



City of Seattle • Gregory J. Nickels, Mayor
Office of Economic Development • Jill Nishi, Director

CLUSTER STUDY

SEATTLE'S INFORMATION AND COMMUNICATIONS TECHNOLOGIES CLUSTER

Submitted By



| BERK & ASSOCIATES |

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EXECUTIVE SUMMARY

The City of Seattle is at the center of the region's Information and Communications Technologies (ICT) Cluster. This Cluster has evolved and grown through the network effects and intersection of skilled and educated people already working in the region's technical fields (engineering, education, research, science and others); the popularity of shared programming knowledge (open-source) programming, fueled and facilitated by the City's coffee-house culture and collaborative values; entrepreneurial and financial wherewithal in the City; and the success of particular home-grown technology companies, notably Microsoft and McCaw Cellular. All of these incubating factors have led to Seattle's reputation as an excellent place for starting a technology company, and for finding work in those companies.

ICT Cluster Jobs. In 2002, employment in Seattle's 856 ICT Cluster companies totaled an estimated 18,250 jobs. For the Seattle-Bellevue-Everett MSA, there were a total of 72,800 jobs in 2,180 ICT Cluster companies. These positions include both technical and non-technical jobs, such as administrative support, finance and management, necessary to support company operations.

However, perhaps the more appropriate measure of the scale and import of this Cluster is the total number of all of ICT Cluster jobs in *all companies* in the MSA. By this measure, the Puget Sound MSA – with a total of 73,670 ICT Cluster jobs – ranks in the top tier regions nationally in terms of Cluster jobs.

The Cluster's strength in this region can also be viewed from another comparative perspective: the percentage of ICT Cluster jobs in the economy relative to other regions in the country. By this location quotient measure, the Seattle MSA ranks third in the

nation for all ICT occupations (behind San Jose and only marginally behind Raleigh Durham) and ranks second in the nation for software programmers and engineers (behind San Jose).

The Seattle MSA has about one-third more people in ICT occupations than in comparable MSAs throughout the country. Compared to the same MSAs, Seattle has about 50% more people in programming and software engineering occupations. In fact, software engineers and programmers define Seattle's ICT Cluster more than any other attributes. Within the regional total of ICT occupations, computer programmers or software engineers comprise 30,000 jobs (41% of all Cluster occupations).

Other occupations which are relatively highly concentrated in the MSA include multi-media artists and animators, post-secondary computer science teachers and network and computer systems administrators.

ICT Cluster Wages. ICT jobs pay roughly twice the median wage of all occupations in the region. In 2002, the typical ICT job paid nearly \$70,000. Programmers and software engineers were paid between \$75,000 and \$80,000 (median wages). The highest paying occupation in the cluster, computer and information systems managers, paid nearly \$99,000 (median wage). This compares with median wages of \$35,270 for all occupations in the MSA in 2002.

Business Income. The companies in the ICT Cluster generate significant business revenue and contribute greatly to the City's fiscal revenues. The ICT Cluster in the City of Seattle generates more than \$3.5 billion in revenues annually – \$1 billion of which

includes telecommunications revenues to businesses based elsewhere. Prepackage Software generates an estimated \$650 million in revenues locally.

Public Revenues. The ICT Cluster generates nearly \$15 million in public revenues to the City of Seattle from B&O taxes (\$4.2 million) and sales tax (\$10.6 million). ICT companies also generate other public revenues, including utilities and property taxes, both of which were beyond the scope of this study to estimate.

Industry Perceptions of the ICT Cluster. Seattle is and will continue to be known as a City that attracts software programmers and developers. The strong supporting network of the University of Washington, venture capital companies and strong institutional support such as the Washington Software Alliance together combine to support the region's ICT Cluster.

Local culture and amenities, such as restaurants and access to the mountains and Puget Sound, will continue to attract the nation's talent to Seattle. Most local companies point to quality of life indicators, such as open space and business culture, as the primary assets of the City in fostering local growth. This finding is consistent with national research on tech companies and talent mobility. Human resources staff also point to local culture and amenities as a powerful recruiting asset. They say traffic congestion and cost of living are the primary deterrents to attracting talent from elsewhere in the world.

Interviews with ICT company representatives suggest that the City's B&O tax and transportation policies rank highest among public policies of interest and concern among ICT Cluster companies. Interviewees suggest B&O tax breaks for tech firms in start-up phase. A common view is that the B&O tax is a deterrent to local

start-ups, which receive revenues before making a profit, resulting in unprofitable start-ups burdened additionally by paying B&O tax. They say that local public policy can support growth in this Cluster by focusing on creating a great City for its residents and by ensuring that business taxes do not serve to stifle innovation and entrepreneurial activity.

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INTRODUCTION

The City of Seattle's Office of Economic Development (OED) seeks to develop a unified, coordinated economic development strategy and plan that will help grow the City's economy. Towards this end, OED identified a group of industry clusters that have job growth potential; provide accessible, family wage jobs; fit with Seattle's comparative advantages and contribute significantly to the City's tax base. Analyses of each of the clusters will inform the development of OED's Five-Year Strategic Action Plan, as well as short-term action strategies.

This report presents findings and analysis of Seattle's Information and Communications Technologies (ICT) Cluster. The City's ICT Cluster is rooted in the region's concentration of technology workers in aerospace, University research and technical occupations in other industries. The success of Microsoft and McCaw Cellular symbiotically grew the Cluster in the 1980s and early 1990s. Subsequently, Amazon.com and other companies emerged from the dot-com era of the late 1990s and today anchor the region's ICT cluster, along with Microsoft and the ever-changing corporate network of telecommunications firms.

An important aspect of understanding the different ICT Cluster is that it is structurally from other industry clusters: the ICT Cluster is as much about *occupations* common to *all* industries as it is about specific businesses engaged in ICT activities. In the City's other clusters, the activities of *firms* define the clusters. The same is partially true in the ICT Cluster, but the Cluster also includes ICT professionals employed in *all* other industries in the City.

Report Organization

This report begins with a brief history and overview of the ICT Cluster in Seattle, illustrating that this Cluster is shaped by both companies and occupations. Next, a cluster map and interpretation provide an overview of today's ICT Cluster in Seattle and the Puget Sound region.

The following sections report analytical findings of jobs and wages, revenues and public revenues. An understanding of the number of jobs and wages associated with those jobs requires examining information of all jobs in ICT-related companies and ICT-occupations in all companies. The report concludes with key findings drawn from the analysis and interviews of ICT Cluster companies.

HISTORICAL CONTEXT OF SEATTLE'S ICT CLUSTER

The genesis of Seattle's ICT Cluster presents an interesting and layered story. The Cluster originated from a common interest in technology among skilled and educated people living in the City. Skilled people living in Seattle and employed in technical fields (engineering, education, research, science and others), through their employment served to advance various information and communication technologies and their applications.

The advancement of programming and communication technologies accelerated in the late 1970's and early 1980's. At this time the City's coffee-house culture and community values already existed, all of which paralleled the popularity of shared programming knowledge (open-source programming) and collaboration – a key reason for the network effects of growth in the ICT Cluster. This culture was prevalent in college towns across the country, and Seattle's larger presence of skilled engineers and programmers accelerated the City's prominence in the ICT realm.

Electronic bulletin boards and many software applications exemplify the products that emerged from these collaborations, based on the desire to share advancements in the emerging technologies.

Local financiers and entrepreneurs then intersected and converged with the programming community to develop businesses applications of various computer technologies. Successful businesses and business models emerged from this environment. Two businesses in particular emerged and continue to drive growth in the ICT Cluster in Seattle: Microsoft and McCaw Cellular.

The success of Microsoft and McCaw Cellular enhanced the City's reputation as a place for commercial success in ICT activities. The

development of new technologies and the breadth of their applications in turn spurred spin-off companies, as employees of these successful firms left their jobs to become entrepreneurs.

