Oregon State Board of Higher Education

Academic Excellence / Economic Development Working Group

Progress Report to the Board

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Context

Living in a Knowledge Economy

A knowledge economy produces new knowledge; transforms knowledge into innovative products, processes, and services; moves innovations into the marketplace; and ultimately, develops new markets.[1] It is global in perspective, collaborative in process, and dynamic in its responsiveness to changing conditions. Most important, it is fed by a healthy postsecondary education system that produces new knowledge and a well-prepared workforce, both of which are sustained by stable funding and inter-sector partnerships.

Understanding the broader implications of living in a knowledge economy, and directing its deliberations and proposed actions toward the realization of higher education's full potential within that context, have been at the root of the first phase of the Academic Excellence and Economic Development (AEED) Working Group. From the identification of opportunity areas to the exploration of current campus initiatives and challenges, the focus of AEED has been very broad, encompassing not only science and technology, but also Oregon's traditional natural resources, health care delivery in communities, K-12 education, and cultural and recreational services. All of these areas impact the state's economic vitality, and all are important to consider in targeting postsecondary contributions.

Importance of an International Perspective

Although the AEED has identified "China" as one of its opportunity areas, recognizing its importance in the world's political and economic marketplace, an international perspective permeates nearly all of the other areas as well, with the possible exceptions of health care delivery and K-12 education. With advances in communication and transportation, the cross-fertilization of ideas, increasingly open markets, and an internationally mobile workforce, more collaboration is taking place across many disciplines, especially in science and technology.[2]

While the size of U.S. investment in higher education and in the research and development enterprise vastly overshadows that of other countries, both developed and developing countries are rapidly expanding their higher education systems and high technology sector. The U.S. now ranks 7th in the ratio of first university degrees awarded to the population of 24-year-olds (see Table 1), and seven other countries are above the U.S. in average years of schooling.[3]

The most recent data on R&D expenditures show that the United States still leads the world in research and development, with an annual expenditure of approximately $2.75 billion (see Table 2). At $963 per person, the U.S. ranks third in per capita R&D expenditures, behind Sweden ($1,083) and Israel ($1,023).

[1] National Science Board, *Science and Engineering Indicators 2004*, p. O-9.
[2] Ibid, pp. O-17-18.
[3] UNESCO Institute for Statistics, *Global Education Digest 2004*, Table 4.

Data on Science and Engineering (S&E)[4] research articles reinforce the U.S.'s leading role in research and innovation. While the proportion of S&E articles produced by U.S. researchers has declined (as the proportion from other countries has increased), the number of citations of U.S. authors and the volume of U.S. patents have increased since the late 1980s. Increases in domestic and international scientific collaborations reinforce the growing internationalization of research and innovation—in 2001, nearly a quarter of co-authored articles published in the U.S. had at least one foreign co-author, up from 10% in the late 1980s.[5]

National Trends in Venture Capital Financing

A significant issue for expanding university/industry links and research commercialization is the availability of venture capital financing. As Table 3 and the accompanying graph show, venture capital financing increased rapidly after the mid-1990s, and especially between 1997 and 2000, at the height of the dot.com boom, before dropping off in 2001. In the U.S., the availability of early stage financing, including funds for proof-of-concept work and initial product development and marketing, have dropped sharply.[6] The issue of financing a new product, application, or technology over the "valley of death" from concept to proof-of-concept, arose as a major issue during this phase of the AEED's work, and is addressed in the findings presented later in this report.

Higher Education and Economic Development

There is now widespread recognition that possessing a bachelor's degree is essential to an individual's future economic well being in the knowledge economy. The comparative earnings data are compelling: the differential between someone with a high school diploma and someone with a bachelor's degree is nearly $24,000 in median annual earnings.[7] Oregon's projected job growth between 2000 and 2010 suggests there will be over 32,000 new jobs for employees with bachelor's degrees and another 6,400 for those with graduate degrees, compared to 12,000 for workers with associate degrees, 4,100 for those with vocational training, and just over 3,000 for those with work experience only.[8]

U.S. universities will continue their significant role in U.S. R&D (universities conduct about half of the nation's basic research) and in training the next generation of scientists and engineers.[9] However, demographic changes in faculty and career choices of students will impact research and development in the U.S. While Table 4 shows that the U.S. continues to produce the largest share of S&E doctoral degrees—more than double the production of Germany and Russia, the next highest doctorate producing countries—that number has been declining since 1998. In the Oregon University System, there have been significant declines over the past

[4] Disciplines within Science and Engineering include: clinical medicine, biomedical research, biology, chemistry, physics, earth/space sciences, engineering/technology, mathematics, psychology, social sciences, health sciences, and professional fields.
[5] National Science Board, *Science and Engineering Indicators 2004*, p. O-7.
[6] Ibid, p. O-19.
[7] U.S. Bureau of the Census, as reported in Postsecondary Education OPPORTUNITY, www.postsecondary.org.
[8] Oregon Employment Department (OLMIS website).
[9] National Science Board, *Science and Engineering Indicators 2004*, p. O-14.

decade in the production of doctoral degrees in the biological and physical sciences.[10] Importantly, the retirement of the large baby boom generation of scientists and researchers raises questions about whether there are enough new doctorate holders nationally to replace those retiring. Increasingly, new science and engineering Ph.D.s have found employment outside of academia.

How Oregon Stacks Up

On total R&D expenditures in U.S. universities (federal, state and local, institutional, industry, and other sources), Oregon ranks right in the middle at 25th (see Table 5). However, that ranking reflects a relatively strong position in attracting federal support—ranking 17th at $72.50 per capita compared to the U.S. average of $66.40—and a relatively weak position in support from state and local and institution sources (42nd)—where these sources constitute 21% of Oregon's postsecondary R&D support compared to the U.S. average of 27% (see Tables 6 and 7).

Oregon ranks 9th in R&D funds from the Environmental Protection Agency and 14th in funds from the U.S. Department of Agriculture,[11] reinforcing some of the initial directions of the AEED in identifying potential in areas related to sustainability and natural resources, noted later in this report.

In its *2003 Development Report Card for the States*, the Corporation for Enterprise Development[12] gives Oregon high marks for sustainability, investment, and distribution of technology:

- 2nd in renewable energy (Washington ranks 1st)
- 4th in manufacturing investment
- 5th in households with computers
- 7th in recycling rate
- 8th in patents issued
- 8th in control of greenhouse gas emissions
- 10th in management of energy costs

These rankings are consistent with the preliminary direction of the AEED in building on Oregon's strengths and reputation in sustainability and technology investment.

Oregon also ranks high on the *2002 State New Economy Index*,[13] which ranks states along 21 indicators divided into five categories: (1) knowledge jobs, (2) globalization, (3) economic dynamism and competition, (4) transformation to a digital economy, and (5) technological innovation capacity. On that index Oregon ranks 11th, behind Massachusetts, Washington, California, Colorado, Maryland, New Jersey, Connecticut, Virginia, Delaware, and New York (see Appendix B).

[10] Oregon University System, *Fact Book 2002*, p. 61.
[11] National Science Foundation, Science and Engineering Profile: Oregon, FY 2001.
[12] Corporation for Enterprise Development, *2003 Development Report Card for the States*, http://drc.cfed.org.
[13] Progressive Policy Institute, *2002 State New Economy Index*. http://www.neweconomyindex.org/states/2002/.

However, Oregon faces serious challenges in building on existing strengths within its postsecondary institutions. Declining state budgets have reduced access to community college courses and threaten access to and quality of OUS universities, making goals for increasing science and engineering degree production harder to attain. Faculty salaries in OUS universities are among the lowest in the country, relative to their peers (see Tables 8-12), giving rise to concerns about future faculty retention and the sustainability of current economic development initiatives. Finally, deferred maintenance erodes the infrastructure needed to attract investment in both instructional and research facilities needed to advance economic development partnerships.

Focus and Process

Purpose and Goals

The AEED Working Group was formed to identify, in a relatively short period of time, two to five areas with high economic development potential that could build on existing or emerging academic excellence in Oregon's postsecondary institutions. The working group's specific goals are to identify initiatives that:

- Show a measurable return on investment over 20 years, with interim results at earlier intervals;
- Collectively, touch every part of Oregon;
- Build on existing or emerging momentum;
- Draw on and reinforce excellence in academic programs; and
- Offer opportunities that are exciting and easy to conceptualize.

The conceptual design for AEED's first phase is displayed on the Strategy Development Matrix shown in Appendix C. It incorporates dimensions related to economic development focus and timeframe, and includes key checkpoints for the initiative development process (including connection to the goals of *Oregon Shines*).

Because the ultimate goal is to engage in a long-term development strategy lasting 20 or more years, even this preliminary phase had to be approached with careful deliberation. Over the next six months, AEED will continue to explore more opportunity areas, with the completion of this phase of work expected in December 2004.

Asking the Right Questions

The challenge presented to the AEED was to link Oregon's current and future economic drivers closer to the priorities and investments made in postsecondary education. In undertaking this phase of the work, AEED members recognized early on that it would be important to focus concretely on several critical questions:

1. What is the nature of the problem in this opportunity or initiative area? Which parts of Oregon and which industries are affected? How do we compare to other states?
2. What are existing examples of initiatives in Oregon in this area? Have they been successful? What has enhanced or impeded success? In what ways have they shown a return on investment?
3. What are examples of successes elsewhere?
4. What is this area's potential for postsecondary contributions?
5. How would an initiative in this area serve to increase jobs in Oregon?
6. What is the potential for leveraging of federal funds, private/public partnerships, and pilot projects?

7. What level of investment would make a difference? What is the likely measurable return on investment?
8. How long would it take to see results? Are the potential solutions short-term (one to five years), medium-term (5 to 10 years), or long-term (10 to 20 years)?
9. Would an initiative in this area be easy to communicate and generate excitement?

Opportunity Areas

Opportunity areas for consideration were identified in conjunction with the core research competency work recently completed by the Oregon Council for Knowledge and Economic Development (OCKED). In addition, because the AEED is taking a very broad view of economic development—looking at what contributes to vital and sustainable communities that are able to attract and retain businesses—the working group included areas such as increasing the supply of medical personnel, improving K-12 education, and keeping top students in Oregon. Initially targeting 15 opportunity areas, the AEED has eliminated one and consolidated others to end up with 10 areas under current review. These areas are:

- Nanoscience and microtechnologies
- Neuroscience and biomedical research
- Engineering and information technology—analog mixed signal, IT workforce, and making sense of complex data
- K-12 education—education and behavior intervention, K-12 administrator preparation, and literacy
- Natural resources—agriculture, fisheries, forestry, food and wine production
- Sustainability and renewable energy
- Supply of medical personnel
- Arts and creative services
- Leisure, recreation, and sports
- Keeping top students in Oregon

In addition to these areas, the AEED is also beginning to develop a concept around an area broadly called "China," which will identify the array of possible initiatives in this critical political and economic world market.

Campus Visits

Between March and May, members of the AEED spent a day on each OUS campus and at Oregon Health and Science University (OHSU) to learn about specific efforts, programs, and faculty strengths in the identified opportunity areas. These visits provided a singular window through which the AEED was able to view the rich and impressive array of initiatives currently under way in Oregon universities. In turn, the visits have shaped and refined the list of opportunity areas as emerging strengths and potential synergistic relationships have been identified. Additional visits to selected community colleges are in process, the first of which took place at Clackamas Community College on June 9th.

As a result of these visits, the first steps toward identifying important campus initiatives and strengths have been made, starting with a matrix displaying for each opportunity area the key campus initiatives that might serve as building blocks, should that area be identified for further development. This matrix—divided into two because of formatting constraints—is contained in Tables 13 and 14.

Subcommittee Reports

In addition to the information gained through the campus visits, the AEED commissioned a brief but focused report on each opportunity area, to provide a better understanding of the needs in that area, current efforts, development potential within Oregon, and barriers to success. The subcommittees were chaired by experts in those fields, and included a small number of postsecondary, governmental, and private sector experts as participants. The chairs of the seven subcommittees that have completed their work at this point are noted below:

- Katy Coba, Director of the Oregon Department of Agriculture (*Agriculture/forestry/fisheries/ food and wine production*)
- Skip Rung, Director of ONAMI (*Nanoscience and microtechnologies*)
- Lesley Hallick, Provost, Oregon Health & Science University (*Neuroscience and biomedical research*)
- Susan Bragdon, Attorney specializing in sustainability and biodiversity issues (*Sustainability and renewable energy*)
- Jack Isselmann, Deputy Director of OECDD (*Engineering and IT related areas*)
- Martha Anne Dow, President, Oregon Institute of Technology (*Supply of medical personnel*)
- Joe Hendricks, OSU Dean of University Honors College, and Dick Kraus, UO Dean of Clark Honors College (*Keeping top students in Oregon*)

Summaries of the subcommittee reports are included in the following pages. The full subcommittee reports are posted on the AEED website at http://www.ous.edu/aeed.htm.

Subcommittee Report Summaries

Nanoscience and Microtechnologies

Chair: Skip Rung

Although Oregon is not now among the top states in NSF nanotechnology research funding, there are potential areas of strong alignment with aspects of the new federal program priorities:

- Oregon industry and academic researchers are that the cutting edge of ongoing research at the micrometer scale.
- Green nanotechnology is an area of competitive advantage for Oregon.
- Oregon is an area with high unemployment and underutilized manufacturing capacity, qualifying it as a federal priority area.
- Strong support from Oregon's congressional delegation (notably Sen. Wyden) could position Oregon well in a future bid for a regional center.

The development of the Oregon Nanoscience and Microtechnologies Institute (ONAMI) brings together several universities (OSU, UO, PSU, OHSU/OGI) and the Pacific Northwest National Laboratory (PNNL) into the state's first Signature Research Center, creating the infrastructure for development of Oregon's potential in this area. ONAMI is targeted at (1) increasing research through strong collaborative teams; (2) developing top talent by producing more Ph.D.s; and (3) generating high wage jobs.

ONAMI research can also support other AEED opportunity areas:

- Sustainable industries and environmentally beneficial business models
- New energy sources from agricultural products
- Healthcare products
- Neuroscience and brain function applications
- Rural economic diversification

ONAMI has been a top priority of OCKED and has received widespread support for funding requests. With the strong efforts of other public and private organizations to build support for ONAMI, this area offers a point of coordination and endorsement for AEED.

Analog Mixed Signal (AMS)

Chair: Jack Isselmann

Analog and mixed signal circuit technologies applications include:

- Power switching devices (e.g., on-board inkjet print heads)
- Imaging chips (digital cameras and camcorders)
- Cellular phones, wireless PDAs, and laptops
- Medical electronics (e.g., pacemakers)
- Micro-Electrical Mechanical Systems (MEMS)

- Sensors
- Global Positioning System (GPS)
- Radio Frequency Identification Systems (RFID)

The AMS market is growing; roughly 15% of recent Portland area venture capital funding events have been in the AMS/Integrated Circuits/wireless area. Another 11% have been in the information security area.

