

THE ROAD AHEAD FOR INFORMATION TECHNOLOGY OCCUPATIONS: A Workforce Strategy For Oregon

PHASE ONE REPORT

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Executive Summary

The capacity to grow Oregon's economy depends on the competitiveness of its businesses and the quality of its workforce. Knowledge-based workers are increasingly the focal point of a state's workforce given their ability to drive innovation or apply technologies and business practices in ways that improve competitiveness. Information Technology ("IT") workers comprise the largest segment of Oregon's knowledge-workers. As stated in a recent US Department of Commerce report, *"The demand for these workers [IT occupations] goes beyond the IT industry, cutting across manufacturing and services, transportation, health care, education and government. The IT professions are among the fastest growing and highest paying jobs in our economy, and despite the downturn in IT-related industries, there is still demand for highly skilled technical workers."*

Oregon has an estimated 71,000 IT workers -- over 85% of these workers are employed outside of high tech, with approximately 20,000 IT workers employed outside the Portland Metropolitan Statistical Area. The Oregon Employment Department and a recent survey of 200 Oregon IT employers both indicate a job growth rate more than double the statewide average. Based on primary and secondary research conducted for this report, **Oregon is estimated to have 5,000 to 6,000 annual openings** (new and replacement jobs) for IT workers in each of the next three years. Many of these jobs will require new skills or knowledge with respect to emerging IT tools and methodologies. Continuous training and life-long learning is a prerequisite, not an option, for IT workers. Accordingly, the ability to receive quality training in a timely and cost-effective manner -- within Oregon -- will play a significant role in the employability of these workers.

IT workforce development is obviously shaped by key trends in information technology. While there are many influencers, national studies and interviews with Oregon IT professionals suggest five trends with significant long-term impact:

- *Outsourcing:* Outsourcing and offshore development are cited as a major influencer of future IT employment as occupations like computer programming become more of a commodity.
- *Technology Standardization:* After a decade of explosive growth in IT spending, organizations are focused on standardizing software applications and reducing the overall technology assets requiring support.
- *Return on Investment (ROI):* ROI criteria are being strictly applied to new IT spending; projects that enable application integration or provide better alignment with core business processes are being given priority.
- *Integration of Technical and Business Skills:* In addition to required technical competencies, future IT jobs will have more of a business analysis and process optimization flavor. Having an understanding of business fundamentals and solid communications skills are essential.
- *Disruptive Technologies:* Another trend with implications for workforce training is the rapid pace of change and innovation in technology. Being able to quickly identify the risks, benefits and needed training for new technologies can provide a competitive advantage for companies and workers.

Given these trends, the IT jobs that remain in the U.S. and Oregon will have a strong business process and operational orientation and will be found either in creating or applying new cutting-edge technologies or in “less glamorous” technical support and infrastructure positions. More standardization means that workers will be expected not only to be proficient in specific platforms or applications, they will also be expected to understand connectivity, integration and messaging technologies and tools. A team approach to IT development with frequent interaction between technical and non-technical workers means that soft skills like teamwork and communication as well as knowledge of business operations and project management are now considered baseline skills for technology employees.

For Oregon employers and IT workers to keep up to date with a rapidly changing set of technologies and skills requires an IT training and education system that is responsive and flexible. Employers and IT professionals noted the following training gaps in Oregon:

- For many high-end technologies and business methodologies, IT workers must travel out of state to find quality training.
- Distance learning and web-based training appear to be under-utilized, especially in rural areas. In addition, there is little consistency in the technologies being used for e-learning.
- Incumbent workers and recent graduates are believed to have the necessary technical foundation skills but lack the project management and business process expertise required in today’s environment.
- There appears to be no systematic, broad-based forum to identify and discuss the business risks and value of disruptive technologies (wireless, Web services, open source, etc.) and to identify associated training needs.
- An array of IT and computer science degree programs are available with apparent capacity to train IT workers. Yet employers question the degree to which curriculum is consistent across campuses and aligned with current industry standardization. Further, employers perceive disconnects between certification and degree programs in higher education, and question the rationale for differences in community college terminal and transfer degrees.

Based on IT trends, hiring projections, focus group discussions and identified training gaps, a set of strategic directions have been developed. These recommendations are intended to provide guidance for further exploration of specific workforce and training programs and are not inclusive of all options, but rather provide the foundation for developed or refined action plans.

The strategic directions found in this report share a set of common characteristics including:

- An awareness of the rapid rate of change within IT and IT occupations and the associated need to be responsive and scalable in training delivery,
- An emphasis on active private sector involvement in the development and delivery of training,
- An understanding of the need to marshal resources and avoid duplication of effort, and
- An appreciation for the large number of high quality, family wage IT jobs found outside of technology firms or “high-profile” software engineering occupations.

Strategic Directions

A. Aggregate Training for Incumbent Workers: Training content is widely available for both generic and highly specialized IT needs. The primary issue in Oregon is aggregating demand at a level sufficient to deliver cost-effective and high quality training.

- Aggregate demand for highly specialized technologies or methodologies across industry sectors to attract intensive “A-level” training seminars to Oregon. (i.e. training that workers must currently travel out of state to obtain.)
- Aggregate demand for generic platform and vendor specific applications as well as project management skills in rural regions and industry sectors to reduce costs of and improve access to training.

B. Enhance Post-secondary Education Programs to Align with Changing Industry Trends

- Develop “business enriched” computer science and information management systems programs with a core set of business fundamentals, project management and work flow analysis skills, including stronger connections with business schools.
- Provide seamless educational progression for IT programs. Increasing IT standardization suggests the need for curriculum at each level of education that is consistent among educational institutions, and can be articulated from one level to the next. Better connections between certification and degree programs should be explored since professional certification in combination with a degree is the new norm for IT workers.
- Increase real-world work experience for students by enhancing efforts to engage employers in work-based experiences, and increasing the use of technical or business solution teams (teams of students and faculty teamed with a company) throughout the post-secondary education system.

C. Develop A Unique IT Market Niche For Oregon

- Encourage and support a broad-based forum for understanding and rapidly adapting to disruptive technologies that can become a barrier or a competitive edge, depending on how well and how fast a company can identify the business value or potential risk. Being able to identify the impact of these technologies and then quickly deploying appropriate training could offer Oregon a differentiating niche for both workforce and economic development.
- Create a standardized statewide training infrastructure that supports rapid development and delivery of new content using both instructor-led training and consistent and scalable distance learning tools. In addition to having “the right people with the right skills”, Oregon has an opportunity to differentiate itself by using its relatively small market size to be nimble and responsive and build a reputation for excellence in specific IT areas.

D. Improve the Effectiveness of Workforce Development Funds and Programs

- Provide specific short-term training to unemployed IT workers to increase their immediate productivity to a new employer. Targeted uses of workforce development funds such as Individual Training Accounts (ITAs) or training partnerships with employers could significantly improve unemployed worker skills and be beneficial to hiring employers.

- Help career guidance counselors and instructors at all levels (high school, colleges, and local/regional workforce boards) to understand today’s IT skills and to attract people with the right “fit.” The typical IT worker has evolved from the quiet programmer in the corner to a problem-solving communicator with a blend of technical, business and people skills.

E. Establish A Statewide Focus on IT Issues

- Establish an Oregon IT Skills Panel led by employers and aligned with the Governor’s Workforce Development Strategy. Since technology workers are employed in so many industries, a statewide, multi-industry forum should be established to identify critical technology and workforce issues that are key to the competitiveness of Oregon businesses and the success of Oregon technology workers.
- Standardize IT applications within educational systems and government agencies. State agencies and post-secondary education systems should explore ways to standardize IT applications to provide consistent IT delivery to customers, minimize IT infrastructure costs, and maximize investments in IT training.

Section 1: Introduction

Purpose Of This Plan

In April 2003, the U.S. Department of Commerce published a comprehensive review of *Education and Training for the Information Technology Workforce*. In the preface to the report, Secretary of Commerce Donald Evans states that “widespread deployment of digital technologies throughout the nation and our ongoing transformation to a knowledge-based economy have created strong demand for workers who can create, apply and use information technologies. The demand for these workers goes beyond the IT industry, cutting across manufacturing and services, transportation, health care, education and government. The IT professions are among the fastest growing and highest paying jobs in our economy, and despite the downturn in IT-related industries, there is still demand for highly skilled technical workers.”

Despite this critical demand, Oregon has no statewide workforce plan or strategic objectives for technology-based occupations and the industries they serve. Therefore, in November 2002, the Oregon Council for Knowledge and Economic Development (OCKED) identified the need for an IT Occupational Roadmap to address one of Oregon’s largest workforce sectors. This recommended roadmap is also consistent with the Oregon Workforce Investment Board’s 2001 Strategic Plan. The plan notes a strong need for “*a well educated, skilled workforce that will keep Oregon’s economy competitive in the global marketplace,*” and “***a highly trained workforce skilled in information technologies and problem solving, and ready to adapt to nearly continuous change.***”

The IT Occupational Roadmap is a two-part project: Part I of the project gathered input from Oregon Chief Information Officers (CIOs) and IT professionals and combined the input with national best practice research to:

- Determine demand for IT jobs in Oregon, including geographic and industry distribution.
- Identify critical economic and workforce trends that will affect the supply and demand of IT jobs, and the key skills and competencies that will be required over the next 5-10 years.
- Determine IT education and training gaps for producing new qualified graduates and keeping incumbent workers up to date on emerging skills and technologies.
- Develop innovative solutions that can address identified IT needs and establish a framework identifying how the state can support our technology workforce.