The job opportunities that came with this success and expanded network of employment options attracted large numbers of skilled programmers to Seattle. Programmers and related talent found the City and its culture attractive for their work. The network effects of the ICT professional community supported entrepreneurial activity because of the increasing numbers of professionals in the talent pool.

In addition to creating job openings, Microsoft and McCaw generated wealth among the companies' talented employees. The wealth grew the local capital available for funding technology companies, further accelerating entrepreneurial activity. Microsoft in particular is identified by local companies as having had this impact.

These regional trends continued into the 1990s, along with development of the Internet on a global scale. Seattle's local programming and communication talent-base naturally became a strong foundation for launching Internet-related companies. The local talent pool, the wide-spread usage of the Internet and the accompanying global perceptions of business opportunities led to the dot-com growth in the 1990s, such as Amazon.com and many others in Seattle.

Today Seattle is the central city in a region known internationally as a cluster of technology businesses and talented people. The following sections rely on existing data and industry representatives to analyze and assess the City's role in the on-going regional development of the ICT Cluster.

ICT CLUSTER OVERVIEW AND CLUSTER MAP

Understanding the ICT Cluster requires an assessment of more than the just those companies commonly referred to as “high-tech.” Technology workers and skills are employed in many companies throughout the region. Exhibit 1 provides an overview of the ICT Cluster relationships between companies by activities, occupations by type, support organizations and the many other industries in the local and regional economy.

When the media and many people think of “high-tech,” they frequently think of the company activities shown in the upper left grouping in Exhibit 1. Some well-known technology companies span more than one of these activities; Microsoft spans nearly all of them. Some companies can be placed easily into one activity or another: Getty Images fits within Image Licensing; and Amazon.com fits within into E-Commerce Retailing. These companies demand a great many types of employees, varying broadly in the skills needed.

The center of Exhibit 1 shows the many highly skilled occupations that develop and utilize technology. Software programmers, network analysts and Web designers all provide the hands-on technical capabilities necessary to drive the ICT Cluster.

More business activities appear on the right edge of the Exhibit, including banks, engineering firms, biotech companies, government and educational institutions. People do not always consider these activities when thinking about high-tech. However, the occupational links to this group of activities show that these ICT Cluster occupations drive the technology tasks related to these more traditional activities.

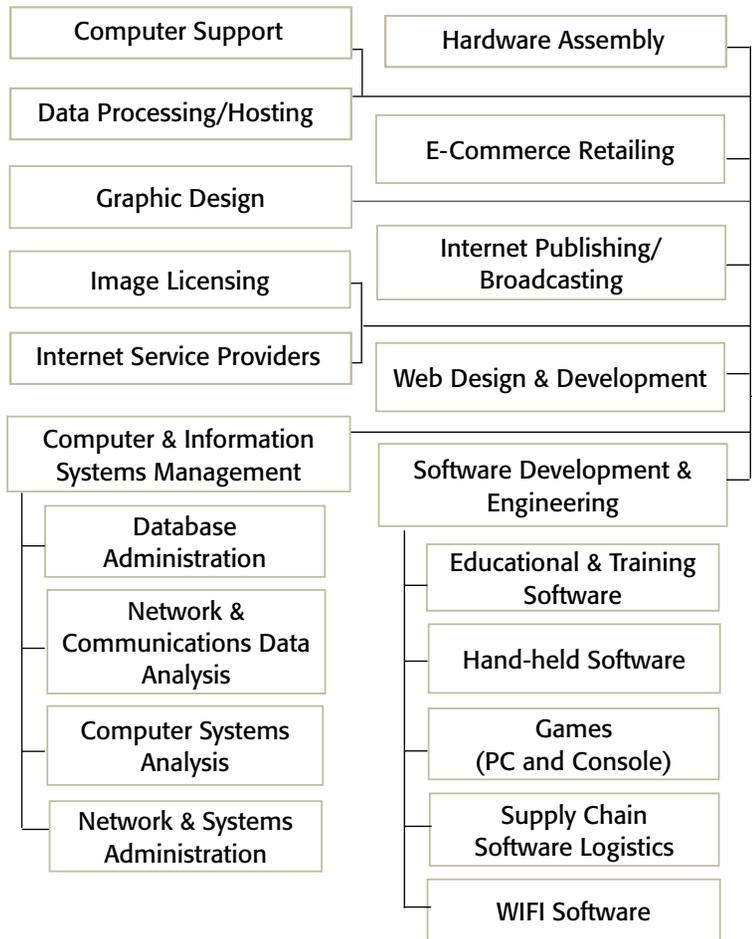
Another group of activities critical to the ICT Cluster – ICT support activities – appears in the lower left portion of Exhibit 1. This grouping reflects the important support activities performed by the University of Washington, the Washington Software Alliance, venture capitalists and others who train, fund and coordinate and generally support the development of the ICT Cluster in Seattle and the region.

Not all traditional industries directly employ people in all of the ICT Occupations shown in Exhibit 1. The size of a company and the degree to which it employs technology together determine the relationship of any given company to technology resources. In many cases, companies employ numerous ICT Occupations, including most commonly computer support professionals, network administrators and computer programmers, in that order. In other cases, especially for small businesses, companies contract these services, creating a consulting industry for every ICT Company Activity shown in Exhibit 1.

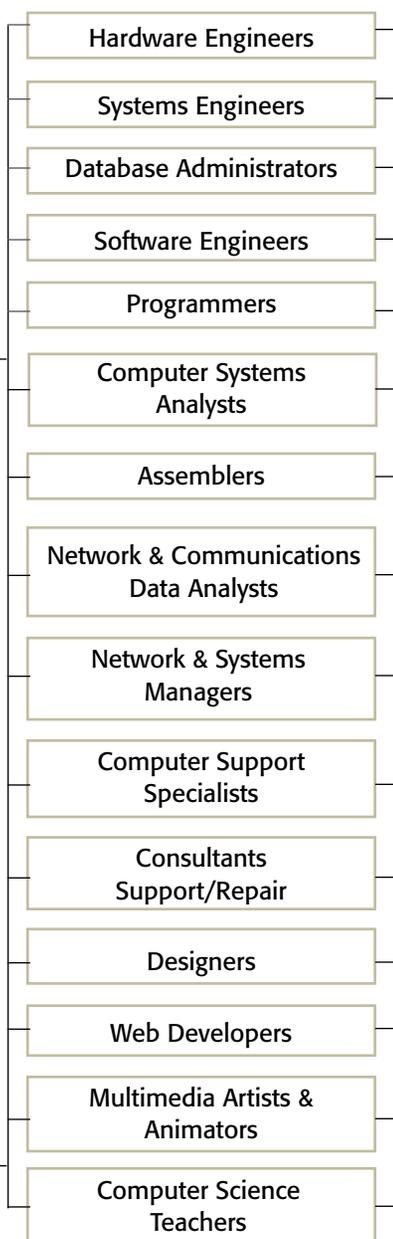
Economic development policy can relate most directly to the ICT Cluster by focusing on the ICT Company Activities and the ICT Occupations. The remainder of this report focuses on these two groups providing a framework for understanding and assessing the role of each of these groups and the ICT Cluster as a whole on Seattle’s economy.