While the subcommittee report identifies strength in this area primarily at OSU and also at PSU, faculty size, facilities, and equipment for these programs are comparatively small, although student enrollment is relatively high. Even with generous funding from industry, AMS related programs in OUS are not funded well enough.

The subcommittee report recommends improved capital funding; increased connections to industry and the OECDD's work in industry clusters; better staffing and support of campus technology transfer offices to increase tech transfer and commercialization; and increased efforts to obtain federal research grants. The challenge to AEED in this area would be to identify and address both short- and long-term investments and benefits.

Information Technology Workforce

Chair: Jack Isselmann

The preliminary subcommittee report on Information to Knowledge/IT Workforce is based on Phase I of an OCKED study, covering just the workforce component. The "Information to Knowledge" component will be addressed in Phase II of the OCKED study and reported to AEED in the next two or three months. Meanwhile, the subcommittee report recommends following the IT workforce study recommendations.

An estimated 71,000 IT workers are currently employed in Oregon, with approximately 5,000 to 6,000 new and replacement jobs opening up for IT workers in each of the next three years. More than half (56%) will require a bachelor's degree; over a third (35%) will require an associate's degree; and only 9% will require less than an associate's degree.

Current training gaps in Oregon include:

- Little in-state training for high-end technologies and methodologies
- Under-utilization of distance learning and web-based training
- Little IT focused training in project management and business processes
- A small proportion of employers (< 30%) using interns, yet wanting workers with experience

The subcommittee report recommends enhancement of postsecondary IT education by increasing business integration instruction, providing a seamless educational progression for students in IT fields, expanding distance education and online offerings, exploring ways to standardize specific curricular elements delivered across multiple campuses, and assisting in providing real-world work experience for graduates.

Neuroscience and Biomedical Research

Chair: Lesley Hallick

Oregon universities have significant areas of strength in both neurosciences and in biomedical research. Over the past two decades, individual spires of excellence at Oregon Health and Science University and at the University of Oregon, in particular, have come together to further strengthen these areas through collaborative research. With the recent addition of biomedical engineering at OHSU/Oregon Graduate Institute, there is even greater potential for development of research, biomedical company formation in Oregon, and employment opportunities.

The dramatic recent growth in research in these areas in Oregon universities has followed investment in facilities. A key strategy has been to invest in the recruitment of investigators who, in turn, compete for national funding, rather than funding intramural research per se. The growth in basic science graduate programs follows research funding growth and develops the future scientific research workforce.

A critical mass of university research provides the intellectual property for spinout companies and the environment in which companies prefer to locate. Flexible, incentivized technology transfer programs are required to recruit and retain the best faculty. Additional strategies are needed to stimulate company formation, success, and retention.

Neuroscience

The University of Oregon's focus on models for the genetics of developmental neuroscience, building on its Institute for Molecular Biology, has made it the national repository of zebrafish genetic strains. Important UO/OHSU research developments and collaborations have ensued from UO's Zebrafish International Resource Center; OHSU is now one of only 3 sites in the U.S. with unique insertional mutagenesis technology in the zebrafish, and Znomics, Inc. was formed by OHSU investigators to select drug targets for high through-put drug screening. Two decades of focused investment in this area at both UO and OHSU have placed Oregon in the top handful of states hosting institutions with neuroscience research programs. Key areas of excellence include:

- Signal transduction: molecular cloning and characterization of neurotransmitter receptors and transporters; neuroendocrinology
- Neurosensory systems and processes: hearing and vision research
- Functional neuroimaging
- Cognition, learning, and memory
- Behavioral neuroscience
- Ion channel function (overlaps with bioenergetics outside of neuroscience)

Biomedical Research

One of the drivers of this area is the aging baby boom population requiring more health care. New research is needed to provide cures, preventions, methods for behavioral modification to more healthy lifestyles, and more cost-effective treatment. Key areas of excellence include:

- Cancer
  - Long-standing critical mass in molecular, cell and developmental biology, areas underlying basic science of growth regulation
  - More recent enhancement of clinical research at OHSU's Oregon Cancer Institute
- Functional genomics (underlies most other areas)
- Reproductive physiology and fertility: early emphasis in endocrinology formed the original basis for neuroscience focus
- Obesity and weight regulation

Other areas of emphasis and excellence include:

- Nutrition
- Chemical biology (design of drugs; drugs based on natural products; overlaps with nanotechnology, biosensors)
- Pathogenesis and vaccine development
- Environmental science, human health, and toxicology
- Research in health policy and decision making
- Link between business development, technology transfer, and biotech startup
  - Identified as a gap in the business community
  - Nascent programs to coordinate a solution at and among OHSU, UO, OSU, and PSU

Biomedical Engineering

Biomedical engineering approaches are well advanced in addressing the leading causes of death and disability in Western societies: heart disease, cancer, stroke, and cognitive decline. Nationally, employment in biomedical engineering is projected to increase 31% by 2010, twice the national average for all occupations. Oregon is host to 185 bioscience companies (50% in devices, software, and diagnostics), providing over 3,200 jobs, and with revenues of $356 million. Key areas of emphasis or excellence in Oregon include:

- Medical devices (projected need for engineers in this area is almost twice the projected need in overall engineering)
- Bioinformatics (functional genomics)
- Neuroengineering (neuroscience areas)
- Biomechanics
- Biosensors, bioactive device coatings (nanotechnology)
- Robotics (nanotechnology)

Agriculture, Forestry, Fisheries, Food and Wine Production

Chair: Katy Coba

As a traditional component of Oregon's economic base, natural resource industries face new opportunities and challenges as they integrate the knowledge-based economy and new technologies with natural resource management. Encompassing a diverse array of products, markets, and technologies, natural resources in Oregon share a common and important advantage: Land. The diversity of climate, soil, water, and biomass conditions affecting

Oregon's land offers advantages that are different from those of the past. More than ever, there is a need to connect high tech, higher education, and natural resource industries.

Significant opportunities for natural resource development identified in the subcommittee report include:

- Nanotechnology/high-tech applied to water issues and conservation
- Renewable energy and bio-fuels
- Mechanization/labor savings applications
- Bio-based products, including natural fibers, bio-lubricants, and natural fumigants
- Value-added food products from Oregon's unique mix of commodities

The subcommittee report identifies several barriers to success:

- Many Oregon companies are partnering with research institutions outside of Oregon for assistance rather than with Oregon institutions.
- There has been little strategic analysis of Oregon's natural resource capabilities and life science applications related to current business activities, and a lack of collaborative effort between natural resources industries and "high tech" industries to identify mutually beneficial goals and strategic efforts.
- More research is needed—both basic and applied—to determine technologies, processes, and applications that employ the use of natural resources in new ways.
- New incentives that are mutually beneficial to private business and higher education are needed. For example, if Oregon universities could more effectively license and share in royalties from new applications of processes, products, and instrumentation developed for use in the natural resources (such as in the University of California system), that would foster the partnerships with Oregon businesses needed to further work in these areas.

Sustainability and Renewable Energy

Chair: Susan Bragdon

By virtue of its reputation, public policies, and current research activity, Oregon has enormous potential for advancing sustainability into a focus for economic development and an overall brand for the state and its postsecondary institutions. Examples of Oregon's cutting edge research and experience include:

- Green chemistry
- Renewable energy
- Smart energy
- Sustainable cities
- Green buildings
- Urban planning
- Architecture

- Engineering
- Sustainable agriculture
- Sustainable forestry
- Atmospheric and oceanographic sciences
- Transportation
- Sustainable business practices
- Law

Oregon has opportunities to lead in sustainability-related economic development in areas of cost reduction, creation of new market niches for certified "green" products, improved international competitiveness, and streamlined regulatory compliance, to name just a few. Higher education's connection to Sustainability may occur through at least four avenues:

(1) Developing a workforce prepared to bring sustainability thinking to public and private enterprise decision making;
(2) Providing a source of research, innovation, and leadership;
(3) Serving as a catalyst to convene stakeholders around a particular problem or issue;
(4) Global consulting with each campus as a model of sustainable business.

The subcommittee report identifies several challenges to achieving the potential for development in this area, among which are:

- No integrative function across all of OUS and a tradition of competition among institutions;
- Lack of a research inventory in the multiple disciplines of work related to sustainability;
- Little grounding in working in an international context; just beginning to develop international connections in sustainability areas.

An additional challenge confronting the AEED is to identify and understand ways in which Sustainability infuses the development of other opportunity areas, such as Agriculture and Nanotechnology. Finally, the biggest initial challenge may be in defining and communicating the meaning of sustainability to avoid connotations of any particular political agenda.

Supply of Medical Personnel

Chair: Martha Anne Dow

Oregon faces a critical shortage of health care workers—physicians, nurses, allied health professionals—and the need is urgent. By 2015, Oregon will need 3,000 more physicians. Within just the next two years, 13% of doctors plan to leave the physician workforce, and the production of new doctors is not enough to make up the difference. By 2010, demand will exceed supply in all other health occupations in significant proportions:

- Registered nurses: 22%
- Medical and clinical lab technicians: 55%
- Medical imaging: 51%
- Dental hygiene: 42%

The needs of an aging population have contributed to the shortage, and on the supply side, more health professionals are leaving healthcare because of working conditions, regulations for staffing and certifications, and the difficulty in aligning training programs to promote upward career mobility. In Oregon, education programs have reached capacity for physical facilities, faculty, staff, and equipment.

Several initiatives in the state are currently being advanced to address this problem, including those from the Governor's Healthcare Conference Initiative, the Oregon Consortium of Nursing Education, the Community Colleges Healthcare Action Plan, the Statewide Simulation Alliance, and many others. The AEED has endorsed an OUS policy package proposal for the 2005-07 budget request that would complement these efforts. The proposal would enhance the production of nursing and allied health professionals educated at EOU, OIT, and SOU, in partnership with community colleges in those areas and with OHSU.

Keeping Top Students in Oregon

Co-chairs: Joe Hendricks, Dick Kraus

Oregon's knowledge economy will depend on producing—not importing—a talented, creative workforce with a commitment to Oregon. Building a reservoir of talent from within the state is accelerated when Oregon's best students are attracted to and retained by intellectually challenging programs that prepare them for advanced study and leadership positions in Oregon's public and private sectors. The focus of subcommittee work in this AEED opportunity area is on the impact and potential expansion of Honors programs in OUS universities to serve the growing demand from Oregon's top high school graduates.

The subcommittee report notes that:

- At least half of current Oregon Honors students would have left the state for college had it not been for the Honors programs.
- Top students are more likely to seek work in the state where they attended college.
- Honors program students have higher graduation rates and are significantly more likely to seek advanced degrees than other students. Advanced degree holders will have higher incomes and contribute more in tax payments to the state Treasury.
- Expanding Honors programs will, just by sheer numbers, increase the proportion remaining in Oregon after graduation.
- Current Honors students reflect a demographic mix of income (e.g., over 40% of Honors College students at OSU receive need-based financial aid) and ethnicity (at OSU, 18% of the 2004 entering class will be comprised of under-represented minority group students).

The AEED has endorsed an OUS policy package proposal for the 2005-07 budget request that addresses expansion of Honors programs in OUS institutions.

Preliminary Findings

1. Innovation often occurs at the interfaces between disciplines. Several of the opportunity areas explored in the subcommittee reports and during campus visits—in particular, nanotechnology, neurosciences and biomedical research, sustainability, and natural resources—have reaped unanticipated benefits from discoveries occurring when diverse disciplinary perspectives and methodologies are applied to an area. Fostering interdisciplinary and multi-disciplinary collaborations will be key to advancing competitive economic development initiatives that draw on the strengths of Oregon's colleges and universities.

Although some institutions already have a well-developed culture of interdisciplinary collaboration, in others such collaboration may happen more by accident than by design. The challenge for academia is to facilitate the natural occurrence of cross-disciplinary collaborations, including a faster process for curriculum change to bring the benefits of cutting edge interdisciplinary work to the classroom.

One way to support this culture change, noted during several campus visits, is to design and populate new and remodeled facilities intentionally to bring diverse disciplines together. New construction at Eastern Oregon University, Oregon State University, and the University of Oregon offer some good examples. By extension, integrating university, public agency, and private sector endeavors into the same physical space would enhance collaborations not only across disciplines but also across sectors, leading to strong partnerships in many areas of economic development. As noted by President Frohnmayer during the UO visit, "Nothing beats the opportunity to be in the same space together."

2. More partnerships are needed across universities, between two-year and four-year institutions, and across public and private sectors. Although the AEED has just begun visits to Oregon community colleges (starting with a visit to Clackamas Community College on June 9th), it is clear from committee discussions that there are opportunities for collaborative work in both applied research and workforce development that have not yet been developed. In just the first community college visit, opportunities were identified for nursing collaborations, GIS applications, and organizational support for small business development, in which OUS/community college partnerships would advance important statewide priorities better than the individual efforts of each sector. Solutions being developed through the Board Working Group on Excellence in Delivery and Productivity ("More Better Faster") would address many of the barriers identified in fostering such partnerships.

A key issue for any future development is the coordination of many efforts, both public and private, to maintain policy consistency and clarity of resource allocation. To that end, discussions are under way regarding the relationship between the Engineering and Technology Industry Council (ETIC) and the Oregon Council for Knowledge and Economic Development (OCKED); coordination with the Oregon Economic and Community Development Department (OECDD) and the Governor's Office; and clearer connections to the Oregon Business Council (OBC), Associated Oregon Industries (AOI), and other private sector organizations. The role of

AEED is viewed as central in connecting postsecondary education to the concerns of all these groups.

As the AEED pursues international connections, in recognition of the global nature of research and economic development, discussions have raised the question of developing a joint OUS campus or center in important international locations, such as Shanghai, to establish a strong presence in a key political and economic world market. In general, the AEED recommends exploring ways in which OUS as a system can establish important connections internationally to address both academic and economic development needs.

3. Cutting-edge research happens in all universities. Although Oregon State University, the University of Oregon, and Oregon Health and Science University are explicitly designated as "research universities" and have mature research programs, that does not mean that important cutting-edge work takes place solely at those institutions. As a large, comprehensive urban university, Portland State University has in recent years developed strong research programs in many areas that support Oregon's economy and its industry clusters.

The campus visits revealed exciting developments at all of the smaller universities—such as the internationally recognized work being done at SOU on climatology and viticulture; new renewable energy products with strong commercial potential developed through joint faculty-student collaborations at OIT; innovative educational software applications being developed through work done at WOU and Teaching Research; and cross-sector collaborations in natural resources and fisheries taking place at EOU with the advantages offered by the new state-of-the-art Science Center.