A second phase of this project will build on the directional framework outlined in this report and develop more specific actions and programs.

Project Background

Numerous studies indicate that economic growth is dependent on the development and deployment of technology and the management of information. The ability to manage information and technology is just as important to agriculture and health care as it is to high technology. We know that industries developing and applying technology to increase their competitiveness are often the leaders of job growth and wealth creation. A good example of the ubiquitous impact of technology on Oregon's economy can be found in the March 9, 2003 article by Joe Cortright in the Oregonian, "*Rural Revival: Harvesting Knowledge Is Our Economic Future*," which illustrates the importance of knowledge-based jobs in all parts of our economy and in all parts of our state.

The demand for information technology (IT) jobs is often underestimated because they exist in an array of industries instead of being concentrated in one sector of our economy. According to the Oregon Employment Department, the top industries in Oregon that employ IT workers include: Business Services, Wholesale Trade, Manufacturing (electronics, machinery, instruments), Engineering and Management Services, Depository Institutions, Health Services, Educational Services, Insurance Carriers, and Government.

Oregon IT jobs are expected to grow faster than other occupations. Even with fewer new openings, replacement IT jobs will continue to be significant. Based on data from Oregon's Labor Market Information System, statewide employment growth in IT related occupations is projected to be much faster than average and the number of annual new openings is expected to be much higher than average. Over the past three years, the Information Technology Association of America (ITAA) reported that 50% of all IT jobs went unfilled due to a lack of qualified applicants that did not have up-to-date skills. Many of those hired replaced people with outdated skills, illustrating the critical need for ongoing education and training.

In addition to core IT occupations, almost every job requires the use of computers, technology and creative problem-solving, making the educational foundation for IT an important aspect to a vast number of other occupations. Therefore, investing in IT training leverages education and training for the more than 70,000 direct IT jobs as well as the tens of thousands of other jobs that use information technology.

Methodology

This project was completed in collaboration with the OCKED Council, the Department of Community Colleges and Workforce Development, Oregon University System and their campuses, Engineering and Technical Industry Council, Oregon Economic and Community Development Department, Department of Administrative Services, Oregon Employment Department, American Electronics Association, Software Association of Oregon, Southern Oregon Telecommunication Council, The Job Council (Medford), Central Oregon Telecommunication Council, CIO groups and others to develop the information and gather input from almost 300 IT employers.

The recommendations from this project were developed through six primary steps:

- **An assessment of IT jobs using data from the Oregon Employment Department** to estimate the number and types of IT jobs in Oregon, the industries of employment, the geographic distribution, and projected growth rate. (Appendix A)
- **A set of one-on-one interviews with IT employers and IT staffing organizations** to understand critical IT trends, IT occupational changes, and changes in Oregon's IT environment. (Appendix B)
- **A statewide survey of 200 IT employers** conducted by Moore Information to quantify the significance of specific IT trends; the current and projected distribution of IT jobs by type of job, industry and geographic region of the state; skills gaps and educational requirements; and preferred training methods. (Appendix C)
- **A set of focus groups** in Portland, Salem and Medford and follow-up interviews with IT employers and universities to validate findings and develop and refine recommendations. (Appendix D)
- **National skills standards** that describe the IT occupational clusters. (Appendix E)
- **National best practices research** of IT occupations, job projections, IT technology trends and business patterns including issues like outsourcing and IT standardization. (Examples are contained throughout the report, with a bibliography of sources in Appendix F)

The specific methodology used for each step is detailed in the corresponding appendices.

Section 2: IT Employment in Oregon

Current Estimates of IT Workers

State of Oregon covered employment data¹ for selected IT occupations indicates that over 65,000 people were employed in information technology (IT) occupations during 2000, not including the self-employed. In addition to covered employment, the Census Bureau estimates that 9% of Oregon workers are sole-proprietors. When an estimate of self-employment is added to covered employment the result is an estimate of **over 71,000 IT workers in Oregon**.

While IT employment is concentrated in Portland, over 20,000 IT jobs are located outside of the Portland metropolitan area (including self-employment estimates). The following table shows the statewide distribution of the covered employment portion of IT jobs (90% of all IT jobs).

Table A: IT Industry Summary By Region
(covered employment only)

	2000 Employment
Statewide	65,487
Central Oregon	2,468
Coast	571
Eastern Oregon	1,188
Portland	47,589
Southern Oregon	2,273
Willamette Valley	12,511

IT workers and IT employers are not homogenous; therefore a one-size-fits-all approach to IT training will not work. By understanding the distribution of IT workers by industry and type of IT employer, type of occupational cluster and geographic location, we can develop training strategies that are better aligned with these variables.

IT Employment By Industry

Data from the Oregon Employment Department indicates that IT employment is disbursed throughout an array of industries across the state.

- Business Services (which includes software, as well as an array of other business services such as advertising, graphic design, equipment leasing, photocopying, and employment leasing and staffing companies) accounts for about 25% of all IT workers. However, when leased employees² are removed from business services, the estimate of IT jobs for this category is approximately 15% of IT jobs.

¹ This data may not include newer IT occupations since many occupational codes used by state and federal government sources are based on older job titles.

² Leased employees that are often contracted to other industries represent approximately 43% of business services.

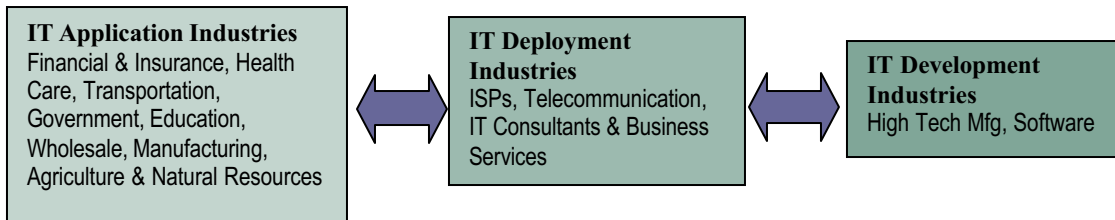
- High tech manufacturing accounts for 16% of IT jobs; wholesale trade accounts for 10.5%; finance, insurance and real estate accounts for almost 8%; government for almost 9%; and education services for about 6% of IT jobs.
- Other significant employers include transportation, utilities, telecommunications, and other manufacturers.

In addition to industry sectors, IT employers can be categorized by their primary use of information technologies.

IT Application Industries: The vast majority of IT employers are industries that apply IT as a way to more effectively manage data and to find timely and cost-effective ways to use that information. Examples of these industries include financial & insurance, health care, transportation, government, education, wholesale, manufacturing, agriculture & natural resources.

IT Deployment Industries: There is a smaller subset of industries that provide the infrastructure for the application of IT technologies. These include Internet service providers, telecommunication companies and IT consultants. They do not develop the technology, yet they are critical to the deployment of IT services.

IT Development Industries: About 20 percent of IT jobs are found in companies that develop the technology (hardware and software) for IT. These companies include software and high tech manufacturers. These companies have the highest skilled workers and must stay on the bleeding edge to be competitive.



<i>Distribution of IT Workforce</i>		
60-65%	10-15%	20-25%
<i>Distribution of Firms</i>		
All parts of the state	Throughout the state with larger firms in metro areas; smaller firms in rural areas	Concentrated in Portland region with smaller clusters in Central & Southern Oregon
<i>IT Business Goal</i>		
Competitive Edge	Leading Edge	Bleeding Edge

Occupational Classification and Educational Requirements of IT Jobs

For the purposes of this study we explored IT occupations in five major occupational clusters based on national skills standards³. We further divided these five clusters into twelve common job categories with shared skills and training requirements. Table B define the five major clusters and the twelve sub-categories, along with example job titles.

Table B: IT Jobs Taxonomy

A. IT Management, Marketing & Sales	B. Network & Infrastructure Services	C. Database & Applications
Management	Network	Database
CIO / CTO IT Director IT Manager (General) Chief Security Officer Computer Operations Manager Telecommunications Manager IT Training Manager IT Program Manager IT Project Manager (General) Technical Recruiter IT Budget / Finance Officer	Network Design & Administration Communications Analyst Data Communications Analyst Network Administrator Network Analyst Network Operations Analyst Network Specialist Network Technician Network Engineer	Data Administrator Data Analyst Data Architect Database Developer Database Manager DSS (Decision Support Services) Database Librarian Data Warehousing Specialist
Marketing & Sales	Computing Environment & Data Center	Software Development
IT Marketing Account Manager IT Sales IT Consulting Sales Technical Sales Manager Technical Sales Support	Systems Administrator Information Systems Administrator Information Systems Operator Information Technology Engineer Release Management & Staging Specialized Hardware Support (e.g. Imaging) Technical Support (Level 2/3)	Technical Lead Systems Analyst Computer/Software Engineer Computer Programmer Programmer/Analyst Embedded Systems Developer Operating Systems Designer Operating Systems Programmer
	Security, Compliance & Quality Assurance	Application Services
	Security Administrator Security Analyst Business Continuity Planner IT Auditor QA Specialist Software/QA Tester Test Engineer	Enterprise Architect Application Integrator Business Systems Analyst Application Systems Analyst Project Manager Software Applications Specialist (CRM, ERP, etc.)

