

Industry Cluster Analysis for Washington State Workforce Development Areas

**Paul Sommers, Seattle University
William B. Beyers, University of Washington
Andrew Wenzl, University of Washington**

November 2008

**A Report Prepared For the Washington State
Workforce Board**

Executive Summary

This report provides an analysis of industry clusters in 12 Workforce Development Area regions within Washington State. Strong clusters may give competitive advantage to a region. Supporting these clusters with adequately educated and trained workers, and complementary economic development programs, are important public sector missions.

The report identifies clusters in each region of the state based on measures of comparative advantage and linkages to other industries. In a series of charts, tables and maps for each region, the report provides data on competitive strength, size, historical and projected growth, exports, and innovation potential. The maps for each region show the location of firms in each regional cluster, demonstrating significant geographic agglomeration of clusters throughout the state. Additional maps show the statewide distribution of several clusters found throughout the state, but with many firms grouped together in certain regions.

A concluding section finds that employment is expanding in more clusters than it is contracting, but there are regions in this state where the strongest industry clusters have been contracting. Focusing public policy on clusters is not a panacea for the economic problems Washington State faces, but the data assembled in this report do provide a guide to the strengths and weaknesses in various regions of the state. Economic development, higher education, workforce development and other agencies and organizations striving to improve economic outcomes for Washington's residents may find this document a useful guide to significant features of the state's economy.

The concluding section also notes that the literature on clusters stresses that regional agglomerations of firms in clusters are expected to produce positive external economies such as more rapid rates of innovation, increased specialization of the workforce, and reduced costs. These "untraded interdependencies," to use the jargon of the cluster literature, are difficult to measure with available statistical data. It is also clear that competitive advantage shifts over time, new industries appear, and older ones sometimes completely disappear. This report provides a picture of the state economy at a point in time, and this picture needs to be periodically updated to provide a useful guide to policy making.

Table of Contents

Executive Summary	i
Table of Contents	ii
List of Tables	iii
List of Figures	iv
I. Introduction – Approach to this Project	1
II. Data Sources and Methodology	2
III. Results of Analyses.....	6
Statewide Clusters.....	6
Clusters by Region.....	8
Region 1: The Olympic Consortium - Clallam, Jefferson, and Kitsap Counties.....	9
Region 2: Pacific Mountain WDA – Grays Harbor, Lewis, Mason, Pacific and Thurston Counties.....	14
Region 3: Northwest WDA – Island, Skagit, and Whatcom Counties	19
Region 4 - Snohomish County WDA	25
Region 5 – Seattle - King County WDA	30
Region 6 - Pierce County WDA	37
Region 7 Southwest Washington WDA – Clark, Cowlitz, Skamania and Wahkiakum Counties.....	43
Region 8: North Central WDA – Adams, Chelan, Douglas, Grant, and Okanogan Counties	52
Region 9: Tri-County WDA – Kittitas, Klickitat, and Yakima Counties.....	57
Region 10: Eastern Washington WDA – Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Stevens, Walla Walla and Whitman Counties	62
Region 11: Benton-Franklin WDA - Benton & Franklin Counties	68
Region 12: Spokane County WDA.....	74
IV. Statewide Findings and Conclusions	82
Appendix I: Methodology.....	89
Data Sources	92
Location Quotients.....	93
Correlation between IMPLAN Location Quotient Measures	95
Identification of key sectors by region.....	98
Development of Diagrams of Linked Clusters	99
Definition of Clusters.....	100
Development of Bubble Charts.....	100
Distribution of Wages by Occupation.....	101
Development of Indices	102
Adjacent State Analysis	104
Development of Maps.....	105
References.....	106
Appendix II: Correspondence Between IMPLAN Industry Codes and NAICS Codes.	107

List of Tables

Table 1: Distribution of Occupational Median Wages in WDA 1	11
Table 2: Middle and High Wage Jobs by Cluster in WDA 1	11
Table 3: Strategic Evaluation of Clusters in WDA 1	12
Table 4: Distribution of Occupational Median Wages in WDA2	16
Table 5: Middle and High Wage Jobs by Cluster in WDA 2	16
Table 6: Strategic Evaluation of Clusters in WDA 2	17
Table 7: Distribution of Occupational Median Wages in WDA3	21
Table 8: Middle and High Wage Jobs by Cluster in WDA 3	21
Table 9: Strategic Evaluation of Clusters in Region 3	22
Table 10: Distribution of Occupational Median Wages in WDA 4	26
Table 11: Middle and High Wage Jobs by Cluster in WDA 4	26
Table 12: Strategic Evaluation of Clusters in Region 4	27
Table 13: Distribution of Occupational Median Wages in WDA 5	32
Table 14: Middle and High Wage Jobs by Cluster in WDA 5	32
Table 15: Strategic Evaluation of Clusters in Region 5	33
Table 16: Distribution of Occupational Median Wages in WDA 6	38
Table 17: Middle and High Wage Jobs by Cluster in WDA 6	38
Table 18: Strategic Evaluation of Clusters in Region 6	39-40
Table 19: Distribution of Occupational Median Wages in WDA 7	45
Table 20: Middle and High Wage Jobs by Cluster in WDA 7	45
Table 21: Strategic Evaluation of Clusters in Region 7	46-47
Table 22: Clark and Portland Metro Area Location Quotients	49-50
Table 23: Distribution of Occupational Median Wages in WDA 8	53
Table 24: Middle and High Wage Jobs by Cluster in WDA 8	53
Table 25: Strategic Evaluation of Clusters in Region 8	54
Table 26: Distribution of Occupational Median Wages in WDA 9	58
Table 27: Middle and High Wage Jobs by Cluster in WDA 9	58
Table 28: Strategic Evaluation of Clusters in Region 9	59
Table 29: Distribution of Occupational Median Wages in WDA 10	63
Table 30: Middle and High Wage Jobs by Cluster in WDA 10	63
Table 31: Strategic Evaluation of Clusters in Region 10	64
Table 32: Distribution of Occupational Median Wages in WDA 11	69
Table 33: Middle and High Wage Jobs by Cluster in WDA 11	69
Table 34: Strategic Evaluation of Clusters in Region 11	70
Table 35: Distribution of Occupational Median Wages in WDA 12	75
Table 36: Middle and High Wage Jobs by Cluster in WDA 12	75
Table 37: Strategic Evaluation of Clusters in Region 12	76
Table 38: Spokane and Kootenai County Location Quotients	77-78
Table A1: Distribution of Location Quotient Values (Output used as measure)	92
Table A2: Correlations among Location Quotient Measures – Clark WDA	93
Table A3: Sales and Purchases Coefficient Distributions for the Spokane WDA	94

List of Figures

Figure 1: Workforce Development Areas in Washington	1
Figure 2: Clusters in Washington State	7
Figure 3: WDA1 Cluster Characteristics.....	10
Figure 4: WDA1 Cluster Linkages	10
Figure 5: WDA1 Cluster Map.....	13
Figure 6: WDA2 Cluster Characteristics.....	15
Figure 7: WDA2 Cluster Linkages	15
Figure 8: WDA2 Cluster Map.....	18
Figure 9: WDA3 Cluster Characteristics.....	20
Figure 10: WDA 3 Cluster Linkages	20
Figure 11: WDA3 Cluster Map.....	23
Figure 12: WDA4 Cluster Characteristics.....	25
Figure 13: WDA4 Cluster Linkages	25
Figure 14: WDA4 Cluster Map.....	28
Figure 15: WDA5 Cluster Characteristics.....	31
Figure 16: WDA5 Cluster Linkages	31
Figure 17: WDA5 Cluster Map.....	35
Figure 18: WDA6 Cluster Characteristics.....	37
Figure 19: WDA6 Cluster Linkages	37
Figure 20: WDA6 Cluster Map.....	41
Figure 21: WDA7 Cluster Characteristics.....	43
Figure 22: WDA7 Cluster Characteristics (except Federal Electrical Utilities)	44
Figure 23: WDA7 Cluster Linkages	44
Figure 24: WDA7 Cluster Map.....	48
Figure 25: WDA8 Cluster Characteristics.....	52
Figure 26: WDA 8 Cluster Linkages	52
Figure 27: WDA 8 Cluster Map.....	55
Figure 28: WDA9 Cluster Characteristics.....	57
Figure 29: WDA9 Cluster Linkages	57
Figure 30: WDA9 Cluster Map.....	60
Figure 31: WDA10 Cluster Characteristics.....	62
Figure 32: WDA10 Cluster Linkages	62
Figure 33: WDA10 Cluster Map.....	65
Figure 34: WDA11 Cluster Characteristics.....	67
Figure 35: WDA11 Characteristics of Additional Clusters	67
Figure 36: WDA11 Cluster Linkages	68
Figure 37: WDA11 Cluster Map.....	71
Figure 38: WDA12 Cluster Characteristics.....	73
Figure 39: WDA12 Characteristics of Additional Clusters	73
Figure 40: WDA12 Cluster Linkages	74
Figure 41: WDA12 Cluster Map.....	79
Figure 42: Employment Change in Clusters Statewide.....	81
Figure 43: Cluster Employment Change Frequencies	81
Figure 44: Employment Trend in Clusters with the Largest Employment	8
Figure A1: Czamanski's Industry Cluster Diagram.....	86
Figure A2: Color Scheme for Bubble Charts	97

I. Introduction – Approach to this Project

This report presents research requested by the Washington State Workforce Board for analyses of the importance of industry clusters in the twelve Workforce Development Area (WDA) regions in Washington State. Figure 1 shows the location of these regions. Section II briefly describes the data sources and methodology used in this report. Appendices provide a detailed methodological discussion, as well as a guide to the employment classification schemes used in the analysis. Section III presents results of the analyses conducted for each WDA, while Section IV offers some more general conclusions and concluding comments about this project.

Figure 1: Workforce Development Areas in Washington



WDA Region	Counties	WDA Name
1	Cllalam, Jefferson, Kitsap Grays Harbor, Lewis, Mason, Pacific,	Olympic Consortium
2	Thurston	Pacific Mountain WDA
3	Island, San Juan, Skagit, Whatcom	Northwest WDA
4	Snohomish	Snohomish County WDA
5	King	Seattle-King County WDA
6	Pierce	Pierce County WDA
7	Clark, Cowlitz, Skamania, Wahkiakum	Southwest Washington WDA
8	Adams, Chelan, Douglas, Grant, Okanogan	North Central WDA
9	Kittitas, Klickitat, Yakima	Tri-County WDA
10	Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Stevens, Walla Walla, Whitman	Eastern Washington WDA
11	Benton, Franklin	Benton-Franklin WDA
12	Spokane	Spokane

II. Data Sources and Methodology

This section provides a brief summary of the methodology used to identify clusters and assess their strategic value within each of the 12 Workforce Development Area (WDA) regions in Washington. A more complete description of the methodology is provided in Appendix 1, along with a review of some of the pertinent literature on cluster issues.

The goal of the analysis is to identify industry clusters in each of the 12 WDA regions within the state of Washington, and to develop measures of the strategic importance of these clusters. This report defines clusters as industries with a relatively high concentration of employment in a particular region of the state, including but not limited to groups of industries that are tied together via strong purchase or sales relationships.

Using data from the IMPLAN¹ input-output model's database for 2006, we computed location quotients (LQs) for each industry. LQs are a measure of the concentration of regional employment in a particular industry relative to the nation's share of employment in that same industry. A LQ greater than one suggests an industry with some competitive advantage, and high LQs are commonly used as part of a methodology for identifying clusters (see discussion in Appendix 1). In this study we found many quite high LQs, as high as 70, indicating an industry with 70 times the national share of employment in one Washington region. We decided to set a flexible floor for the minimum LQ to be regarded as a strong industry cluster. This flexible floor allowed approximately 5 percent of industries in the state to qualify as clusters. The charts below show the exact level of this floor for each region.

We then looked for evidence that these industries are strongly tied to other industries within each region via sales or purchases, a key characteristic of clusters as defined by Harvard Professor Michael Porter and other cluster experts. We used the inter-industry sales and purchase coefficients in the 12 regional IMPLAN models constructed for this project to measure inter-industry ties within each region. Similar to the selection of a floor for LQs, we choose a minimum size for sales or purchases coefficients that would suggest relatively strong inter-industry ties. Each of the 12 regional models has up to 90,000 coefficients due to the fine level of industry detail in the IMPLAN models. Based on an examination of the distribution of coefficient sizes in one region, we selected .05 (5 percent of either total industry sales or purchases) as the minimum sized coefficient to be considered a "strong" inter-industry linkage. Experiments with lower linkage levels suggested that diagramming linkages within a region would become intractable if the floor was set any lower. Therefore we used the .05 minimum linkage rule in developing diagrams of inter-industry linkages in all regions of the state.

After examining the 12 regional industry linkage diagrams (contained in the text below in Section III) we decided to add relatively large regional industries with lower LQs greater

¹ IMPLAN is an input-output modeling system offered by the Minnesota IMPLAN Group that can be applied to any county or multi-county region. For this report, we developed IMPLAN models for each of the 12 WDA regions in Washington using IMPLAN's 2006 data files. See www.implan.com for more information about this model.

than 1 but less than the floor level in each region. This decision brought selected health care and construction industries into the analysis along with a handful of large service industries.

The charts, tables, and maps in the next section therefore include three types of industries designated as “clusters.”

1. Industries with high location quotients;
2. Combinations of industries with high location quotients and industries to which these “core industries” are tied by large sales or purchase coefficients; and
3. Large industries with more modest location quotients greater than 1 but less than the standard “floor” level for that region.

Having identified clusters in each region based on relative size and inter-industry ties, we then developed a series of measures for each cluster depicting size, growth, wages levels and distribution, research and development potential, and level of export sales. These variables can be used to assess the strategic importance of each cluster in a region, using an index developed by ranking the clusters from highest to lowest value on each variable. The highest ranked cluster is assigned a score of 1, with the other clusters receiving lower scores based on their ranking on that variable. The index is constructed by summing the ranks across all of the variables and subtracting the sum from 100.² This procedure results in an index with high values indicating greater strategic importance. The data on all of these variables, and the rankings and index values, are shown below in tables labeled “strategic matrix.”

Some of the data in the strategic matrices below come from the IMPLAN database, while other variables were extracted from very detailed data provided by the Washington Employment Security Department (ESD). ESD must comply with federal rules designed to protect the confidentiality of firms who respond to the employment and occupational surveys ESD administers as part of the federal Bureau of Labor Statistics employment statistics program. When the entry “n/a” is shown in the strategic matrices below, it indicates that data have been suppressed by ESD or the authors of this report in compliance with the confidentiality rules. Particularly in very rural regions of the state, the clusters are quite small, and in a number of cases have too few firms to meet the confidentiality rules. Complete definitions of each variable included in the strategic assessment are provided in Appendix I.

Using data on the distribution of the median wages of each of approximately 700 occupations in each region of the state, two measures of the distribution of wages were calculated for each cluster:

- *Middle wage jobs* – the percentage of jobs in each cluster falling within the 25th to the 75th percentile of regional median occupational wages; and

² In some regions with a large number of clusters, 120 was used instead of 100 to avoid having many negative index values. Because the number of clusters varies from region to region, and some regions are “normalized” against a value of 100 and others against 120, the index values are not comparable from one region to another. This index score is only intended to be used to assess relative strength of clusters within a single region.

- *High wage jobs* – the percentages of jobs in each cluster with occupational median wages above the 75th percentile of regional median occupational wages.

The regional middle wage range varies around the state, varying from \$21,202 to \$27,803 for the 25th percentile, and from \$43,328 to \$ 65,215 for the 75th percentile. These ranges encompass the estimates of living wages for different household sizes constructed by the Northwest Federation of Community Organizations (NWFCO). According to NWFCO, a living wage for a single adult living alone in Washington in 2007 was \$23,940 in annual income, while a household with a single adult and two children needed \$52,369 in annual income to achieve the same living standard. These two estimates bracket the range estimated for other household types in the NWFCO study.³ Thus, the middle wage estimates shown in the tables below can be used as a rough guide to the number of jobs in each cluster that pay a living wage.

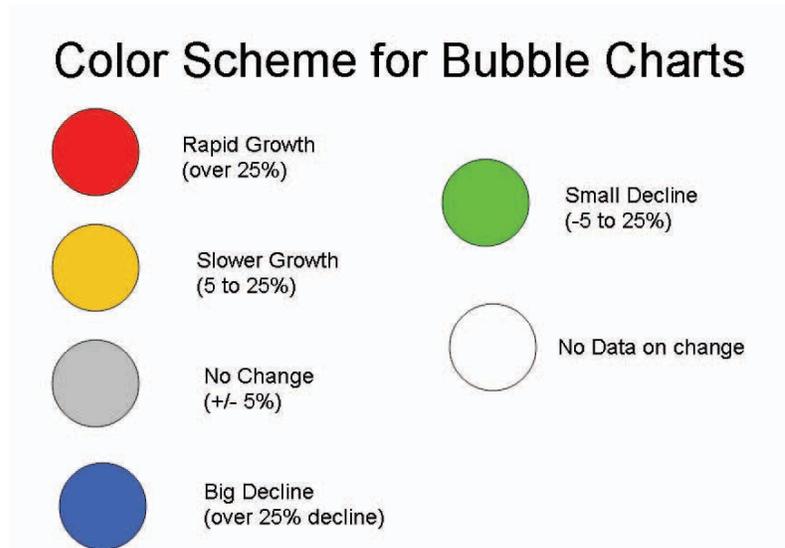
Since all of the publicly reportable data on the variables used to construct the index is included in the matrix for each region, readers can experiment with alternative indexing procedures such as dropping some variables or weighting the variables differentially. Some agencies might want to emphasize the wage distribution variables, while others might put greater emphasis on the research and development potential or export orientation of clusters.

One further note is necessary about wage and earnings data presented in the charts and tables below. Each regional section includes wage distribution tables drawn from the Employment Security Department's occupational data files. These tables show the mean and median level of wages for the occupations in each of a region's clusters. In addition, the 25th and 75th percentile levels of occupational wages are shown; these variables are described above. The data for mean, median, 25th percentile and 75th percentile come from the occupational wage surveys conducted by Employment Security, and they are subject to confidentiality rules that result in significant data suppression since the confidentiality rule is applied to each individual occupation. Thus coverage of total employment in the cluster is lower than for a final measure, earnings per worker. The earnings per worker measure is derived from the IMPLAN database, and consists of both employee and proprietor's earnings divided by cluster employment. Inclusion of proprietor's earnings gives a better measure of the income generation of each cluster since in some industries proprietors are a relatively high proportion of the total workforce (e.g., construction contractors, doctors, dentists, lawyers and other professionals). Because the measure is constructed with totals for each industry, less data suppression is present. However, the inclusion of proprietors' earnings produces earnings per worker levels that may seem quite high in some industries if one is more accustomed to use of occupational wage data that do not include proprietors' earnings.

The maps included below are based on latitude/longitude data for individual business establishments in each cluster provided by the Employment Security Department. The colored dots on the maps in the pages below depict one or more businesses at a particular location, with the colors indicating various clusters present in the region. A key for the

³ Chinitz, Julie, et al. 2007 Northwest Job Gap Study. Seattle: Northwest Federation of Community Organizations, p. 17 (nwfco.org/pubs/2007.1218_NW.JG.The.Race.For.Wages.pdf).

map colors is shown below. When several firms are located closely together, a single dot on the map may represent multiple firms.



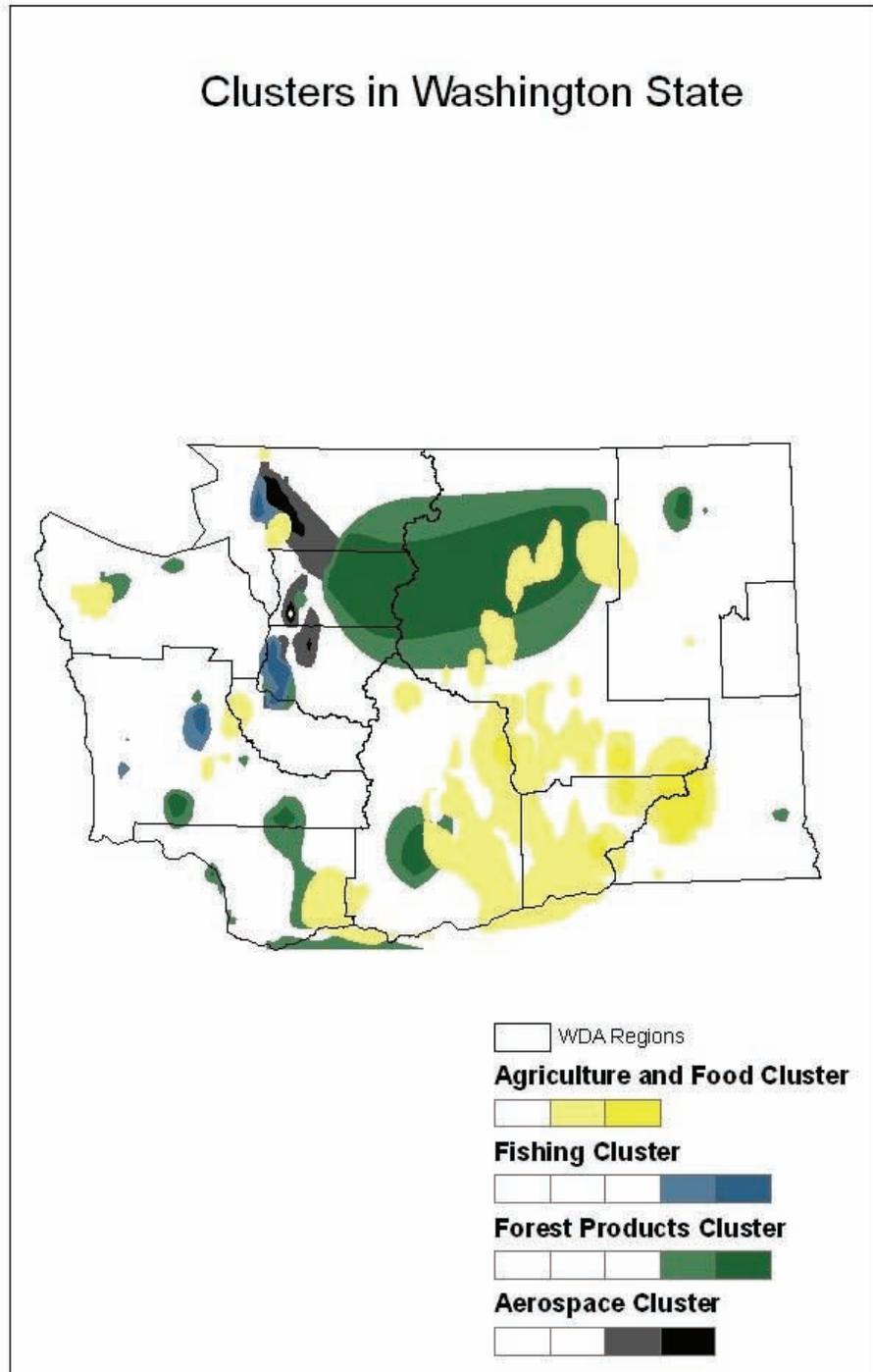
III. Results of Analyses

The geographic distribution of several statewide clusters is discussed first in this section, followed by the presentation of detailed results for each WDA.

Statewide Clusters

The statewide “heat map” on the next page shows the relative concentration and strength of local “clustering” effects of establishments in selected industry clusters across Washington State. This map is illustrative of the characteristics of these clusters across the state, and highlights the diversity of intensity in clustering characteristics of firms across industries. Areas on the map with darker shades show a denser concentration of firms than the areas with lighter shades of the same color. This map shows the relatively strong clustering tendencies of firms in the aerospace industry in the western portion of the state, chiefly in Region 5 (King), Region 4 (Snohomish), and Region 3 (Whatcom). The Agriculture cluster is more broadly dispersed across WDA regions, with a large number of establishments across the eastern portion of the state. The agricultural component of this map thus shows the broad importance of agriculture across the state, as most of the regions in the western portion of the state have clusters of agricultural establishments as well, albeit small relative to those of the eastern portion of the state. Fishing is tightly clustered in a few regions in the west, with strong local clusters of firms in the Puget Sound Region, the coastal regions, and the Whatcom/Skagit region. The statewide map also shows the importance of Forest Products clusters across the state, but chiefly in the northern and the southwestern portions of the state.

Figure 2: Clusters in Washington State



Clusters by Region

In the remainder of this section, short text sections describe major findings from our analysis for each region, and a series of charts and tables is presented for each region:

- a. A bubble chart showing cluster strength (LQ), employment level, average wage level, and employment growth from 2001 to 2007. Growth is expressed in percentages of the 2001 level and grouped into categories of employment change as shown below.
- b. A cluster diagram showing linked sectors and “isolates,” i.e. sectors with relatively strong LQs but relatively weak linkages to other sectors in that region. For purposes of the discussions in the remaining pages, both linked sectors and isolates are referred to as “clusters.”
- c. Tables showing the distribution of wages region-wide and within each cluster.
- d. A strategic factors matrix showing various characteristics of each cluster and an index based on the sum of rankings of each characteristic’s value in that region.

Region 1: The Olympic Consortium - Clallam, Jefferson, and Kitsap Counties

In this region, the largest cluster is related to the Navy bases located in Kitsap and Jefferson County. Kitsap is home to Navy Region Northwest, which includes the Navy installations at Bremerton and Bangor, the Puget Sound Naval Shipyard, and the research facility at Poulsbo, as well as a munitions depot on Indian Island in Clallam County. Together these installations employed nearly 28,000 in 2007, a level of employment that is 14 times the national average. The cluster with the highest LQ, on the other hand, is fishing, a cluster that includes local seafood processing plants and marine-related construction (dock installation and repair). This is a small cluster with employment estimated at just 843, but this employment level is nearly 20 times the national average for this set of industries. A number of other clusters are shown on the charts beginning on the next page, including forest products, construction, architectural and engineering services, and nursing/residential care services. All of these clusters provide employment in this region equal to 90% of the employment in the Navy-related cluster, demonstrating the dominant influence of the Navy installations on the economy of this region.

No employment projection is available for the large Navy cluster. Declines in employment were experienced in the Fishing/Seafood and Forest Products clusters, and additional declines are expected from now out to 2018. Many of the clusters with lower levels of comparative advantage, however, were growing in recent years and are expected to continue to expand at a moderate pace.

The top 5 clusters in the region, measured by location quotient or degree of comparative advantage, all have high percentages of exports (sales to customers outside Washington State). However, three of these 5 clusters are projected to experience employment declines in the years ahead, and the 5th, sporting goods manufacturing, is quite small and is expected to experience only a modest employment gain consistent with its recent historical growth. The last of the 5 is the Navy focused cluster for which we have no growth projection. Six of the 8 clusters for which we are able to display wage distribution data have a middle wage percentage higher than the regional average, and 4 of the 8 have a high wage percentage higher than the regional average. The strategic value index for these clusters places Architectural and Engineering Services at the top of the list, followed by the Navy focused cluster, Business Support Services, Wood Products, and Ship and Boat Building.

The map showing establishment in key clusters for Region 1 shows a largely dispersed pattern of establishments across the clusters, with establishments centered along Highway 101 throughout the region. However, there are large concentrations of firms in the Wood Products cluster centered near Forks and Port Angeles. Sporting Goods manufacturing clusters are evident along Highway 101 between Port Angeles and Sequim, with another concentration in the Port Townsend and Quilcene areas. Not surprisingly, Ship and Boat Building activities are wholly centered in Port Angeles, Port Townsend, and near the Navy base in the Bremerton area. Fishing establishment locations are especially pronounced in the Hood Canal area.

Table 1: Distribution of Occupational Median Wages in WDA 1

Wage Type	Annual Wages
Mean Wages	\$41,714
Pct25 Wages	\$24,043
Median Wages	\$35,184
Pct75 Wages	\$52,954

Table 2: Middle and High Wage Jobs by Cluster in WDA 1

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Fishing	79	-	0%	0	0%
Wood Products	1,048	833	79%	172	16%
Ship and Boat Building	899	461	51%	388	43%
Sporting Goods Mfg.	306	214	70%	37	12%
Nursing and Residential Care Facilities	3,691	2,252	61%	349	9%
Architectural and Engineering Services	1,679	674	40%	847	50%
Other Amusement, Gambling, & Recreation	1,433	806	56%	39	3%
Construction	672	482	72%	183	27%
State & Local Non-Education	8,375	4,990	60%	1962	23%
Cluster Total	18,182	10,712	59%	3977	22%
All Industries	119,515	58,716	49%	27995	23%
Clusters as % of All Industries	15%	18%			

Table 3: Strategic Evaluation of Clusters in WDA 1

Cluster	LQ	Output (\$ millions)	Employment	Earnings/Worker	Percent of Jobs in Middle Wage Range	Percent of Jobs in High Wage Range	Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Emp Ch 2006-16	R&D Occ's as % Empl.	Exports as % Output
Fishing	19.79	42	843	35,888	0%	n/a	-52.2%	-31.9%	-25.7%	-30.1%	0.0%	58.4%
Navy Focused Cluster	14.28	1,686	27,964	54,088	n/a	n/a	n/a	n/a	n/a	n/a	n/a	100.0%
Wood Products Focused Cluster	8.46	823	2,294	78,991	79%	16%	-17.2%	-5.8%	17.8%	-7.2%	2.7%	76.9%
Ship and Boat Building	5.95	114	460	82,528	51%	43%	25.4%	27.8%	62.9%	-29.0%	9.9%	99.5%
Sporting Goods Mfg.	5.83	48	239	48,565	70%	12%	25.9%	5.4%	46.8%	5.6%	1.6%	95.3%
Nursing and Residential Care Facilities	2.02	180	3,775	27,490	61%	9%	-11.0%	7.2%	34.8%	23.7%	0.5%	19.7%
Business Support Services	1.79	77	1,516	18,472	n/a	n/a	42.1%	262.7%	211.8%	18.1%	1.4%	65.4%
Architectural and Engineering Services	1.74	295	2,799	38,815	40%	50%	13.3%	46.5%	123.8%	16.6%	43.5%	54.0%
Other Educational Services	1.73	53	1,184	15,248	n/a	n/a	-25.4%	-20.3%	-7.1%	11.3%	4.1%	21.8%
Other Amusement, Gambling, & Recreation	1.65	79	1,159	21,255	56%	3%	7.9%	51.6%	91.1%	20.0%	0.0%	9.4%
Construction	1.76	1,345	10,929	36,874	72%	27%	-9.2%	35.0%	72.2%	6.1%	0.6%	7.9%
Other State & Local Gov't. Enterprises	1.71	253	1,166	48,067	n/a	n/a	n/a	n/a	n/a	n/a	n/a	25.0%
State & Local Non-Education	0.41	585	9,696	55,311	60%	23%	n/a	n/a	n/a	n/a	n/a	0.0%

Notes:
 Employment projection for all fishing and hunting used for fishing industry.
 Employment projection for all nursing services used for nursing and residential care facilities.
 Statewide employment projection for business support services used for this region.
 Statewide occupation data used to estimate R&D occupation percentages for fishing, nursing and residential care facilities, business support services, and other educational services.