With a special role in their respective regions, EOU, SOU, and OIT serve not only the instructional needs of regional populations, but also a broader "economic gardening" function[14] that depends on active engagement in research.

4. Innovative discoveries at Oregon universities often experience the "Valley of Death" and move too slowly into the private sector. Taking a new discovery, technology, or application from concept to proof-of-concept is hampered by the lack of seed funding (pre angel and venture capital funding) and an early connection to business and marketing expertise needed to create an initial market or business opportunity analysis. There are some efforts under way to address the proof-of-concept funding problem (for example, the OHSU Foundation is looking at piloting a pre-angel round fund to address Valley of Death issues), but by and large, it remains a major challenge. In addition, each institution is trying to better connect the resources of its business school to its innovative discoveries, but there is still much to do here as well. Regional institutions may not have the business expertise available to apply to the proof-of-concept period, and may need to depend on expertise from other institutions or the small business agency offices nearby.

[14] Pioneered in Littleton, Colorado, "economic gardening" aims at creating a nurturing environment for entrepreneurs, and includes the elements of information; physical, quality of life, and intellectual infrastructure; and business connections to trade associations, R&D organizations, academic institutions, and industry clusters.

Another issue identified during campus visits and subcommittee discussions concerned the need to streamline and enhance the technology transfer process. New developments at Oregon State University and the University of Oregon, aimed at integrating expertise from business and law, offer good models. Portland State's Interdisciplinary Center for Law and Entrepreneurship teams PSU MBA students and law students from Lewis and Clark College to facilitate technology transfer for local entities such as OHSU. However, we may also need to look at the number of approvals and simply streamline the system we currently use.

In the larger context, steps taken to streamline the entire technology transfer process, including at the state level, would also better serve efforts to bring new research to commercial application. New organizational structures under consideration to replace OCKED and the Higher Education Technology Transfer (HETT) Fund could provide valuable support.

Finally, we observed that while much of our bioscience or medical research could be a significant economic engine for Oregon in the future, currently there are few Oregon-based venture capital firms that have expertise or interest in these areas. This means that out-of-state firms invest in Oregon research and they often encourage the resulting company to move to their state, where there is more of an ecosystem supporting that type of industry.

5. More vehicles are needed for communicating important research and its potential application. At least two suggestions emerged from the campus visits and subcommittee reports that could facilitate better communication and dissemination of important research to businesses and the broader public. The first, proposed by President Frohnmayer, is to establish and fund a conference center for high visibility integrated conferences and symposia, focusing on interdisciplinary approaches to research topics with economic development potential. Located in beautiful Oregon and with strong place identification, such conferences and symposia could become eagerly anticipated annual events that bring visibility and build communities of interest.

The second suggestion concerns an inventory of research activity in key opportunity areas that would help government agencies and business organizations identify contacts and potential resources. While there are important development and maintenance concerns associated with such a project, it would be worthwhile to explore its potential with the OUS Provosts' Council and the Oregon Economic and Community Development Department.

6. Sustainability has enormous potential as a designated opportunity area for further development. Sustainability offers opportunities for significant improvements in business practice; it draws on major areas of existing research expertise (nanoscience and microtechnologies, green chemistry, natural resources, renewable energy, transportation and urban planning, to name a few); it addresses critical needs in every part of Oregon (for example, concerns about development and use of water resources in Eastern and Southern Oregon); and it builds on Oregon's long-standing national and international reputation for innovation and cutting-edge policy in this area. In cooperation with other statewide efforts—the Sustainability Board, OECDD, and Brand Oregon initiatives—the Board of Higher Education and the Oregon University System can be leaders in advancing Oregon's reputation as the "Sustainability State."

Oregon is already a leader in the acquisition of sustainability-related research funding, ranking 9th in the U.S. in Environmental Protection Agency research support to universities. A visible statewide focus on sustainability could enhance Oregon's competitiveness in securing external funding. Further, the subcommittee report noted that a significant amount of international funding is available, and both the development of international connections and a clear state priority on sustainability would increase the possibility of funding success.

Many of the challenges to achieving the potential for this area noted in the subcommittee report can be addressed by adopting the ideas identified here: steps taken to foster interdisciplinary thinking and practice will support the interdisciplinary nature of sustainability efforts; greater partnership and collaboration will help break down barriers erected out of a tradition of competition among institutions; better vehicles of communication will improve access to postsecondary expertise; and approaches to establishing an international presence for OUS will provide the international context, perspective, and opportunities currently missing in the sustainability area.

7. Building the academic excellence that will propel Oregon's economic development means energizing the public to make a fundamental reinvestment in higher education. Supporting the institutional capacity for excellence—attracting and retaining top quality faculty and students, offering courses needed for majors in demand, providing faculty the time necessary for student advising and mentoring, and supporting scholarly activity that brings national recognition in a variety of disciplines—depends on a stable and predictable funding base. In the current constrained budget environment, building excellence may, under some circumstances, require the choice to discontinue some institutional activities and redirect resources to those that will more directly advance critical State, Board, and institutional priorities.

Next Steps

Between March and July 2004, the AEED identified opportunity areas for consideration; visited all seven OUS campuses, plus Oregon Health and Science University and Clackamas Community College; established subcommittees for each area and received reports from seven of them; selected Sustainability as one of its recommended strategic initiative areas; and began to address inter-sector organizational issues. The preliminary findings suggest some possible future recommendations and courses of action, and will be expanded when the remaining opportunity areas have been reviewed.

Between September and December, the AEED will hear presentations from the remaining subcommittees: the broad area of K-12 education, including administrator preparation, education and behavior intervention, and early literacy; arts and creative services; and leisure, recreation, and sports. The AEED will also further define and explore the opportunity area currently called "China," anticipating that it will involve connections to several of the other areas as well.

Visits to other community colleges and, hopefully, to private colleges, will also be scheduled for the fall. A final report for this first phase of the AEED work, incorporating the results of all the subcommittee analysis and campus visits, and identifying the 2 to 5 primary areas for further initiative development, will be presented to the Board in January 2005.

Following the January report, the AEED plans further in-depth discussions of the selected initiative areas, in anticipation of a set of proposals for the 2007-09 biennium. These discussions will connect to the excellent work taking place in Oregon's universities through such vehicles as expert panels of research faculty, and will offer a more robust view of each area's potential.

Meanwhile, the preliminary findings suggest some directions that campuses and the Board could pursue immediately. These include:

- Addressing technology transfer organization, processes, and support for OUS campuses;
- Identifying possible solutions to the problem of early-stage proof-of-concept financing;
- Developing effective vehicles for communication of research;
- Collaborating with the Board's Working Group on Excellence in Delivery and Productivity ("More Better Faster") to remove barriers between OUS and community colleges in addressing workforce and business development needs; and
- Coordinating with the Governor's Office, OECDD, OCKED, ETIC, CCWD, and OBC to develop a statewide framework and consistent agenda for presenting economic development initiatives to the Legislature.

Tables

Table 1

First University Degrees Awarded in Selected Countries

	Total Population	First University Degrees	Rank	24-year-olds	Ratio First University Degrees to 24-year-old Population	Rank
United States	**293,027,571**	**1,253,121**	**1**	**3,703,000**	**33.8**	**7**
China	1,298,847,624	567,839	2	19,639,000	2.9	22
Russia	143,782,338	554,814	3	2,170,000	25.6	15
Japan	127,333,002	542,314	4	1,719,400	31.5	9
France	60,424,213	275,316	5	762,200	36.1	6
United Kingdom	60,270,708	274,440	6	696,600	39.4	3
South Korea	48,598,175	209,747	7	783,600	26.8	14
Germany	82,424,609	178,618	8	892,800	20.0	18
Italy	58,057,477	150,677	9	726,600	20.7	17
Canada	32,507,874	116,160	10	397,200	29.2	12
Australia	19,913,144	112,745	11	269,200	41.9	1
Netherlands	16,318,199	69,809	12	187,000	37.3	5
Sweden	8,986,400	34,097	13	102,200	33.4	8
Israel	6,199,008	30,267	14	102,200	29.6	11
Finland	5,214,512	25,269	15	65,600	38.5	4
Belgium	10,348,276	22,526	16	125,200	18.0	20
Norway	4,574,560	22,421	17	54,400	41.2	2
Switzerland	7,450,867	19,028	18	76,600	24.8	16
Ireland	3,969,558	18,669	19	69,000	27.1	13
Austria	8,174,762	15,132	20	92,400	16.4	21
Denmark	5,413,392	11,951	21	65,000	18.4	19
Iceland	293,966	1,318	22	4,200	31.4	10

Sources: (1) National Science Board, *Science and Engineering Indicators 2004*. (2) U.S. Central Intelligence Agency, *The World Fact Book* (online version).

Table 2

R&D Expenditure Ratios in Selected Countries

	Total Population	Total R&D Expenditures, 2001 or Latest (million $)	Rank	R&D Expenditure per Capita ($)	Rank	R&D Expenditure as % of GDP	Rank
United States	**293,027,571**	**274,642**	**1**	**963**	**3**	**2.80**	**7**
Japan	127,333,002	98,605	2	776	6	3.09	4
China	1,298,847,624	55,543	3	44	22	1.09	21
Germany	82,424,609	52,134	4	633	8	2.50	9
France	60,424,213	31,265	5	528	11	2.20	10
United Kingdom	60,270,708	27,014	6	459	16	1.90	16
South Korea	48,598,175	21,113	7	446	17	2.96	6
Canada	32,507,874	16,328	8	531	10	1.94	14
Italy	58,057,477	14,986	9	260	20	1.07	22
Russia	143,782,338	11,967	10	83	21	1.16	20
Sweden	8,986,400	9,606	11	1,083	1	4.61	2
Netherlands	16,318,199	8,344	12	524	12	1.95	13
Australia	19,913,144	7,205	13	289	19	1.53	18
Israel	6,199,008	6,249	14	1,023	2	4.89	1
Switzerland	7,450,867	5,266	15	734	7	2.64	8
Belgium	10,348,276	4,725	16	462	15	1.98	12
Finland	5,214,512	4,335	17	836	5	3.42	3
Austria	8,174,762	4,158	18	513	13	1.91	15
Denmark	5,413,392	3,093	19	583	9	2.15	11
Norway	4,574,560	2,187	20	485	14	1.64	17
Ireland	3,969,558	1,443	21	376	18	1.16	19
Iceland	293,966	257	22	911	4	3.04	5

Sources: (1) UNESCO Institute for Statistics; (2) U.S. Central Intelligence Agency, *The World Fact Book* (online version).

Table 3

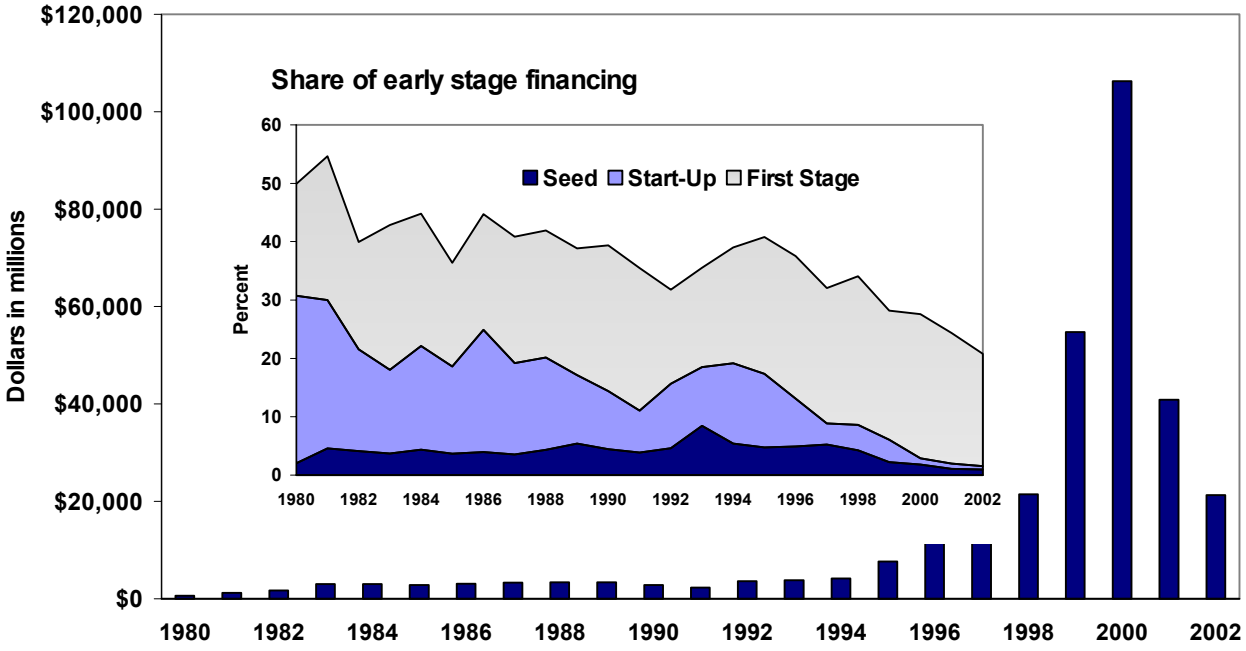
U.S. Venture Capital Disbursements, by Financing Stage: 1980-2002

Dollars in millions

	Seed		Start-Up		First Stage		Later Stage		Total
	$ in millions	Percent	$ in millions	Percent	$ in millions	Percent	$ in millions	Percent	$ in millions
1980	11.7	2.0	164.9	28.7	110.0	19.2	287.7	50.1	574.3
1981	54.1	4.6	301.2	25.4	291.7	24.6	537.3	45.4	1,184.3
1982	68.3	4.1	288.2	17.4	304.2	18.4	993.7	60.1	1,654.4
1983	111.9	3.7	431.5	14.3	746.6	24.8	1,720.3	57.1	3,010.3
1984	132.4	4.4	539.1	17.8	687.3	22.7	1,674.3	55.2	3,033.1
1985	104.5	3.7	424.3	14.9	504.4	17.8	1,805.3	63.6	2,838.5
1986	120.7	4.0	639.4	20.9	604.5	19.8	1,687.9	55.3	3,052.5
1987	116.1	3.5	516.5	15.7	713.1	21.7	1,947.9	59.1	3,293.6
1988	144.9	4.3	529.1	15.8	729.3	21.8	1,944.2	58.1	3,347.5
1989	182.3	5.4	394.8	11.7	732.0	21.7	2,057.9	61.1	3,367.0
1990	124.2	4.4	278.3	10.0	698.4	25.0	1,695.9	60.6	2,796.8
1991	87.9	3.9	162.5	7.2	554.5	24.4	1,464.9	64.5	2,269.8
1992	166.1	4.6	395.7	11.0	577.5	16.1	2,447.5	68.2	3,586.8
1993	319.9	8.4	382.2	10.1	645.2	17.0	2,446.6	64.5	3,793.9
1994	223.7	5.4	570.4	13.8	824.0	19.9	2,530.1	61.0	4,148.2
1995	360.3	4.7	964.6	12.6	1,789.3	23.4	4,521.0	59.2	7,635.2
1996	569.9	4.9	953.6	8.2	2,835.1	24.4	7,251.9	62.5	11,610.5
1997	790.0	5.2	545.3	3.6	3,502.2	23.2	10,242.7	67.9	15,080.2
1998	908.1	4.2	941.1	4.4	5,457.3	25.4	14,141.5	65.9	21,448.0
1999	1,222.1	2.2	2,095.2	3.8	12,127.2	22.1	39,340.7	71.8	54,785.2
2000	1,927.1	1.8	1,143.0	1.1	26,215.7	24.7	76,984.0	72.4	106,269.8
2001	429.9	1.1	377.9	0.9	9,126.7	22.4	30,890.7	75.7	40,825.2
2002	203.7	1.0	117.0	0.5	4,096.2	19.3	16,861.9	79.2	21,278.8

Seed funds are for proof of concept; startup funds for product development/early marketing; and first-stage funds for capital replenishment.

