DOCUMENT RESUME

ED 478 878 CE 085 247

TITLE	Renewing Oregon's Economy: Growing Jobs and Industries through Innovation. A Report from the Oregon Council for Knowledge and Economic Development.
PUB DATE	2003-00-00
NOTE	73p.; Produced by the Oregon Council for Knowledge and Economic Development. Cover date is December 2002.
AVAILABLE FROM	For full text: http://www.ous.edu/cpa/OCKED/OCKEDfinal2002report.pdf.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	EDRS Price MF01/PC03 Plus Postage.
DESCRIPTORS	Business Administration Education; *Capital; *Economic Development; Elementary Secondary Education; *Entrepreneurship; Government Role; Higher Education; Knowledge Base for Teaching; *Labor Force Development; Outcomes of Education; Postsecondary Education; Research and Development; School Business Relationship; Science Education; Skill Development; *Statewide Planning; Tables (Data); Technological Advancement; Technology; *Technology Transfer
IDENTIFIERS	*Oregon

ABSTRACT

The Oregon Council for Knowledge and Economic Development (OCKED), a collaborative effort among Oregon's higher education institutions, economic development department, and the private sector, is charged with developing strategies to enhance Oregon's economic competitiveness in a knowledge-based, global economy. This report describes the council's efforts and recommendations in three areas: research and technology transfer; capital and business formation; and workforce development. The document contains an executive summary, the council report, four appendixes, and a glossary. The council report contains: (1) the objectives of the study; (2) the OCKED mission; (3) a table showing how Oregon ranks in research and development, capital, business formation, workforce, and higher education measures; (4) goals, outcomes, and recommendations for the three areas; (5) and a list of the council members, advisors and consultants. Appendix A contains the research and technology transfer committee report, Appendix B contains the capital and business formation committee report, Appendix C contains the workforce development committee report, and Appendix D contains the economic development metrics. The document also contains a glossary of economic development metrics. (SLR)

OCKED

Renewing Oregon's Economy:

Growing Jobs and Industries Through Innovation

A Report from the
Oregon Council for Knowledge and Economic Development

December 2002

A Collaboration of Oregon Business, Government and University Leaders

OREGON COUNCIL FOR KNOWLEDGE AND ECONOMIC DEVELOPMENT

OCKED

Renewing Oregon's Economy: Growing Jobs and Industries Through Innovation

Table of Contents

Section	Page
Executive Summary	
Council Report	**1 to 12**
Appendix A: Research and Technology Transfer Committee Report	1-A to10-A
Appendix B: Capital and Business Formation Committee Report	1-B to 8-B
Appendix C: Workforce Development Committee Report	1-C to10-C
Appendix D: Economic Development Metrics	1-D to 21-D
Glossary of Economic Development Metrics	22-D to 28-D

For More Information on the Oregon Council for Knowledge and Economic Development or this report:

Contact: Diane Vines or James Coonan
Telephone: 503-725-5700
Email: BusinessAlliances@ous.edu
Web: www.ous.edu/cpa/OCKED

Oregon Council for Knowledge and Economic Development

Executive Summary

December 2002

"Oregon's future depends on a commitment to a bold strategy that will achieve long-term, sustainable economic growth, create quality jobs and compete in a global economy."

It was with this charge that the Oregon Council on Knowledge and Economic Development (OCKED) developed a comprehensive set of strategies to enhance Oregon's economic competitiveness in a knowledge-based, global economy. The official report, *Renewing Oregon's Economy: Growing Jobs and Industries Through Innovation*, was presented to the Governor and the 2003 Legislature in late 2002, outlining economic development policies and funding recommendations.

The bottom line is that new ideas and innovation are the economic drivers of the 21st Century. Industries and regions that invest in the development and application of technology will lead the creation of jobs and be more competitive and profitable. With *more than 90 percent of technology jobs found in industries outside of high tech,* innovation and knowledge workers are just as critical to banks, retail stores, tree nurseries and hospitals as to software companies and semiconductor plants. Because of this, the state needs a strategy to foster the development and use of technology across the broad spectrum of industries and businesses – from the eastern borders of the state to the Pacific coastline – so that we can support economic development and continue to create and sustain jobs for all Oregonians.

The Council believes that innovative ideas are essential to keeping Oregon competitive. OCKED's recommendations recognize the shift in economic development, towards a focus on developing, retaining and attracting people who will lead the next generation of businesses, and whose ideas can be turned into globally competitive products and services.

In summary, this report describes the Council's efforts and recommendations in three areas considered critical to building an economy that creates quality job growth and economic development throughout Oregon:

1. **Research and technology transfer:** enhance the capacity for focused research and development – through the creation of Signature Research Centers – that translate research into commercial applications, and increase the economic benefit of research through technology transfer efforts between universities and industry;
2. **Capital and business formation:** increase the amount of pre-seed, seed and institutional venture capital available to emerging businesses, especially in the technology and bioscience sectors, and develop programs and incentives to deepen management expertise and attract and retain top management talent;
3. **Workforce development:** ensure that Oregon's existing workforce has the skills needed for today's knowledge-based economy; increase our higher education capacity and national ranking in science, engineering, information technology and business management; and promote knowledge-based skills early and consistently throughout our K-12 education system.

OCKED's proposals emphasize investments that generate high rates of return and will multiply the initial investment several fold over the next decade. The Council's recommendations include a $35 million request in new initiatives from the general fund in the 2003-05 biennium – less than one percent of total state spending – which will spur new investment, new jobs and new businesses in Oregon for years to come.

OCKED is a collaborative effort among Oregon's public and private higher education institutions, economic development department, and the private sector that was established under Senate Bill 273 by the 2001 Oregon Legislature. Its mission is to promote knowledge-based economic development in the state by focusing specifically on ways to increase high-quality research and development; developing successful private-public models for intellectual property and profit sharing; increasing technology and knowledge transfer; providing sufficient capital for investment in and commercialization of technology developed by higher education; and promoting the development of a technologically skilled workforce.

Oregon Council for Knowledge and Economic Development

Council Report

December 2002

The Objective

"Today, a new economy is clearly emerging: it is a knowledge and idea-based economy where the keys to wealth and job creation are the extent to which ideas, innovation and technology are embedded in all sectors." The State of the New Economy Report

A knowledge-based economy is everyone's agenda. It affects all industries in all parts of the state. The ability to innovate and stay competitive is just as important to agriculture and retail as it is to high technology. We know that industries developing and applying technology to increase their competitiveness will lead to future job growth and wealth creation. Investments in research and development, ready access to capital, world-class technical talent, and mature entrepreneurial networks are now prerequisites for economic development.

The Oregon Council for Knowledge and Economic Development (OCKED or " the Council") is committed to helping the state establish a competitive climate and build the asset base required for the knowledge economy. Our focus is on promoting leadership and collaboration for economic development and investing in the three issues that drive quality job growth and wealth creation: (1) enhancing the skills of Oregon's knowledge-based workforce throughout the state; (2) commercializing research into profitable business ventures; and (3) accessing capital and business expertise to ensure our businesses thrive.

Oregon's economic health and national and global competitiveness is relatively poor. The Council recognizes that economic development efforts need to be a combination of short- and long-term strategies that systematically invest in building our competitiveness and sustaining our capacity to create new businesses and jobs. OCKED members agree that there is an extreme sense of urgency to address the issues contained in this report. Now is the time to invest in a sustained effort to enhance Oregon's economy.

The OCKED Mission

The Oregon Council for Knowledge and Economic Development was established under Senate Bill 273 by the 2001Oregon Legislature. The mission of the Council is to promote knowledge-based economic development in the state of Oregon. To this end, the Council will: *"focus specifically on ways to increase high-quality research and development; develop successful private-public models for intellectual property and profit sharing; increase technology and knowledge transfer; provide sufficient capital for investment in and commercialization of technology developed by higher education; and promote the development of a technologically skilled workforce."*

OCKED is a collaborative effort among Oregon's public and private higher education institutions, economic development leadership, and the private sector. Legislation calls for the Council to act as an "early warning system and play an advisory role, providing guidance and leadership to state officials and state agencies on issues, plans, and the necessary infrastructure for improvement in the areas of knowledge-based economic development and the creation of knowledge-based initiatives." The Council provides a unique forum for discussing issues, encouraging the interplay of university knowledge and emerging growth industries, and coordinating the application of the state's assets in higher education, business, industry, and capital resources.

Why It's Important

The influence of technological innovation on our economy and our society proliferates each year. Information and technology have driven economic growth in all industries, reduced inflation, and fueled productivity gains. Technology is expected to have an even more profound impact on the economy in the 21st century.

The knowledge economy has redefined the rules of economic development with continual and ever-more rapid change in markets, technology, and firms. During the twentieth century, economic advantage moved from the Henry Ford era of scale and mass production to an era of "dynamic efficiency" where innovation and agility are most important. Finding new ways to add value, streamline operations, and develop new goods and services is at the core of this innovation-oriented economy.

The clearest lesson about the knowledge economy is that those who have more knowledge and those who are good at creating new knowledge and ideas will be in the best position to prosper.[1] Places that invest more in research and development seem to have more sustained economic activity. Over the past several decades, the return on investment in human capital has never been higher. This is highlighted by the fact that:

- The largest part of the growth in America's real gross domestic product is the result of new insights, discovery and commercialization of ideas (Greenspan, 2000);
- Income levels in regions with high overall educational attainment grew at a rate almost double the growth of areas with lower educational attainment (Gottlieb and Fogerty, 1999).

As economist Joe Cortright notes, "Places seeking economic development need to assure that they are good locations for the development of new ideas and the formation of new firms if they are to be able to succeed in an increasingly global, knowledge-based economy.... Efforts to maintain a region's current [traditional] arrangement of firms, markets and technologies may have the effect of retarding the development of more efficient and sustainable activities."

[1] Cortight, 21st Century Economic Strategy

How Oregon Measures Up

Oregon currently ranks in the middle of all states on key measures that indicate our ability to compete in a global and knowledge-based economy. OCKED recommends that Oregon adopt the explicit goal of being a top 10 ranked state in new economy measures. States with high rankings in knowledge-based measures also tend to have higher incomes, net wealth, and stable business growth. Appendix D (a comprehensive summary of economic and workforce measures comparing Oregon to other states) shows that investment in and focus on the critical drivers of a knowledge economy has as much or more impact on economic competitiveness than a state's population and geographic size.

Research & Development Measures	**Oregon rank**	**Value of OR Measure**	**Value of 10th ranked state**
Total R&D Dollars per $1,000 of GSP[2]	26	$ 18.00	$ 35.43
Federal R&D Obligations per $1,000 of GSP	32	$ 3.72	$ 8.03
SBIR[3] Awards per 10,000 businesses (1998-2000 avg)	17	5.8	8.2
STTR[4] Awards per 10,000 businesses (1998-2000 avg)	19	0.4	0.8
Capital Measures	**Oregon rank**	**Value of OR Measure**	**Value of 10th ranked state**
VC[5] Funds per $1,000 of 1999 GSP	16	$ 5.41	$ 8.16
IPO[6] funds per $1,000 of GSP	22	$ 2.45	$ 5.45
Business Formation Measures	**Oregon rank**	**Value of OR Measure**	**Value of 10th ranked state**
US Patents per 10,000 businesses	13	147	169
"Gazelle"[7] jobs	19	13.7%	14.4%
% of technology company births (% tech start-ups compared to all start-ups)	29	6.5%	9.77%
Net technology company creation: net formation per 10,000 establishments (comparison of births over deaths - ability to sustain firms)	41	11.7	37.8
Workforce Measures	**Oregon Rank**	**Value of OR Measure**	**Value of 10th ranked state**
Employment in IT occupations in non-IT industries as a share of total jobs	25	1.5%	2.1%
Civilian scientists and engineers as a percentage of the workforce	14	.52%	.62%
Managers, professionals and technicians as a share of total workforce	1	31.4%	27.8%
% of civilian workforce with a recent bachelor's degree in science or engr.	14	1.65%	1.92%
% of civilian workforce with a recent master's degree in science or engr.	18	.31%	0.38%
Higher Education Measures	**Oregon Rank**	**Value of OR Measure**	**Value of 10th ranked state**
Bachelor's degrees granted as a percent of the 18-24 year old population (1997-98)	31	4.5 % (13,652 degrees)	5.86%
Percent of bachelor's degrees granted in science and engineering (1997-98)	31	17.40% (2,369 degrees)	19.30%
Science and engineering graduate students as percent of the 18-24 year old population (1999)	31	1.20% (3,733 students)	1.78%

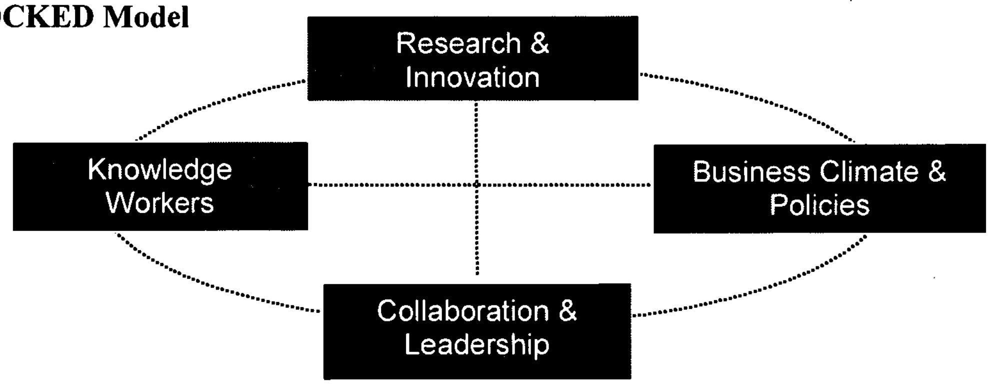
Sources: U.S. Department of Commerce, State Science and Technology Indicators, 2001; Milkin Institute, 2002; New Economy Index, 2002.

[2] Gross State Product
[3] Small Business Innovation Research program
[4] Small Business Technology Transfer program
[5] Venture Capital
[6] Initial Public Offering
[7] Jobs created by fast growing, emerging growth companies

The Unfinished Agenda

Oregon's economy requires an integrated system that equally and fully invests in the key drivers of business and job growth: research and innovation, knowledge workers, business climate and policies, and leadership and collaboration. OCKED established separate committees to work on each of these issues, engaging experts from around the state to assist the Council in developing specific action-oriented recommendations.

The OCKED Model



Research and Innovation (OCKED Research & Tech Transfer Committee): Oregon's capacity to translate ideas into businesses is critical for economic development. Basic research (in universities and industry) produces new insights that, in turn, are refined into practical applications through applied research. The idea is then commercialized and diffused into widespread use, in turn creating new businesses and jobs. This economic cycle is dependent on the research and technology transfer strength of our universities, the ability for universities and industry to collaborate on new ideas, the depth of talent in our entrepreneurial community, and institutions that support commercialized research.

Creating knowledge and ideas and transforming them into new companies and jobs requires:

- Increasing the capacity to conduct research, including more research dollars and in-depth expertise.
- Focusing research on areas with high returns on investment, such as well-paying jobs, viable businesses, and new wealth that build on Oregon's strengths.
- Expediting and streamlining the research and development process to more quickly and effectively move ideas into commercial products and services.

Business Climate and Policies (OCKED Capital & Business Formation Committee): Oregon continues to be at a significant disadvantage for starting or relocating a knowledge-based company. Investors and industry leaders perceive Oregon as a place that does not welcome business development. The lack of focused economic development programs and funding is compounded by out-of-date policies that are not in line with national best practices. Our high personal income and capital gains tax rates inhibit entrepreneurs and venture capital investors from staying in or moving to Oregon. With fewer scientific researchers, senior management and investors, we also have fewer spin-off companies from existing firms and fewer new start-ups, thus further eroding our ability to develop a competitive advantage.

In a time of slow economic development, key sources of business growth become critical. Our ability to foster a risk-tolerant, growth-oriented investment environment will be key to Oregon's economic recovery. The primary objective of the OCKED's capital and business formation recommendations is to stimulate economic activity in Oregon. We believe that if these priorities are implemented they will achieve the following direct benefits:

- Provide revenue stability to the state by removing or reducing the volatility of capital gains tax receipts;
- Leverage multiple increments of additional private sector investment by removing the barriers to early-stage venture capital;
- Create new jobs and businesses in industries that have high multiplier effects and that pay family wages;
- Expand Oregon's entrepreneurial capacity by attracting people with senior management experience and investment income; and
- Enhance the benefits to higher education created by recent legislation that allows institutions to hold stock in companies that spin off from tech transfer efforts.

Knowledge Workers (OCKED Workforce Development Committee): Knowledge workers hold the jobs that invent new products, translate data and information into usable services, and manage businesses. They are key to a company's productivity, competitive edge, and ability to adapt to changes in markets and customers. Knowledge and technology workers are employed in places like banks, hospitals, manufacturing firms, trucking and distribution companies, high tech establishments, law offices, ad agencies, government and agriculture. Like certain industries that tend to lead economic growth, these occupations are indicators of a state's competitive advantage and economic sustainability.

The demand for qualified technology and knowledge-based workers continues to grow despite the recent economic downturn and high unemployment rate. In fact, the majority of the top ten family-wage, high demand jobs are technology-related occupations. More than 90 percent of these jobs found throughout the state are in industries <u>outside</u> high technology (insurance and financial services, health care, wholesale trade, transportation services, etc.). ***Despite this widespread need, Oregon has no statewide workforce strategy to address the needs of these occupations and their industries of employment.***

Future job growth depends on having a critical mass of highly skilled workers supported by:

- A flexible and responsive training system for our existing workforce to help employees obtain up-to-date technical and entrepreneurial skills, as well as continue to stay marketable when looking for new employment.
- Adequate funding and support for higher education to significantly increase the effectiveness of and access to technology, sciences and business management programs throughout the state, thereby growing and employing our own knowledge-based workers.
- A system that prepares the next generation for well-paying jobs by ensuring that our K-12 system teaches math, science, problem-solving and technology skills early and consistently; exposes students to hands-on experiences and the variety of technology and science careers; and provides teachers with adequate and ongoing training in these same areas.

Collaboration & Leadership (The OCKED Council, Advisors, and Partners): The ability to implement and realize the benefits of our research, workforce, and business formation recommendations depends on the state's willingness to make economic development a priority in Oregon. Oregon needs a shared economic vision among public and private sector leaders and collaboration among higher education, government and industry to work towards a set of common economic goals. OCKED views its role as an active player in convening and leading efforts to enhance Oregon's economy.

