2016 Oregon Innovation Index

Why Innovation?

Innovation matters.

It matters to businesses because innovation gives them a competitive advantage - those that can recognize market opportunities and address them quickly and effectively are more likely to grow and succeed, especially in an ever-more global 21st Century economy.

It matters to governments because those cities and states that can attract and cultivate the innovative firms and top-notch talent able to innovate not just once, but over and over again, will be more successful in the new economy.

It matters to communities because innovation brings good jobs, better public infrastructure and the diverse social, commercial, and cultural resources that make life better.

It matters to Oregon's future.

The Innovation Index

The Oregon Innovation Index was created to measure the state's innovation economy and identify opportunities for enhancing competitiveness. It is a key yardstick used by Business Oregon to track the state's success in building an innovation-based economy. An innovation-based economy is one that encourages new ideas, products and approaches to meet current or emerging demands of consumers. It directly impacts the ability of communities to grow and prosper.

Business Oregon and the Oregon Innovation Council (Oregon InC), a public-private partnership charged with creating an innovation-based economic strategy, identified key factors necessary for a healthy innovation economy, including: public-private partnerships for research and development, ready access to capital, statewide entrepreneurial networks, and targeted investments in emerging industries where Oregon has a global competitive advantage.

The first Innovation Index, published in 2004, evaluated nine indicators to track Oregon's progress. It was updated and expanded in 2007 to include 20 indicators to ensure that each stage of the innovation process, the expected outcomes, and the environment that leads to innovation were being measured. The 2009 Index continued the framework established in 2007 with updated data for each of the indicators. The 2016 Index also includes 20 indicators, but five of the indicators established in 2007 have been replaced with different indicators, primarily related to science, technology, engineering, and math (STEM) workforce and education.

The composite scores of the 2007 and 2009 indices were composed of a weighted sum of the 1-year, 5-year and national ranking performance for each indicator. The methodology for the 2016 Index composite score has changed. Instead of looking at 1 and 5-year trends, the 2016 Index looks at 10-year trends, in addition to national ranking and performance relative to the U.S. average. The
shorter term trends were removed because they were less valuable indicators of underlying trends. The composite score is still weighted, like before, with the 10-year trend weighted at 50 percent, national rank weighted at 33 percent, and performance relative to the U.S. average weighted at 17 percent. Due to the different indicators and methodology used in the 2016 Index, the composite score from this index is not comparable to past scores from previous indices.

The Index uses the 10-year trend data to provide an introspective look at Oregon’s innovation economy. The index also looks at current performance compared to the U.S. for context on how well the state is doing in advancing innovation capacity.

### Oregon’s 2016 Innovation Scorecard

<table>
<thead>
<tr>
<th>Indicator</th>
<th>10-yr Trend</th>
<th>Relative to U.S. Average (latest yr)</th>
<th>Latest National Ranking</th>
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<tr>
<td><strong>Invention</strong></td>
<td></td>
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<tr>
<td>Invention Disclosures</td>
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<td><strong>Translation</strong></td>
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<tr>
<td>R&amp;D Investments</td>
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<tr>
<td>SBIR/STTR Awards</td>
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<td>University Licenses/Options</td>
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<td>University Licensing Income</td>
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<tr>
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<td><strong>Innovative Environment</strong></td>
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<td>Educational Attainment</td>
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<td>Migration of Knowledge Workers</td>
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<td><strong>2016 Innovation Score (out of 100)</strong></td>
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<td><strong>67</strong></td>
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</table>

¹Represents 9 year analysis from 2005 to 2014.  
Source: Business Oregon.
The Innovation Score

Oregon’s 2016 Innovation Score is 67. A score of 100 would mean Oregon was nationally ranked in the top ten for every indicator, had a positive 10-year trend for every indicator, and performed above the U.S. average for every indicator. Obviously, a score of 100 would be nearly impossible to attain for any state, given the number and variety of indicators used in the Index. As such, the score of 67 should not be evaluated as one would for academic grading (90-100 equals an A, 80-89 equals a B, etc.).