U.S. Venture Capital Disbursements: 1980-2002



Source: National Science Board, *Science & Engineering Indicators 2004*.

Table 4

Science and Engineering Doctoral Degrees Awarded in Selected Countries

	Total Population	All Doctoral Degrees	Science & Engineering Doctoral Degrees	Rank	Science & Engr % of All Doctoral Degrees	Science & Engr Doct. Degrees per 100,000 Population	Rank
United States	**293,027,571**	**40,744**	**25,509**	**1**	**62.6**	**8.7**	**9**
Germany	82,424,609	24,796	11,803	2	47.6	14.3	4
Russia	143,782,338	18,274	10,409	3	57.0	7.2	15
United Kingdom	60,270,708	14,208	8,521	4	60.0	14.1	5
China	1,298,847,624	13,001	8,153	5	62.7	0.6	21
Japan	127,333,002	16,078	7,401	6	46.0	5.8	18
France	60,424,213	9,903	6,577	7	66.4	10.9	7
South Korea	48,598,175	6,143	2,865	8	46.6	5.9	17
Canada	32,507,874	3,978	2,249	9	56.5	6.9	16
Australia	19,913,144	3,687	2,030	10	55.1	10.2	8
Sweden	8,986,400	3,049	1,848	11	60.6	20.6	1
Italy	58,057,477	3,557	1,731	12	48.7	3.0	20
Netherlands	16,318,199	2,483	1,309	13	52.7	8.0	12
Switzerland	7,450,867	2,733	1,223	14	44.7	16.4	3
Finland	5,214,512	1,891	974	15	51.5	18.7	2
Austria	8,174,762	1,790	913	16	51.0	11.2	6
Belgium	10,348,276	1,147	789	17	68.8	7.6	14
Israel	6,199,008	688	497	18	72.2	8.0	13
Denmark	5,413,392	913	462	19	50.6	8.5	10
Ireland	3,969,558	501	325	20	64.9	8.2	11
Norway	4,574,560	658	195	21	29.6	4.3	19
Iceland	293,966	-	-		-	-	-

Sources: (1) National Science Board, *Science and Engineering Indicators 2004*. (2) U.S. Central Intelligence Agency, *The World Fact Book* (online version).

Table 5

Total R&D Expenditures 2001 - All Sources

		Total R&D Expenditures Per Capita ($)	Total R&D Expenditures ($ in thousands)	Population
1	Maryland	301.3	1,644,467	5,458,137
2	Massachusetts	245.3	1,576,517	6,427,801
3	Alaska	179.6	115,601	643,786
4	New Hampshire	154.5	196,975	1,275,056
5	Iowa	149.8	439,810	2,936,760
6	New Mexico	147.8	274,209	1,855,059
7	Utah	146.0	338,127	2,316,256
8	Connecticut	144.1	498,745	3,460,503
9	Nebraska	139.7	241,638	1,729,180
10	Pennsylvania	136.8	1,687,457	12,335,091
11	North Carolina	136.7	1,137,279	8,320,146
12	Wisconsin	133.9	728,618	5,441,196
13	North Dakota	133.4	84,574	634,110
14	Rhode Island	133.3	142,564	1,069,725
15	New York	129.2	2,476,090	19,157,532
16	Colorado	127.1	572,950	4,506,542
17	Hawaii	126.1	156,976	1,244,898
18	California	125.9	4,422,032	35,116,033
19	Vermont	124.7	76,882	616,592
20	Missouri	119.6	678,460	5,672,579
21	Montana	118.5	107,744	909,453
22	Washington	116.4	706,579	6,068,996
23	Georgia	115.5	988,883	8,560,310
	U.S.	113.2	32,652,261	288,368,698
24	Michigan	110.2	1,107,195	10,050,446
25	**Oregon**	**103.9**	**366,023**	**3,521,515**
26	Texas	103.0	2,244,117	21,779,893
27	Illinois	101.6	1,280,807	12,600,620
28	Alabama	99.3	445,299	4,486,508
29	Delaware	99.1	79,985	807,385
30	Kansas	99.0	268,800	2,715,884
31	Louisiana	96.5	432,356	4,482,646
32	Indiana	94.9	584,418	6,159,068
33	Minnesota	93.5	469,208	5,019,720
34	Arizona	91.7	500,548	5,456,453
35	South Carolina	88.0	361,404	4,107,183
36	Ohio	87.2	995,972	11,421,267
37	Mississippi	84.3	242,133	2,871,782
38	Virginia	83.7	610,717	7,293,542
39	Wyoming	83.5	41,632	498,703
40	Oklahoma	73.1	255,217	3,493,714
41	Tennessee	73.0	423,264	5,797,289
42	Kentucky	72.5	296,895	4,092,891
43	New Jersey	70.9	609,470	8,590,300
44	Idaho	61.5	82,496	1,341,131
45	Florida	59.7	997,048	16,713,149
46	Nevada	53.3	115,934	2,173,491
47	Maine	52.6	68,034	1,294,464
48	Arkansas	51.9	140,741	2,710,079
49	West Virginia	43.9	79,076	1,801,873
50	South Dakota	42.3	32,185	761,063

Source: National Science Foundation and U.S. Census data, as reported by National Center for Higher Education Management Systems.

Table 6
Federal R&D Expenditures 2001

		Federal R&D Expenditures Per Capita ($)	Federal R&D Expenditures (In $ Thousands)	Population
1	Maryland	219.1	1,196,085	5,458,137
2	Massachusetts	177.4	1,140,358	6,427,801
3	New Mexico	100.1	185,733	1,855,059
4	Colorado	97.3	438,664	4,506,542
5	Rhode Island	94.9	101,560	1,069,725
6	Connecticut	94.8	327,983	3,460,503
7	Pennsylvania	92.8	1,144,586	12,335,091
8	Utah	92.0	213,163	2,316,256
9	Alaska	90.3	58,129	643,786
10	New Hampshire	90.2	115,067	1,275,056
11	New York	81.8	1,566,387	19,157,532
12	Vermont	81.2	50,095	616,592
13	Washington	80.6	488,877	6,068,996
14	North Carolina	78.7	655,093	8,320,146
15	Hawaii	78.5	97,716	1,244,898
16	Iowa	74.7	219,361	2,936,760
17	**Oregon**	**72.5**	**255,324**	**3,521,515**
18	Missouri	72.3	409,999	5,672,579
19	California	72.0	2,527,074	35,116,033
20	Wisconsin	71.0	386,441	5,441,196
21	Alabama	69.7	312,522	4,486,508
	U.S.	66.4	19,140,653	288,368,698
22	Montana	62.3	56,668	909,453
23	Michigan	61.8	621,578	10,050,446
24	Illinois	58.8	741,522	12,600,620
25	Texas	56.5	1,231,083	21,779,893
26	Georgia	55.2	472,593	8,560,310
27	Delaware	54.6	44,052	807,385
28	Minnesota	53.4	267,955	5,019,720
29	Mississippi	50.7	145,505	2,871,782
30	Ohio	49.1	560,767	11,421,267
31	North Dakota	48.8	30,950	634,110
32	Arizona	48.7	265,716	5,456,453
33	Virginia	47.3	344,849	7,293,542
34	Tennessee	45.7	264,897	5,797,289
35	Nebraska	44.2	76,507	1,729,180
36	Kansas	42.2	114,732	2,715,884
37	South Carolina	41.2	169,257	4,107,183
38	Louisiana	40.8	182,794	4,482,646
39	Indiana	40.3	247,944	6,159,068
40	Wyoming	40.1	20,017	498,703
41	Nevada	31.8	69,085	2,173,491
42	New Jersey	31.4	270,121	8,590,300
43	Kentucky	29.2	119,648	4,092,891
44	Florida	28.0	468,099	16,713,149
45	Oklahoma	27.6	96,349	3,493,714
46	Idaho	25.6	34,347	1,341,131
47	Arkansas	23.6	64,030	2,710,079
48	South Dakota	21.6	16,407	761,063
49	West Virginia	19.7	35,526	1,801,873
50	Maine	19.4	25,124	1,294,464

Source: National Science Foundation and U.S. Census data, as reported by National Center for Higher Education Management Systems.

Table 7

State, Local, and Institutional R&D Expenditures 2001

		State & Local and Institutional R&D Per Capita ($)	State & Local R&D Expenditures ($ in thousands)	Institutional R&D Expenditures ($ in thousands)	Population
1	Nebraska	78.0	7,007	127,825	1,729,180
2	North Dakota	69.2	1,440	42,409	634,110
3	Iowa	55.6	59,668	103,688	2,936,760
4	Maryland	49.6	59,552	210,933	5,458,137
5	Wisconsin	45.4	40,423	206,671	5,441,196
6	Montana	44.7	19,745	20,919	909,453
7	Alaska	44.0	3,212	25,129	643,786
8	Georgia	43.9	78,760	297,178	8,560,310
9	Kansas	43.9	45,153	74,134	2,715,884
10	New Hampshire	43.3	12,194	43,031	1,275,056
11	Hawaii	41.8	33,125	18,903	1,244,898
12	Louisiana	41.2	84,579	100,102	4,482,646
13	Indiana	40.5	45,456	203,717	6,159,068
14	South Carolina	39.3	30,135	131,435	4,107,183
15	Oklahoma	36.9	40,615	88,219	3,493,714
16	Wyoming	36.6	2,038	16,216	498,703
17	New Mexico	36.5	11,872	55,841	1,855,059
18	Kentucky	34.8	41,129	101,439	4,092,891
19	California	34.4	255,051	954,309	35,116,033
20	Michigan	34.3	66,764	278,153	10,050,446
21	Arizona	33.7	14,269	169,472	5,456,453
22	Missouri	33.4	25,166	164,074	5,672,579
23	North Carolina	32.9	120,663	152,944	8,320,146
24	Utah	32.9	21,445	54,787	2,316,256
25	Rhode Island	32.8	5,511	29,617	1,069,725
26	Illinois	31.3	82,742	311,854	12,600,620
	U.S.	30.7	2,310,643	6,540,543	288,368,698
27	Mississippi	30.4	39,287	48,018	2,871,782
28	Idaho	30.1	18,389	21,948	1,341,131
29	New York	28.3	127,737	413,608	19,157,532
30	Minnesota	27.9	58,468	81,784	5,019,720
31	Texas	27.4	227,494	368,538	21,779,893
32	Vermont	26.6	4,052	12,338	616,592
33	Connecticut	26.4	15,167	76,044	3,460,503
34	Maine	26.3	8,536	25,528	1,294,464
35	Delaware	26.3	4,712	16,486	807,385
36	New Jersey	26.2	52,159	172,716	8,590,300
37	Virginia	24.6	70,081	109,548	7,293,542
38	Washington	24.3	18,644	128,599	6,068,996
39	Ohio	23.9	80,268	193,173	11,421,267
40	Florida	23.4	113,939	276,809	16,713,149
41	Arkansas	22.3	36,942	23,358	2,710,079
42	**Oregon**	**22.0**	**41,449**	**35,864**	**3,521,515**
43	Pennsylvania	21.1	51,467	208,810	12,335,091
44	Alabama	20.1	5,232	85,133	4,486,508
45	Massachusetts	18.4	38,180	80,007	6,427,801
46	West Virginia	17.7	2,471	29,429	1,801,873
47	Colorado	17.6	21,934	57,315	4,506,542
48	Nevada	17.5	10,275	27,681	2,173,491
49	Tennessee	17.4	43,812	56,888	5,797,289
50	South Dakota	16.7	9,041	3,631	761,063

Source: National Science Foundation and U.S. Census data, as reported by National Center for Higher Education Management Systems.

Table 8

2003-04 Average Faculty Total Compensation at Peer Universities for OSU

Weighted Distribution of Faculty by Rank; Ranked by All Ranks Average

(Dollars in thousands)

Rank	Institution	State	Prof	Assoc	Asst	Instr	All Ranks
1	Michigan State University	MI	127.8	98.2	82.3	51.6	101.5
2	University of California Davis	CA	136.0	91.3	78.5	-	101.0
3	Purdue University Main Campus	IN	125.7	90.8	79.7	49.4	97.6
4	Iowa State University	IA	115.1	88.4	74.9	50.5	91.8
5	North Carolina State	NC	109.2	82.4	73.7	67.2	88.4
6	University of Arizona	AZ	113.3	81.4	72.4	-	88.3
7	***Oregon State University***	***OR***	***105.1***	***85.2***	***74.5***	***54.3***	***87.4***
8	Colorado State University	CO	105.4	78.4	67.0	-	83.0
	Weighted Average (without OSU)		120.5	88.6	76.6	52.5	94.3
	Oregon State University % of average		87.2%	96.2%	97.3%	103.4%	92.7%

NOTE: Source data are reported by universities on November 30th of each academic year; therefore, increases awarded after November are not included.

Source: American Association of University Professors, ACADEME: The Annual Report on the Economic Status of the Profession 2003-04, March/April 2004.

