

Summaries of Selected Opportunity Area Subcommittee Reports

Engineering and Information Technology

Chair: Bruce Schafer

A recent Oregon Employment Department report indicates that, despite the recession, employers continue to say that there is a shortage of skilled workers in the state, and that vacancies exist in all major occupations even in a period of lower hiring activity. These shortages of skilled labor lower company productivity and sales, and thus the revenue they provide to the state in taxes, and are related to the number of jobs that companies can maintain. A second concern of employers in the report was that employees have insufficient "soft skills" such as problem-solving, critical thinking skills, interpersonal skills, and management and leadership skills. These are the types of skills, in fact, that college graduates are able to bring with them into the workplace.

Since 1997, the Oregon University System has participated in a mutually beneficial partnership with the private sector to "grow our own" engineers and computer scientists to fuel the state's largest sector, high tech, and all of its sectors that use technology. Today in Oregon, technology is used in industries as diverse as agriculture and healthcare, forestry and electronics, and utilities and retail.

This partnership is represented by the Engineering and Technology Industry Council (ETIC), made up of executives representing a wide variety of industries from throughout Oregon as well as leadership from Oregon universities. Through this effort, OUS and its industry partners are meeting the state's goals of making engineering and technology education a strategic resource that fuels our economy and creates opportunities for all Oregonians.

The ETIC 2005-2007 Budget in the Governor's Recommended Budget is \$21.7 million of the OUS General Fund budget.

ETIC Strategic Objectives Include:

- Doubling the annual number of work-ready technical graduates, a goal that ETIC is well on its way to meeting, in order to increase Oregon's in-state technical talent, making it easier to generate new technologies and grow new businesses and jobs;
- Tripling the federal research dollars flowing to Oregon;
- Growing nationally ranked programs that supply the highly skilled graduates needed to retain and attract companies and jobs to the state, and which allow existing Oregon companies to recruit locally, increasing the number of top jobs that go to Oregonians;
- Increasing the quality and diversity of engineering and technology students to be able to meet state demand;
- Providing increased opportunities for high paying jobs to Oregonians, whether they are new to the workforce, entrepreneurs, or displaced by changes in the economy;
- Quickly forming industry-higher education partnerships to mold and adapt to global markets for Oregon industry and economic advantage; and

- Fostering inter-campus and community college collaborations for programs and research that provide statewide opportunities for education and training.

Since 1999, ETIC's efforts have increased the number of undergraduate and graduate engineers and computer scientists by 40%, and is forecast to increase those numbers by more than 74% by 2009. ETIC's movement towards its goals have generated a high level of confidence in Oregon's business community that sustained investments and clear objectives can achieve the end result of more high skill technology workers for our industries. This confidence has brought about a financial commitment from the private sector that has grown from \$7.1 million in the 1997-1999 biennium to \$37.1 million in the 2003-2005 biennium to match public support of \$5 million in 1997-1999 and \$20.9 million in 2003-2005.

Healthcare Workforce

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. Partnerships for sharing resources and providing statewide access to educational programs will increase capacity in nursing and allied health. This enhancement and expansion of healthcare workforce education includes five major objectives:

- To double the output of nursing and allied healthcare professional within the next ten years.
- To assure timely impact on the healthcare workforce and the economy through placement of graduates in the high paying unfilled positions (rural and urban) in the state.
- To enhance capacity in the core basic courses and create opportunities for sharing these courses throughout the institutions of higher education.

- To cooperatively develop innovative delivery modes to meet both rural and urban needs.
- To ensure that the evolving medical technologies including digital information systems are supported with educational programs.

Community College Partnerships and Solutions to Address Healthcare Workforce Shortages

Partnerships and collaborations are not new to Oregon's community colleges. In the past, individual colleges have formed partnerships with high schools, clinical/practicum sites, Area Health Education Centers (AHECs), fire departments and ambulance companies, other community colleges, and with four-year colleges and universities. What is new is a statewide coordinated approach to address capacity issues through the Community College Healthcare Action Plan and key industry partnerships.

Oregon Nursing Consortium

The Oregon Consortium for Nursing Education (OCNE) is a coalition of community colleges, private and public university schools of nursing established in response to the critical nursing shortage and the 2001 Strategic Plan promulgated by the Oregon Nursing Leadership Council (ONLC). OCNE is one mechanism by which Oregon nursing programs can dramatically expand their capacity and enrollment, and prepare graduates of these programs with competencies to address the rapidly changing health care needs of Oregon's aging and ethnically diverse populations. The consortium is currently under construction with numerous groups involved in development of:

- An organizational framework and agreements among partner institutions;
- A competency-based four-year baccalaureate curriculum with an associate degree exit option;
- Simulation laboratories strategically located throughout the state and a network arrangement for shared simulation expertise and materials;
- Faculty for competency based curriculum design, state of the art simulation and clinical teaching.