Research & Technology Transfer Priority Recommendations

GOALS AND OBJECTIVES

Dramatically increase high quality research and development efforts that will create new products, services and businesses leading to high paying jobs and sustained economic growth for Oregon:

- Increase the capacity for high quality research and development;
- Facilitate the translation of research into commercial applications;
- Increase the value and economic benefit of research and technology transfer.

DESIRED OUTCOMES

By 2010, Oregon will have established at least three fully funded and operational Signature Research Centers that will significantly increase our research capacity and competitiveness while directly contributing to the economic growth of Oregon industries. In doing so, Oregon will:

- Double federal, state, and industry research and development dollars;
- Double the number of Small Business Innovation Research (SBIR) and Small Business Technology Transfer Research (STTR) awards;
- Double the number of university-based spin-offs; and
- Double license income per $100M of sponsored research.

RECOMMENDATIONS

Priority A: Establish nationally recognized "Signature Research Centers" (focal points) that concentrate people, funding, facilities, and support on building a competitive advantage in specific research areas that have strong commercialization potential. Centers should be targeted on research expertise directly linked to Oregon's knowledge-based industries and that have the greatest possibility of creating new businesses, competitive wage jobs and increasing public and private investment. Centers will be collaborative efforts among various public and private research institutions. The implementation will include:

- Pilot an initial Signature Research Center in *Multiscale Materials and Devices;*
- Identify and establish plans for up to three additional Centers;
- Establish a "development corporation" to provide technical and managerial support to Centers.

Priority B: Direct the missions and functions of the state boards of education, Oregon Health & Science University and Oregon Economic and Community Development Department to promote the creation, dissemination and commercialization of ideas.

Higher Education

- Continue to ensure the protection of the Bayh-Dole Act;
- Revise missions to include specific language about commercialization of research;
- Streamline state-level review of research and technology transfer agreements and bring into alignment with best practices nationwide. Exempt university contracts from legal sufficiency review by the Oregon Attorney General;
- Create yearlong entrepreneurial leaves-of-absence and "industry experts in residence" programs.

Oregon Economic & Community Development Department (OECDD):

- Create a statewide Technology Roadmap that identifies barriers to and opportunities for Oregon's knowledge-based industries, and develops tech transfer and knowledge-economy strategies;
- Develop a supporting database of R&D assets and actively market those assets; and
- Establish a commercialization liaison within the agency.

Priority C: Provide adequate seed funding for technology transfer efforts throughout the state including OECDD's support for the Higher Education Technology Transfer (HETT) fund and tech transfer efforts in rural Oregon and traditional industries, as well as the Oregon University System's continued pursuit of alternative funding sources, including philanthropic resources.

Capital & Business Formation Priority Recommendations

GOALS AND OBJECTIVES

Enhance the ability to start and grow companies and to promote entrepreneurs willing to commercialize ideas in Oregon:

- Increase amount of pre-seed, seed and institutional venture capital available for Oregon's technology and bioscience business sectors;
- Remove the barriers to business formation and modify state policies to reflect current best practices; and
- Enhance the entrepreneurial and management capacity in Oregon by increasing the depth of existing talent and attracting additional world-class executives and researchers.

DESIRED OUTCOMES

Oregon must achieve the following capital and business formation goals by 2010:

- Double the amount of venture capital funds per $1,000 of Gross State Product (GSP);
- Increase the rate of US patents per 10,000 businesses by 50%;
- Double business start-ups per $100M of sponsored research; and
- Double the net formation (comparison of births over deaths) of technology and bioscience companies.

RECOMMENDATIONS

Anticipated results: Every dollar of early stage capital has a high multiplier effect in terms of additional investment, new jobs and personal income created. Example: An Oregon Seed Fund with $20M in capital helped 50 Oregon companies create over 3,000 jobs, realize revenues of over $798M, and leverage over $570M of additional investment. According to the National Venture Capital Association, venture-backed companies in Oregon accounted for over 23,000 jobs and $3.3B in revenues during 2000.

Priority A: Significantly increase investment and the presence of institutional venture capital firms in Oregon.

- Work with philanthropic foundations and state retirement funds already investing in private equity funds to encourage their venture capital partners to establish an Oregon office staffed by a partner-level investor who will review Oregon investment deals on a regular basis;
- Reduce or eliminate capital gains to remove existing barriers to private investment and be more competitive with other states;
- Work with OECDD to treat venture capital as an industry cluster and to develop a strategy to expand and recruit a larger venture capital industry sector in Oregon.

Priority B: Enhance the depth of management and entrepreneurial capacity.

- Develop an "Invest in Oregon" incentive package that would attract highly qualified venture fund managers and world-class researchers. The objective of this package is to increase new investments and attract key talent that will directly result in the creation of new jobs and wealth and increase our competitiveness and ability to attract additional firms;
- Establish training and networking programs to develop qualified CEOs and help train companies in various aspects of business management, technology assessment and project planning, company formation and capitalization, regulatory requirements and other skills.

Knowledge-Based Workforce Development Priority Recommendations

GOALS AND OBJECTIVES

Develop an integrated workforce strategy, aligned with Oregon's leading industries, that keeps current workers on the leading edge, expands the ability to educate knowledge workers in Oregon, and prepares Oregon youth for the knowledge-based jobs of the future.

Quality: Raise Oregon's commitment to excellence in educating and training knowledge- and technology-based workers.

Capacity: Expand Oregon's capacity to meet the growing demand for knowledge- and technology-based workers.

Capability: Provide quality education and training for knowledge- and technology-based occupations in all geographic regions of the state.

DESIRED OUTCOMES

Oregon must achieve a world-class competitive workforce by 2010. Specifically, the state must dramatically increase:

- The number of skilled and qualified Oregon workers able to fill rapidly growing and changing technology-based jobs;
- The number of Oregon students entering and graduating from Oregon universities with Bachelor's, Master's and Ph.D.s in technology, engineering, science and business management fields; and
- The awareness of and interest in science and technology among K-12 students, and the competency of teachers in the knowledge and application of technology, math and science.

RECOMMENDATIONS

These recommendations address incumbent workers, higher education and K-12 issues as an integrated system. They are intended as a package of strategies each contributing to both immediate and long-term workforce needs and should not be interpreted as stand alone projects.

Priority A: Qualified and Skilled Workers For Today's Jobs: Immediately enhance the skill level of the current workforce by developing a statewide roadmap for a knowledge-based workforce focusing on high demand occupations critical to multiple Oregon industries in all parts of the state.

- Develop a statewide action plan for high demand technology-reliant occupations that increases technical and entrepreneurial and business management skills;
- Coordinate the development and delivery of curriculum in a manner that reduces redundant programs and increases the capacity to train workers; and
- Develop a statewide strategy to more effectively utilize distance and e-learning.

Priority B: Higher Education Capacity and Effectiveness: Actively support higher education efforts that significantly increase the capacity and quality of people graduating with degrees in technology, engineering, sciences, and business programs.

- Support the full set of recommendations of the Engineering and Technology Industry Council (ETIC) to double engineering graduates, create top-tier academic programs, expand labs and facilities, and enhance pre-college programs;
- Increase the quality and depth of programs in business and information management to increase Oregon's capacity for entrepreneurial development and successful commercialization of ideas.

- Ensure Joint Boards of Education leadership commitment to, and development of policies that, ensure full transferability of accredited courses, promote collaboration, minimize the development of redundant curriculum and fully utilize distance and e-learning capacity.

Priority C: <u>K-12 Capabilities</u>: Increase the number of students aware of and prepared to enter science and technology fields, and increase the number of teachers who are competent in the use and application of technology in the classroom.

- <u>Students</u>: Dramatically increase Oregon's participation in the International Science and Engineering Fair (ISEF). Establish ongoing industry and higher education involvement and a sustained funding source for student participation in science and technology fairs.
- <u>Teachers</u>: Enhance the capacity of teachers to use technology in classrooms by supporting an additional 250 teachers per year to complete technology, math, and science training with at least 60% of these teachers from economically distressed communities. Support "teachers in industry" internship programs for at least 100 additional teachers each year.

General Council Recommendation

Continue the work of the Oregon Council for Knowledge and Economic Development. The mission and recommended course of the Council represents issues essential to Oregon's immediate and long-term economic vitality. As the state seeks direction for an economic recovery, leadership must focus its attention on the issues and industries that lead economic growth and provide the basis for sustained competitiveness. The Council's mission and the state's need for economic growth have resulted in an intersection that is both timely and critical.

- To ensure full implementation of strategies and a continued focused on economic development issues, the Council recommends the continuation of the Oregon Council for Knowledge and Economic Development until January 2, 2008.

COUNCIL MEMBERS

OCKED Chair
Allen Alley
CEO, PixelWorks

Members
Ann Bunnenberg
CEO, Electrical Geodesics, Inc.

Rep. Tom Butler

Sen. Ryan Deckert

Randall Edwards
State of Oregon, Treasurer

Scott Gibson
Gibson Enterprises

Sen. Tom Hartung

Jim Johnson
Business & Civic Entrepreneur

Rep. Al King

Jill Kirk
Principal
Lindberg Kirk Millar

Keith Larson
Director, Strategic Investments
Intel Corporation

C. Frost Lee
CEO, In-Med, Inc

Jim Lussier
St. Charles Medical Center

Dwight Sangrey
Golder Associates

Carl Talton
Government Affairs and Economic
Development, Portland General Electric

EX-OFFICIO MEMBERS

Jim Berchtold
President, Oregon Independent College
Foundation

Richard Jarvis
Chancellor, Oregon University System

Don Van Luvanee
Oregon State Board of Higher Education

Cam Preus-Braly
Commissioner of Community Colleges and
Workforce Development

Brett Wilcox
Chair, OECDC

TECHNICAL ADVISORS

John Castles
Trustee, MJ Murdock Charitable Trust

Katy Coba
Director, Oregon Economic & Community Development Dept.

Jim Craven
Government Affairs Manager
American Electronics Association

Dan Dorsa
Vice President for Research,
Oregon Health Sciences University

Martha Anne Dow
President, Oregon Institute of Technology

Gordon Hoffman
Northwest Technology Ventures

Joe Johnson
President, Clackamas Community College

Don Krahmer
Schwabe Williamson & Wyatt, PC

David Marks
President, Marks Metal Technology

Harvey Matthews
Associated Oregon Industries

Bill Newman
Northwest Technology Ventures

Lura Powell
Director, Pacific NW National Laboratory

Wally Rhines
CEO, Mentor Graphics Corp.

Paul Risser and Timothy White
President and Interim President,
Oregon State University

Mike Salsgiver
Government Affairs
Portland Business Alliance

Duncan Wyse
President, Oregon Business Council

STAFF & CONSULTANTS

Chris Bright
Pixelworks, Inc.

James Coonan
Director of Business Alliances
Oregon University System

Ron Fox
Oregon Economic & Community Development Department

Cam Preus-Braly
Department of Community Colleges and Workforce Development

Diane Vines
Vice Chancellor for Corporate and Public Affairs, Oregon University System

Consultants
Patricia Scruggs
Scruggs & Associates

Ken Ray
Fleishman-Hillard Portland

APPENDIX A:

OREGON COUNCIL ON KNOWLEDGE & ECONOMIC DEVELOPMENT
Research and Technology Transfer Committee Report

The Objective

Science and technology policies and programs have become an integral part of economic development plans in most states. The formation of the Oregon Council for Knowledge and Economic Development (OCKED) marks Oregon's entry to the list of states with a science and technology focus in economic development. The purpose of the OCKED Research and Technology Transfer Committee is to identify and address the issues that are at the core of Oregon's science and technology potential, and to develop a set of recommendations that will advance Oregon's ability to conduct research that promotes new businesses and jobs.

Science and technology assets have proven to be powerful when seeking the type of competitive advantage needed in the new economy. New business formation flows directly from research and commercialization of new or uniquely adapted technology. A national study by the U.S. Department of Commerce reports that industry clusters are advanced by creating unique advantages rooted in the research and technology centers of a state, and by being able to solve competitiveness challenges through the application of technology and the expertise in their state's science and technology community. In other words, a state's science and technology capacity is the foundation for its economic future. Fostering business development in the state depends on significantly enhancing our ability to conduct and commercialize research related to Oregon industries that offer the most promise.

Goals and Objectives

Dramatically increase high quality research and development efforts that will create new products, services and businesses leading to high paying jobs and sustained economic growth for Oregon.

- Increase the capacity for high quality research and development;
- Facilitate the translation of research into commercial applications;
- Increase the value and economic benefit of research and technology transfer.

Outcomes and Measures

By 2010, Oregon will have established at least three fully funded and operational Signature Research Centers that will significantly increase our research capacity and competitiveness while directly contributing to the economic growth of Oregon industries. In doing so, Oregon will:

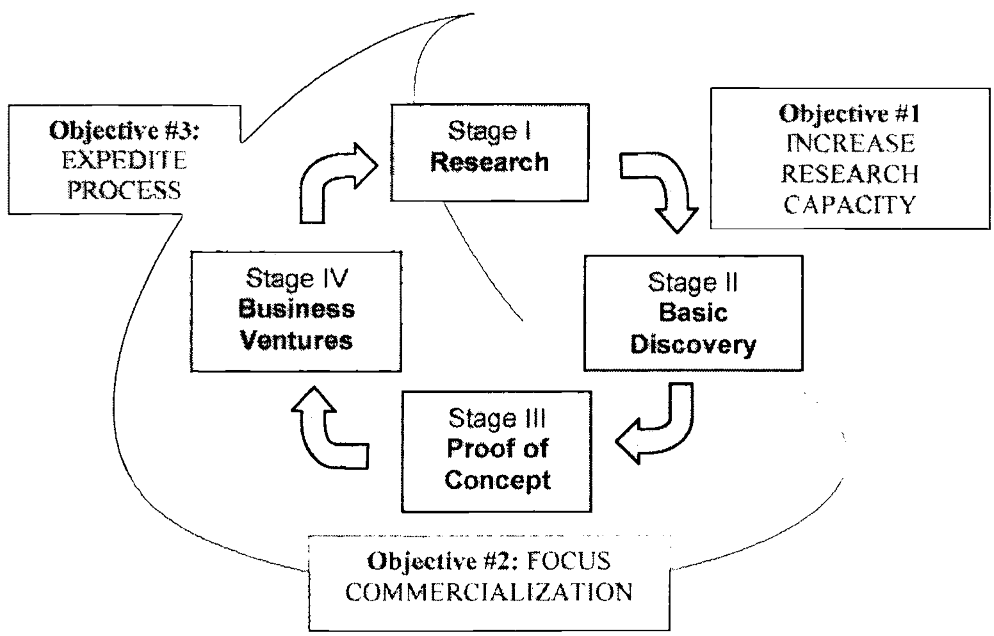
- Double federal, state, and industry research and development dollars;
- Double the number of Small Business Innovation Research (SBIR) and Small Business Technology Transfer Research (STTR) awards;
- Double the number of university-based spin-offs; and
- Double license income per $100 million of sponsored research.

Why It's Important

Transforming knowledge and ideas into new business ventures requires a systems approach that thinks about R&D as a set of interrelated activities. This continuum can be described in four stages: 1) research; 2) basic discovery; 3) proof of concept; and 4) development of business ventures. Each stage is advanced by the effective utilization of our people, research processes, capital and policies. Utilizing these assets and translating research dollars into viable businesses and jobs depends on:

- Increasing the capacity to conduct research, including more research dollars and in-depth management and research expertise;
- Focusing our research on areas with high returns on investment -- well-paying jobs, viable businesses, and new wealth -- that build on Oregon's strengths;
- Expediting and streamlining the research and development process to more quickly and effectively move ideas into commercial products and services.

Figure A: Oregon's Research & Technology Transfer Model



Our Knowledge Assets

Within the R&D continuum there is a set of "knowledge assets" that enhance or inhibit our ability to transfer a concept into a marketable product or service. These elements include intellectual capital (experienced researchers); our ability to conduct and collaborate on research (process); the quality and quantity of our research infrastructure; adequate capital formation for commercializing research; policies and cultures that support tech transfer and commercialized research; and our depth of management and access to markets. The specific requirements of each asset change as the process advances along the continuum. The following table highlights what Oregon needs to have a competitive research and technology transfer environment.

	Increase Research Capacity	Focus Commercialization and Build Expertise	Add Value and Expedite the Process
Intellectual (Human) Capital	• World-class researchers with commercialization experience • Recruitment packages that will attract talent to Oregon • Education for researchers about industry-university technology transfer	• Avenues for private sector expertise to participate in university research • Consulting experiences for faculty, entrepreneurial leaves and sabbaticals for faculty	• In depth and experienced management capacity
Collaboration	• The ability to easily collaborate across institutions and with the private sector • The ability to develop large, joint research efforts	• Streamlined, state-level review/approval process and common set of ground rules for academic/industry research • Aligning research focus with Oregon's knowledge-based industry clusters • Enabling two-way interaction between university and industry research	• University involvement in state recruitment and retention efforts • Promoting research and technology transfer assets as part of economic development efforts
Capital	• Significant amount of federal research dollars, especially funding associated with large projects • Administration funds to cover indirect costs • Targeted and sustained state investments in R&D	• Providing commercialization capital that transitions basic discovery to proof of concept	• Early stage seed and venture capital
Policies & Culture	• Strong support and promotion of research and technology transfer efforts within academic institutions	• Protecting policies such as the Bayh-Dole Act • Effective Small Business Innovation Research programs (SBIRs) • Clear policies about ownership and control of intellectual property	• Regulatory relief in research and technology transfer activities of public universities • Benchmarking standards of excellence
Management & Markets	• Incentives (hiring, tenure, and promotion processes) for researchers to collaborate with industry, remove disincentives for faculty to be more entrepreneurial	• Depth of business development expertise • Clearly identified commercialized research/market niches	• Mature business development and management resources and networks that assist with technology, money and market access • Licensing efforts for existing industries that retool and develop new technologies
Infrastructure	• World-class facilities that attract quality research with adequate state and local support • High speed Internet access		

How We Measure Up

Overall, Oregon ranks in the third quartile on key research measures, just below the national average in most cases. The state ranks higher in the amount of research dollars per scientist, yet ranks lower in the total number of scientists per capita and the commercialization of research into businesses and products. Compared to other states, researchers in Oregon obtain fewer federal research dollars that are critical in early stage capital formation. The following measures highlight Oregon's current research and development capacity.