Table 9

2003-04 Average Faculty Total Compensation at Peer Universities for UO

Weighted Distribution of Faculty by Rank; Ranked by All Ranks Average

(Dollars in thousands)

Rank	Institution	State	Prof	Assoc	Asst	Instr	All Ranks
1	University of Michigan	MI	142.4	100.8	84.3	74.5	109.1
2	University of Virginia	VA	139.0	95.0	77.5	58.1	103.3
3	University of California Santa Barbara	CA	141.5	91.3	78.2	-	102.8
4	University of North Carolina Chapel Hill	NC	126.4	90.4	76.2	80.0	98.2
5	Indiana University Bloomington	IN	126.5	89.0	76.4	-	96.4
6	University of Iowa	IA	125.5	86.6	77.4	-	95.6
7	University of Colorado Boulder	CO	118.7	87.3	75.2	55.0	93.0
8	University of Washington	WA	113.8	82.4	76.1	53.3	90.0
9	***University of Oregon***	***OR***	***109.7***	***80.7***	***72.0***	***53.2***	***86.9***
	Weighted Average (without UO)		128.8	90.6	78.1	59.6	98.7
	University of Oregon % of average		85.2%	89.1%	92.2%	89.3%	88.0%

NOTE: Source data are reported by universities on November 30th of each academic year; therefore, increases awarded after November are not included.

Source: American Association of University Professors, ACADEME: The Annual Report on the Economic Status of the Profession 2003-04, March/April 2004.

Table 10

2003-04 Average Faculty Total Compensation at Peer Universities for PSU

Weighted Distribution of Faculty by Rank; Ranked by All Ranks Average

(Dollars in thousands)

Rank	Institution	State	Prof	Assoc	Asst	Instr	All Ranks
1	University of Illinois Chicago	IL	122.4	89.4	77.5	61.6	96.0
2	Western Michigan University	MI	122.0	91.9	71.7	55.4	94.6
3	George Mason University	VA	124.1	88.6	70.0	54.0	93.7
4	University of Toledo	OH	116.5	84.2	72.8	59.6	90.9
5	Indiana U/Purdue U at Indianapolis	IN	108.6	86.3	71.0	53.3	87.9
6	San Diego State University	CA	105.5	87.3	74.1	-	87.8
7	University of Wisconsin Milwaukee	WI	105.8	83.9	74.5	52.2	87.2
8	University of Memphis	TN	105.1	79.1	70.0	48.6	83.9
9	***Portland State University***	***OR***	***99.4***	***80.7***	***68.1***	***53.0***	***82.1***
10	University of Texas Arlington	TX	99.1	76.6	71.4	-	81.6
	Weighted Average (without PSU)		113.4	86.0	72.7	54.0	90.0
	Portland State University % of average		87.7%	93.8%	93.7%	98.2%	91.2%

NOTE: Source data are reported by universities on November 30th of each academic year; therefore, increases awarded after November are not included.

Source: American Association of University Professors, ACADEME: The Annual Report on the Economic Status of the Profession 2003-04, March/April 2004.

Table 11

2003-04 Average Faculty Total Compensation at Peer Universities on List Shared by EOU, SOU, and WOU

Weighted Distribution of Faculty by Rank; Ranked by All Ranks Average

(Dollars in thousands)

	Institution	State	Prof	Assoc	Asst	Instr	All Ranks
1	California State Univ Stanislaus	CA	102.6	81.5	64.1	-	82.0
2	University of Michigan Flint	MI	90.0	77.8	66.5	-	77.2
3	University of Wisconsin Parkside	WI	88.8	76.9	65.7	-	76.2
4	Plymouth State University	NH	90.2	74.9	61.4	-	74.8
5	SUNY College at Fredonia	NY	92.5	73.0	58.6	39.8	73.8
6	Mary Washington College	VA	90.9	69.2	53.5	-	71.0
7	***Western Oregon University***	***OR***	***81.0***	***69.0***	***58.5***	***50.4***	***69.1***
8	Southern Utah University	UT	80.4	69.4	57.7	56.1	69.1
9	Southeast Missouri State University	MO	83.0	67.2	57.9	47.5	69.0
10	***Southern Oregon University***	***OR***	***79.4***	***66.0***	***58.5***	***48.1***	***67.5***
11	Eastern Washington University	WA	79.1	65.5	58.8	-	67.4
12	Fort Hays State University	KS	79.0	62.7	54.7	47.6	65.3
13	***Eastern Oregon University***	***OR***	***71.4***	***63.8***	***54.7***	***44.9***	***62.8***
	Weighted Average (without OUS universities)		87.0	70.8	59.3	47.5	71.9
	Eastern Oregon University % of average		82.1%	90.1%	92.2%	94.4%	87.4%
	Southern Oregon University % of average		91.3%	93.2%	98.6%	101.2%	94.0%
	Western Oregon University % of average		93.2%	97.4%	98.6%	106.0%	96.2%

NOTE: Source data are reported by universities on November 30th of each academic year; therefore, increases awarded after November are not included.

Source: American Association of University Professors, ACADEME: The Annual Report on the Economic Status of the Profession 2003-04, March/April 2004.

Table 12

2003-04 Average Faculty Total Compensation at Peer Universities on OIT List
Weighted Distribution of Faculty by Rank; Ranked by All Ranks Average*
(Dollars in thousands)

Rank	Institution	State	Prof	Assoc	Asst	Instr	All Ranks
1	California State Polytechnic Pomona	CA	107.5	86.0	71.7	-	87.4
2	Southern Polytechnic State University	GA	86.5	75.2	62.0	53.8	74.1
3	Purdue University North Central	IN	92.0	72.7	58.4	49.3	74.0
4	University of Houston Downtown	TX	85.3	71.3	61.3	63.0	72.8
5	***Oregon Institute of Technology***	***OR***	***79.6***	***70.1***	***62.2***	***58.2***	***70.5***
6	Western Carolina University	NC	82.5	69.0	60.3	-	70.1
7	East Tennessee State University	TN	81.9	68.8	59.3	45.4	69.4
8	Weber State University	UT	82.5	66.6	59.4	51.4	69.2
9	Pittsburg State University	KS	81.6	68.8	56.9	47.2	68.6
10	SUNY College of Technology at Alfred	NY	82.0	65.5	54.7	47.2	67.1
11	University of Southern Colorado	CO	71.5	57.6	56.5	29.0	60.7
12	West Virginia University Instit of Tech	WV	67.9	56.5	47.8	35.3	56.8
	Weighted Average (without OIT)		86.7	71.2	61.0	48.0	72.4
	Oregon Institute of Technology % of average		91.8%	98.4%	102.0%	121.3%	97.3%

NOTE: Source data are reported by universities on November 30th of each academic year; therefore, increases awarded after November are not included.
Source: American Association of University Professors, ACADEME: The Annual Report on the Economic Status of the Profession 2003-04, March/April 2004.

Table 13

Oregon Universities' Initiatives in AEED Opportunity Areas:

Research Universities

Opportunity Area	OSU	PSU	UO	OHSU
Nanoscience and Microtechnologies	• ONAMI partnership (Skip Rung, Director) – includes UO, PSU, OHSU, PNNL. Also SOU in instructional program. • OSU Multiscale Materials and Devices research cluster • Center for Microtechnology-Based Energy, Chemical, and Biological Systems (MECS) • OSU/PNNL Microproducts Breakthrough Institute • Transparent Electronics research group • OSU Integrated Electronics research cluster • OSU Multiscale Fabrication Facility	• ONAMI partnership • PSU Nanostructures and Microscopy research groups • PSU IC Design and Test Lab • PSU Nanofabrication Electron Microscopy and Microanalysis Facility	• ONAMI partnership • UO Materials Science Institute (MSI) (James Hutchison, Director) – home for ONAMI • Center for Advanced Materials Characterization in Oregon (CAMCOR) (Dave Johnson, Director)– "high tech extension service" • UO Green Chemistry Program– world leader in this area • Oregon Center for Optics	• School of Dentistry – Use of nanotechnology in biomaterials research (e.g., implants) • Clinical research in Medicine not yet connected to ONAMI but discussions under way • Biomedical engineering (OGI) future plan (2-3 years) to appoint faculty with expertise in biological and electrical phenomena at very small scale • OGI Materials and Device research group
Analog Mixed Signal	• OSU has a nationally highly ranked but small AMS group, with high faculty productivity (research and degree production) and sought-after grads. • Internationally known for work on state-of-the-art analog-to-digital and digital-to-analog converters.	• Highly regarded Integrated Circuit Design and Test Laboratory. • Expertise and valuable industry connections in wireless networks, network security, and computer forensics. • Octavian Scientific, Inc., a startup research company, located at PSU (enabled by passage of Ballot Measure 10) to have direct access to PSU's cutting edge research and intellectual property in integrated circuit design and test.		• OGI received $300,000 Intel grant to develop sensors with on-board data processing and wireless communication capability for monitoring and responding to cognitive input. • OGI has NASA-sponsored research in areas of software reliability and safe/secure distributed systems.

Opportunity Area	OSU	PSU	UO	OHSU
Information Technology	• Strong Industrial and Manufacturing Engineering group developing wireless technology applications • National leader in developing Vehicle Mileage Tracking (VMT) application. • Business Solutions Group (in the College of Business) providing product testing and applications development for industry and student internship experience for more than 50 students annually.	• RAINS program (Regional Alliances for Infrastructure and Network Security) – public/private consortium with >60 Oregon companies; PSU is leading academic partner. • PSU Computer Science department one of 50 programs in U.S. awarded Center of Academic Excellence in Information Security Education by National Security Agency.	• Computational Intelligence Research Laboratory – focus on questions in artificial intelligence including search, knowledge representation, and reasoning, has provided basis for UO start-up firm • Computational Science Institute – a multidisciplinary field from which arises technologies that have potential industrial applications	
Sustainability & Renewable Energy	• Sustainable Business Initiative (OSU Coll. of Business) – how to create to performance when bottom line is measure on economic, environmental and social performance. How to manage a product's complete life cycle; how to market "greener" products. • Institute for Natural Resources (Gail Achterman, Director). Interdisciplinary approaches, both within OSU and with other OUS institutions. Plan to grow from $650K annual research grants to $3M. With Sun Grant, renewable energy research to increase from current $1M to $7M by 2006. • Sustainable Plant Research and Outreach Center (SPROUT) – partnership between Oregon Garden Foundation, OSU,	• Sustainability is a priority for the institution, with interdisciplinary research focused on (1) ecosystem health, (2) sustainable cities, (3) voluntary business environmental management, and (4) intelligent transportation systems. • PSU's interdisciplinary water resources faculty group works on issues of sustainability related to water quality, availability, problem remediation, supply, and public policy. • Much research through PSU Department of Environmental Sciences and Resources (ESR). • PSU Business School has several faculty members with expertise in incorporating sustainable strategy,	• UO Dept of Planning, Public Policy and Management – infuses sustainability concepts into all areas of curricula and research (health, community development, public policy, etc.) • Institute for Policy Research and Innovation (Michael Hibbard) – One of the concentrations of IIPR is sustainability, for example in ecological restoration opportunities (e.g., juniper removal); conservation-based development (e.g., range-fed beef). • Institute for a Sustainable Environment (Robert Ribe) - projects assist regions and communities in the Pacific Northwest and around the world to develop and maintain	• OGI Dept. of Environmental and Molecular Systems – focused on connections between human and ecosystem health

Opportunity Area	OSU	PSU	UO	OHSU
	USDA, and other public & private institutions. Focus on use of plants and plant material to create a more sustainable environment. • Rural Studies Program, focused on outreach activities and research partnerships to meet needs of rural Oregon.	management, and accounting. • New certificate program: "Implementing Sustainability: Building Human Capacity for Implementing Best Practices." • Oregon congressional delegation among co-sponsors of proposed HR 4664, would fund 6 "sustainability education centers" across the U.S., modeled after initiatives under way at PSU: "green" capital construction, multi-disciplinary research; public forums and community outreach projects on sustainability.	communities and local economies through sustainable practices. • Institute for Housing Innovations (Don Corner) – is active in multidisciplinary research, planning and public service in the planning, development and creation of sustainable buildings and communities. • Environmental Studies Program (Dan Udovic) • Lundquist School of Business – offers classes that focus on encouraging business practices and process that advance sustainability (Mike Russo) • Solar Energy Center (Frank Vignola) • Energy Studies Laboratory, School of Architecture	
Natural Resources (Agriculture, etc.)	**Water Resources** • Center for Water & Environmental Sustainability (Denise Lach) • > 50 faculty in 6 colleges & 12 departments working on water issues. Faculty research strength; more on editorial boards of top water journals than all UC schools combined. • Working with ONAMI on advanced treatment technologies • New Graduate Program in Water Resources; expect to train	• PSU's Food Industry Leadership Center works with food distributors and retailers. Works with state's food processors and product retailers to help market Oregon products worldwide. • Faculty in PSU's Center for Lakes and Reservoirs research aquatic invasive species related to the agricultural community, esp. in irrigation systems and water resources.		

Opportunity Area	OSU	PSU	UO	OHSU
	75-125 students each year. **Agriculture** • Emphasizing 4 areas in the future: (1) food, nutrition & health; (2) development of bio-based energy & products; (3) water and watersheds; (4) ecological services. • Future economic development initiatives focused on: (1) development of bio-based energy via Sun Grant Initiative; (2) food product development for small scale entrepreneurs; (3) nutritionally-enhanced foods. • Extension Service programs throughout Oregon and 11 branch experiment stations, including Food Innovation Center in Portland (targets collaborative activity with entrepreneurs in food industry). **Forestry** • College of Forestry investing $250K per year in initiatives to address economic & environmental priorities: (1) Forest fuels, fire & forest resilience; (2) water & aquatic resources in private managed forests; (3) forest plantation productivity & value enhancement; (4) wood products innovation management; (5) wood durability in construction; (6)			

Opportunity Area	OSU	PSU	UO	OHSU
	forest-related outdoor recreation & tourism. **Oregon Wine Industry** • Over past 20 years, Oregon's wine industry has grown to >250 wineries; wine sales >$200M. • Developing a new OSU Vine & Wine Institute – integrates and aligns multi-disciplinary teaching and research, field station resources. Partnering with Chemeketa CC. • New integrated Viticulture & Enology B.S. degrees • Development of new marketing and small business programs to sustain small family businesses.			
Neuroscience & Biomedical Research	• Center for Obesity Research and Training (Tammy Bray). Interdisciplinary systems approach to examine critical roles of health behaviors, physical environments, physical activity and nutrition in prevention and treatment of obesity. • Linus Pauling Institute, with major research areas in heart disease, cancer, aging, and neurodegenerative diseases. • Center for Gene Research and Biotechnology, with research in genomics, biocomputing and bioinformatics, and image and image analysis.	• Biomedical Signal Processing (BSP) Lab – extracting clinically significant information from physiologic signals; focus on projects to help physicians make decisions that improve people's lives—e.g, reduce tremors in patients with Parkinson's Disease and treat traumatic brain injury. • Biology faculty working to better understand cellular processes to improve health, in areas such as heart and obesity issues in aging populations; great potential for commercialization. • Engineering faculty developing robotic and adaptive devices at	• Center for Cognitive Neuroscience (Helen Neville, Director) • Brain, Biology, and Machine Initiative – cognitive neuroscience, molecular biology, genetics, computational science • Institute of Neuroscience – basic scientific and biomedical research activity (Biomedical example - gene duplication and anti-cancer drug screening by John Postlethwait) • Institute of Molecular Biology – basic scientific and biomedical research activity (Biomedical example - Mitochondrian Project by Roderick Capaldi.	• OHSU Cancer Institute – world class cancer research (esp. Brian Druker, Craig Nichols) • Center for the Study of Weight Regulation and Associated Disorders • Strength in stem cell research, building on it • Znomics, Inc. – building on high density of zebrafish researchers in Oregon (e.g., UO is home to Zebrafish International Resource Center). OHSU one of only 3 sites in U.S. with unique insertional mutagenesis technology. Permits more efficient and rapid