³ Career Clusters, Focusing Education on the Future; U.S. Department of Education, Education Development Center, Information Technology Association of America, National Alliance of Businesses

D. Interactive Media & Communications	E. Technical Support
<i>Creative & Web Services</i> Audio/Video Engineer Media Specialist Media Designer Multimedia Developer Multimedia Producer Production Assistant Web Programmer / Developer Web Designer Web Specialist Web Master	<i>External Support & Call Center</i> Call Center Support Representative Customer Service Representative Call Center Supervisor Outbound Sales Representative Outbound Sales Supervisor Product Support Engineer (Level One) Sales Support Technician (Level One) EDI / Data Transmissions Specialist
<i>Technical Writing</i> Technical Writer Electronic Publications Specialist Publisher Online Publisher Technical Communicator Editor Publications Services Librarian Services	<i>Internal Support & Help Desk</i> Help Desk Specialist or Technician PC Support Specialist Technical Support Specialist Hardware Technician Network Support (Level One) Administrative Services

Education & Training Requirements

IT jobs examined in this study are available for all levels of education. Entry-level (lower skilled) jobs with a high school diploma or GED and short-term training can be found for a small percentage of IT jobs. These jobs are typically found in call centers, customer service and data entry/processing environments.

Jobs requiring an associate’s degree can be found in approximately 35-40% of IT jobs. These jobs are typically located in network, data center operations, technical support and some aspects of web development and quality assurance functions. People with vendor-specific or professional certifications along with their degree are viewed as more employable as compared to counterparts with similar work experience and no additional certifications.

Bachelor’s degrees are the most common educational requirement for IT jobs, with an estimated 50-60% of all IT jobs requiring at least a four-year degree. Virtually all workers interested in jobs relating to IT management, programming, software development, systems architecture, application integration and security and compliance will require at least a four-year degree. As with an associate’s degree, professional certification in addition to a degree is becoming more common in the workplace.

Our research indicates that certification was found to be most valuable to people with a degree or at least five to seven years of work experience. Certifications with no accompanying degree or relevant work history have limited value in the job market. In other words, we found very few jobs (especially family wages with any type of upward mobility) for people with only a certification and limited work experience. This suggests that workforce development funds and programs would be better applied helping people obtain associate's degrees or retraining incumbent workers so that certifications would then have more value.

Wages for IT Jobs

Wages for IT jobs are well above the state average for all jobs. The average IT job pays 80% more than the average state wage with most IT wages ranging from \$42,000-\$62,000 per year. Recent salary information shows the median wage for a variety of IT positions with varying educational requirements and experience.

Table C: Portland Metro Wages for Selected IT Occupations

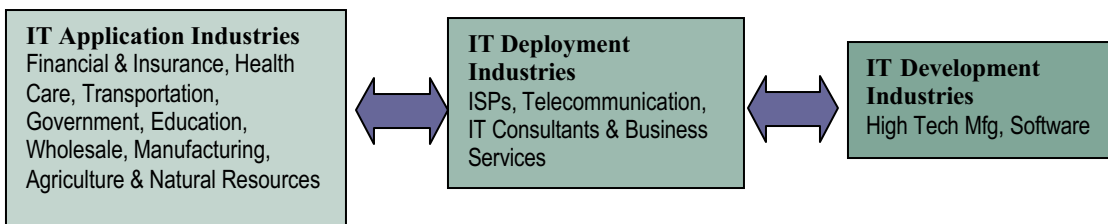
OCCUPATION	MEDIAN WAGE	TYPICAL MINIMUM EDUCATION	AVERAGE YEARS OF EXPERIENCE
Data Entry Clerk I	\$23,252	High School Diploma	0-3
Data Entry Clerk II	\$26,236	High School Diploma	2-5
Computer Operator I	\$30,323	Associate's Degree	0-3
Computer Operator II	\$35,124	Associate's Degree	2-5
Help Desk Support	\$40,895	Associate's Degree	0-2
Programmer I	\$48,112	Associate's Degree	0-3
Programmer II	\$56,041	Associate's or Bachelors Degree	2-5
Database Analyst I	\$46,156	Bachelor's Degree	0-2
Database Analyst II	\$60,259	Bachelor's Degree	2-4
Applications System Analyst I	\$47,016	Bachelor's Degree	0-3
Applications System Analyst II	\$61,400	Bachelor's Degree	2-5
Software Engineer I	\$53,402	Bachelor's Degree	0-2
Software Engineer II	\$61,357	Bachelor's Degree	2-4
Network Administrator	\$55,849	Bachelor's Degree	0-2
Software Quality Assurance	\$57,176	Bachelor's Degree	2-4
Systems Administrator	\$61,687	Bachelor's Degree	2
Webmaster	\$62,623	Bachelor's Degree	2-4
Database Administrator	\$78,327	Bachelor's Degree	2-4
I/S Audit Manager	\$84,875	Bachelor's Degree	7

Source: Salary.com, August 2003

Occupations & Educational Emphasis By Type of IT Industry

The variation in industry sectors and use of information technologies can result in different demand patterns for IT occupations. For instance, database and network jobs comprise a higher percentage of IT jobs in industries that apply IT (financial services, health care, government), whereas programmers are a higher percentage of the IT workforce in industries that develop technology. This variation in the distribution patterns of occupational clusters also means that varying industries may emphasize educational requirements differently. As an example, a significant portion of IT workers in high tech and software industries have four-year degrees, while IT application industries have a higher percentage of their workforce with associate’s degrees. The emphasis on certification also varies by type of industry.

The following table highlights these distribution patterns by type of IT use.



<i>Priority IT Occupations</i>		
Application Services	Computing Envir. & Data Center	Software Development
Database	Network	Marketing & Sales
IT Management	Security, Compliance & QA	Technical Writing
Network	External Support & Help Desk	External Support
Internal & External Support		Creative & Web Services
<i>Importance of Four-Year Technical Degree</i>		
Medium	Medium to High	High
<i>Importance of Certification</i>		
Medium to High	Medium to High	Low to Medium
Often used as a differentiating factor in hiring; More focused on professional certification	Tends to be more vendor specific or focused on issues like security	Technical degrees matter most
<i>Incumbent Worker Training Needs</i>		
High	Medium to High	Medium

IT Job Outlook In Oregon

Our survey of IT employers is very consistent with national growth projections. Oregon employers estimate a 9.1% annual growth rate for the next three years, compared to a 9.5% national growth rate projected by the Bureau of Labor Statistics. Oregon's Employment Department projects a growth rate for IT jobs at a rate two and a half times greater than the average for all jobs. IT job openings will be a combination of new and replacement jobs. All of these statistics point to one thing: IT jobs will continue to be in demand and the ever-changing skills and technologies will require ongoing training and professional development.

It is estimated that there will be 5,000 to 6,000 IT job openings in the next few years increasing by a rate of 9% each year. This includes both new and replacement jobs.

The survey conducted for this study represented approximately 10% of the state's IT jobs. Using the survey results as a baseline for statewide projections, this would mean that there would be approximately 6,300 new and replacement IT jobs each year in Oregon, increasing to over 7,500 jobs in three to five years. As a comparison, the Oregon Department of Employment estimates almost 3,000 annual openings (with a small percentage of those being replacement jobs). However, interviews and focus groups suggest that the rate of replacement jobs will be higher in the future as compared to new (incremental) hires being the focus during the recent high growth period from 1997-2000. Therefore, a range of 5,000 to 6,000 annual openings for IT jobs would be a conservative baseline number for the purposes of workforce development planning.

Table D highlights the outlook for common IT occupations. *(Note that the annual openings include a smaller percent of replacement jobs than recent input from employers indicates.)*

Table D: Examples of Selected Entry Level IT Occupations

OCCUPATION	TOTAL PROJ. JOBS 2010	% CHANGE 2000-2010	ANNUAL OPENINGS	AVERAGE WAGE	OUTLOOK ⁴
Computer Support Specialists	12,917	68.1%	565	\$38,590	Much higher than average
Computer Engineers	9,688	48.2%	350	\$71,036	Much higher than average
Computer Systems Analysts	7,659	40.1%	248	\$58,662	Much higher than average
Engineer/Math/Science Managers	4,819	23.1%	151	\$80,376	Slightly higher than average
Computer Programmers	6,491	7.9%	96	\$55,827	Less than average
Technical Writers	911	20.0%	27	\$52,257	Slightly higher than average
Data Base Administrators	751	43.9%	26	\$50,994	Much higher than average
State Average – All Jobs		12.5%			

Source: Oregon Employment Department OLMIS data

⁴ Outlook based on comparing IT occupation growth to state average for all jobs.