Expenditures for R&D: 1999

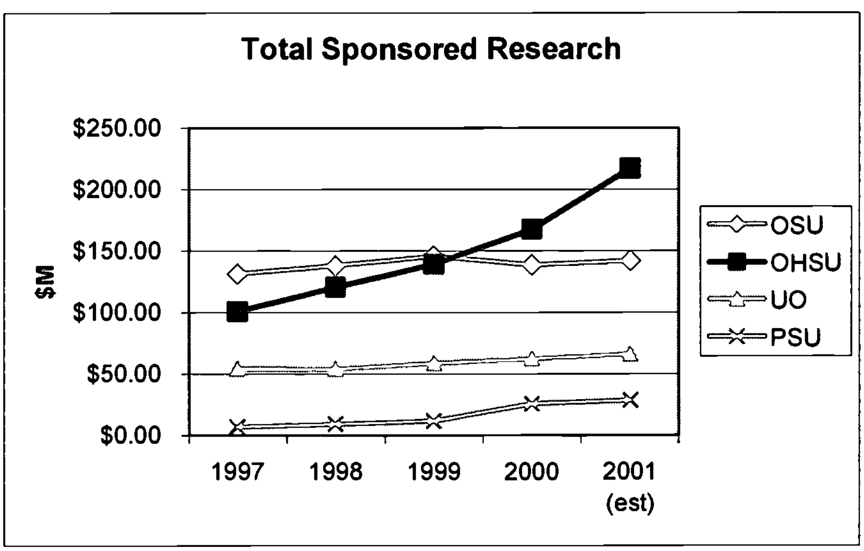
	Oregon Rank	Total R&D, millions	R&D per $1,000 GSP
Total R&D performed per $1,000 of GSP	26	$1,974	$18.00
Industry-performed R&D per $1,000 of GSP	24	$1,540	$14.04
University performed R&D per $1,000 of GSP	24	$319.7	$2.91
Federal Obligations for R&D per $1,000 of GSP	32	$408	$3.72

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001

Average Annual Number of Awards

	Oregon Rank	Avg Annual Awards	Awards per 10,000 Firms
Average annual number of SBIR awards per 10,000 Business Establishments (1998-2000)	17	58	5.8
Average annual number of STTR awards per 10,000 business establishments (1997-1999)	19	4	0.4

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001



Source: AUTM 2001 Data

Note: Additional metrics and comparisons to other states are found in Appendix D

Technology Transfer Measures at the University Level

	License Income per Research $	# of Patent Applications/ $1M research	Start-up companies formed	Inventions disclosed per $1M research
OHSU	$ 0.01	0.4	2	0.4
OSU	$ 0.01	0.2	6	0.2
UO	$ 0.00	0.2	5	0.2
90th Percentile	$ 0.06	0.5	25	0.8

Source: The Chronicle of Higher Education 2002

The Unfinished Agenda: Research and Technology Transfer Challenge

There is a set of nationally recognized factors that are critical to the success of research and technology transfer efforts. Oregon must enhance its R&D capacity and ensure that it is directly related to our economic development efforts.

Oregon lacks research or technology "signatures"— areas where we are recognized as national and global leaders in specific R&D segments. This is due to:

- Limited world-class facilities, (including facilities for "commercialized research" that can bring together academia and industry teams);
- A lack of a critical mass of world-class researchers with proven experience in translating ideas into businesses, and a lack of recruitment packages that can attract researchers;
- The absence of commercialization and pre-seed capital to translate research into new products and businesses; and
- Poor alignment between university research strengths and the state's industry clusters.

Oregon's universities appear to lack consistent support and recognition that commercial and collaborative research is an important element of higher education's mission. This has led to agreements for collaborative research between industry and universities that are burdensome and inconsistent, indicating the need for an integrated, replicable commercialization process. This is compounded by inadequate incentives for faculty researchers to participate in collaborative research efforts, as tenure, promotion and rewards do not always recognize transitional or collaborative research efforts.

Oregon has very limited state and local funding for research and technology transfer efforts; in part because of a lack of public understanding about the benefits and importance of research and commercialization activities. This lack of public support can have a significant effect on research and resulting economic development efforts as seen by the potential erosion of the Bayh-Dole Act.

To move ahead, the OCKED Council strongly believes that Oregon must:

- Build a national reputation in targeted areas by focusing research and commercialization efforts in segments consistent with Oregon's existing and emerging knowledge-based industry clusters;
- Concentrate research on new economic opportunities that will benefit the entire state, including rural and disadvantaged communities;
- Significantly increase collaboration and the ability to conduct large, joint research projects among universities and the private sector;

- Examine research and commercialization capacity and opportunities on both a statewide and an institutional level;
- Ensure that research efforts are available to small and medium sized companies.

Breakthrough Opportunities

Based on Oregon's strengths and challenges related to research and technology transfer, the OCKED Council proposes a set of prioritized recommendations. Together, these recommendations significantly enhance the state's ability to increase research, focus the commercialization on areas with high returns, and expedite the process to achieve desired results in an effective and time sensitive manner.

Figure B: Model for Tech Transfer Recommendations

Increased Research	+	Focused Commercialization	+	Expedited Process	=	Sustained Economic Development

Priority Recommendations

Priority A: Establish nationally-recognized "Signature Research Centers" (SRC) that concentrate people, funding, facilities and support in locations where Oregon has a strong possibility to commercialize research, create new businesses, produce competitive wage jobs and increase public and private investment. Centers should be targeted on areas of expertise that have the greatest ability to translate research into business ventures by capitalizing on our R&D capacity while directly linking to Oregon's knowledge-based and emerging industries. First steps include:

- Selecting, by November 2002, a pilot area for Signature Research that connects current research capacity to existing Oregon industries. The anticipated focus of this initial pilot will be in the area of Multiscale Materials and Devices (See Attachment 1).
- Develop an implementation plan for the pilot SRC and obtain seed funding from public, philanthropic and private sources.
- Use the results of the statewide technology roadmap strategy (See priority A) to identify up to three other research disciplines for future Signature Research Centers.
- Establishing a "Development Corporation" that acts as a support structure to provide specific business and industry expertise to universities in areas related to signature research.
- Introduce legislative bill(s) as needed to effectively develop a signature research model.

  Cost: $10 Million of initial start-up funds; $20 million capital improvements; State Funding to leverage approximately $50-100M of federal investment;

Priority B: Direct and focus the missions and functions of State Boards of Education, Oregon Health & Science University and the Oregon Economic and Community Development Department to reflect the importance of the knowledge economy and the role of higher education and economic development organizations in the creation, dissemination and commercialization of ideas.

Higher Education

- Continue to ensure the protection of the Bayh-Dole Act.
- OCKED will work with State Boards of Education to recommend revised language for higher education's mission based on national best practices and will work with the Boards to adopt such language by 2003.
- Streamline state-level review of research and technology transfer agreements and bring into alignment with best practices nationwide. Specifically, under ORS 351.086, exempt university contracts from legal sufficiency review by the Oregon Attorney General.
- Create yearlong entrepreneurial leaves-of-absence for faculty who wish to work with companies aligned with Oregon's signature research areas. Include review of best practices nationwide and consider how leaves-of-absence relate to tenure.
- Create yearlong "industry experts-in-residence" programs at Oregon's universities for industry technology experts in Oregon's signature research areas.

Cost: $0. Policy changes and realignment of existing priorities and resources

OECDD:

- OCKED will work with Oregon Economic and Community Development Department (OECDD) to develop a statewide Technology Roadmap that increases resources and focuses state efforts on the commercialization of ideas and the development of knowledge-based industries. The Roadmap will be a result of an objective and quantitative assessment process that identifies Oregon's greatest opportunities to capitalize on commercial research efforts.
- Using the Technology Roadmap, OCKED will work with OECDD during 2003-2004 biennium to increase the role of state government in linking R&D assets to economic development by:
    - Identifying barriers to Oregon's knowledge based industries and technology transfer capacity; reviewing national best practices and developing a set of tech transfer and knowledge-economy strategies for OECDD;
    - Creating a supporting database of research and development assets;
    - Integrating research and technology transfer into economic marketing efforts; and
    - Establishing a commercialization liaison within the agency.

Cost: $200,000 for development of statewide technology roadmap and implementation of supporting database.

Priority C: Provide adequate seed funding for Technology Transfer Efforts throughout the state.[1]

- OECDD is to provide $4 million in seed funding (2003 budget) for the Higher Education Technology Transfer (HETT).
- OECDD is to provide $1 million in seed funding (2003 budget) to promote technology transfer in rural Oregon and traditional industries.
- Oregon University System will continue to pursue alternative funding sources including philanthropic resources.

Cost: $5 million

[1] Seed funding of this nature has shown significant return on investment for the State. For example, the $20M of initial ORTDA funds leveraged an additional $570M in investment, created over 3,000 jobs, and helped launch 30 companies.

Support of Other OCKED Committee Recommendations

Support the OCKED Capital Committee recommendations to provide tax incentives to accelerate commercialized research in Oregon. These tax incentives would focus business development on areas with high return consistent with Signature Research Centers and Oregon's knowledge-based industries.

- Provide tax incentives for Oregon companies that fund research (privately or in cooperation with universities) related to the state's signature research areas.
- Support capital committee's recommendations to enhance tax policy for qualified business investment in Oregon, and to develop a package of incentives for entrepreneurs within signature research areas that provide incentives and tax credits.

Cost: To be determined as an outcome of Capital Committee priority recommendation #2

Critical Long-Range Recommendations

Develop government/university/industry (GUI) collaborative structure to oversee and promote commercialization activities.

- Structure would act as coordinating entity to receive and disburse funds to identified commercialization activities including Signature Research Centers, HETT Fund, Development Corporation, etc.
- Entity would provide third party accountability to Legislature.
- Entity would provide on-going overview, support and evaluation of identified commercialization activities.
- Entity would provide strategic coherency for the ongoing implementation of statewide commercialization activities by bringing together key partners from industry, university and state economic development.

Fund and implement the appropriate development corporation structure to assist Signature Research Centers in conducting research that can be more readily commercialized, support the development of initial business ventures, and help develop the management capacity to start and operate a business.

Cost: To be determined as an outcome of priority recommendation #2

Fund and implement at least three Signature Research Centers by 2008 based on the research and planning efforts conducted in 2002-2003.

Cost: To be determined as an outcome of priority recommendation #2

Provide system and statewide incentives for start-up companies to more readily participate in commercialized research efforts.

- Provide small grants through OECDD and OUS to emerging companies to allow access to university resources that support their research and business development efforts.
- Allow small technology development companies aligned with Oregon's signature research areas to access State of Oregon benefit plan.

Cost: To be determined as an outcome of priority recommendation #1.

Membership of Technology Transfer/R&D Committee

Chair
Jim Johnson, New Economy Coalition

Members
Representative Tom Butler
Ann Bunnenberg, Electrical Geodesics/Oregon Biomedical Technology Alliance
James Coonan, Oregon University System
Don Gerhart, University of Oregon
Gordon Hoffman, New Technology Ventures
Bill Hostetler, Oregon State University
Representative Al King
Frost Lee, In-Med Systems
Rich Linton, University of Oregon
David Marks, Marks Metal Technologies
Adrian Roberts, Battelle
Todd Sherer, Oregon Health & Science University
Sandy Shotwell, Alta Biomedical
Diane Vines, Oregon University System
Carl Wilcox, Oregon Biomedical Technology Alliance

Interested Parties
Senator Tom Hartung
Lura Powell, Pacific Northwest National Lab
Phil Romero, University of Oregon
Bob Dryden, Portland State University
Mike Driscoll, Portland State University
Scott Dawson, Portland State University

Attachment 1: OCKED Signature Research Center Pilot

Proposed Area of Focus:
Multi-Scale Materials and Devices for Energy, Environmental and Biological Systems

Description: Multiscale Materials and Devices incorporate nanoscale materials into microscale structures to achieve smaller, faster, and better controlled processes for numerous applications. The efficiency and miniaturization breakthroughs expected from these technologies, in which Oregon has a nationally competitive position, will have a major impact on energy, chemical/environmental, and biological systems representing \$10-\$100B in commercial market opportunities. These opportunities cover a healthy and diverse range of market sectors, lead times, and risk levels.

Examples of Applications (potential market opportunity):
- Man-portable and automotive heating and cooling (\$1Bs)
- Fuel cell systems for vehicles, battery replacement (\$1-10Bs)
- Small, efficient heat pumps, distributed HVAC (\$10-100Ms)
- Cell-based biosensors (\$10-100Ms); advanced bio-separation systems (\$10Ms+?)
- High efficiency thermoelectric & photovoltaic materials, nanoparticle solutions (\$10Ms+?)
- Micro-reactors for water purification and toxic waste remediation (\$10-100Ms)
- Nanoparticle solutions, microporous materials

Line of Sight to Oregon Industries
- Energy & Natural Resources
- Health Care & Bioscience
- High technology, fabrication and materials, process CAD
- Instruments & Measurement
- Machinery and Equipment
- Sustainable Technologies

Strong Existing Research & Collaboration: Research for multi-scale materials and devices currently exists at *Oregon State University and University of Oregon, with supporting work at Portland State University and Oregon Health Sciences University*. Examples of active research include the OSU Center for Microtechnology-based Energy, Chemical, and Biological Systems (MECS), the OSU/PNNL Microproducts Breakthrough Institute, the UO Materials Science Institute, and the UO Center for Advanced Materials Characterization. These few examples include over 38 faculty/100 Ph.D. students and over \$22 million in grants won (federal and private) during the past three years.

There is both existing and potential collaboration among Oregon universities. OSU and UO have long recognized their complementary strengths in this field. PSU, UO and OSU have collaborated on a \$34 million proposal to the National Science Foundation. A strong and growing collaboration exists with our \$600M/yr. regional federal laboratory, *Pacific Northwest National Laboratory* (PNNL).

High Probability of Attracting Significant Public and Private Support: Basic and applied research in this area has strong potential of being supported by the DARPA, other DOD agencies, Department of Energy, National Science Foundation, and private industry. *Initial estimates indicate that annual grants of \$30 million or more could be achieved within 5 years, assuming strong political support, an initial capital/operating investment, and highly leveraged matching funds for major federal grants.*

High Probability of Creating New Businesses and Jobs in Oregon: 5-6 companies have already spun out of OUS and PNNL research in the areas of energy-related products and water purification systems. Several other startup/spinoff opportunities are pending, and formation of this center will help influence them to locate in Oregon. Over 15 Oregon companies (including Hewlett-Packard, Intel, LSI Logic, Forrest Paints, Borden Chemical) have sponsored MMD research, made equipment grants, or purchased characterization services from the universities.

APPENDIX B:

OREGON COUNCIL FOR KNOWLEDGE & ECONOMIC DEVELOPMENT

Capital and Business Formation Committee Report

The Objective

The OCKED Capital and Business Formation Committee has been asked to develop a set of recommendations to enhance Oregon's ability to start and expand businesses that drive economic growth. As detailed in the full Council report, Oregon's job and wealth creation will be led by scientific and technology-based industries that develop, apply and adopt marketable discoveries. The strength of the state's science and technology businesses determines the extent to which the state's economy may capitalize on new technologies and markets. These science and technology businesses are the catalyst for competitive breakthroughs that may be adopted within other industries — resulting in a multiplier effect across the state. For this reason, the OCKED Capital and Business Formation Committee has chosen to focus on businesses with bioscience and technology-based applications.

Oregon continues to be at a significant disadvantage for starting or relocating a knowledge-based science or technology company. The state is perceived as lacking focused economic development programs and funding, which are compounded by out-of-date policies that are not aligned with national best practices. Our high personal income and capital gains tax rates inhibit entrepreneurs and venture capitalists from staying in or moving to Oregon. With fewer scientific and technology senior management and investors, we also have fewer spin-off companies from existing firms and fewer new start-ups which erodes our ability to develop a competitive advantage.

In a time of slow economic development, key sources of business growth become critical. Our ability to foster a risk-tolerant, growth-oriented investment environment will be key to Oregon's economic recovery. The primary objective of the OCKED's capital and business formation recommendations is to stimulate economic activity in Oregon. We believe that if these priorities are implemented they will achieve the following direct benefits.

1) Provide revenue stability to the state by removing or reducing the volatility of capital gains tax;
2) Leverage multiple increments of additional private sector investment by removing the barriers to early stage venture capital;
3) Create new jobs and businesses in industries that have high multiplier effects and pay family wages;
4) Expand Oregon's entrepreneurial capacity by attracting people with senior management experience and investment income; and
5) Enhance the benefits to higher education created by recent legislation that allows institutions to hold stock in companies that spin off from tech transfer efforts.

Early investment is not only critical to new business formation, it has high economic multipliers that benefits all Oregonians. Without putting Oregon on a competitive playing field, we will continue our flight of capital to neighboring states. Our recommendations are about bringing new wealth and new jobs to this state, and doing so at the stage that has the greatest return on investment.

Goals and Objectives

Enhance the ability to start and grow companies, and to promote entrepreneurs willing to commercialize ideas in Oregon. Specifically:

- Increase the amount of pre-seed, seed and institutional venture capital available for Oregon's technology and bioscience business sectors;
- Remove the barriers to business formation and modify state policies to reflect current best practices; and
- Enhance the entrepreneurial and management capacity in Oregon by increasing the depth of existing talent and attracting additional world-class executives and researchers.

Outcomes and Measures

Oregon must achieve the following capital and business formation goals by 2010:

- Double the amount of venture capital funds per $1,000 of GSP;
- Increase the rate of US patents per 10,000 businesses by 50%;
- Double business start-ups per $100M of sponsored research; and
- Double the net formation (comparison of births over deaths) of technology and bioscience companies.

Why It's Important

Importance of Venture Capital in Economic Development

According to national studies, venture capital investment produces higher returns than other capital-backed financing. DRI-WEFA, an international economic consulting firm, compared over 16,000 venture-financed companies to non-venture-backed public companies over a 30-year period from 1970-2000. The comparison indicated that venture-backed companies had twice the sales, paid three time the amount of federal taxes, generated twice the exports, and invested three times as much in R&D for each $1,000 of assets.

The high return of venture capital investment has proven itself in Oregon as well. An example of how early stage investment helps Oregon can be illustrated by the investment of one Oregon seed fund that invested $20 million in 50 companies. Those 50 companies created over 3,000 jobs, realized revenues of almost $800 million, and leverage over $570 million in additional investment.

Venture-backed companies also have an edge for sustaining their competitiveness. According to the DRI-WEFA study, "The involvement of venture capitalist in the early stages of the company sets a level of discipline that does well by the company in future years. These factors, combine with a commitment to R&D and breakthrough innovation, gives the venture-backed organizations that make it to the public market an edge."

