

Seattle as a Digital City: Unexpected or Inevitable?

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Introduction

When I (Richard Morrill) arrived in Seattle in the summer of 1955, to study urban geography, and soon to become immersed in the early days of Regional Science, the city offered not the remotest hint of what was to come. Seattle was an unusually egalitarian, middle class city, highly unionized, and dominated by manufacturing -- Boeing aircraft, Kenworth trucks, Todd shipyards, Weyerhaeuser, US Plywood and other forest product giants. It had the UW (University of Washington) but it was a second tier state university, with a smallish medical school and no teaching hospital. Forty years later, by 1995, Seattle had transformed into one of the nation's and world's most hi-tech, digital, wired, computer-oriented, information rich cities, and, concomitantly, it changed from provincial and egalitarian to a global and far more unequal city,¹ from a suburb-like city of families and a cultural backwater, to a city unusually rich in singles and unmarried partners, and cultural innovators. Like San Francisco, Seattle is fairly extreme on this dimension. The University of Washington similarly emerged as one of the leading research universities, including in computer sciences as well as biomedical research. According to Atkinson's "Metropolitan New Economy Index", Seattle ranked 3rd, behind only San Francisco and Austin, as most advanced in the digital economy. (Atkinson 2003) (Table 1).

What is the basis for this remarkable transformation? Who and what were the

1. While the income distribution in Seattle may have become less egalitarian, with relatively more wealthy households over time, this city also has ended up with one of the more egalitarian income distributions among a set of 100 large cities examined by Berube and Tiffany (2004).

TABLE 1 The Metropolitan New Economy Index

SEATTLE		
Indicator	Rank	Score
Overall Score	3	68
All Knowledge Jobs	6	12
Managerial, professional and tech jobs	7	44%
Workforce education	9	0.64
Aggregate globalism score	1	15.2
Export focus of manufacturing*	1	\$129,000
Economic dynamism score	5	11.7
"Gazelle" jobs (fast growing companies)	49	7%
Job Churning (startups and failures)	39	9.4
New traded companies	2	28
Digital economy score	7	12
Online population	3	53%
Broadband capacity	9	3.62
Computer use in schools	42	62%
Commercial internet domain names	10	1.12
Innovation capacity	9	11%
High-Tech jobs	23	3.40%
Degrees in science and engineering	31	9.7
Patents (per 1000 workers)	22	0.5
Academic R&D	22	9.9
Venture capital (% of regional product)	2	2.71%

agents of change; what is the particular nature of the hi-tech, information-oriented "new economy" global place? Who and what has been left behind, but also how fragile is this global city position?

This paper briefly reviews the theory of high tech regional development, traces the fairly brief history of hi-tech development and evaluates its global role and significance, then reviews the Seattle story in relation to the theory of high tech development, but also describes the local geography of these sectors of the economy, and the benefits and costs of the transformation.

The Theory of the Geography of High Tech Development

The theory remains a little messy and somewhat contradictory, in part because on the one hand, it concerns the high tech and information sectors themselves, but on the other implicates firms, sectors and activities which utilize telecommunications (e.g., Amazon or the Port of Seattle) or which reflect the high-tech culture and workforce (e.g., Starbucks)(Atkinson 1998).

The two main economic theories are in basic contradiction. If telecommunications advances are the latest and strongest annihilators of the tyranny of distance

in the saga of transportation revolutions, then economic activity should be increasingly footloose, leading to dispersal to lower cost locations or economically attractive areas, often smaller places (Hepworth 1990; Graham and Marvin 1996). But against this is the classic theory of the returns to agglomeration and urbanization, that the larger the city, the greater the pool of talent, the volume and variety of supportive resources, including universities, the exchange benefits of the clustering of competing firms, the quality of conventional access (e.g., airports) -- in short, the conditions that engender innovation and productivity, despite higher costs (Porter 1990; Castells and Hall 1994; Markusen 1996; Goddard 1991; Harrison et al 1996).

To a degree the contradiction is overcome by the dispersion of routine activities to lower cost locations, but the retention of higher level control, professional and managerial, and R&D continues in metropolitan areas (Todtling 1994; Pollard and Storper 1996; Oh and Masser 1995). Studies of individual sectors are illustrative (Beyers 1989; Glasmeier and Howland 1995; Warf 1995; Hall et al 1987; Park and Lewis 1991; Cortwright and Mayer 2002).

A sub-theory of urbanization/agglomeration is that a specific set of very large cities emerge as "global cities", especially attractive to innovative people and firms, because of exceptional access, financial, cultural and educational resources. (Sassen 1989; Salomon 1996; Castells 1989; Batten 1995; Mitchell 1997).

A second urbanization/agglomeration sub-theory is more cultural, that is the attractiveness and tolerance of certain places to political and social liberals, to the unconventional and artistic, including gays and lesbians. Richard Florida argues that these attractive cities with a high degree of tolerance are attractive to the creative individuals needed for high tech development, and that there is a high correlation between his measures of tolerance and urban amenities, and the strength of high tech development during the 1990s (Florida 2002). In strong contradiction to such urban attractiveness is the counter-argument that many large cities and metropolitan areas, because of both higher costs attendant on high density, high rents, congestion, costly public transportation and high social costs associated with large racial minorities, especially Black or Hispanic, often a sizeable underclass, will drive economic activities and concerned people out to smaller cities, as occurred so prominently in the 1970s.

Perhaps a third urban sub-theory, but perhaps more honestly a matter of serendipity or personal choice is that many successful innovators just happen to live in a particular place and choose to stay there, an idea not popular with the theoretically tidy, but which cannot be ignored.

A related set of theory deals with location within a metropolitan region, and the balance of activity between central city and suburbs. Again, advanced telecommunications should enable and encourage decentralization of activity from the high cost congested core to lower cost suburban locations with space and better external connections. But benefits of agglomeration and face-to-face contact make CBDs and very large "edge cities" attractive, especially to professional and business services. And, as nationally, these opposing forces are both acted upon in the metropolis with decentralization of routine functions and concentration of higher level control activities (Horan et al 1996; O'Hullachain and Reid 1992; Stanback

1995).