Rankings

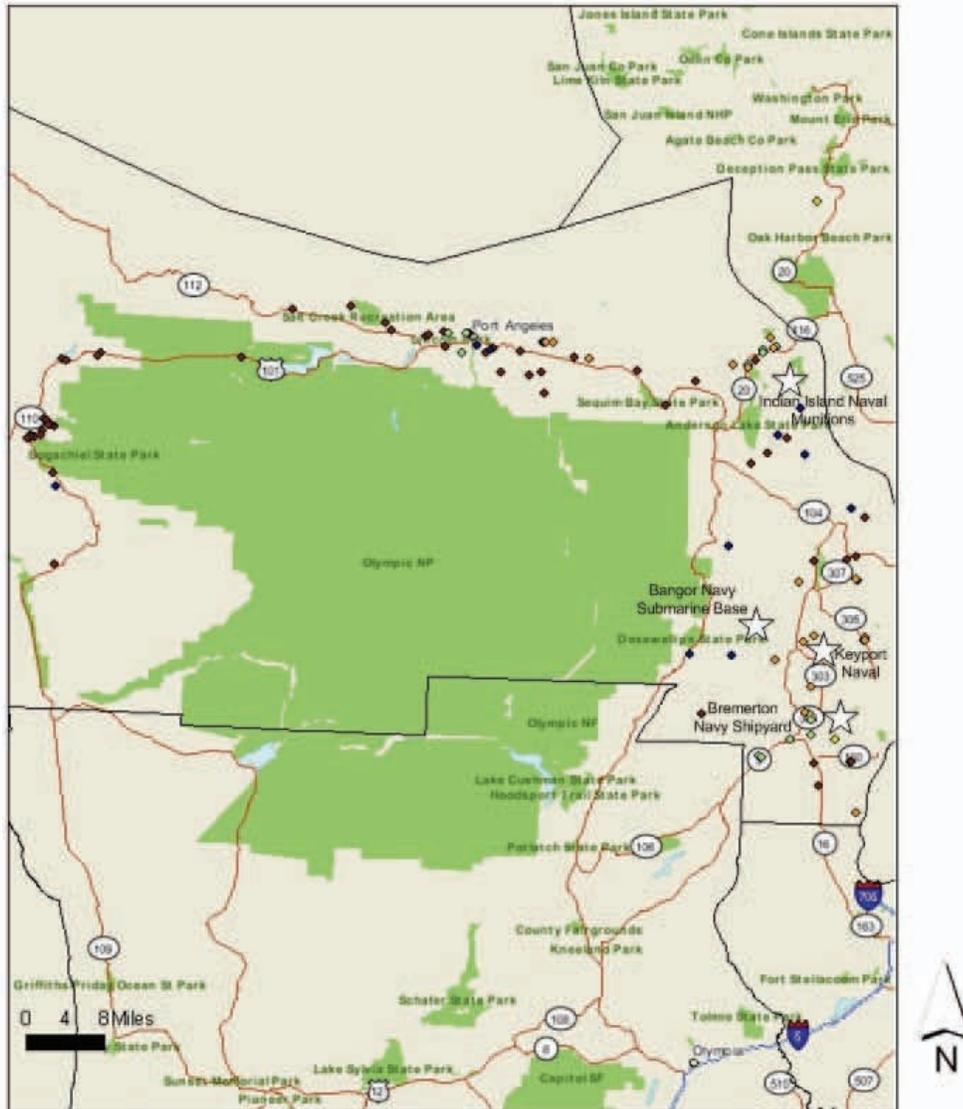
Cluster	LQ	Output	Employment	Earnings	Percent of Jobs in Middle Wage Range	Percent of Jobs in High Wage Range	Chg Est 01-07	Chg Emp	Chg Wage	Projected Emp Ch 2006-16	R&D Occ's as % Empl.	Exports as % Output	Sum of Ranks	(120-Summed Scores)
Fishing	1	13	11	9	9	13	10	10	10	10	9	5	110	10
Navy Focused Cluster	2	1	1	4	5	1	5.5	5.5	5.5	5.5	5.5	12	54	67
Wood Products Focused Cluster	3	3	6	2	1	8	8	8	8	8	4	3	62	58
Ship and Boat Building	4	8	12	1	7	6	3	5	5	5	9	2	63	57
Sporting Goods Mfg.	5	12	13	5	3	9	2	7	6	7	7	5	76	44
Nursing and Residential Care Facilities	6	7	4	10	4	12	7	6	7	1	8	8	9	39
Business Support Services	7	10	7	12	5	2	1	1	1	3	6	4	59	61
Architectural and Engineering Services	8	5	5	7	2	5	4	3	2	4	1	6	52	68
Other Educational Services	9	11	8	13	8	3	9	9	9	5	3	8	95	25
Other Amusement, Gambling, & Recreation	10	9	10	11	5	10	5	2	3	2	10	10	87	33
Construction	11	2	2	8	5	7	6	4	4	6	7	11	73	47
Other State & Local Gov't. Enterprises	12	6	9	6	6	4	5.5	5.5	5.5	5.5	5.5	7	78	43
State & Local Non-Education	13	4	3	3	5	11	5.5	5.5	5.5	5.5	5.5	13	80	41

Note:
 Missing values are assigned the median rank.

Figure 5: WDA1 Cluster Map

Washington State WDA Region 1 Cluster Firms

- ◆ 1 Sporting Goods Manufacturing
- ◆ 1 Ship/Boat Building and Repair
- ◆ 1 Fishing
- ◆ 1 Wood Products
- ◆ 1 Navy Related (indirect)



Region 2: Pacific Mountain WDA – Grays Harbor, Lewis, Mason, Pacific and Thurston Counties

The largest cluster in this region is state and local government; since the region includes the state capitol this is not a surprising result. The cluster with the highest location quotient is forest products (regional employment 33 times the national average). Fishing and seafood processing also has a high location coefficient, about 16 times higher than the national figure. A number of additional clusters were found in this region, all having a modest degree of comparative advantage compared to the previously mentioned clusters.

The state/ local government and fishing/seafood clusters expanded at a modest pace in recent years, and further expansion is expected in the years ahead. Rapid expansion is expected for three clusters: other ambulatory health care, other construction, and business support services. The “Other construction” cluster includes miscellaneous construction activities (excluding buildings, utility systems and road building) plus two linked sectors: architectural and engineering services and other state and local government enterprises. The other state and local government enterprises category often includes municipal and county PUD utility systems. What the three sectors combined represent is a bit of a mystery, since utility construction is not included in the “other construction” sector. One type of construction that would fall in the other construction sector is marine construction (dock and marine terminal construction and maintenance); thus this cluster may be capturing marine terminal development within this region.

Six of 10 clusters for which occupational data are available in this region have a higher percentage of middle wage jobs than the regional average, but just 3 have a higher percentage of high wage jobs than the regional average. The strategic matrix suggests that state and local government is the highest value cluster, followed by forest products coal mining and other ambulatory health care.

The WDA 2 map shows a relatively dispersed geography of establishments. With the exception of a strong localized cluster of Sporting Goods and Camper Manufacturing firms along Interstate 5 in the Chehalis area, most of the other industry clusters are co-located, with Fishing and Other Accommodations along the water along the Coast, Hood Canal, and the South Puget Sound areas of the region. Forestry clusters are present across all areas of the region, with Other Accommodation co-located in many of these areas as well. Greenhouse and Nursery cluster firms are also relatively diffuse throughout the region.

Table 4: Distribution of Occupational Median Wages in WDA2

Wage Type	Annual Wages
Mean Wages	\$40,617
Pct25 Wages	\$24,096
Median Wages	\$34,611
Pct75 Wages	\$50,907

Table 5: Middle and High Wage Jobs by Cluster in WDA 2

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Forest Products	6,031	5,141	85%	549	9%
Fishing, Seafood Processing & Shipbuilding	1,411	283	20%	56	4%
State & Local Govt - Non-Education	12,415	7,332	59%	3,705	30%
Other Accommodations	1,917	434	23%	20	1%
Sporting Goods Mfg.	313	185	59%	38	12%
Agriculture and Forestry Support	717	17	2%	4	1%
Animal Production - except Cattle & Poultry	2,160	2,160	100%	-	0%
Business Support Services	1,348	267	20%	35	3%
Other ambulatory health care services	1,273	799	63%	348	27%
Other new construction	184	122	66%	49	27%
Cluster Total	27,769	16,740	60%	4,804	17%
All Industries	174,968	89,848	51%	37,697	22%
Clusters as % of All Industries	16%	19%			

Table 6: Strategic Evaluation of Clusters in WDA 2

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output
					Middle Wage Range	High Wage Range						
Forest Products	33.48	2,594	8,686	60,164	85%	9%	-26.2%	1.9%	20.0%	-8.7%	1.7%	71.9%
Fishing, Seafood Processing & Shipbuilding	15.92	474	2,891	38,696	20%	4%	-23.4%	20.6%	64.4%	-0.5%	0.3%	91.7%
Coal Mining	9.25	265	741	83,595	59%	30%	0.0%	-77.8%	-40.3%	n/a	n/a	81.9%
Travel Trailer & Camper Mfg.	7.54	69	356	41,112	23%	1%	n/a	n/a	n/a	n/a	n/a	95.9%
State & Local Gov't - Non-Education	5.57	2,350	35,579	60,574	59%	30%	n/a	n/a	n/a	12.5%	19.4%	0.0%
Other Accommodations	3.63	31	356	18,478	23%	1%	5.7%	20.3%	53.5%	12.1%	0.0%	56.6%
Sporting Goods Mfg.	3.26	40	198	48,561	59%	12%	20.5%	22.0%	47.2%	-15.9%	95.1%	95.1%
Agriculture and Forestry Support	2.95	2,008	57,967	22,670	2%	1%	-5.2%	11.3%	19.0%	n/a	n/a	0.4%
Animal Production - except Cattle & Poultry	2.46	45	1,065	10,081	100%	0%	54.1%	442.3%	556.3%	n/a	n/a	37.7%
Business Support Services	1.92	2414	122,548	21,053	20%	3%	21.0%	146.9%	139.9%	22.4%	0.3%	73.7%
Cattle ranching and farming	1.85	129	1,102	6,864	n/a	n/a	-34.0%	-38.4%	-35.3%	n/a	n/a	50.6%
Other State and local gov't. enterprises	1.77	276	1,274	47,946	n/a	n/a	41.1%	34.4%	73.2%	6.3%	11.8%	17.1%
Other ambulatory health care services	1.67	250	1,580	60,254	63%	27%	41.1%	34.4%	73.2%	-100.0%	1.2%	20.7%
Other new construction	1.51	134	1,302	52,851	66%	27%	18.6%	48.3%	82.9%	6.0%	0.7%	17.5%

Notes:
 Power generation and supply projection used for other state/local government enterprise employment increase.
 R&D percentage for power generation and supply used for other state/local government enterprise.
 R&D percentage for statewide travel trailer and camper manufacturing used for the regional industry.

Rankings

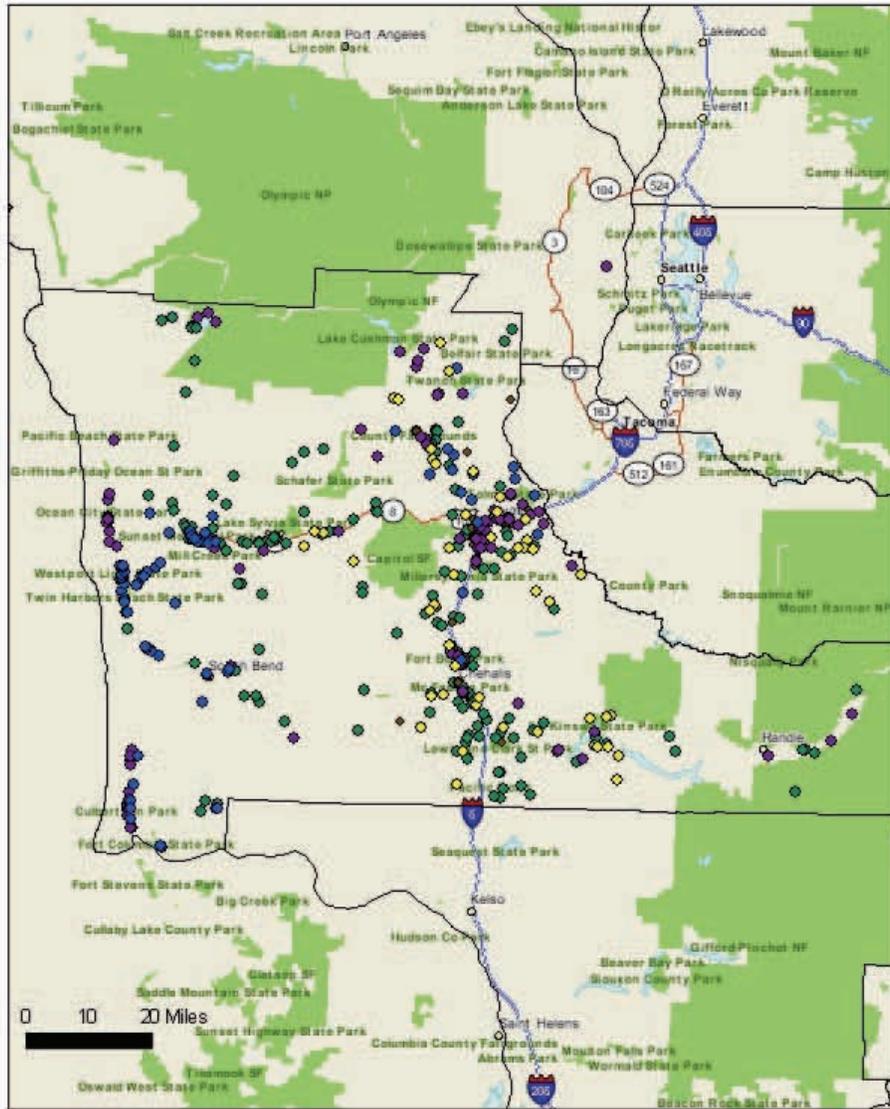
Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Index (120-Summed Ranks*
					Middle Wage Range	High Wage Range							
Forest Products	1	1	1	2	4	2	6	9	8	7	4	6	60
Fishing, Seafood Processing & Shipbuilding	2	5	3	9	9	10	7	6	5	5	6	7	72
Coal Mining	3	7	9	11	8	6	1	11	11	5	5	4	48
Travel Trailer & Camper Mfg.	4	11	10	10	8	8	9	6	6	5	5	1	79
State & Local Gov't - Non-Education	5	3	1	12	7	7	2	6	6	2	2	2	41
Other Accommodations	6	14	11	12	9	9	10	6	6	3	9	7	64
Sporting Goods Mfg.	7	13	12	14	6	5	4	5	7	8	1	2	20
Agriculture and Forestry Support	8	12	8	13	13	12	11	1	1	1	5	5	45
Animal Production - except Cattle & Poultry	9	4	14	10	10	12	8	8	9	5	5	13	34
Business Support Services	10	2	13	11	11	11	8	2	2	2	1	8	22
Cattle ranching and farming	11	10	7	14	6.5	6.5	11	10	10	5	5	5	76
Other State and local gov't. enterprises	12	6	6	7	6.5	6.5	6	6	6	4	3	12	16
Other ambulatory health care services	13	9	4	3	4	4	3	2	4	9	5	10	39
Other new construction	14	8	5	5	5	3	4	3	3	5	6	11	50
													72

Note:
 Clusters or industries with missing values are assigned the median rank for missing values.

Figure 8: WDA2 Cluster Map

Washington State WDA Region 2 Cluster Firms

- 2 Greenhouse/Nursery
- 2 Fishing
- 2 Other Accommodations
- 2 Sporting Goods and Camper Manufacturing
- 2 Forest Products



Region 3: Northwest WDA – Island, Skagit, and Whatcom Counties

The Northwest WDA is distinguished by a substantial agriculture and food products cluster, and several clusters with very high LQs indicating significant competitive advantage, such as aluminum reduction with an employment concentration 60 times the national average, fishing and seafood concentration 22 times the national figure, and petroleum refining and abrasive products over 16 times the national figure. Two clusters in this region have extraordinarily high average compensation levels over \$175,000 per year – petroleum refining and boat builders.

However, the biggest clusters in this region had declining employment in recent years (aluminum - sharp decline; agriculture and fishing & seafood--modest decline). The outlook for the future is mixed in these clusters: employment in aluminum production is expected to decline, while expanded employment levels are expected in the agriculture/food and fishing/seafood clusters. The clusters expected to expand most rapidly in this region are forest products and the very small abrasive products sector.

The middle wage jobs percentage exceeds the regional average in 6 of 7 clusters for which occupational data are available in this region. The high wage percentage is greater in just 2 of the 7 clusters. The strategic matrix gives the highest overall rating to petroleum refining, followed by boatbuilding, fishing, and several other clusters rated only slightly lower.

Establishments in this region are highly clustered in relatively few areas, particularly when compared to WDA 2 and other more diffuse WDA regions. Due to the presence of the expansive North Cascades National Park and the relative lack of state or federal highways in this region, activities are principally centered in the western portion of the Interstate 5 corridor and to the north near the United States-Canada border. As shown in the accompanying map, the firms in the Fishing cluster are largely concentrated in three places: the greater Bellingham area of northern Whatcom County, the Anacortes area which is in the Southwestern portion of the region, and to a somewhat lesser extent, the Blaine area near the United States-Canada border. Likewise, Agriculture and Food are highly clustered in the northern and southern areas of the WDA region, with an especially strong cluster of these firms near the northern border with Canada. Firms in the Forest Products cluster and Industrial Specialties in this region are comparatively more dispersed.

Figure 9: WDA3 Cluster Characteristics

WDA 3

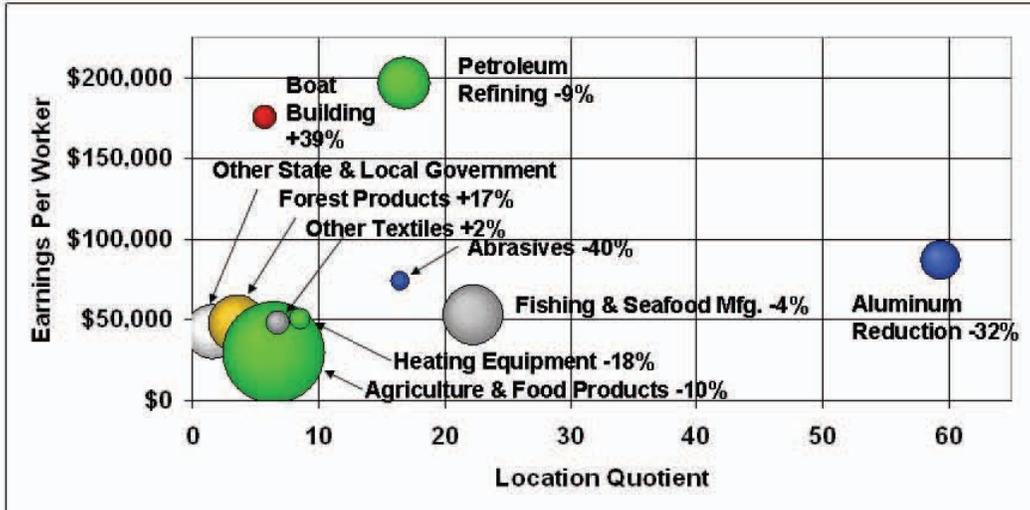


Figure 10: WDA 3 Cluster Linkages

Table 7: Distribution of Occupational Median Wages in WDA3

Wage Type	Annual Wages
Mean Wages	\$38,604
Pct25 Wages	\$23,257
Median Wages	\$32,231
Pct75 Wages	\$47,024

Table 8: Middle and High Wage Jobs by Cluster in WDA 3

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Petroleum Refining	1667	304	18%	1,252	75%
Abrasive Products	467	389	83%	47	10%
Heating Equipment ex Furnaces	249	187	75%	51	20%
Other Misc. Textiles	625	358	57%	83	13%
Agriculture-Food Products	5362	5294	99%	67	1%
Boat Building	1612	1056	66%	482	30%
Forest Products	2572	2133	83%	381	15%
Cluster Total	12554	9721	77%	2,363	19%
All Industries	157026	83788	53%	33,188	21%
Clusters as % of All Industries	8%	12%			

Table 9: Strategic Evaluation of Clusters in Region 3

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output
					High Wage Range	High Wage Range						
Primary Aluminum Reduction	59.28	879	558	93,496	n/a	n/a	-50.0%	-32.1%	-21.3%	-3.6%	5.2%	99.5%
Fishing & Seafood Processing	22.19	2,008	436	53,483	n/a	n/a	-48.0%	-4.2%	49.2%	4.0%	0.3%	84.2%
Petroleum Refining	16.70	1,511	12,782	196,633	18%	75%	26.9%	-8.5%	40.0%	7.6%	16.3%	83.7%
Abrasive Products	16.42	215	67	74,042	83%	10%	-16.7%	-40.0%	-15.1%	13.2%	0.0%	94.5%
Heating Equipment ex furnaces	8.50	232	57	51,047	75%	20%	33.3%	-17.8%	14.7%	2.8%	3.6%	100.0%
Other Misc. Textiles	6.70	291	46	48,399	57%	13%	-10.4%	1.9%	19.3%	-4.8%	34.6%	96.6%
Agriculture-Food Products	6.41	5,434	1,118	30,065	99%	1%	-19.3%	-10.1%	15.2%	0.7%	2.9%	82.0%
Boat Building	5.68	290	100	175,628	66%	30%	11.2%	39.2%	70.1%	-1.4%	8.5%	99.1%
Forest Products	3.53	1,864	415	47,261	83%	15%	-17.7%	17.0%	48.2%	21.1%	1.2%	66.4%
Other State and local government	1.53	337	1,638	42,689	n/a	n/a	n/a	n/a	n/a	n/a	n/a	42.9%

Notes:

Statewide employment projection used for aluminum reduction and steel wire drawing.
 Statewide R&D employment used for steel wire drawing.

Rankings

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Index (120-Summed Ranks* Scores)
					High Wage Range	High Wage Range							
Primary Aluminum Reduction	1	5	5	3	4	4	9	8	9	8	4	2	62
Fishing & Seafood Processing	2	2	6	5	4	4	8	4	2	4	8	6	55
Petroleum Refining	3	4	1	1	7	1	2	5	4	3	2	7	40
Abrasive Products	4	10	9	4	2	6	5	9	8	2	9	5	73
Heating Equipment ex furnaces	5	9	10	6	4	3	1	7	7	7	5	1	63
Other Misc. Textiles	6	7	11	7	6	5	4	3	5	9	1	4	68
Agriculture-Food Products	7	1	4	10	1	7	7	6	6	6	6	8	69
Boat Building	8	3	8	2	5	2	3	1	1	7	3	3	51
Forest Products	9	8	7	8	3	4	6	2	3	1	7	9	62
Other State and local government	10	6	3	9	4	4	5.5	5.5	5.5	5.5	5.5	10	73.5

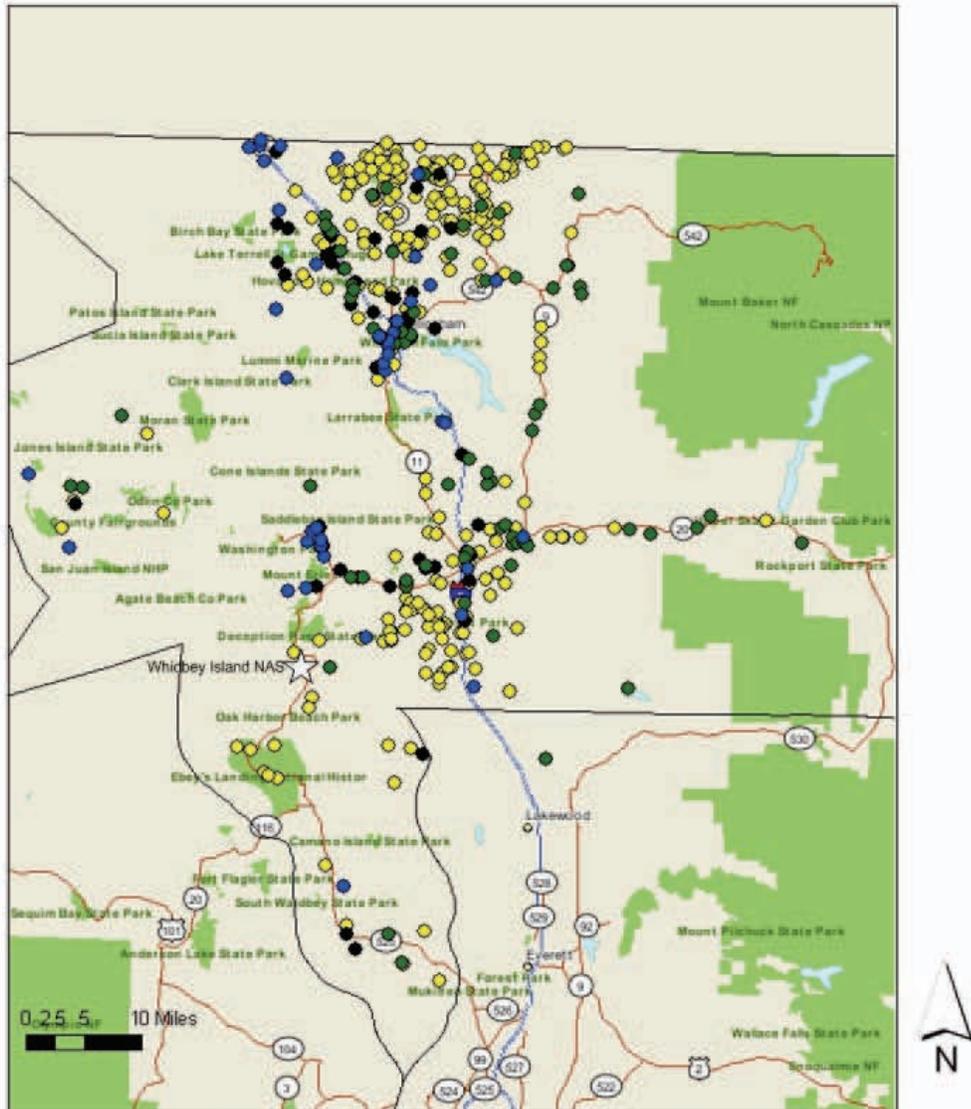
Note:

Missing data assigned the median rank.

Figure 11: WDA3 Cluster Map

Washington State WDA Region 3 Cluster Firms

- 3 Fishing
- 3 Forest Products
- 3 Industrial Specialties
- 3 Agriculture and Food Products



Region 4 - Snohomish County WDA

The Snohomish WDA is home to Boeing's major aircraft assembly plant and it is no surprise to see that this region has an extremely high location quotient for the aerospace cluster – 50 times the national density of employment in this cluster. Aerospace is also the largest cluster in the county; in fact, aerospace is 1.5 times as large as all of the other clusters shown in the following charts and table for this region. The second largest cluster in the region is the federal military cluster, consisting mainly of the Navy base in Everett. As in WDA 3, the boat building industry in the Snohomish WDA stands out with a very high average compensation level, over \$200,000 per year.

Aerospace, the largest cluster and the one with the highest location quotient, grew very slowly from 2001 to 2007; however a much more robust growth rate is expected out to 2018 with the percentage change from 2006 to 2016 expected to reach nearly 20 percent. The military cluster, second largest in the region, is projected to change little in employment level in the years ahead. The sheet metal products cluster expanded by 67% from 2001 to 2007 and is projected to expand by another 26% from 2006 to 2016. Forest products and electrical machinery employment declined in recent years, and this downward trend is expected to continue.

In this region, 8 of 11 clusters for which occupational data are available have a higher percentage of middle wage jobs than the regional average, but only 3 of the 11 have a higher percentage of high wage jobs. Aerospace is the most highly ranked cluster overall in this region, scoring well above several closely ranked clusters including federal military, boat builders, electrical machinery, and abrasive products.

As shown in the accompanying map, there is a strong aerospace cluster evident in the Paine Field/Mukilteo region of WDA 4. Several industrial specialties are very important and exhibit relatively strong clustering tendencies, with a strong cluster near Monroe at the Highway 2 and 522 interchange. The Edmonds area, in the far southwest of this region, shows a concentration of firms in the Fishing cluster. Just northeast of Edmonds, the Lynnwood area shows a strong concentration of Industrial Specialty firms. The Forest Products cluster in WDA 4 is predominant primarily in the northern portion of Snohomish county, with especially strong concentrations in the Marysville and Arlington areas.