Building Oregon's Science and Technology Industries

Science and technology companies tend to start up in unique ways. They are often high-risk ventures. Their development cycle from idea to a marketable product is longer than other industries. They often require a more specialized management and workforce. For these reasons, traditional business financing options for bioscience and technology start-up companies are extremely limited.

Companies that attract venture capital are considered to be at the cutting edge of science and technology, or have a product or service whose growth and demand will far exceed the average business growth rate. For technology and bioscience start-up companies, the availability of pre-seed, seed and later-stage funding is one of the biggest obstacle to starting and growing successful businesses in Oregon. Since access to an adequate early stage capital is a limiting factor for potential growth, the Capital and Business Formation Committee chose to focus its preliminary efforts on these critical stages of capital access.

Despite some similarities in risk, early-stage capital requirements and availability differ notably between technology, healthcare/biosciences, and consumer products & services' industries. The Capital and Business Formation Committee approached the capital formation issue by choosing two types of risk-oriented investment that correspond to two industry segments that are key to Oregon's economy: **technology & biosciences**.

Early-stage technology and life/bioscience companies require substantial risk-oriented investment over several years to overcome the technical and regulatory hurdles present in their industries. There is a recognized gap in early stage investments of less than $2,000,000. Filling this gap in investments is critical to forming companies and sustaining them over an extended development lifecycle. Having this funding available also allows companies to stay in the originating community and not be forced to relocate closer to available capital sources.

Health care, biosciences, and other heavily regulated industries tend to have long maturation cycles. Research and development, proof of concept, and initial development stages takes years, and the processes of commercializing ideas have long lead times. For this industry sector, **pre-seed and development funding through growth funding** (including federal research dollars) are critical stages for Oregon start-up companies.

Technology industry sectors and the application of technology to more traditional industries have a shorter pre-seed and development cycle and a better-developed and knowledgeable local investment community. However, these sector businesses experience a scarcity of **institutional venture funding** at the initial and follow-on stages.

How We Measure Up

To the venture community, you must be part of a hot market. Being in the middle of the pack gets you nowhere. You need to consistently be in the top ten (preferably the top five). By all discernible measures, Oregon lacks the depth and breadth of pre-seed and seed capital resources necessary to fund the initial, earliest stages of business that will propel Oregon's economy forward. The following table summarizes Oregon's ranking among measures considered key to science and technology company capital and business formation. It includes Oregon's comparison to the 10th ranked state and the type of improvement we need to make a top-ten ranking.

A Summary of Oregon's Capital & Business Formation Capacity

Capital Measure	Value	Oregon rank	Value of 10th ranked state
VC Funds per $1,000 of 1999 GSP	$ 5.41	16	$ 8.16
IPO funds per $1,000 of GSP	$ 2.45	22	$ 5.45

SBIR Awards per 10,000 businesses (1998-2000 avg.)	5.800	17	8.2
Total R&D Dollars per $1,000 of GSP	$ 18.00	26	$ 35.43
Federal R&D Obligations per $1,000 of GS	$ 3.72	32	$ 8.03

Business Formation Measure	**Value**	**Oregon rank**	**Value of 10th ranked state**
US Patents per 10,000 businesses	147	13	169
Percent of technology company births (% tech start-ups compared to all start-ups)	6.5%	29	9.77%
Net technology company creation: net formation per 10,000 establishments (comparison of births over deaths--ability to sustain firms)	11.7	41	37.8

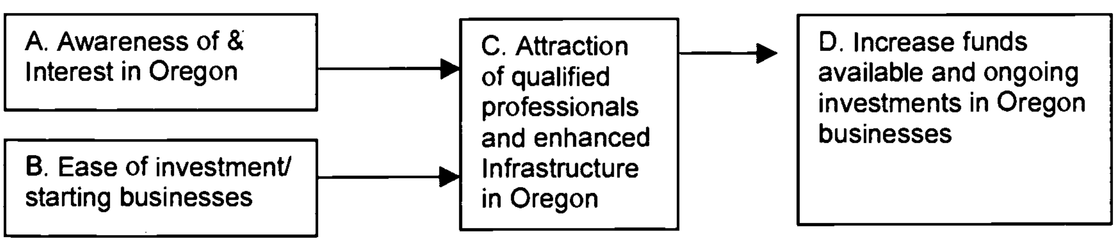
Source: Department of Commerce, October 2001

The Unfinished Agenda: Capital Challenge

To the venture community, Oregon is considered a third-tier state in investment opportunity. While the amount of venture funds in the state increased dramatically from 1995-2000 (and then fell in proportion with the nation during 2001), our relative investment compared to other states remains low. Several factors drive our low investment rate. Some are related to issues outside our immediate control (e.g., Portland and Oregon are considered small markets). However, the state has some control over other factors. OCKED Capital and Business Formation Committee chose to focus on issues that the state could address over the next five years to significantly enhance our business climate.

To achieve more available seed venture funds and qualified business start-ups, we must ensure that Oregon nurtures a foundation for increased investment that will foster new seed and venture funds in the state. Recommendations to enhance Oregon's capital and business formation goals have been organized into four key elements of a capital formation framework.

Capital Formation Framework



- This stronger foundation starts with investor awareness and interest in Oregon. Achieving a greater awareness within the seed and venture community will require a more proactive approach with increased efforts to communicate Oregon opportunities for investors located outside the state.
- Second, the state must have a business climate that makes it easy and rewarding to invest in and start business ventures. Achieving a more encouraging climate for investments will require that state regulations and tax policies be aligned with those of competing U.S. and international entities.

- Third, we must have the depth of management, research and other professional talent necessary to support each industrial segment (i.e., bioscience, technology, etc.) as well as the physical infrastructure (i.e., roads, educational institutions, etc.) necessary to facilitate new start-ups and expanding businesses.
- Finally, with these elements in place, Oregon can more effectively implement efforts to increase the number of seed funds in the state.

While the ultimate goal is to increase the number of capital funds and amount of investment in Oregon, the other three elements must be in place to provide a solid foundation for sustaining investment. With these elements in place, Oregon is likely to sustain new business development.

Breakthrough Opportunities

With the recent economic downturn and the Northwest having the highest unemployment in the nation, now is the time to invest in attracting capital and forming new businesses. We cannot expect to create jobs in a knowledge-based economy using old policies that are no longer competitive. It is critical to concentrate on the engine that drives economic development for our high growth businesses, focusing the state's limited resources on targeted strategies with a high multiplier effect in new jobs, businesses and wealth creation.

Anticipated results: Every dollar of early stage capital has a high multiplier effect in terms of additional investment, new jobs and personal income created. Example: An Oregon Seed Fund with $20M in capital helped 50 Oregon companies create over 3,000 jobs, realize revenues of over $798M, and leverage over $570M of additional investment. According to the National Venture Capital Association, venture-backed companies in Oregon accounted for over 23,000 jobs and $3.3B in revenues during 2000.

Priority Recommendations

Priority A: Significantly Increase Investment and the Presence of Institutional Venture Capital Firms in Oregon

Specific actions include:

- Work with philanthropic foundations and state retirement funds, which are already investing in private equity funds, to encourage their venture capital partners to establish an Oregon office staffed by a partner-level investor, and review Oregon investment deals on a regular basis.
- Reduce or eliminate capital gains to remove existing barriers to private investment and be more competitive with other states.
- Work with OECDD to treat venture capital as an industry cluster and to develop a strategy to expand and recruit a larger venture capital industry sector in Oregon.

Priority B: Enhance the depth of Management and Entrepreneurial Capacity

Specific actions include:

- Develop an "Invest in Oregon" incentive package that would attract highly qualified venture fund managers and world-class researchers. The objective of this package is to increase new investments and attract key talent that will directly result in the creation of new jobs and wealth, and increase our competitiveness and ability to attract additional firms.
- Establish training and networking programs to develop qualified CEOs and help train companies in various aspects of business management, technology assessment and project planning, company formation and capitalization, regulatory requirements and other skills.

Proposed Qualification Criteria:
The New Business In Oregon Package would apply to individuals from one of three categories that relocate to Oregon to start, expand or transfer viable enterprises.

Venture Capital Partners: New eligibility would require **all** of the following:

1) Partner level in existing VC fund;
2) Fund(s) has at least $75-100 million uninvested;
3) Fund concentrates on either technology and/or bioscience investments;
4) Partner relocates to Oregon or is hired in Oregon to represent the fund;
5) Fund makes at least one Oregon private equity investment per year of greater than $2 million (debt and convertible debt not eligible).

Qualified Signature Researchers in universities and qualified bioscience companies. Eligibility would require meeting the following criteria (benefit to be earned after the fact based on specific outcomes being achieved):

1) Senior PhD or MD researchers with active research projects and with proven experience of translating research into commercialized business ventures;
2) Senior research executive who has authority to make fundamental decisions about the direction of university research.

Cost: $200,000 for initial set-up of QBTC program during 2003/2005 bienniums, after which application fees will cover administrative cost of program.

Cost: $150,000 per biennium of new funds with $150,000 of private sector contributions to develop and administer a database, as well as marketing, retention and recruitment efforts to venture capital partners and senior researchers.

Recommendations Already Underway

Philanthropic Seed Fund

Establish a philanthropic bioscience pre-seed fund that allows individuals and foundations to invest in pre-seed stages of bioscience ventures. OHSU Foundation has just begun such a program capitalized with $1.25M and now looking for a match from local foundations and philanthropists. Establish giving program for donors and foundations directed to this pre-seed fund with potential returns to evergreen the fund.

Support Of Other OCKED Committee Recommendations

Increase Higher Education Technology Transfer (HETT) funding.

The Capital and Business Formation Committee strongly endorses the Technology Transfer Committee's recommendation to provide $5 million of seed funding to the recently established HETT fund.

Critical Long-term Recommendations

Enhance the infrastructure that supports the needs of new and emerging firms.

Shared facilities that provide infrastructure on a mid-to long-term basis.

- Provide incentives for private developers and landlords to create facilities that attract bioscience operations or to convert existing facilities to space that contains wet labs, clean rooms and air handling suitable for bioscience companies.
- Investigate re-conversion of semiconductor manufacturing capacity to bioscience manufacturing (with the side effect of attracting management talent via the firms that locate in the space created).
- Examine the role of state investment in bioscience facilities, especially facilities related to Oregon's "Research Signatures."

Directed focus on specific competencies and fostering industry-related sector collaborations.

- Closely examine the WTC model of state-of-the-art facilities in targeted scientific domains that are available for joint R&D and pre-commercial and commercial projects.
- Support Tech Transfer Committee efforts to establish a "Development Company" that is managed by a team of experienced executives having a track record in product development, intellectual property, business development, commercialization of technologies and corporate finance.

Modify Oregon's Securities Regulation

Modify Oregon securities regulations to be more aligned with other high investment states such as Delaware.

Promote Private Investment

Investigate and develop detailed recommendations for increasing private investment into funds such as the Oregon Growth Account (OGA) including contingent tax credits for private sector investments directed to in-state venture funds and managed by OGA.

Membership of Capital & Business Formation Committee

Chair
Scott Gibson, Gibson Enterprises

Members
Randal Edwards, Oregon Treasurer
Ann Bunnenberg, Electrical Geodesics, Inc.
Jim Johnson, New Economy Coalition
Frost Lee, MD, In-Med Inc.
Rep. Tom Butler
Rep. Al King
Lynn Stevenson, New Ventures, Biotechnology
Mardi Saathoff, Tektronix, Inc.
Phil Romero, Dean University of Oregon Business School
Scott Dawson, Dean, Portland State University Business School
Bill Newman, Northwest Technology Ventures (ORTDA)
Derek Ridgley, Silicon Valley Bank
Mike Henderson,
Ron Fox, Oregon Economic and Community Development Department

Research and Technical Support
Patrick Allen, Oregon Economic and Community Development Department
Patricia C. Scruggs, Scruggs & Associates, Inc.

APPENDIX C:

OREGON COUNCIL FOR KNOWLEDGE AND ECONOMIC DEVELOPMENT

Workforce Development Committee Report

The Objective

Knowledge workers hold the jobs that invent new products, translate data and information into usable services, and manage businesses. They are key to a company's productivity, competitive edge and ability to adapt to changes in markets and customers. Knowledge and technology workers are employed in places like banks, hospitals, manufacturing firms, trucking and distribution companies, high tech establishments, law offices, ad agencies, government and agriculture. Like certain industries that tend to lead economic growth, these occupations are indicators of a state's competitive advantage and economic sustainability.

In today's economy, innovation is led by science and technology fields. In addition to scientists and engineers, business management and information technology play critical roles in translating technical ideas into viable businesses. Together, this triad of occupations comprises the core of our knowledge-based workforce.

However, Oregon has a mixed record in terms of these critical jobs. The state ranks 25th in the number of information technology jobs and 14th in the number of scientists and engineers per capita. Oregon's ability to grow our own knowledge workers is even more of a concern. The need for scientists and engineers continues to increase while college enrollment in these fields continues to decrease. Oregon ranks 30th in the number of engineering graduates and 31st in the number of science and engineering graduate students.

Oregon's future will depend on having a critical mass of highly skilled technology workers and researchers. Workers must not only have the prerequisite education and skills to get a job, they must constantly update those skills and acquire new skills. Learning is truly life-long and new occupations are created every day. This means that the state must have the following:

- A flexible and responsive training system for our existing workforce to help employees obtain up-to-date technical and entrepreneurial skills, as well as continue to stay marketable when looking for new employment;
- Adequate funding and support for higher education to significantly increase the effectiveness of and access to technology, sciences and business management programs throughout the state; thereby growing and employing our own knowledge-based workers; and
- A system that prepares the next generation for well-paying jobs by ensuring our K-12 system teaches math, science, problem-solving and technology skills early and consistently; exposes students to hands-on experiences and to the variety of new and traditional technology and science careers; and provides teachers with adequate and ongoing training in these same areas.

Workforce Development Goals:

Develop an integrated workforce strategy, aligned with Oregon's key industries, that keeps current workers on the leading edge, expands the ability to educate knowledge workers in Oregon, and prepares Oregon youth for knowledge-based jobs of the future.

Quality: Raise Oregon's commitment to excellence in educating and training knowledge- and technology-based workers.

Capacity: Expand Oregon's capacity to meet the growing demand for knowledge- and technology-based workers.

Capability: Provide quality education and training for knowledge- and technology-based occupations in all geographic regions of the state.

Desired Outcomes:

Oregon must achieve a world-class competitive workforce by 2010. Specifically, the state must dramatically increase:

- The number of skilled and qualified Oregon workers able to fill rapidly growing and changing technology-based jobs;
- The number of students entering and graduating from Oregon universities with Bachelor's Degrees, Master's Degrees and Ph.D.s in technology, engineering, science and business management fields; and
- The awareness of and interest in science and technology among K-12 students and competency of teachers in the knowledge and application of technology, math and science.

Knowledge-based Workforce Measures:

For Oregon to have a world-class competitive workforce, the state must strive to achieve the following goals in the next five years:

- Address immediate skill gaps by doubling the number of incumbent workers receiving training in technology and entrepreneurial skills. Specifically:
    - o Develop a statewide roadmap for Oregon's knowledge workers that identifies critical knowledge-based occupations that can help re-employ Oregon's workforce.
    - o Triple the funding (over 2001-2002 levels) for incumbent worker training grants that focus on capacity building efforts and direct training in information technology.
- Significantly increase the number of students graduating from Oregon universities with math, science, computer science or engineering degrees. Specifically:
    - o Double the number of Oregon high school students entering four-year math, science or engineering programs.
    - o Double the capacity of four-year and graduate-level university computer and information science programs.

- Increase the number of teachers adequately trained in the use and application of technology in the classroom. Specifically:
  - Provide scholarships for 250 teachers each year to receive technology, math and science training, with 60% of those teachers from schools in distressed communities.

Why It's Important

A technically literate workforce is everyone's agenda. Nationally, eight of the top ten family-wage, high-demand jobs are in technology fields. Approximately *90% of technology-based jobs are **not** found in high tech companies*; they are, in fact, disbursed among a variety of traditional sectors: manufacturing, natural resource, agriculture, business services, financial institutions, insurance, wholesale trade, telecommunications and utilities. Despite this demand, Oregon has no statewide workforce plan or strategic objectives for these occupations and the industries they serve.

Knowledge/technology-based jobs come in all shapes and sizes and pay well above state, regional and national average wages. Occupations of all kinds, not just engineering and science, are dependent on analytical skills and the application of technology to solve problems. Educational requirements for technology jobs range from certificates to advanced college degrees. These technical and professional jobs are among the fastest growing occupations and are projected to continue their growth at an overall rate significantly higher than other jobs. The average wage of typical technology occupations in Oregon in the year 2000 ranged from $38,590 to $80,376, significantly more than the state average of $32,776.

Research and experience also indicate that a qualified workforce is best sustained through a well-integrated system of K-12, higher education and industry. Since technology is a part of almost any occupation, our education system must provide strong math and science programs; sufficient creative and design elements; and solid literacy elements in writing, communication and technology. A technically proficient workforce combines a solid set of core literacy and problem-solving skills with occupational or technology specialties. Our education system should ensure students develop the following base skills:

- Basic literacy skills in reading, writing, math and science;
- Analytical and creative problem-solving skills as well as orientation to systems and innovation;
- Basic technology skills in the operation of computers and computer applications; and
- An ability to understand and manage technological systems with sensitivity to societal issues and human activity.

Technical literacy is most effectively achieved when introduced early and consistently. Introducing technical literacy in K-12 education will encourage interest in these well-paying jobs and articulating programs into college and university programs. Appropriate equipment, training materials, teacher training and revised curricula are required to ensure our students are prepared for future jobs.

Technical literacy also requires an education system that is dynamic and responsive. Education is no longer required to be place- or time-bound. The Internet and e-learning allow curriculum developed at one location to be taught virtually anywhere; it can also reduce the costs of redundant curriculum development as well as increase access to training options and to non-traditional formats.