Within metropolitan areas, the cultural urban agglomeration theory is particularly apt, as preference for in-city 'urbanist' living is extremely strong among young singles and couples, highly educated professionals, educated empty nesters in general, and counter-cultural and GLBT households in particular. Again, the counter-theory to this is the decline of the city core and even of inner suburbs in the face of an urban underclass and racial conflict. The outcome of these competing forces is likely to depend on the relative size of these sub-populations and the seriousness of poverty and racial problems.

Agents of Change: A Brief History of the Emergent Digital Seattle

Seattle always had aspirations to greatness, from the very first settlement at Alki, loosely interpreted as 'New York, by and by'. Seattle long felt an inferiority complex compared to the more cultured and older Portland and Vancouver, and tried a variety of schemes to become world-class: the Alaska-Yukon exhibition of 1906, the Seattle World's Fair 1962, attracting professional sports² and the like. The city boomed in the 1960s, on the strength of Boeing, but collapsed 1970-1973, in a severe recession precipitated by Boeing layoffs. Business and government realized the need to diversify, but contrary to possible claims of a series of political leaders, mayors and governors, and editors of newspapers, there was no *intention* or plan or expectation of becoming 'Silicon valley north'. Rather it began to happen from that low point on, because of a series of individuals and events and conducive conditions which resulted in Richard Florida's terminology of a city rich in the 'creative class' (Florida 2002). However, there has been a deliberate strategy of encouraging high tech development in the city at least since 1985 (City of Seattle 1985). The city's community development department identified South Lake Union as a neighbourhood needing additional employers and having characteristics that suggested a potential for high tech employment in biosciences and other high tech fields.

Although Bill Gates and Microsoft are of course overwhelmingly the most important basis for the transformation of Seattle, the story does begin a little earlier than 1975, when Bill Gates and Paul Allen founded Microsoft in Albuquerque. The first influence is that of Boeing itself, the historic dominant force in the economy. Although an industry historically of machinists and assemblers, clearly the design and manufacturing of aircraft after the 1960s became increasingly high-tech, and the role and share of engineers had risen. Boeing Computer Services was a significant operation of the company for many years. Especially in periods of Boeing layoffs and recession, these talented engineers constituted a pool of cre-

2. The Sonics basketball team was formed in 1967; the Seahawks football team took the field in 1976; and the Mariners baseball club started hitting in 1977; see http://www.nba.com/sonics/history/sonics_history.html#2; <http://www.nflhistoryguide.com/ss/history.htm>; <http://seattle.mariners.mlb.com/NASApp/mlb/sea/history/timeline1.jsp>.

ative professionals, some of whom created and participated in other high-tech enterprises.

A person of critical importance was Warren Magnuson, senior Senator for Washington, and who was instrumental in transforming the University of Washington from a provincial to a world class university. The secret of this was the creation and nurturing of a premier health sciences complex, including teaching hospitals, the medical school for not only Washington, but Alaska, Idaho, Montana and Wyoming, the creation of the Fred Hutchinson Cancer Research Center in 1975, the bringing in of immense grants and ultimately the spin-off of biotech industry.³ The resulting research complex is now touted as what will finally (in Paul Allen's mind) put Seattle on the map as a major biosciences centre. Immunex (now Amgen) was founded in the early 1980s and grew to be the nation's second largest biotechnology company until it was acquired by the largest – Amgen – in 2002. The ascendancy of health sciences, while at first resented, in fact led to the upgrading of the entire university, including medicine, engineering, and computer sciences.⁴ According to US News and World Report, the University of Washington Medical Center ranked 1st in the nation in the primary care field and 10th in research; Computer Sciences ranked 7th, and Engineering 25th.

Another independent path to information sector growth was via telecommunications, not the traditional phone companies, but the creation of McCaw Cellular, early pioneer in wireless technology (1980) later becoming AT&T Wireless, and then the establishment of Voicestream, later becoming T-Mobile (and part of Deutsche Telefon). Innovative movement of goods was pioneered by UPS, founded as a delivery service in Seattle in 1907 as the American Messenger Co., and still carried on by Airborne Express (now part of DHL).

Nor should we discount the somewhat independent role of place and environment. Seattle in the late 1960s and in the 1970s spawned a strong and active environmental movement, the rise to industry leadership of REI under the leadership of mountaineer Jim Whittaker, and the spawning of other leaders in outdoor recreation gear such as K2. Seattle and the greater region became increasingly seen by outdoor lifestyle enthusiasts as preferred alternatives to overcrowded California. The spirit of aggressive entrepreneurship also became expressed in the rise to prominence of Nordstrom, for upscale clothing, and Costco for lower cost but high quality mass merchandising. Although not invented in Seattle, advanced high tech services in retailing and wholesaling, and transportation services, especially marine transportation, were early and aggressively adopted by such firms as Costco and Bon-Macys (now Macys).

But the social environment was probably as critical, a liberalism and tolerance

3. See a biography of Sen. Magnuson and his role in funding the University of Washington Medical Center, the Fred Hutchinson Cancer Research Center, and the predecessor of the National Institute of Health at http://www.historylink.org/output.cfm?file_id=4255 (September 2004).
4. The University of Washington is ranked among 46th among national universities in the United States by US News and World Report (http://www.usnews.com/usnews/edu/college/directory/brief/drglance_3798_brief.php); its medical school is ranked 1st in the nation (http://www.usnews.com/usnews/edu/grad/rankings/med/brief/mdprank_brief.php); and its graduate program in Computer Science and Engineering is ranked 7th (<http://lazowska.cs.washington.edu/usnews/2003/cs.htm>).

that DID predate and indirectly encourage the new Seattle. Seattle is highly attractive to the young, singles, partners and families, a consequence of the high degree of tolerance of alternate lifestyles, as in the form of both same sex and opposite sex partner households, in its affirmation of abortion rights by public vote, perhaps even in the rise of a distinctive music scene, from Jimmy Hendrix, Nirvana, Pearl Jam, and a museum to celebrate these contributions to popular music, Paul Allen's Experience Music Project. This city also enjoys quality opera and symphony performances, housed in new state-of-the-art performance halls funded in large part by high tech wealth. These cultural and social attributes fit Florida's creative class theory to a 't', and Seattle is one of his major examples (Florida 2002).