Figure 12: WDA4 Cluster Characteristics

WDA 4

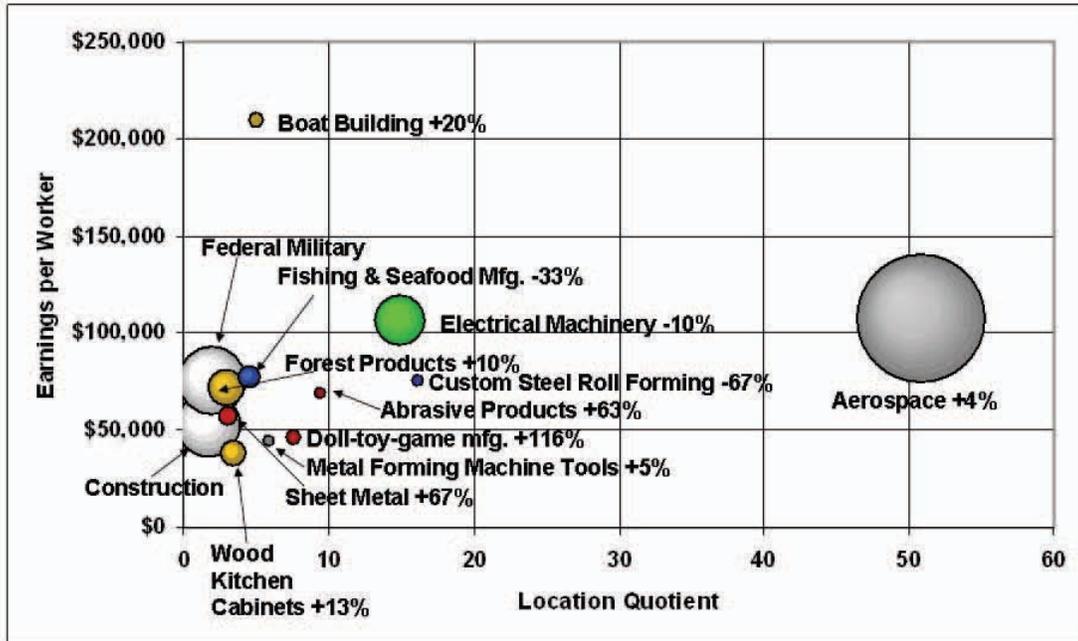


Figure 13: WDA4 Cluster Linkages

Region 4 backward linkages >.05; LQ>2.5; forward linkages in red; LQ>10 in red

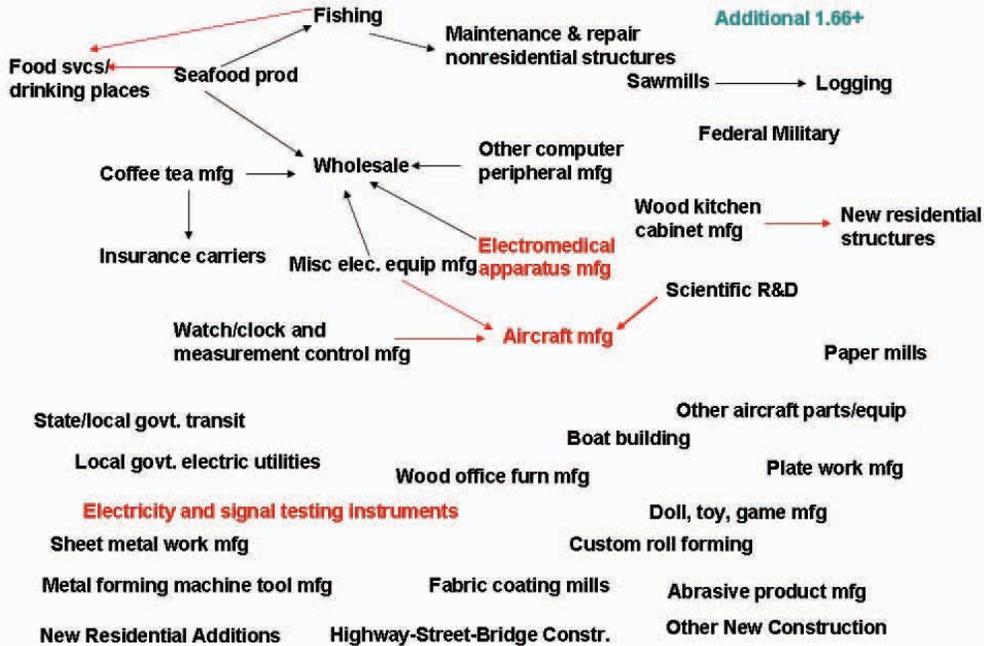


Table 10: Distribution of Occupational Median Wages in WDA 4

Wage Type	Annual Wages
Mean Wages	\$45,831
Pct25 Wages	\$26,225
Median Wages	\$38,273
Pct75 Wages	\$58,498

Table 11: Middle and High Wage Jobs by Cluster in WDA 4

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Aerospace	30,588	6,014	20%	16,940	55%
Custom Steel Roll Forming	39	19	49%	7	18%
Electrical Machinery	3,734	1,033	28%	2,559	69%
Doll-Toy-Game Mfg.	734	532	72%	92	13%
Metal Forming Machine Tools	73	59	81%	14	19%
Boat Builders	1,296	736	57%	231	18%
Fisheries & Seafood Products	227	32	14%	18	8%
Wood Kitchen Cabinets	1,142	977	86%	105	9%
Sheet Metal Products	1,296	1,000	77%	233	18%
Forest Products	1,821	1,140	63%	219	12%
Other Construction	3,964	2,849	72%	970	24%
Cluster Total	196,654	76,115	39%	21,388	11%
All Industries	255,312	117,534	46%	54,803	21%
Clusters as % of All Industries	77%	65%			

Table 12: Strategic Evaluation of Clusters in Region 4

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output
					in Middle Wage Range	in High Wage Range						
Aerospace	50.86	26,549	13,221	107,959	20%	55%	-20.69%	4.35%	32.37%	19.44%	36.25%	82.43%
Custom Steel Roll Forming	16.13	192	86	75,911	49%	18%	-40.00%	-67.40%	-76.32%	3.65%	2.56%	98.78%
Electrical Machinery	14.86	4,060	1,585	106,905	28%	69%	-17.36%	-10.36%	17.20%	-18.83%	35.78%	67.70%
Abrasive Products Mfg.	9.44	183	56	69,672	n/a	n/a	162.50%	62.85%	83.82%	19.13%	4.67%	93.97%
Doll-Toy-Game Mfg.	7.61	360	88	46,536	72%	13%	16.77%	116.02%	245.81%	-7.22%	0.27%	38.39%
Metal Forming Machine Tools	5.81	181	29	45,138	81%	19%	12.50%	4.87%	37.46%	7.18%	9.59%	94.49%
Boat Builders	5.01	331	127	210,236	57%	18%	38.30%	19.60%	22.15%	-62.54%	6.40%	99.06%
Fisheries & Seafood Products	4.48	894	127	77,575	14%	8%	-43.27%	-32.61%	3.12%	3.58%	0.47%	56.77%
Wood Kitchen Cabinets	3.4	1030	158	38,678	86%	9%	-1.97%	12.86%	52.54%	1.84%	2.63%	60.10%
Sheet Metal Products	3.09	604	126	57,353	77%	18%	5.03%	66.79%	102.00%	26.54%	6.10%	97.91%
Forest Products	2.89	818	2,078	72,216	63%	12%	-1.89%	9.89%	37.09%	-11.48%	1.15%	85.29%
Federal Military	1.90	7,253	606	75,786	n/a	n/a	n/a	n/a	n/a	-0.59%	21.74%	100.00%
Other Construction	1.69	496	6,713	53,070	72%	24%	n/a	n/a	n/a	n/a	n/a	37.51%

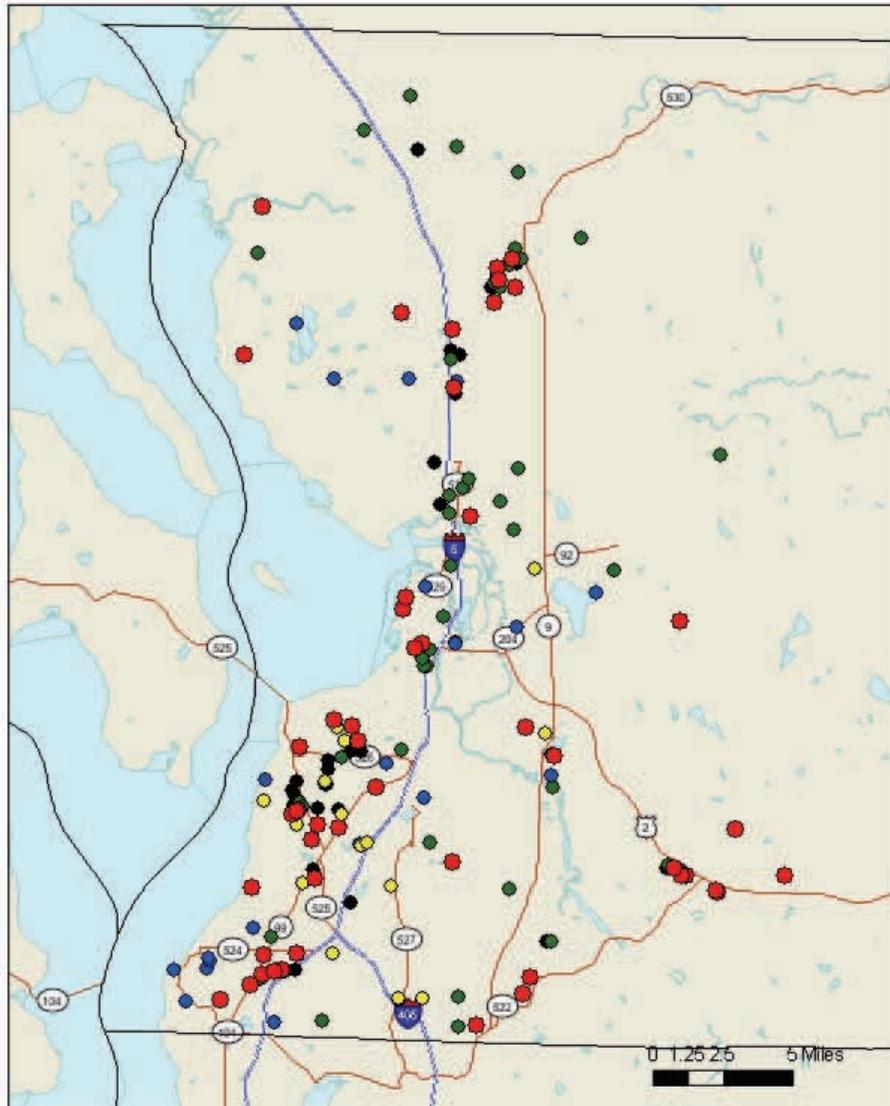
Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Sum of Ranks*	Index (120-Summed Scores)
					in Middle Wage Range	in High Wage Range								
Aerospace	1	1	1	1	2	4	9	8	8	8	2	1	8	55
Custom Steel Roll Forming	2	11	11	5	5	8	10	11	11	5	5	9	3	94
Electrical Machinery	3	3	4	3	3	3	8	9	9	11	11	2	9	73
Abrasive Products Mfg.	4	12	12	8	6	1	1	3	3	3	3	7	6	66
Doll-Toy-Game Mfg.	5	9	10	11	4	4	3	1	1	1	9	12	12	87
Metal Forming Machine Tools	6	13	13	12	2	6	4	7	7	4	4	4	5	83
Boat Builders	7	10	7	1	7	9	2	4	4	12	12	5	2	70
Fisheries & Seafood Products	8	5	9	4	11	13	11	10	10	6	6	11	11	109
Wood Kitchen Cabinets	9	4	6	13	1	12	7	5	5	7	7	8	10	87
Sheet Metal Products	10	7	9	9	3	7	5	2	2	1	1	6	4	65
Forest Products	11	6	3	7	6	11	6	6	6	10	10	10	7	89
Federal Military	12	2	5	6	6	2	6	6	6	8	8	3	1	63
Other Construction	13	8	2	10	5	5	6	6	6	6.5	6.5	6.5	13	81

Note:
Missing data assigned the median rank value.

Figure 14: WDA4 Cluster Map

Washington State WDA Region 4 Cluster Firms

- 4 Industrial Specialties
- 4 Electrical Machinery
- 4 Fishing
- 4 Forest Products
- 4 Aerospace



Region 5 – Seattle - King County WDA

King County has two very large clusters – software/computer services and aerospace – that also have quite high location quotients, about 15 times the national proportion of employment in these two clusters. However, another cluster has an even higher location quotient of nearly 19 – Overhead Cranes and Hoist Manufacturing. Fishing/Seafood also has a high location quotient, with cluster employment in this county about 10 times the national figure. King County is the center of the largest metro area in the state, and thus it is not surprising to see over a dozen other clusters in the region, most of them with modestly high location quotients in the range of 1.7 to 4.7.

Of the two large clusters, software/computer services has expanded steadily in this region since the founding of Microsoft and in the years shown in the table below, 2001-07. Aerospace, on the other hand, is known for its up and down employment cycles; from 2001-07, employment in this cluster contracted, but an expansion is projected from 2006-16. Fishing/seafood employment contracted modestly from 2001-07 and is expected to expand very slowly from 2006-16. Of the remaining clusters, a mix of expansions and contractions is shown in the historical data, but only one is expected to continue contracting from 2006-16 – electromedical apparatus.

The wage distribution in this region is distinctive, in that just 8 of the 19 clusters have a higher percentage of middle wage jobs, a lower percentage of clusters with a relatively high ratio of middle wage jobs than many other regions. However, there are also 8 clusters with a higher percentage of high wage jobs than the regional average, a higher ratio than many of the other regions.

Turning to the strategic matrix, software/computer services achieves the highest overall score, followed by aerospace, and nonstore retailers. The range of index scores is quite large for this region, including some negative numbers. A negative number does not indicate that the cluster has negative impacts on the economy; the proper interpretation of the index is just that there is a tremendous range between the scores for the top-ranked clusters and those receiving lower index scores. Water transportation, for example, with an index score of just 34, ranks first on exports and change in wages. The two lowest ranked clusters, sporting goods manufacturing and performing arts, received low rankings on many of the variables and are not near the top on any variable. These clusters, however, may be highly ranked on some other characteristic for which we did not have an available measure. Water transportation is part of the logistics and international trade cluster that has received priority ranking in the Puget Sound Regional Council's cluster strategy, and performing arts includes the music industry that has been strongly supported by the City of Seattle. The overall index is quite sensitive to which variables are included; some users of this study may find it useful to construct alternative indexing methods based on the supplied data.

The map for this region demonstrates that King County has a tremendous number of firms relative to other regions in the state. This region has a mature, diverse, and growing economy, with clusters of Aerospace, Fishing, Industrial Specialties, Computer

Services, and Service Specialties. The level of intensity and complexity of the accompanying map perhaps obscures readability but illustrates an important point of the geographic intensity of firms in WDA 5 versus all other regions of the state. As in other regions, however, there are some clustering effects that can be disentangled from the sheer mass of establishments in this region. Fishing is highly clustered in the western portion of King County, with large numbers of establishments in the Ballard/Ship Canal and Downtown areas of Seattle, as well as near the King County Airport. Computer Services firms are highly clustered in the Bellevue/Redmond and downtown Seattle areas, though many of these establishments are also dispersed throughout the region. Clusters of Industrial Specialties firms are especially pronounced in the SODO (south downtown) region of Seattle, nodes in Bellevue, Redmond, Factoria, and Issaquah on the Eastside, and Tukwila and the 167 corridor in the Southern area of the region. Aerospace firms are clustered in the King County Airport/Boeing Field area south of Seattle, Renton, and with a very strong presence in the Highway 167 corridor. Service Specialties are highly concentrated in the downtown Seattle area.

Figure 15: WDA5 Cluster Characteristics

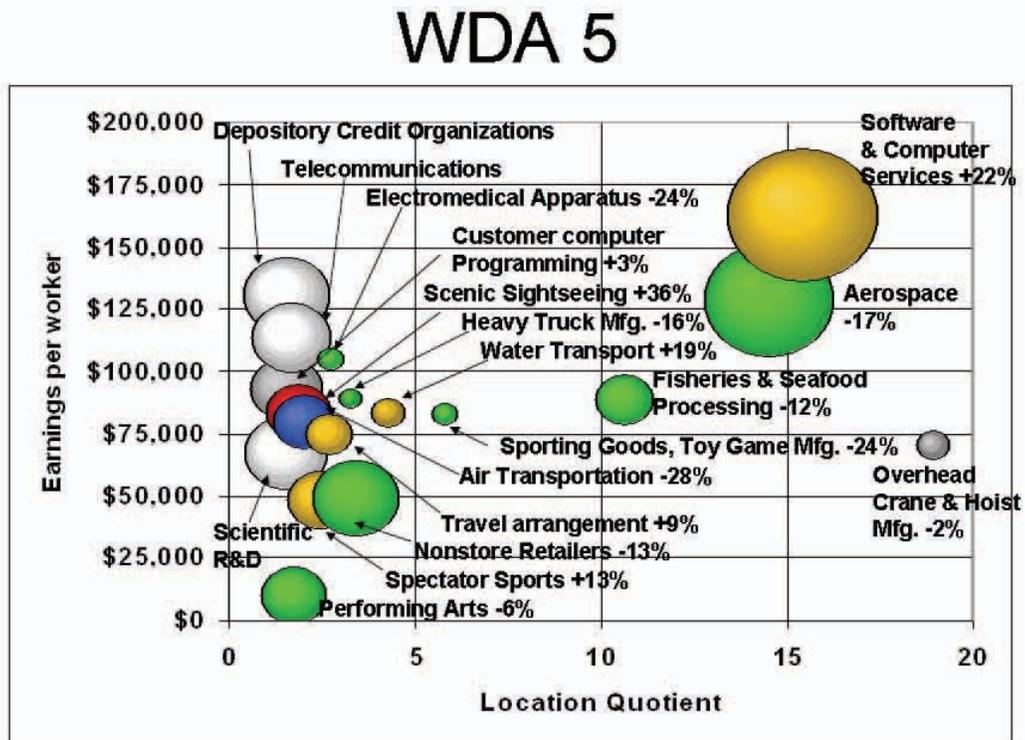


Figure 16: WDA5 Cluster Linkages

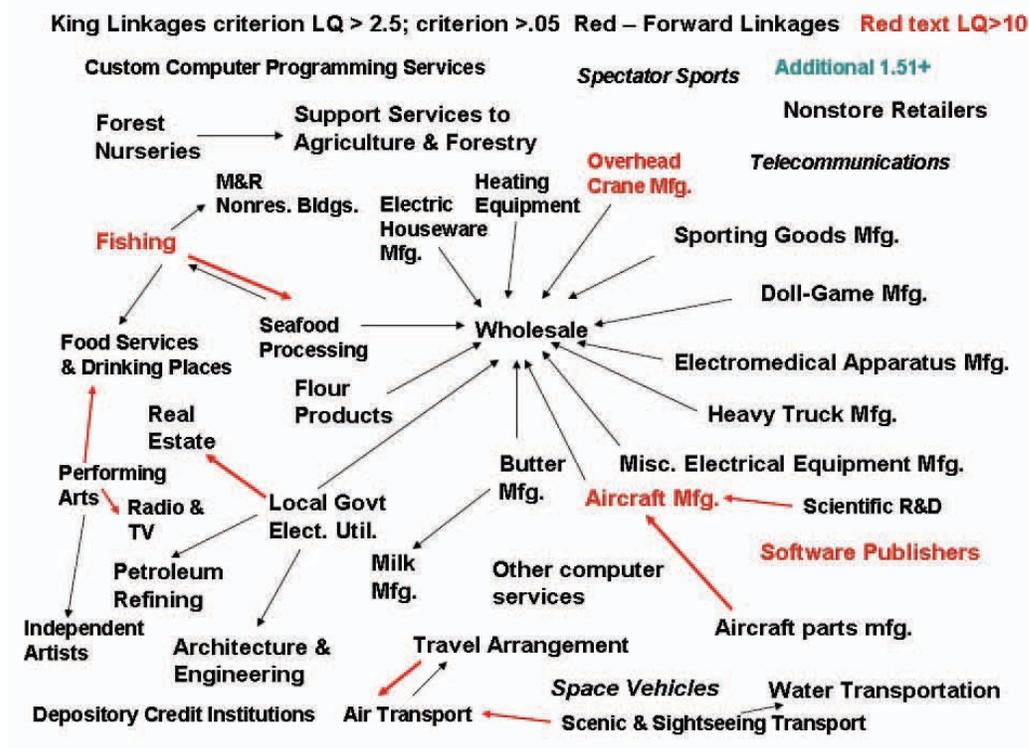


Table 13: Distribution of Occupational Median Wages in WDA 5

Wage Type	Annual Wages
Mean Wages	\$ 51,557
Pct25 Wages	\$ 27,803
Median Wages	\$ 41,328
Pct75 Wages	\$ 65,215

Table 14: Middle and High Wage Jobs by Cluster in WDA 5

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Overhead Cranes & Hoist Mfg.	3,476	2,797	80%	478	14%
Software/Computer Services	45,526	7,866	17%	37,545	82%
Aerospace	44,398	18,130	41%	22,654	51%
Fisheries	4,544	1,644	36%	207	5%
Sporting Goods and Toy Mfg.	4,235	2,694	64%	789	19%
Water Transportation	3,006	1,496	50%	1,338	45%
Nonstore retailers	7,620	4,870	64%	664	9%
Heavy Truck Mfg.	84	60	71%	2	2%
Electromedical Apparatus	4,081	2,702	66%	1,181	29%
Travel Arrangement	4,636	3,642	79%	742	16%
Spectator Sports	2,557	1,077	42%	132	5%
Air Transportation	10,173	4,512	44%	976	10%
Performing Arts	2,241	724	32%	80	4%
Telecommunications	13,164	6,055	46%	6,848	52%
Scientific Research & Development	9,272	5,288	57%	3,747	40%
Custom Computer Programming	21,852	5,002	23%	16,730	77%
Depository Credit	15,789	7,556	48%	4,783	30%
Other Ambulatory Health Care	8,712	11,626	75%	2,293	20%
Other Construction	5,060	6,450	78%	1,007	16%
Cluster Total	196,654	76,115	39%	98,896	50%
All Industries	1,213,382	644,364	53%	260,770	21%
Clusters as % of All Industries	16%	12%			

Table 15: Strategic Evaluation of Clusters in Region 5

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output
					High Wage Range	Middle Wage Range						
Overhead Cranes & Hoist Mfg.	18.91	3,029	960	70,358	80%	14%	-28.2%	-1.8%	39.9%	16.94%	11.85%	42.49%
Software/Computer Services	15.41	58,938	29,353	140,922	17%	82%	2.9%	21.5%	-5.0%	46.77%	70.49%	74.27%
Aerospace	14.52	42,877	22,651	126,261	41%	51%	1.4%	-17.1%	15.1%	10.55%	39.18%	81.48%
Fisheries	10.60	9,119	1,729	64,062	36%	5%	-32.4%	-11.8%	26.3%	5.30%	0.47%	71.90%
Sporting Goods and Toy Mfg.	4.67	3,436	13	83,197	64%	19%	-12.2%	-24.4%	-5.4%	0.53%	0.91%	20.06%
Water Transportation	4.26	3,118	1,698	83,372	50%	45%	-2.8%	19.4%	41.8%	7.46%	1.63%	87.60%
Nonstore retailers	3.41	19,858	4,657	49,228	64%	9%	5.1%	-13.4%	42.9%	22.70%	3.95%	77.50%
Heavy Truck Mfg.	3.26	1,278	1,253	89,424	71%	2%	0.0%	-16.1%	19.8%	-4.36%	2.30%	41.46%
Electromedical Apparatus	2.72	1,681	710	105,183	66%	29%	-9.3%	-23.5%	0.0%	-14.41%	20.53%	54.75%
Travel Arrangement	2.69	5,708	1,108	74,917	79%	16%	-29.5%	8.5%	77.6%	9.36%	3.67%	67.05%
Speciator Sports	2.45	11,152	905	48,511	42%	5%	-13.9%	13.0%	56.8%	11.69%	0.70%	61.51%
Air Transportation	2.01	10,142	2,468	79,844	44%	10%	-11.2%	-27.9%	-9.7%	8.38%	3.97%	79.95%
Performing Arts	1.74	10,789	242	10,113	32%	4%	-13.1%	-6.0%	28.2%	6.87%	0.76%	62.43%
Telecommunications	1.69	16,936	8,613	113,709	46%	52%	n/a	n/a	n/a	n/a	n/a	32.1%
Scientific Research & Development	1.54	18,247	2,119	67,030	57%	40%	n/a	n/a	n/a	22.5%	50.2%	49.9%
Custom Computer Programming	1.51	13,870	1,380	92,870	23%	77%	-1.7%	2.5%	37.4%	30.2%	70.6%	40.1%
Depository Credit	1.51	18,817	8,028	103,827	48%	30%	n/a	n/a	n/a	n/a	n/a	38.0%
Other Ambulatory Health Care	1.45	14,940	2,542	53,067	75%	20%	22.1%	25.7%	69.1%	13.63%	4.22%	49.92%
Other Construction	1.08	2,463	19,261	49,699	78%	16%	-16.8%	12.1%	46.3%	1.01%	4.37%	48.89%

Note: Projected employment change and R&D employment in Heavy Truck Mfg. estimated by national occupational data; state data are suppressed by ESD under confidentiality rules.

Table 15 continued

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in Middle Wage Range	Percent of Occupations in High Wage Range	Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ. as % Empl.	Exports as % Output	Sum of Ranks*	Index (120-Summed Scores)
Overhead Cranes & Hoist Mfg.	1	16	15	1	12	1	13	14	8	7	5	6	14	8
Software/Computer Services	2	1	1	1	19	1	1	3	2	14	1	2	5	68
Aerospace	3	2	2	2	15	4	4	4	13	12	8	4	2	71
Fisheries	4	12	10	14	16	17	16	16	10	10	13	17	6	145
Sporting Goods and Toy Mfg.	5	14	19	9	8	10	10	10	15	15	15	14	19	153
Water Transportation	6	15	11	8	10	5	7	7	3	6	11	13	1	96
Nonstore retailers	7	3	6	17	7	15	2	2	11	5	3	10	4	90
Heavy Truck Mfg.	8	19	13	7	5	19	5	12	11	16	16	12	15	142
Electromedical Apparatus	9	18	17	4	6	8	8	14	13	17	17	5	10	129
Travel Arrangement	10	13	14	11	2	11	15	6	1	9	9	11	7	110
Spectator Sports	11	9	16	18	14	16	12	4	4	3	7	16	9	135
Air Transportation	12	11	8	10	13	14	9	16	16	16	10	9	3	131
Performing Arts	13	10	18	19	17	18	11	9	9	9	12	15	8	159
Telecommunications	14	6	4	4	12	3	8.5	8.5	8.5	9	9	9	18	103.5
Scientific Research & Development	15	5	9	13	9	6	8.5	8.5	8.5	4	4	3	12	101.5
Custom Computer Programming	16	8	12	6	18	2	6	7	8	2	2	1	16	102
Depository Credit	17	4	5	5	11	7	8.5	8.5	8.5	9	9	9	17	109.5
Other Ambulatory Health Care	18	7	7	15	4	9	1	1	1	2	6	8	11	89
Other Construction	19	17	3	3	16	12	13	5	5	4	14	7	13	126

Note: missing values assigned the median rank

Region 6 - Pierce County WDA

Pierce County is the home of Ft. Lewis and McChord AFB – two large military bases that give this county a large military cluster with a location quotient of 9.7 and employment estimated at over 34,600. The county also has an aircraft parts manufacturing cluster with a location quotient of 10.8, the highest in the county, and a concrete pipe and gypsum products cluster with location quotient over 6. Many of the other clusters in this region are tightly “clustered” on the bubble chart below, with location quotients between 1.5 and 4.5, along with average wages between \$50,000 and \$70,000.

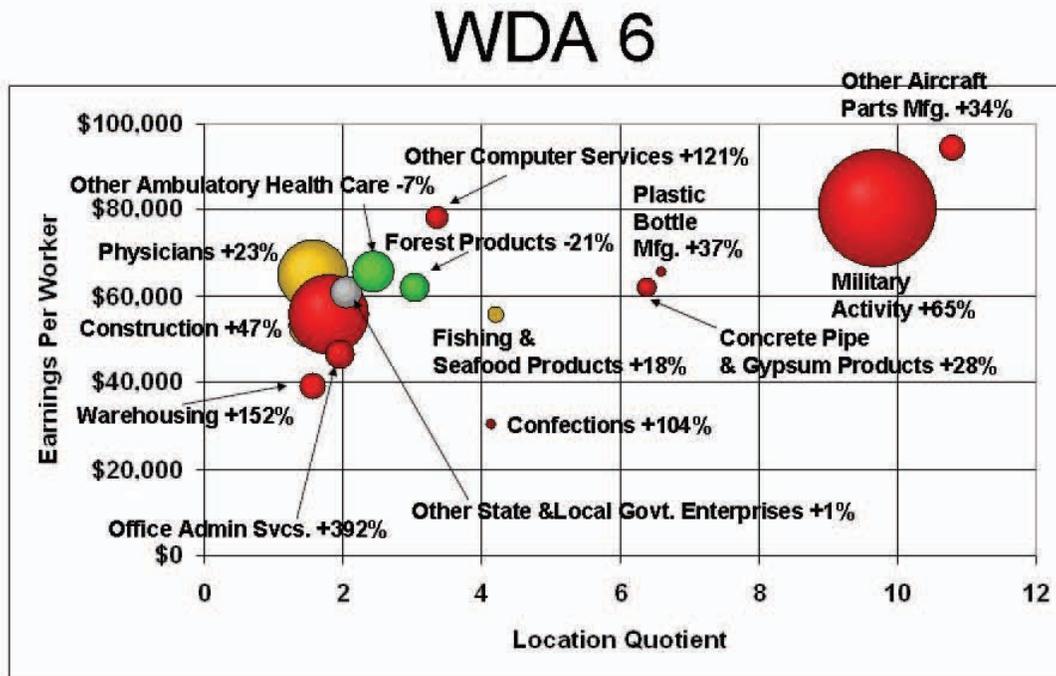
Most of the clusters in this region are colored red and yellow in the bubble chart below, indicating substantial growth in this part of the state from 2001 to 2007. The military cluster stands out as being both relatively large and having a quite high growth rate from 2001 to 2006. However, several other clusters grew much more more rapidly than the military cluster, including office administration, warehousing and storage, other computer services, and confectionary manufacturing. The growth projections for the years 2006-16 are also very positive, with only one sector projected to shed employees over this decade (Forest Products). The largest forest products firm in the region is Weyerhaeuser, which is re-organizing to focus mostly on growing trees for the wood and paper products markets, selling off its manufacturing operations to companies headquartered outside Pierce County. Thus corporate re-structuring is causing some decline in employment within Pierce County, but manufacturing employment related to this cluster may not be affected directly by the re-structuring.