How We Measure Up

Oregon's Overall Educational Attainment

	OR 2000	WA 2000	CA 2000	CO 2000	US 2000
Percent of population 25 or older with an Associate's Degree	6.65	8.03	7.13	6.98	6.32
Percent of population 25 or older with a Bachelor's Degree	16.4	18.4	17.09	21.57	15.54
Percent of population 25 or older with a Graduate/Professional Degree	8.68	9.32	9.53	11.12	8.86
Percent of population 25 or older with a Bachelor's Degree or higher	25.08	27.72	26.62	32.69	24.4

Source: Census Scope, 2002

Recent Science and Engineering Degrees in the Workforce: 1999

	Oregon Rank	Recent Degrees Employed	Value
Percent of civilian workforce with a recent Bachelor's Degree in science or engineering	14	29,030	1.65%
Percent of civilian workforce with a recent Master's Degree in science or engineering	18	5,540	0.31%
Percent of civilian workforce with a recent Ph.D. in science or engineering	20	2,390	0.14%

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001

Degrees Granted as a Percent of the 18-24 Year Old Population

	Oregon Rank	Degrees Granted	Value
Associate's Degrees granted as a percent of the 18-24 year old population (1997-98)	31	5,850	1.93%
Total Bachelor's Degrees granted as a percent of the 18-24 year old population (1997-98)	31	13,652	4.50%
Percent of Bachelor's Degrees granted in science and engineering (1997-98)	31	2,369	17.40%
Science and engineering graduate students as percent of the 18-24 year old population (1999)	31	3,733 (S&E Graduate Students)	1.20%

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001

Projected Job Growth for Science & Engineering Occupations in Oregon

Occupational Title	2000-2010 % Growth	Average 2000 Wage
Computer Support Specialist	68.1%	$38,590
Computer Systems Analyst	40.1%	$58,662
Other Computer Scientists	72.8%	NA
Computer Engineers	48.0%	$71,036
Electrical Engineer	25.5%	$60,195
Other Engineers	42.0%	NA
Medical Scientists	10.5%	$54,976
State Average (all jobs)	12.5%	$32,776

Source: Oregon Employment Department

While Oregon's high schools still rank high in SAT scores (second in the nation), students are not continuing postsecondary education in science and engineering fields. According to the Software Association of Oregon (SAO), in 2001:

- Only 11.3% of students took a technology class other than keyboarding.
- Only 6% of schools had a teacher dedicated to teaching computer programming.
- Less than 50% of the technology classes taught any type of programming and half the high schools did not teach any programming.

The Unfinished Agenda: Workforce Challenge

Having a skilled workforce spans generations. Economic development depends on training current workers for today's jobs, the ability of higher education programs to produce skilled workers for the immediate future and the long-term investment in our K-12 system. All of these issues are equally important and inter-related.

We need to immediately retrain existing workers for today's high demand jobs. The use and application of technology and the skill sets needed to successfully deploy new applications change at an ever-increasing pace. These skills apply to data entry jobs as well as engineers — and to jobs found in banks, hospitals, and wholesale firms, in manufacturing and in software companies. Oregon needs a statewide workforce strategy and increased investment in training for these high demand science and technology jobs that significantly impact our economy.

We need to ensure qualified people are entering the workforce at all times. Since the majority of high demand jobs require college degrees, our higher education system must be fully funded and have world-class facilities; qualified faculty; and nationally recognized science, technology and engineering programs. In Oregon, it is projected that there will be many more jobs than the number of Oregon university graduates in key fields such as computer science, information technology and electrical engineering. The state must increase the capacity of these programs throughout the state in order to meet this demand and be less reliant on importing talent.

Students and workers need the ability to complete education and training in a timely manner regardless of place. Credits for the same or similar programs should be easily transferable between institutions. The state education system should promote more collaboration and less redundancy in the development of curriculum and successful courses developed at one state institution should be available to others through distance and e-learning classes.

We must continually expose students to new career options central to their economic well-being. The careers available to students are ever changing. Teachers and counselors in primary and secondary schools need to understand various science and technology careers in order to expose students to careers to which they might not otherwise come into contact. Many career options for today's students were not available when their parents completed school. If students are not exposed to these new and growing careers, we cannot expect them to continue their education in science and technology fields.

We must raise awareness and increase student interest in science and technology fields. Even if students are exposed to different career options, they are not likely to choose a science or technology field if they are uninterested in the subject. Early and consistent exposure to applied math and science directly impacts a student's interest in those fields. Participation in efforts outside the classroom (i.e., science and technology fairs or after school and summer programs) is equally important.

We must provide our teachers with the same level of training we provide other incumbent workers. If we expect our technology workers to have up-to-date skills and our students to be prepared for work when they graduate, we need to invest the same level of training in our teachers. Teachers are the workforce of the education system, yet there is inadequate training to keep them up-to-date with current skills and information. The state needs to systematically ensure teachers have access to training and that the evaluation system for teachers includes incentives for training. Oregon schools need to ensure that teachers with matching qualifications teach key classes. For instance, research indicates that 5th and 8th grade math and science classes are critical points for students (especially for girls and minorities). However, on average, less than 40% of teachers instructing those classes have math or science degrees.

Breakthrough Opportunities

Ensuring a knowledge-based workforce will require the implementation of recommendations at four integrated levels:

- Addressing immediate incumbent worker skill gaps and identifying high demand occupations that can re-employ Oregonians;
- Strengthening the capacity of the higher education system in technology-based fields and promoting collaboration and articulation among programs;
- Increasing the interest of students and workers in knowledge/technology careers; and
- Enhancing the capacity of teachers to use and teach with technology.

These recommendations address the current workforce, higher education and K-12 issues as an integrated system. They are intended as a package of strategies, each contributing to both immediate- and long-term workforce needs and should not be interpreted as stand-alone projects.

An Integrated Framework:

	Knowledge-based Jobs		
	Engineering & Science	Information & Data Management	Business Management
Incumbent Workers (Immediate)	**Priority A** Addressing Critical Occupations & Immediate Opportunities		
Higher Education (Short-term)	Engineering Technology Industry Council (ETIC)	**Priority B** **Building Capacity & Excellence**	
K-12 Education (Long-term)	**Priority C** **Preparing for the Future**		

Priority Recommendations

Priority A: <u>Qualified and Skilled Workers For Today's Jobs:</u> Immediately enhance the skill level of the current workforce by developing a statewide roadmap for a knowledge-based workforce, focusing on high demand occupations critical to multiple Oregon industries in all parts of the state.

- Develop a statewide action plan for high demand technology-reliant occupations that clearly articulates statewide growth, industry needs, training and education capacity, and implementation strategies to fill these critical jobs. The strategy should include base skills, technological skills, and entrepreneurial and business management skills, and should fully integrate industry and public/private education training efforts throughout the state.
- Develop regional alliances of education and training partners to coordinate the development and delivery of curriculum in a manner that reduces redundant programs and increases the capacity to train workers.
- Develop a statewide strategy to more effectively utilize distance and e-learning; identifying current infrastructure gaps, system constraints, capacity issues and usability factors.

Cost: $350,000 for planning and development costs; $100,000 for a roadmap and action plan; $150,000 for regional alliances; $100,000 for e-learning action plan. Implementation to be determined.

Priority B: <u>Higher Education Capacity and Effectiveness:</u> Actively support higher education efforts that significantly increase the capacity and quality of people graduating with degrees in technology, engineering, sciences and business programs.

- *Support the full set of recommendations of the Engineering and Technology Industry Council (ETIC):*
  - Immediately and dramatically increase state-granted engineering degrees;
  - Accelerate the development of a top-tier bioscience school;
  - Create a top-tier engineering school;
  - Increase engineering faculty and expand laboratories;
  - Enhance pre-college programs;
  - Increase the quality and diversity of engineering and computer science students.

  Cost: Full ETIC recommendations will require $40 million.
- *Work with business schools to increase the depth of business management programs to include entrepreneurial skills, information technology and management, and technical marketing issues.*
- *Ensure that leadership commitment and policies of the Joint Boards of Education:*
  - Fully ensure complete transferability of accredited courses among higher education institutions in Oregon;
  - Provide adequate incentives to minimize the development of redundant curriculum and promote collaboration of curriculum delivery; and
  - Fully utilize distance and e-learning capacity to increase the access of education and training programs to rural and distressed communities.

  Cost: $75,000 for coordination of efforts.

Priority C: <u>K-12 Capabilities</u>: Increase the number of students aware of and prepared to enter science and technology fields and increase the number of teachers who are competent in the use and application of technology in the classroom.

Student interest: In 2004, Oregon will be host to the International Science and Engineering Fair (ISEF). This event is the world's largest pre-college celebration of science and technology and brings together more than 600 teams of 9th-12th graders from around the globe. Past student competitions have led to significant patented inventions. The after effects of this exposure can be profound, including establishing a foundation for ongoing training efforts, increasing the emphasis of science and technology within schools and raising awareness of science and technology careers across the state.

- Work with Saturday Academy, Business Education Compact, OMSI, workforce boards and other youth programs to sponsor at least 10-12 teams throughout Oregon to participate in the competition for the International Science and Engineering Fair (ISEF). The effort would target at least one team, consisting of 9th-12th grade students and teachers, in each workforce development region of the state. Each team would have industry and higher education mentors and advisors who would promote long-term relationships among K-12, higher education and private industry.
- Establish ongoing industry and higher education involvement and a sustained funding source for student participation in science and technology fairs.

Cost: approximately $75,000-125,000 for 2003-2004 ISEF teams and coordination; $100,000 per year for ongoing student efforts.

Teacher training: Enhance the capacity of teachers to use technology in classrooms and to teach to current math, science and technology standards. While the availability of computers and Internet access in schools is increasing, teachers are still not adequately trained in how to use, teach with, or integrate appropriate technologies into their curricula. If students are to meet national academic benchmarks and graduate with career-based skills, then teachers need to have current skills. Oregon has strong industry involvement in very successful and cost-effective teacher training programs for math, science and technology. However, program funding is inadequate to reach the number of teachers needing this assistance.

- Establish a scholarship fund for 250 teachers to complete technology, math and science training. At least 60% of these teachers would be from economically distressed communities.
- Support "teachers in industry" internship programs for at least 100 teachers each year.
- Establish a sustained funding source for training at least 250 teachers per year in technology and science. Develop incentives at the district and teacher levels to participate in training.

Cost: approximately $150,000-200,000 annually for teacher training and internships.

Critical Long-Range Recommendations

- *Ensure our state workforce grant programs align with economic development needs.* Focus decisions and resource allocation criteria for state and federal training dollars on industry and occupation clusters that have the greatest demand and that align with Oregon's knowledge-based economy. Include entrepreneurial skills in training programs and ensure that adequate grants are awarded to address incumbent worker training requirements.

- *Dramatically increase awareness among students, teachers, parents and the public about knowledge- and technology-based occupations and the education and training requirements for family-wage jobs in these professions.* Target outreach efforts to female, minority and rural populations that are currently under-represented in these fields. While filling immediate needs is critical, it is equally important to sustain a steady pipeline of students who intend to enter knowledge-based occupations. The demand for knowledge-based workers continues to increase while student enrollment in related programs has decreased. Interest in entering careers such as engineering, bioscience, information technology or other technological fields can be stimulated through direct student experience and by ongoing teacher, parent and public advocacy and understanding of these careers.
- *Provide incentives and/or redirect the focus of state scholarships to encourage students to enter knowledge- and technology-based fields.*
- *Increase the instructional quality of 5th and 8th grade math and science teachers and enhance ways for the private sector to participate in math and science classes.* Examine the best practices in other states and develop a concise set of recommendations for enhancing 5th and 8th grade math and science capacity.
- *Establish a statewide "Certificate of Technological Literacy" available to current and emerging workers.* The certificate would represent a set of nationally recognized skills and competencies used consistently by secondary and postsecondary educational institutions throughout the state. This certificate could be used as a stand-alone certificate articulated with high school Certificates of Initial Mastery (CIM) and Certificates of Advanced Mastery (CAM) programs to enhance the competitiveness of non-college degree jobs, as a core interdisciplinary curriculum for higher education programs in both community colleges and universities and as a professional development/continuing education certificate for current workers.

Membership of Workforce Development Committee

Chair
Jill Kirk, State Board of Education

Members
Cam Preus-Braly, Dept. of Community Colleges and Workforce Development
Carl Talton, Portland General Electric
Don VanLuvanee, retired
Dwight Sangrey, Golder Associates
Joe Johnson, Clackamas Community College
Richard Jarvis, Oregon University System
Ronald Adams, Oregon State University
Ryan Deckert, State Senator

Interested parties
Duncan Wyse, Oregon Business Council
Lita Colligan, Portland Development Commission
Sharon McFarland, Worksystems, Inc.

Report written by: Patricia C. Scruggs, Scruggs & Associates, Inc.

APPENDIX D:

OREGON COUNCIL FOR KNOWLEDGE AND ECONOMIC DEVELOPMENT
Economic Development Metrics

This set of metrics shows Oregon's comparative ranking for measures typically used by public and private sector organizations for identifying economic development strengths and weaknesses, especially those related to building a knowledge-based economy. The data and information contained in this section was distilled from the U.S. Department of Commerce Office of Technology Policy's State Science and Technology Indicators report, "The Dynamics of Technology-based Economic Development," printed in October 2001.

Each measure explains its relative importance to economic development and lists the top 10 states and Oregon's comparative ranking for that measure. The measures are divided into three categories that corresponds to the priorities and focus of the Oregon Council on Knowledge and Economic Development: Part I) Research and Development, Part II) Education and Workforce, and Part III) Capital and Business Formation.

Part I: RESEARCH & DEVELOPMENT

Total Performed R&D Expenditures

R&D expenditures are the total of the basic research, applied research, and development performed by private industry, federal government, academic, and non-profit organizations located in the state. GSP is the output of goods and services produced by the labor and property located in the state. This metric describes the importance of R&D activities to a state's economy. It is directly related to the number of workers and capital employed in the conduct of research and development. Long-run economic growth is universally deemed to be highly dependent on the R&D activities of scientists and engineers. R&D expenditures also provide insight into the perceived importance of research and, hence, how supportive the business climate is to research.

Expenditures for Total R&D Performed per $1,000 of GSP: 1999

State	Total R&D, millions	GSP, millions	Value	Rank	Percent of U.S. Value
New Mexico	$3,279	$51,026	$64.26	1	259%
Michigan	$18,799	$308,310	$60.97	2	246%
Rhode Island	$1,651	$32,546	$50.73	3	205%
Massachusetts	$12,190	$262,564	$46.43	4	187%
Maryland	$8,087	$174,710	$46.29	5	187%
Washington	$8,336	$209,258	$39.84	6	161%
California	$47,965	$1,229,098	$39.02	7	157%
Delaware	$1,343	$34,669	$38.74	8	156%
Idaho	$1,309	$34,025	$38.48	9	155%
Arizona	$5,091	$143,683	$35.43	10	143%
Oregon	$1,974	$109,694	$18.00	26	73%
United States	$229,322	$9,253,147	$24.78	—	100%

Source: National Science Foundation and Bureau of Economic Analysis

Industry-performed R&D Expenditures

This metric describes the importance of R&D activities to the industry sector of a state's economy. Industry funds and performs more R&D than all other sectors of the economy combined. In 1999, industrial sources provided 67% of all R&D funding and performed 75% of all R&D.

Expenditures for Industry-performed R&D per $1,000 of GSP: 1999

State	Total R&D, millions	GSP, millions	Value	Rank	Percent of U.S. Value
Michigan	$17,714	$308,310	$57.46	1	300%
Rhode Island	$1,264	$32,546	$38.84	2	203%
Delaware	$1,261	$34,669	$36.37	3	190%
Idaho	$1,210	$34,025	$35.56	4	186%
Massachusetts	$9,314	$262,564	$35.47	5	185%
Washington	$7,231	$209,258	$34.56	6	181%
California	$39,047	$1,229,098	$31.77	7	166%
Arizona	$4,434	$143,683	$30.86	8	161%
New Jersey	$9,453	$331,544	$28.51	9	149%
New Mexico	$1,342	$51,026	$26.30	10	137%
Oregon	$1,540	$109,694	$14.04	24	73%
United States	$177,000	$9,253,147	$19.13	—	100%

Source: National Science Foundation and Bureau of Economic Analysis

University-performed R&D Expenditures

This metric describes the importance of university research to a state's economy. Universities tend to be oriented toward basic research that focuses on long-term, fundamental knowledge and discoveries of new underlying principles. In 1999, universities performed 11.6% of the total R&D performed in the U.S. Universities' faculty, facilities and knowledge contribute substantially to the resource base that attracts new businesses to a state.

Expenditures for University-performed R&D per $1,000 of GSP: 1999

State	University R&D, thousands	GSP, millions	Value	Rank	Percent of U.S. Value
Maryland	$1,387,262	$174,710	$7.94	1	270%
Massachusetts	$1,402,522	$262,564	$5.34	2	182%
Iowa	$375,300	$85,243	$4.40	3	150%
New Mexico	$224,500	$51,026	$4.40	4	150%
Utah	$273,192	$62,641	$4.36	5	149%
Montana	$84,460	$20,636	$4.09	6	139%
North Carolina	$1,012,576	$258,592	$3.92	7	133%
Hawaii	$156,810	$40,914	$3.83	8	131%
Nebraska	$205,363	$53,744	$3.82	9	130%
Vermont	$64,791	$17,164	$3.77	10	129%
Oregon	$319,700	$109,694	$2.91	24	99%
United States	$27,168,593	$9,253,147	$2.94	—	100%

Source: National Science Foundation and Bureau of Economic Analysis

Federal R&D Obligations

Federal obligations are the amounts of money for orders placed, contracts awarded, services received, and similar transactions directed to a state during a given period of time. The recipients of R&D obligations may be federal agencies, industrial firms, universities and colleges, non-profits, state and local governments and federally funded R&D institutions. This metric measures the magnitude of federal R&D dollars flowing into a state to support employees, administrators and facilities as well as to support research that may lead to wealth creation from new technologies, new products and new businesses in the state. Federal R&D obligations also reflect the capabilities and capacities of the research institutions within a state.

Federal Obligations for R&D per $1,000 of GSP: 1999

State	Fed Obligations for R&D, thousands	GSP, millions	Value	Rank	Percent of U.S. Value
Maryland	$8,094,369	$174,710	$46.33	1	602%
New Mexico	$2,068,291	$51,026	$40.53	2	527%
Virginia	$5,750,372	$242,221	$23.74	3	309%
Alabama	$1,806,956	$115,071	$15.70	4	204%
California	$15,600,123	$1,229,098	$12.69	5	165%
Rhode Island	$391,717	$32,546	$12.04	6	156%
Massachusetts	$3,129,401	$262,564	$11.92	7	155%
Ohio	$3,687,855	$361,981	$10.19	8	132%
Colorado	$1,438,682	$153,728	$9.36	9	122%
New Jersey	$2,661,153	$331,544	$8.03	10	104%
Oregon	$408,099	$109,694	$3.72	32	48%
United States	$71,193,660	$9,253,147	$7.69	—	100%

Source: National Science Foundation and Bureau of Economic Analysis

Another method of measuring research and development is by per capita expenditures.