When the growth rate for the five occupational clusters are compared to the educational requirement typical for those jobs we find that 56% will require a bachelor's degree, 35% of jobs will require an associate's degree, and 9% would require less than an associate's degree. Given a base rate of 6,000 annual openings, we can project that 3,360 new and replacement hires would require a bachelor's degree, 2,100 would require at least an associate's degree, and 540 IT jobs would require less than an associate's degree.

If new graduates filled one in ten new jobs, then our education system would need to produce at least 210 associate's degrees each year and 336 bachelor and master's degrees. If 15% of job openings went to new graduates, that number would be approximately 315 associate's degrees and 500 bachelor or master's degrees. In 2002, Oregon's educational system produced 729 associate's degrees, 675 bachelor's degrees and 132 master's degrees in related computer science and information sciences. Therefore, it appears that Oregon has the educational foundation in place to meet anticipated job demand. The more strategic question is whether existing programs are keeping pace with the skills and training required in the workplace.

Section 3: Highlights of Findings

National Trends and Employment Data

Information technology is an important part of the national economy – much of the growth in productivity and wealth creation in recent decades can be attributed to the broad application of digital technologies. Although there has been (and continues to be) spirited debate about the payback from investments in technology, there can be little doubt about the pervasive nature of IT and IT workers across all industry sectors and occupations. In this section we will highlight recent national trends and data points to set the stage for a more detailed discussion of Oregon’s IT occupations.

National Job Growth: The job outlook for IT workers remains strong despite the recent economic downturn. Nationally, the Bureau of Labor Statistics estimates a 9.5% annual job growth for IT jobs between 2000 and 2010.⁵ The Information Technology Association of America (ITAA) estimates approximately 490,000 new and replacement IT jobs nationally in the next twelve months (with a 5 to 15% growth rate for most IT occupations).

The ITAA has been conducting a national survey of IT employment since 1995. In their most recent survey (May 2003), they reported 10.3 million IT jobs nationally as of the first quarter of 2003. This is close to the historic high point of 10.4 million in the year 2000. The IT workforce shrank by about 500,000 workers in 2001 – an understandable decline given the dot.com implosion and the end of Year 2000 remediation efforts. The net job market for IT workers has slowly recovered over the past 18 months thanks in large part to a reduction in layoffs coupled with modest amounts of new hiring. While turnover remains higher than other industries, the level of job churn for IT employees has also declined from the rate seen several years ago. Employees are seeking security in a tight job market while employers have shed most of their marginal performers and are refocusing on retention of employees who have experience in their environment.

Hot Skills: In their *Mid-Year IT Staffing Update* (August 2003), CIO Magazine reports “application development and project management remain at the top of the list of hot skills. However, demand for these IT skills is down slightly from the survey six months ago while demand for help desk staff is on the rise. When asked to indicate which IT skills were most in demand, IT executives listed application development (58%), project management (47%), database management (42%), and help desk/user support (42%). Networking skills, listed as ‘in-demand’ by more than half the survey respondents in January was cited as a needed skill by only 30% of the respondents in the July survey.”

Increasingly, employers are citing “soft skills” and business expertise as key ingredients in the success of IT workers. Although there is an expectation among employers that job candidates will closely match their criteria with respect to education, technical expertise, work experience and soft skills/business expertise, they frequently cite the latter category as the area where the

⁵ US Department of Commerce, Education and Training for the Information Technology Workforce, June 2003

biggest gaps exist among both candidates and incumbent workers. The trend in this area is summarized well in the Department of Commerce report: “Today, IT is central to nearly all core business functions and to the overall operation of most companies, and IT professionals are integral to the core business team. Accordingly, “soft skills” (e.g., interpersonal skills, oral and written communications, teamwork, problem solving, and critical thinking) and business skills (e.g., needs analysis, project management, client/customer relations, understanding company financial information, and cost-benefit analysis), which have for many years been important to the advancement of non-technical professional workers, have become increasingly important for IT workers as well.”

Although computer programming and software engineering remains the largest single category in the ITAA survey, we would note that these jobs only represent about twenty percent of the overall total. Employment figures by major job category for the first quarter of 2003 are shown below:

IT Employment: Quarter 1, 2003

Category	Employment	% Of Total
Computer Programming / Software Engineering	2,144,377	20.8%
Technical Support	1,904,842	18.5%
Other	1,290,719	12.5%
Enterprise Systems	1,113,883	10.8%
Database Development & Administration	1,011,331	9.8%
Web Development & Administration	885,070	8.6%
Network Development & Administration	729,417	7.1%
Digital Media	694,251	6.7%
Technical Writing	538,759	5.2%
Total:	10,312,650	

Source: Information Technology Association of America, 2003

Compared to the previous year’s survey, Technical Support had the largest reported increase (8.8%) while Network Design and Administration was the slowest growth area with a reported decline of -.6%. These trends are consistent with those reported in the CIO Magazine survey referenced above.

Training: Another interesting trend from the CIO survey is the perceived importance of training as an employee motivator: 66% of those surveyed indicated that training was the top benefit being used to motivate staff. This compares quite favorably to the 27% response for monetary incentives like salary, bonuses and stock options. As noted in the Department of Commerce report, “Many employers do believe that creating training opportunities for their IT workers is important for recruitment, retention, and high-quality work, and many offer assistance to IT workers who wish to expand their education or technical skills. Generally, companies train IT

workers in three areas: technical skills, soft skills (such as conducting effective meetings and conflict resolution) and IT management-related skills (such as strategic management, business processes, project management, and leadership).” Despite this increased emphasis on training, most employers view training as a way to augment existing staff skills and will still look to recruit new employees or hire contractors to meet immediate skill gaps.

Outsourcing: Outsourcing and offshore development are being broadly cited as a major influencer of future IT employment in the U.S. Forrester Research has projected that 3.3 million U.S. services jobs will move offshore by 2015 – this includes 472,000 IT positions. This compares to a total of only 27,711 IT jobs that moved offshore in the year 2000. The workforce implications of this trend are obvious: as the level and sophistication of services available outside the U.S. continues to increase, the IT jobs that remain in the U.S. are likely to have a strong business process/operational orientation and will be found either in creating and applying cutting edge technologies or in technical support and infrastructure positions.

Technology Standardization: A national trend with IT workforce implications is the desire within many organizations to standardize their technical environments and reduce the number of software applications being supported. This movement towards standardization and integration is driven in large part by greater scrutiny of the return on investment from technology projects -- much of the ongoing cost of IT is driven by recurring charges for maintenance, technical support and license fees. Further, the growth and adoption during the 1990’s of feature-rich enterprise software packages left many organizations with a software portfolio replete with incompatible processes, data duplication and batch interfaces. Currently evolving approaches for software integration (e.g. Web Services, XML, Service Oriented Architectures, etc.) will require new skills and training for the IT workforce. The skills sets needed to integrate existing applications, develop reliable data warehouses and build new applications that fit seamlessly into the existing environment should remain in demand for the foreseeable future.

Disruptive Technologies: Another trend with broad impacts on workforce training programs is the ongoing rapid pace of change and innovation in technology. Harvard professor Clayton Christensen popularized the concept of disruptive technologies in his 1997 book, “The Innovator’s Dilemma.” The concept is relatively straightforward: a new lower-quality and less expensive product is introduced, usually to a smaller, “fringe” group of customers, has increasing sales and eventually improves enough in quality that it displaces existing products in the marketplace. Mini-mills in the steel industry and the impact of personal computers on the minicomputer market are frequently cited examples of this phenomenon. Disruptive technologies in IT include examples such as the Internet, wireless technologies, or open source. Being able to rapidly identify the risk and benefits of disruptive technologies in IT can be a competitive advantage to companies and workers.

Interview Highlights

We conducted a series of interviews with industry leaders and technology recruitment experts to identify IT workforce trends and properly frame a survey to assess future job demand. Appendix B contains the complete write-up of these interviews and the roster of those interviewed. Although each interview had its own flavor and focus, a number of common themes emerged:

- Computer programming has become more of a commodity item; this has contributed to a significant increase in the use of outsourced and/or offshore development resources.
- IT organizations are focused on standardizing and reducing the number of applications being supported, this is viewed as an inevitable reaction after a period of explosive growth in IT spending driven by Year 2000, Internet and enterprise application projects.
- Return on investment (ROI) criteria are being strictly applied to new IT spending; projects that integrate existing applications or provide improved data mining and decision support capabilities are being given priority (as is the hiring of individuals with those skills).
- Employers are increasingly looking for business and communications skills in addition to core technical competencies; in Oregon, the IT jobs of the future will likely have more of a business analysis and process management flavor.
- In challenging economic times, training is often one of the first discretionary expenses that organizations cut; this comes at a time when there is an increasing need for training to upgrade skills for displaced workers or assist workers seeking to enhance their career options.
- Greater involvement of the private sector in the educational system is viewed as desirable in areas such as internships, curriculum design and providing teaching resources.
- Achieving the right balance of life-long learning skills and knowledge of specific technologies is a critical success factor for education providers; we need to give our students real world experience without focusing too much on deployment skills that will quickly become obsolete.
- Oregon must focus its investments in technology education and support for technology entrepreneurship in areas with the greatest potential for success; we cannot be “all things to all people” and expect to compete in a global economy.