Exhibit 1: Information & Communications Technologies (ICT) Cluster

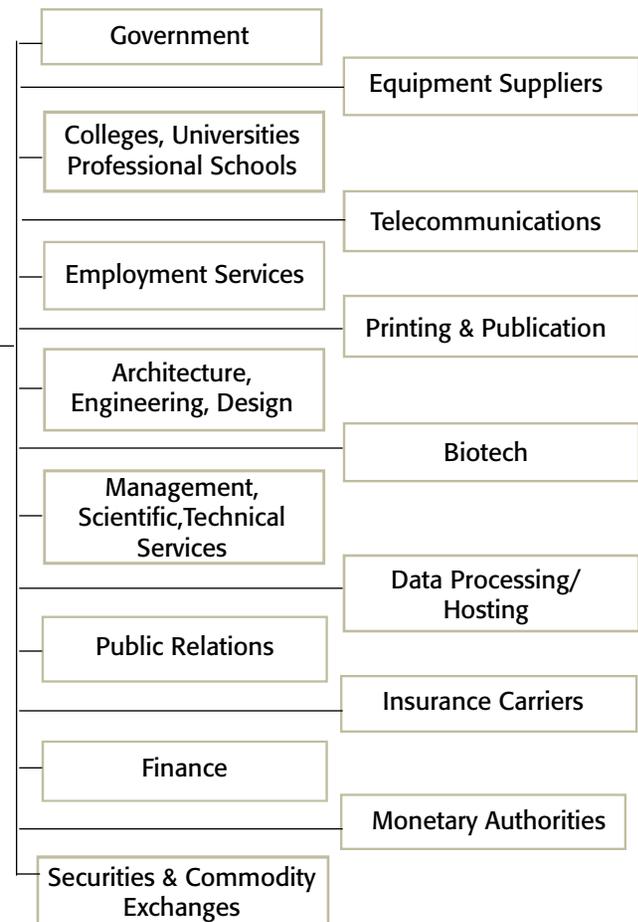
ICT COMPANY ACTIVITIES



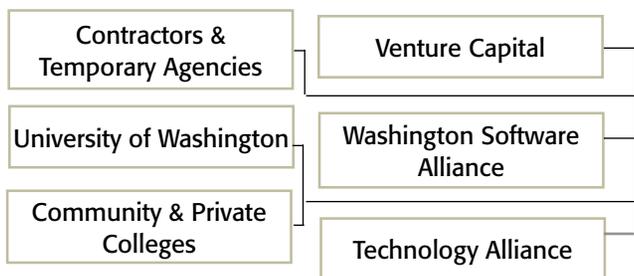
ICT OCCUPATIONS



ACTIVITIES WITH CONCENTRATIONS OF ICT OCCUPATIONS



ICT SUPPORT ACTIVITIES



ICT CLUSTER JOBS ANALYSIS

This section begins with *ICT Cluster Companies Analysis*, an analysis of the jobs associated with the ICT companies in Seattle, including all jobs (technical and non-technical) necessary for those companies to succeed. This analysis shows how some ICT businesses have clustered in Seattle, focusing on the activities shown in Exhibit 1. *ICT Cluster Occupations Analysis* follows, in which all ICT-specific occupations are assessed, regardless of the type of company within which those occupations exist.

ICT Cluster Companies Analysis

This analysis relies on the Standard Industrial Classification System (SICs, U.S. Census Bureau). The SICs chosen reflect a thorough review of the SIC codes assigned to companies known to participate directly in the ICT Cluster. The review included researching the *Puget Sound Business Journal* and other local and national sources to identify Seattle and regional businesses engaged in ICT Cluster activities. SICs assigned to those companies in Washington State Employment Security Department (ESD) employment records, data managed by Puget Sound Regional Council (PSRC), helped to determine which codes represented the ICT activities of interest for this report.

This research determined that ICT Cluster companies exist primarily within the following industries (SIC codes in parentheses), grouped as follows:

- Telecommunications
 - Radiotelephone Communications (4812)
 - Telephone Communications, Except Radio Telephone (4813)
 - Telegraph and Message Communications (4822)

- Communications Services, Not Elsewhere Classified (NEC, 4899)
- Computers and Software
 - Computer Storage Devices (3572)
 - Computer Peripheral Equipment, NEC (3577)
 - Office Machines, NEC (3579)
 - Computer Programming Services (7371)
 - Prepackaged Software (7372)
 - Computer Integrated Systems Design (7373)
 - Computer Processing and Data Preparation and Processing Services (7374)
 - Information Retrieval Services (7375)
 - Computer Facilities Management Services (7376)
 - Computer Related Services, NEC (7379)

The North American Industrial Classification System (NAICS) will entirely replace SICs eventually. At present, however, data such as current and historic employment data from PSRC and ESD, have not transitioned to NAICS. The result is a choice between NAICS, with less complete data and more descriptive categories and SICs, with better data coverage but more cumbersome and outdated industry categories. This report uses SICs.

For Seattle, the most notable limitation to using SICs would be the exclusion of Amazon.com, classified under SICs as Catalog and Mail-Order Houses (SIC 5961). For this study, Amazon was given special consideration and added to Computer Programming Services (SIC 7371) for some data summaries. No other company appears to merit such treatment, based on employment total significant enough to affect an understanding of the cluster. (Amazon.com had approximately 2,000 jobs in Seattle in 2002, based on Puget Sound Business Journal articles.)

Covered Employment Analysis by Company

In 2002, employment at Seattle's 856 ICT Cluster companies totaled an estimated 18,255 covered jobs, as shown in Exhibit 2. Covered employment for the City in 2002 totaled 479,241, according to Puget Sound Regional Council (PSRC data). (Covered employment refers to those jobs "covered" by the State's unemployment insurance programs. In general, covered employment excludes 10-15% of all jobs. Excluded jobs include

the proprietors and owners of a company, including self-employed individuals.)

Employment in Seattle's ICT Cluster companies represents 3.4% of the City's total employment. Countywide, which of course includes Microsoft, 2,179 ICT Cluster companies include 72,800 (5.4%) of the 1.3 million jobs. Microsoft includes 25,000 of these jobs (Puget Sound Business Journal; August 16, 2002).

**Exhibit 2:
ICT Cluster Employment in Seattle and King County (2002)**

Description	Seattle		King County	
	Jobs	Firms	Jobs	Firms
Telecommunications				
Radiotelephone Communications	519	35	11,352	90
Telephone Communications, Except Radiotelephone	4,762	83	6,318	186
Telegraph and Other Message Communications	*	*	*	*
Communications Services, NEC	*	*	*	*
	5,354	125	17,805	289
Computers and Software				
Computer Storage Devices	*	*	*	*
Computer Peripheral Equipment, NEC	*	*	516	13
Office Machines, NEC	*	*	*	*
Computer Programming Services	4,557	217	8,782	597
Prepackaged Software	3,258	123	33,900	308
Computer Integrated Systems Design	410	25	1,201	86
Computer Processing and Data Preparation and Processing Services	914	29	1,380	66
Information Retrieval Services	993	94	2,879	195
Computer Facilities Management Services	41	7	827	16
Computer Related Services, NEC	2,723	234	5,400	606
	12,901	732	54,997	1,891
ICT Cluster Total	18,255	857	72,802	2,180

Source: Puget Sound Regional Council, Washington State Employment Security Department

Notes: '*' indicates data have been suppressed per data confidentiality agreements

Seattle's ICT Cluster companies include 23% of King County ICT company jobs and 39% of the ICT companies, as shown in Exhibit 3. Regarding all industries and all jobs, Seattle jobs account for 44% of all jobs in the County. Excluding Microsoft would show that 44% of the County's non-Microsoft jobs are in Seattle, roughly the same share of all jobs in all industries in the County. The clustering of ICT jobs in the Eastside includes many more jobs

than those directly employed at Microsoft, with Microsoft attracting many companies to locate near its Redmond campus. This latter point merely underscores the largely evident role that Microsoft plays in attracting ICT jobs east of Lake Washington.

The Microsoft jobs exclude contract employees at Microsoft. Contract employees continue to grow in numbers nationwide.