Similar to King County, Pierce County has a relatively low number of clusters with a higher percentage of jobs within the middle wage range (5 of 8 clusters for which data are available), and a relatively high number of clusters with a higher percentage of high wage jobs than the regional average (8 of 12 clusters).

Looking at the overall ranking of cluster strategic value, military activity is the highest ranked cluster overall, followed by computer services and other aircraft parts manufacturing. The remaining clusters fall well below these three clusters in overall rankings.

The two military bases, Ft. Lewis and McChord AFB, located along I-5 south of Tacoma and adjacent to the cities of Lakewood and Dupont, are represented on the map by a star. This region also has a diverse set of industrial clusters, with Forest Products, Fishing, Manufacturing, and Computer Services clusters. As shown in the accompanying map, these establishments are largely spread across the region. A strong Forest Products cluster is evident in the industrial and port lands east of downtown Tacoma, and in the Southeastern portion of the region. A strong cluster of Fishing firms is apparent in Gig Harbor. Computer Services firms are largely spread throughout the Region, but with a cluster in the downtown Tacoma area. Firms in the Manufacturing Specialties cluster are spread throughout the industrial areas of the Region, but with small clusters in the Highway 509/Fife and Highway 522/Interstate 5 Interchange areas.

Figure 18: WDA6 Cluster Characteristics



Sightseeing Not Displayed Due to Disclosure Rules

Figure 19: WDA6 Cluster Linkages

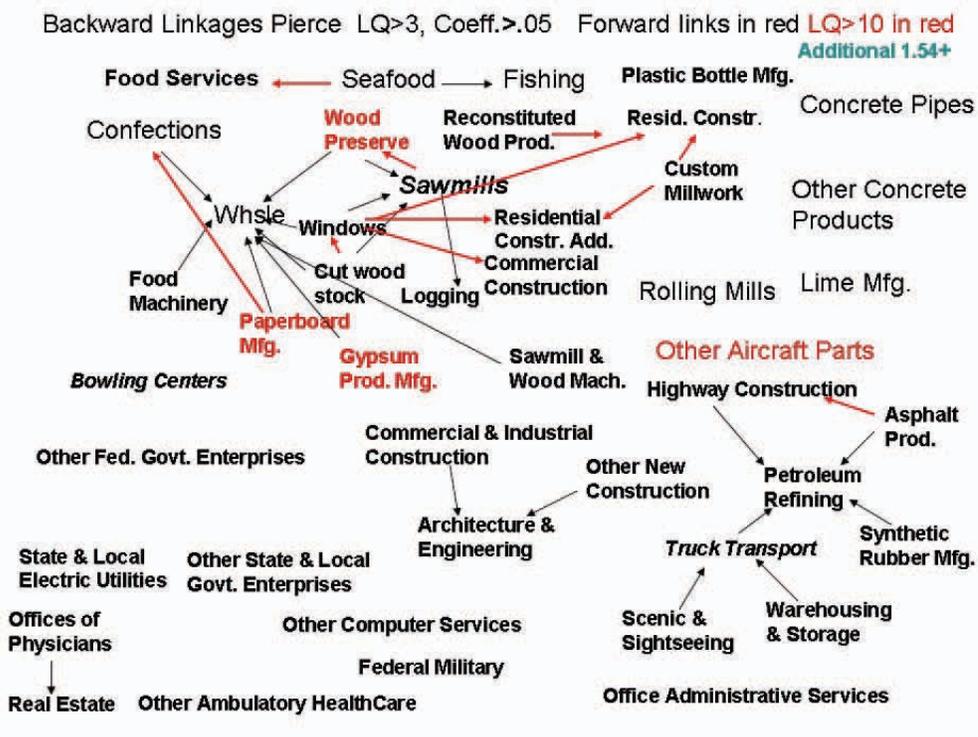


Table 16: Distribution of Occupational Median Wages in WDA 6

Wage Type	Annual Wages
Mean Wages	\$42,160
Pct25 Wages	\$24,419
Median Wages	\$35,264
Pct75 Wages	\$51,778

Table 17: Middle and High Wage Jobs by Cluster in WDA 6

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Other Aircraft Parts Mfg.	3,421	2,742	80%	620	18%
Plastic Bottle Mfg.	2,980	1,856	62%	979	33%
Gypsum Products Mfg.	15,178	6,611	44%	5,902	39%
Military Activity	9,291	4,342	47%	4,779	51%
Fishing & Seafood Processing	2,263	894	40%	1,255	55%
Confectionary Mfg.	59	21	36%	-	0%
Forest Products	307	125	41%	180	59%
Office Administrative Services	1,523	753	49%	659	43%
Construction	256	130	51%	112	44%
Offices of Physicians, Dentists and Other Health Care Practitioners	1,955	3,085	63%	872	28%
Warehousing and Storage	762	1,946	39%	100	5%
Cluster Total	35,278	17,474	50%	14,486	41%
All Industries	277,443	133,820	48%	62,306	22%
Clusters as % of All Industries	13%	13%			

Table 18: Strategic Evaluation of Clusters in Region 6

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	
					in Middle Wage Range	in High Wage Range							
Other Aircraft Parts Mfg.	10.78	1,634	420	94,308	80%	18%	10.0%	34.4%	71.4%	n/a	12.9%	8.1%	97.9%
Gypsum Products Mfg.	10.39	271	97	70,683	47%	51%	(combined w concrete pipe)			n/a		n/a	100.0%
Military Activity	9.71	34,624	3,100	80,698	62%	33%	0.0%	64.7%	123.3%			1.4%	94.2%
Plastic Bottle Mfg.	6.59	359	132	65,880	n/a	n/a	-4.3%	37.0%	104.0%	9.4%	3.3%	3.3%	99.6%
Concrete Pipe Mfg.	5.44	125	32	56,656	n/a	n/a	0.9%	28.0%	56.4%	12.3%			
Other Concrete Products mfg.	4.51	519	154	58,252	44%	39%	(combined w concrete pipe)						
Fishing & Seafood Processing	4.19	679	113	55,990	40%	55%	-31.0%	17.5%	175.8%	0.0%		0.0%	65.5%
Confectionary Mfg.	4.12	298	97	30,634	36%	0%	-6.7%	103.8%	141.3%	7.6%		1.8%	98.1%
Other Computer Services	3.36	1,420	312	78,289	n/a	n/a	45.8%	120.8%	162.9%	38.0%		66.8%	87.9%
Forest Products	3.02	2,366	4,520	62,024	41%	59%	-13.9%	-20.7%	19.1%	-17.6%		1.0%	78.5%
Other Ambulatory Health Care Services	2.43	4,174	704	65,929	n/a	n/a	0	-0.065791	0.1933	19.3%		2.8%	46.0%
Other State and Local Government													
Enterprises	2.05	2,541	621	61,071	n/a	n/a	0.0%	1.2%	32.7%	2.9%		6.4%	42.3%
Office administrative services	1.94	2,143	329	46,549	49%	43%	34.6%	391.9%	972.7%	12.1%		3.0%	6.0%
Construction	1.78	15,410	1,926	56,037	51%	44%	0.3%	46.7%	90.2%	n/a		n/a	28.9%
Offices of Physicians, Dentists and													
Other Health Care Practitioners	1.57	12,573	1,357	65,045	63%	28%	12.9%	23.2%	56.3%	23.9%		0.9%	17.8%
Warehousing and Storage	1.56	1,993	130	56,027	39%	5%	17.1%	152.1%	264.6%	12.8%		0.2%	57.6%

Notes:

Change in employment and wages for military activity is for 2000 to 2007 and is taken from a military impact analysis provided by the Tacoma-Pierce County Chamber of Commerce; compensation data do not reflect the value of on-base shopping and non-cash compensation provided to military personnel.
 Change in establishments for other state and local government enterprises set at 0; change in employment and wages, and percent exports, based on power generation and supply industry.

Table 18 continued
Rankings

LQ	Cluster or Industry	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Sum of Ranks*	Index (120-Summed Scores)
					in Middle Wage Range	in High Wage Range								
1	Other Aircraft Parts Mfg.	9	1	7	1	1	5	8	9	5	2	4	61	59
6	Military Activity	1	2	11	2	5	8	5	6	7	7	1	56	64
2	Plastic Bottle Mfg.	13	11	7	5	2	11	7	7	9	9	5	88	32
3	Concrete Pipe Mfg.	16	16	9	6	6	6	9	10	7	4	2	94	26
4	Other Concrete Products mfg.	12	10	10	6	6	6 (combined w concrete pipe)	9	10	7	4	2	94	26
5	Gypsum Products Mfg.	15	14	14	7	7	4 (combined w concrete pipe)	11	3	12	13	8	118	2
7	Fishing & Seafood Processing	11	13	12	9	9	5	14	11	12	13	8	118	2
8	Confectionary Mfg.	14	15	14	11	11	11	12	4	10	8	3	115	5
9	Other Computer Services	10	9	9	6	6	6	1	4	1	1	6	59	61
10	Forest Products	5	1	7	8	8	1	13	14	13	10	7	103	17
11	Other Ambulatory Health Care Services	3	5	5	4	6	9	13	13	3	6	10	89	31
12	Enterprises	4	6	6	6	6	10	12	12	11	3	11	101	19
13	Office administrative services	7	8	13	4	4	2	1	1	8	5	14	79	41
14	Construction	6	3	10	3	3	7	6	8	4	7	12	82	38
15	Offices of Physicians, Dentists and Other Health Care Practitioners	2	4	4	6	6	4	10	11	2	11	13	92	28
16	Warehousing and Storage	8	12	11	10	10	3	2	2	6	12	9	101	19

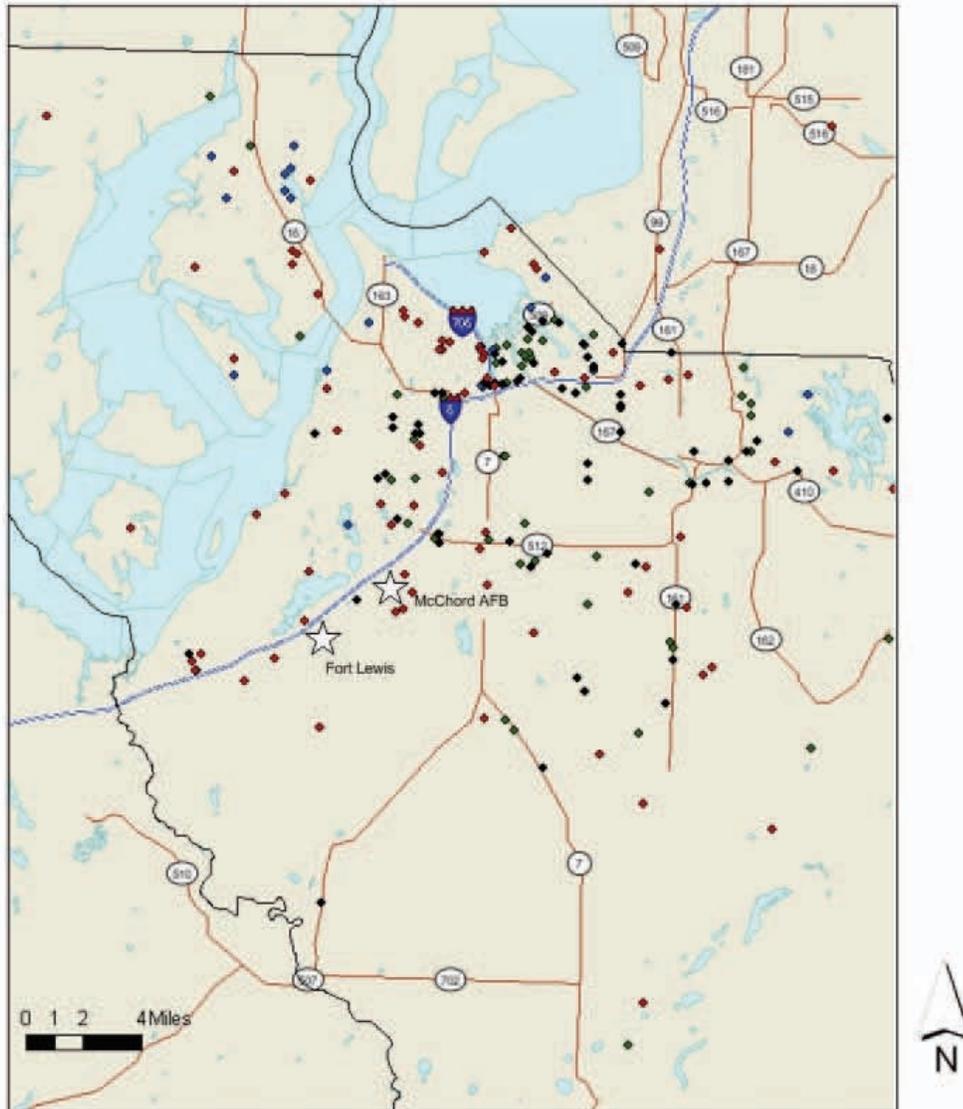
Note:

Missing values assigned the median rank value.

Figure 20: WDA6 Cluster Map

Washington State WDA Region 6 Cluster Firms

- 6 Computer Related Services
- 6 Manufacturing Specialties
- 6 Fishing
- 6 Forest Products



Region 7 Southwest Washington WDA – Clark, Cowlitz, Skamania and Wahkiakum Counties

On the following pages, readers will find two bubble charts, one including a cluster labeled “Federal Electric Utilities,” and a second excluding this cluster which has a very high location quotient, but including the remaining clusters in this region bit with a more restricted scale for the location quotient dimension that permits readers to discern variations among the remaining clusters.

The bubble chart for this region does not show federal electric utilities; this industry has an extremely high location quotient of nearly 72. Readers familiar with this region will recognize this “industry” as the Bonneville Power Administration and its Ross Complex located within the city limits of Vancouver, WA in Clark County. The Ross Complex is a major distribution facility for power generated at BPA dams; it also houses a research facility for testing and evaluating power distribution equipment.⁴ The employment level in this sector is also large (1,565) but well below the largest clusters in this region.

Going on to the clusters shown on the bubble chart for this region, construction and forest products are also prominent clusters, the two largest in the region, and forest products also has a high location quotient. Industrial machinery, semiconductors, and food products also have fairly high location quotients and each of these clusters employs more than 1,000 workers. Ambulatory health care, personal care, gambling and other entertainment, and auto rental are large industries with lower location quotients.

Looking at the growth trends, we do not have a growth projection for the federal electric utilities sector. Forest products employment declined in recent years, and this trend is expected to continue in the years ahead. The construction cluster contracted in the immediate past but is projected to grow in the years ahead. Substantial expansion was seen in the service clusters (personal care, other ambulatory health care, and auto rental) in recent years, and expansion at a more modest pace is projected in the years ahead. Substantial expansion of the gambling and other entertainment cluster is projected.

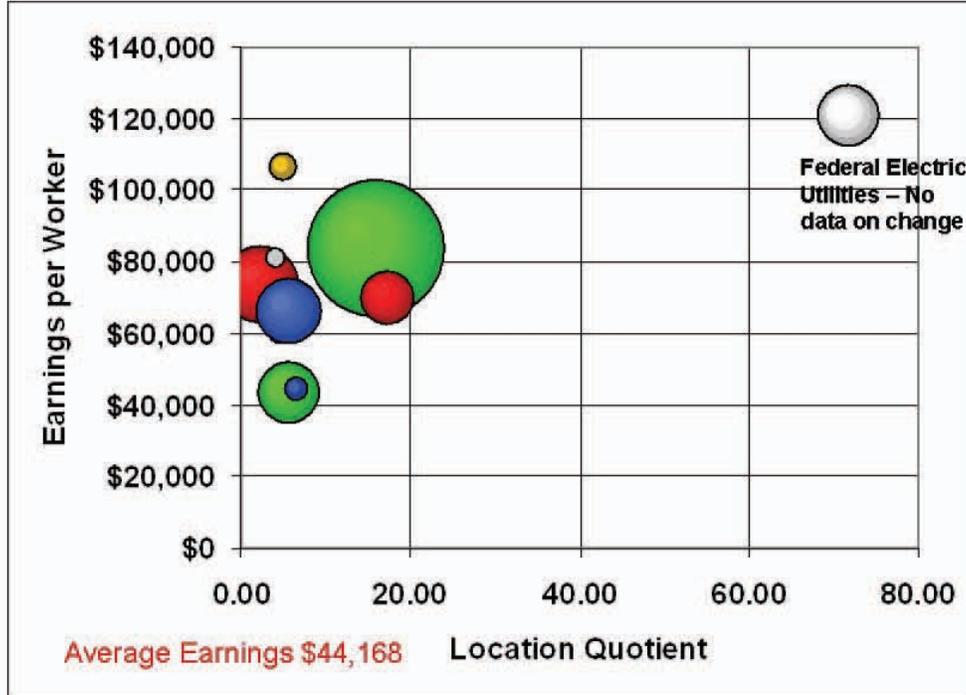
In this region, 7 of 9 clusters for which occupational data are available have a higher percentage of middle wage jobs, and 5 have a higher percentage of high wage jobs. The strategic value scores suggest that federal electric utilities and forest products are the highest value clusters. These two key clusters are followed by other ambulatory health care, industrial machinery, and semiconductors.

This region is heavily dependent upon Forest Products activities, and these firms are highly clustered in the greater Kelso and Longview areas to the north, along Highway 4 to the northwest, and in the greater Vancouver area as well. Semiconductor and Service clusters are evident in the Vancouver region. Firms in the Manufacturing Specialties cluster and the Food Products cluster are relatively dispersed across the region.

⁴ See http://www.atsdr.cdc.gov/hac/PHA/bonneville/bpa_p1.html (October 2008).

Figure 21: WDA7 Cluster Characteristics

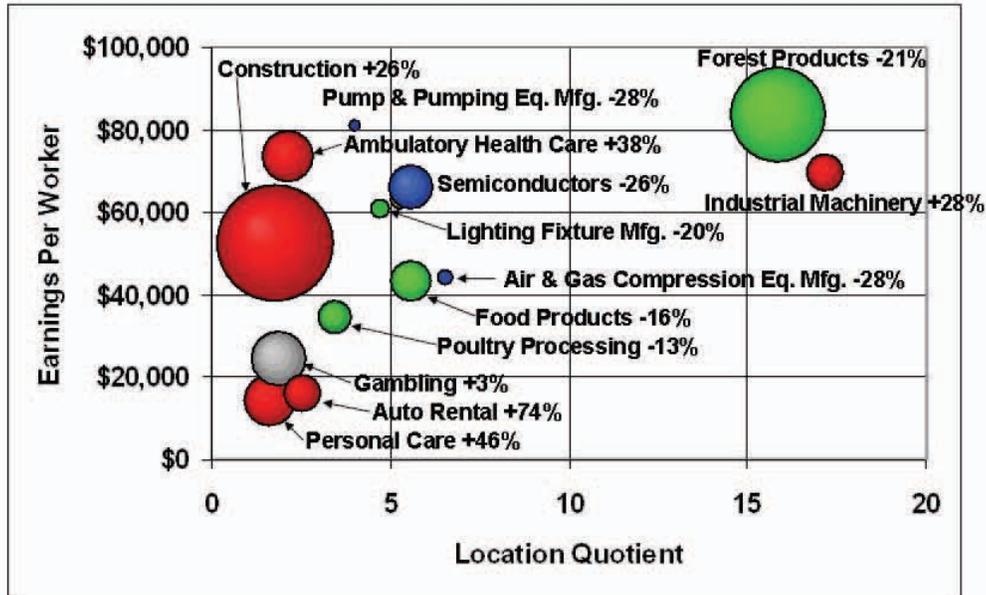
WDA 7 – Clark, Cowlitz, Skamania & Wahkiakum



Note: Labels and change in employment for other sectors in WDA 7 are shown on the next figure.

Figure 22: WDA7 Cluster Characteristics (except Federal Electrical Utilities)

WDA 7 Except Federal Electrical Utilities



Relay and Industrial Control Mfg. Not Displayed Due to Disclosure Rules.
Other Commercial and Service Industry Machinery is covered by semiconductors.

Figure 23: WDA7 Cluster Linkages

Clark purchase co > .05; LQ > 4; bold=intraindustry transactions > .05

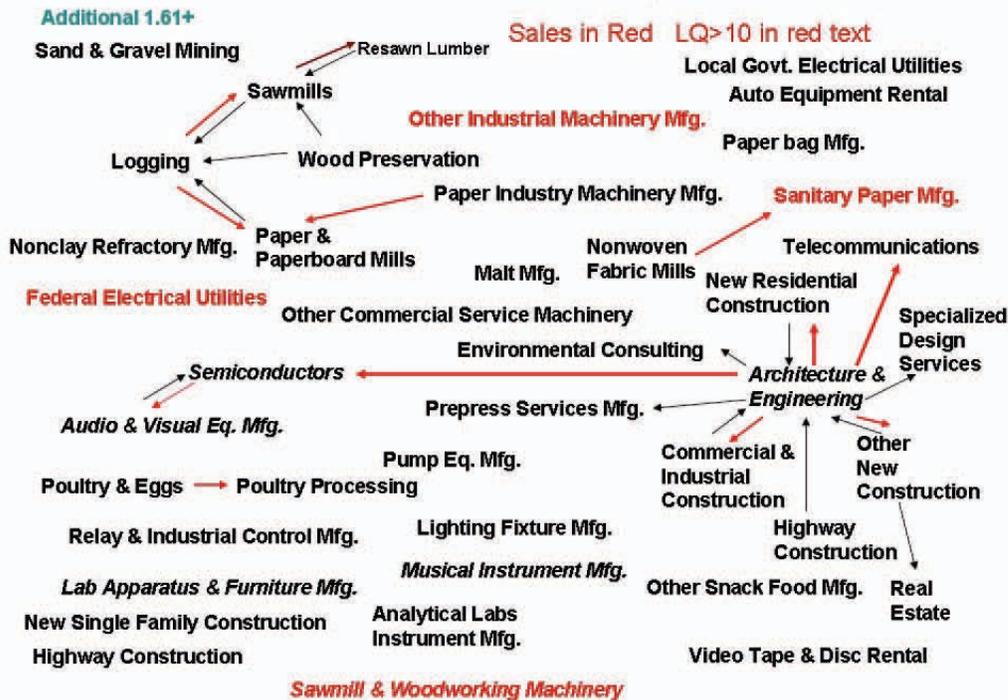


Table 19: Distribution of Occupational Median Wages in WDA 7

Wage Type	Annual Wages
Mean Wages	\$41,422
Pct25 Wages	\$23,649
Median Wages	\$33,754
Pct75 Wages	\$50,894

Table 20: Middle and High Wage Jobs by Cluster in WDA 7

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Industrial Machinery	984	630	64%	301	31%
Forest Products	7402	5785	78%	1057	14%
Air & Gas Compression Equipment Mfg.	257	184	72%	68	26%
Other Commercial and Service Industry Machinery	2825	1921	68%	862	31%
Auto Rental	158	23	15%	36	23%
Other Ambulatory Health Care	1882	1061	56%	608	32%
Gambling	2711	1467	54%	46	2%
Construction	4091	3169	77%	834	20%
Personal Care	96	1003	10%	37	4%
Cluster Total	20406	15243	75%	3849	19%
All Industries	170994	89080	52%	38302	22%
Clusters as % of All Industries	12%	17%			

Table 21: Strategic Evaluation of Clusters in Region 7

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output
					in Middle Wage Range	High Wage Range						
Federal Electrical Utilities	71.65	1,574	982	120,783	n/a	n/a	n/a	n/a	n/a	n/a	n/a	71.2%
Industrial Machinery	17.17	1,077	296	69,808	64%	31%	12.8%	27.6%	57.7%	1.5%	13.6%	22.7%
Forest Products	15.86	7,293	3,611	83,777	78%	14%	-13.9%	-20.7%	19.1%	-15.9%	1.7%	87.8%
Air & Gas Compression												
Equipment Mfg.	6.53	219	78	44,502	72%	26%	-33.3%	-27.8%	-10.1%	21.8%	8.6%	94.6%
Food Products	5.59	1,493	518	43,352	n/a	n/a	-25.4%	-16.4%	-1.3%	5.1%	1.8%	75.5%
Semiconductors	5.55	1,727	1,339	66,315	n/a	n/a	-6.3%	-26.1%	-14.2%	2.1%	19.4%	79.7%
Other Commercial and Service												
Industry Machinery	5.29	363	51	63,129	68%	31%	-40.0%	-6.2%	15.7%	n/a	n/a	64.2%
Lighting Fixture Mfg.	4.73	284	71	60,947	n/a	n/a	-34.6%	-20.5%	-3.5%	n/a	n/a	100.0%
Pump & Pumping Eq Mfg.	4.02	141	83	81,021	n/a	n/a	-33.3%	-27.8%	-10.1%	21.8%	8.6%	96.7%
Poultry Processing	3.46	1,039	236	34,688	n/a	n/a	-42.2%	-12.6%	14.1%	n/a	n/a	58.7%
Auto Rental	2.52	1,111	135	16,418	15%	23%	59.3%	74.1%	89.7%	17.1%	7.0%	40.2%
Other Ambulatory Health Care	2.13	2,399	437	73,528	56%	32%	38.2%	38.2%	80.2%	16.8%	0.3%	46.8%
Gambling	1.85	2,430	180	24,736	54%	2%	-1.0%	-2.6%	36.2%	31.2%	0.0%	46.4%
Construction	1.75	11,176	1,339	52,452	77%	20%	-5.6%	26.9%	73.0%	6.5%	0.8%	19.0%
Personal Care	1.61	2,346	102	14,552	10%	4%	23.5%	46.1%	69.5%	33.6%	0.0%	33.5%

Note:

Percentage employment increase and percent R&D occupations for all food product manufacturing statewide used for food products in the region.

Table 21 continued
Rankings

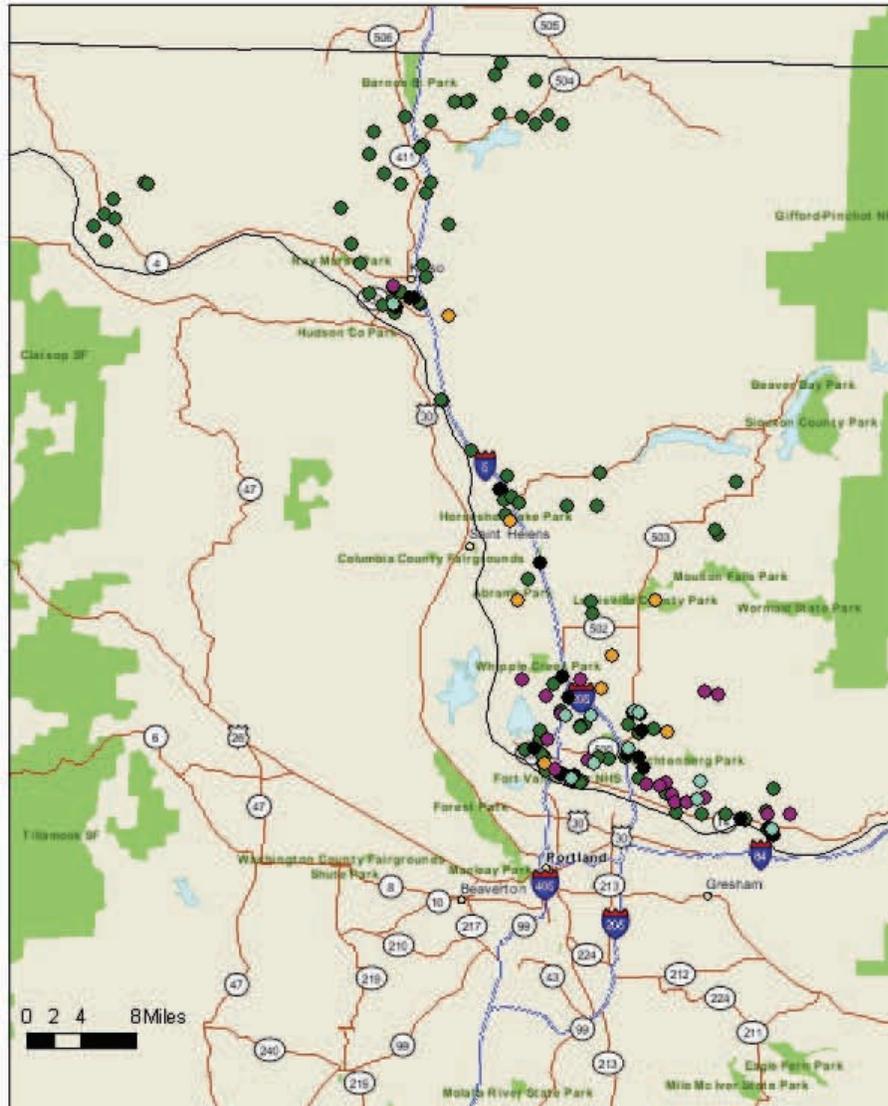
Cluster or Industry	LQ	Output (\$ millions)		Earnings/ Worker		Percent of Occupations in Middle Wage Range		Percent of Occupations in High Wage Range		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Sum of Ranks*	Index (120-Summed Scores)
		Employment	(\$ millions)	Worker	1	5	Range	Range	5								
Federal Electrical Utilities	1	7	4	4	1	5	5	5	7.5	7.5	7.5	6	6	6	7	65	56
Industrial Machinery	2	10	7	5	5	5	5	2	4	4	4	10	2	2	14	70	50
Forest Products	3	2	1	2	2	1	1	7	8	8	11	7	11	7	4	64	56
Air & Gas Compression	4	14	13	10	10	3	3	4	10	10	13	12	3	3	3	92	28
Equipment Mfg.	5	8	5	11	11	5	5	5	9	9	9	10	8	6	6	87	33
Food Products	6	6	3	6	6	5	5	5	7	7	12	14	9	1	5	79	41
Semiconductors																	
Other Commercial and Service																	
Industry Machinery	7	12	15	7	7	4	4	3	13	13	7	8	6	6	8	96	24
Lighting Fixture Mfg.	8	13	14	8	8	5	5	5	12	12	10	11	6	6	1	99	21
Pump & Pumping Eq Mfg.	9	15	12	3	3	5	5	5	11	11	14	13	4	4	2	97	23
Poultry Processing	10	11	8	12	12	5	5	5	14	14	8	9	6	6	9	103	17
Auto Rental	11	9	10	14	14	8	8	5	1	1	1	1	5	5	12	82	38
Other Ambulatory Health Care	12	4	6	4	4	6	6	1	2	2	3	2	6	9	10	65	55
Gambling	13	3	9	13	13	7	7	9	5	5	6	6	2	10	11	94	26
Construction	14	1	2	9	9	2	2	6	6	6	5	3	7	8	15	78	42
Personal Care	15	5	11	15	15	9	9	8	3	3	2	4	1	11	13	97	23

Note:
Missing values assigned the median rank value.