Industry R&D Dollars Per Capita, 1998

	State	Level
1	DE	3327.66
2	MA	1725.80
3	RI	1336.43
4	WA	1314.38
5	MI	1287.95
6	NJ	1286.51
7	CA	1088.28
8	NH	1000.99
9	CT	951.24
10	CO	898.22
20	OR	454.59

Academic R&D Dollars Per Capita, 1999

	State	Level
1	MD	270.42
2	MA	228.26
3	AK	152.29
4	NC	134.19
5	HI	131.72
6	IA	131.18
7	UT	130.06
8	NM	129.50
9	CO	127.91
10	CT	127.77
24	OR	97.41

Federal R&D Dollars Per Capita, 1998

	State	Level
1	MD	1573
2	NM	1328
3	VA	676
4	MA	587
5	GA	580
6	AL	541
7	RI	521
8	CA	441
9	CO	358
10	MO	265
32	OR	98

Source: Milken Institute, 2001

SBIR Awards

For this metric, the number of Small Business Innovation Research Program (SBIR) awards were calculated per 10,000 business establishments. This metric indicates the degree to which small companies in each state are participating in federally funded research and development and adding to the U.S.' base for technical achievement. The SBIR program funds research to evaluate the feasibility and scientific merit of new technology and to develop the technology as a way to encourage technological innovation within small businesses.

Average Annual Number of SBIR Awards per 10,000 Business Establishments: 1998-2000

State	Average Annual SBIR Awards	1999 Establishments	Value	Rank	Percent of U.S. Value
Massachusetts	662	173,267	38.2	1	605%
New Mexico	82	42,918	19.0	2	301%
Maryland	217	127,431	17.0	3	270%
Colorado	224	133,743	16.7	4	265%
Virginia	245	173,550	14.1	5	223%
New Hampshire	48	37,180	13.0	6	206%
California	882	784,935	11.2	7	178%
Connecticut	86	92,454	9.3	8	148%
Utah	44	53,809	8.2	9	130%
Arizona	93	112,545	8.2	10	130%
Oregon	58	99,945	5.8	17	91%
United States	4,413	6,988,975	6.3	—	100%

Source: Small Business Administration and U.S. Census Bureau

STTR Awards

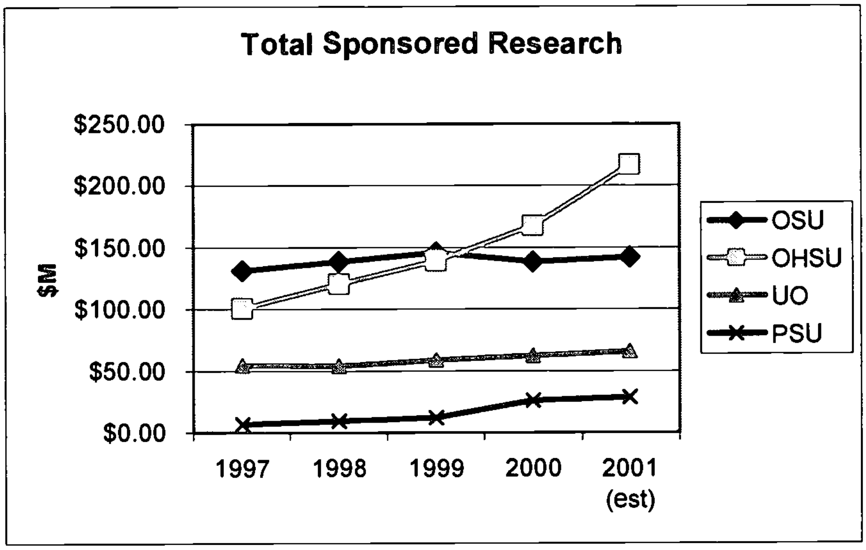
Small Business Technology Transfer Program (STTR) awards indicate the degree to which partnerships of small companies and non-profit research institutions in each state are participating in federally funded research and development and adding to the U.S.' base for technical innovation. The STTR program funds research to evaluate the feasibility and scientific merit of new technology and to develop the technology to a point where it can be commercialized. It encourages technological innovation within small businesses and builds strategic links with research institutions.

Average Annual Number of STTR Awards per 10,000 Business Establishments: 1997-1999

State	Average Annual STTR Awards	1999 Establishments	Value	Rank	Percent of U.S. Value
Massachusetts	46	167,929	2.8	1	583%
New Mexico	6	42,608	1.4	2	298%
Utah	6	52,025	1.2	3	257%
Montana	4	30,957	1.2	4	250%
Virginia	20	172,182	1.2	5	245%
Wyoming	2	17,888	1.1	6	236%
Maryland	13	126,577	1.0	7	211%
Colorado	13	130,354	1.0	8	205%
Alabama	9	100,316	0.9	9	190%
California	65	773,925	0.8	10	177%
Oregon	4	99,183	0.4	19	78%
United States	327	6,901,963	0.5	—	100%

Source: Small Business Administration and U.S. Census Bureau

Research from Oregon Universities



Source: AUTM 2001 Data

Licensing Income per Dollar of Research Spending

Rank	Institution	Amount	
1	Florida State U	$	0.35
2	Columbia U	$	0.28
3	Brigham Young U	$	0.23
4	Dartmouth College	$	0.18
5	Michigan State U	$	0.12
6	Stanford U	$	0.08
7	Yale U	$	0.08
8	U of Florida	$	0.08
9	Tulane U	$	0.08
10	Carnegie Mellon U	$	0.07
63	Oregon Health Sciences U	$	0.01
78	Oregon State U	$	0.01
92	U of Oregon	$	0.00

Source: The Chronicle of Higher Education, 2002

Average Income per License

Rank	Institution	Amount
1	Florida State U	$ 3,921,771.55
2	Clemson U	$ 520,556.05
3	Michigan State U	$ 513,122.69
4	Carnegie Mellon U	$ 416,762.74
5	Columbia U	$ 389,908.23
6	Yale U	$ 388,264.25
7	U of Florida	$ 360,537.36
8	Tulane U	$ 346,860.77
9	Dartmouth U	$ 289,568.43
10	New York U	$ 266,130.91
83	Oregon Health Sciences U	$ 22,318.77
87	Oregon State U	$ 20,560.29
100	U of Oregon	$ 13,421.67

Source: The Chronicle of Higher Education, 2002

Number of U.S. Patent Applications Filed per $1-million Spending on Research

Rank	Institution	Number
1	Lehigh U	12.4
2	U of Akron	1.6
3	California Institute of Technology	1.1
4	Brigham Young U	1.0
5	Thomas Jefferson U	0.8
6	East Carolina U	0.7
7	Arizona State U	0.7
8	Princeton U	0.6
9	U of Maryland-Baltimore County	0.6
10	U of Maryland at College Park	0.5
33	Oregon Health Sciences U	0.4
69	U of Oregon	0.2
98	Oregon State	0.2

Source: The Chronicle of Higher Education, 2002

Technology Transfer Measures at the University Level

	License Income per research $1M	# of Patent Applications per $1M research	# of start-up companies formed	Inventions disclosed per $1M research
OHSU	$ 0.01	0.4	2	0.4
OSU	$ 0.01	0.2	6	0.2
UO	$ 0.00	0.2	5	0.2
90th Percentile	$ 0.06	0.5	25	0.8

Source: The Chronicle of Higher Education, 2002

Universities that Formed the Most Start-up Companies

Rank	Institution	Number
1	Massachusetts Institute of Technology	90
2	U of California System	82
3	Stanford U	65
4	California Institute of Technology	51
5	Washington Research Foundation, U of Washington	42
6	U of Utah	35
7	U of Minnesota	32
8	U of Georgia	30
9	U of Michigan	29
10	Johns Hopkins U	27
62	Oregon State U	6
69	U of Oregon	5
91	Oregon Health Sciences U	2

Source: The Chronicle of Higher Education, 2002

Number of Inventions Disclosed per $1-million Spending on Research

Rank	Institution	Number
1	Brigham Young U	4.5
2	U of Akron	2.5
3	East Carolina U	1.6
4	California Institute of Technology	1.2
5	Ohio U	1.1
6	U of Maryland-Baltimore County	1.0
7	Thomas Jefferson U	1.0
8	U of Utah	0.9
9	Princeton U	0.9
10	Arizona State U	0.9
71	Oregon Health Sciences U	0.4
99	Oregon State U	0.2
113	U of Oregon	0.2

Source: The Chronicle of Higher Education, 2002

Part II: CAPITAL AND BUSINESS FORMATION METRICS

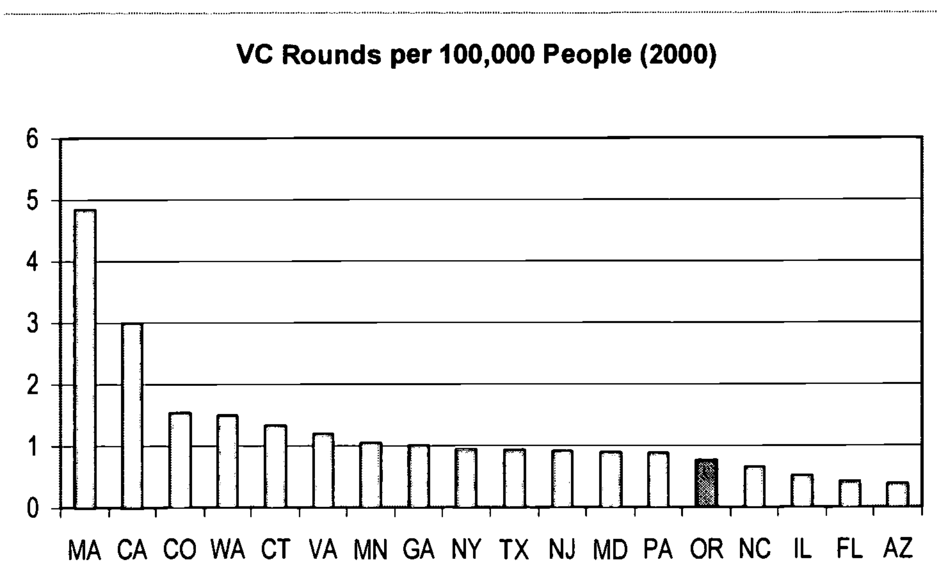
Venture Capital

Venture capital funds are equity investments made in private companies by the venture capital community. This metric provides an indication of the role that venture capital financing plays in each state. The industries and individual companies in which venture capitalists choose to invest reflect their opinions as to the sources of future wealth creation. Companies that attract venture capital investment are perceived to be working at the cutting edge of technology in their respective industries and are deemed to have a high chance for success.

Amount of Venture Capital Funds Invested per $1,000 of GSP: 2000

State	Venture Capital Invested, millions	1999 GSP, millions	Value	Rank	Percent of U.S. Value
Massachusetts	$8,848	$262,564	$33.70	1	365%
California	$37,765	$1,229,098	$30.73	2	333%
Colorado	$4,162	$153,728	$27.07	3	293%
Washington	$2,400	$209,258	$11.47	4	124%
New Hampshire	$485	$44,229	$10.96	5	119%
Maryland	$1,679	$174,710	$9.61	6	104%
Connecticut	$1,297	$151,779	$8.55	7	93%
Virginia	$1,983	$242,221	$8.19	8	89%
Utah	$511	$62,641	$8.16	9	88%
New Jersey	$2,355	$331,544	$7.10	10	77%
Oregon	$593	$109,694	$5.41	16	59%
United States	$84,437	$9,153,560	$9.22	—	100%

Source: PricewaterhouseCoopers Money Tree and Bureau of Economic Analysis



Source: Calculations using Venture One data and 2000 Census data

State Venture Capital Comparison by Year
Amount VC Investment
($M)

	US State		1995 Total	1996 Total	1997 Total	1998 Total	1999 Total	2000 Total	2001 Total
			Total	Total	Total	Total	Total	Total	Total
1	California	CA	$2,502.87	$4,024.37	$5,621.74	$7,401.24	$22,900.64	$40,068.94	$13,527.04
2	Massachusetts	MA	$688.22	$1,098.07	$1,287.07	$1,742.78	$4,580.29	$9,375.70	$4,018.23
3	Texas	TX	$343.26	$459.37	$728.50	$910.66	$2,080.54	$5,511.36	$2,522.78
4	New York	NY	$210.73	$259.08	$489.36	$1,094.37	$2,950.68	$5,685.63	$1,583.57
5	New Jersey	NJ	$260.30	$202.34	$318.94	$316.50	$668.98	$2,598.07	$1,023.41
6	Colorado	CO	$279.00	$281.23	$369.84	$638.28	$1,560.11	$4,409.31	$978.89
7	Pennsylvania	PA	$157.19	$257.25	$278.33	$636.07	$1,195.61	$2,201.07	$857.16
8	Washington	WA	$307.32	$392.63	$379.47	$744.18	$1,839.00	$2,559.87	$825.81
9	Maryland	MD	$106.45	$130.72	$133.32	$284.69	$750.05	$1,834.32	$788.78
10	Virginia	VA	$300.16	$354.65	$337.20	$723.49	$1,008.99	$2,278.53	$759.00
11	Georgia	GA	$158.47	$219.28	$286.28	$372.53	$997.18	$1,957.49	$692.01
12	Florida	FL	$192.20	$378.05	$490.47	$417.47	$1,273.05	$1,796.41	$688.99
13	Illinois	IL	$119.74	$300.32	$344.26	$262.26	$642.30	$1,764.99	$554.53
14	North Carolina	NC	$178.25	$129.00	$279.43	$271.39	$1,001.00	$1,437.89	$463.97
15	Connecticut	CT	$93.39	$267.66	$162.11	$303.83	$589.59	$1,231.03	$395.31
16	Minnesota	MN	$177.83	$112.31	$186.64	$264.96	$578.85	$998.74	$360.69
17	Missouri	MO	$87.35	$13.95	$118.70	$154.88	$105.45	$566.46	$258.95
18	Oregon	OR	$33.45	$78.54	$79.35	$52.39	$419.26	$672.67	$224.40
19	New Hampshire	NH	$33.50	$39.76	$40.35	$100.35	$183.87	$664.06	$217.82
20	Ohio	OH	$78.90	$119.57	$139.04	$119.00	$297.50	$414.60	$181.82
21	Utah	UT	$17.20	$67.78	$56.12	$61.05	$232.68	$512.70	$181.40
22	Washington, DC	DC	N/A	$8.80	$12.00	$59.55	$104.85	$344.05	$179.68
23	Arizona	AZ	$70.40	$94.78	$121.34	$135.63	$258.08	$434.35	$143.12
24	Delaware	DE	$4.12	$3.32	$0.09	N/A	$16.80	$137.68	$100.00
25	Michigan	MI	$45.09	$57.20	$34.19	$78.20	$114.44	$296.42	$89.35

Source: Venture One

SBIC Funds

Congress created the Small Business Investment Company (SBIC) Program to fill the gap between available venture capital and the financial needs of small business in start-up and growth situations. SBICs are profit-motivated businesses that provide equity capital, long-term loans, debt-equity investments, and management assistance to small businesses. SBICs make funding available to all types of manufacturing and service industries, but many focus on companies with new products or services because of the strong growth potential of such firms. This metric provides an indication of the role that SBIC financing plays in each state.

Average Annual Amount of SBIC: Funds Disbursed per $1,000 of GSP: 1998-2000

State	Avg. Annual # of SBIC Funding Disbursements	Average Annual SBIC Funds Disbursed	1999 GSP, millions	Value	Rank	Percent of U.S. Value
Massachusetts	218.3	$224,419,686	$262,564	$0.85	1	184%
Wyoming	0.7	$14,776,807	$17,448	$0.85	2	183%
Colorado	72.7	$121,929,991	$153,728	$0.79	3	171%
California	603.3	$900,033,271	$1,229,098	$0.73	4	158%
Kansas	43.7	$58,902,643	$80,843	$0.73	5	157%
Connecticut	69.7	$109,913,135	$151,779	$0.72	6	156%
New York	733.7	$490,818,536	$754,590	$0.65	7	140%
Ohio	75.3	$193,477,477	$361,981	$0.53	8	115%
Pennsylvania	156.7	$199,546,098	$382,980	$0.52	9	112%
Louisiana	11.3	$65,819,946	$128,959	$0.51	10	110%
Oregon	19.7	$33,831,627	$109,694	$0.31	28	67%
United States	3,716.0	$4,290,447,642	$9,253,147	$0.46	—	100%

Source: Small Business Administration and Bureau of Economic Analysis

IPO Funds

Initial Public Offerings (IPO) occur when a privately owned company wishes to offer shares of its common stock to the public. IPOs are another method by which companies raise capital for growth and expansion. This metric provides an indication of the role that IPO financing plays in each state.

Average Annual Amount of IPO Funds Raised per $1,000 of GSP: 1998-2000

State	Avg. Annual IPO Funds Raised, millions	1999 GSP, millions	Value	Rank	Percent of U.S. Value
Washington	$4,497	$209,258	$21.49	1	401%
Massachusetts	$3,423	$262,564	$13.04	2	243%
New York	$8,090	$754,590	$10.72	3	200%
Georgia	$2,729	$275,719	$9.90	4	185%
Missouri	$1,649	$170,470	$9.67	5	181%
California	$11,294	$1,229,098	$9.19	6	172%
Maryland	$1,488	$174,710	$8.52	7	159%
Texas	$4,356	$687,272	$6.34	8	118%
Colorado	$900	$153,728	$5.85	9	109%
Oklahoma	$471	$86,382	$5.45	10	102%
Oregon	$269	$109,694	$2.45	22	46%
United States	$49,552	$9,253,147	$5.36	—	100%

Source: Hale and Dorr LLP

Average number of Business Start-ups per $100M Sponsored Research: 1998-2000

Oregon	.90
AUTM Median	.72
AUTM Top Quartile	1.63

Average amount of Licensed Income per $100M Sponsored Research: 1998-2000

Oregon	$ 642,416
AUTM Median	$ 700,000
AUTM Top Quartile	$1,800,000

Average number of Patents per $100M Sponsored Research: 1998-2000

Oregon	10.2
AUTM Median	10.3
AUTM Top Quartile	16.7

Source: AUTM 2000 data

U.S. Patents

This metric was measured by the average number of U.S. patents issued in a particular state for the three-year period of 1998-2000. The level of patent activity is one measure of the amount of intellectual property being created within a state.