**Exhibit 3:
ICT Cluster Employment,
Seattle as a Percentage of King County Jobs and Firms (2002)**

Description	Jobs	Firms
Telecommunications		
Radiotelephone Communications	5%	39%
Telephone Communications, Except Radiotelephone	75%	45%
Telegraph and Other Message Communications	*	*
Communications Services, NEC	*	*
	30%	43%
Computers and Software		
Computer Storage Devices	*	*
Computer Peripheral Equipment, NEC	*	*
Office Machines, NEC	*	*
Computer Programming Services	52%	36%
Prepackaged Software	10%	40%
Computer Integrated Systems Design	34%	29%
Computer Processing and Data Preparation and Processing Services	66%	44%
Information Retrieval Services	34%	48%
Computer Facilities Management Services	5%	44%
Computer Related Services, NEC	50%	39%
	23%	39%
ICT Cluster Total	25%	39%

Source: Puget Sound Regional Council, Washington State Employment Security Department

Notes: '*' indicates data have been suppressed per data confidentiality agreements

These jobs can show up in temporary agency employment or as self-employed, thereby understating the number of jobs at Microsoft and other ICT companies that rely on contract labor. The temporary agency employment data include receptionist help and other non-technical staff support. Importantly, no known data exist showing counts of contract employees in Seattle's ICT Cluster.

Contract employees represent a group of workers partially excluded from the company data presented in Exhibits 2 and 3. Many contractors work through temporary staff agencies, though including all such companies would include many temporary workers that do not work at ICT Cluster companies. Also, some contractors do not work through temp agencies and are considered self-employed. Again, including all self-employed workers would capture more self-employed workers than should be considered as part of the ICT Cluster. In the next section, analysis of *occupations*, contract workers are not a limitation of the data and are included based on what they do on a contract basis.

Other companies have a significant presence in the industries identified above, but they have other primary activities. Most prominent among these companies are retailers that have a large Internet presence: REI, Nordstrom, Eddie Bauer and many others. The section that follows focuses on occupations, and many of the ICT Cluster occupations held at these retailers are included in the occupational data analysis.

ICT Cluster Occupational Analysis

Occupational data are available for the Seattle-Bellevue-Everett MSA only (King County and Snohomish County), though important inferences for the City can come from the MSA data, shown in Exhibit 4. ICT Cluster occupations span all industries in the Seattle and the MSA economies. Understanding the occupational concentration in the MSA, and how those concentrations differ from elsewhere in the country, illustrate the clustering phenomenon present in Seattle.

ICT Cluster occupations of interest are:

- Computer and information systems managers
- Computer programmers
- Computer software engineers, applications
- Computer software engineers, systems software
- Computer support specialists
- Computer systems analysts
- Database administrators

**Exhibit 4:
ICT Cluster Jobs by Occupation
Seattle-Bellevue-Everett MSA (2002)**

	Total Jobs 2002	% of Total Jobs 2002	% of ICT Cluster Jobs 2002	Total Jobs 2000	Change in Jobs 2000-2002	% Change 2000-2002
All Occupations	1,297,430	100.0%		1,396,380	(98,950)	-7%
Total ICT Cluster Jobs by Occupation	73,670	5.7%	100.0%	86,820	(13,150)	-15%
Computer software engineers, applications	11,280	0.9%	15.3%	12,560	(1,280)	-10%
Computer programmers	9,860	0.8%	13.4%	9,100	760	8%
Computer support specialists	9,180	0.7%	12.5%	9,280	(100)	-1%
Computer software engineers, systems software	8,860	0.7%	12.0%	11,590	(2,730)	-24%
Computer systems analysts	8,570	0.7%	11.6%	11,840	(3,270)	-28%
Other computer and mathematical operations	7,900	0.6%	10.7%	10,510	(2,610)	-25%
Network and computer systems administrators	4,880	0.4%	6.6%	5,750	(870)	-15%
Computer and information systems managers	3,830	0.3%	5.2%	4,780	(950)	-20%
Network systems and data communications analysts	2,980	0.2%	4.0%	3,270	(290)	-9%
Graphic designers	2,290	0.2%	3.1%	3,030	(740)	-24%
Database administrators	1,610	0.1%	2.2%	2,310	(700)	-30%
Multi-media artists and animators	1,250	0.1%	1.7%	990	260	26%
Computer hardware engineers	820	0.1%	1.1%	1,450	(630)	-43%
Computer science teachers, postsecondary	360	0.0%	0.5%	360	-	0%

Source: U.S. Bureau of Labor Statistics

- Network and computer systems administrators

- Network systems and data communications analysts
- Computer hardware engineers
- Computer science teachers, postsecondary
- Multi-media artists and animators
- Graphic designers

Very few industries exclude these occupations altogether. Those few industries without ICT Cluster occupations include Florists, Vending Machine Operators, Taxi and Transit Providers, Tourist Companies and a few others. Even so, undoubtedly some individuals within those industries apply technology in their work everyday.

Some non-ICT industries have large numbers of ICT occupations. Those with the greatest numbers and concentrations of ICT jobs include (4-digit NAICS code in parentheses):

- Insurance Carriers (5241)
- Professional and Commercial Equipment and Supplies Merchant Wholesalers (4234)
- Data Processing, Hosting, and Related Services (5182)
- Colleges, Universities, and Professional Schools (6113)
- Architectural, Engineering, and Related Services (5413)
- All levels of government (local, state and federal)
- Employment Services (5613)
- Management, Scientific, and Technical Consulting Services (5416)
- Specialized Design Services (5414)
- Professional and Commercial Equipment and Supplies Merchant Wholesalers (4234)
- Other Telecommunications (5179)
- Monetary Authorities - Central Bank (5211)
- Securities and Commodity Exchanges (5232)

Seattle has strong employment in many of these areas, which describe where many of Seattle's ICT jobs are held.

Occupational Data Analysis

The Seattle-Bellevue-Everett MSA includes 73,670 ICT Cluster jobs, which includes jobs across all types of companies, shown in Exhibit 4. The occupational titles shown in the Exhibit come from occupational data titles determined by the U.S. Bureau of Labor Statistics. The titles shown in the Exhibit were chosen based on research for this study, including interviews of human resource managers in some of the region's ICT Cluster companies.

In comparison, all jobs in ICT Cluster *companies*, such as the data shown in Exhibit 2, total 63,900 for the MSA (including the 61,200 in King County, shown in Exhibit 2, plus 2,700 covered jobs in Snohomish County in ICT Cluster companies). The MSA's 63,900 jobs include non-technical jobs, such as administrative support, finance, management and all of the other non-technical positions necessary to run companies. This demonstrates that there are many more ICT jobs in the region in industries not thought of "high tech." This finding is important in understanding the region's clustering advantages.

Recent Changes in ICT Cluster Employment Levels

In 2002, ICT jobs in the Seattle-Bellevue-Everett MSA composed 5.7% of the MSA's total jobs. Computer programmers (9,860 jobs) and software engineers (11,280 jobs for applications software engineers and 8,860 for systems software engineers) combine to account for 30,000 occupation in the cluster (41% of all ICT occupations). This large proportion of occupations show that software programmer and engineers more so than any other occupation define the ICT Cluster in Seattle, a key finding that the interviews confirmed (as shown in the final section of this report). ICT jobs are well known to have grown rapidly in past years. The reality in recent years, however, is that these occupations have

suffered along with the regional economy during the recent recession. In fact, as shown in Exhibit 4, ICT jobs declined 15% from a peak in 2000, during which time the MSA as a whole lost 7% of its jobs.

Some occupations were hurt harder than others. Computer systems analysis lost the greatest number of jobs (3,270), representing 28% of all such occupations. Software engineers ranked second in terms of the most jobs lost (2,730 or 24% of the total jobs in the field).