The state performed best in the categories of Translation, Invention, and Economic Prosperity. In patents, Oregon continues to outperform for its size, due in large part to an established, competitive high technology industry with strong research and development. Within Translation, Oregon has made strong gains in SBIR/STTR awards and university licenses and options. Oregon’s overall Economic Prosperity has improved as well. Oregon’s percentage of GDP from manufacturing is the second highest in the U.S. Wages have improved in Oregon, and the gap in average wage between Oregon and the U.S. has shrunk.

The state performed worst in the categories of Commercialization and Innovative Environment. Entrepreneurship has waned in Oregon over the past 10 years, but this issue is not limited to Oregon. Nationwide, rates of entrepreneurship are flat or down, depending on the measure used, as less Americans are starting businesses than before. While Oregon increased its educational attainment and STEM workforce over the past 10 years, Oregon ranks low in the number of STEM graduates from Oregon colleges and universities as a percentage of adults age 18-24.
**INVENTION**

*Patents, Citations, & Invention Disclosures*

**Key Message**
New ideas are generated in Oregon at an increasing rate. In order to maximize value to the state, Oregon needs to focus on developing these ideas into new products and services for new and existing businesses.

**Significance**
The number of *invention disclosures*—the first step in determining if an invention should be patented—and *patents* measure the extent to which intellectual property is created in the state. *Patent citations*—when an inventor cites a previous patent in a patent application—are a measure of the technical relevance of a patent to later inventions. Commercially feasible research and development (R&D) reflects the innovative abilities of the various public and private research institutions to catalyze new products, jobs and companies.

**Performance**
Oregon ranked 24th nationally in the number of invention disclosures coming out of the university system in 2014. The number of invention disclosures filed by the state’s research institutions has grown steadily since 2004, although disclosures per million dollars in research expenditures is essentially the same as it was 10 years ago after recovering from decreases brought on by the Great Recession (Figure 1).

Oregon ranked 6th in the nation in patents per million persons and 12th in patent citations per million persons in 2014. The 10-year trends for both indicators are very positive. Oregon's growth in patents per million persons over the past 10 years, though, has lagged the U.S. Still, Oregon's rate remains much higher than the U.S. and is well above average (Figure 2). Growth in patent citations per million persons has generally kept pace with the U.S. and is nearly the same rate as the U.S., despite a relatively high rank of 12th amongst states (Figure 3).
Figure 2
Patents Per Million Persons

Figure 3
Patents Citations Per Million Persons

TRANSLATION
Research & Development

Key Message
Oregon’s competency in forging research and development (R&D) partnerships among universities and private industry gives the state a competitive advantage. Because these R&D expenditures typically leverage federal and private support, bringing new dollars into the state, it is important for the state to continue to enhance this key source of innovation in our economy.

Significance
R&D expands the knowledge base of industry and produces new products, which are key to sustained economic growth. New ideas, processes, and products fuel innovation and attract investment in Oregon companies.

Performance
Oregon’s R&D spending is driven by private industry, which accounted for 84% of total R&D expenditures in 2011. Total R&D expenditures in Oregon increased 91 percent between 2002 and 2011 (2001 data on total expenditures not available) (Figure 4). Oregon ranked 10th nationally in industry R&D as a percentage of private sector Gross Domestic Product by state (GDP by state—the value of all goods and services produced in the state) in 2012 (Figure 5). Oregon’s industry R&D as a percentage of private sector GDP is higher than the U.S. average and increased 29 percent between 2002 and 2012 (Figure 6).
### Industry R&D Performance by State in Millions

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<thead>
<tr>
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</table>

**TRANSLATION**

**SBIR/STTR**

**Key Message**
The SBIR and STTR (Small Business Innovation Research/Small Business Technology Transfer) federal R&D grant programs drive innovation in small businesses. Oregon should continue to focus on increasing its share of these federal grants by enhancing the tools available to small business owners to successfully learn about and apply for SBIR/STTR funding.

**Significance**
SBIR and STTR grants from federal agencies allow entrepreneurs to conduct research and develop new technologies. These programs often provide initial funding to help small companies turn ideas into commercially viable products.