Highlights from Oregon IT Employer Survey

In Spring 2003, a survey of IT employers was conducted with companies from all regions of the state and in all major industry sectors (Software & Business Services; Wholesale, Distribution and Transportation; High Tech Manufacturing; Other Manufacturing; Finance, Insurance and Health Care; Government and Education; and Telecommunications, Utilities and others). Moore Information conducted the survey and received 200 valid responses with a 95% confidence level. The survey contained questions about key IT trends, current and projected IT jobs, importance of

degrees and certification, preferred training methods, and core competencies of recent graduates. (Refer to Appendix C for complete survey results.)

The survey classified IT jobs into five primary categories based on national skills standards and interviews with Oregon IT employers. The job clusters include:

- IT management, technical sales and marketing,
- Network, data center operations and security/quality assurance,
- Database, applications and software development and programming,
- Interactive media including web, multimedia, and technical writing, and
- Internal and external technical support and customer service.

Overall, the information provided by Oregon employers closely reflects national trends and recent IT studies. These common threads between Oregon and national trends underscore the need for competitive workforce training and the necessity for Oregon to tap into the numerous best practices that have been developed elsewhere. Highlights of the survey include:

IT Trends

- Employers currently view information security, e-business and the Internet as having the most significant impact on IT functions within their company. This is followed by networking and wireless/mobile computing.
- About one in four companies (26%) outsource more than 10% of their IT functions with approximately 50% of that outsourcing going to other Oregon companies.
- IT application companies (wholesalers, health care, financial services, other manufacturers, etc.) were slightly more likely to outsource than software or high tech companies. Likewise a higher percentage of companies with fewer than 10 IT employees currently outsource a portion of their IT operations, yet larger IT shops indicated they will outsource more in the future.

Current IT Employment

- The distribution of IT jobs within a company is typical of IT departments across the nation: 27% in database, applications, and programming; 24% in technical support or customer service; 23% in network, operations and IT security; 18% in IT management, sales and marketing; and 8% in interactive media.
- The distribution of IT occupational clusters varies according to industry. Not surprising, IT application industries like financial services or wholesalers have a higher percentage of jobs in networks and data center operations than companies that develop IT products and services (i.e. software or high tech) which have a higher percentage of jobs within the interactive media category. Understanding this distribution can help training providers to target their services to industries with the greatest demand.
- The recent downturn in the economy has allowed employers to find more qualified applicants in state. On average less than 20% of jobs were recruited from out of state,

with the highest percent (24%) in applications and programming, and the lowest in interactive media (14%).

Projected IT Employment

- Oregon IT employers project a 9.1% annual growth rate in IT jobs. These include both replacement and new job hires. This is consistent with the 9.5% growth projected by the Bureau of Labor Statistics and the 5-15% rate projected by national IT studies.
- Two out of every three employers with more than 20 IT employees expect to hire over the next three years, while one in three smaller IT shops expect to hire during the same time period.
- The greatest number of new or replacement jobs are anticipated to remain in database, application and programming occupations, followed by network, operations and IT security positions.
- While the total number of projected hires in interactive media and technical writing are the smallest of all categories, this cluster has the highest rate of job growth (42% increase over a three year period).⁶
- Software and business service industries projected hiring new and replacement jobs at a rate more than double the average for all survey respondents (more than 20% per year compared to 9.1%).⁷
- Finance, insurance, health care, government, education, and other manufacturing indicated a steady hiring rate between 9-10% per year, while wholesale, distribution and transportation had the lowest projected hiring rate at less than 2% per year.

Education and Training Requirements

- Most high-end IT jobs require at least a four-year degree, yet some jobs are available to those with less than a four-year degree.
 - Almost 40% of companies said they had specific jobs for people with an associate's degree and approximately 18% of other firms said it would depend on experience but would consider an associate's degree for specific jobs. These jobs were found most often in network, data center operation and technical support areas.
 - Approximately 17% of employers said they had jobs for people with only a high school education or a certification. These were found primarily in the areas of customer support, help desk or technical support.

6 This survey result is one of the few that does not correspond to national data. However, the percentage of existing interactive jobs in Oregon appears to be lower than average as compared to national studies. Therefore, a rapid growth rate would put the percentage of Oregon interactive jobs more in alignment with national averages

7 Since these companies tend to be on the leading edge of IT technologies, historically there is more job-hopping and turnover that increases the job churn within this industry.

- Certification is increasingly used as a screening tool in hiring. 70% of employers noted that certification was somewhat or extremely important for new hires with less than five years experience. Certification was slightly more important to IT application industries and to companies with more than 10 IT employees.
- Almost one in three companies said they had recently hired a new graduate from an Oregon educational institution; 57.5% of those hires from a university and 42.5% from a community college. Over 90% of these companies were satisfied or very satisfied with the skills and preparedness of their new hire.
- Overall, less than 30% of companies used IT interns; government and education employers were the only sector where more than half of employers used interns. Not surprising, 55% of larger companies had interns, while only 21% of companies with fewer than 10 IT employees had interns.

Skills Gaps & Preferred Training Methods

- Most employers stated that newer applicants had adequate teamwork and communication skills, yet were still significantly lacking in project management and business fundamental skills that are increasingly important to IT.
- Over 70% of employers train IT employees in off-site seminars and workshops and 67% use web or online methods. More than 50% of employers also noted that they used self-study, trade associations and community colleges for IT training. Only one in three companies used universities or on-site private instruction.
- Web based/distance learning is the training method that most employers intend to increase in use, almost double the rate of other methods.
- While off-site instruction was the most commonly used method today, only one in three employers intended to increase its use. This corresponds with interview comments about reduced training budgets and prohibitions on out of state travel.

Focus Group Highlights

A series of focus groups were held in Portland, Salem and Medford during June to review and expand upon data provided by a statewide survey and best practice research. A complete recap of the focus groups can be found in Appendix D. The focus group participants came from a cross-section of private and public employers, large and small organizations and varied geographies.

Overall, the focus group participants were in agreement with the macro trends identified by national research and the Oregon statewide survey. Specific areas of strong agreement include:

- Job churn is down significantly and the number and quality of applications for open positions has increased dramatically over the past three years.
- There is an ongoing shift in resources away from “pure” programming and development roles to roles that primarily support packaged applications.

- Training is becoming very difficult for public sector employers due to restrictions on out-of-state travel.
- Integration of web services into mainstream applications is increasingly important. Although the Internet bubble may have burst, the web is having a pervasive affect on how IT services are delivered.
- With less funding support and higher delivery expectations, IT departments are working very hard to strengthen the network and “simplify” applications — limiting options but ensuring that the available options are very high quality.
- We are increasingly using cross-functional teams; project management and problem solving skills are vital. With limited staff, system architects who understand how all the pieces fit together are a “must have.”
- As technologies change, must have employees who are life-long learners. While employers can provide some training, it is becoming increasingly important for workers to initiate their own training.
- On-line training is an important tool but it is not sufficient for very technical positions (e.g., systems programmers, database analysts, etc.) Training for high-end IBM and Cisco training is not generally available in Oregon; only the largest employers can afford to have this type of training brought on-site
- Certifications are an important screening factor; however, college education and experience are still the primary attributes in final hiring decisions.

Worker Skills & Training Needs:

Almost without exception, participants commented on the increasing need for IT personnel to have non-technical “soft skills” to be effective in the current workplace. The development or implementation of new systems has become more of an iterative process with involvement of non-technical business users throughout the process. Actual business knowledge of the industry in question – whether gained via internships or previous work -- experience is considered to be of paramount importance. Aptitude in problem solving and logical reasoning is considered a strong predictor of success in an IT career, regardless of academic degree. A number of participants noted that many of their IT staff have liberal arts or other types of degrees.

Focus groups were asked to identify training needs based on incumbent workers, new hires and areas of high turnover. While training needs were found in most IT occupations, they were concentrated in the following areas.

- The number one area identified for incumbent level training was in the areas of IT security, compliance and quality assurance. Most discussion and interest in the IT security area revolves around skill upgrades for existing staff in both technical infrastructure and development job functions rather than significant new hiring.
- Another area of increased incumbent training need was noted in interactive and web services. This was also an area where employers experience a high rate of turnover. (second only to internal support and help desk jobs)

- There remains a strong demand for incumbent training in software development and programming, application services, and network design and administration. Employers noted that for highly specialized applications there were very few training options available in Oregon.
- The need for continuing customer service training appears to be due to the high turnover in this occupational cluster. Being able to aggregate demand for this type of training was important for smaller employers and those in rural areas.

The focus groups reinforced the differences in training needs and hiring expectations for large versus small employers, as well as regional differences primarily related to average company size and availability of resources.