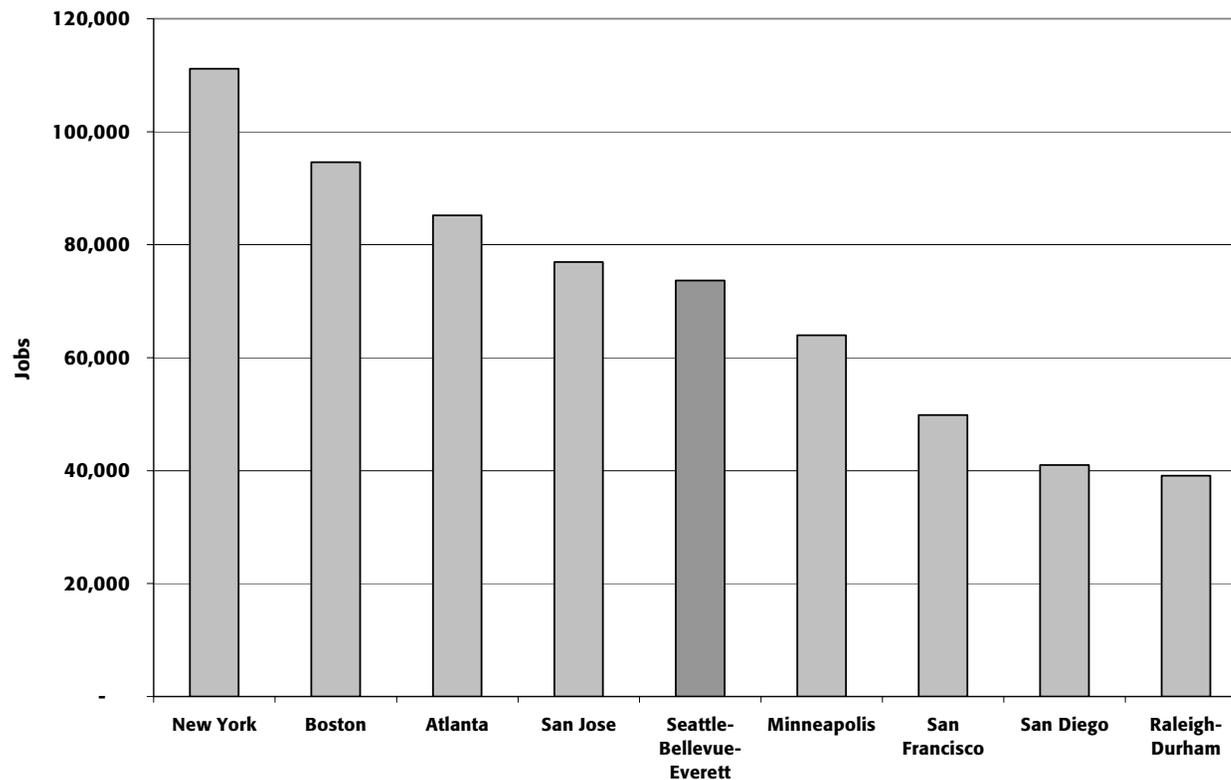
Showing historic growth proved beyond the scope of this study: the occupational titles changed in 1999, thereby making it impossible to match like jobs to the more recent occupation definitions developed in 2002.

Seattle's ICT Cluster Employment Compares Well With Other U.S. Regions

The region's 73,670 ICT Cluster occupations rank proportionately high among all other MSAs in the country, as shown in Exhibit 5. As the Exhibit shows, although a few cities with larger economies than Seattle, (New York, Boston and Atlanta) have a larger number

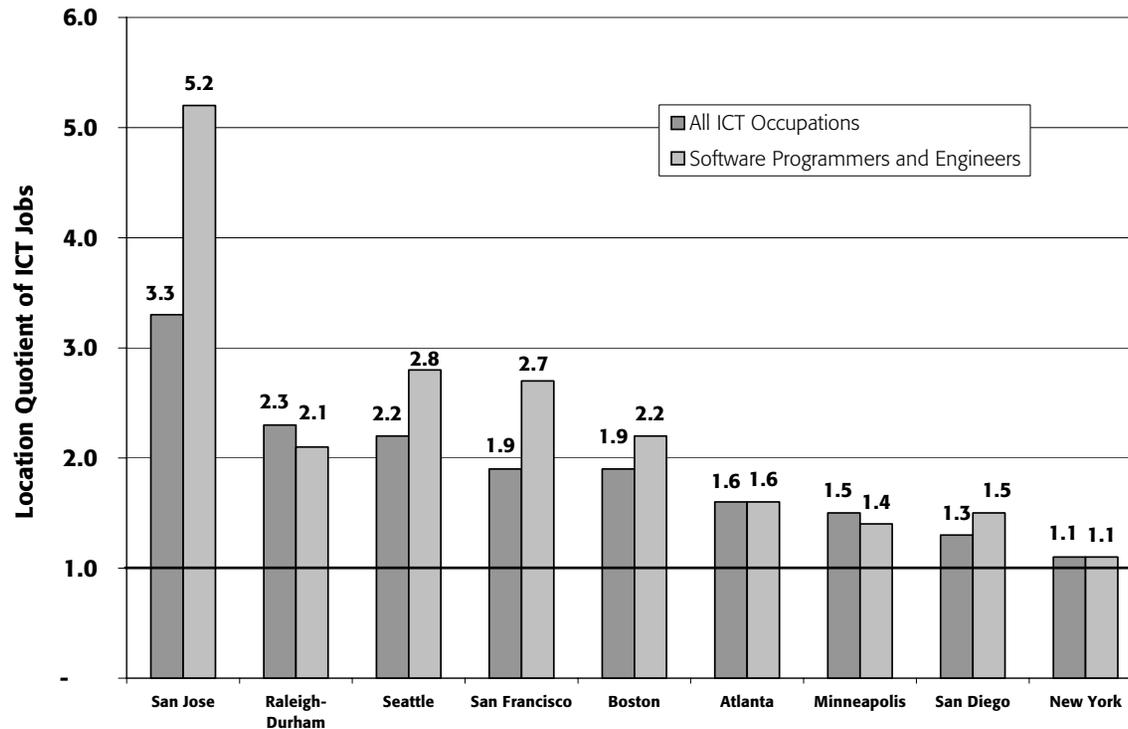
of ICT occupations, Seattle's ICT ranks concentration within the top five cities in the U.S. The size of the larger economies nation-wide attracts large amounts of these occupations, showing New York at the top of the list of MSAs shown in Exhibit 5. (Note that the MSAs shown in the Exhibit do not represent the nine largest MSAs in the country; rather those shown represent MSAs either similar in size to Seattle and/or known for large concentrations of ICT jobs.)

**Exhibit 5:
Total Jobs in ICT Cluster Occupations (2002)**



Source: U.S. Bureau of Labor Statistics

**Exhibit 6:
Relative Concentrations of ICT Cluster Occupations
In Selected Metropolitan Statistical Areas (2002)**



Source: U.S. Bureau of Labor Statistics; Note: Comparable MSAs include s combined data from San Francisco, Boston, Atlanta, Minneapolis, and San Diego.

A comparison of the region's ICT Cluster jobs as a percentage of total jobs to the relative percentage on a national scale helps to understand the degree to which ICT Cluster jobs have concentrated in this area. Equally of interest is how the percentage of the other MSAs economies compares to the national economy and other MSAs.

Compared to the nation as a whole, the Seattle MSA has more than twice (2.2 times) the ICT Cluster jobs, as a percentage of each respective economy, as shown in Exhibit 6. In Exhibit 6, a value of 1.0 indicates that the area of interest has the same percentage of ICT Cluster jobs within its economy as does the U.S. economy. The values are called *location quotients*.

San Jose reflects a high concentration of ICT Cluster jobs in that region, with a location quotient of 3.3. This suggests that ICT jobs in San Jose represent 3.3 times the share of the national economy. As shown in Exhibit 6, for cities with location quotient values less than Seattle's (2.2), ICT jobs compose a smaller share of their economy than in Seattle. Importantly, the Cities of San Francisco, Boston, Atlanta, Minneapolis, San Diego and New York all have a smaller share of their jobs in ICT occupations than does Seattle. Many of these cities are known for their concentration of tech-related jobs, but in terms of occupations, they each fall considerably shorter than the Seattle-Bellevue-Everett MSA with respect to percentage concentration of ICT employment.