**Performance**
In 2014, Oregon received $43.5 million in SBIR and STTR awards, an increase of 70 percent from 2004. Oregon SBIR and STTR awards accounted for 2.7 percent of total awards nationally in 2012, the latest year for which U.S. data is available (Figure 7). Since 2002, Oregon’s share of SBIR and STTR awards has more than doubled. Oregon received 63 SBIR awards and 7 STTR awards in 2014.

Oregon ranked 11th among all states in SBIR and STTR awards per $1 million of GDP in 2014. Oregon’s performance in this measure has improved since 2004, when Oregon was ranked 17th in the nation. Oregon had the fifth largest increase in SBIR and STTR award dollars per million in GDP amongst all states from 2004 to 2014 (Figure 8).

![Figure 7](image-url)
Figure 8

Change in SBIR/STTR Award Dollars per Million in GDP, 2004-2014

Source: Small Business Administration and U.S. Department of Commerce, Bureau of Economic Analysis
TRANSLATION

University Licensing Income & Options

**Key Message**
Oregon universities have had increasing success in generating income from the licensing of new technologies to businesses. Continued focus on this measure will increase linkages between higher education and private businesses that will help commercialize new technologies.

**Significance**
*University licensing income*—the amount firms pay universities to use their technology—and *options*—the agreement firms make with universities to use their technology—are indications of the commercial viability of university inventions. The number of licenses and options executed in a given year tells how many university inventions appear to have commercial potential. The amount of income universities receive is an indication of the value companies assign to the intellectual property developed at research institutions.

**Performance**
Oregon ranked 9th in the nation in the number of licensing options executed and 22nd in the nation in licensing income in 2014. Oregon ranked below the U.S. average in licensing income per $1 million in research expenditures. University licensing income in Oregon has more than tripled since 2004 (Figure 9). This increase indicates that Oregon research universities are generating more income from private sector use of their intellectual property. Likewise, the number of licenses and options executed at Oregon universities in 2014 was two-and-a-half times larger than 2004. This indicates that companies are increasingly integrating university research into their products and services.

![Figure 9](image-url)

**Figure 9**
Licenses & Options Executed & License Income by Oregon Research Universities

Source: Association of University Technology Management; Statistics Access for Tech Transfer.
COMMERCIALIZATION

Venture Capital

Key Message
Attracting venture capital into the state is vital for innovative Oregon businesses to thrive. Venture capital investments in Oregon have grown in recent years. Continuing this trend will be vital to growing Oregon’s innovation economy.

Significance
Access to capital plays a crucial role in new firm formation and stimulating economic growth. Venture funds and angel investors provide the risk capital many companies need to begin or expand their operations.

Performance
Oregon venture capital investment in 2014 was at its highest level since 2007, and 33 percent higher than 2004. While Oregon venture capital investment today is a far cry from the levels of investment seen in the run up prior to the dot-com bubble bursting, investment trends in recent years are positive. Comparatively, though, Oregon’s share of venture capital investment in the U.S. has steadily declined, from 0.62 percent in 2004 to 0.37 percent in 2014 (Figure 10).

Oregon ranked 18th in the nation in venture capital investment per $1,000 of GDP in 2014. Despite ranking in the second quintile, Oregon’s venture capital investment per $1,000 of GDP is below the U.S. average (Figure 11). This is mainly due to a handful of states—primarily California and Massachusetts—that receive large amounts of venture capital investment, driving the U.S. average well above the median for states.
Figure 11

Venture Capital Investment per $1,000 of GDP

COMMERCIALIZATION
Entrepreneurial Activity

Key Message
States that are able to generate and support entrepreneurship will be well-positioned to develop new products and services. Startup firms have the potential to grow rapidly and provide leadership in developing new markets that benefit both emerging and existing businesses around the state.

Significance
*Entrepreneurship*—the creation of new companies—is often used as a measure of the extent to which new ideas are introduced into the market. These new ideas are one measure of innovation in an economy. The Kauffman Foundation’s Index of Entrepreneurial Activity calculates the percentage of individuals ages 20 to 64 who start a new business.

Performance
In 2015, Oregon ranked 29th in the nation in entrepreneurial activity. This is down from a ranking of 18th in 2005. Oregon's entrepreneurship rate also declined from 0.33 percent in the 2005 Index to 0.27 percent in 2015. The U.S. rate has remained relatively unchanged, but other measures of entrepreneurship, such as establishment births from the Bureau of Labor Statistics’ Business Employment Dynamics, show a decline in entrepreneurship nationwide. Nonetheless, Oregon’s rank in this measure has slipped compared to other states, and is now below the U.S. average (Figure 12).