Microsoft has played an especially significant role in the transformation of Seattle. Bill Gates, Paul Allen and Microsoft are what thrust Seattle into the top tier of digital cities. Gates and Allen were high school friends at the elite Lakeside School in Seattle, and were encouraged in early computer experiments by teachers and friends and family. After studying at Harvard, they founded Microsoft in 1975, in Albuquerque. They returned to Seattle in 1979, locating first adjacent to SR520 in the 'edge city' of Bellevue, and then outgrowing the space and relocating to a campus on a 20 acre former farm in what was then considered to be a remote suburb called Redmond. The farm site was picked by Gates in lieu of a downtown Seattle office tower. This choice had the fateful effect of creating the east-west SR520 corridor of the highly educated and professional and affluent, between Microsoft on the east to downtown Seattle on the west, with the University of Washington and Lake Union in between. Subsequently, as is well known, Microsoft has become a quasi-monopoly, not only from the domination of Windows, but of the Office suite, with world wide revenues reaching \$36.8 billion in the year ending Jun 30, 2004,⁵ and with nearly 30,000 employees in just the Seattle-area home operations.

Figures 1 and 2 show the impact the software industry has had on Seattle. The location quotients for employment, comparing the Seattle MSA to the nation, show that by 1990, the first year of the NAICS-based series, software published had already gained prominence with an LQ of nearly 6. However, as Microsoft's dominance of personal computer operating systems and office applications grew, the Seattle LQ for software publishing rose to almost 10 by 2000, and then climbed still further through the recent recession and recovery to reach 13.4 in 2004. The computer systems design industry also grew more rapidly in Seattle than in the nation, but very modestly so by comparison with software publishing. The LQs for computer systems design reached almost 1.5 in 2001 and declined to under 1.2 in 2004 as many of the 'dot coms' shrank or disappeared altogether. The wage based LQs (Figure 2) are even more astonishing, with Microsoft's stock options pumping up the LQ for software publishing to 24 in 1999, and even in 2004 with stock option grants a phenomenon of the past, the wage LQ still stood at 13.

Whether it was the presence of Microsoft, or also the influence of the University of Washington, and the other factors discussed above, Seattle has, mainly

5. Microsoft 2003 Annual Report, http://www.microsoft.com/msft/earnings/FY04/earn_rel_q4_04.mspx#Income (September 2004).

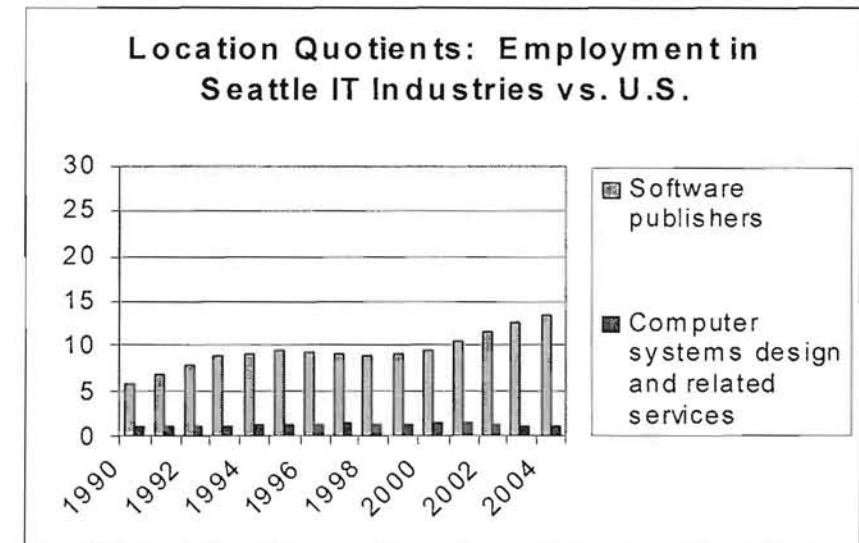


FIGURE 1 Location Quotients: Employment in Seattle IT Industries vs the US

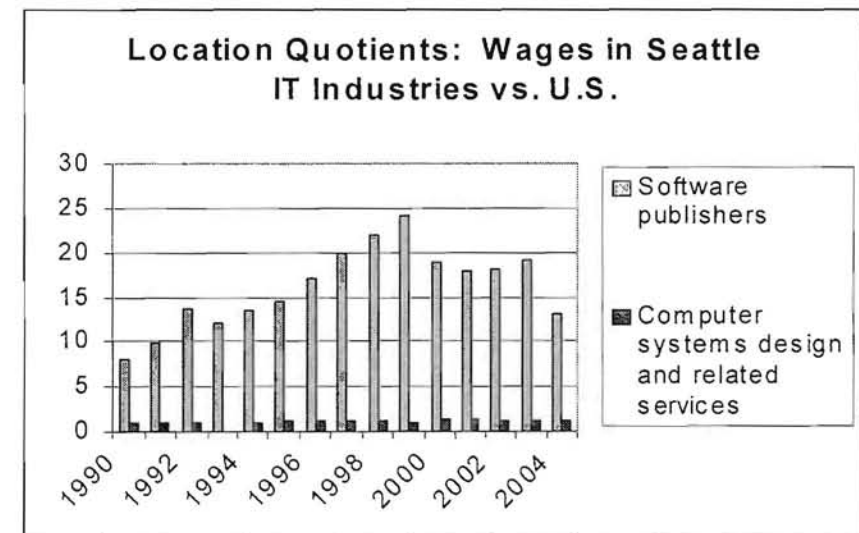
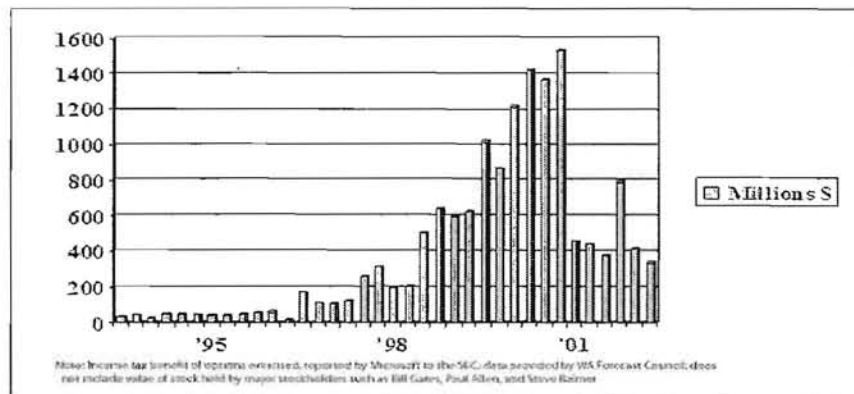