Figure 24: WDA7 Cluster Map

Washington State WDA Region 7 Cluster Firms

- 7 Semiconductors
- 7 Service Specialties
- 7 Manufacturing Specialties
- 7 Food Products
- 7 Forest Products



Clark County & Adjacent Oregon Counties

Data for three counties in Oregon adjacent to Clark County were estimated. These are Multnomah, Clackamas, and Washington counties. In many instances, sectors that show strong concentration in Clark county have very low location quotients in the Oregon Counties. However, there are several cases where there are strong location quotients in both Clark County and in the Portland metro area. These include sawmill machinery (262), Cut wood stock manufacturing (118), paper industry machinery (264), semiconductors (311), laboratory apparatus manufacturing (374), and musical instrument manufacture (386). Lesser concentrations are found in Oregon in Other Industry Machinery (269), pump and pump equipment manufacturing (288), audio and video equipment manufacturing (309), video & tape rental (433), auto rental (432), and other ambulatory care (466). In the case of semiconductors, the concentration in the Portland area is stronger than in Clark County.

Table 22: Clark and Portland Metro Area Location Quotients

IMPLAN Sector	Description	Clark Location Quotients	Oregon Location Quotient
14	Logging	6.86	0.45
25	Sand, gravel, & clay mining	5.14	0.63
35	New Residential Additions	1.98	0.97 ⁵
38	Commercial and Institutional Construction	1.58	
39	Highway Construction	1.95	
41	ther New Construction	1.91	
50	Malt mfg.	58.99	0.00
70	Poultry processing	3.41	0.00
79	Other snack food mfg.	10.92	0.05
95	Nonwoven fabrics	5.13	0.00
112	Sawmills	8.88	0.39
113	Wood preserving	6.81	0.59
116	Engineered wood products	3.29	0.02
118	Cut stock mfg.	5.03	3.20
130	Die cut paper	9.67	0.08
134	Sanitary Paper mfg.	27.02	0.00
187	Nonclay refractories	15.11	0.00
262	Sawmill machinery	20.90	11.33
264	Paper industry machinery	10.51	2.78
269	All other industry machinery	18.45	1.34
273	Other commercial service industry mach	5.32	0.62
288	Pump & pump eq. mfg.	3.84	1.64
289	Air & Gas compress. Mfg.	7.74	0.00
309	Audio & video equipment Mfg..	4.25	2.11
311	Semiconductor Manufacturing	6.04	8.55
326	Lighting fixture mfg.	4.76	0.71
336	Relay & industrial controls	4.53	0.23

⁵ Data are for all construction; data not available in the IMPLAN sectoring scheme for individual sectors in Oregon.

Table 22 continued

IMPLAN		Clark Location	Oregon
Sector	Description	Quotients	Location
			Quotient
374	Lab apparatus	8.83	2.17
386	Musical instrument mfg.	4.97	3.29
432	Auto Rental	2.52	1.36
433	Video & tape rental	6.78	1.53
466	Other Ambulatory Care	2.13	1.25
478	Gambling & recreation	1.85	0.02
487	Personal Care	1.61	0.75
495	Federal electrical utilities	70.57	Data not available
498	State & Local govt. electricity	6.78	Data not available

Region 8: North Central WDA – Adams, Chelan, Douglas, Grant, and Okanogan Counties

The North Central region is mostly rural, and agriculture is the dominant industry. Agriculture has a very high location quotient (24.6) and is the largest cluster in the region (over 32,700 employees). Two other industries, while much smaller, also have location quotients over 20: local government electricity and cut stone production. Forest products is a small cluster with about 730 employees. Several small metal manufacturing sectors are combined into a metals sector because they have too few establishments to show individually, and two service clusters with over 1,000 employees, gambling/other entertainment and other ambulatory health care, are also shown on the charts below.

The largest cluster, agriculture was growing in recent years and is expected to continue to expand, albeit very slowly. Few other growth projections are available for this region since much of the ESD data is suppressed to protect the confidentiality of firms in very small industries. Gambling/other entertainment and other ambulatory health care are both expected to expand modestly.

The available occupational data for 5 clusters include 2 that have a higher percentage of middle wage jobs, and 2 that have a higher percentage of high wage jobs, than the regional averages. Due to the suppression, the ranking of clusters is based on only about half of the variables used in other regions. Hence, the rankings for this region are not comparable to the other regions. However, the rankings of the top three sectors do not change if only the variables with complete data are considered. These top ranking sectors are agriculture & food products, local government electricity, and metals.

Agriculture and Food Products establishments are important and highly clustered throughout the region. There is a strong cluster of Forest Products firms in Wenatchee, though they are relatively dispersed in other areas of the region. The strongest concentration of Manufacturing Specialty cluster firms is in the Moses Lake area.

Figure 25: WDA8 Cluster Characteristics

WDA 8

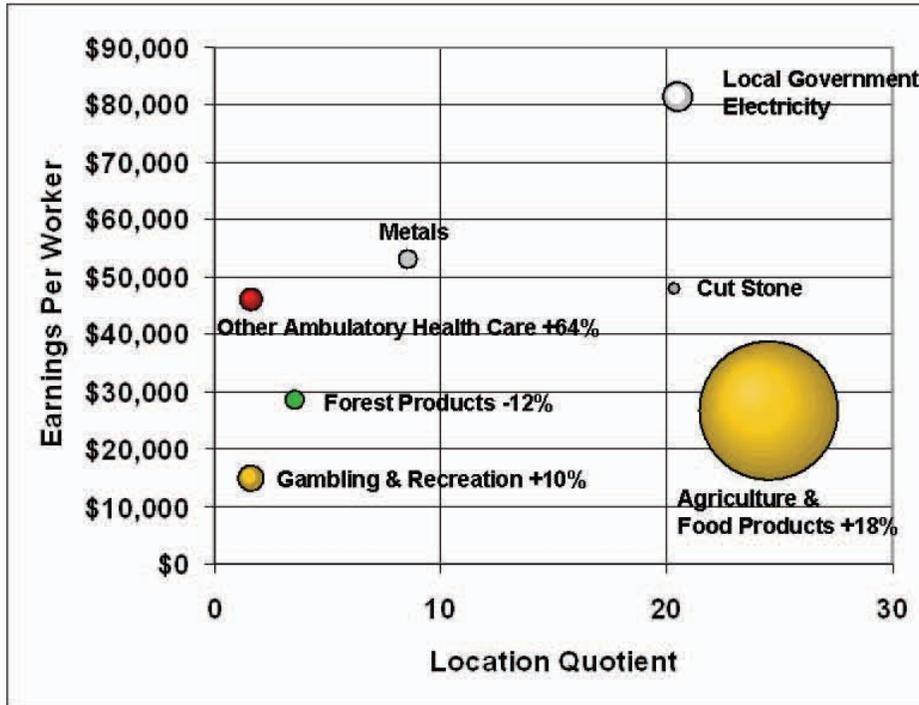


Figure 26: WDA 8 Cluster Linkages

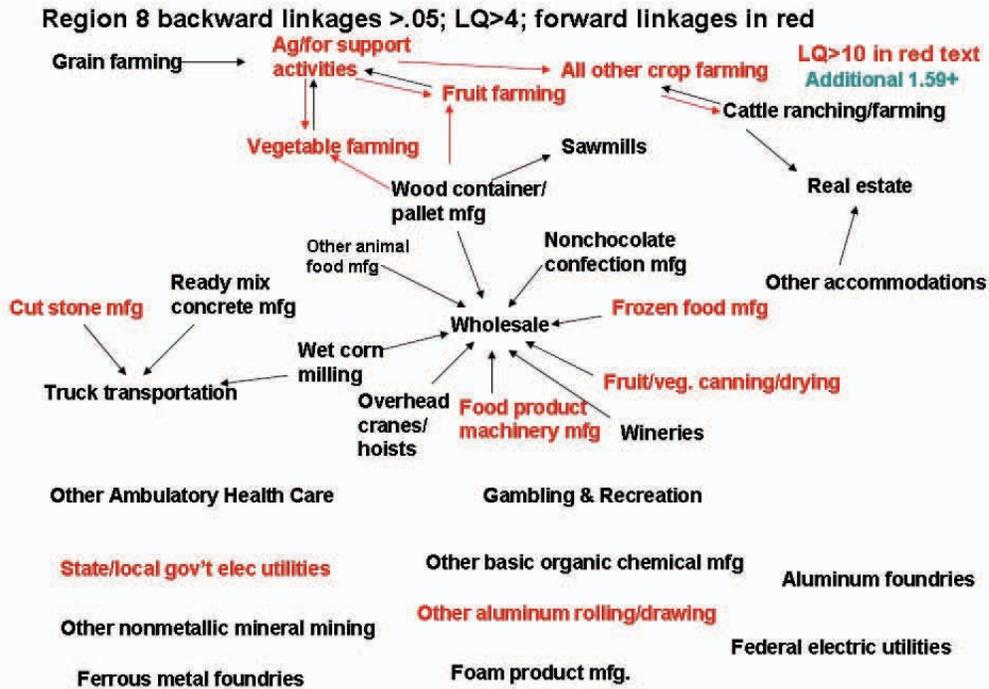


Table 23: Distribution of Occupational Median Wages in WDA 8

Wage Type	Annual Wages
Mean Wages	\$35,216
Pct25 Wages	\$21,356
Median Wages	\$29,050
Pct75 Wages	\$41,551

Table 24: Middle and High Wage Jobs by Cluster in WDA 8

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Agriculture & Food Products	23,708	22,422	95%	598	3%
Cut Stone production	489	24	5%	86	18%
Forest Products	773	202	26%	89	12%
Gambling & Recreation	1,060	684	65%	33	3%
Other Ambulatory Health Care	1,061	532	50%	451	43%
Cluster Total	27,091	23,864	88%	1,257	5%
All Industries	110,433	70,696	64%	17,818	16%
Clusters as % of All Industries	25%	34%			

Table 25: Strategic Evaluation of Clusters in Region 8

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output
					in Middle Wage Range	in High Wage Range						
Agriculture & Food Products	24.56	32,746	3,051	26,684	95%	n/a	-18.1%	17.8%	47.6%	0.5%	0.5%	89.9%
Local Government Electricity	20.45	1,605	653	81,482	n/a	n/a	n/a	n/a	n/a	n/a	n/a	38.0%
Cut Stone production	20.34	339	39	48,024	5%	18%	n/a	n/a	n/a	24.7%	13.9%	81.2%
Metals	8.57	696	132	53,066	n/a	n/a	n/a	n/a	n/a	n/a	n/a	99.9%
Forest Products	3.53	734	135	28,670	26%	12%	-15.9%	-11.5%	22.1%	n/a	n/a	59.1%
Gambling & Recreation	1.65	1,356	69	15,085	65%	3%	10.5%	10.2%	16.6%	14.8%	0.0%	44.1%
Other Ambulatory Health Care	1.59	1,046	139	46,272	50%	43%	55.0%	63.8%	143.8%	33.1%	3.0%	26.8%

Notes:

Employment data for many sectors cannot be disclosed due to confidentiality issues. Projected employment increase and R&D Occupations in Agriculture and Food Products based on food processing industries only; no data available for crop production on these variables.

Rankings

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Sum of Ranks*	Index (100-Summed Scores)
					in Middle Wage Range	in High Wage Range								
Agriculture & Food Products	1	1	1	6	1	5	4	2	2	3	2	2	30	70
Local Government Electricity	2	2	2	1	3	3	3.5	3.5	3.5	2	2	2	6	34
Cut Stone production	3	7	7	3	5	2	3.5	3.5	3.5	1	2	2	3	44
Metals	4	6	5	2	3	3	3.5	3.5	3.5	2	2	2	1	39
Forest Products	5	5	4	5	4	3	3	4	3	2	2	2	4	44
Gambling & Recreation	6	3	6	7	2	4	2	3	4	2	1	1	5	55
Other Ambulatory Health Care	7	4	4	3	4	1	1	1	1	2	3	3	7	63

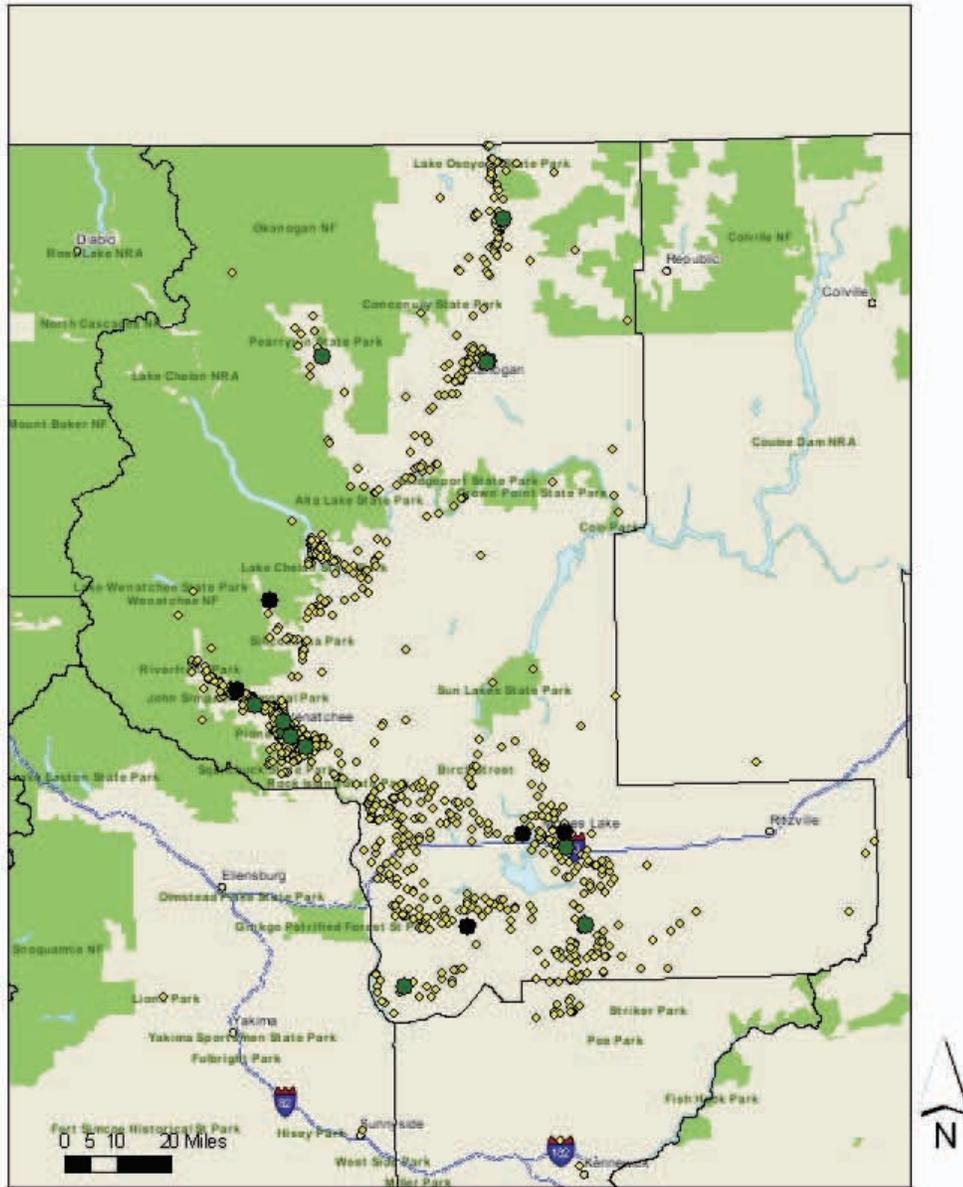
Note:

Sectors with missing data assigned the median value.

Figure 27: WDA 8 Cluster Map

Washington State WDA Region 8 Cluster Firms

- 8 Manufacturing Specialties
- 8 Forest Products
- 8 Agriculture and Food Products



Region 9: Tri-County WDA – Kittitas, Klickitat, and Yakima Counties

The data for this region show a large agriculture and food products cluster with a high location quotient and rapid growth in recent years. The growth may be due to the rapid expansion in the number of wineries in the Yakima Valley, one of several regions in the state that have seen a substantial increase in wine grape growing and winery production.

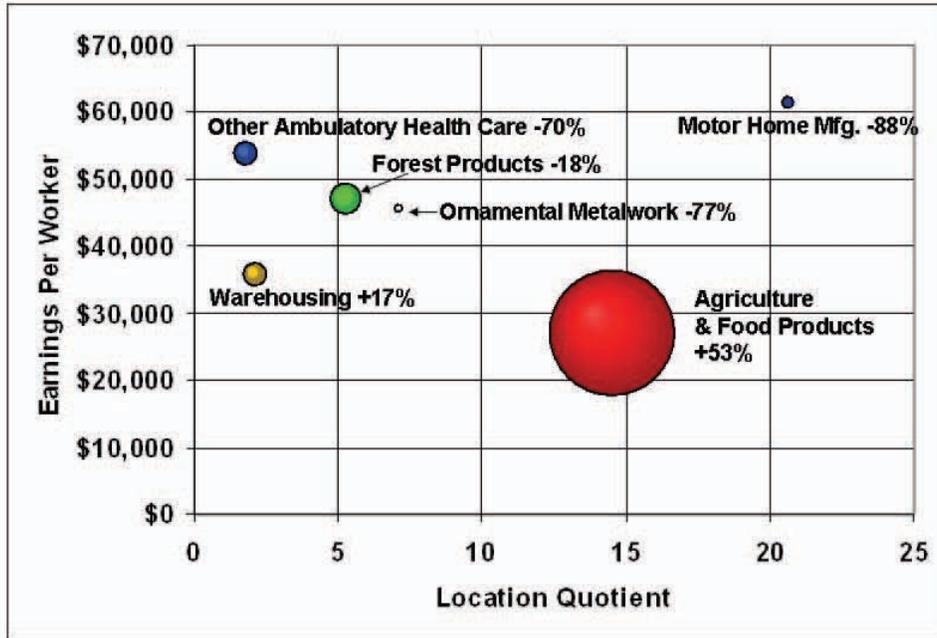
Another cluster with a very high location quotient and high wages is motor home production. This region also has a high location quotient for aircraft parts manufacturing, but the data cannot be displayed due to confidentiality rules. Several other clusters shown on the charts below with 1,000 to 2,000 employees.

In all of the 5 clusters for which occupational data are available, the percentage of middle wage jobs is higher than the regional average, and 2 of the clusters have a higher percentage of high wage jobs compared to the regional average. The strategic value index gives the highest scores to the agriculture and food products cluster, and other ambulatory health care. However, the range of scores on this index is quite narrow since so few clusters are listed in the table. The lowest score given is for warehousing. The indexing method does not recognize the unique value of warehouses in an agricultural region; without the warehouses many of the agricultural products would have far less value, especially the fruit products for which this region is well known.

Note in the accompanying map, the strong clustering of firms in Manufacturing in the Yakima area, the clustering of Forest Products firms in the Ellensburg and in the southwest portion of the region, and the intense clustering of Agriculture and Food Products firms in the Ellensburg and Yakima areas.

Figure 28: WDA9 Cluster Characteristics

WDA 9



Relay & Industrial Controls and Other Aircraft Parts Not Displayed Due to Disclosure Rules

Figure 29: WDA9 Cluster Linkages



Table 26: Distribution of Occupational Median Wages in WDA 9

Wage Type	Annual Wages
Mean Wages	\$35,808
Pct25 Wages	\$21,202
Median Wages	\$29,489
Pct75 Wages	\$43,328

Table 27: Middle and High Wage Jobs by Cluster in WDA 9

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Motor Home Mfg.	377	258	68%	57	15%
Agriculture & Food Products	28,988	24,433	84%	797	3%
Ornamental metalwork	783	508	65%	183	23%
Forest Products	1,369	930	68%	266	19%
Other Ambulatory Health Care	1,033	694	67%	299	29%
Cluster Total	32,550	26,823	82%	1,602	5%
All Industries	126,379	79,293	63%	21,741	17%
Clusters as % of All Industries	26%	34%			

Table 28: Strategic Evaluation of Clusters in Region 9

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output
					in Middle Wage Range	in High Wage Range						
Motor Home Mfg.	20.60	276	94	61,601	68%	15%	0.0%	-87.8%	-44.4%	-15.4%	4.0%	91.9%
Agriculture & Food Products	14.48	32,456	3,432	26,994	84%	3%	-20.1%	53.4%	629.9%	5.8%	0.4%	77.4%
Ornamental metalwork	7.09	207	37	45,589	65%	23%	24.1%	-76.5%	22.8%	25.5%	0.9%	98.2%
Forest Products	5.23	1,991	481	47,138	68%	19%	-40.1%	-18.3%	254.9%	-14.9%	5.5%	72.9%
Warehousing	2.08	1,080	65	35,878	n/a	n/a	-8.9%	17.7%	32.2%	6.3%	0.7%	53.1%
Other Ambulatory Health Care	1.76	1,296	191	54,019	67%	29%	0.0%	-70.4%	50.0%	16.6%	2.3%	33.3%

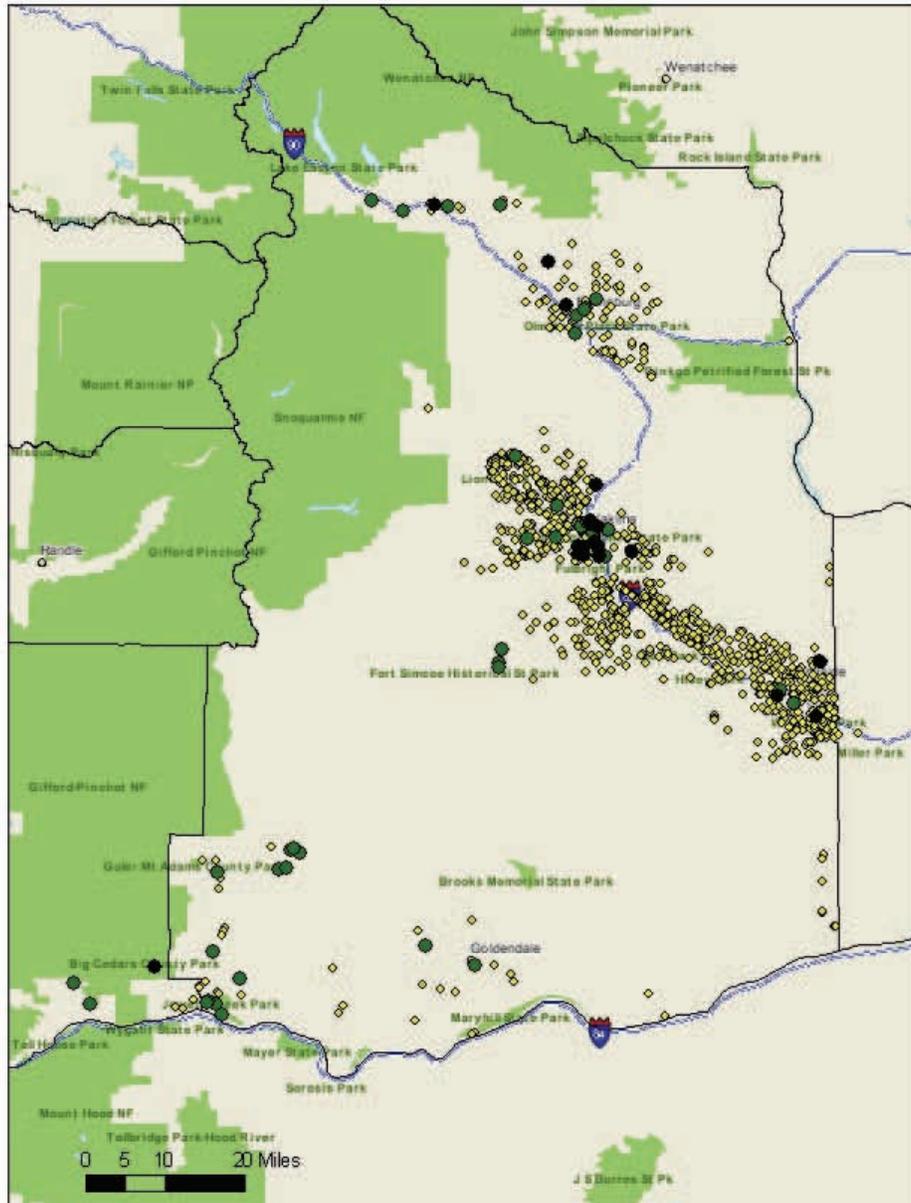
Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Sum of Ranks*	Index (100-Summed Scores)
					in Middle Wage Range	in High Wage Range								
Motor Home Mfg.	1	5	4	1	2	4	3	6	5	6	6	2	41	59
Agriculture & Food Products	2	1	1	6	1	5	5	2	1	1	4	5	3	36
Ornamental metalwork	3	6	6	4	5	2	2	4	3	2	2	3	1	41
Forest Products	4	2	2	3	3	3	6	6	4	4	5	1	4	57
Warehousing	5	4	5	5	3	3	4	3	6	6	3	4	5	50
Other Ambulatory Health Care	6	3	3	2	4	1	1	1	2	2	1	6	6	64

Note:
Missing values in matrix above are assigned the median rank value.

Figure 30: WDA9 Cluster Map

Washington State WDA Region 9 Cluster Firms

- 9 Manufacturing Specialties
- 9 Forest Products
- ◇ 9 Agriculture and Food Products



Region 10: Eastern Washington WDA – Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Stevens, Walla Walla and Whitman Counties

This vast rural region covers most of eastern Washington except for Spokane County (WDA12). Within these 8 counties, the two largest clusters are agriculture/food products and forest products, followed by colleges and universities, and depository credit organizations. The many alumni of Washington State University, Whitman College and Walla Walla Community College are proud of the college and university cluster located in two of the counties in this region, and a growing wine industry in Walla Walla County brings some growth to the agriculture cluster, although there have been employment losses in agriculture/food products overall in recent years. Two small clusters stand out with high location quotients and growth in recent years: mining and heating equipment manufacturing.

The agriculture/food products cluster is projected to expand slightly in the years ahead, while the projection for forest products is a continued slow contraction of employment. Heating equipment is projected to contract in employment in the years ahead, while continued growth is projected for mining.

Two of the 5 clusters for which occupational data are available have a higher percentage of middle wage jobs, and a different pair of clusters have a higher percentage of high wage jobs than the regional average. The strategic value index gives the highest overall score to mining, followed by agriculture/food products, forest products, and heating equipment.

There is a clear north-south divide in terms of the location of establishments in these clusters. Agricultural and Food clusters are apparent in the southern areas of the region, while the northern areas are characterized by the strong presence of clusters in Forest Products, Mining, and Heating Equipment.