Raleigh-Durham comes closest to Seattle with location quotient of 2.3. However, the Raleigh-Durham economy has considerably fewer total ICT jobs, as shown above in Exhibit 5.

Exhibit 6 also shows the relative concentrations of software programmers and engineers, combined. In general, focusing on this subset of ICT occupations further highlights Seattle's concentration of these jobs. In some cases, the relative concentration of programmers and engineers is higher than that of all ICT occupations. The opposite is true in other cases, Seattle, San Jose, San Francisco, Boston and San Diego.

Some ICT occupations in the Seattle MSA are more heavily concentrated than others, as shown in Exhibit 7. Multi-media artists and animators rank first in terms of their relative concentration in Seattle. (A value of 1.0 would suggest that there are exactly as many of these jobs in Seattle as would be expected, given only the size of its economy; higher values show clustering of these jobs.)

**Exhibit 7:
ICT Cluster Occupations Concentration Ranking
Seattle-Bellevue-Everett MSA (2002)**

	Relative Concentration (1.0 = average)
Computer software engineers, systems software	2.2
Multi-media artists and animators	2.1
Computer software engineers, applications	1.7
Computer science teachers, postsecondary	1.6
Network and computer systems administrators	1.5
Total ICT Cluster Jobs	1.5
Network systems and data communications analysts	1.4
Computer programmers	1.4
Computer support specialists	1.4
Computer systems analysts	1.2
Computer hardware engineers	1.0
Database administrators	1.0
Graphic designers	1.0

Source: U.S. Bureau of Labor Statistics

Note: Relative concentration compared to the comparable MSAs: San Francisco, Boston, Atlanta, Minneapolis, and San Diego.

ICT CLUSTER WAGES ANALYSIS

ICT occupations are widely known for having relatively higher wages. Exhibit 8 confirms this fact, with the various ICT occupations ranked in the Table by median wage. In aggregate, the 73,670 jobs in ICT occupations have median wages nearly twice the median wage of all occupations in the Seattle-Bellevue-Everett MSA.

As Exhibit 8 shows, wages for Information systems managers rank highest among ICT occupations, with median wages of \$98,580 in

2002. Software programmers and software engineers, which combined account for more than 30,000 jobs, have median wages ranging from \$75,720 to \$80,420.

The wages for these ICT occupations in the Seattle MSA compare favorably to other MSAs throughout the country, as shown in Exhibit 9. San Jose ranks highest, with median wages for all ICT occupations greater than \$80,000 in 2002.

**Exhibit 8:
ICT Cluster Median Wages by Occupation
Seattle-Bellevue-Everett MSA (2002)**

	Median Wage	Total Jobs
All Occupations	\$35,270	1,297,430
Total ICT Cluster Jobs by Occupations	\$69,864*	73,670
Computer and information systems managers	\$98,580	3,830
Computer programmers	\$80,420	9,860
Computer software engineers, systems software	\$75,720	8,860
Computer software engineers, applications	\$78,510	11,280
Computer hardware engineers	\$46,710	820
Computer systems analysts	\$67,960	8,570
Network systems and data communications analysts	\$61,760	2,980
Database administrators	\$57,210	1,610
Other computer and mathematical operations	\$66,600	7,900
Network and computer systems administrators	\$60,823	4,880
Multi-media artists and animators	\$69,120	1,250
Graphic designers	\$42,360	2,290
Computer support specialists	\$54,400	9,180
Computer science teachers, postsecondary	\$47,980	360

Source: U.S. Bureau of Labor Statistics

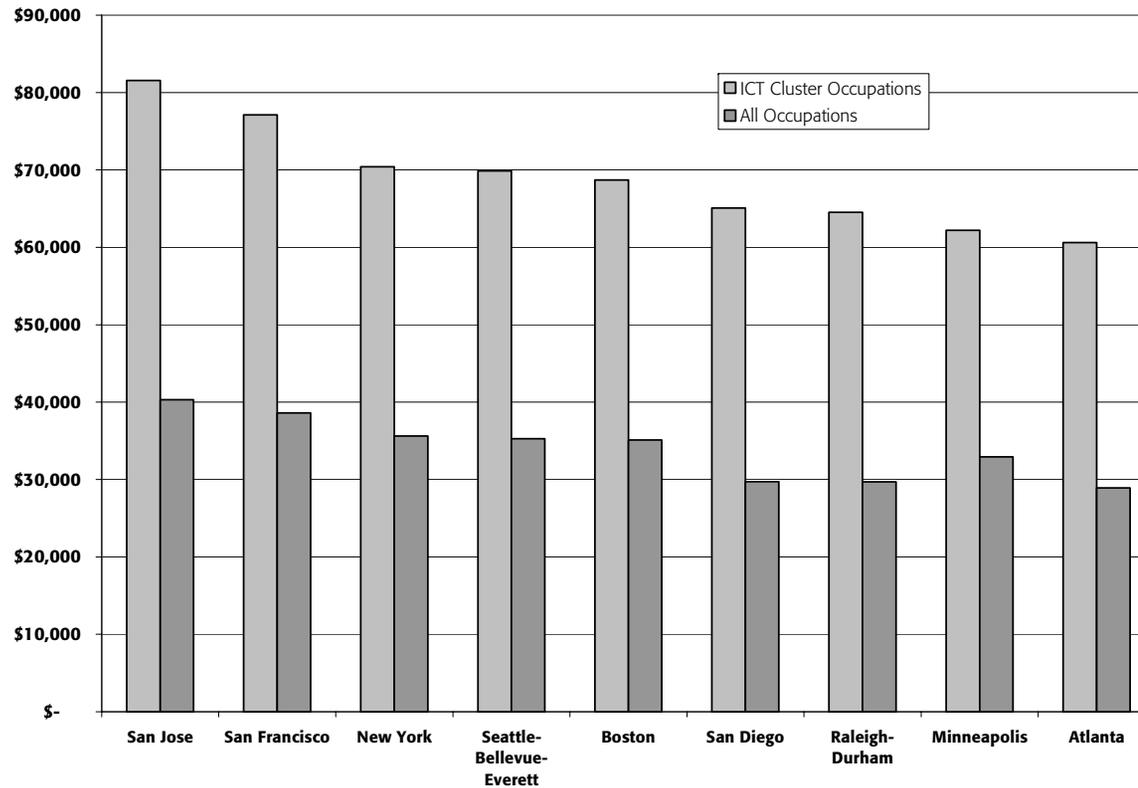
* Weighted average of ICT occupation median wages, weighted by number of jobs per occupation.

However, of course, those areas are also well known for having higher costs of living. Seattle's median ICT wages rank closely behind New York's, as does Boston's. Seattle's ICT wages rank notably higher than those in other MSAs, including San Diego, Raleigh-Durham, Minneapolis and Atlanta.

Wages tell only part of the story of the financial benefits among ICT workers, as is well known to anyone who followed the stock

market during the late 1990s and into 2000. Stock options and ownership made many ICT workers in the region very wealthy. As discussed above, the wealth generated among ICT employees became capital that has fostered entrepreneurship and additional job growth in the Cluster. Stock market declines have reportedly decreased the popularity of options as a recruitment incentive and lessened the wealth-generating affect of workers in recent years.

**Exhibit 9:
ICT Cluster Occupation Wages by MSA (2002)**



Source: U.S. Bureau of Labor Statistics.

BUSINESS INCOME AND PUBLIC REVENUES

ICT companies generate large amounts of revenue. These revenues affect the entire economy, including public revenues such as sales taxes and property taxes. Business income *directly* drives ICT companies' contributions to public revenues through the business and occupations (B&O) taxes more than other tax sources, such as the retail sales tax and utility taxes. The more prosperous ICT companies drive up demand for office space, thereby increasing property tax revenues as well. This report includes estimates of B&O and sales tax to the City of Seattle. Estimating other impacts is beyond the scope of this study.