In September 2002, directors from all nursing programs in Oregon voted to support the consortium and to work with their college administration and clinical partners in understanding the benefits of consortium partnership. As a result of the vote of support, a steering committee was formed to continue tactical planning. In March 2003 the consortium met to begin planning the curriculum and defining partnership, functions and the consortium's initial structure.

All nursing educational institutions in Oregon are eligible to be partners in the consortium at one of two levels. Full partners have committed to developing and implementing the new nursing curriculum at their campuses. Associate partners provide advisory input into the new curriculum but have no current plans to implement the new curriculum at their campus.

The consortium has made great strides in preparing for curriculum development. During the next two years, with the generous support of the Northwest Health Foundation and a HRSA grant, the OCNE will continue to develop a set of core concepts and overall curriculum plan with courses, course titles, credit hour allocation, and course competencies.

Governor's Healthcare Workforce Initiative

The state is facing a critical shortage of healthcare workers and many challenges to overcoming the shortage. The Governor's initiative aims to direct short-term efforts to alleviate critical skills shortages through the creation of multi-sector partnerships and collaborations, and the implementation of new and innovative solutions.

The Oregon Employment Department states that healthcare occupations are the fastest growing category of workers in Oregon and that Oregon's overall healthcare employment will grow 17% by 2010. There are numerous unfilled vacancies and an expectation of massive retirements in the next ten years. These positions are high paying jobs and, if filled, would add \$52 million to the Oregon economy.

The Governor's Healthcare Workforce Initiative has six key elements:

- Create a statewide network of simulation centers;
- Ensure that the existing telecommunications capacity around the state is operational, accessible, and affordable;
- Increase the number of healthcare faculty;
- Encourage regulatory flexibility;
- Encourage shared use of facilities and equipment; and
- Ensure the articulation of healthcare prerequisite courses among public and private colleges and universities.

Oregon Institute of Technology Allied Health Programs and the Center for Health Professions

Oregon Institute of Technology is embarking on a capital campaign for funding to enhance enrollment capacity for allied health programs including a new facility. To fulfill the statewide mission in allied health education, major outreach and partnership objectives are moving forward. The following are new activities underway:

- Partnership with Rogue Community College providing a Respiratory Care program in Medford.
- Delivery of dental hygiene in La Grande with Oregon Dental Services and Eastern Oregon University.
- Specific planning with Clackamas Community College to enhance a healthcare industry cluster development in Portland.
- Discussions with Umpqua, Chemeketa, Portland, and Klamath Community Colleges to develop cooperative programs in allied health.
- Development of a forum in late fall with the community colleges that deliver health-related programs to discuss coordination and sharing resources.
- Assessing short-term and long-term workforce needs with the medical industries for the allied health workforce.
- Development of hospital-supported financial aid for students.

Education

Chair: Phyllis Edmundson

Each level of public education in Oregon has experienced serious fiscal pressures as the state grapples with the economic downturn. Too often the needs of one segment have been pitted against those of the others, without considering the importance of maintaining quality in all parts of the continuum of PK-20 education in Oregon.

Currently PK-20 education in Oregon does not operate as a system. While there are many collaborative projects and connecting points among various elements of PK-12, community colleges, and OUS institutions, these linkages tend to develop in response to short-term funding opportunities, interests of individuals who may build partnerships to accomplish specific objectives, governing board interest in collaborations, or perceived benefits to one or more segments of the educational community. There is no one system that connects all of Oregon's education segments, so connections are built institution-by-institution rather than system-by-system.

The subcommittee presented three initiatives for consideration as the Higher Education Board seeks ways the Oregon University System can contribute to building a world class PK-20 educational system: a virtual policy research and development center that will serve Oregon's need for data and policy analysis to inform decisions about public PK-20 education; a plan for recruitment, preparation, and retention of diverse, highly competent educators for all Oregon's PK-12 schools; and a proposal to create an information system that systematically links the sectors of public PK-20 education in order to promote collaboration and inform parents, students, and educational advisors about postsecondary educational opportunities and options.

Initiative One: A Virtual Policy Research and Development Center on PK-20 Education

While there are several research centers at OUS institutions that conduct research and develop programs about and for public schools, the agendas of these centers tend to be driven by available funding opportunities through external grants. There is no single source for long-term comparative studies of data that could inform decisions about educational policy.

There is a great need in Oregon for public policy research to inform and evaluate policy development and implementation by the legislature, Oregon Department of Education, the State Board of Education, the State Board of Higher Education, and other state agencies. Schools, community colleges, and universities also need to have predictable and local resources for research that evaluates and informs their assessment, evaluation, and program development and improvement efforts.

Oregon has a number of very strong research and development centers located at universities and as independent not-for-profit institutions. However, there is little coordination of efforts and entities seeking help with policy analysis or research and evaluation do not have a single point of entry to go to for assistance that would bring together and mobilize resources that exist throughout the system. Because there are not consistent funding streams for many of the research and development activities, there is little continuity in the data and no regularly scheduled studies and reports.

If education is critical to economic development, and if a sound PK-20 system requires a solid foundation of research and policy analysis, then the creation and support of a consortium for PK-20 policy and evaluation would be a wise investment.