Figure 31: WDA10 Cluster Characteristics

WDA 10

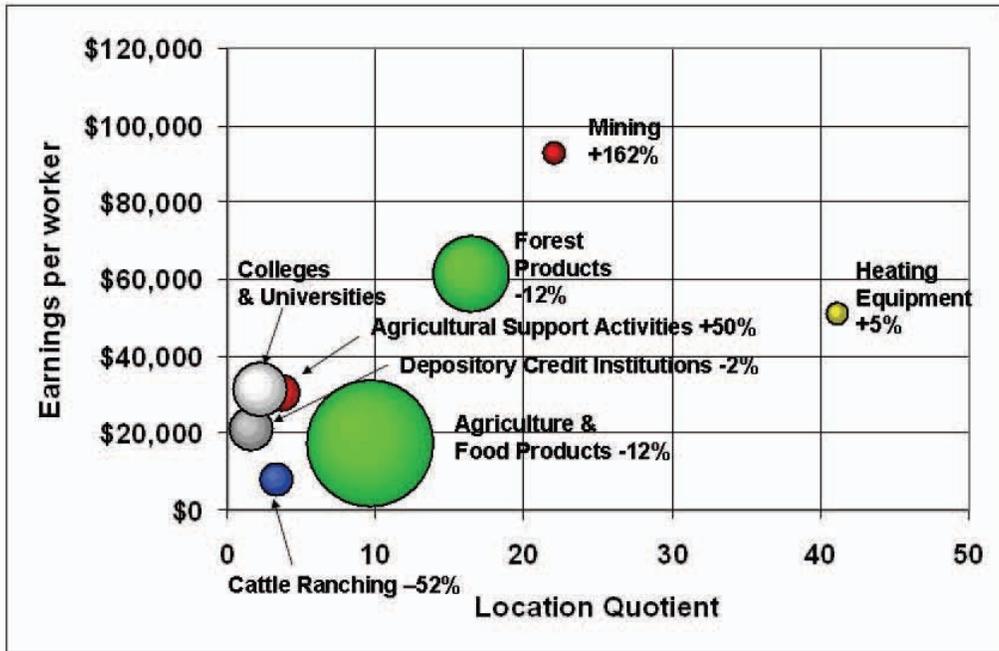


Figure 32: WDA10 Cluster Linkages

Purchases Region 10 LQ>4, coefficient >.05 Sales Coefficients in red

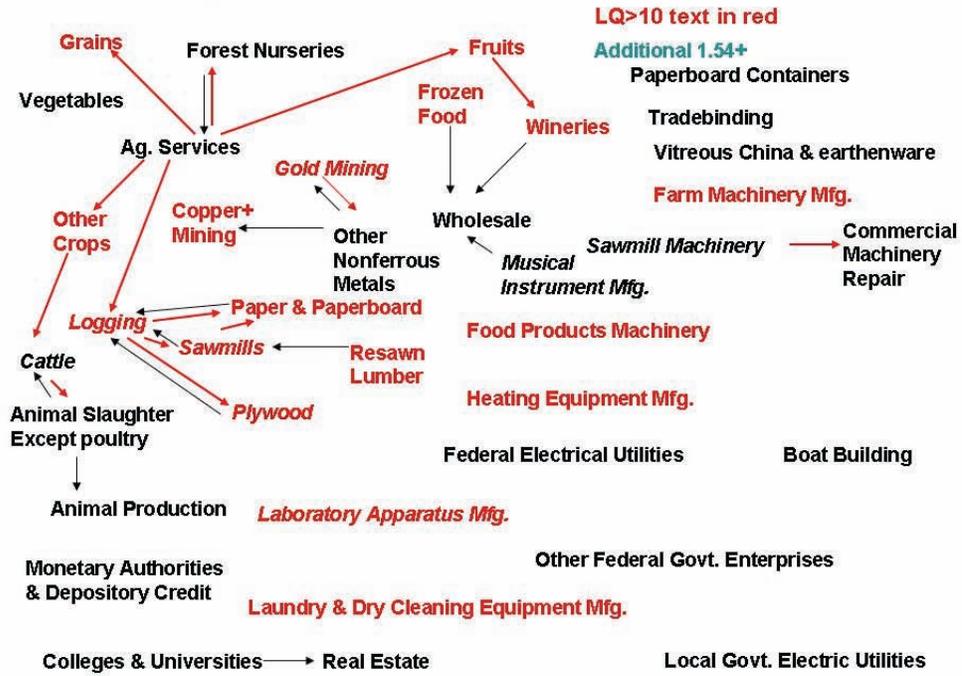


Table 29: Distribution of Occupational Median Wages in WDA 10

Wage Type	Annual Wages
Mean Wages	\$38,979
Pct25 Wages	\$22,597
Median Wages	\$32,129
Pct75 Wages	\$48,043

Table 30: Middle and High Wage Jobs by Cluster in WDA 10

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Mining	268	24	9%	188	70%
Forest Products	1,233	950	77%	144	12%
Agriculture & Food Products	4,717	373	8%	59	1%
Agricultural & Forestry Support Services	262	103	39%	9	3%
Depository Credit Organizations	1,020	765	75%	224	22%
Cluster Total	7,500	2,215	30%	624	8%
All Industries	70,074	31,026	44%	13,512	19%
Clusters as % of All Industries	11%	7%			

Table 31: Strategic Evaluation of Clusters in Region 10

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Middle Wage Jobs as % Empl.
					in Middle Wage Range	in High Wage Range							
Heating Equipment Except Warm Air Furn	41.06	317	79	51,196	n/a	n/a	0.0%	5.3%	29.2%	-7.1%	2.8%	100.0%	n/a
Mining	22.04	266	89	92,917	9%	70%	-28.6%	162.4%	221.6%	6.3%	10.4%	89.2%	0.0%
Forest Products	16.46	3,366	1,243	61,577	77%	12%	-19.7%	-12.0%	4.3%	-6.9%	1.1%	82.6%	2.8%
Agriculture & Food Products	9.58	8,907	1,008	17,471	8%	1%	-17.0%	-11.8%	9.4%	2.0%	0.0%	84.0%	n/a
Agricultural & Forestry Support Services	3.7	812	29	30,379	39%	3%	53.3%	50.4%	93.4%	12.8%	0.0%	12.5%	23.4%
Cattle Ranching	3.32	678	92	7,911	n/a	n/a	-0.4%	-51.6%	-38.1%	2.0%	0.0%	48.0%	30.4%
Colleges & Universities	2.25	1,611	94	31,422	n/a	n/a	n/a	n/a	n/a	n/a	n/a	54.0%	n/a
Depository Credit Organizations	1.54	1,063	280	21,181	75.0%	22.0%	7.5%	-2.0%	22.3%	1.5%	0.0%	0.4%	0.1%

Note: Regional employment growth rate for all agriculture applied to agriculture and food products clusters and the cattle ranching industry.

Rankings

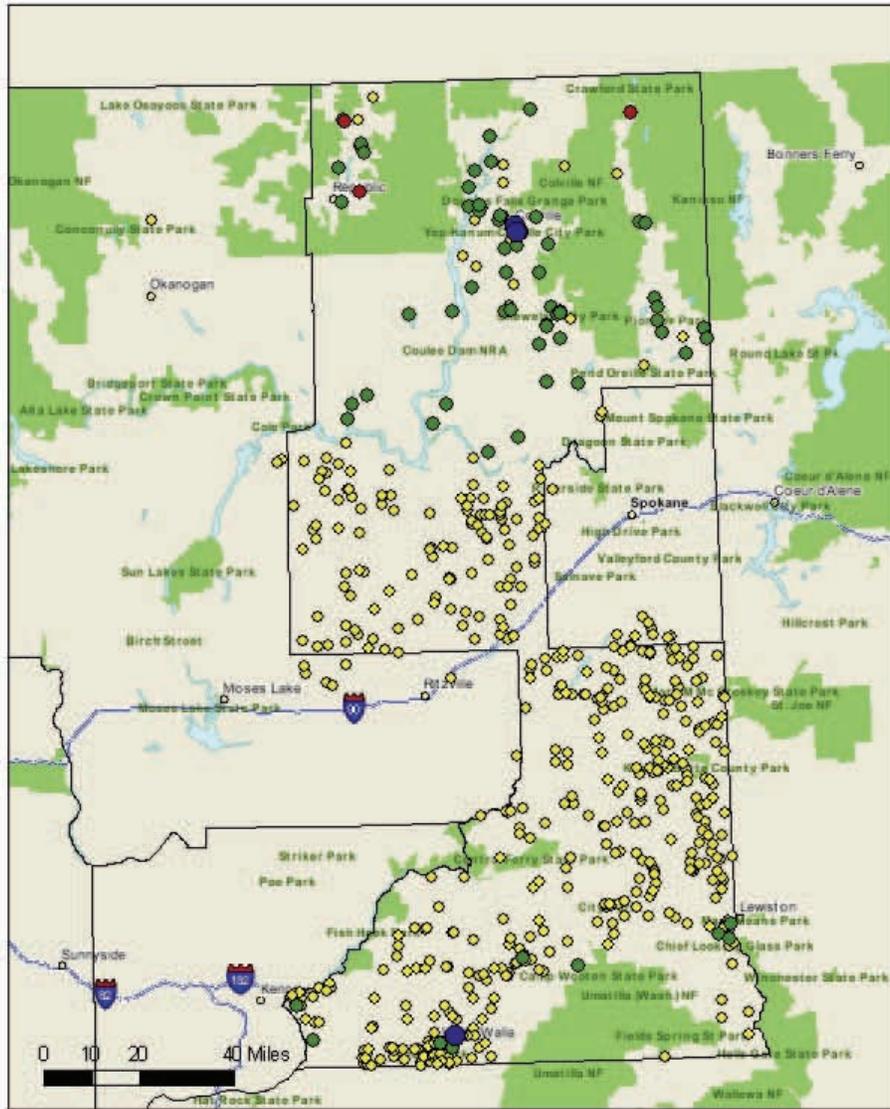
Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/Worker	Percent of Occupations		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.	Exports as % Output	Index (100-Summed Scores)
					in Middle Wage Range	in High Wage Range							
Heating Equipment Except Warm Air Furn	1	7	7	3	3	3	2	3	3	7	2	1	42
Mining	2	8	6	1	4	1	5	1	1	2	1	2	66
Forest Products	3	2	1	2	1	3	4	5	5	6	3	4	34
Agriculture & Food Products	4	1	2	7	5	5	3	4	4	3	4	3	61
Agricultural & Forestry Support Services	5	5	8	5	3	4	7	6	6	1	4	7	45
Cattle Ranching	6	6	5	8	3	3	6	7	7	4	4	6	61
Colleges & Universities	7	3	4	4	3	3	4.5	4.5	4.5	4.5	4.5	5	35
Depository Credit Organizations	8	4	3	6	2	2	1	2	2	5	4	8	49

Note: Missing values in matrix above are assigned a median rank value of 4.5.

Figure 33: WDA10 Cluster Map

Washington State WDA Region 10 Cluster Firms

- 10 Heating Equipment
- 10 Mining
- 10 Forest Products
- 10 Agriculture and Food Products



Region 11: Benton-Franklin WDA - Benton & Franklin Counties

This region brings together advanced technology and agriculture, creating a unique economic structure within this state. The Hanford Reservation is located in Benton County. The site of nuclear materials production during World War II, the Hanford Reservation now hosts a mix of nuclear waste management and advanced engineering and scientific activities. This outpost of advanced technology site in a southeastern Washington region known for many agricultural products, and the Tri-Cities area contains a number of food processing plants. The urban places in this region were founded as trans-shipment points; water, rail, and freight transportation remains an important set of economic activities today.

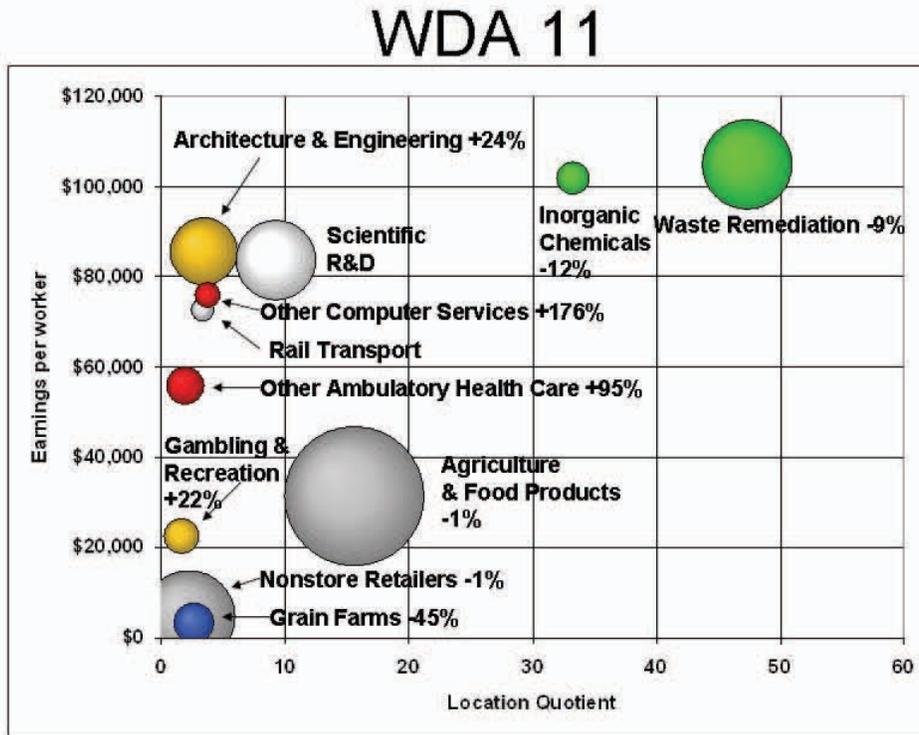
Waste remediation shows up as the cluster with the highest location quotient in this region, followed by inorganic chemicals, agriculture/food products, and scientific research and development. Agriculture/food products is the largest cluster, followed by nonstore retailing, scientific research and development, and architecture/engineering.

The data for this region show employment declines in recent years for several of the top clusters, waste remediation, inorganic chemicals, and agriculture/food products. However growth in employment is expected in these clusters out to 2016 (with the exception of scientific research and development for which no projection is provided by ESD). The second bubble chart shows data for several substantial clusters that have lower location quotients than those shown in the first bubble chart. Almost all of these clusters are expected to grow in the years ahead, with the exception of religious organizations (no data can be shown) and grain farms.

The available occupational data for 9 of this region's clusters show a higher percentage of middle wage jobs in just 3 clusters, but 5 clusters have a higher percentage of middle wage jobs than the regional average. Waste remediation and management is the highest ranked cluster overall, followed by other computer services, scientific research and development, architecture/engineering, and agriculture/food products. All of these clusters except agriculture/food products are closely tied to the waste remediation/management activities on the Hanford Reservation.

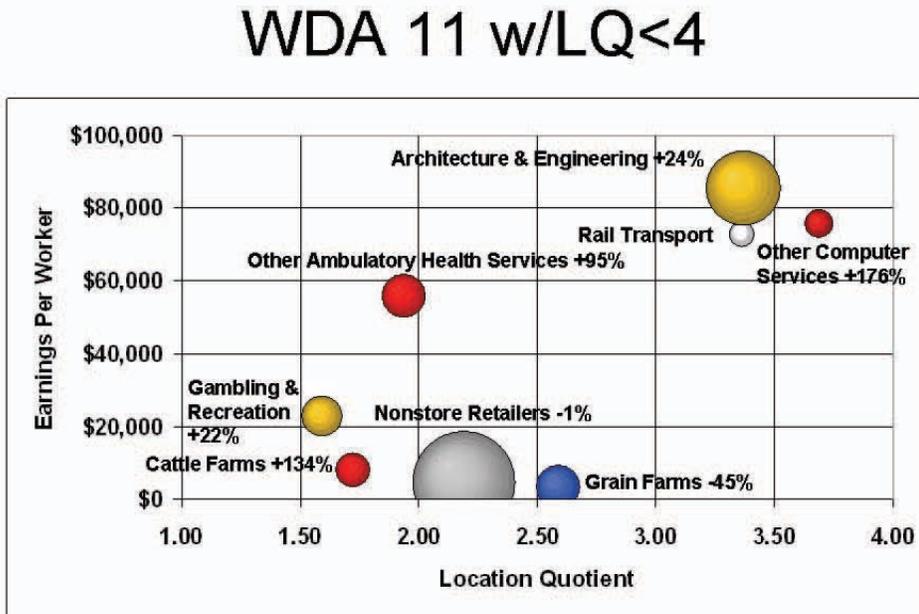
Most of this region's clusters are centered on the Tri-Cities area (with an especially dense geographic clustering of Waste/Remediation establishments), while Agriculture and Food are also concentrated to the north and west of the Tri-Cities area. The level of clustering of establishments in one region (Tri-Cities) in this region is very high relative to the other 11 WDA regions in Washington State.

Figure 34: WDA11 Cluster Characteristics



Religious Organizations Not Displayed Due To Disclosure Rule

Figure 35: WDA11 Characteristics of Additional Clusters



Religious Organizations Not Displayed Due To Disclosure Rule

Table 32: Distribution of Occupational Median Wages in WDA 11

Wage Type	Annual Wages
Mean Wages	\$ 44,091
Pct25 Wages	\$ 22,669
Median Wages	\$ 34,848
Pct75 Wages	\$ 57,902

Table 33: Middle and High Wage Jobs by Cluster in WDA 11

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Waste Remediation & Management	5,160	1,171	23%	4,194	81%
Agriculture & Food Products	14,594	1,998	14%	2,242	15%
Other Computer Related Services	633	262	41%	556	88%
Architecture & Engineering	3,477	820	24%	1,938	56%
Rail Transport	346	30	9%	49	14%
Nonstore Retail	78	58	74%	60	77%
Other Ambulatory Health Care	819	656	80%	118	14%
Gambling & Recreation	1,185	679	57%	21	2%
Cluster Total	24,288	4,339	18%	9,039	37%
All Industries	96,155	42,164	44%	13,359	14%
Clusters as % of All Industries	25%	10%			

Table 34: Strategic Evaluation of Clusters in Region 11

Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in Middle Wage Range		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.		Exports as % of Output		Middle Wage Jobs as % of Empl.
					in High Wage Range	in Low Wage Range					% Empl.	% Output	% Empl.	% Output	
Waste Remediation & Management	47.35	6,362	1,831	104,989	n/a	n/a	20.0%	-9.4%	22.5%	7.5%	32.0%	93.7%	5.4%	n/a	n/a
Other Basic Inorganic Chemical Mfg.	33.24	809	445	101,956	n/a	n/a	20.0%	-11.9%	-0.1%	n/a	n/a	84.7%	n/a	n/a	n/a
Agriculture & Food Products	15.54	14,980	2,065	31,415	14%	15%	-15.8%	-0.7%	17.0%	15.0%	2.8%	91.8%	37.9%	n/a	n/a
Scientific Research & Development	9.24	4,991	674	83,596	n/a	n/a	27.1%	175.7%	290.9%	39.8%	70.0%	96.3%	16.7%	n/a	n/a
Other Computer Related Services	3.69	511	109	75,980	41%	88%	-1.0%	23.6%	35.1%	22.1%	68.4%	74.0%	16.3%	n/a	n/a
Architecture & Engineering	3.37	3,652	530	85,567	24%	56%	14%	n/a	n/a	-0.9%	0.3%	75.6%	6.1%	n/a	n/a
Rail Transport	3.36	462	103	72,732	n/a	n/a	-25.9%	-45.1%	-41.4%	n/a	n/a	93.6%	n/a	n/a	n/a
Grain Farms	2.59	1,216	43	7,864	74%	77%	-22.8%	-0.8%	17.8%	11.5%	0.0%	54.3%	57.9%	n/a	n/a
Nonstore Retail	2.19	6,537	159	4,743	80%	14%	54.1%	95.4%	137.0%	25.4%	1.0%	49.1%	81.3%	n/a	n/a
Other Ambulatory Health Care	1.94	1,199	180	55,745	n/a	n/a	37.0%	134.0%	182.9%	4.4%	0.0%	48.0%	n/a	n/a	n/a
Cattle Farms	1.72	729	74	7,864	57%	2%	12.4%	21.7%	56.2%	6.8%	0.0%	47.7%	n/a	n/a	n/a
Gambling & Recreation	1.59	1,018	70	22,688											

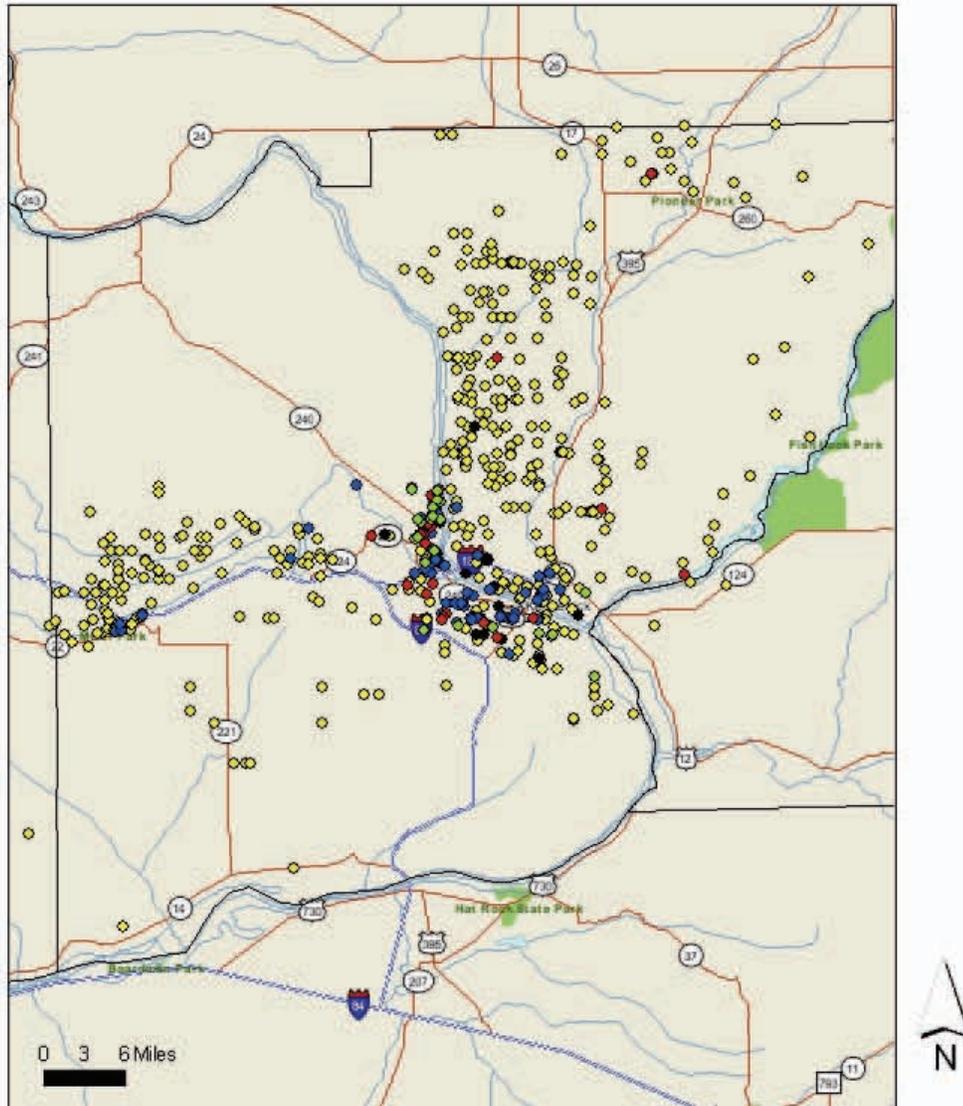
Cluster or Industry	LQ	Employment	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in Middle Wage Range		Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	R&D Occ'n. as % Empl.		Exports as % of Output		Index (120-Summed Scores)
					in High Wage Range	in Low Wage Range					% Empl.	% Output	% Empl.	% Output	
Waste Remediation & Management	1	3	2	1	4	4	4	9	6	6	3	2	45	75	
Other Basic Inorganic Chemical Mfg.	2	10	5	2	4	4	5	10	10	5.5	5.5	6	69	51	
Agriculture & Food Products	3	1	1	9	6	4	9	6	9	4	4	4	60	60	
Scientific Research & Development	4	4	3	4	4	4	6	6	6	5.5	5.5	1	53	67	
Other Computer Related Services	5	12	9	5	4	1	3	1	1	1	1	5	48	72	
Architecture & Engineering	6	5	4	3	5	3	7	4	5	3	2	8	55	65	
Rail Transport	7	13	10	6	7	5	6	6	6	9	6	7	88	32	
Grain Farms	8	6	13	11	4	2	11	11	11	5.5	5.5	3	93	27	
Nonstore Retail	9	2	7	13	2	4	10	7	7	5	7	9	80	40	
Other Ambulatory Health Care	10	7	6	7	1	6	1	3	3	2	5	10	61	59	
Cattle Farms	11	11	11	12	4	4	2	2	2	8	8	11	86	34	
Gambling & Recreation	12	9	12	10	3	7	6	5	4	7	9	12	96	24	

Note: Variables with missing data assigned the median rank.

Figure 37: WDA11 Cluster Map

Washington State WDA Region 11 Cluster Firms

- 11 Waste Remediation/Management
- 11 Scientific R&D
- 11 Architecture and Engineering
- 11 Other Specialties
- 11 Agriculture and Food Products



Region 12: Spokane County WDA

Spokane sits on the state's eastern border, and as the largest city between Seattle and Minneapolis/St. Paul, it has traditionally served as a major distribution and services center for a largely rural hinterland. This strategic position has earned this city the informal title of capitol of the "Inland Empire." The data in the charts and tables below show two clusters with quite high location quotients, aluminum sheet manufacturing and non-ferrous metals. Both of these clusters with high location quotients have been contracting in employment in recent years.

The other clusters in the county are closely bunched in the first bubble chart; hence a second bubble chart is provided with an expanded scale for these clusters. High tech manufacturing, a substantial cluster in this region, has been contracting in recent years. This cluster includes manufacturing of aircraft, communications, and computer equipment, as well as electrical signal testing and other electrical equipment. Most of the other clusters shown on this second bubble chart have been expanding, including a number of service industries and two small manufacturing industries. The bubble charts suggest a region undergoing a transformation from its traditional industrial base to a more services oriented economy.

Occupational data are available for 11 clusters in this region. 3 of these clusters have a higher percentage of middle wage jobs than the regional average, and 4 have a higher percentage of high wage jobs.

For many of Spokane's clusters, the data are very incomplete due to data suppression by ESD to protect the confidentiality of individual firms or small groups of firms in the modestly sized clusters found in the Spokane region. Therefore the strategic analysis may provide limited information. Other ambulatory health services receives the highest score, followed by high tech manufacturing, colleges and universities, and construction.

Figure 41 shows that the vast majority of the firms in these clusters are centered around Spokane, with very few in outlying areas of the region. Services establishments are highly concentrated in the downtown area of Spokane, but with other concentrations just north and east of the downtown area as well. High Technology Manufacturing establishments are clustered further to the east, in the Orchard Park and Liberty Lake areas. Other Manufacturing clusters are evident just east of downtown Spokane, though there are strong clusters to the west near the Highway 2/Interstate 90 interchange and further east near Liberty Lake.