Average Annual Number of U.S. Patents Issued per 10,000 Businesses: 1998-2000

State	Average Annual Patents	1999 Establishments	Value	Rank	Percent of U.S. Value
Idaho	1,258	36,975	340	1	253%
California	18,844	784,935	240	2	179%
Connecticut	2,061	92,454	223	3	166%
Massachusetts	3,798	173,267	219	4	163%
Minnesota	2,891	137,305	211	5	157%
New Jersey	4,325	231,823	187	6	139%
Delaware	432	23,381	185	7	138%
New Hampshire	673	37,180	181	8	135%
Vermont	374	21,598	173	9	129%
Michigan	3,989	236,456	169	10	126%
Oregon	1,469	99,945	147	13	110%
United States	93,827	6,988,975	134	—	100%

Source: US Patent and Trademark Office

High-technology Establishments

This metric refers to the percentage of the total number of establishments within a state that fall into one of the 31 Standard Industrial Classification (SIC) codes defined as high-technology industries. High-technology businesses are those with employment in both research and development, and in all technology oriented occupations. The percentage of a state's business base that is classified as high-technology provides a measure of the extent to which the state's business base is prepared to capitalize on new technology. States with the highest percentage of high technology businesses will be the best prepared to take advantage of the shift in the national economy toward higher value-added products and information services.

Percent of Establishments in High-technology SIC Codes: 1998

State	Establishments in High-tech SICs	Total Establishments	Value	Rank	Percent of U.S. Value
New Jersey	19,038	230,860	8.20%	1	143%

Massachusetts	13,812	167,929	8.20%	2	143%
Colorado	10,325	130,354	7.90%	3	138%
New Hampshire	2,788	36,842	7.60%	4	132%
Maryland	9,566	126,577	7.60%	5	131%
Virginia	12,871	172,182	7.50%	6	130%
California	54,815	773,925	7.10%	7	123%
Minnesota	9,270	134,981	6.90%	8	119%
Connecticut	6,342	92,362	6.90%	9	119%
Nevada	2,990	44,613	6.70%	10	117%
Oregon	5,222	99,183	5.30%	20	92%
United States	397,942	6,922,251	5.70%	—	100%

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001

High-technology Establishment Births

Establishment births are defined as establishments that were not recorded with the Census Bureau in 1997 and came into existence and were placed on the record during 1998. This metric provides an indication of the degree to which establishment births are concentrated in the high technology SIC codes. States with higher percentages of high-technology births are making progress in their shift toward the high-technology sector. The number of establishment births per 10,000 business establishments indicates how supportive the state's business climate is to the formation of new businesses, particularly high-technology businesses, and how strong the sense of entrepreneurship is in that state.

Percent of Establishment Births in High-technology SIC Codes: 1998

State	Establishment Births in High-tech SICs	Total Establishment Births	Total Establishments	Value	Rank	Percent of U.S. Value
Massachusetts	1,948	15,400	167,929	12.6%	1	157%
New Jersey	2,999	23,946	230,860	12.5%	2	155%
Maryland	1,426	12,841	126,577	11.1%	3	137%
Virginia	1,965	18,283	172,182	10.7%	4	133%
New Hampshire	378	3,539	36,842	10.7%	5	132%
Minnesota	1,322	12,410	134,981	10.7%	6	132%
Colorado	1,677	15,929	130,354	10.5%	7	130%
Delaware	260	2,586	22,871	10.1%	8	124%
Illinois	2,771	28,415	304,533	9.80%	9	121%
Connecticut	796	8,235	92,362	9.70%	10	120%
Oregon	692	10,703	99,183	6.50%	29	80%
United States	57,973	717,742	6,922,251	8.10%	—	100%

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001

Net High-technology Business Formations

The net high-technology business formation in a state is defined as the number of high-technology establishment births, minus the number that ceased operations in that same year. This metric provides a measure of the state's ability to create and sustain the formation of new nigh-technology businesses.

Net Formations of High-technology Establishments per 10,000 Business Establishments: 1998

State	Establishment Births in High-tech SICs	Establishment Deaths in High-tech SICs	Net Formations	Total Establishments	Value	Rank	Percent of U.S. Value
New Jersey	2,999	1,674	1,325	230,860	57.4	1	213%
Nevada	594	340	254	44,613	56.9	2	212%
Delaware	260	131	129	22,871	56.4	3	210%
Colorado	1,677	1,048	629	130,354	48.3	4	179%
Massachusetts	1,948	1,212	736	167,929	43.8	5	163%
Minnesota	1,322	795	527	134,981	39.0	6	145%
Maryland	1,426	933	493	126,577	38.9	7	145%
New Hampshire	378	236	142	36,842	38.5	8	143%
Georgia	2,057	1,310	747	194,213	38.5	9	143%
Virginia	1,965	1,315	650	172,182	37.8	10	140%
Oregon	692	576	116	99,183	11.7	41	43%
United States	57,973	39,353	18,620	6,922,251	27.0	—	100%

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001

Part III: EDUCATION AND WORKFORCE METRICS

Science Test Scores

This metric reports the average overall score for the field of science by eight grade public school students by state from the 1996 National Assessment of Educational Progress (NAEP). It is an indicator of how effectively students in a particular state are learning science at the elementary and middle school levels.

National Assessment of Educational Progress (NAEP) Average State Science Scores: 1996

State	Value	Rank	Percent of U.S. Value
Maine	163	1	110%
Montana	162	2	109%
North Dakota	162	2	109%
Wisconsin	160	4	108%
Minnesota	159	5	107%
Iowa	158	6	107%
Wyoming	158	6	107%
Massachusetts	157	8	106%
Nebraska	157	8	106%
Vermont	157	8	106%
Oregon	155	12	105%
United States	148	—	100%

Source: National Assessment of Educational Progress

High School Completion

This metric estimates the percentage of a state's population aged 25 and older that has completed high school. The amount of education an individual has directly correlates with his earnings potential. A better-educated workforce impacts the state's ability to grow established businesses and to attract new ones.

Percent of the Population that has Completed High School: 2000

State	Value	Rank	Percent of U.S. Value
Washington	91.80%	1	109%
South Dakota	91.80%	1	109%
Minnesota	90.80%	3	108%
Utah	90.70%	4	108%
Alaska	90.40%	5	107%
Nebraska	90.40%	5	107%
Vermont	90.00%	7	107%
Wyoming	90.00%	7	107%
Colorado	89.70%	9	107%
Iowa	89.70%	9	107%
Oregon	88.10%	14	105%
United States	84.10%	—	100%

Source: U.S. Census Bureau, 2000

Associate's Degrees Granted

This metric calculates the number of associate's degrees conferred by institutions in the 1997-1998 academic year. This metric represents the next step in the higher education institutional ladder beyond a high school diploma, a better-educated workforce and a corresponding potential for a state's ability to grow and attract businesses.

Associate's Degrees Granted as a Percent of the 18-24 Year Old Population: 1997-1998

State	Associate's Degrees Granted	1998 Population 18-24 Yrs of Age	Value	Rank	Percent of U.S. Value
Rhode Island	3,592	83,035	4.33%	1	197%
Florida	48,209	1,206,087	4.00%	2	182%
Wyoming	2,028	53,105	3.82%	3	174%
Idaho	5,093	139,361	3.65%	4	166%
Washington	19,164	539,752	3.55%	5	162%
Iowa	8,905	276,701	3.22%	6	147%
New York	51,401	1,598,032	3.22%	7	147%
New Hampshire	2,898	95,762	3.03%	8	138%
North Dakota	2,030	68,004	2.99%	9	136%
Hawaii	3,459	119,455	2.90%	10	132%
Oregon	5,850	303,420	1.93%	31	88%
United States	558,101	25,426,901	2.19%	—	100%

Source: U.S. Department of Education and U.S. Census Bureau, 2000

Bachelor's Degrees Granted

This metric calculates the number of bachelor's degrees conferred by institutions in the 1997-1998 academic year. States ranking high in the number of bachelor's degrees granted have invested in their higher education infrastructure and have a population of young adults who believe higher education is an important investment in their future.

Total Bachelor's Degrees Granted as a Percent of the 18-24 Year Old Population: 1997-1998

State	Bachelor's Degrees Granted	1998 Population 18-24 Yrs of Age	Value	Rank	Percent of U.S. Value
Rhode Island	8,169	83,035	9.84%	1	213%
Vermont	4,455	52,011	8.57%	2	185%
Massachusetts	40,727	505,375	8.06%	3	174%
New Hampshire	7,600	95,762	7.94%	4	171%
North Dakota	4,588	68,004	6.75%	5	146%
Delaware	4,418	67,145	6.58%	6	142%
Iowa	17,543	276,701	6.34%	7	137%
Pennsylvania	63,484	1,022,038	6.21%	8	134%
Nebraska	10,071	166,843	6.04%	9	130%
New York	93,577	1,598,032	5.86%	10	126%
Oregon	13,652	303,420	4.50%	31	97%
United States	1,177,037	25,426,901	4.63%	—	100%

Source: U.S. Department of Education and U.S. Census Bureau, 2000

Percent of Bachelor's Degrees in Science and Engineering

Science and engineering (S&E) bachelor's degrees are defined as bachelor's degrees with a major field of study in the area of natural sciences, mathematics and engineering. The number of S&E bachelor's degrees granted gives an indication of the capacity of a state's higher education system to train technical workers. It also indicates the orientation of a state's higher education resources toward science and technology.

Percent of Bachelor's Degrees Granted in Science and Engineering: 1997-1998

State	S&E Bachelor's Degrees	Total Bachelor's Degrees	Value	Rank	Percent of U.S. Value
Wyoming	438	1,706	25.70%	1	146%
Montana	1,192	4,932	24.20%	2	137%
South Dakota	1,030	4,273	24.10%	3	137%
Alaska	322	1,479	21.80%	4	124%
Colorado	4,389	21,314	20.60%	5	117%
Michigan	9,039	44,186	20.50%	6	116%
Idaho	925	4,602	20.10%	7	114%
North Dakota	894	4,588	19.50%	8	111%
Arizona	3,565	18,381	19.40%	9	110%
Maine	1,048	5,442	19.30%	10	109%
Oregon	2,369	13,652	17.40%	31	99%
United States	207,244	1,177,037	17.60%	—	100%

Source: U.S. Department of Education

Science and Engineering Graduate Students

This metric demonstrates the total number of S&E graduate students as a percentage of the 18-24 year old population, and indicates where the next generation of scientists and engineers with advanced degrees are being trained. States with the highest percentages of S&E graduate students have invested most heavily in creating the infrastructure to train students for advanced S&E degrees.

Science and Engineering Graduate Students as a percent of the 18-24 Year Olds: 1999

State	S&E Graduate Students	Population 18-24 Yrs of Age	Value	Rank	Percent of U.S. Value
Massachusetts	19,786	512,732	3.86%	1	250%
New York	39,808	1,618,762	2.46%	2	159%
Connecticut	6,063	255,714	2.37%	3	153%
Colorado	8,242	392,703	2.10%	4	136%
Delaware	1,441	69,255	2.08%	5	135%
Maryland	9,169	441,978	2.07%	6	134%
Kansas	5,600	271,382	2.06%	7	133%
Illinois	22,581	1,143,197	1.98%	8	128%
Rhode Island	1,641	83,921	1.96%	9	126%
Pennsylvania	18,208	1,025,209	1.78%	10	115%
Oregon	3,733	311,544	1.20%	31	78%
United States	401,390	25,965,778	1.55%	—	100%

Source: National Science Foundation and U.S. Census Bureau, 2000

Recent Science and Engineering Bachelor's in the Work Force

For this metric, the percent of the civilian workforce with a recent (1990-1998) degree in science or engineering was calculated. This metric indicates where recent graduates with bachelor's degrees in S&E are choosing to work. The presence of large numbers of recent S&E graduates enriches a state's workforce and catalyzes the transfer of current technical knowledge into the local economy.

Percent of Civilian Work Force with a Recent Bachelor's Degree in Science or Engineering: 1999

State	Recent S&E Bachelor's Degrees Employed	Civilian Labor Force, thousands	Value	Rank	Percent of U.S. Value
Massachusetts	97,340	3,284	2.96%	1	209%
North Carolina	94,020	3,868	2.43%	2	171%
Colorado	54,760	2,264	2.42%	3	170%
Vermont	7,720	336	2.30%	4	162%
Washington	64,560	3,075	2.10%	5	148%
South Dakota	8,190	400	2.05%	6	144%
Kansas	28,350	1,434	1.98%	7	139%
Maine	13,190	670	1.97%	8	139%
Nebraska	17,650	912	1.94%	9	136%
Minnesota	51,780	2,703	1.92%	10	135%
Oregon	29,030	1,761	1.65%	14	116%
United States	1,973,510	138,992	1.42%	—	100%

Source: National Science Foundation SESTAT Database and Bureau of Labor Statistics 2001

Recent Science and Engineering Master's in the Work Force

For this metric, the percent of the civilian workforce with a recent (1990-1998) master's degree in science or engineering was calculated to indicate where recent graduates with master's degrees in S&E are choosing to work. The presence of large numbers of recent S&E graduates enriches a state's workforce and catalyzes the transfer of current technical knowledge into the local economy.

Percent of Civilian Work Force with a Recent Master's Degree in Science or Engineering: 1999

State	Recent S&E Master's Degrees Employed	Civilian Labor Force, thousands	Value	Rank	Percent of U.S. Value
Massachusetts	19,060	3,284	0.58%	1	180%
Maryland	14,810	2,775	0.53%	2	166%
Colorado	11,550	2,264	0.51%	3	158%
Virginia	17,940	3,528	0.51%	4	158%
Nebraska	4,090	912	0.45%	5	139%
Washington	13,470	3,075	0.44%	6	136%
West Virginia	3,330	816	0.41%	7	127%
California	67,410	16,596	0.41%	8	126%
New Jersey	16,860	4,205	0.40%	9	124%
Illinois	24,340	6,378	0.38%	10	118%
Oregon	5,540	1,761	0.31%	18	98%
United States	447,710	138,992	0.32%	—	100%

Source: National Science Foundation SESTAT Database and Bureau of Labor Statistics 2001

Recent Science and Engineering Doctorates in the Work Force

For this metric, the percent of the civilian workforce with a recent (1990-1998) PhD in science or engineering was calculated. This metric indicates where recent graduates with Doctorate degrees in S&E are choosing to work. The presence of large numbers of recent S&E graduates enriches a state's workforce and catalyzes the transfer of current technical knowledge into the local economy.

Percent of Civilian Work Force with a recent Ph.D. in Science or Engineering: 1999

State	Recent S&E Doctorate Degrees Employed	Civilian Labor Force (000s)	Value	Rank	Percent of U.S. Value
Massachusetts	11,240	3,284	0.34%	1	251%
New Mexico	2,660	809	0.33%	2	241%
Maryland	7,710	2,775	0.28%	3	204%
Delaware	950	390	0.24%	4	178%
Connecticut	3,200	1,708	0.19%	5	137%
New Jersey	7,510	4,205	0.18%	6	131%
Colorado	4,020	2,264	0.18%	7	130%
Vermont	590	336	0.18%	8	129%
California	29,140	16,596	0.18%	9	129%
Minnesota	4,250	2,703	0.16%	10	115%
Oregon	2,390	1,761	0.14%	20	99%
United States	189,680	138,992	0.14%	—	100%

Source: National Science Foundation SESTAT Database

Information Technology Jobs

Information technology permeates the economy. States with a larger number of workers trained and skilled in the use of information technology have a competitive advantage over states with a smaller share of IT workers. IT workers are found not only in software and computer companies but in virtually every sector where IT is used, including industries such as banking, health care and insurance.

IT Occupations in Non-IT Industries as a Share of Total Jobs: 2002

Rank	State	Score
1	Colorado	3.3%
2	Washington	2.8%
3	Virginia	2.5%
4	Massachusetts	2.5%
5	Maryland	2.4%
6	New Mexico	2.2%
7	Utah	2.2%
8	Connecticut	2.2%
9	California	2.2%
10	Delaware	2.1%
25	Oregon	1.5%
—	United States	1.7%

Source: 2002 State New Economy Index

Statewide Computer Related Employment, Growth, and Educational Requirements in Oregon

Occupational Title	2000 Employment	2010 Employment*	2000-2010 % Growth*	Avg. Annual Wage	Competitive Educational Requirements
Computer Support Specialists	7,683	12,917	68.1%	$38,590	Associate's and related work experience
Computer Programmers	6,014	6,491	7.9%	$55,827	Bachelor's
Computer Systems Analysts	5,466	7,659	40.1%	$58,662	Bachelor's and related work experience
Other Computer Scientists	3,082	5,327	72.8%	n/a	Master's

2000-2001 % growth for all occupations statewide = 12.5% ** Projected*

Source: Oregon Employment Department

Top 10 Oregon Industries For Selected Computer Occupations (rank order by number of jobs) in	
1	Computer Programming, Data Proc & Related Services
2	Electronic Components, Excluding Computer
3	Depository Institutions
4	Wholesale Trade, Durable Goods
5	Insurance Carriers
6	State Government
7	Admin of Human Resource Programs
8	Health Services
9	Educational Services
10	Wholesale Trade

Source: Oregon Employment Department

Statewide Engineering Related: Employment, Growth, and Educational Requirements in Oregon

Occupational Title	2000 Employment	2010 Employment*	2000-2010 % Growth*	Avg. Annual Wage	Competitive Educational Requirements
Computer Engineers	6,535	9,688	48%	$71,036	Bachelor's and related work experience or Masters
Electrical Engineers	4,377	5,492	23.5%	$60,195	Bachelor's and related work experience or Masters
Electric/Electronic Eng Techs	2,598	3,193	23%	$39,035	Associate
Other Engineers	1,480	2,105	42%	n/a	Master's

2000-2001 % growth for all occupations statewide = 12.5% ** Projected*
Source: Oregon Employment Department

Top 10 Oregon Industries For Selected Engineering Occupations (rank order by number of jobs) in	
1	Electronic Components, Excluding Computer
2	Computer Programming, Data Proc & Related Services
3	Measuring & Controlling Instruments, Etc
4	Industrial & Commercial Machinery & Computer Equipment
5	Engineering, Accounting, Research & Related Firms
6	Personnel Supply Agencies
7	Wholesale Trade, Durable Goods
8	Other Federal Government
9	Communications
10	Wholesale Trade

Source: Oregon Employment Department

Statewide Technical Support: Employment, Growth, and Educational Requirements in Oregon

Occupational Title	2000 Employment	2010 Employment*	2000-2010 % Growth*	Avg. Annual Wage	Competitive Educational Requirements
Other Professional and Technical Workers	13,930	17,460	25.3%	n/a	Bachelor's
Designers	2,030	2,413	18.9%	$31,000	Bachelor's
Technical Writers	759	911	20.0%	$52,257	Bachelor's

2000-2001 % growth for all occupations statewide = 12.5% ** Projected*
Source: Oregon Employment Department

Top 10 Oregon Industries For Selected Technical Support Occupations (rank order by number of jobs) in	
1	State and Local Government
2	Federal Government
3	Business Services
4	Retail Stores
5	Engineering, Accounting, Research and Related Firms
6	Social Services
7	Computer Programming, Data Processing and Related Services
8	Wholesale Trade
9	Electronic Components, Excluding Computer
10	Membership Organizations

Source: Oregon Employment Department

Other Capacity Measures

Households with Computers

As indicated by this measure, home access to computers continues to increase at a rapid rate across the country. Computer ownership is highest among households with the highest income and education levels. The presence of a computer in the home tends to promote digital literacy by providing more convenient access to software programs for a variety of uses.