![Figure 12: Kauffman Index of Entrepreneurial Activity](source.png)
COMMERCIALIZATION
New Business Creation

Key Message
Startup firms have the potential to grow rapidly and provide leadership in developing new markets that benefit both emerging and established industries around the state. The nationwide decline in the rate of new business creation highlights the need to encourage entrepreneurship and foster new business creation.

Significance
New businesses create new jobs, which expand and strengthen economies. They introduce new, innovative practices to the marketplace that lead to new and improved products or services. A high rate of new business creation is an indication of an innovative, dynamic, and entrepreneurial economy.

Performance
The rate of new business creation nationwide is at its lowest point in 20 years. States are doing well to maintain their new business creation rates, let alone grow them. In 2014, Oregon ranked 17th in the nation in the number of new establishments per 1,000 employed in the state and exceeded the U.S. average (Figure 13). Oregon's rate of new business creation in 2014, 11.8, was unchanged from its rate in 2004. The U.S. rate declined from 10.4 to 10.2.
COMMERCIALIZATION
University Startups

Key Message
University startups are a good indication that commercialization of university research is paying off. Streamlining the process which transfers university research to new business ventures will increase Oregon’s ability to attract new investment and encourage collaborative partnerships between researchers and entrepreneurs.

Significance
*University startups*—companies formed from university research—measure the number of new businesses that are created as a direct result of university intellectual property. This measure demonstrates the strength of Oregon’s university system in commercializing research and fostering entrepreneurship.

Performance
Oregon ranked 27th nationally in university startups in 2014. Oregon has not made significant gains in the number of university startups over the past 10 years (Figure 14) and is below the U.S. average. The number of university startups from year-to-year tends to be volatile. To reduce this pipeline volatility, the state should continue to focus on commercializing research and utilizing research funding for market-ready products and services at Oregon universities.

![Figure 14](image_url)

*Source: Association of University Technology Managers; Statistics Are We for Tech Transfer.*
ECONOMIC PROSPERITY
Manufacturing GDP

Key Message
Oregon’s high value-added manufacturing is a vital source of innovation in the state and gives Oregon a distinct competitive advantage. Manufacturing drives industry R&D in Oregon, the U.S. and throughout the world. It is important for the state to maintain and grow this key source of innovation in our economy.

Significance
Manufacturing accounts for about 70 percent of all industry R&D worldwide and in the U.S. Manufacturing R&D leads to the development of new, innovative products that generate additional demand, enabling manufacturers to compete and succeed in the global economy. Manufacturing GDP demonstrates Oregon’s strength in innovation and the skill and productivity of its workers.

Performance
Oregon derives more of its GDP from manufacturing than any other state, but one (Figure 15). Oregon’s manufacturing percentage of GDP is over twice as high as the U.S. average. In terms of GDP, manufacturing is by far the largest industry in Oregon, accounting for over a quarter of total GDP in the state. The 10-year trend is positive as well, meaning manufacturing is becoming more and more important to Oregon’s economy.

Figure 15
Manufacturing Percentage of GDP, 2014
**ECONOMIC PROSPERITY**

**Average Wage**

**Key Message**
Oregon must continue to focus on growing the wages of workers statewide. One of the key drivers of wage growth is human capital development. A skilled and educated workforce creates value for Oregon companies, thereby contributing to average wage growth.

**Significance**
Average wage measures trends in the average annual pay of workers in Oregon. This measure is limited to workers covered by unemployment insurance, which excludes self-employed workers. Wages have been adjusted for inflation.

**Performance**
The real average annual wage in Oregon has grown over the past 10 years. While the average wage dropped in Oregon during the Great Recession, as it did in most states, wage growth rebounded strongly over the past six years. Oregon’s wage growth since the recession has been stronger than average as evidenced by Oregon’s shrinking wage gap with the U.S. average annual wage (Figure 16). Despite recent growth, though, Oregon’s average annual wage as a percentage of the U.S. average wage in 2014 was essentially the same as 2004.