Opportunity Area	OSU	PSU	UO	OHSU
		various scales in areas such as increasing physical activity, remote surgical procedures, and at the micro and nanoscales devices that work within the body.	Research leading to new approaches for diagnosing diverse sets of diseases.) • Integrated Cognitive Neuroscience, Informatics & Computation (ICONIC) – using computing systems for rapid diagnosis of brain conditions. Joint effort of UO, Electrical Geodesics, Inc., & IBM (Allen Malony). • Oregon Neuroinformatics Center (Allen Malony) • Lewis Center for Neuroimaging (Ray Nunnally) • The Zebrafish International Resource Center is housed at the UO. Its mission is to provide a central repository for wild-type and mutant strains of zebrafish and for materials and information about zebrafish research.	development of targeted drug discovery. • Vaccine & Gene Therapy Institute (VGTI) – infectious diseases, including HIV/AIDS, cancers, biodefense, emerging diseases. • Dentistry: Development of biomimetic materials to form new mineral similar to tooth enamel and dentin; development of new minimally invasive means of detecting early oral cancers (currently having one of lowest survival rates). • Biomedical engineering (OGI): neuroengineering; biomedical optics; cardiovascular; biosensors and nanotechnology • "The Oregon Opportunity" – plan for enhancing OHSU research in biomedical and engineering fields • New OHSU River Campus – goal to bring OHSU to top 20 nationally ranked research institutions
Healthcare Workforce	• Educational programs in preventive health (nutrition and food management, public health, exercise and sports science) through the College of Health and Human Sciences.	• Successes in preparing applicants for medical school admission. • National reputation in preparing students to become physician assistants. • Partnership agreements with	• Public/private partnerships: Human Physiology curriculum partners with MDs to have students do surgical observations, shadow medical professionals in work settings. Curricular model brings med	• Oregon Consortium of Nursing Education (OCNE) – collaborations among all Oregon postsecondary institutions, through interinstitutional agreements supporting dual enrollments,

Opportunity Area	OSU	PSU	UO	OHSU
		OHSU in broad range of research placements for students interested in medical careers. • Partner with OHSU on grant to increase number of underrepresented minority students seeking health careers. • Received funding from ODS for new labs and scholarships for pre-dental program.	school into non-med school environment. • Higher ed partnerships: Exploring partnership with OHSU medicine and nursing (UO for basic science; OHSU for clinical), potential of expanding OHSU capacity in Eugene area	common transcript and financial aid packages, common competencies and curriculum, and shared use of training resources. • Oregon Area Health Education Center (AHEC) – rural community health clerkship; family practice residency training; Oregon Burdick Interdisciplinary Team Training (OrBITT) • Oregon Rural Practice-Based Research Network (ORPRN) – brings latest medications and procedures to rural Oregonians through their own doctors • Plan to meet physician demand: (1) philanthropic and state support to expand Medical School; (2) change in federal guidelines regarding GME funding; (3) develop alternative model for medical education; (4) OHSU-Community health system partnership to increase number of students in clinical setting.
Education & Behavior Intervention	• New double major in School of Education to focus on preparing math and science teachers. • Center for Teaching, Learning, and Collaborative Research, a new center focused on enhancing teaching as an academic discipline.	• Center for Student Success provides services to schools and school districts • More than 10 years of research and development work in children with autism: behavior and educational intervention (Joel Arick, P-I)	• UO research in education & behavior identified by OCKED as one of 5 core research competencies • UO Coll of Educ rated as the most productive education research faculty of all public or private graduate education	

Opportunity Area	OSU	PSU	UO	OHSU
		• Research and development on alternative testing for students with low incidence disorders • Regional Research Institute in Graduate School of Social Work does $5 million in research on education and social service issues • Center for Learning and Teaching funded by NSF to improve teaching of math and science, develop research and a diverse teaching and professorial workforce • Bilingual Teacher Pathway program prepares bilingual teachers for area schools • Portland International Center for Ecology, Culture and Leadership prepares leaders in sustainability education • Center for Science Education: research and support for science in k-12 schools • Research and teacher preparation for inclusive educational environments	programs in the nation for 7 of the last 8 years • Institute on Violence & Destructive Behavior (Hill Walker & Jeff Sprague) – preventing school violence • "Positive Behavior Support" – research by George Sugai & Rob Horner	
K-12 Administrators		• New administrator prep program with start-up resources from congressional earmark to PSU – collaboration with Wallace Foundation, focus on urban and rural schools; 14 licensed administrators produced, all in Oregon schools. • Largest program to prepare school administrators in	• UO Coll. of Educ offers online & on-site training for district and school leadership	

Opportunity Area	OSU	PSU	UO	OHSU
		Oregon.		
Literacy		• Research and development on curriculum and instruction in literacy for students with learning disabilities (Steve Isaacson and Patricia Gildroy) • Research and development in adolescent literacy (Carrol Tama), whole language (Sandra Wilde), second language learning (Yer Thao, Xiaoqin Sun-Irmenger)	• Institute for the Development of Educational Achievement (Deborah Simmons, Ed Kame'enui, Roland Good, David Chard) – research on importance of early development of reading skills (K-3)	
Keeping Top Students in Oregon	**Honors College** • OSU University Honors College (Joe Hendricks, Dean) • Undergraduate research and thesis opportunities in Honors College. • Large percentage of ethnic minority students. **Internships** • Significant learning experiences through structured internships, such as the MECOP/CECOP programs in engineering and MIS. **International Degree Program** • Offered as a double degree, the International Degree program includes educational and cultural experiences in an international community.	• PSU University Honors Program (Lawrence Wheeler, Director) • Honors program aimed at students intending to pursue advanced degree • Emphasis on place-bound and first-generation students • Targeting increased opportunities for upper division students pursuing honors tracks • Emphasis on supporting the Washington, D.C. internship project • Senior thesis under mentorship of senior faculty member in academic major	• UO Clark Honors College (Dick Kraus, Dean) • Importance of opportunities for undergrads to do research • "Professional Distinctions" program – to help students increase their marketability through focused work in a professional area (e.g., writing or data analysis) • Looking at other routes for emergent excellence—first generation, late bloomers. Look at year 3 (junior) instead of year 1 (freshman)	

Opportunity Area	OSU	PSU	UO	OHSU
Arts & Creative Services	• Collaborative program in theatre arts with LBCC.	• PSU creative services initiative—brings together faculty in fine and performing arts, engineering, and business with representatives from creative industry cluster to deliver novel programs directed to workforce needs in this sector. • Opera program has received first place awards for productions. • PSU's Leroy Vinnegar Jazz Institute focuses on important historical, cultural, and economic role jazz can play in Oregon. Focal point for region's music/tourism industry, attracting outstanding student musicians, supporting region's jazz musicians.	• UO Art Museum (Christie McDonald) – focus on Asian art collections • Arts Bridge Program • Oregon Humanities Center	
Leisure, Recreation, & Sports	• New degree in Outdoor Recreation Leadership and Tourism offered at OSU-Cascades Campus.		• Warsaw Sports Marketing Center (Paul Swangard) – brings together Nike, Columbia, Addidas North America. Portland as a Silicon Valley for design and creative energy. Future marketing center in China (Shanghai) • Festival and Event Management Certificate – classes and guidance offered to regional leaders in nonprofits and tourism organizations related to festival and event management.	

Opportunity Area	OSU	PSU	UO	OHSU
Interdisciplinary and Cross-disciplinary; Other	• Austin Entrepreneurship Program (Jon Down, Director) – housed at new Weatherford Hall facility; center of campus-wide integration of entrepreneurship efforts (residential, instructional, research, business community connections). • A number of interdisciplinary programs including programs in Environmental Sciences, Natural Resources, Water resources, and International Studies.	• Business Accelerator (College of Business) under development – cooperative effort with Portland Development Commission and "Starve Ups" (group of start-up company founders). Will provide opportunities for faculty and students to work with start-up companies; build additional long-term funding sources; build long-term relationships for PSU. • Business School MBA collaboration with Lewis & Clark law school to facilitate tech transfer for local organizations (e.g., OHSU). • Center for Emerging Technologies brings together faculty from science, engineering, & business to accelerate development of new interdisciplinary research and products. • Other Education focus: Preparing Math & Science teachers – multiple sources of funding, including NSF Center for Learning & Teaching in the West, NCLB, Boeing, etc. Encourages collaborations with university math/science faculty. Results: 3X grads in 2 years. • PSU water resources research group – faculty from sciences, engineering, geography, environmental sciences, and	Cross disciplinary work: • Neuroscience (brain) and education • Nanoscience (Materials science, chemistry) and neuroscience • Information technology and biomedical research (e.g., Oregon NeuroInformatics Center) • Sustainability • Information Technology and Neuroscience (e.g. Zebrafish Information Network) • Technology and Entrepreneurship Fellows Program – collaboration between UO Lundquist College of Business Center for Entrepreneurship, UO Law School, UO Material Science Institute and the Pacific Northwest National Laboratory - enables science, business and law students interested in technology and entrepreneurship to participate actively in evaluating, developing, and launching high-technology start-up businesses.	• Biomedical engineering at OGI – new program, admitted first class in 2003. Interdisciplinary perspectives to address common problems. • OGI Center for Spoken Language – speech technology research group focused on human health

Opportunity Area	OSU	PSU	UO	OHSU
		urban/public affairs; focus on civic involvement, government policies, regulations regarding water quality, availability, and supply.		

Table 14

Oregon Universities' Initiatives in AEED Opportunity Areas: Regional Universities and OIT

Opportunity Area	EOU	SOU	WOU	OIT
Nanoscience and Microtechnologies	• Collaboration with OHSU – OGI on proposed ETIC funded enhancement of biomedical/nanoscience research on EOU campus.	• Collaborative Materials Science program with UO, fully implemented 2004-05 • SOU Ferroelectrics Research Project (NSF funded) – internationally known; includes opportunities for undergraduate research and publication		• Oregon Renewable Energy Center (OREC) – opportunities in microsensors for "smart energy" and ground source heat pumps, wireless sensor deployment in healthcare
Analog Mixed Signal				
Information Technology	• EOU and PSU's Engineering program will explore Computer Science articulation.	• Computer Science Department: data mining, computer security, HIPAA, computer forensics • Focus on cyber security • RAINS-NET steering committee (Regional Alliances for Infrastructure and Network Security) • Spatial data structures – patent just submitted	• Computer Science Division collaborates with ETIC to double the number of graduates in IT • Seniors in Computer Science are required to complete an internship through which they work directly with Oregon employers to enhance productivity.	• B.S. in IT – expanding distance delivery of bacc. IT degree and a minor in collaboration with EOU. • Collaborations with high tech and healthcare industries to customize educational programs to meet special needs and provide access through web-based delivery. • Ongoing IT initiative in ETIC to double IT grads.
Sustainability & Renewable Energy	• Science Center hosting ODFW – research on water use and sustainability • ODFW partnership with Confederated Tribes of the Umatilla Indian Reservation on fish pathology research	• Member of Pacific Northwest Cooperative Ecosystems Studies Unit (CESU) – 3 research grants from this collaboration • Southern Oregon Institute for Environmental Studies – aligns SOU's sciences, social sciences and public policy programs with	• Natural Science Division maintains collaborative teaching and research efforts with the Luckiamute Watershed Council. • Environmental Science Institute offers research and teaching opportunities throughout Oregon and abroad.	• Oregon Renewable Energy Center (OREC) – "smart energy" (convergence of telecommunications, computing and energy); wind energy pricing modeling for City of Portland; residential building energy performance monitoring; innovative building energy

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		the character and needs of the region • Planned Sciences addition to include Health-Technology-Environment Center • Organic Spectroscopy Laboratory and Biotechnology Research Center – received grants of >$750,000.		systems; diesel electric hybrid vehicles; fuel-cell powered vehicles; electricity generation using low temperature waste heat; combined solar panel-inverter "appliance" systems. • Geo-Heat Center (John Lund, Director) – geothermal energy applied research since 1975; collaborations with Oregon Department of Energy.
Natural Resources (Agriculture, etc.)	• New Science Center hosts agriculture-related disciplines in partnership with OSU-Agriculture Science Program and Oregon Dept of Fish & Wildlife research unit, providing potential for strong collaborations • Site for ODFW research on salmon recovery • Desire to better connect to Agricultural Experiment Stations and Extension Programs in the region • Interest in enhancing agriculture, forestry and natural resources curriculum and research program in partnership with OSU	• Research on viticulture and climatological conditions (Greg Jones) – internationally recognized; developed a model that assesses a particular plot's promise as a vineyard. • Grants from Oregon Wine Board to establish multiple varietal reference vineyards in Umpqua and Rogue/Applegate valleys.	• Service Learning project in Precision Agriculture resulted in development of a remote sensing application for a berry grower in Oregon who needed help with his operation in Mexico	
Neuroscience & Biomedical Research	• Partnership with OHSU to provide biotechnology research facilities in new Science Center	• Research areas: biotechnology, microbiology and health, environmental health, laser deposited sensors, nutrition and health • Sophisticated biotechnology research instrumentation	• WOU Neurocognitive Laboratory houses a 32-channel EEG/ERP system that records brain activity of human subjects during cognitive and behavioral tasks.	