FIGURE 2 Location Quotients: Wages in Seattle IT Industries vs the US

since 1980, spawned or attracted many additional major players of the high-tech, computer, biotech and information world. Adobe is another major software player in Seattle. Adobe's local office started out as a separate firm called Aldus, which invented Pagemaker. Adobe invented "true type" fonts for laser printers down in San Jose. In 1994, these two companies merged and now operate under the Adobe



Value of Microsoft Stock Options

name. In 1998, the growing Seattle operation was moved from Pioneer Square to new quarters in the Fremont neighborhood. In lieu of a suburban location they first considered. This move met employee preferences to stay in the city, and reinforced the significance of the central city in this metropolitan area. Probably the largest and most visible computer-related firm after Microsoft is the giant e-commerce retailer, Amazon, founded in 1994 and also located in the city of Seattle, realized its first profit in the last quarter of 2003 on revenues of \$2 billion. Another significant company is Real Networks, whose streaming technologies are transforming the broadcast industries. Infospace, Attachmate, WRQ, Expedia, and many smaller software and internet based service firms have grown up in this area, with a tremendous explosion of growth in the 1990s (Table 2). While like many others, the area was hurt by the dot.com bust, the software and internet services sectors have survived. In addition to the local startups, well known companies that started in other states have put branch plants in the Puget Sound. Intel, creator of many of the computer chips that all of these digital industries use, has a research facility south of Tacoma and a second smaller facility near the University of Washington. Hewlett-Packard has a plant north of Seattle, near Everett. Siemens and Phillips have medical device plants in the area as well.

The Fred Hutchinson Cancer Research Center, FHCRC, or the "Hutch" has expanded hugely, on the east shore of Lake Union. Nearby is the Zymogenetics facility, housed in the shell of an historic former electric generating plant. Other firms are located nearby including Rosetta Inpharmatics, now a subsidiary of Merck; Corixa, which is moving from downtown to the edge of the South Lake Union neighborhood; and Corus Pharma located to the west near the waterfront. Paul Allen, the City of Seattle, and the University of Washington have teamed together to create a large biomedical complex at the south end of Lake Union on land that Allen acquired over the last 20 years. Several research institutions have leased space in the first phase of this redevelopment of South Lake Union, including the Seattle Biomedical Research Institute and Children's Orthopedic Hospital.

TABLE 2 High Tech (Biomedical, Computers, Telecommunications) in Seattle

Biotechnology and Medical Research		
Area	Employment	Some major firms
Seattle		
Univ. of Washington	5000	UW
Lake Union	4500	FHCRC, Zymogenetics, Seattle Biomedical Research
Downtown	3200	Amgen, Dendreon, Corixa, Cell Therapeutics
Eastside		
CanyonPark-Bothell	2500	Philips Ultrasound
Overlake-Bellevue	1000	Spacelabs
Region	17400	
Computer Software, Hardware, Services		
Area	Employment	Some major firms
Seattle		
Fremont-Lk Union	4000	Adobe
UW	3000	
Downtown	11000	Real Networks
Eastside		
I-90	3500	
Bothell-Canyon Pk	1200	
Downtown Bellevue	5000	
SR520 corridor	35000	Microsoft
Everett	1000	Intermec
South King county	2500	Boeing
Dupont	2000	Intel
Region	75000	
Telecommunications (Radio)		
Area	Employment	Some major firms
Downtown Seattle	1000	
I-90	3000	T-Mobile
Redmond	7000	AT& Wireless
Everett	2000	Verizon
Region	13000	
Total Hi-Tech	105000	

A specialized hospital has been created to accommodate patients undergoing biotechnology-based treatment regimes including experimental drug trials using products created at the nearby research institutions and companies. At last, the 20 year old vision of a high tech neighborhood is becoming a reality.

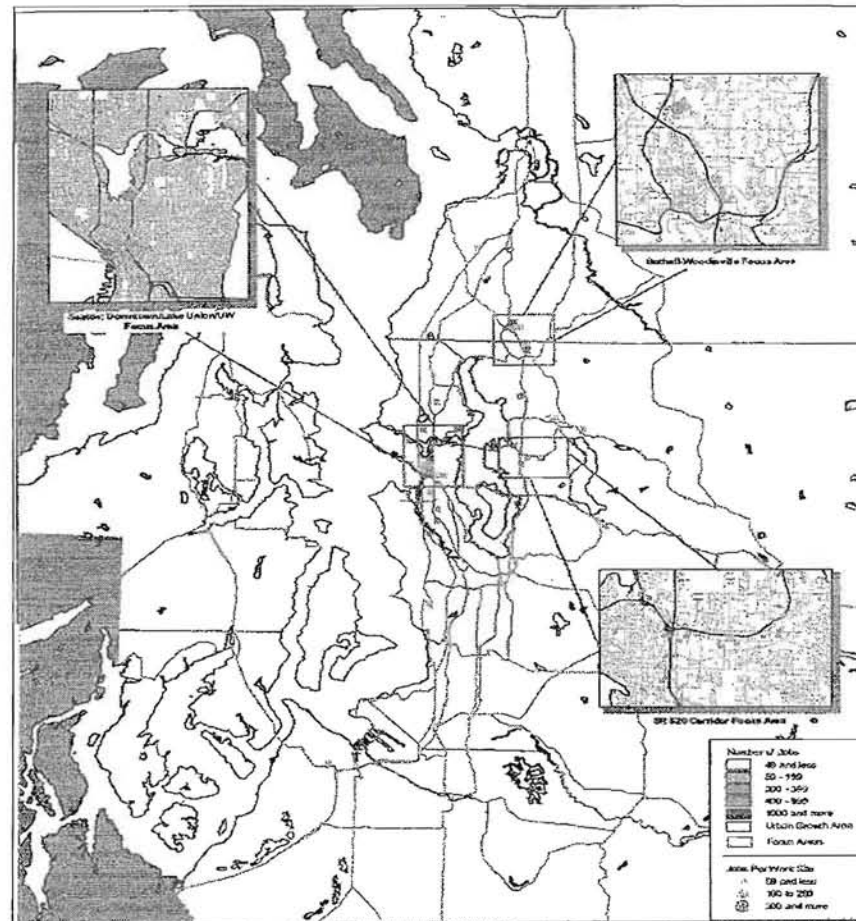


FIGURE 3A Biotechnology and Medical Research Jobs
Source: Puget Sound Milestones: Regional Economic Profile