![Figure 16](image)
ECONOMIC PROSPERITY
High Technology Employment

Key Message
Oregon has a well-established high technology industry group, which commercializes new ideas and generates high-wage jobs. More and more, companies, both large and small, are dependent on technological innovation to compete in the global economy. Thus, it is important to maintain the state’s competitive advantage in high technology industries.

Significance
Technology sector industries—as defined by the 2014 State New Economy Index—are an important part of an economy because they are key engines of innovation and a source of high-paying jobs. States with a critical mass of jobs in technology-generating industries tend to attract other businesses and workers with a high degree of inventiveness, and help to increase the competitiveness of all traded sector industries.

Performance
Oregon ranked 15th nationally in percentage of high technology jobs in 2012. Oregon’s high technology industry group includes over 75,000 manufacturing and service jobs that accounted for 5.5 percent of Oregon’s private sector employment (Figure 17). High tech jobs are at their highest percentage of private employment in Oregon since 2000, when high tech jobs accounted for 6.3 percent of jobs, amounting to employment of nearly 86,000. Unlike the 1990s, though, when job growth in Oregon high tech was fueled by computer and electronic products, recent job growth in high tech is being led by high tech services, such as internet publishing, computer systems design, data centers, and software publishing.
ECONOMIC PROSPERITY

Exports

Key Message
Oregon's relatively high ranking in exports and proximity to China and other emerging markets demonstrates the state's competitive advantage in developing global markets and providing customers worldwide with high quality, innovative products and services.

Significance
Export-oriented companies have a multiplier effect on the local economy. As these companies work to meet the demand for their products, they rely on local firms to supply goods and services, which benefit the state's economy. Exports create additional demand for traded sector goods and services, which in turn create jobs, spur innovation, and increase wages in Oregon.

Performance
In 2014, Oregon exported $20.9 billion worth of goods to 198 countries and territories around the world. Oregon ranked 12th in the nation in exports as a share of GDP by state. From 2004 to 2010, Oregon's exports as a share of GDP were considerably higher than the U.S. average, but since then Oregon has maintained a share similar to that of the U.S. (Figure 18). 2014 was the first time in four years that Oregon surpassed the U.S. average in this measure.

Figure 18
Exports as Percentage of GDP

**INNOVATIVE ENVIRONMENT**

**Educational Attainment**

**Key Message**
Educational attainment is an important indicator of the human capital that is available in Oregon. The role of education in creating a successful innovation environment cannot be overstated. Investments in Oregon's educational system—kindergarten through graduate school—and continued in-migration of highly educated workers benefit the state in the form of a highly skilled workforce.

**Significance**
Educational attainment is a key driver of the innovation economy. Innovation cannot occur if educated people are not plentiful in Oregon companies, universities, and other innovation incubators.

**Performance**
Educational attainment is rising in Oregon. In 2014, Oregon ranked 17th in the nation in percentage of adults with a Bachelor's degree or higher. Over the past 10 years, Oregon has improved steadily in this measure (Figure 18). In 2004, Oregon had the same percentage of adults with a Bachelor's degree or higher as the U.S. Oregon's rate is now higher than the U.S. average.

![Figure 19](image)

*Source: U.S. Census Bureau, American Community Survey, 1-Year Estimates.*
INNOVATIVE ENVIRONMENT

STEM Workforce

Key Message
Growing Oregon's science, technology, engineering, and mathematics (STEM) workforce is vital to the state's economic competitiveness and growth. STEM workers are the professionals spearheading research and development of innovative products and services and are increasingly in demand by Oregon's innovative companies.

Significance
STEM workers are at the center of an innovation economy. Oregon's research and development capacity and competitiveness is directly connected to STEM. Growing the STEM workforce, both through in-migration of knowledge workers and increasing the number of STEM graduates from Oregon universities, is key to attracting and growing innovative businesses.

Performance
Oregon STEM employment ranked 15th in the U.S. in 2014 as a percentage of total employment. More importantly, Oregon's STEM employment is rising. Oregon had the tenth-largest increase in STEM employment between 2004 and 2014 amongst all states (Figure 20). At 6.3 percent, STEM employment in Oregon was also above the U.S. average of 6.1 percent.