Gross Revenues

As shown in Exhibit 10, revenues in Seattle have been estimated based on data provided by the State Department of Revenue (DOR). Gross revenues are only reported statewide for all companies based in Washington State, requiring estimates to discuss gross revenues of Seattle ICT activity. DOR provided the following data, summarized by SIC for 2002: Statewide gross revenues; taxable retail sales (TRS) occurring within the City of Seattle and TRS occurring outside of the City. The split of TRS occurring inside and outside the City provide a means to allocate Statewide gross revenues to the City.

**Exhibit 10:
Estimated Revenues for ICT Cluster Companies in Seattle (2002)**

Description	Statewide Gross Revenues, 2002	% of Taxable Retail Sales in Seattle	Estimated Seattle Gross Revenues, 2002
Telecommunications			
Radiotelephone Communications	\$934,447,353	16%	\$152,334,368
Telephone Communications, Except Radiotelephone	\$4,704,207,337	17%	\$781,263,576
Telegraph and Other Message Communications	\$133,144,806	47%	\$62,429,028
Communications Services, NEC	\$588,376,680	12%	\$70,346,504
	\$6,360,176,176		\$1,066,373,477
Computers and Software			
Computer Storage Devices	\$12,575,286	n/a	n/a
Computer Peripheral Equipment, NEC	\$758,082,830	46%	\$348,397,830
Office Machines, NEC	\$3,985,710	n/a	n/a
Computer Programming Services	\$1,043,160,559	34%	\$351,190,872
Prepackaged Software	\$2,351,602,823	28%	\$651,110,825
Computer Integrated Systems Design	\$470,834,925	26%	\$120,499,477
Computer Processing and Data Preparation and Processing Services	\$618,016,716	24%	\$149,854,686
Information Retrieval Services	\$279,563,274	36%	\$99,986,218
Computer Facilities Management Services	\$9,525,476	62%	\$5,900,215
Computer Related Services, NEC	\$2,262,220,927	29%	\$659,035,320
	\$7,809,568,526		\$2,385,975,442
ICT Cluster Total	\$14,169,744,702		\$3,452,348,919

Source: Washington State Department of Revenue, City of Seattle

As shown in Exhibit 10, the State's telecommunications activity generates more than \$6 billion in revenue, of which an estimated \$1.0 billion occurs within the City.

Prepackaged Software businesses in Seattle rank second among these industries in terms of gross income, generating \$651 million. Computer Programming services have total revenues of \$351 million. Computer peripheral manufacturers' revenues in Seattle are \$348 million.

Electronic Shopping and Amazon.com. Statewide revenues for companies in Electronic Shopping (NAICS 454111) totaled \$256 million in 2002; company-specific data for Amazon are not available, per State confidentiality agreements. Amazon.com likely contributes most significantly to the Statewide total of Internet retailing, but attributing revenues to a State is a clear challenge for Internet retailers. To illustrate this challenge, Amazon reported to shareholders net sales of \$3.9 billion in 2002 and \$5.3 billion in 2003. The industry statewide gross revenue of \$256 million obviously does not include many Amazon's revenues.

Most of the Amazon's revenues are reported in other states. The same would be true of other Internet retailers and large corporations of other industries based in Seattle. For these reasons, this study does not reconcile these limitations of using SICs and the exclusion of Amazon.com from this portion of the analysis.

B&O Taxes

The City of Seattle collects and reports B&O tax receipts using 4-digit Standard Industrial Classifications (SICs), shown in Exhibit 11. Telecommunications taxation is complex with many different segments of service, each taxed at different rates. Exhibit 11 shows the City collected \$411,963 in B&O taxes in 2002 from telecommunications companies.

Software and computer companies combined to pay \$3.8 million in B&O taxes in 2002. Companies classified by the Computer Programming Services SIC paid the most: \$1.1 million. However, many companies in this SIC could be classified just as easily in one of the many other SIC codes within Computers and Software.

Exhibit 11:
Estimated B&O Tax Receipts for ICT Cluster Companies in Seattle (2002)

Description	B&O Taxes Paid
Telecommunications	
Radiotelephone Communications	\$2,360
Telephone Communications, Except Radiotelephone	\$317,985
Telegraph and Other Message Communications	\$17,234
Communications Services, NEC	\$74,385
	\$411,963
Computers and Software	
Computer Storage Devices	n/a
Computer Peripheral Equipment, NEC	n/a
Office Machines, NEC	\$56,556
Computer Programming Services	\$1,077,800
Prepackaged Software	\$415,469
Computer Integrated Systems Design	\$219,409
Computer Processing and Data Preparation and Processing Services	\$218,698
Information Retrieval Services	\$161,114
Computer Facilities Management Services	\$45,214
Computer Related Services, NEC	\$1,598,394
	\$3,792,655
ICT Cluster Total	\$4,204,618

Source: Washington State Department of Revenue, City of Seattle

Note: Excludes B&O receipts from Amazon.com and other tech companies classified in as catalog retailers

Taxable Retail Sales

Exhibit 12 shows \$781 million in taxable retail sales in the City of Seattle attributable to ICT Cluster activity, generating \$6.6 million in local retail sales tax revenue (0.85%). Telecommunications companies account for most of this total (\$5.1 million; 78%). Software products are typically sold through wholesale channels before going to retail.

In addition, in 2002 the City received \$170,000 in local sales taxes paid by local Electronic Shopping companies.

Exhibit 12: Taxable Retail Sales and Estimated Retail Tax Receipts from ICT Cluster Companies in Seattle (2002)

Description	Seattle Taxable Retail Sales	Sales Tax Revenue to the City
Telecommunications		
Radiotelephone Communications	\$118,245,925	\$1,005,090
Telephone Communications, Except Radiotelephone	\$439,841,019	\$3,738,649
Telegraph and Other Message Communications	\$1,588,474	\$13,502
Communications Services, NEC	\$48,962,452	\$416,181
	\$608,637,870	\$5,173,422
Computers and Software		
Computer Storage Devices	n/a	n/a
Computer Peripheral Equipment, NEC	\$2,748,394	\$23,361
Office Machines, NEC	n/a	n/a
Computer Programming Services	\$26,480,530	\$225,085
Prepackaged Software	\$23,144,147	\$196,725
Computer Integrated Systems Design	\$5,822,121	\$49,488
Computer Processing and Data Preparation and Processing Services	\$22,249,916	\$189,124
Information Retrieval Services	\$8,395,254	\$71,360
Computer Facilities Management Services	\$1,753,987	\$14,909
Computer Related Services, NEC	\$82,214,829	\$698,826
	\$172,809,178	\$1,468,878
ICT Cluster Total	\$781,447,048	\$6,642,300

Source: Washington State Department of Revenue, City of Seattle

INDUSTRY PERCEPTIONS OF SEATTLE'S ICT CLUSTER

In addition to the data analysis, interviews of professionals in ICT companies and related organizations provided first-hand perspectives on clustering in Seattle and emerging opportunities. Interviews included representatives from the following local and regional companies:

- Avenue A
- AT&T Wireless
- Aventail
- The Cobalt Group
- CapGemini (tech-related consulting)
- Microsoft Games Division
- University of Washington Computer Science Department
- TeraBeam
- TCS Seattle (Formerly XY Point)
- Washington Software Alliance

The following sections provide a distillation of the information learned from the interviews, grouped into key findings.

Software developers define the ICT Cluster in Seattle.

- Software development as a whole is strong in Seattle, though no particular strength is known within that category. Some concentrations appear to exist: Educational Software; Wireless Software (PDA); Legal field (data mining, digimining); Training Software.
- Global competition exists for Seattle in recruiting software labor, but the talent has clustered in Seattle.

- Local companies recruit from all over the world. The specialized knowledge required for some is not always available here.
- Game development is a niche of programmers, and clustering effects are strong. There are a lot of tech people that want to work in games, including artists and programmers. Game development is popular because programmers get to push the hardware capabilities.