Geography of the High Tech Industries

The high-tech computer, information-oriented, and biomedical industries have a distinct geography, essentially anchored by the University of Washington in the centre, with downtown Seattle at the south and western end, and Microsoft at the eastern end, although there are significant outliers. The major corridor may be called a downtown-Lake Union-University-Microsoft axis, or even the '520' corridor, since the 520 bridge across Lake Washington connects the major components.

Figures 3A, 3B and 3C locate many of the leading high-tech players, organized into biotechnology, computer-related, and telecommunications. Table 2 lists employment by sector by broad regions. Hi-tech employment is over 100,000. In

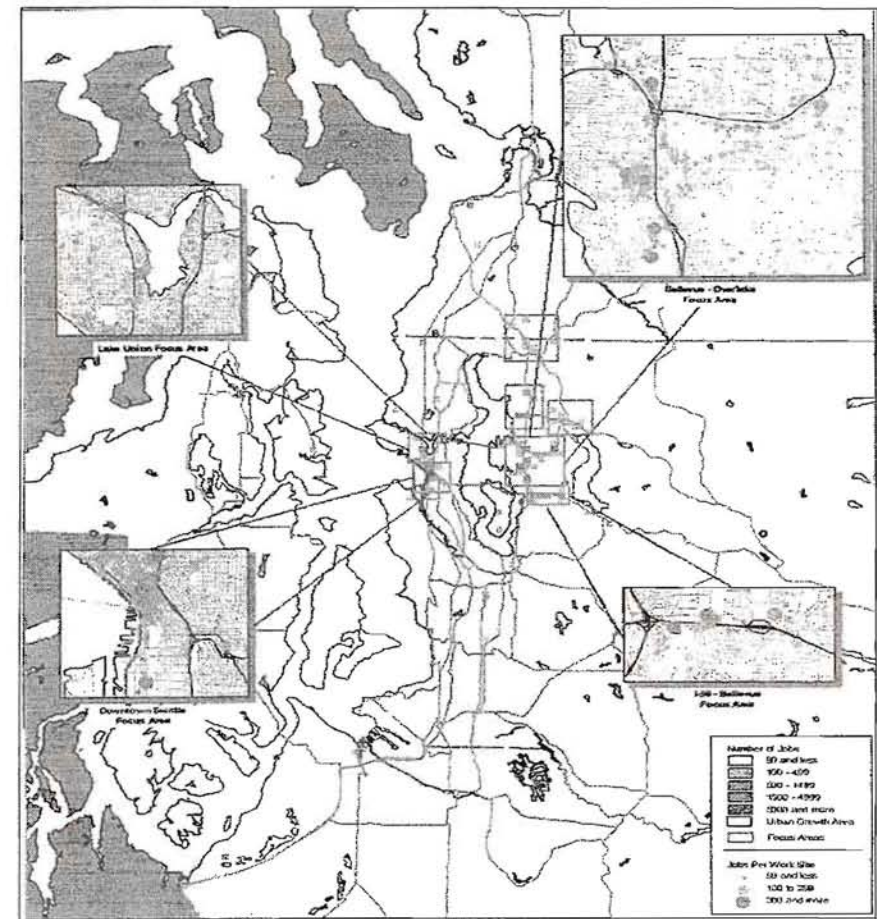


FIGURE 3B Computer-Related Jobs
Source: Puget Sound Milestones: Regional Economic Profile

Redmond, just off SR520, is the large campus of Microsoft, with approximately 30,000 employees. With their high incomes, they have astounding leverage on the regional and state economy, easily matching that of Boeing's 60,000 Puget Sound employees. In addition to pumping wage and salary income into the local economy, Microsoft granted valuable stock options to many of its earliest employees that created billions of dollars of fungible assets that have been used to start new companies along with a variety of other investments and examples of conspicuous consumption including mega house and yachts.⁶ As much as \$14.5 billion was

6. The City of Kirkland hosts an annual mega-yacht show, and some of the vessels are built in one of seven luxury yacht builders in the Puget Sound. These yacht builders juggle orders from Persian Gulf oil sheiks and the high tech moguls of the Seattle area. One source estimates that 80 % of the mega-yachts in the United States are built in the Puget Sound (<http://www.britainusa.com/seattle/MarineReport.pdf>).