Recommended Actions

Focus group participants were asked about their ideas on how the State of Oregon could improve its ability to provide continuing education & training to technology workers and employers. The responses centered on several themes.

- Aggregate demand for training to increase the quality of available programs. If demand across industries and regions can be combined, Oregon could attract more quality “A” level training.
- Promote learning and training networks for IT workers by region and by IT area, including niche technology groups (e.g. network administrators) where workers can share knowledge.
- Make training portable and just-in-time, making better use of web-based training, on-line and distance learning programs and asynchronous learning networks⁸.
- Increase real world experience for graduates, including internships, work teams and other industry based experience; Introduce co-op programs where students alternate classroom time with actual work in the business world.
- Reduce the divide between certifications and degrees. Provide classes that could lead to certification or provide credit for certifications earned.
- Promote better understanding of needed IT skills. Educate career counselors and K-12 teachers about the wide array of skills that are required in today’s IT environment. Provide better training to undergraduate advisors on the true nature of IT occupations and the types of jobs that will likely be available.
- Provide a seamless and quality education. Provide opportunity to move from a two-year degree into a job and still pursue a four-year degree through distance learning.
- Provide project management and business process analysis classes; add significant business skills, customer service and communications courses to core programs.

⁸ **Asynchronous learning networks (ALNs) are a means for students to take courses and access knowledge on demand. Unlike some distance learning approaches that emphasize time- and place-dependent delivery in a lecture format, ALNs seek to emphasize interaction by using information and communications technology tools to link people and provide a framework for self-paced learning.**

Key IT Trends and Associated Workforce Implications

When the information from interviews, research, surveys and focus groups were combined, a set of specific IT trends and corresponding workforce implications were identified. These trends and implications form the foundation for the recommendations contained in this report.

Trend: Computer programming has become more of a commodity; contributing to a significant increase in outsourcing and/or offshore development. To many industry observers, this trend appears to be as irreversible as the ongoing migration of manufacturing jobs out of the U.S.

Implication: *Investments in training programs and planning for academic curricula should be focused on areas where there are legitimate opportunities for future employment. IT & Software engineering jobs that remain in Oregon and the United States will be in emerging technologies where innovation and high value-added services are essential.*

Trend: IT organizations are focused on standardizing and reducing the number of applications being supported, this is an inevitable reaction after a period of explosive growth in IT spending driven by Year 2000, Internet and enterprise application projects.

Implication: *The amount of training sought for specific applications (e.g. CRM, Supply Chain, Financials) may decline in relative terms while the demand for training in integration, messaging, connectivity and other enabling technologies will likely increase.*

Trend: Return on investment (ROI) criteria are being strictly applied to new IT spending; projects that integrate existing applications or provide improved capabilities are being given priority. This reflects a growing awareness of the need to align IT projects (and their associated costs) with core business processes.

Implication: *IT project managers, business analysts and systems architects specialists will need to continue to enhance their financial modeling and cost-benefit skills as IT becomes increasingly integrated into the core fabric of the business. Training in this area is not as likely to be platform or vendor specific.*

Trend: Rather than seek the most advanced functionality in their application software, many organizations are trading functionality (and its inherent complexity) for increased flexibility. Agility, customer-centricity and responsiveness are highly desirable attributes for most businesses.

Implication: *There may be an opportunity to differentiate Oregon as a place where application integration skills are readily available – this could be accomplished by focused training or affinity groups for individuals who already have significant experience in a technology occupation.*

Trend: The pendulum has swung from employees/job candidates being in the driver's seat to employers having a large pool of qualified candidates and the negotiating advantage. Employers expect to find employees who match their skill and experience requirements almost exactly. Overall job churn is down, both in Oregon and in the U.S. as a whole. Employees desire stability and perceive limited options in the marketplace.

Implication: *Programs to assist displaced workers and provide entry level opportunities must be creative in the way that employers are enticed to participate and realistic with respect to the types of outcomes that can be achieved. Conversely, we need to have flexibility and sufficient staying power in training programs so they can be ramped up quickly if and when the demand for IT workers improves.*

Trend: In addition to core technical competencies, IT jobs of the future will have more of a business analysis and process management flavor. Communication and interaction with business line personnel are essential. The days of “the nerd in the corner” are rapidly disappearing.

Implication: *Communication, business process and customer service skills must be incorporated into training for IT staff at all levels. Career and job counselors must be trained to properly describe IT occupations and identify suitable candidates.*

Trend: Balancing life-long learning skills and specific technologies is critical for education providers; students need real world experience without focusing too much on deployment skills that quickly become obsolete. Greater involvement of the private sector in the educational system is thought to be desirable (internships, curriculum design and teaching resources, etc.) Employers just aren’t hiring people without relevant experience; that experience has to come from somewhere.

Implication: *We should reevaluate the way internships and student projects are structured to make them more closely aligned with real business objectives. There should be an emphasis on teaming and ensuring that students are involved over a long enough period of time for real work to be produced and a realistic learning experience and evaluation to occur.*

Trend: Much of the growth in future IT occupations may be in areas related to network and server maintenance that are sometimes regarded as less “glamorous” than computer programming and systems analysis.

Implication: *Provide opportunities for family wage jobs in all parts of the state. We need to ensure that the academic/training “footprint” to provide this type of training is also broad-based with multiple delivery options.*

Trend: In the current challenging economy, training is often one of the first expenses to be cut; this comes at a time when there is an increasing need for training to upgrade skills for displaced workers or assist workers seeking to enhance their career options.

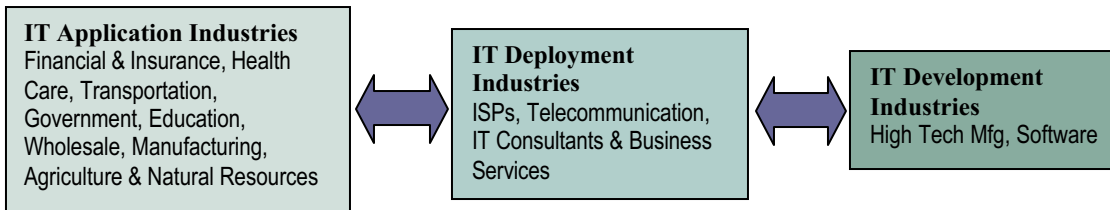
Implication: *There may be a need for increased public sector involvement in initiating and maintaining needed training. Public dollars should be used to develop a “wholesale” approach that builds capacity and just-in-time training across industries and regions, rather than funding customized training for individual firms.*

Trend: As information systems and computing becomes ubiquitous, the focus is shifting from rapid innovation to risk management and the adaptation to disruptive technologies.

Implication: *There is an increased need for workers to understand and incorporate sound practices for business continuance and security, and for our workforce system to develop delivery channels that can quickly respond to training needs caused by disruptive technologies.*

Applying IT Trends and Implications to Various Types of IT Employers

Key IT drivers and workforce implications can be further refined using the definitions of IT industries where employers are described as those that apply, deploy or develop information technologies. Identified below are the commonalities and differences among various industries and types of IT uses.



<i>IT Drivers</i>		
Application standardization and integration	Business Continuance, Disaster Recovery	Rapid adoption of breakthrough technologies, (e.g. XML, .NET, Open Source, etc.)
Focus on business services, ROI	Security	Strategic vision, anticipation of new trends (e.g. pervasive computing, wireless, RFID, etc.)
ASP, outsourcing options	Server consolidation, centralized management	Availability/shortage of specific, highly sought after skills
Data mining, business intelligence	On-demand computing, 24/7 availability	Partnerships with industry leaders
Business process tools integrated with development platform	Contract flexibility (e.g. out clauses, volume pricing, etc.)	Knowledge and application of software development methodologies
Technical staff with specific industry expertise	Implementation expertise, change control	
Industry regulatory requirements (e.g.. HIPAA)	Staff flexibility as market conditions change	
<i>Priority IT Occupations</i>		
Application Services	Computing Envir. & Data Center	Software Development
Database	Network	Marketing & Sales
IT Management	Security, Compliance & QA	Technical Writing
Network	Internal Support & Help Desk	External Support
External Support & Call Center	Creative & Web Services	
<i>Importance of Four-Year Technical Degree</i>		
Medium	Medium to High	High
<i>Importance of Certification</i>		
Medium to High	Medium to High	Low to Medium
Often used as a differentiating factor in hiring; More focused on professional certification	Tends to be more vendor specific or focused on issues like security	Technical degrees matter most
<i>Incumbent Worker Training Needs</i>		
High	Medium to High	Medium
<i>Impact of Disruptive Technologies</i>		
Medium	Medium to High	High

Section 4: A Framework for IT Workforce Recommendations

Overview

The recommendations that follow are intended to provide strategic direction and focus for the development of priorities and more detailed plans in Phase II of this project. These recommendations are meant to serve as the foundation for targeted discussions among education and training providers, the Governor’s workforce advisors, state agencies, industry associations and workforce boards who share a common interest in the development and delivery of coordinated actions based on identified industry demand.