Potential funding partnerships include federal funds, public/private partnerships, and pilot projects.

Initiative Two: Recruitment, Preparation, and Retention of Diverse, Highly Competent Educators for all of Oregon's PK-12 Schools

When we talk about attracting new industries to Oregon, the quality of public schools quickly emerges as a major criterion for business siting decisions. Increasingly research confirms the common sense notion that the quality of schools and the level of education of the workforce depend, to a large extent, on the effectiveness of teachers and school administrators. Oregon's PK-12 schools and universities have a circular relationship: without good teachers, students will not be well-prepared for postsecondary education; without good higher education, including teacher preparation programs, schools will not have a continuing resource of well-prepared teachers and school leaders.

Recruiting, preparing, and retaining quality teachers will be of vital importance for the future education of Oregon's children and youth in the coming decade. Currently, the state of Oregon licenses approximately 6,300 new teachers each year. Of the new teachers licensed in Oregon in 2002-03, 56% were from outside the state. By the end of the third year of teaching, 27% of new teachers will have decided to leave their positions. Only 63% of the teachers will still be in classrooms in the fifth year.

Similar to many states, the highest areas of need for educators are special education, mathematics, school counseling, speech pathology, foreign languages, high school principals, technology education, library media, science, superintendents, English as a second language, and bilingual education. Rural communities in Oregon experience a greater difficulty hiring new teachers in every area but especially in those mentioned above. To make matters even more difficult, neighboring states actively recruit for beginning teachers trained in Oregon.

Another potentially dangerous trend is the drop in newly employed Hispanic/Latino teachers. Hispanic/Latino teachers newly employed by Oregon Public School Districts dropped from 15% in 2000-2001 to 10.7% in 2001-2002. New pipelines of qualified Hispanic and Latino teachers are needed. At the same time that Oregon is experiencing record enrollment of students for whom English is a second language, school districts are hard pressed to hire enough qualified ESOL/Bilingual prepared teachers.

A statewide Consortium for Teacher Recruitment, Preparation, and Retention is needed to develop legislative initiatives and school-community college-university partnerships focused on the following goals:

- Provide mentoring and professional support needed to retain teachers in Oregon;
- Resolve Oregon's teacher shortages and reliance on out-of-state hires through strategic planning and analysis of supply and demand data, and resource allocation to high need areas;
- Provide data bases that assure high quality data are available for planning and policy analysis;
- Help school districts meet the NCLB requirements for "highly qualified teachers";

- Maintain strong and responsive teacher preparation, hiring, and retention of minority teachers in Oregon's schools;
- Document Oregon's teachers' impact on student achievement; and,
- Facilitate articulation of potential teachers from community colleges into Oregon's teacher preparation programs.

The Consortium would include representatives from the Oregon Teacher Standards and Practices Commission, the Oregon Department of Education, the Oregon University System, Oregon's Community Colleges, Oregon Education Association, Confederation of Oregon School Administrators, Oregon Legislators, and Oregon's economic leaders. A key to making this consortium work effectively will be to fund it from several sources including the OUS budget, the PK-12 budget, and the community college budget. This shared funding insures that all segments of public education in Oregon have a stake in assuring quality teachers for all schools.

Initiative Three: Building Systemic Linkages Across the Sectors to Support Student Progress

Note: The information that follows serves as an introduction and placeholder for this initiative

- The proportion of recent high school graduates enrolled in college in Oregon declined from 45.5% in 1994 to about 35% in 2000 and now falls below the regional figures of nearly 40% (NCES, Digest of Education Statistics, 1997-2000).
- Reports indicate that 41% of all first-time community college freshmen and 29% of university freshmen require some remediation before entering college-level work (Policy Brief, P-16, Education Commission of the States, October 2000).
- There is no one consolidated area or clearinghouse where parents can find help in successfully guiding their children through the P-16 system in a smooth manner that ensures they are well prepared to take on the next set of academic challenges.
- There is no one consolidated system that allows parents to consider all factors in postsecondary education, including financial aid and career options. "In 2002, Oregon moved to the 2nd from the 3rd highest tuition and fees for the 15 western states (Department of Community Colleges and Workforce Development report, January 2004, from WICHE data)

A statewide system of coordinated and accessible educational options is needed to assure that every student is prepared to access a full range of high quality postsecondary educational options. It will allow Oregon families to better understand what is required of students for admission and make it possible for them to compare options while designing a successful educational plan.

Funding for this initiative has not been identified.

Neuroscience and Biomedical Research

Chair: Provost 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 in 2001 by OHSU investigators to select drug targets for high through-put drug screening. UO's Brain Biology and Machine Initiative (BBMI) has led to formation of *Electrical Geodesics Inc.* to enable the development and worldwide distribution of brain-mapping technologies, and *Cerebral Data Systems* to assist with the development of telemedicine applications for brain injury, epilepsy, and stroke. 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

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)

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 at 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

Sustainability

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.

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.