Percent of Households with Computers: 2000

State	Value	Rank	Percent of U.S. Value
Utah	66.10%	1	130%
Alaska	64.80%	2	127%
New Hampshire	63.70%	3	125%
Colorado	62.60%	4	123%
Oregon	61.10%	5	120%
Washington	60.70%	6	119%
Connecticut	60.40%	7	118%
Delaware	58.60%	8	115%
Wyoming	58.20%	9	114%
Minnesota	57.00%	10	112%
United States	51.00%	—	100%

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001

Households with Internet Access

Rural households showed significant gains in household Internet access between 1998 and 2000, putting them at approximately the same rate as all households across the country. Individuals 50 years of age and older are among the least likely to be Internet users, but are the fastest growing groups of Internet users. Not every household with Internet access uses it, and not all Internet use is accessed through the home. More than half of all Americans were projected to be using the Internet by the middle of 2001. Email is the most widely used Internet application and online bill paying and shopping are seeing the fastest growth.

Percent of Households with Internet Access: 2000

State	Value	Rank	Percent of U.S. Value
New Hampshire	56.00%	1	135%
Alaska	55.60%	2	134%
Colorado	51.80%	3	125%
Connecticut	51.20%	4	123%
Oregon	50.80%	5	122%
Delaware	50.70%	6	122%
Washington	49.70%	7	120%
Utah	48.40%	8	117%
New Jersey	47.80%	9	115%
Vermont	46.70%	10	113%
United States	41.50%	—	100%

Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001

GLOSSARY:

OREGON COUNCIL FOR KNOWLEDGE AND ECONOMIC DEVELOPMENT
Economic Development Metrics

Part I: Research and Development

OCKED Core Competencies Database
The Oregon Council for Knowledge and Economic Development (OCKED) has identified a critical need to develop a statewide database of research core competencies to help the Council develop a technology roadmap. Oregon Economic and Community Development Department (OECDD) has committed $50K to help create this database, which would include statewide capabilities at both public and private institutions of higher education and research hospitals. OECDD also hopes to use this database as a recruitment tool to attract companies to the state and to assist Oregon companies in accessing higher education resources.

Association of University Technology Managers (AUTM)
AUTM is a non-profit association representing over 3,200 technology managers and business executives who work with intellectual property. AUTM's membership includes more than 600 universities, research institutions, teaching hospitals, companies and government organizations. The AUTM annual report is an assembly of research and commercialization indices from members representing educational and other nonprofit research organizations. The data is self-reported and AUTM makes no independent verification of the data presented. It is the generally accepted benchmark used by technology transfer managers nationwide. (Source: www.autm.net)

Total Performed R&D Expenditures per $1000.00 of GSP
Total R&D expenditures are composed of basic research, applied research, and development performed by private industry, federal government, academic, and non-profit organizations located throughout the state. The measurement of total R&D expenditures related to goods and services produced (GSP) describes the return on state's research investment. (Source: National Science Foundation and Bureau of Economic Analysis)

Industry Performed R&D per $1000.00 of GSP
This metric refers to all research, basic and applied, as well as development performed through private industry. The industry sector of a state's economy accounts for more R&D expenditures than all other sectors of the economy combined. In 1999, industrial sources provided 67% of all R&D funding and performed 75% of all R&D in Oregon. (Source: National Science Foundation and Bureau of Economic Analysis)

University Performed R&D
University research is extremely important to a state's long-term growth. Universities tend to be oriented toward basic research that focuses on long-term, fundamental knowledge and discoveries of new underlying principles. (Source: National Science Foundation and Bureau of Economic Analysis)

Federal Obligations for R&D per $1000.00 of GSP
Federal obligations are the amounts of money for orders placed, contracts awarded, services received, and similar transactions. Recipients of R&D obligations may be federal agencies, industrial firms, universities and colleges, non-profits, state and local governments, and federally funded R&D institutions. This metric measures the magnitude of federal R&D dollars flowing

into a state to support research that may lead to wealth creation from new technology, new products and new businesses in the state. Federal R&D obligations also reflect the capabilities and capacities of the research institutions within a state. (Source: National Science Foundation and Bureau of Economic Analysis)

Per Capita Expenditures
R&D expenditures categorized by industry, academia, and federal obligations divided by population.

SBIR Awards
Small Business Innovation Research program (SBIR) awards are granted to evaluate the feasibility and scientific merit of new technology and to develop the technology as a way to encourage technological innovation within small businesses.

Average Annual Number of SBIR Awards per 10,000 Business Establishments
This metric indicates the degree to which small companies in each state are participating in federally funded research and development and adding to the U.S.' base for technical achievement. (Source: Small Business Administration and U.S. Census Bureau)

STTR Awards
The Small Business Technology Transfer program (STTR) funds research to evaluate the feasibility and scientific merit of new technology and to develop the technology to a point where it can be commercialized. The benefits to STTR awards are twofold; they encourage technological innovation within small businesses and they build strategic links with research institutions.

Average Annual Number of STTR Awards per 10,000 Business Establishments
STTR awards indicate the degree to which partnerships of small companies and non-profit research institutions in each state are participating in federally funded research and development by adding to the U.S.' base for technical innovation. (Source: Small Business Administration and U.S. Census Bureau)

Total Sponsored Research
The total amount of research support committed to Oregon's public universities during a fiscal year period. The support includes contributions from federal government, local government, industry, foundations, voluntary health organizations, and other non-profit organizations. Committed support accounts for all monies received, it does not account for expenditures. (Source: AUTM 2001 Data)

License Income
The amount of money paid or received for licensed technologies that became a product that was sold either to the public or to industry is referred to as license income. License income has many different variables: license issue fees, payments under options, annual minimums, running royalties, termination payments, equity received when cashed-in, and software and biological material end-user license fees equal to $1000.00 or more. (Source: AUTM)

Licensed Income per $100 million Sponsored Research (three year average)
This metric compares the amount of licensing income received in Oregon from 1998 through 2000 to the median and top quartile members of the Association of University Technology Managers (AUTM) during that same period. (Source: AUTM 2000 data)

U.S. Patents
A U.S. patent is a grant made by a government that confers upon the creator of an invention the sole right to make, use, and sell that invention for a set period of time.

Average Annual Number of U.S. Patents Issued per 10,000 Businesses
This metric measures the average number of U.S. patents issued in a particular state for the three-year period of 1998-2000. The level of patent activity is one measure of the amount of intellectual property being created within a state. (Source: U.S. Patent and Trademark Office)

Patents per $100 million Sponsored Research (three year average)
This metric compares the number of patents filed by Oregon's higher education institutions from 1998 through 2000 to the median and top quartile members of the Association of University Technology Managers (AUTM) during that same period. (Source: AUTM 2000 data)

Licensing Income per Dollar of Research Spending
This metric describes the relationship between R&D expenditures and the income generated from licensing technologies created in higher education institutions. (Source: *The Chronicle of Higher Education*)

Average Income per License
The average income per license indicates the amount of income received from licenses divided by the number of licenses issued in the given year. (Source: *The Chronicle of Higher Education*)

Patent Applications
Any applications filed in the U.S. during the year requested, including provisional applications, provisional applications that are converted to regular applications, new filings, continuations, divisionals, reissues, and plant patents are included in this definition.

Number of U.S. Patent Applications Filed per $1 million Spending on Research
The number of U.S. patents applied for in a given year divided by total research expenditures in millions is the definition of this metric. (Source: *The Chronicle of Higher Education*)

Start-Ups
Companies that are dependent upon licensing institution's technology for initiation are considered start-ups.

Universities that Formed the Most Start-up Companies
Start-up companies are important measures of the economic impact universities have on their local economy. Universities that form start-ups are positively impacting economic development through licensing technology. (Source: *The Chronicle of Higher Education*)

Invention Disclosures
Invention disclosures include any number of disclosures made public, no matter how comprehensive, during the year requested.

Number of Inventions Disclosed per $1 million Spending on Research
This metric is defined as the number of invention disclosures for in a given year divided by total research expenditures in millions. (Source: *The Chronicle of Higher Education*)

Part II: Capital and Business Formation Metrics

Venture Capital Funds
Venture capital funds are equity investments made in private companies by the venture capital community. Typically venture capital investment indicates a company is working at the cutting edge of technology in their respective industries and is deemed to have a high chance for success.

Amount of Venture Capital Funds Invested per $1,000 of GSP
This metric provides an indication of the role that venture capital financing plays in each state. The industries and individual companies that venture capitalists choose to invest in reflect their opinions as to the source of future wealth creation. (Source: PriceWaterhouseCoopers Money Tree and Bureau of Economic Analysis)

Venture Rounds
Venture firms raise money in groupings called rounds. A specific round may raise $50 to $100 million or more.

Venture Rounds per 100,000 People
This metric reflects the number of venture capital rounds available to fund Oregon's emerging growth companies. It indicates how Oregon ranks in numbers of rounds when compared with 17 other states. (Source: Calculations using Venture One data and 2000 Census data)

State Venture Capital Comparison by Year
A comparative table of 25 states and the amount of venture capital investments made each year from 1995 through 2001. (Source: Venture One)

SBIC Funds
The Small Business Investment Company (SBIC) program was designed to fill the gap between available venture capital and the financial needs of small business in start-up and growth situations. SBICs are profit-motivated businesses that provide equity capital, long-term loans, debt-equity investments, and management assistance to small businesses.

Average Annual Amount of SBIC: Funds Disbursed per $1,000 of GSP
This metric provides an indication of the role that SBIC financing plays in each state. (Source: Small Business Administration and Bureau of Economic Analysis)

IPO Funds
Initial Public Offerings (IPO) occur when a privately owned company wishes to offer shares of its common stock to the public in order to raise capital from growth and expansion.

Average Annual Amount of IPO Funds Raised per $1,000 of GSP
This metric provides an indication of the role that IPO financing plays in each state. (Source: Hale and Dorr LLP)

Business Start-ups per $100 million Sponsored Research (three year average)
This metric compares the number of start-up companies established in Oregon from 1998 through 2000 to the median and top quartile members of the Association of University Technology Managers (AUTM) during that same period. (Source: AUTM 2000 data)

High-technology Establishments
High-technology businesses are those with employment in both research and development, and in all technology-oriented occupations. The percentage of a state's business base that is classified as high technology provides a measure of the extent to which the state's business base is prepared to capitalize on new technology.

Standard Industrial Classification (SIC) Codes
The U.S. government uses SIC codes to classify businesses by industry and to calculate the economic activity of these industries within the U.S. economy.

Percent of Establishments in High-technology SIC Codes
This metric refers to the percentage of the total number of establishments within a state that fall into one of the 31 Standard Industrial Classification (SIC) codes defined as high-technology industries. States with the highest percentage of high-technology businesses will be the best prepared to take advantage of the shift in the national economy toward higher value-added products and information services.

High-technology Establishment Births
Establishment births are defined as companies that were not recorded with the Census Bureau in 1997 and came into existence and were placed on the record during 1998.

Percent of Establishment Births in High-technology SIC Codes
This metric provides an indication of the degree to which establishment births are concentrated in the high technology SIC codes. The number of establishment births per 10,000 business establishments indicated how supportive the state's business climate is to the formation of new businesses, particularly high-technology businesses, and how strong the sense of entrepreneurship is in that state. (Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001)

Net High-technology Business Formations
The net high-technology business formation in a state is defined as the number of high-technology establishment births, minus the number that ceased operations in that same year.

Net Formation of High-technology Establishments per 10,000 Business Establishments
This metric provides a measure of the state's ability to create and sustain the formation of new high-technology businesses. (Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001)

Part III: Workforce Development Metrics

National Assessment of Educational Progress (NAEP) Average State Science Scores
This metric reports the average overall score in the field of science by eighth grade public school students by state from the 1996 National Assessment of Educational Progress (NAEP). It is an indicator of how effectively students in a particular state are learning science at the elementary and middle school levels. (Source: National Assessment of Educational Progress)

Percent of the Population that has Completed High School
This metric estimates the percentage of a state's population aged 25 and older that has completed high school. (Source: U.S. Census Bureau)

Associate's Degree
An academic degree conferred by a two-year college after the prescribed course of study has been successfully completed.

Associate's Degrees Granted as a Percent of the 18-24 Year Old Population
This metric calculates the number of associate's degrees conferred by institutions in the 1997-1998 academic year. These numbers represent the next step in the higher education institutional ladder beyond a high school diploma. (Source: U.S. Department of Education and the U.S. Census Bureau)

Bachelor's Degree
An academic degree conferred upon those who successfully complete the undergraduate curriculum at a college or university. Also called baccalaureate.

Total Bachelor's Degrees Granted as a Percent of the 18-24 Year Old Population
This metric calculates the number of bachelor's degrees conferred by institutions in the 1997-1998 academic year. A high number of bachelor's degrees granted suggest that a state has invested wisely in their higher education infrastructure and that they have a population of young adults who believe higher education is an important investment in their future. (Source: U.S. Department of Education and the U.S. Census Bureau)

Percent of Bachelor's Degrees in Science and Engineering
The number of science and engineering (S&E) bachelor's degrees granted gives an indication of the capacity of a state's higher education system to train technical workers. It also indicates the orientation of a state's higher education resources toward science and technology. (Source: U.S. Department of Education)

Science and Engineering Graduate Students as a percent of the 18-24 Year Olds
This metric demonstrates the total number of S&E graduate students as a percentage of the 18-24 year old population, and indicates where the next generation of scientists and engineers with advanced degrees are being trained. (Source: National Science Foundation and U.S. Census Bureau 2000)

Percent of Civilian Work Force with a Recent Bachelor's Degree in Science or Engineering
This metric indicates where recent graduates with bachelor's degrees in S&E are choosing to work. The presence of large numbers of recent S&E graduates enriches a state's workforce and catalyzes the transfer of current technological knowledge in the local economy. (Source: National Science Foundation SESTAT Database and Bureau of Labor Statistics 2001)

Percent of Civilian Work Force with a Recent Master's Degree in Science or Engineering
For this metric, the percent of the civilian workforce with a recent (1990-1998) master's degree in science or engineering was calculated to indicate where recent graduates with master's degrees in S&E are choosing to work. (Source: National Science Foundation SESTAT Database and Bureau of Labor Statistics 2001)

Percent of Civilian Work Force with a recent Ph.D. in Science or Engineering
This metric indicates where recent graduates with doctorate degrees in S&E are choosing to work. (Source: National Science Foundation SESTAT Database)

Statewide Computer Related Employment, Growth, and Education Requirements
This metric forecasts employment numbers in computer-related positions for 2000 to 2010 along with forecasted growth trends and competitive educational requirements necessary to compete for those positions. (Source: Oregon Employment Department)

Top 10 Industries for Selected Computer Occupations
This metric lists 10 specific industries that employ computer-oriented positions ranked according to the number of positions filled. (Source: Oregon Employment Department)

Statewide Engineering Related: Employment, Growth and Education Requirements
This metric forecasts employment trends in various engineering positions for 2000 to 2010 along with forecasted growth trends and competitive educational requirements necessary to compete for those positions. (Source: Oregon Employment Department)

Top 10 Industries for Selected Engineering Occupations
This metric lists 10 specific industries that rely on employing engineers. The industries are ranked according to the number of engineering jobs created. (Source: Oregon Employment Department)

Statewide Technical Support: Employment, Growth, and Education Requirements
This metric forecasts employment numbers of various technical support occupations for 2000 to 2010 along with growth trends and competitive educational requirements necessary to compete for those positions. (Source: Oregon Employment Department)

Top 10 Industries for Selected Technical Support Occupations
This metric lists the top 10 industries for selected technical support occupations. The industries are ranked according to the number of technical support positions created. (Source: Oregon Employment Department)

Percent of Households with Computers
This metric shows the percentage of families with access to a computer in their home. The presence of a computer in the home tends to promote digital literacy by providing more convenient access to software programs for a variety of uses. (Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001)

Percent of Households with Internet Access
This metric shows the percentage of families with Internet access in their home. Email is the most widely used Internet application and online bill paying and shopping are seeing the fastest growth. (Source: U.S. Department of Commerce, State Science and Technology Indicators, 2001)

Glossary written by: Charles L. Triplett III, Oregon University System

NOTES

Oregon Council for Knowledge and Economic Development

A Collaboration of Oregon Business, University and Government Leaders

The Oregon Council for Knowledge and Economic Development is comprised of 15 members appointed by the Governor and confirmed by the Oregon State Senate. Its mission is to promote knowledge-based economic development, foster collaboration among leadership of public and private institutions of higher education, economic development, and the private sector, and to act as an early warning system for the State of Oregon in the above areas.

For more information please contact:

Diane Vines or James Coonan
Phone: 503-725-5700
Email: businessalliances@ous.edu

www.ous.edu/cpa/OCKED

Oregon University System

Oregon Economic & Community development department

Oregon Department of Community Colleges and Workforce Development (CCWD)

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

ERIC®

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Renewing Oregon's Economy: Growing Jobs and Industries Through Innovation

Author(s): Oregon Council for Knowledge + Economic Development

Corporate Source: Oregon Council for Knowledge + Economic Development

Publication Date: December 2002

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 1	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2A	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2B
Level 1 ☒	Level 2A ☐	Level 2B ☐
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) and paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, please

Signature: Mary Lynn Veden	Printed Name/Position/Title: Mary Lynn Veden, Program Coordinator	
Organization/Address: Oregon University System	Telephone: 503-725-5710	FAX: 503-725-5709
	E-Mail Address: mary_lynn_veden@ous.edu	Date: 7/21/03

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
4483-A Forbes Boulevard
Lanham, Maryland 20706

Telephone: 301-552-4200
Toll Free: 800-799-3742
FAX: 301-552-4700
e-mail: info@ericfac.piccard.csc.com
WWW: http://ericfacility.org

EFF-088 (Rev. 2/2003)