The strategic directions found in this report share a set of common characteristics. These include:

- An awareness of the rapid rate of change within the IT field – any new programs or program modifications must have sufficient flexibility to respond quickly to new technical innovations and avoid rapid obsolescence.
- An emphasis on employer-led efforts with active private sector involvement throughout the full lifecycle of planning, execution and evaluation.
- An understanding of the need to marshal resources and avoid duplication of effort – we will seek to share and streamline development of new training capabilities that can then be deployed across multiple companies, regions and/or academic institutions.
- An appreciation for the large number of high quality, family wage IT jobs found outside of technology firms or “high-profile” software engineering occupations.

Not only is it important to have the “right people with the right skills,” it is essential for a state our size to differentiate itself and build a reputation for excellence in specific IT areas. Oregon can use its relatively small market size as an advantage to be nimble and responsive. We believe there are three specific IT areas where Oregon can develop a competitive edge by:

- *Focusing on a specific area of training:* For example, developing leading edge training for connectivity and integrated technologies.
- *Focusing on specific delivery methods:* Developing a training “infrastructure” that is quickly deployable and scalable using standardized distance learning technologies and asynchronous learning networks.
- *Being early adopters⁹ of training within selected applications:* Developing the capacity to rapidly identify and deploy needed training related to emerging and disruptive technologies.

As a group, these strategic directions provide guidance for incumbent, emerging, and unemployed worker training, as well as statewide policy implications for public sector IT employers.

⁹ To fill the gap in what is commonly known as the “diffusion of innovation” curve between early adopters and the majority of users where there is still a significant competitive advantage

Strategic Directions

A. Aggregate Training for Incumbent Workers

A-1: Aggregate training for highly specialized technologies or methodologies.

Training for high-end technical skills (operating system, middleware, database internals) and emerging methodologies (application integration, messaging, connectivity) tend to be intensive seminar-type efforts that depend heavily on the expertise of the instructor(s) and feature hands-on interaction. When these technologies or methodologies are new, national training firms or large technology vendors are the most common provider. The Oregon market is often too small to get the first round of training or the “A” team of instructors. Therefore, companies must send their employees out of state to get timely and high quality training.

Incumbent Worker Training/Professional Development

Potential Approaches	Key Partners
Aggregate highly specialized technology training needs across regions and industries to attract high quality intensive training seminars and boot camps to Oregon (Currently workers must travel out of state to receive this type of training)	Alliance of state and regional industry associations and professional trade groups, led by an industry association such as the Software Association of Oregon that represents companies at the leading edge of IT.

Emerging Workforce & Post-Secondary Programs

Potential Approaches	Key Partners
Ensure Engineering & Technology Industry Council (ETIC) and Oregon Masters in Software Engineering (OMSE) efforts are well aligned and support the foundation skills associated with industry training efforts for highly specialized technologies.	ETIC and OMSE to be involved in any statewide IT Skills Panel or Alliance of IT industries.

A-2: Aggregate demand and deliver cost-effective training for generic platform or vendor specific skills to rural regions and targeted industry groups

Since the majority of IT employers, especially outside the Portland region, having fewer than 10 IT employees generic platform or vendor training tends to be driven by cost and location. Examples of this training include network administration, server maintenance, general database and report-writing tools. The content training programs tend to be readily available and are most often delivered by the vendor, a private third-party trainer, or a community college/university. Being able to aggregate demand for this type of training in rural areas or by industry can increase the number of workers who have access to up-to-date skills and knowledge.

Potential Approaches	Key Partners
Aggregate demand by region: Establish regional training alliances to connect the demand (through existing business or industry groups) with existing content, and be delivered through available training channels (like community colleges or universities). In most cases, this would be a matter of connecting existing organizations within a region.	Local business and industry groups, local training providers (including universities, community colleges, and private vendors), and Local/Regional workforce boards.
Training for skills upgrades can also be accomplished through industry associations where there are common technical infrastructure and enterprise systems. Here the state can assist industry and professional groups such as HIMSS (Healthcare Information and Management Systems Society) identify and aggregate training for IT workers in healthcare.	Oregon Workforce Investment Board, industry associations and IT trade groups and training providers.

Preferred delivery methods for both regional and industry aggregation appear to be:

Delivering intensive just-in-time training for technologies including boot camps and web-based or distance learning programs. A key component of success in this area will be using a “develop once, deploy often” model that can avoid duplication of effort and provide consistent content and quality of instruction across the state. Classroom style instruction occurring once or twice a week for a period of time, was not viewed as effective as a training method for IT workers

Linking small employers to training being conducted at larger employers in their region. For example, in Southern Oregon, larger employers have held technical training for their employees and opened up a limited number of spaces to smaller companies in the region. Formalizing this type of program would be a cost effective way for incumbent worker training to occur.

B. Enhance Post-Secondary Education Programs to Align with Changing Industry Trends

B-1: Increase business integration skills in IT workers

A significant number of companies noted the need for employees to have skills and knowledge that allows them to understand how IT systems and solutions fit into overall business operations. In the past, IT departments developed systems after business plans were developed—often as a stand-alone functional discipline. Now IT is increasingly part of the initial business planning process. Four types of skills were noted as critical to the current IT environment, yet missing in many employees:

- Business fundamentals,
- Business process and work flow analysis,
- Project management, and
- Customer service skills.

Incumbent Worker Training/Professional Development

Potential Approaches	Key Partners
Aggregate business operations and process training needs across regions and industries to attract high quality intensive training seminars and boot camps to Oregon. (Currently workers must travel out of state to receive this type of training.)	Coordinated effort among industry and professional trade groups. Coordination should be led by a group having the ability to objectively pull together training needs across industries.
Develop pilot programs for IT/business alignment training using asynchronous learning networks.	Universities and the alliance of industry and trade groups.
Establish a common project management and customer service training program focused on IT applications that can be deployed by multiple training providers throughout the state. (Utilize existing programs as the foundation for this training ensuring case studies and examples are IT oriented.)	A statewide workforce effort lead by an agency such as CCWD or OECDD that convenes industry/trade groups and training providers to develop and deploy training.

Emerging Workforce & Post-Secondary Programs

Potential Approaches	Key Partners
Universities: Inclusion of business process, critical thinking and analysis skills, as well as project management and communication skills within computer science, computer engineering, and information systems programs.	Business schools and computer science departments with input from the IT Skills Panel or alliance of industry and professional trade groups.
Community College Programs: Associate degrees and transfer programs should include curriculum that incorporates strong problem-solving, and project management skills, and provide training on communications and customer service.	Community colleges, employers and IT Skills Panel

B-2: Provide seamless educational progression for IT

An increasing move toward IT standardization points to a strong need to ensure that course curriculum for each level of education is consistent among educational institutions and can be articulated from one level to the next. At the community college level, the connections between terminal and transfer degrees should be reevaluated for uniformity. Since certification (in addition to a degree) is increasingly important, better connections between certification and degree programs at post-secondary education institutions should be explored.

Potential Approaches	Key Partners
Ensure, to the extent possible, seamless articulation from advanced high school programs, to community colleges to universities. Much work is already underway in this area. The focus on this issue should continue and should include the soft skills and business operations skills described in this report.	K-12 and post-secondary institutions with input from IT employers

Improve the integration between IT related associate degrees and transfer programs within the community college system, this could be explored using pilot programs targeted on areas with less of a hardware specific component.	Community college System with input from IT employers
Better connect certifications with technical degrees. Certifications as well as a degree are common requirements in today's market, yet the post-secondary education system treats them very separately. We should explore ways to bring these two important aspects of IT training and education into better alignment.	Community college and university Systems with input from IT employers

B-3: Provide real-world work experience for graduates

While the majority of employers are looking for workers with specific experiences, less than one in three companies employed interns in IT. In addition to traditional intern programs, more schools are developing technical or business solution teams (e.g. OSU's Business Solution Team) that connect students and faculty to real IT project within a company or organization. These types of applied experiences must be fully supported by academic institutions and industry.

Potential Approaches	Key Partners
Promote the use technical or business solutions teams as a way for students to get "real world" experience. Assist schools to establish these types of programs and garner support from Deans and professors to actively support these programs.	Community Colleges and University Systems, and computer science and IT departments within campuses.
Assist industry groups and regions in increasing the number of IT interns. Examine barriers and incentives for firms with fewer than 20 IT employers to establish an intern program.	At a state level, this issue could be addressed by an IT Skills Panel. At a regional level, Local/Regional Workforce Boards could convene employers and educational institutions.

C. Develop A Unique IT Market Niche For Oregon

C-1: Recognize the potential impact and rapidly respond to disruptive technologies

Oregon has no forum for understanding and rapidly adapting to disruptive technologies (i.e. wireless, open source, internet). These technologies can become a barrier or competitive edge, depending on how well and how fast a company can identify the business value or potential risk of these technologies. Being able to identify the impact of these technologies to Oregon industries and then quickly deploying appropriate training would provide Oregon a differentiating niche for both workforce and economic development.