Figure 38: WDA12 Cluster Characteristics

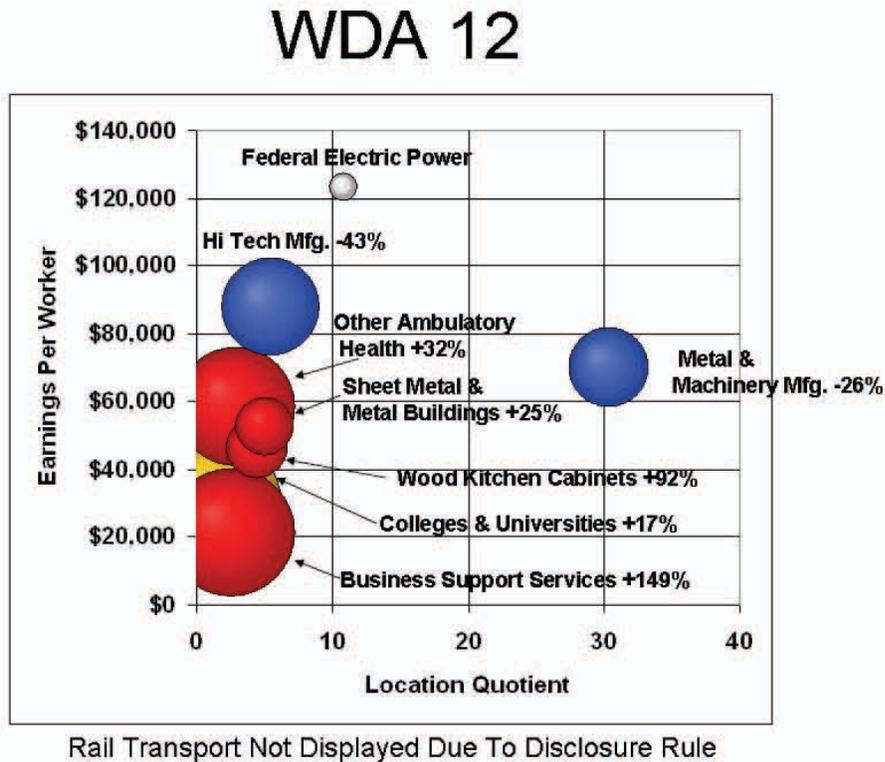


Figure 39: WDA12 Characteristics of Additional Clusters

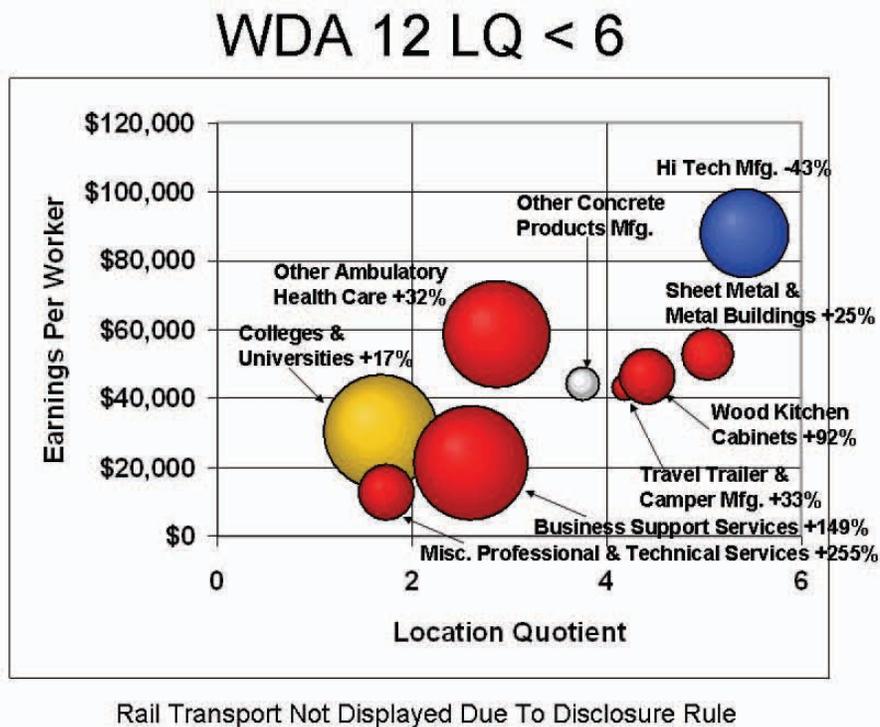


Figure 40: WDA12 Cluster Linkages

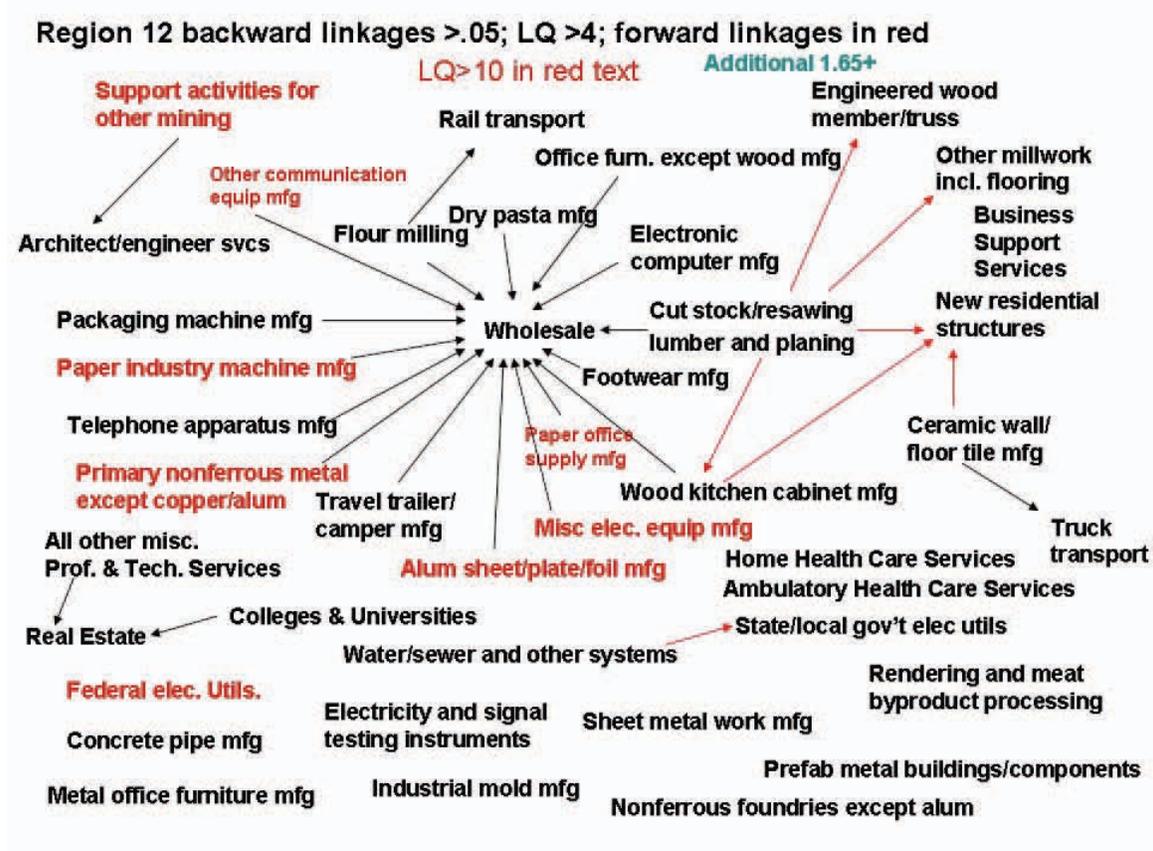


Table 35: Distribution of Occupational Median Wages in WDA 12

Wage Type	Annual Wages
Mean Wages	\$37,877
Pct25 Wages	\$22,272
Median Wages	\$31,250
Pct75 Wages	\$46,093

Table 36: Middle and High Wage Jobs by Cluster in WDA 12

Cluster	All Employment	Middle Wage Jobs	Percent Middle Wage Jobs	High Wage Jobs	Percent High Wage Jobs
Metal & Machinery Manufacturing	721	456	63%	65	9%
High Tech Manufacturing	2,895	1,313	45%	1,204	42%
Sheet Metal & Metal Bldgs	1,360	1,043	77%	197	14%
Wood Kitchen Cabinet Mfg.	1,041	958	92%	57	5%
Travel Trailer & Camper Mfg.	423	197	47%	45	11%
Other Concrete Products Mfg.	899	793	88%	94	10%
Other Ambulatory Health Services	3,230	2,223	69%	962	30%
Business Support Services	3,209	1,562	49%	277	9%
Misc. Prof. & Technical Services	1,238	312	25%	161	13%
Health Care except Other Ambulatory Health Services	22,844	9,654	42%	7,506	33%
Construction	14,436	10,054	70%	3,403	24%
Cluster Total	52,296	28,565	55%	13,971	27%
All Industries	217,461	115,991	53%	48,396	22%
Clusters as % of All Industries	24%	25%			

Table 37: Strategic Evaluation of Clusters in Region 12

Cluster or Industry	LQ	Employer	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in			Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	Occ'n. as % Empl. R&D	Exports as % Output
					Middle Range	High Range	in High Wage Range						
Metal & Machinery Manufacturing	30.32	1,667	1,018	70,446	63%	n/a	9%	-45.5%	-25.9%	-18.2%	n/a	n/a	0.966129
Federal Electric Power Services	10.86	233	149	123,670	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	29.3%
High Tech Manufacturing	5.42	2,631	2,366	88,033	45%	42%	42%	16.7%	-42.7%	-17.2%	-18.6%	30.0%	54.1%
Sheet Metal & Metal Bldgs	5.04	935	195	52,593	77%	14%	14%	0.0%	25.3%	73.9%	20.5%	0.0%	99.3%
Wood Kitchen Cabinet mfg.	4.41	1,042	139	46,382	92%	5%	5%	-25.2%	91.6%	175.8%	-7.5%	0.0%	0.4%
Travel Trailer & Camper Mfg.	4.18	263	52	43,015	47%	11%	11%	-25.0%	32.7%	73.0%	n/a	n/a	73.7%
Other Concrete Products Mfg.	3.76	355	58	44,107	88%	10%	10%	n/a	n/a	n/a	n/a	n/a	n/a
Other Ambulatory Health Services	2.86	3,783	587	58,542	69%	30%	30%	31.8%	32.3%	70.5%	25.4%	1.0%	49.1%
Business Support Services	2.60	4,418	227	21,499	49%	9%	9%	35.7%	149.3%	184.4%	17.8%	0.7%	9.9%
Misc. Prof. & Technical Services	1.74	1,106	350	12,772	25%	13%	13%	202.4%	255.0%	318.7%	42.1%	2.2%	69.9%
Colleges & Universities	1.68	4,188	240	30,360	n/a	n/a	n/a	-6.7%	17.1%	43.6%	n/a	n/a	40.9%
Health Care except Other	1.40	24,368	2,085	55,104	42%	33%	33%	-4.7%	46.7%	119.2%	22.4%	0.005288	25.5%
Ambulatory Health Services	1.17	16,539	2,056	48,790	70%	24%	24%	14.5%	30.4%	55.4%	8.1%	1.5%	14.0%
Construction													

Cluster or Industry	LQ	Employer	Output (\$ millions)	Earnings/ Worker	Percent of Occupations in			Chg Est 01-07	Chg Empl 01-07	Chg Wage 01-07	Projected Employment Increase 2006-16	Occ'n. as % Empl. R&D	Exports as % Output
					Middle Range	High Range	in High Wage Range						
Metal & Machinery Manufacturing	1	7	4	3	6	6	9	11	10	11	4.5	4.5	2
Federal Electric Power Services	2	13	10	1	6	6	6	6	6	6	4.5	4.5	8
High Tech Manufacturing	3	6	1	2	9	1	1	1	4	10	8	1	5
Sheet Metal & Metal Bldgs	4	10	9	6	3	3	5	6	8	5	4	7	1
Wood Kitchen Cabinet mfg.	5	9	11	8	1	1	11	10	3	3	7	8	12
Travel Trailer & Camper Mfg.	6	12	13	10	8	7	7	9	5	6	4.5	4.5	3
Other Concrete Products Mfg.	7	11	12	9	2	2	8	6	6	6	4.5	4.5	6.5
Other Ambulatory Health Services	8	5	5	4	5	5	3	3	6	7	2	4	6
Business Support Services	9	3	8	12	7	7	10	2	2	2	5	5	11
Colleges & Universities	10	8	6	13	11	11	6	1	1	1	1	1	4
Misc. Prof. & Technical Services	11	4	7	11	6	6	6	8	9	9	4.5	4.5	7
Construction	12	1	2	5	10	2	2	7	4	4	3	6	9
Health Care except Other	13	2	3	7	4	4	4	5	7	8	6	3	10
Ambulatory Health Services													

Note:
Variables with missing data assigned the median rank.

Spokane County and Kootenai County

The table below contains location quotients for sectors concentrated in Spokane County, and in Kootenai County ID, which is located east of Spokane County. In most sectors that are concentrated in Spokane County there are low levels of location quotients in Kootenai County. However, there are cases where sectors are concentrated in both counties. These include support activities for other mining (29), water & sewage systems (32), cut stock – resawn lumber (118), primary nonferrous metals except copper & aluminum (215), industrial mold manufacturing (279), miscellaneous electrical equipment manufacturing (343), office furniture except wood (370), and other miscellaneous professional services (450). Weaker concentrations in Idaho are found in concrete pipe manufacturing (194), other aircraft parts manufacturing (353), and other ambulatory health care (466). Much stronger concentrations are found in Kootenai County than in Spokane County in cut stock – resawn lumber (118), miscellaneous electrical machinery manufacturing (343), and office furniture except wood (370).

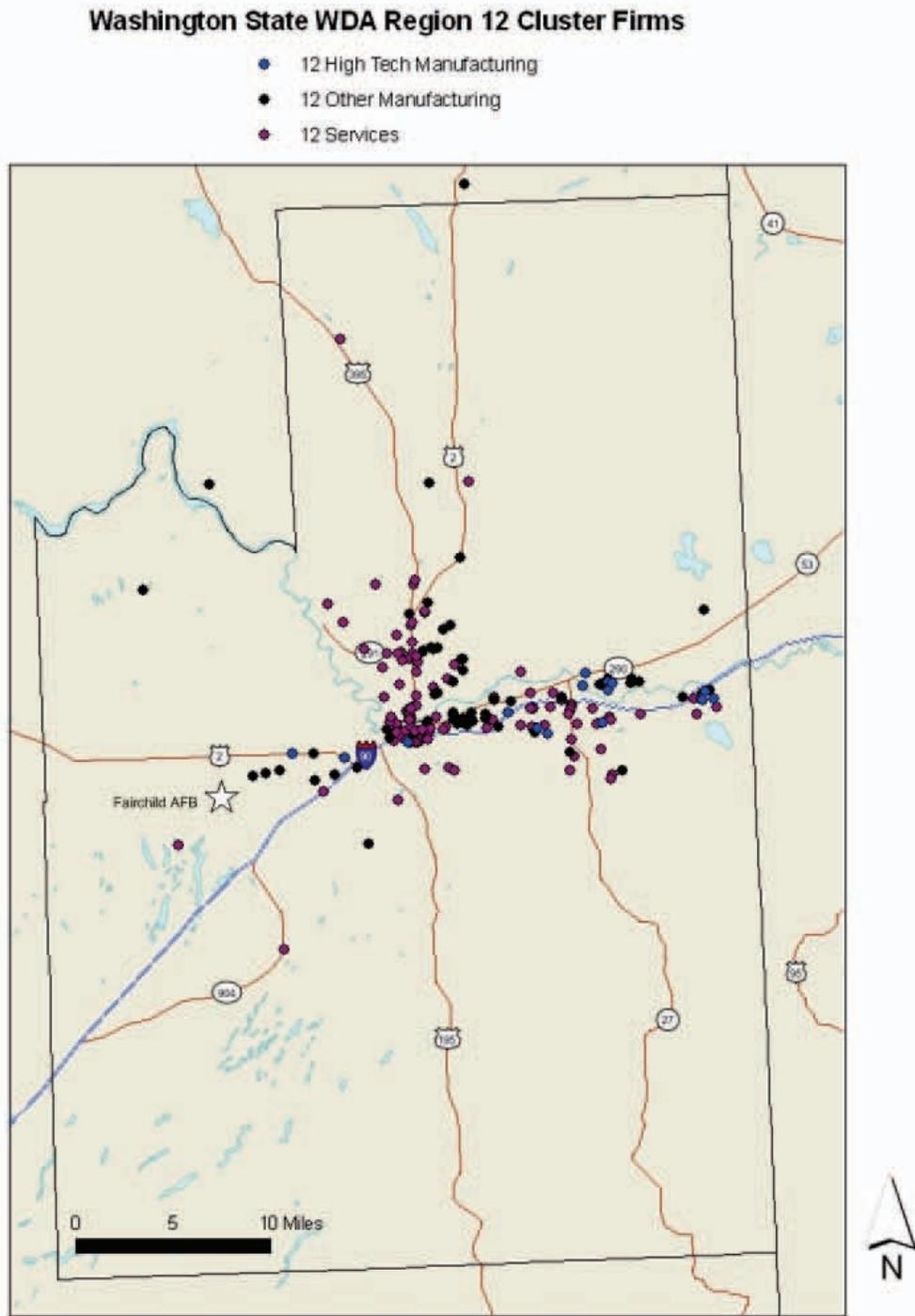
Table 38: Spokane and Kootenai County Location Quotients

NAICS	Description	Spokane LQ	Kootenai LQ
29	Support activities for other mining	9.19	4.16
32	Water- sewage and other systems	3.59	2.52
48	Flour milling	3.95	0.00
69	Rendering and meat product	3.71	0.00
76	Dry Pasta mfg.	8.07	0.00
110	Footwear Mfg	48.33	0.00
118	Cut stock - resawn lumber	3.70	21.83
131	Die-cut paper office supplies	9.66	0.00
186	Ceramic wall & floor tile	8.08	0.00
194	Concrete Pipe Mfg.	4.33	1.91
211	Aluminum sheet / plate	28.89	0.00
215	Primary nonferrous metals ex copper & aluminum	43.94	15.93
223	Nonferrous foundaries ex. Aluminum	8.10	1.07
232	Prefabricated metal buildings	4.83	0.00
236	Sheet metal work	4.13	0.22
264	Paper Industry Machinery	11.56	0.00
279	Industrial Mold Mfg.	2.88	2.94
297	Packaging machinery mfg.	5.68	0.00
302	Electronic computer mfg	4.27	0.00
306	Telephone apparatus mfg.	5.93	0.00
308	Other communications eq. mfg.	10.19	0.00
318	Electricity & signal testing eq.	7.08	0.00
343	Misc. Electrical Eq. Mfg.	9.19	17.22
353	Other Aircraft Parts Mfg.	3.17	1.34

Table 38 continued

NAICS	Description	Spokane LQ	Kootenai LQ
349	Travel Trailer & Camper Mfg.	3.66	0.51
362	Wood kitchen cabinets	3.71	0.87
365	Metal Household Furniture Mfg.	2.94	0.00
370	Office Furniture ex. Wood	3.26	41.92
392	Rail Transportation	3.62	0
450	Other Misc. Prof. Services	2.56	15.28
455	Business Support services	2.68	0.69
462	Colleges & Universities	1.60	0.00
464	Home Health Care	1.23	3.12
466	Other Ambulatory Care	2.26	1.64
495	Federal Electrical Utilities	8.81	Data not available

Figure 41: WDA12 Cluster Map



IV. Statewide Findings and Conclusions

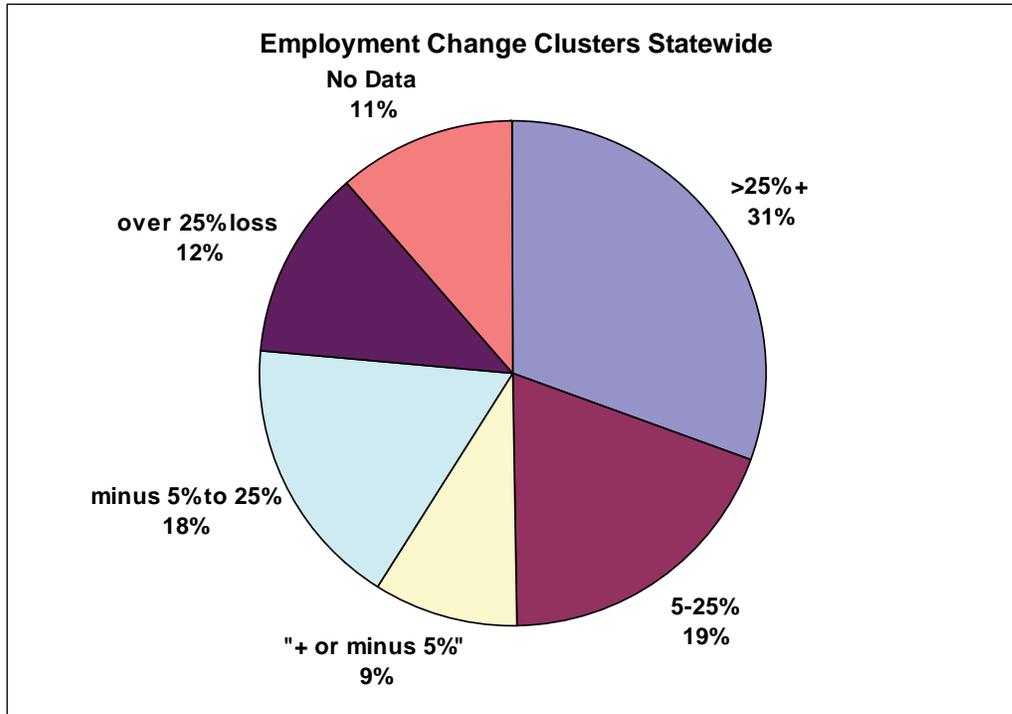
This last section presents some statewide findings, and provides some brief concluding comments. The statewide findings are based on one key indicator for regional economies—employment. Future research could develop other aggregate measures of statewide performance by cluster groups.

Statewide Findings

We provide some conclusions about overall patterns displayed in the complex diagrams and tables contained in this report, as evidenced by one measure of importance to local economic development officials and interests--employment. As discussed in Appendix I, it has been argued by the scholarly community that clusters are related to positive rates of growth in regions. How does this analysis support this argument? We now present some limited data on this question; much more research could be done to tease out from the data presented in this report answers to this question.

Figure 42 below shows the frequency distribution of employment change in clusters across the twelve Workforce Development regions. This pie-chart is a simple tabulation of the classification of the bubbles in the bubble charts for each region. Eleven percent of the clusters did not have data on employment change. If we disregard these clusters, it is clear that more regions had clusters with growing employment levels than regions with declining employment levels. This finding supports the general notion of clusters as a basis for economic development strategies. However, it fails to address the

Figure 42: Employment Change in Clusters Statewide



size or importance of the cluster in regional economies. Another perspective is gained in Figure 43, which shows for clusters by Workforce regions the distribution of clusters by growth trend over 2001-2007. This figure provides a more complex report on the cluster concept across the Workforce regions.

Figure 43: Cluster Employment Change Frequencies

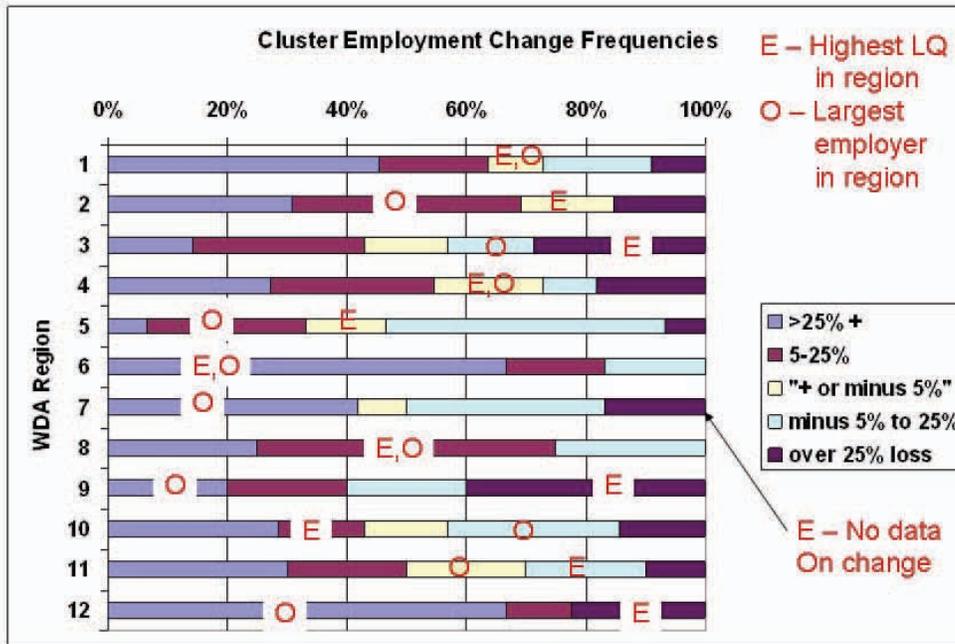
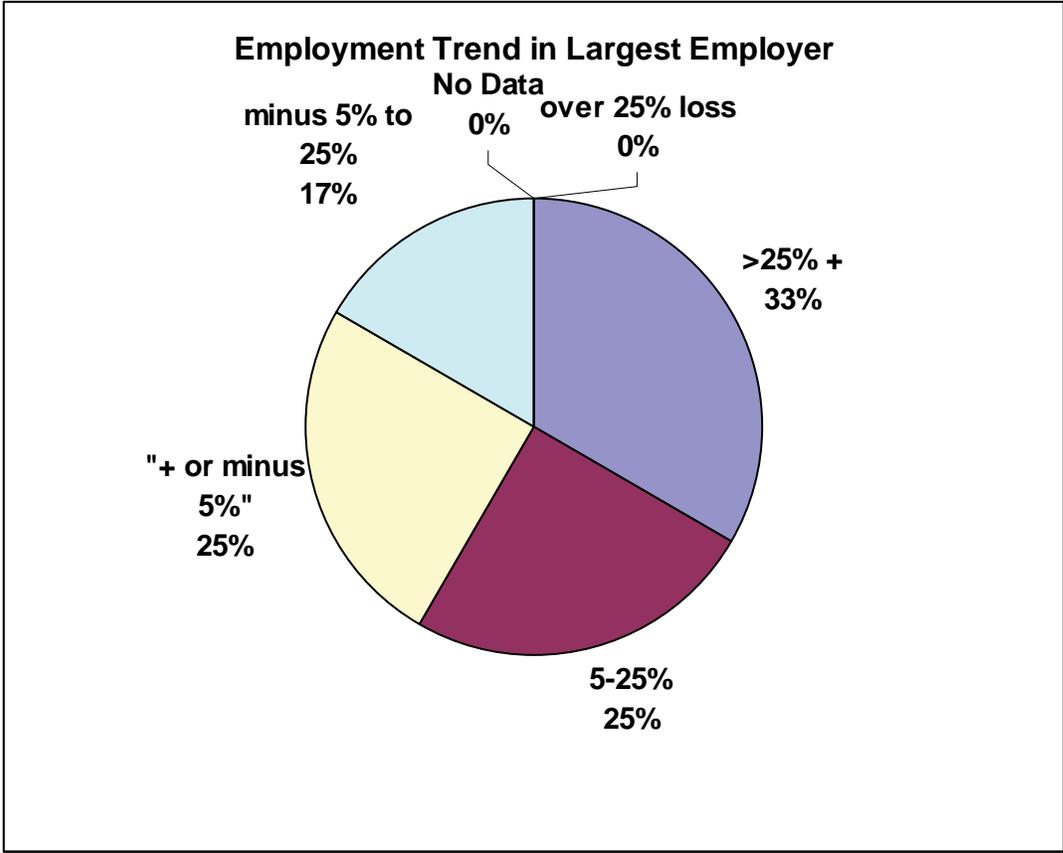


Figure 43 shows the share of clusters in each Workforce Region with valid data on employment change. The letter E indicates the class interval in which the largest location quotient is found in each region, while the letter O indicates the largest cluster as measured by employment in each region. This figure reports a more complex pattern than found in Figure 42. Regions 1, 2, 4, 6, 8, and 12 show a domination of growth in employment across clusters. Regions 3, 7, 10 and 11 are split between growth and decline.

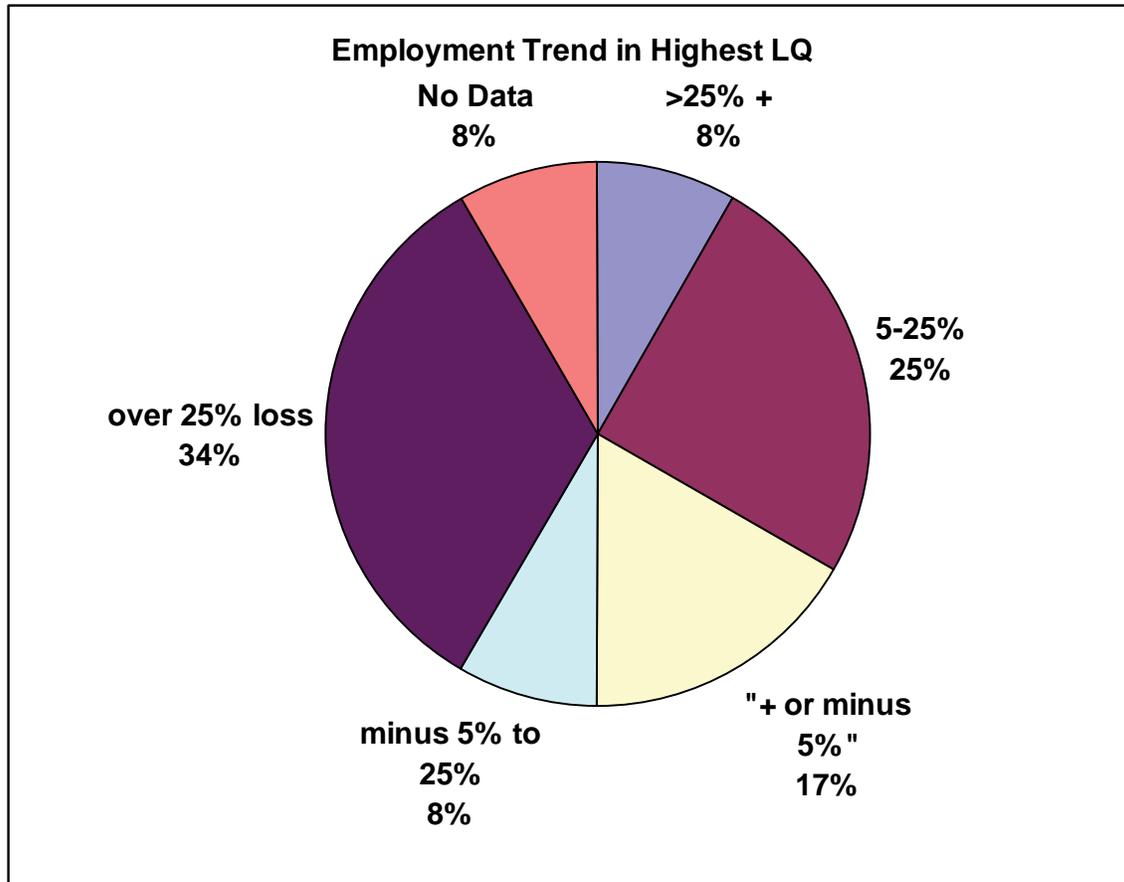
Figure 44 reports the frequency of employment trends for the largest employer in each workforce region. This figure indicates that most of the regions largest employer had employment gains over the 2001-2007 time period. Only 2 regions had losses of over 5% in their largest employer.

Figure 44: Employment Trend in Clusters with the Largest Employment



Another perspective on cluster employment trends is presented in Figure 45. This figure reports the distribution of employment trends in the sectors with the highest location quotients in each workforce region. Here we can see that only one-third of the regions had their most concentrated industries with growth over 5%, while more regions had losses of at least 5% in their most concentrated sector. It should be noted that in some regions the most concentrated industry was not a very large employer. The strategic analyses presented in Section III dissects these trends in more detail at the regional scale.

Figure 45: Employment Trend in Clusters with the Highest LQ



Regions in the Washington economy are strongly dependent upon many different sectors. The linkage diagrams indicate many “isolates,” sectors with concentration but not linkages with other sectors that are significant. Are these “clusters” within the framework of the Porter model? We cannot test this entirely in this project, as we do not have data on nontraded interdependencies and other significant aspects of external economies presumed to be important to these sectors. However, we can assume, based on our understanding of relationships across industry lines in this state that are not easily captured with available statistical data, that there are significant non-traded interdependencies and external economies for many of the isolates we identify in the charts above:

- non-store retailers in region 5 – many links to information technology companies, reliance on the IT labor pool in King/Snohomish counties
- wine in regions 10 and 11 – research and development, and workforce ties to local higher education institutions
- architecture/engineering and scientific R&D in region 11 – part of the complex of companies developing technologies and infrastructure for radioactive waste management on the Hanford reservation.