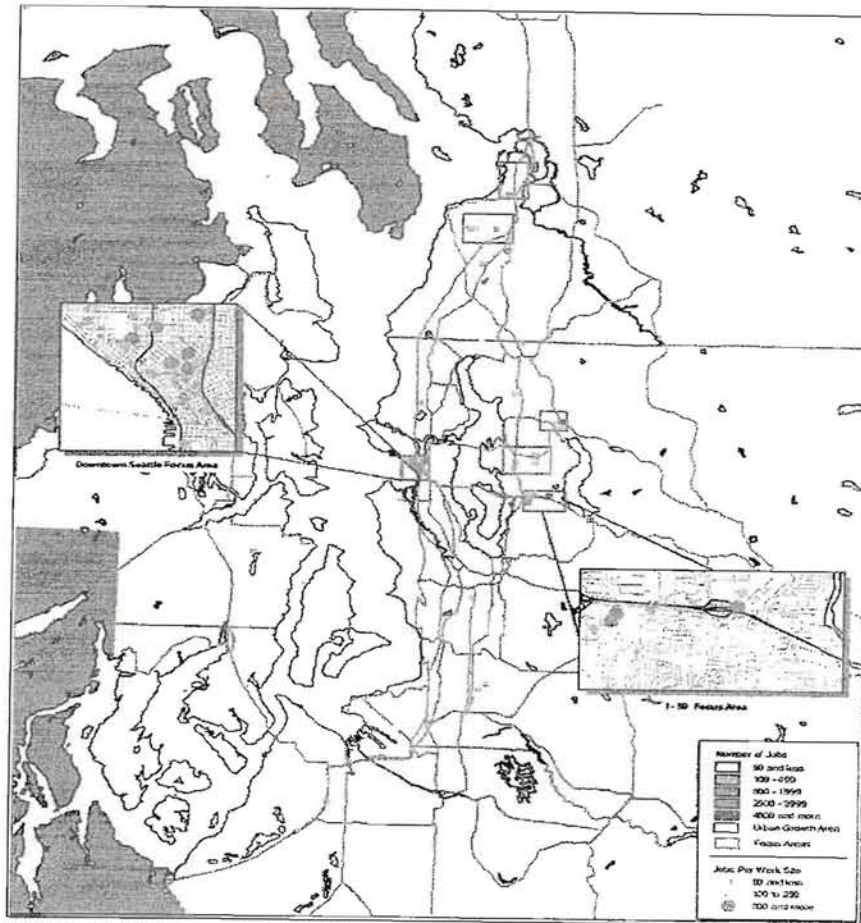


FIGURE 3C Telecommunications Jobs
Source: Puget Sound Milestones: Regional Economic Profile

pumped into the regional economy in the 1990s through Microsoft stock options, \$4.5 billion in 200 alone, creating a permanent investor class.

Together, these are the basis for probably one quarter of the entire regional economy. Between Microsoft and downtown Bellevue (the Overlake area) are dozens of additional computer software, computer retail and service establishments. Redmond itself is the main headquarters operations of AT&T Wireless (now part of Cingular), recently relocated from downtown Bellevue. That 'edge city' core, however, houses probably 8,000 high-tech jobs, mainly in computers and computer services. Farther north, up the I-405 corridor, in Woodinville, Bothell and Canyon Park (in the next county north) are several additional players, including Philips Ultrasound (biomedical) and a University of Washington branch campus.

South of downtown Bellevue where I-90 traverses the city, is another major

high-tech activity cluster, with firms such as T-Mobile (originally Voicestream) and Attachmate.

West across SR520, is the main University of Washington campus, with its large computer science program, the even larger health science complex, teaching hospital and biomedical research facilities, and the Applied Physical Laboratory, probably with 10,000 or so high-tech employees. West from the UW is a cluster of activities in Fremont, notably Adobe and Getty Images. South from the UW, half way to downtown, is the already substantial Seattle Cancer Care Alliance, including the main research arm, the Fred Hutchinson Cancer Research Center, and Zymogenetics and beyond, the high growth South Lake Union cluster, with new buildings going up to house the new University of Washington research laboratories, the Seattle Biomedical Research Institute, Merck's subsidiary Rosetta, and others.

Southeast of downtown Seattle lies Amazon, in a former Public Health Service Hospital. Northwest of downtown is the large new waterfront operations of Amgen, formerly Immunex. Downtown itself plays the role of high level business, communication and professional services, finance, real estate, law, engineering and design, but also houses such hi-tech firms as Dendreon, Corixa, Cell Therapeutics and Real Networks. Just east and above downtown is First Hill, and a large complex of hospitals and related laboratories, including Harborview, operated by the UW, and Swedish hospital, a significant center of research as well as highly specialized care, and the Pacific Northwest Research Institute, allied with both Swedish and Seattle University.

The region south of Seattle is generally seen as more industrial and commercial and transport oriented, and a less affluent part of the metropolis. Nevertheless there are a few high tech activities, for example Boeing's Seattle, Tukwila, Renton and Kent facilities, and Intel, which has a research centre in Dupont, south of Tacoma.

Figures 4 and 5 show the distribution of workers by residence, in the professional occupations generally and in the information-computer software area specifically. It is quite remarkable how much the location of workers and residents coincide, at least in a broad corridor sense. Although from Figure 5 it is quite clear that the majority of Microsoft workers also live on the east side, an intriguing fact from the 2000 census, and from traffic studies, is that the number of commuters going east on 520 equals that coming west. This is in part because of the large number of Microsoft and other eastside high-tech workers who prefer to live in Seattle, with its more liberal atmosphere and more vibrant culture, a choice which contributes to gentrification in the core city.

Impact of High Tech Development on the City Region

Technology industries grew rapidly in Seattle in the late 1990s. Statewide data show the dramatic growth, and the impact of the recession which resulted in dramatic shrinkage of all sectors except software publishing. Internet Service Providers have less than half the employment in Washington that this industry had