Potential Approaches	Key Partners
Establish an innovation and early adopter forum for disruptive technologies. This forum could be a committee of an IT Skills Panel or IT Industry Alliance as suggested in the first recommendation. The forum would assess the impact of disruptive technologies to Oregon industries and suggest ways to more rapidly deploy solutions. This rapid deployment could differentiate Oregon from other states.	IT Skills Panel, industry associations and IT employers. A committee of the skills panel could be led by industry groups such as AeA or SAO.

C-2: Create a standardized statewide IT infrastructure that supports rapid and scalable deployment of workforce training.

The Oregon University System and Department of Community Colleges and Workforce Development should examine ways to standardize technologies to allow training components to be rapidly deployed within a consistent, scalable framework. Not only would a consistent IT infrastructure provide a more consistent learning environment for students and incumbent workers, it would be more cost effective for the university system. In addition, this type of rapid deployment model could strengthen relationships between post-secondary education and businesses across the state, and could be a recruitment and retention tool for economic and workforce development organizations.

Potential Approaches	Key Partners
Examine ways to standardize IT technologies used by Oregon post-secondary institutions to deliver training and education programs, including web, distance learning and asynchronous learning networks. Identify and execute a pilot project to demonstrate advantages of a consistent technical framework with associated cost savings.	Oregon University System, Department of Community Colleges and Workforce Development, and IT Skills Panel

D. Improve the Effectiveness of Workforce Development Funds and Programs

D-1: Update the skills of unemployed IT workers

As the economy recovers, many unemployed IT workers are likely to need some short-term training to be immediately productive to a new employer. Exploring more targeted uses of workforce development funds such as Individual Training Accounts (ITAs) or training partnerships with employers could significantly improve unemployed worker skills and be beneficial to hiring employers.

Potential Approaches	Key Partners
<i>Use of Individual Training Accounts (ITAs) and other Workforce Investment Act funds to assist recently unemployed IT workers get up-to-date skills.</i> These workers need to have at least two years experience in the IT field. Support training to pay for professional or vendor certifications, especially those related to high demand areas such as network, enterprise and application integration, and project management.	Oregon Workforce Investment Board, Local/Regional Workforce Boards, IT Skills Panel

<p><i>Examine training partnerships between one-stops, workforce agencies and employers. Enable qualified candidates (those with relevant IT background and other technical and non technical skills, yet perhaps missing a specific certification or training on company specific applications) to receive training through workforce funds and be hired upon completion of training. The workforce funds would pay for training gap if employer agrees to hire upon successful completion. [as per the MetroTech program in Virginia]</i></p>	<p>Local/Regional Workforce Boards, IT Employers</p>
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D2: Help workforce and career guidance counselors and instructors to understand today’s IT skills and to attract people with the right “fit”

Today’s competitive IT employee has a blend of technical, business and people skills. The typical IT worker has evolved from the quiet programmer in the corner to the problem-solving communicator of technical solutions. Information needs to be distributed to career counselors and technology instructors at all levels (high school, colleges, and local/regional workforce boards to understand what it takes to be an IT worker in today’s environment. Instructors need to communicate and demonstrate to students the importance of operational and soft skills as well as technical skills.

Potential Approaches	Key Partners
<p>Ensure the national skills standards for IT are readily available to one-stops, K-12, community colleges and universities.</p>	<p>Oregon Workforce Investment Board</p>
<p>Develop interactive informational sessions and career exploration workshops in K-12 between industry and schools that expose teachers, students and counselors to the variety of IT jobs and the skills and prerequisites needed to pursue an IT based education. (Models readily available in health care, trade industries and other occupational clusters)</p>	<p>Oregon Workforce Investment Board, IT Skills Panel, Local/Regional Workforce Boards</p>

E. Establish A Statewide Focus on IT Issues

E-1: Develop an ongoing structure for understanding technology workforce issues

Since technology workers are employed in so many industries, a statewide, multi-industry forum should be established to identify critical technology and workforce issues that are key to the competitiveness of Oregon businesses and the success of Oregon technology workers.

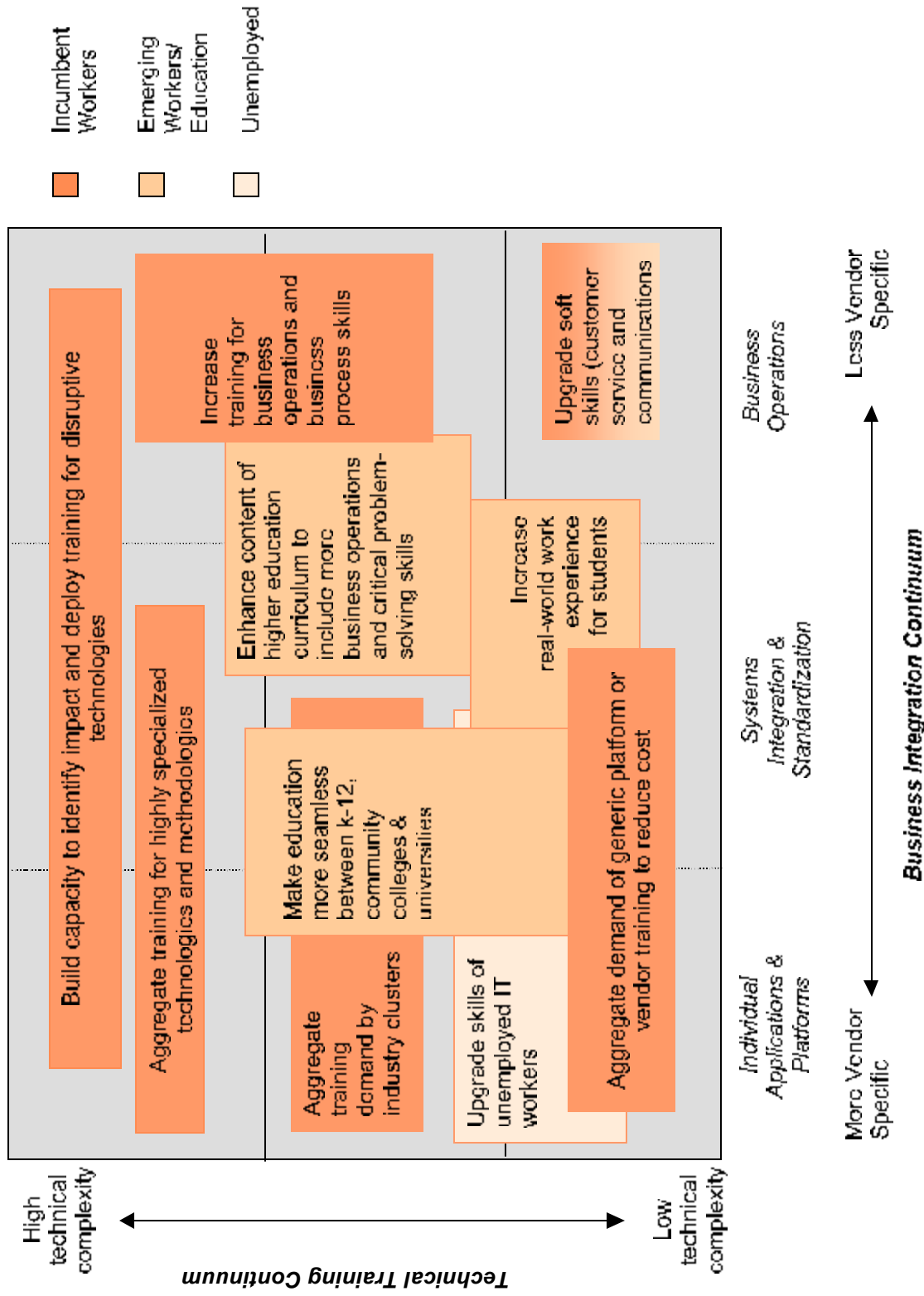
Potential Approaches	Key Partners
<p>Establish an Oregon IT Skills Panel based on the state’s health care skills panel model. The panel would be an industry-led alliance of IT employers, educational institutions and other training providers that would identify critical workforce trends and act as an ongoing conduit to the wide array of industries that employ IT workers.</p>	<p>IT employers, colleges and universities, and training providers, coordinated by the Department of Community Colleges and Workforce Development.</p>

E-2: Standardize IT applications within state agencies to provide a consistent IT infrastructure, reduce operating costs, and maximize workforce training efforts.

The lack of standardization in information technologies used within and among state agencies is no different than a lack of standardization across a company with multiple locations — training costs are higher and additional training is required for employees. State government should explore ways to standardize IT applications across agencies to minimize cost and maximize investments in IT training.

Potential Approaches	Key Partners
<p>Work with the State CIO and Governor’s Advisory Committee for Government Performance and Accountability to identify areas where IT applications and platforms can be standardized among state agencies. Pilot standardization in at least one application to demonstrate performance enhancements, training benefits and cost savings.</p>	<p>Governor’s Advisory Committee for Government Performance and Accountability, The Department of Administrative Services, State CIO, and appropriate state agencies</p>

Overall IT Training Objectives



Appendices

The following appendices are found in a separate document that is available upon request.

A. Employment Department Data

B. Summary of Interviews

C. Survey Results

D. Recap of Focus Groups

E. National Skills Standards

F. Bibliography