Seattle possesses many strengths that attract ICT Cluster talent.

- Most company founders cite a love for the City as a key reason to start a business here.
- The University Washington (UW) has a computer science department that ranks in the top ten of all such programs in the country. As such the UW is a key driver of the local tech economy. Companies all mentioned proximity to the UW as an important source of talent.
- The large base of software employees is a key strength.
- Some cross-pollination exists between companies, but not extensively within City limits.
- The City is conducive to attracting programmers to live here, with amenities that programmers like: liberal culture, the City accepts diversity, outdoor recreation activities, good public transit.
- Many companies still ride a wave of venture capital financing in Seattle from the late 1990s. Some signed long-term leases or developed great office space, buying time to grow.

- Microsoft spawns new businesses. Microsoft brings in technical people and then people move on to other things in Seattle.
- Tech infrastructure fosters innovation. Maintaining cutting edge bandwidth infrastructure attracts the software development community. Better infrastructure opens up more possibilities to innovate.
- The City is perceived as a great place to start new ventures: lots of capital, lots of talent.

Demographics are changing in the ICT Cluster.

- The ICT Cluster is no longer exclusively a young person's domain. Software staffs are aging; software is turning into an industry better representing America.
- Hiring is now focused on bringing in more experienced staff.

Urban issues that challenge Seattle affect recruitment.

- The big issues challenging ICT Cluster growth in Seattle include transportation for recruitment and retention issues. In Seattle, companies want better transit; Eastside companies want more roads.
- Seattle is less expensive than other tech areas, including: Silicone Valley (San Jose), New York City, Research Triangle Park.

Business taxes are watched closely.

- Seattle is emerging from a multiyear episode of battling over the taxation of Intellectual Property. Companies describe the battle as over, but the industry remembers it.

- Companies would like to see lower taxes for software development.
- Giving a tax credit for development would be helpful. ICT Cluster companies perceive that the City offers no tax breaks to their industry. Some may qualify for existing R&D tax credits without knowing that they qualify. Others may perceive the R&D tax credits to fall short of needs.
- Many companies in their early stages do not make profits; taxes are especially burdensome at the early stages.

Opportunities are emerging in biotech.

- Biotech in Seattle is perceived to be an opportunity for local software development companies.

Technology presents challenges to developing local clusters.

- Game developers work with Seattle companies from all over the world: Australia, England, Sweden, California, Texas.
- Other countries are aggressively changing laws to foster ICT growth. England and Ireland have tax systems reportedly designed to help game developers. Tax laws promote start-ups.
- Other countries are also aggressively investing in education. Microsoft opened research centers in India and Cambridge, U.K. to be closer to universities.
- Seattle talent is heavily Microsoft-focused. Skills in Unix and other platforms are not as prevalent here as elsewhere. Competing platforms have clustered more heavily elsewhere.

- Technologies are always changing. Recruitment includes always asking people to leave behind what they know in order to learn new skills.
- The trend is for larger companies to have several development sites throughout the country and the world (e.g. India and Chile). Human capital initiative is what the trend is about. Groups are moved from company to company. A common goal is to find the perfect development team that can “get in the zone together.”

Emerging technologies present growth areas.

- Wireless software has potential.
- Internet programming: new platforms are emerging; Java and other languages are aging.

Some concerns exist about local economy trends.

- One concern is a perception of losing talent to other creative centers, such as Boston and the Research Triangle Park area.
- The downturn of the economy is preventing people from moving. They fear they will need to downsize immediately after signing a new lease, for example.
- Another trend is an outmigration of IT workers from tech companies into traditional industries and businesses. Traditional business offers low risk, fewer hours. Payoff (in the form of stock options) is less important than it was during the 1990s.
- Companies perceive that biotech is not currently meeting projected images of the industry’s impact on local jobs and economic growth.
- Companies perceive a lack of programs for business retention, not just in Seattle but throughout the Central

Puget Sound community. Companies would like grants for training and development.

Suggestions focus on livability and taxes.

- Strategies that generally make the City a better place to live and work would help ICT companies recruit people to move to Seattle.
- Some view tax policies as “not prohibitive,” others would like to see tax breaks to support companies in their start-up phases.

SUMMARY AND CONCLUSIONS

The City of Seattle is at the center of the region's Information and Communications Technologies Cluster. This Cluster has evolved and grown through the network effects and intersection of: skilled and educated people already working in the region's technical fields (engineering, education, research, science and others); the popularity of open-source programming, fueled and facilitated by the City's coffee-house culture and collaborative values; entrepreneurial and financial wherewithal in the City; and the success of particular home-grown technology companies, notably Microsoft and McCaw Cellular. All of these incubating factors have led to Seattle's reputation as an excellent place for starting a technology company, and for finding work in those companies.

Thus, the ICT Cluster should be understood in two ways: (1) the companies that compose the Cluster; and (2) the tech-related occupations that span all sectors of the regional economy.

ICT Cluster Jobs. In 2002, employment in Seattle's 856 ICT Cluster companies totaled an estimated 18,250 covered jobs. For the Seattle-Bellevue-Everett MSA, there are a total of 72,800 jobs in 2,180 ICT Cluster companies. These positions include both technical and non-technical jobs, such as administrative support, finance and management, necessary to support company operations.

However, the more appropriate measure of the scale and import of this Cluster is the total number of all of ICT Cluster jobs in all companies in the MSA. By this measure, the Puget Sound MSA – with a total of 73,670 ICT Cluster jobs – ranks in the top tier regions nationally in terms of Cluster jobs.

The Cluster's strength in this region can also be viewed from another comparative perspective: the percentage of ICT Cluster jobs in the economy relative to other regions in the country. By this location quotient measure, the Seattle MSA ranks third in the nation for all ICT occupations (behind San Jose and only marginally behind Raleigh Durham) and ranks second in the nation for software programmers and engineers (behind San Jose).

In fact, software engineers and programmers define Seattle's ICT Cluster more than any other attributes. The Seattle area has 1.5 to two times the concentration of these occupations within its economy than comparable metropolitan areas – and nearly three times the concentration as the national economy as a whole. Other occupations which are relatively highly concentrated in the MSA include multi-media artists and animators, computer science teachers (post-secondary) and network and computer systems administrators.

ICT Cluster Wages. ICT occupations pay very well and in years past stock options made many of the tech company employees very wealthy. The total median wage for the Cluster in the MSA is \$69,864 (in 2002 dollars). Software programmers and software engineers, which account for more than 30,000 jobs (41% of the total), have median wages of \$75,720 to \$80,420, and information systems managers, which rank highest among ICT occupations, had median wages of \$98,580 in 2002. This compares with median wages of \$35,270 for all occupations in the MSA in 2002.

Business Income and Public Revenues. The companies in the ICT Cluster generate large amounts of revenue and contribute greatly to the City's fiscal revenues. The ICT Cluster in Seattle generates more than \$3.5 billion in revenues annually – \$1 billion of which includes telecommunications revenues to businesses based elsewhere. In 2002, these industries paid the City of Seattle \$4.2 million in B&O taxes – not including utility taxes paid by phone companies. The Cluster contributed nearly \$6 million in retail sales tax. Their demand for office space drives up property values and property tax revenues and they contribute to utility taxes as well, most significantly in telephone taxes.

Industry Perceptions of the ICT Cluster. Seattle is and will continue to be known as City that attracts software programmers and developers. The strong supporting network of the University of Washington, venture capital companies and strong institutional support such as the Washington Software Alliance together combine to support the region's ICT Cluster.

Local culture and amenities, such as restaurants and access to the mountains and Puget Sound, will continue to attract the nation's talent to Seattle. Local public policy can support this growth by focusing on creating a great City for its residents and by ensuring that business taxes do not stifle innovation and entrepreneurial activity.