10 columns.

Chart G-5: Corporation for Enterprise Development, *2000 Development Report Card for the States*, <http://drc.cfed.org>

Chart G-6: American Electronics Association, Cyberstates 4.0, <http://www.aeanet.org/>

FINANCIAL CAPACITY

Charts FC-1 & FC -2: PricewaterhouseCoopers *MoneyTree™ Reports*, www.pwcmoneytree.com. Note: This percentage growth is computed as the least squares fit of venture investment over the eight quarters divided by the average investment during that period.

Chart FC-3: IPO.com, www.ipo.com/ipoinfo/search.asp?p=IPO. High tech IPOs were selected from the Index SIC codes (see definition of technology industry). Numbers are for second half of 1999 and first half of 2000.

Chart FC-4: Northwest Venture Associates, *Venture Capital in the Northwest*. The report summarizes NW venture capital investment and fundraising activities by Northwest venture capital funds for the five years ending December 31, 1999, www.nwva.com/

Chart FC-5: State Science and Technology Institute, www.ssti.org/Digest/subjectinx.htm. SBIR award numbers for National Institutes of Health were not available; however, based on the 1998 numbers, the trend would hold true.

Chart FC-6: National Institute of Standards and Technology, www.nist.gov. The ATP award amount for Washington companies was estimated by simply dividing the total ATP project award amount by the number of companies involved in the project.

HUMAN POTENTIAL

Chart HP-1: U.S. Census Bureau, www.census.gov/population/www/socdemo/educ-attn.html

Chart HP-2: Washington State Higher Education Coordinating Board, www.HECB.wa.gov/

Chart HP-3: National Scores: The College Board, www.collegeboard.org/sat/cbsenior/yr2000/nat/natgen00.html;
Washington scores: The College Board, www.collegeboard.org/sat/cbsenior/yr2000/wagen00.html

Chart HP-4: Washington State Superintendent of Public Instruction, *State WASL Trend*,
www.k12.wa.us/edprofile/stateReport.asp?sReport=stateWASLTrend

QUALITY OF LIFE

Chart QL-1: Washington State Office of Forecast Council, Washington State Economic Climate Study,
www.wa.gov/ofc

Chart QL-2: Texas Transportation Institute, Texas A&M University, *1999 Annual Mobility Report*,
<http://mobility.tamu.edu>

Chart QL-3: National Association of Home Builders, *Housing Opportunity Index*,
www.nahb.com/facts/hoi/2000_3Q/complete_ranking.htm

Chart QL-4: Washington Center for Real Estate Research, *Housing Affordability Index*,
www.cbe.wsu.edu/~wcrer/HMUPDATE/3rdq00/00_HAIFTTq3.htm. The county index numbers were grouped by region; within each region a weighted average was calculated based on the percentage of homes sales for each county within each region.

Chart QL-5: The Disaster Center, www.disastercenter.com/crime. The index is the sum of violent crimes and property crimes. Violent crimes include murder, forcible rape, robbery and aggravated assault. Property crimes are burglary, larceny-theft and vehicle theft. Numbers for the U.S. and for Washington State are found on separate links.

Chart QL-6: Washington State Arts Commission, www.arts.wa.gov/, and individual professional sports leagues.

Created in 1983 by the state's legislature, the Washington Technology Center's purpose is to positively affect the creation and retention of jobs in Washington-based companies ...by increasing the effectiveness and ability of those companies to adopt and deploy technology ...that leverages the investment made in research at the state's universities.

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INDEX REPORT STAFF

Dr. Lee Cheatham, Washington Technology Center
Dr. Paul Sommers, University of Washington
Ellen E. Barker, Washington Technology Center
Matt Hanbey, University of Washington



WASHINGTON TECHNOLOGY CENTER

*300 Fluke Hall
Box 352140
Seattle, WA 98195-2140*

*tel: 206-685-1920
fax: 206-543-3059*

*e-mail: info@watechcenter.org
www.watechcenter.org*