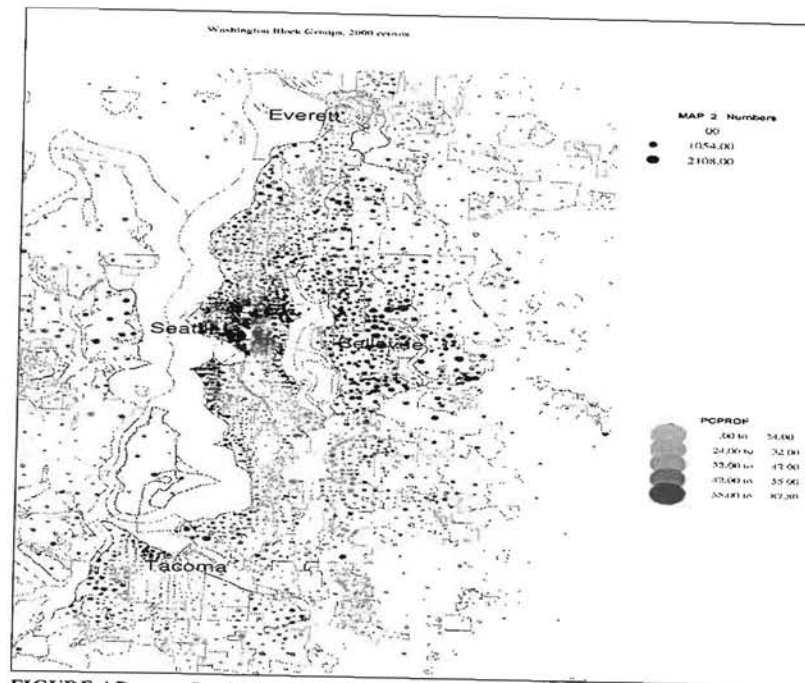


FIGURE 4 Percent Professional and Managerial Jobs, 2000

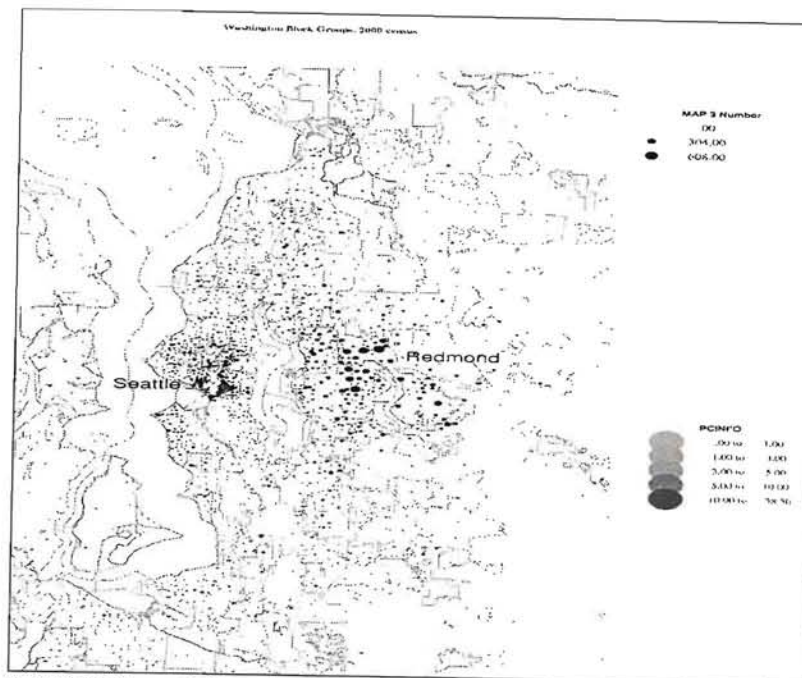


FIGURE 5 Percent Information Occupations, 2000

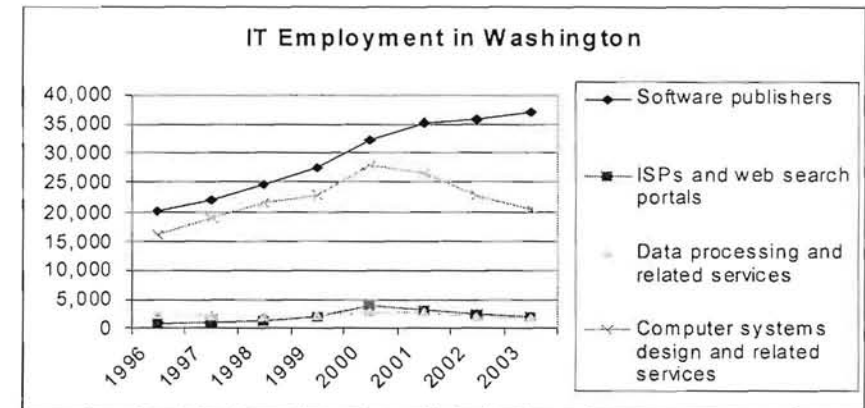


FIGURE 6 IT Employment in Washington

Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages

reached in 2000; data processing services have declined by nearly 40 % in employment; and systems design services have contracted by 28 %. Throughout this period, software publishing, led by Microsoft, has continued to grow, albeit at a much slower pace than in the late 1990s. As of 2003, software publishing had expanded by over 14 % from its level in 2000. Work published by the Washington Technology Center suggests that these industries are heavily concentrated in the Seattle area.⁷ Adding these information technology sectors together, total information technology employment peaked at 67,700 in 2001, and then declined 10 % to 60,900 in 2003 (Figure 6).

The evolution of a high-tech digital Seattle of course profoundly transformed the people of Seattle -- into a different form of human capital (Conway 1996). The defining characteristic of the workers in these information and technology sectors is that they are highly educated. The whole Seattle region has a very high share of the college educated, and the city of Seattle has an extraordinary 51 % with a BA or above. Many are young, and an unusually high share are unmarried, even if they are coupled. Partly because of these characteristics, but also because so many of these high-tech jobs, especially health related, are in the central city of Seattle, an unusually high share has chosen to live in the city rather than the suburbs. The effect of this has been to foster gentrification within the city, inflating land and housing values, and displacing less affluent households, including thousands of Blacks out of the city to poorer suburbs. Gentrification has primarily taken place in the very area surrounding Lake Union and to the east of downtown Seattle, and carried out by educated and relatively young professionals, and aided by an informal alliance of the city and of developers (Morrill 2004). A quite high share, probably over 50 %, of these new economy workers are migrants, coming from other states and countries, and greatly contributing to a more cosmopolitan charac-

7. Washington Technology Center, Index of Innovation and Technology, Seattle, 2000, <http://www.watechcenter.org/downloads/2000techindex.pdf>, p. 12 (September 2004).

ter. Half the BA's needed by the region's high tech employers were 'imported' from other states and countries. Thus, Washington high-tech growth is indirectly subsidized by quality labor educated particularly in California, the Midwest and Asia (Morrill 1997).

The city of Seattle, because it is home to so many of the new economy workers, has a distinctive political culture, heavily Democratic, and liberal on environmental and social issues, and willing to be taxed for good causes and projects, including rail rapid transit, but not cars (although many seem to own SUVs). Ironically, many of these people, utterly dependent on the globalized economy and culture, were among the protesters at the WTO meeting in Seattle (the Battle in Seattle) in 1999!

A consequence of the transformation of Seattle to a digital city has been a parallel change from being a fairly egalitarian city in 1970 to a far more unequal city by 2000. There are substantial numbers of the obviously rich and influential, but of course far more who have not been lifted by a rising tide, but who are being relegated to an expanding servant class, and displaced from the rediscovered urban core. This intellectual and environmental elite would have been liberal Republicans before 1980, but now are the core of the Democratic establishment, having displaced the traditional blue-collar populist Democrats of the earlier industrial city. For an alternative, lively and irreverent study of the rise of Seattle as a digital city, including detailed stories about Microsoft, Amazon, Starbucks and McCaw Cellular, and the infamous WTO riots, read Fred Moody's *Seattle and the Demons of Ambition*.