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**Figure 20**

<table>
<thead>
<tr>
<th>State</th>
<th>2004 STEM Employment</th>
<th>2004 Total Employment</th>
<th>2004 STEM % of Employment</th>
<th>Rank</th>
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<td>Michigan</td>
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<td>84,740</td>
<td>1,576,890</td>
<td>5.4%</td>
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INNOVATIVE ENVIRONMENT
STEM Graduates

Key Message
States with high numbers of STEM graduates are amongst the most innovative economies in the U.S. States recognize this and the number of STEM graduates nationwide are rising. States that increase the number of their STEM graduates will likely grow their innovation economies faster than states that do not.

Significance
The innovation economy needs a high quality STEM workforce to succeed and grow. States can grow their STEM workforce through in-migration or by creating STEM graduates at state universities. States with high numbers of STEM graduates, though, tend to have more innovative economies than states with low numbers of STEM graduates. The innovation ecosystem created by large numbers of STEM graduates offers a significant competitive advantage for those states.

Performance
Oregon is not amongst the leaders in the U.S. in STEM graduates (Figure 21). Oregon ranked 31st in STEM graduates as a percentage of the population age 18 to 24 in 2014. Oregon’s ratio of 18.14 was also lower than the U.S. average of 18.65. While Oregon has increased its STEM graduates from 2004, it is not keeping pace with growth in STEM graduates in other states. Between 2004 and 2014, Oregon’s STEM graduates rate increased 25 percent, but that was not enough to prevent Oregon from falling from 24th in the U.S. in 2004 to 31st in 2014.

Figure 21
STEM Graduates by State

INNOVATIVE ENVIRONMENT

Migration of Knowledge Workers

Key Message
States and their businesses compete for talent. States that are the most successful in attracting U.S. knowledge workers increase their educational attainment, which leads to higher incomes and lower unemployment.

Significance
Educational attainment is a major factor in determining a population's income and unemployment. Highly educated people are more likely to have higher incomes and lower unemployment than those who are less educated. Knowledge workers are attracted to states that offer high-paying jobs and a high quality of life. They are also more involved in the innovation economy, as many innovation jobs require a Bachelor’s degree or higher.

Performance
Oregon ranked 24th in the nation for migration of U.S. knowledge workers in 2014 (Figure 22). This ranking is based on the educational attainment of U.S. in-migrants to states from all other states. Oregon has been successful attracting knowledge workers to the state since 2004, as the educational attainment of in-migrants has increased. The educational attainment of Oregon in-migrants is about the same as the U.S. average.

Figure 22
Migration of Knowledge Workers in U.S., 2014

Source: U.S. Census Bureau, American Community Survey One-Year Estimates
**INNOVATIVE ENVIRONMENT**

**Broadband Access**

**Key Message**
Oregon’s ability to develop and maintain broadband internet access is vital in a business environment that emphasizes global markets and internet-dominated communication. States that are able to increase the speed and reliability of internet connections will be leaders in the innovation economy.

**Significance**
Broadband—defined as 25 megabits (Mbps) for downloads and 3 Mbps for uploads—access allows for faster transmission of data, which is critical for businesses that rely on the internet to communicate with customers, suppliers, and colleagues. Broadband access facilitates knowledge dissemination and collaboration by reducing the costs associated with telecommunications and business transactions.

**Performance**
Oregon ranked 14th in the U.S. in broadband access in 2013. 93 percent of Oregon’s population has access to broadband internet connections. Oregon’s broadband access rate is much higher than the U.S. average of 83 percent, and about equal to California’s rate, but lower than Washington’s (Figure 23).

![Figure 23: Broadband Access, 2013](image)
Acknowledgements

The Innovation Index was developed by Business Oregon's Economic Strategies & Policy Division in partnership with the Innovation & Entrepreneurship Division. The Index was prepared and produced by Michael Meyers, Economist, with assistance from Heather Stafford, Assistant Director of Innovation and Entrepreneurship; Mark Brady, Innovation Strategist; Nathan Buehler, Marketing Manager; and Carmen Spuhler, Webmaster.

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