Opportunity Area	EOU	SOU	WOU	OIT
		• Area attracts small businesses related to healthcare (e.g., BioMed Diagnostics) • Center for Rural Nursing Research		
Healthcare Workforce	• OHSU Nursing program on EOU campus and throughout the region via federally supported Frontier Delivery Program • OHSU research facilities in new Science Center • Joint program in Dental Hygiene, with OIT and ODS • Proposed OIT/SOU/EOU Policy Package for 2005-07: Productivity in Nursing Education and the Allied Health Professions	• Emphasis on liberal arts to provide model integration of nursing & lib arts • Pre-Nursing curriculum in anatomy & physiology; microbiology; chemistry, nutrition, human development • Proposed OIT/SOU/EOU Policy Package for 2005-07: Productivity in Nursing Education and the Allied Health Professions	• WOU has pre-professional programs in dental hygiene, dentistry, medicine, nursing, occupational therapy, optometry, physician assistant, pharmacy, physical therapy, podiatry, and veterinary medicine.	• Center for Health Professions: OIT – Radiologic science, nuclear medicine, diagnostic medical sonography, vascular tech, dental hygiene, health sciences, respiratory therapy OIT/OHSU – Clinical laboratory science, emergency medical technology OHSU – Nursing • Proposed OIT/SOU/EOU Policy Package for 2005-07: Productivity in Nursing Education and the Allied Health Professions • Partnerships with community colleges, hospitals, and equipment vendors to maximize efficiencies for resources and continuing professional development • Digitization in health care
Education & Behavior Intervention	• EOU has regional programs in teacher licensure aimed at providing access for those who are time and place bound. • Graduate programs in special education, literacy, and English		• Teaching Research, in collaboration with College of Education – national reputation; multi-disciplinary program of research, evaluation, program/model development,	

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	for Speakers of Other Languages serve the special needs of rural Oregonians. • EOU has, over the last decade, developed several science education grants with NSF, DOD, DOE, and ODE to develop science curriculum and teacher in service.		training, technical assistance, direct service. • State level teacher quality and teacher effectiveness projects • "SimSchool" – funded by U.S. Dept of Education – to refine and disseminate an interactive simulation tool to help prospective teachers practice making instructional decisions and assess their ability to impact student learning. Based on Teacher Work Samples methodology. • Contextual teaching and learning – innovative partnerships with Ohio State University and George Washington University • Research in Traumatic Brain Injury – Oregon TBI consulting team; Oregon Brain Injury Resource Network; studying resilience in students with TBI	
K-12 Administrators	• EOU has strong ties to regional K-12 • EOU collaborates with Lewis and Clark College to help serve rural Oregon with administrator licenses	• Remote location and growing demand for school administrators putting pressure on SOU and RCC to develop SOU-based doctoral program (rather than relying on UO- or PSU-based programs).	• Teaching Research and the College of Education are providing scholarships to future teachers who are willing to work in the schools with the highest needs and for teachers currently working in high need schools to support coursework in specific areas such as special education, bilingual/ESOL, and literacy.	• Pre-college programs • Support for development of a high school with a technology focus sponsored by Klamath Falls City Schools

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Literacy	• EOU is a leader in the State in Reading and Literacy Education		• Participating institution in Collaborative Reading Endorsement And Distance Education (CREADE) • Working with Oregon Department of Education to address literacy needs of secondary level students • Partnerships with local schools (WOU literacy courses co-taught onsite with one-on-one time with struggling readers) • Teaching Research – Training in Early Literacy – Partnerships for Early Childhood Educators in Rural Communities (PERC) – to maximize literacy learning in rural areas	
Keeping Top Students in Oregon	• EOU has a distinctive Honors Program that stresses civic engagement via service learning.	• Freshman Honors program focused on special honors classes in a variety of disciplines. • Churchill Honors Program offers 3-year humanities-based study with special emphasis on ethics, with senior year focus on research-based community service projects in their majors.	• Four-year Honors Program focuses on interdisciplinary courses in the first year, with an array of arts and sciences courses in the remaining 3 years, and thesis work in the 3rd and 4th years. • Two-year Honors Associate Program – students enter in their junior year, either after completing the first 2 years at WOU, or by transferring from another college (most likely with a Block Transfer from an Oregon community college). • Teaching Research and WOU Coll. of Education are providing scholarship support for future teachers who are willing to	• Honors College emphasizing undergraduate research with an integrated team approach in the Oregon Renewable Energy Center, available to students in all engineering-related programs.

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			teach in high need schools.	
Arts & Creative Services	• EOU has initiated the Community School of the Arts outreach program in the creative, visual and performing arts offering instruction in the community and region • Working in partnership with regional tourism agency and Chamber of Commerce, EOU is jointly producing arts programming for eastern Oregon • The Eastern Oregon Regional Arts Council (EORAC) is based on the EOU campus. • EORAC and EOU partner in writing grants and producing arts programs for eastern Oregon.	• SOU has been an incubator for Arts & Culture enterprises, with involvement in the founding of the SOU initiatives including Oregon Cabaret Theater, Cascade Theatre Restoration Project, the design of Craterian Theatre in Medford , and the establishment of the Oregon Shakespeare Festival. • Building on its responsiveness to this sector, SOU plans to expand student opportunities for community engagement by seeking support to develop a systematic and integrated set of arts internships. • Campus resources include KSOR, the flagship of Jefferson Public Radio, reaches > 1 million in 60,000 sq mi area; Rogue Valley Community Television; and the 11 sq foot Center for Visual Arts. • SOU's American Band College is a summer program providing master's level education to 200 students from across the U.S. and around the world. SOU plans to replicate this model with programs in theatre and other areas. • SOU plans to expand capacity	• WOU's Summer Jazz Workshop attracts high school musicians from across the state. • WOU Symphony provides employment and cultural opportunities throughout the mid-Willamette Valley. • Rainbow Dance Theatre is a professional dance troupe in residence at WOU. • Salem Repertory Theatre is a professional acting company in residence at WOU. • The Smith Fine Arts Series provides opportunities for residents from the mid-Willamette Valley and beyond to enjoy international performing arts groups. Visiting performers frequently present outreach performances to K-12 students in the area. • Well-known educators, writers, artists, and others present public lectures as part of the Endowed Jensen Lectureship.	• Klamath Community TV created in partnership with City of Klamath Falls and Klamath County. OIT develops and manages educational programs including creative programs for young children (e.g., "Mother Goose") funded by Oregon Community Foundation.

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		in areas of the fine and performing arts, which provide a practical, interdisciplinary arts education that is connected to specific arts industry opportunities-music performance, technical theatre and video/digital arts. • SOU's Center for Shakespeare Studies, Schneider Museum of Art and summer programs will continue to provide audience development and community education in the arts, building future audiences and markets for the arts.		
Leisure, Recreation, & Sports		• Coursework for teachers in recreation and leisure activities • Curriculum linked to study of outdoor and recreational aspects of Business, Psychology, and Education		
Interdisciplinary and Cross-disciplinary; Other	• New Science Center will serve as catalyst and host for collaborations across disciplines and sectors – in agriculture, natural resources, health, biotechnology	• Strategic initiatives for development of the study of Family Health and Well-being, Global and Multicultural studies, and Environmental studies. • Linkage of First Nations Studies curriculum across Social Science disciplines.	• Regional Resource Center on Deafness – oversees Region X continuing ed opportunities throughout Alaska, Idaho, Oregon, & Washington for interpreters; provides consultation and training for needs of deaf and hard-of-hearing individuals • Service Learning undergraduate applied research projects provide business performance enhancements for private, public, and nonprofit organizations.	• Active faculty collaborations across disciplines (e.g., computer technology, information technology, and health sciences) • Active program in pre-college initiatives and collaborating with Saturday Academy and OSU Extension.

Appendices

Research and Development Indicators in Selected Countries

	Total Population (July 2004 Estimates)	Total R&D Expenditures, 2001 or Latest (million $)	R&D Expenditure per Capita ($)	R&D Expenditure as % of GDP	Science & Engineering Articles	First University Degrees	24-year-olds	Ratio First Univ Degrees to 24-year-old Population
Europe								
Austria	8,174,762	4,158	513	1.91	4,526	15,132	92,400	16.4
Belgium	10,348,276	4,725	462	1.98	5,984	22,526	125,200	18.0
Denmark	5,413,392	3,093	583	2.15	4,988	11,951	65,000	18.4
Finland	5,214,512	4,335	836	3.42	5,098	25,269	65,600	38.5
France	60,424,213	31,265	528	2.20	31,317	275,316	762,200	36.1
Germany	82,424,609	52,134	633	2.50	43,623	178,618	892,800	20.0
Iceland	293,966	257	911	3.04	174	1,318	4,200	31.4
Ireland	3,969,558	1,443	376	1.16	1,665	18,669	69,000	27.1
Italy	58,057,477	14,986	260	1.07	22,313	150,677	726,600	20.7
Netherlands	16,318,199	8,344	524	1.95	12,602	69,809	187,000	37.3
Norway	4,574,560	2,187	485	1.64	3,252	22,421	54,400	41.2
Russia	143,782,338	11,967	83	1.16	15,846	554,814	2,170,000	25.6
Sweden	8,986,400	9,606	1,083	4.61	10,314	34,097	102,200	33.4
Switzerland	7,450,867	5,266	734	2.64	8,107	19,028	76,600	24.8
United Kingdom	60,270,708	27,014	459	1.90	47,660	274,440	696,600	39.4
North America								
Canada	32,507,874	16,328	531	1.94	22,626	116,160	397,200	29.2
United States	**293,027,571**	**274,642**	**963**	**2.80**	**200,870**	**1,253,121**	**3,703,000**	**33.8**
Asia								
China	1,298,847,624	55,543	44	1.09	20,978	567,839	19,639,000	2.9
Japan	127,333,002	98,605	776	3.09	57,420	542,314	1,719,400	31.5
South Korea	48,598,175	21,113	446	2.96	11,037	209,747	783,600	26.8
Middle East								
Israel	6,199,008	6,249	1,023	4.89	6,487	30,267	102,200	29.6
Oceania								
Australia	19,913,144	7,205	289	1.53	14,788	112,745	269,200	41.9

Sources: (1) UNESCO Institute for Statistics (R&D expenditures; school life expectancy). (2) National Science Board, *Science and Engineering Indicators 2004* (S&E articles; degrees data). (3) U.S. Central Intelligence Agency, *The World Fact Book* (online version).

Research and Development Indicators in Selected Countries

	All Doctoral Degrees	Science & Engineering Doctoral Degrees	Science & Engr % of All Doctoral Degrees	Science & Engr Doct. Degrees per 100,000 Population	School Life Expectancy (Years)
Europe					
Austria	1,790	913	51.0	11.17	15
Belgium	1,147	789	68.8	7.62	16
Denmark	913	462	50.6	8.53	15
Finland	1,891	974	51.5	18.68	NA
France	9,903	6,577	66.4	10.88	15
Germany	24,796	11,803	47.6	14.32	15
Iceland	-	-	-	-	16
Ireland	501	325	64.9	8.19	
Italy	3,557	1,731	48.7	2.98	15
Netherlands	2,483	1,309	52.7	8.02	16
Norway	658	195	29.6	4.26	17
Russia	18,274	10,409	57.0	7.24	NA
Sweden	3,049	1,848	60.6	20.56	16
Switzerland	2,733	1,223	44.7	16.41	15
United Kingdom	14,208	8,521	60.0	14.14	16
North America					
Canada	3,978	2,249	56.5	6.92	15
United States	**40,744**	**25,509**	**62.6**	**8.71**	**15**
Asia					
China	13,001	8,153	62.7	0.63	NA
Japan	16,078	7,401	46.0	5.81	14
South Korea	6,143	2,865	46.6	5.90	15
Middle East					
Israel	688	497	72.2	8.02	15
Oceania					
Australia	3,687	2,030	55.1	10.19	17