Seattle in Relation to Theory of High Tech Location

Seattle is amazingly successful. By 2005, it had recovered from the dot.com bust of the early 2000s. Boeing is soaring as are most of the icons of a presumptively global Seattle, including Microsoft, Starbucks, REI, Costco and Amazon. How well does theory predict this?

Seattle seems to be a convincing example of the continuing relevance and power of an urbanist/agglomeration basis for an unusually high share of high-tech, biotech, information sector firms, and of innovative and successful enterprises using these technologies and catering to these professionals (Sommers 2000). The underlying assets were and are the University of Washington, a strong health services and research complex, and a traditionally young but well-educated labor force. Seattle's relative isolation enabled it to become a 'regional capital' of transportation, communication, trade, health and business services, wholesale and retail trade, greater than its relatively small size should predict.

Yet the counter-theory is applicable too. The major firms and sectors like Boeing, Paccar, Microsoft, Amazon and others do disperse or outsource many routine operations, with the metropolis holding the higher skilled and professional components.

If it is a 'global' city in the sense of current theory, and we believe it is, it is an unusually small one, with but 3 million people in a fairly modest regional

market of less than ten million. If it is, such status is a function of its strategic position relative to Asia and California and to the fact that Boeing, Microsoft, Paccar, Starbucks, Costco, Amazon and other firms are global competitors.

But this economic theory is insufficient to explain Seattle's success. The cultural or social form of an urbanist/agglomeration theory is absolutely critical. Beginning already in the 1960s and a powerful force in itself by the 1980s was Seattle's attractiveness to the young (17-45) and to the educated (often elsewhere), built on a reputation of tolerance of alternate lifestyles, excellent educational opportunities, superb environmental attractions, and a high level of confidence and innovativeness that contributed to the creation, survival and growth of high tech and related sectors. And despite all these moderately convincing arguments, we believe that Seattle's success cannot be explained without admitting that the founders of so many enterprises liked it here and chose to stay, e.g., Microsoft, Amazon, Starbucks, REI and Fred Hutchinson. All could have relocated to larger metropolitan areas, as did Boeing.

Seattle is unusual with respect to the balance of city and suburb in that there is no difference in wealth and opportunity. The benefits of urbanist/agglomeration ideas help us understand the concentration of activity in and near downtown Seattle, and between downtown and the University of Washington, only 3 miles away. But this is enabled and reinforced by an environmental and social situation, a physical topography and extant housing stock highly attractive to reinvestment by educated professionals, and we repeat, by the absence of a significant underclass. Indeed so attractive is it to live in the central core that gentrification has displaced thousands of the relatively poor and of minorities southward, often beyond the city.

If downtown Seattle and the University of Washington anchor the western central city high tech and information sectors, Microsoft and downtown Bellevue define the eastern suburban end of the axis (the SR 520 corridor). But theory predicts this: Seattle, despite infill and densification has space for only 630,000. The 'eastside' across Lake Washington has up to a million, affluent and educated, protected from Seattle by distance, water and congestion, easily justifying the rise of the highly successful and competitive edge city of Bellevue (central place theory in action). But why did Gates choose Bellevue for Microsoft and then relocate farther out to Redmond? Who really knows except Gates did envision a real college-like campus, and the Redmond site, originally slated for a regional shopping centre which was turned down, was available at a critical juncture of growth.

So yes, extant theory works, but the Seattle case requires a stronger component of physical and social environment, and of individual founder preferences than may be true of larger more obviously global cities.

Conclusion

The dot.com bust and the slowdown of air travel, have damaged the twin pillars of the Seattle economy, computers and commercial aircraft. Dozens of small firms died, and high tech employment dropped 10 % from its 2000-2001 peak. However, biotechnology continues to grow, and Microsoft itself has continued to expand, if at a slower pace than earlier. The loss of Boeing's headquarters to Chicago was a blow to Seattle's claim of world-class status, and the continuing inability to resolve serious local transportation problems threatens additional losses of jobs and firms.

But this has happened before, in the early 1970s, 1980s and 1990s recessions. The pool of talent remains, as does the general social and environmental attractiveness of the area to migrants. The three main groupings of high-tech activities, biomedical, computers, and telecommunications remain subject to volatility, but are basically growing sectors in an ever more technological and globally interdependent world. Thus the region has a remarkable confidence, which is probably warranted, based on trajectories of adaptability and innovation over the last century and a half of this youthful metropolis.

We purposefully chose the title, Seattle as a Digital City: Unexpected or Inevitable? Neither word is quite right. Was this dramatic transformation of Seattle unexpected? -- Yes, in many ways the scale of the transformation and its unintended consequences such as the creation of the Redmond to Seattle high tech axis and the many impacts of the huge stock options granted by Microsoft have surprised long time residents as well as observers in the rest of the world who did not expect this city to emerge as a serious player in advanced technology. Was it inevitable? Certainly not. Microsoft could have stumbled. Or, its founders could have granted massive dividends that might not have contained the wealth among local residents sufficiently to have spawned the technology boom of the 1990s. Paul Allen could have spread his investments far more thinly around the globe in pursuit of cable technology industry dominance rather than concentrating to the degree he has in the Seattle area. Local entrepreneurs could have been less prescient in their guesses about which information technology, telecommunications, and bioscience technologies to back. Local and state public officials certainly could have done more to promote technology industry growth through investments in education and research, and by providing the infrastructure to support private real estate development aimed at technology industries. In fact many of these issues are currently the topic of lively debates in elections, the state legislature, city council chambers, universities, and economic development organizations in the region as public and private leaders strive to forge a consensus on these matters that can move the region forward more deliberately into further development of the digital and bioscience industries in this area. One could argue that the natural setting and our position relative to California and to East Asia created almost inescapable opportunities for attracting creative persons and firms. But it is perhaps more honest to admit a large element of serendipity, the right creative people at the right time. The region has a remarkable confidence, which is probably warranted, based on trajectories of adaptability and innovation over the last cen-

tury and a half of this youthful metropolis.

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