Appendix B

2002 State New Economy Index - Ranked by Overall Score

	State	2002 Overall Score	Change from 1999	Rank in 1999	Knowledge Jobs	Info. Tech. Jobs	Managerial, Prof. Tech. Jobs	Workforce Education	Educ. Level of Manufacturing Workforce	Globalization	Export Focus of Manufacturing	Foreign Direct Investment	Economic Dynamism	Gazelle Jobs
1	Massachusetts	90.0	7.7	1	14.59	2.50%	31.40%	58.2	1.13	11.18	$38,209	6.00%	16.19	15.40%
2	Washington	86.2	17.2	4	13.24	2.80%	27.70%	53.1	1.53	11.35	$82,911	3.70%	19.83	16.50%
3	California	85.5	11.2	2	11.92	2.20%	28.80%	48.2	1.65	11.26	$65,021	4.60%	16.56	15.60%
4	Colorado	84.3	12.0	3	15.15	3.30%	28.30%	59.6	1.4	11.11	$66,182	4.30%	14.08	14.20%
5	Maryland	75.6	16.4	11	14.78	2.40%	31.40%	60.9	0.95	9.49	$29,243	4.10%	12.26	14.10%
6	New Jersey	75.1	14.2	8	11.65	1.90%	27.80%	52	1.15	12.66	$68,225	6.30%	10.42	12.40%
7	Connecticut	74.2	9.3	5	12.69	2.20%	28.50%	56	0.82	11.65	$46,347	6.20%	11.39	14.60%
8	Virginia	72.1	13.3	12	13.33	2.50%	28.00%	59.1	0.47	10.18	$31,182	5.00%	12.81	14.70%
9	Delaware	70.5	10.6	9	11.55	2.10%	27.20%	51.1	1.09	15.26	$122,362	6.90%	7.7	11.00%
10	New York	69.3	14.8	16	11.8	1.70%	27.80%	53.8	1.2	11.74	$71,676	4.90%	10.11	13.10%
11	**Oregon**	**68.9**	**12.8**	**15**	**12.63**	**1.50%**	**31.40%**	**52.3**	**1.66**	**9.81**	**$44,549**	**3.70%**	**10.6**	**13.70%**
12	Minnesota	68.7	12.2	14	12.39	1.90%	27.80%	56.1	0.99	9.79	$47,600	3.50%	10.18	13.90%
13	Utah	68.7	4.7	6	11.46	2.20%	24.60%	52.8	1.4	8.58	$21,286	3.30%	12.03	14.20%
14	Texas	67.6	15.3	17	10.2	1.90%	27.80%	43.5	1.25	11.21	$65,281	4.50%	12.8	15.20%
15	New Hampshire	67.6	5.1	7	12.48	1.50%	27.20%	58	1.56	10.5	$22,314	6.00%	9.59	14.50%
16	Arizona	67.2	8.0	10	9.22	1.90%	25.20%	44	0.88	9.34	$40,694	3.30%	13.51	15.70%
17	Illinois	64.7	16.3	22	11.28	1.70%	28.30%	50.8	1.01	10.28	$37,726	4.80%	11.17	13.40%
18	Florida	62.7	11.9	20	9.36	1.50%	24.90%	46.3	1.16	10.62	$56,588	4.20%	12.83	14.40%
19	Pennsylvania	62.3	15.6	24	10.42	1.40%	26.30%	51.2	0.95	10.04	$33,165	4.70%	9.87	13.40%
20	Idaho	61.6	13.7	23	9.76	1.40%	27.40%	45.4	1.19	9.39	$39,778	3.40%	8.72	12.00%
21	Rhode Island	61.5	16.2	29	11.06	1.60%	25.60%	53.8	1.2	9.39	$18,154	4.70%	7.76	13.70%
	U.S.	**60.3**	**12.2**		**10**	**1.70%**	**26.50%**	**49.2**	**1.0**	**10.0**	**$42,913**	**4.70%**	**10.0**	**13.80%**
22	Georgia	60.1	13.5	25	9.35	1.80%	24.80%	44.8	1.04	10.39	$26,811	5.60%	12.44	13.50%
23	Michigan	60.0	15.4	34	10.39	1.30%	25.70%	50.5	1.52	11.42	$53,783	5.40%	7.87	12.60%
24	Missouri	58.9	14.7	35	10.04	1.70%	25.20%	50.4	0.67	8.83	$21,252	3.70%	11.5	13.90%
25	Maine	58.3	12.7	28	10.53	1.40%	30.40%	45.6	1.11	10.1	$19,657	5.60%	8.44	11.90%
26	North Carolina	57.5	12.3	30	9.45	1.70%	24.90%	47.7	0.63	11.09	$23,904	6.70%	10.12	13.50%
27	New Mexico	57.2	5.8	19	9.96	2.20%	27.30%	42.7	0.81	7.46	$12,980	2.20%	8.28	11.40%
28	Vermont	56.9	5.0	18	8.83	0.90%	23.40%	51.5	0.65	10.6	$56,925	4.10%	8.31	13.90%
29	Kansas	56.7	10.9	27	10.34	1.70%	26.60%	52	0.12	9.28	$24,100	4.20%	8.38	13.50%
30	Ohio	56.5	11.7	33	9.47	1.30%	25.30%	48.2	0.98	9.89	$29,524	4.70%	7.47	13.30%
31	Alaska	56.3	-1.4	13	9.76	1.10%	27.10%	51.5	0.19	12.76	$115,098	3.80%	8.02	11.70%
32	Nevada	55.7	6.7	21	5.53	0.90%	18.60%	38.8	1.22	9.9	$53,540	3.30%	11.77	13.10%
33	Nebraska	54.4	12.6	36	9.91	1.60%	25.30%	46.6	1.56	8.71	$33,079	2.80%	7.8	12.80%
34	Oklahoma	54.1	15.5	40	8.91	1.10%	25.60%	47.5	0.69	8.29	$19,927	3.00%	12.43	14.20%
35	Hawaii	53.7	7.6	26	10.07	1.10%	23.00%	53.3	1.76	12.69	$34,699	8.30%	5.43	8.50%
36	Montana	52.8	23.8	46	9.96	0.90%	26.90%	51.2	1.04	9.26	$33,385	3.60%	7.45	10.80%
37	Indiana	52.8	11.8	37	8.02	0.90%	22.10%	46.6	1.28	10.22	$22,406	5.60%	8.52	12.30%
38	Iowa	52.2	18.7	42	9.22	1.20%	24.80%	47.5	1.3	7.87	$14,535	2.70%	8.48	11.70%
39	Tennessee	52.2	7.1	31	8.26	1.20%	23.10%	48.6	0.39	10.45	$26,083	5.70%	9.63	12.60%
40	Wisconsin	52.0	7.1	32	9.15	1.20%	23.00%	49.3	1.33	8.79	$21,403	3.60%	6.92	11.90%
41	South Carolina	51.1	11.4	38	7.3	0.90%	23.30%	45	0.39	11.61	$23,974	7.40%	9.08	13.20%
42	Kentucky	48.6	9.2	39	7.45	0.90%	22.80%	42.7	1.33	10.49	$31,120	5.40%	8.41	12.80%
43	South Dakota	47.4	15.1	43	8.33	1.20%	21.80%	47.5	1.17	6.92	$8,601	1.70%	8.26	14.00%
44	North Dakota	46.1	17.1	45	8.04	0.30%	23.60%	50.5	0.73	8.31	$31,317	2.40%	4.96	10.00%
45	Louisiana	45.9	17.7	47	6.65	0.80%	24.40%	39.3	0.74	8.52	$20,058	3.30%	9.45	13.00%
46	Wyoming	45.7	11.2	41	7.13	0.70%	24.40%	43.1	0.5	7.96	$14,074	2.90%	6.68	10.30%
47	Alabama	45.3	13.0	44	7.1	0.90%	24.20%	43.4	0.18	9.04	$19,717	4.10%	9.17	13.60%
48	Arkansas	41.7	15.5	49	5.9	0.50%	21.30%	44.6	0.01	8.14	$11,110	3.30%	8.38	11.80%
49	Mississippi	40.9	18.3	50	7.29	0.60%	22.30%	45.7	1.01	7.3	$9,650	2.20%	9.7	14.70%
50	West Virginia	40.7	13.9	48	6.71	0.80%	24.20%	38.7	0.98	8.9	$20,361	3.80%	6.26	11.20%

Source: Progressive Policy Institute 2002.

2002 State New Economy Index - Ranked by Overall Score

	State	The Digital Economy	Online Population	Internet Domain Names	Technology in Schools	Digital Government	Online Agriculture	Online Manufacturers	Broadband Telecommunications	Innovation Capacity	High Tech Jobs	Scientists and Engineers	Patents	Industry Investment in R&D	Venture Capital
1	Massachusetts	14.06	56.70%	1.34	1.06	3.06	3.8	87.50%	5.42	18.58	10.40%	0.92%	0.94	2.45%	3.58%
2	Washington	13.64	61.30%	0.97	1.95	4.38	3.9	87.00%	4.03	13.41	6.60%	0.59%	1.03	2.25%	1.34%
3	California	13.72	52.10%	1.86	0.02	3.68	3.7	84.50%	5.22	17.41	8.90%	0.62%	1.2	2.56%	3.39%
4	Colorado	12.43	60.10%	1.04	2.31	2.79	3.9	86.60%	3.47	17.14	10.00%	0.63%	1.21	2.18%	3.00%
5	Maryland	11.89	61.40%	1.25	0.87	3.57	2.8	81.70%	3.76	14.22	6.60%	1.05%	1.01	1.18%	1.31%
6	New Jersey	12.72	60.00%	1.13	2.01	3.6	2.6	79.80%	4.74	14.8	7.10%	0.63%	1.29	3.21%	1.21%
7	Connecticut	12.41	58.60%	1.01	0.42	3.11	3.8	87.90%	4.43	13.34	6.60%	0.65%	1.13	2.16%	1.01%
8	Virginia	12.1	58.50%	1.2	2.81	3.3	2.8	87.20%	3.04	11.36	7.50%	0.56%	0.51	1.15%	1.11%
9	Delaware	9.21	58.40%	1.08	3.58	2.78	2.8	66.70%	2.38	14.72	3.40%	1.07%	1.49	3.63%	0.31%
10	New York	11.68	53.00%	1.27	0.86	3.72	3.9	77.40%	4.44	12.09	5.30%	0.56%	1.06	1.87%	0.90%
11	**Oregon**	**12.62**	**61.20%**	**0.83**	**2**	**3.16**	**4.6**	**88.70%**	**3.35**	**11.45**	**6.30%**	**0.52%**	**0.81**	**1.33%**	**0.96%**
12	Minnesota	12.38	63.50%	0.69	3.21	3.1	2.9	91.70%	3.06	12.17	6.90%	0.48%	1.05	2.10%	0.64%
13	Utah	13.25	61.40%	1.1	2.47	3.57	3.9	87.80%	3.42	11.62	6.40%	0.52%	0.85	1.54%	0.90%
14	Texas	11.04	51.20%	0.8	2.63	4.34	2.7	85.30%	3.58	10.8	5.70%	0.39%	0.83	1.51%	0.86%
15	New Hampshire	10.89	63.50%	0.96	0.49	1.76	3.8	85.80%	3.23	12.54	9.60%	0.43%	0.49	1.70%	1.56%
16	Arizona	12.15	53.10%	1.34	1.65	2.69	3.9	86.00%	3.96	11.51	5.80%	0.38%	0.95	3.00%	0.39%
17	Illinois	10.87	51.30%	0.88	2.06	3.55	3.6	85.50%	3.44	10.01	4.80%	0.41%	0.65	1.83%	0.54%
18	Florida	10.67	52.00%	1.11	1.16	3.83	2.8	81.40%	3.77	8.53	4.30%	0.26%	0.66	0.80%	0.50%
19	Pennsylvania	10.04	55.00%	0.74	1.42	3.85	2.6	86.40%	2.98	11.29	4.60%	0.50%	0.81	2.76%	0.54%
20	Idaho	10.14	55.80%	0.49	2.87	2.6	5	84.20%	2.41	13.07	5.90%	0.44%	1.53	3.68%	0.04%
21	Rhode Island	10.34	56.70%	0.77	1.39	1.64	3.8	79.40%	4.22	12.44	4.40%	0.64%	0.72	4.29%	0.41%
	U.S.	**10.0**	**54.00%**	**0.95**	**2.0**	**3.0**	**3.0**	**84.50%**	**3.0**	**10.0**	**5.30%**	**0.49%**	**0.8**	**1.91%**	**1.10%**
22	Georgia	8.46	50.30%	0.91	1.6	2.95	1.1	84.50%	3	9.15	4.80%	0.32%	0.52	0.80%	0.93%
23	Michigan	10.61	56.40%	0.59	1.35	4.49	2.9	87.70%	3.1	9.42	3.20%	0.40%	0.69	2.33%	0.17%
24	Missouri	10.27	57.30%	0.52	2.94	3.06	2.9	86.00%	2.89	8.15	3.80%	0.38%	0.45	0.81%	0.34%
25	Maine	11.38	60.40%	0.57	2.79	3.7	3.8	89.50%	2.39	7.87	3.30%	0.44%	0.32	0.48%	0.49%
26	North Carolina	7.22	47.20%	0.63	0.84	3.45	2	84.10%	2.41	9.82	4.50%	0.46%	0.49	1.69%	0.69%
27	New Mexico	7.92	49.80%	0.71	1.32	1.39	3.9	82.10%	2.66	13.77	5.80%	1.21%	0.77	3.15%	0.02%
28	Vermont	7.94	60.50%	0.63	1.84	0.93	3.8	81.20%	1.55	11.53	6.30%	0.70%	0.83	1.73%	0.27%
29	Kansas	10.65	58.00%	0.48	2.74	3.6	2.6	85.60%	3.22	8.34	3.90%	0.32%	0.42	1.31%	0.40%
30	Ohio	11.3	55.00%	0.62	3.47	3.85	2.8	87.50%	3.22	8.68	3.50%	0.41%	0.57	1.44%	0.18%
31	Alaska	8.98	68.80%	0.63	3.35	2.83	2.7	72.40%	1.23	7.17	2.10%	0.48%	0.48	0.18%	0.01%
32	Nevada	11.97	52.10%	1.71	0.35	3.03	3.9	78.30%	4.45	7.03	2.70%	0.22%	0.57	0.70%	0.04%
33	Nebraska	10.98	55.40%	0.41	3.82	3.18	3.1	84.60%	3.62	7.66	4.90%	0.33%	0.34	0.42%	0.16%
34	Oklahoma	8.03	49.70%	0.46	1.81	1.25	1.9	88.00%	3.52	7.17	2.90%	0.34%	0.47	0.46%	0.05%
35	Hawaii	8.89	50.90%	1.16	1.95	2.54	2.7	72.70%	3.26	7.47	2.00%	0.50%	0.36	0.11%	0.48%
36	Montana	9.21	57.60%	0.36	1.65	2.97	4.5	87.30%	1.86	7.84	1.80%	0.51%	0.67	0.24%	0.17%
37	Indiana	9.63	55.50%	0.49	2.07	4.29	2.6	89.00%	2.19	7.39	3.40%	0.34%	0.39	0.66%	0.16%
38	Iowa	9.87	58.30%	0.3	3.37	2.83	3.5	86.90%	2.3	7.85	3.90%	0.34%	0.56	0.71%	0.03%
39	Tennessee	7.64	52.50%	0.58	1.33	2.07	1.3	86.50%	2.78	7.27	2.60%	0.34%	0.34	1.01%	0.13%
40	Wisconsin	10.08	57.00%	0.47	2.59	3.33	3	87.70%	2.61	8.18	3.50%	0.35%	0.52	1.24%	0.17%
41	South Carolina	7.7	47.70%	0.46	2.94	2.73	1.6	88.40%	2.27	6.7	2.50%	0.29%	0.24	0.57%	0.29%
42	Kentucky	7.32	53.20%	0.43	2.59	2.89	0.1	87.80%	2.14	6.64	2.50%	0.27%	0.3	0.53%	0.21%
43	South Dakota	9.27	58.80%	0.29	3.64	3.43	2.9	84.30%	1.79	6.54	4.70%	0.31%	0.13	0.06%	0.01%
44	North Dakota	9.66	56.50%	0.37	2.94	3.38	3.6	90.30%	1.73	7.24	2.60%	0.44%	0.39	0.55%	0.00%
45	Louisiana	7.04	43.40%	0.48	0.39	3.2	1.9	88.90%	2.99	6.35	1.60%	0.33%	0.41	0.17%	0.08%
46	Wyoming	9.59	62.30%	0.35	3.05	1.57	3.9	88.60%	1.78	6.53	1.40%	0.41%	0.43	0.18%	0.00%
47	Alabama	5.07	46.20%	0.52	0.42	1.54	1.9	79.80%	2.3	7.15	3.30%	0.36%	0.24	0.54%	0.27%
48	Arkansas	6.06	44.30%	0.32	1.66	3.14	1.9	86.00%	1.88	6.07	2.40%	0.27%	0.21	0.40%	0.01%
49	Mississippi	3.74	41.80%	0.32	1.05	2.11	0.8	83.40%	1.55	5.9	1.90%	0.30%	0.21	0.20%	0.03%
50	West Virginia	5.26	46.70%	0.37	2.9	2.16	2.8	77.40%	0.96	6.62	2.10%	0.34%	0.33	0.61%	0.01%

Appendix C
Oregon Postsecondary Education Economic Investment
Strategy Development Matrix

Economic Investment Focus	Short-Term (1 to 5 years)	Medium-Term (5 to 10 years)	Long-Term (10 to 20 years)
1. Solving business problems in communities (removing barriers)			
2. Preparing a quality workforce and citizenry			
3. Developing and commercializing research results			
4. Conducting basic and applied research			

Statewide Goals (from *Oregon Shines*)

- Quality jobs for Oregonians
- Safe, caring, engaged communities
- Healthy, sustainable surroundings

Checklist for completing the matrix

Do the strategies and initiatives, taken together, demonstrate…

- Geographic diversity across Oregon?
- Attention to the three statewide goals?
- A mix of short-, medium-, and long-term strategies?
- Measurable return on investment?
- Policy connections among ongoing initiatives of the public and private sectors, where appropriate?