Readers with detailed knowledge of other isolated industries in the other nine regions can probably supply more examples of interdependencies that we could not capture with the available data. A recent test of the Porter model in the United Kingdom

came to a similar conclusion. In this paper the authors found a similar pattern as we have found, and they suggest that the main ties in clusters may be in the form of untraded interdependencies⁶.

An intriguing pattern is also present in the wage distribution data. There is a great deal of suppression in the occupational data files due to application of the federal confidentiality rule at the individual occupation level, which may limit the validity of this finding. However, in seven of the twelve regions, the identified clusters have a relatively high percentage of jobs in occupations with median wages greater than the regional average. Significant cluster strength appears to be a key to relatively high wages for working men and women. A higher percentage of high wage jobs is found in just four of the twelve regions, indicating that very high wages are frequently found in industries that do not have significant competitive strength or strong inter-industry ties.

Concluding Comments

This report presents insights into the industrial specialties of the Workforce Development Areas in Washington State on a multidimensional spectrum. The data requirements for this project were a challenge, but we were able to develop good measures of industry clusters in all of the WDA regions. The linkage diagrams, bubble charts, strategic analysis, and maps each provide perspective on industry clusters across the state. Clearly, much more work could be done to develop detail on clusters in WDA regions. Especially important would be evidence related to the role of “non-traded interdependencies” and institutions.⁷

What can we conclude about the analyses reported for the twelve WDA regions in Washington State from this analysis? What does the measurement strategy employed here reveal statewide about these regions? Were the input-output model linkage measures, location quotients, earnings measures, and growth measures reported on the bubble charts robust ways of depicting industrial specialties in these regions? Does the prioritization of clusters seem intuitive, given local knowledge about these regions? Do the maps help crystallize where these sectors are located? We cannot answer these questions. People in the WDA regions will have to take the data presented in this report and take them to another level of understanding, given local knowledge about their region. However, given our general knowledge of the structure of the state economy, we feel as though this analysis has produced an understanding of regional structure that is useful, rich in detail, and indicative of clusters in which these regions have positions of competitive advantage.

This project is rooted in data for a specific time period, and the results are tied to it. Regional economies change over time, and it is important to revisit estimations of the type reported here. Concentrations of large industries in regional economies change slowly over time, while new smaller sectors may arise and disappear quickly. Average

⁶ Frank McDonald, Qihai Huang, Dimitrios Tsaglis, and Heinz Josef Tüselmann (2007) “Is there evidence to support Porter-type Cluster Policies,” *Regional Studies*, Vol. 41, No. 1, pp. 39-49.

⁷ Storper, op.cit.

earnings levels of existing sectors, and other data estimated in this project through the use of IMPLAN and ESD data will change each time these data are computed. Thus, it will be important for agencies interested in analyses of this type to revisit their estimation from time to time.

Appendix I: Methodology

The motivation for this project is the very popular notion that regional competitive advantage is rooted in “industry clusters,” agglomerations of businesses in selected industries within regions. If there is evidence that a region has a strong concentration of such industries, it can be presumed that there is some basis for comparative advantage. This comparative advantage could be evidenced by multiple measures of concentration—such as employment levels, sales levels, and value added. The work of Michael Porter is frequently cited as a foundation for the cluster approach. In a recent paper he writes:

“We define clusters as a geographically proximate group of interconnected companies, suppliers, service providers and associated institutions in a particular field, linked by externalities of various types.⁸”

This definition was operationalized by Porter through an analysis of industry distributions at two levels: states and Bureau of Economic Analysis Economic Areas. The analysis relied on use of input-output data to identify linkages, and correlation analyses for measurement of concentration. Concentrations of industry in specific geographic regions can be measured through the use of indices such as location quotients. Connections between industries can be revealed through the use of input-output data. However, many of the more subtle dimensions of the Porter framework—especially the role of institutions and external economies—are not easily measured through the use of off-the-shelf quantitative measures.

There is a large literature focused on industry clusters, agglomeration, and regional development. We will touch on several themes in this research, but do not develop an extensive review of this literature.

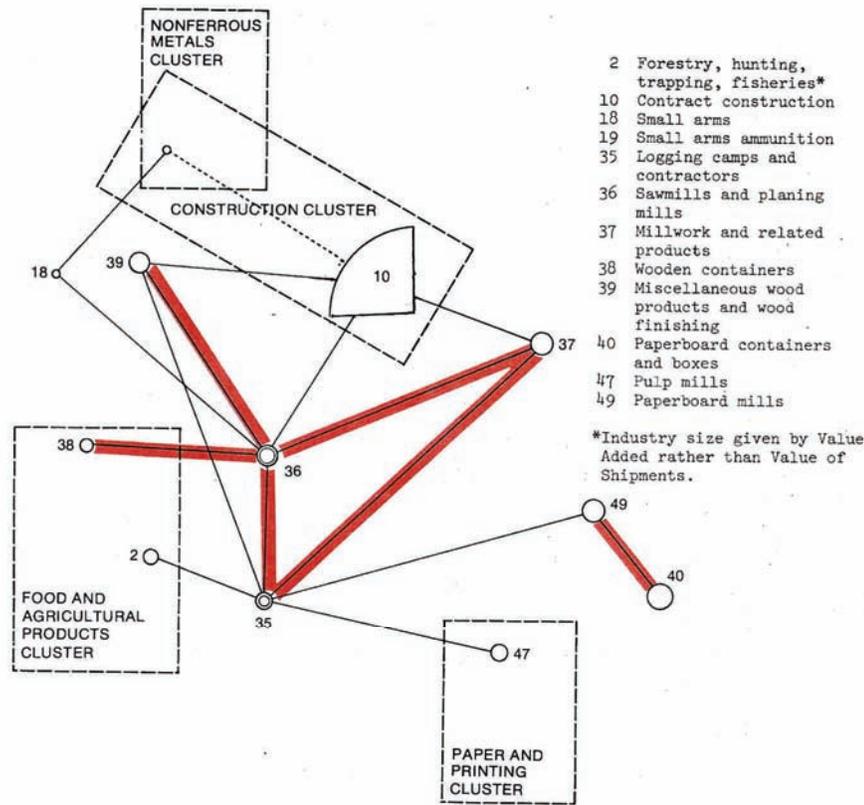
Back in the 1970’s geographers and regional scientists began to explore the measurement of linked industries and their geographical distribution through the use of input-output data. One of the pioneering pieces of research along these lines was undertaken by Czamanski.⁹ He developed diagrams of industry clusters based on the U.S. input-output table, examining patterns of forward and backward linkages. Linkage diagrams like Figure 2 were developed for sixteen industry complexes. Czamanski then went on to explore the geographical distribution of these clusters, developing data for 196 Standard Metropolitan Statistical Areas (SMSA’s), with underlying information on 162 industries in these regions. This analysis led to the identification of “spatial industrial complexes” where linked sectors in the national analysis were found in spatial proximity to each other in significant concentrations.

⁸ Michael E. Porter, “The Economic Performance of Regions,” *Regional Studies*, Vol 37 No. 6&7, p. 562

⁹ Stan Czamanski, (1974) *Study of Clustering of Industries*. Dalhousie University; Institute of Public Affairs; Stan Czamanski (1976) *Study of Spatial Industrial Complexes*. Dalhousie University, Institute of Public Affairs.

Figure A1: Czamanski's Industry Cluster Diagram

WOOD AND WOOD PRODUCTS



S. Czamanski - 1973

Source: Czamanski 1976, p. 66.

Czamanski's early work spawned a literature on "spatial linkages," as scholars tried to extend his pioneering research with improved computing capability and in some cases survey data.¹⁰ However, another mode of analysis also became fashionable in the 1980's, epitomized by the work of Allan Scott¹¹. In this work Scott emphasized the urban agglomerations of sectors such as motion pictures and high tech, as evidenced by

¹⁰ Streit, M.E., "Spatial Association and Economic Linkages Between Industries," *Journal of Regional Science*, IX, No. 2, August 1969, pp. 177-188; Richter, Charles E., "Industrial Linkages and Geographic Association," *Journal of Regional Science*, IX, No. 1, April 1969, pp. 19-28.

¹¹ Allen Scott (1988) *Metropolis: From the Division of Labor to Urban Form*. Berkeley: University of California Press.

maps showing high degrees of clustering. This work did not rely on linkage evidence, such as developed in input-output models, but rather focused on the types of external economies presumed to be associated with these agglomerations. Influenced very much by work on industrial districts found in Europe, Scott and others started work documenting some of these structural aspects, including the seminal paper of Storper and Christopherson documenting the vertical disintegration of the motion picture industry, as producers moved from large studio complexes with almost self-contained production systems, to fragmented clusters of specialists assembled for a particular film project¹².

Storper continued the development of concepts surrounding the interaction of participants in these agglomerations that went beyond transactional relationships. He developed the notion of “untraded interdependencies” to capture these institutional aspects that gave competitive advantage to producers in regions with strong industry agglomerations¹³. Other regional development specialists have also called attention to these structural characteristics, but at the heart of much of this literature is the presumption that industry agglomerations are characterized by a dense web of interindustry relationships, in addition to the “buzz” that is in the air when competitors and collaborators are spatially concentrated¹⁴.

The present project has its foundations in this rich literature on linkages and agglomerations, and it measures some of the key attributes considered in the industry cluster literature for regions in Washington State. So far as we are aware, this report provides the first empirically-based identification of regional clusters in Washington State based on measurements of industry strength and inter-industry linkages. Prior work on clusters in this state has examined the strength within Washington of clusters that were defined at a national level,¹⁵ or has provided very detailed examinations of clusters defined at a local level through discussions with cluster participants.¹⁶ In addition, the

¹² Michael Storper & Susan Christofferson, "Flexible specialization and regional industrial agglomeration: the case of the U.S. motion picture industry," *Annals of the Association of American Geographers*. Vol. 77(1) pp. 104-177.

¹³ Michael Storper (1997) *The Regional World: Territorial Development in a Global Economy*. New York: Guilford Press.

¹⁴ Rosenfeld, Stuart A. (2002) *A Governor's Guide to Cluster-Based Economic Development*, prepared for the National Governor's Association, Washington, D.C.; Jacobs, Jane (1961), *The Death and Life of Great American Cities*, New York: Random House; Florida, Richard (2002), *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. New York, Basic Books, 2002; Sommers, Paul and Dan Carlson, (2000), *Ten Steps to a High Tech Future: The New Economy in Metropolitan Seattle*. Washington D.C.: The Brookings Institution.

¹⁵ Sommers, Paul. *The Cluster Approach to Economic Development*. Seattle: Concept Paper for the Washington Office of Trade and Economic Development by the Daniel J. Evans School of Public Affairs, November 30, 2000; Sommers, Paul. *Cluster Strategies for Washington*. Report for Office of Trade and Economic Development by the Daniel J. Evans School of Public Affairs, December 2001; Sommers, Paul. and Deena Heg. *Occupational Supply and Demand by Industry Cluster and Region*. Olympia, WA: Report for the State Board for Community and Technical Colleges and the Workforce Training and Education Coordinating Board by the Daniel J. Evans School of Public Affairs, University of Washington, October 2002.

¹⁶ Beyers, William, et al. (2003) *Seattle Music Industry Cluster Study*, Prepared for the City of Seattle Office of Economic Development; Sommers, Paul and Derik Andreoli, *Seattle's Maritime Cluster: Characteristics, Trends and Policy Issues*. Seattle: Report for City of Seattle Office of Economic

Puget Sound Regional Council published a report identifying 15 clusters in the four county Puget Sound region, but the report does not make clear how these clusters were identified.¹⁷ In this report, we identify strong and relatively large industries in each region, and assess the strength of the connections these industries have to other industries within the same region. Very strong or relatively large industries and those with strong inter-industry linkages are identified as clusters. Using maps, we show the spatial agglomeration of these industry groupings or “clusters.” Finally, we offer data on several characteristics of these clusters that may give them strategic value in relation to the mission of several economic development and workforce-oriented state agencies.

The importance of a cluster with evidence of concentration may be tempered by other factors—such as change in level of concentration in recent years or level of earnings per laborer. In this project we have endeavored to speak to these dynamics of clusters, as well as to identify them in the twelve WDAs in Washington State. We have structured our report to give emphasis to the distinctive qualities of each WDA. Several clusters turn out to be common to many WDAs, and we present data for them in statewide maps.

For each WDA we identified concentrations of industries at a detailed NAICS¹⁸ level and used a threshold basis for determining which of these should be the subject of more detailed analysis. For the selected industries, we developed measures of earnings, employment, historical and projected future change in employment, exports, and innovation potential. Results of these analyses are reported in Section III for each WDA. In Section II we describe in more detail the data sources and methods used in this study.

Data Sources

The RFP called for the use of four-digit NAICS codes as the level of detail for the analyses to be conducted in this study. It also called for multiple dimensions to be measured using these detailed NAICS codes. We made a data request to the Washington State Employment Security Department (ESD) for data on the number of establishments, employment, and wages paid by each four-digit NAICS code industry in each of the 12 WDAs. In addition, recognizing that the inter-industry linkage analysis described below would require very detailed data on inter-industry purchases and sales within Washington, we prepared input-output models for each WDA using the IMPLAN® model.¹⁹ The IMPLAN-supplied database provides an independent set of employment

Development by Daniel J. Evans School of Public Affairs, University of Washington, draft, November 2003.

¹⁷ Economic Competitiveness Group and Global Insight (2005), *Economic Analysis of the Central Puget Sound Region*, Vol. II of the Regional Economic Strategy, report for Puget Sound Regional Council, Seattle, WA, p. 26.

¹⁸ NAICS refers to the North American Industry Classification System, a typology for classifying industries. NAICS is used by federal and state agencies for reporting employment and other economic statistics. See <http://www.census.gov/epcd/www/naics.html> for a complete explanation of this system.

¹⁹ IMPLAN is an input-output modeling system developed by the Minnesota Implan Group (see www.implan.com). The IMPLAN system allows users to create single county or multiple county models within any U.S. state. These models describe inter-industry purchases and sales within the region the user specifies, and are typically used for economic impact analyses.

estimates at a level of detail that in many industries is equivalent to, or even more detailed, than the ESD dataset of 4-digit NAICS industries. IMPLAN provides data on up to 500 industries, as many as are present in the region a user specifies; the ESD data covered approximately 315 industry categories. The greater detail available in the IMPLAN database, along with other critical factors such as the inclusion of government-owned enterprises (e.g., electric power generation and distribution utilities, and the Puget Sound Naval Shipyard) as separate industries, led to a decision to rely mostly on the IMPLAN data in conducting the analysis, supplementing the IMPLAN data with the ESD data for factors such as the number of establishments in an industry, the change in establishments, employment, and wages over time; and the proportion of employment in an industry within R&D occupations. This decision was reinforced by a very compressed schedule for completing the project; the IMPLAN data were available immediately but access to the ESD data, which include confidential information not normally released to independent analysts, required approval of a data sharing agreement which took several weeks to accomplish.

We carried out a correlation analysis to verify that the IMPLAN and ESD data provided similar estimates of employment levels, and that we could rely on IMPLAN output estimates in calculating location quotients to assess industry strength or comparative advantage. We calculated Pearson correlations among employment level, wage level and establishment count using the ESD data for four of the WDAs. In each WDA the correlations among number of establishments, employment, and wage level is above .96. In addition, employment and output in the IMPLAN dataset are highly correlated, with similarly high correlation coefficients. Due to classification differences between the IMPLAN sectors and the NAICS categories, the correlation between IMPLAN's measure of employment and the ESD measure of employment is lower, about .6, but still highly significant.

Accordingly, we used IMPLAN data to identify strong industries as well as to identify the linkages among industries in each WDA. Use of a single data source for both assessing industry comparative advantage and linkages to other industries minimizes errors due to classification differences between IMPLAN sectors and the NAICS categories used by ESD. The ESD data is then used in describing the characteristics of each cluster, and in suggesting ways of measuring the strategic value of clusters.

Location Quotients

We also were asked to use an input-output model to identify linked industries that are concentrated in the WDAs. The RFP specified use of a metric commonly used by regional economists and geographers to assess the relative strength or comparative advantage of an industry – the location quotient. Location quotients (LQs) compare the proportion of regional employment in a particular industry to the same proportion nationally. If a region within Washington has a higher percentage of regional employment in an industry such as wood products than the nation does, the ratio of these two percentages is a number greater than 1. LQs greater than 1 suggest that the region must be exporting some of its product and therefore it must have comparative advantage.

Very high LQs show the distinctive strengths of a region, and Washington State has a number of industries that have extremely high LQs measured at a sub-state regional level.

The clear options for the linkage task were the 2002 Washington input-output model, or the IMPLAN modeling system. The 2002 Washington input-output model was developed with 50 sectors of detail, mostly at the two-digit NAICS level of detail. This is much less detail than sought by the Workforce Board. However, we also had access to the IMPLAN system, and used its software to develop inter-industry transactions matrices for all twelve WDAs. The Appendix presents a concordance matrix, or “crosswalk,” between the IMPLAN sectoring scheme and ESD four-digit NAICS codes. The IMPLAN model is based on the 500+ sector benchmark U.S. input-output tables, and clearly produces greater than 4 digit levels of industry detail in many sectors. The IMPLAN system also produced estimates of output, employment, wages & salaries, proprietors income, domestic and foreign exports, and several other measures for each sector.

Using the IMPLAN software, we developed input-output models for each of the 12 WDA regions. For each region, we extracted reports on output and employment for each industry listed in the model for that region, as well as the sales and purchase coefficients for the industries in each region. We then calculated location quotients for each of the IMPLAN sectors for all twelve regions across the various measures produced by the IMPLAN system. This task was completed several weeks before ESD was able to supply us with their data. The IMPLAN input-output models and location quotients based on the IMPLAN system were the primary data used to identify:

- (1) sectors with strong concentrations in given WDAs,
- (2) and among those sectors with strong concentration (high LQs) in each region, sectors that were strongly linked to each other.

The RFP suggested that sectors with LQ’s greater than 1.1 or 1.2 might be used to define concentrated industries. We undertook an analysis of the distribution of the LQ values in all 12 WDAs using the IMPLAN data. Table 1 below summarizes the results of this analysis. It shows that across all 12 WDAs, 79.4% of the location quotients were with values of 1.0 or less, while 12% had values between 1 and 2. After some experimentation, we decided to identify approximately 5% of the sectors in each region with a location quotient threshold; this threshold is shown in Table 1 as the values colored in yellow. A second round of sectors was added to the cluster diagrams in Section III, with lower location quotients than the thresholds discussed in this paragraph. These added industries are relatively large industries that accounted for at least 1.46% of output in each region, but which had location quotients somewhat below our threshold value for each region but greater than 1.0. These added sectors ensure that all relatively large sectors within each region are included in the results below.

Correlation between IMPLAN Location Quotient Measures

Alexander and Lindbergh²⁰ have documented the strong correlation between alternative measures of economic activity in particular geographic regions. We anticipated that there would be a strong correlation between the location quotient values we calculated for the sectors in the various WDAs. Based on this analysis and the assurance provided by Alexander and Lindbergh's classic analysis of this issue, we chose to use just one of these measures (sales or output) as the basis for identifying the sectors that were considered to be concentrated in each WDA.

Table 2 below shows Spearman correlations for the location quotient values in one of the WDAs, Clark County. This table was calculated in SPSS, using values for sectors with valid data, and values greater than zero. It is evident from this table that every measure calculated is significantly correlated with every other measure, at the .000 significance level—a remarkable level of agreement—and a strong defense of our decision to use only one of the IMPLAN measures (output) for identification of concentrated industries.

We did not calculate identical tables for the other eleven WDAs, but it is virtually certain that they too would show this every high level of correlation. While all of the values in Table 2 are highly significant, the values for proprietors income do have a lower but still highly significant correlation with the other measures.

²⁰ Alexander, J. & J. Lindberg (1961) "Measurements of Manufacturing: Coefficients of Correlation," *Journal of Regional Science*, Vol. 3, No. 1, pp. 71-81.

Table A1: Distribution of Location Quotient Values (Output used as measure)

LQ	WDA1	WDA2	WDA3	WDA4	WDA5	WDA6	WDA7	WDA8	WDA9	WDA 10	WDA 11	WDA 12	Sum	% of Total	Cumulative
Up to 1	405	381	418	405	410	372	378	411	393	404	420	356	4753	79.38%	91.50%
>1 to 2	59	77	36	63	63	85	65	46	58	42	43	89	726	12.12%	93.09%
>2 to 2.5	9	9	6	7	4	10	16	3	7	10	4	10	95	1.59%	94.37%
>2.5 to 3	6	6	8	5	8	8	5	6	5	5	5	10	77	1.29%	95.74%
>3 to 4	4	7	14	5	4	6	8	7	7	6	9	5	82	1.37%	96.59%
>4 to 5	3	4	4	0	3	8	6	5	3	3	1	11	51	0.85%	97.23%
>5 to 6	1	3	3	4	1	3	6	2	3	4	5	3	38	0.63%	97.65%
>6 to 7	2	1	1	1	0	2	1	3	5	4	2	3	25	0.42%	97.88%
>7 to 8	3	2	0	1	0	0	3	1	2	2	0	0	14	0.23%	98.15%
>8 to 9	1	0	1	0	1	1	0	3	4	1	1	3	16	0.27%	98.40%
>9 to 10	1	2	0	3	1	0	2	2	1	1	1	1	15	0.25%	98.63%
>10 to 11	2	0	0	0	0	3	1	1	2	3	0	2	14	0.23%	98.70%
>11 to 12	0	0	0	0	0	0	1	0	0	2	0	1	4	0.07%	98.78%
>12 to 13	1	0	1	0	0	0	0	0	0	1	0	2	5	0.08%	98.88%
>13 to 14	0	0	0	0	1	1	1	0	1	1	0	1	6	0.10%	98.90%
>14 to 15	0	1	0	0	0	0	0	0	0	0	0	0	1	0.02%	98.98%
>15 to 16	0	1	1	0	0	0	0	0	1	1	1	0	5	0.08%	98.98%
>16 to 17	0	0	2	1	0	0	0	0	0	0	0	0	3	0.05%	99.03%
>17 to 18	0	0	0	3	1	0	0	0	1	1	0	0	6	0.10%	99.13%
>18 to 19	0	0	0	0	1	0	1	1	0	1	0	0	4	0.07%	99.20%
>19 to 20	1	0	0	0	0	0	0	0	0	0	0	0	1	0.02%	99.22%
>20	1	5	4	1	1	0	5	8	6	7	7	2	47	0.78%	100.00%
Total	499	499	499	499	499	499	499	499	499	499	499	499	5988		
% >2.5	5.2%	6.4%	7.8%	4.8%	4.4%	6.4%	8.0%	7.8%	8.2%	8.6%	6.4%	8.8%		8.8%	
% >3	4.0%	5.2%	6.2%	3.8%	2.8%	4.8%	7.0%	6.6%	7.2%	7.6%	5.4%	6.8%		6.8%	
% >4	3.2%	3.8%	3.4%	2.8%	2.0%	3.6%	5.4%	5.2%	5.8%	6.4%	3.6%	5.8%		5.8%	

Table A2: Correlations among Location Quotient Measures – Clark WDA

Correlations

	OUTPUT	EMPLOY	EMPCOMP	PROPRIET	OTHPROP	INDBTAX	VALUADD
OUTPUT	1	.998**	.989**	.745**	.991**	.988**	.994**
Pearson Correlation							
Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
N	301	299	299	289	301	288	301
EMPLOY	.998**	1	.981**	.746**	.985**	.977**	.987**
Pearson Correlation							
Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
N	299	299	299	289	299	287	299
EMPCOMP	.989**	.981**	1	.685**	.993**	.992**	.996**
Pearson Correlation							
Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
N	299	299	299	289	299	287	299
PROPRIET	.745**	.746**	.685**	1	.719**	.722**	.723**
Pearson Correlation							
Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
N	289	289	289	289	289	285	289
OTHPROP	.991**	.985**	.993**	.719**	1	.996**	.997**
Pearson Correlation							
Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
N	301	299	299	289	301	288	301
INDBTAX	.988**	.977**	.992**	.722**	.996**	1	.999**
Pearson Correlation							
Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
N	288	287	287	285	288	288	288
VALUADD	.994**	.987**	.996**	.723**	.997**	.999**	1
Pearson Correlation							
Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
N	301	299	299	289	301	288	301

** . Correlation is significant at the 0.01 level (2-tailed).

There are small variations in the size of the observations in Table 2, as for some sectors there is no income from a particular source, or it is not reported. The most common exclusions are for proprietors income (many manufacturing and all government sectors have no proprietor income), while the IMPLAN system does not report some of the categories in Table 2 for public sectors.

Identification of key sectors by region

To identify linked sectors, we first defined the sectors that were concentrated in the WDAs, using the location quotient analysis. The next step in the analysis was to determine a threshold for “linkages,” or sectors to which the concentrated sectors had significant linkages.

The RFP suggested doing this stage of the analysis through the use of measures of forward and backward linkages from the input-output models based on sales and purchases coefficients as a share of intermediate sales and purchases. However, initial analyses using this definition revealed significant problems with sectors that had few forward linkages within the region. A good example is aerospace, which sells 1.7% of its output within Washington State. If we were to use data on forward interindustry linkages aerospace, this would show strong forward linkages within aerospace, and linkages to retail and architecture and engineering. The non-aerospace markets are small, and not significant for the aerospace industry. Similar problems were evident with measures of backward linkages just based on Washington intermediate purchases. We decided that the only reasonable solution was to use sales coefficients and purchases coefficients based on total sales and purchases. This strategy has worked well to identify linked industries in the WDAs using the IMPLAN input-models.

To determine the level of forward and backward linkages to be included in the analysis of linked sectors, we calculated distributions of sales and coefficient distributions for all of the WDAs. These data yielded similar distributions across all of the regions. Table 3 shows the values of these distributions for the Spokane WDA. The values for the other regions are similar, and are not reproduced in this report. They are in the data matrices underlying this report. Table 3 indicates that the Spokane IMPLAN model had 89,401 cells. The values in these cells are highly skewed, with most of them having a value as sales or purchases coefficients less than .01 or 1%. After some experiments on cut-off values for linkages with these coefficients, and the location quotient values, we decided that values above .05 would be a basis for “significant” linkages. It should be noted that Czamanski’s work back in the 1970’s used 0.2 as a linkage criterion, but his work was based on national rather than regional data.²¹ The criterion suggested below—.05—was used for all of the regions as the basis for identifying linked industries.

In the Spokane County example, we find about 0.2% to 0.26% of the linkages meeting the .05 criterion. We explored relaxing this criterion, and it quickly made

²¹ Czamanski, S. (1974) *Study of Clustering of Industries*. Institute of Public Affairs, Dalhousie University, Halifax, Nova Scotia; Czamanski, S. (1976) *Study of Spatial Industrial Complexes*. Institute of Public Affairs, Dalhousie University, Halifax, Nova Scotia.

diagramming the linkages intractable. It would be possible in future work to analyze particular regions at a greater level of detail using a lower threshold for the linkage criterion.

Table A3: Sales and Purchases Coefficient Distributions for the Spokane WDA
(number of cells with values in the categories)

Coefficient	Sales	Purchases
Up to 0.00001	55945	54878
>0.00001 to 0.0001	13532	11305
>0.0001 to 0.001	12867	13891
>0.001 to 0.01	5850	8083
>0.01 to 0.02	586	637
>0.02 to 0.03	207	228
>0.03 to 0.04	115	126
>0.04 to 0.05	68	72
>0.05 to 0.06	51	43
>0.06 to 0.07	33	38
>0.07 to 0.08	21	26
>0.08 to 0.09	10	17
>0.09 to 0.1	10	13
>.01	106	44
Total	89401	89401
% >0.05	0.26%	0.20%

Development of Diagrams of Linked Clusters

Using the IMPLAN forward and backward linkage matrices, we first selected in EXCEL only the cells with coefficients greater than 0.05. We also identified for each region the sectors with values above the location quotients linkage criterion. These data were used to produce diagrams of linked industries and concentrated sectors in each region (see the charts for each region in Section III).

In these diagrams the following scheme was used to represent linkage relationships. A black arrow shows significant purchasing relationships. The arrow tail is directed to the purchasing sector, while the arrow head is directed towards the sector from which purchases are made. A red arrow shows a sales linkage, with the arrow head directed towards the sector making the purchase, and the arrow tail directed towards the supplying sector. In cases where both sales and purchases are greater than .05, both red and black arrows are diagrammed.

In cases where the intra-industry linkage is greater than .05, the type face is shown in italic. Sectors with a location quotient over 10 have their name in red type. In many cases sectors have no significant linkages to other sectors, and thus there are no arrows linked to these “isolates.”

The initial location quotient linkage criterion for each region is indicated on the diagrams, and in green type the minimum value of the location quotients for sectors added to the original sectors is indicated.

Three groups of sectors appear linked on a number of the individual WDA diagrams: a cluster related to forest products, another cluster related to agriculture and food products, and a third cluster related to fishing and seafood processing. A map is provided at the beginning of Section III showing the distribution of establishments in these three statewide clusters (see Figure 4 below).

The other linkage that appears on a number of diagrams is to wholesaling. This linkage bears a bit of explanation regarding the way in which wholesalers are treated in input-output models. These models are developed in “producers prices,” with sales of goods distributed through wholesalers shown as sales from the producing industry to the purchasing industry, and the value of the margin earned by the wholesaler for distributing goods is the value reported for sales by wholesalers. In most of the diagrams for the WDAs, the wholesale margins are likely related to purchases of goods not manufactured within the region, but rather purchased from local wholesalers who imported the goods being distributed from manufacturers located outside the local area.

After examining the 12 regional industry linkage diagrams (contained in the text below in Section III) we decided to add relatively large regional industries with lower LQs greater than 1 but less than the floor level in each region. This decision brought selected health care and construction industries into the analysis along with a handful of large service industries.

Definition of Clusters

The charts, tables, and maps in Section III therefore include three types of industries designated as “clusters.”

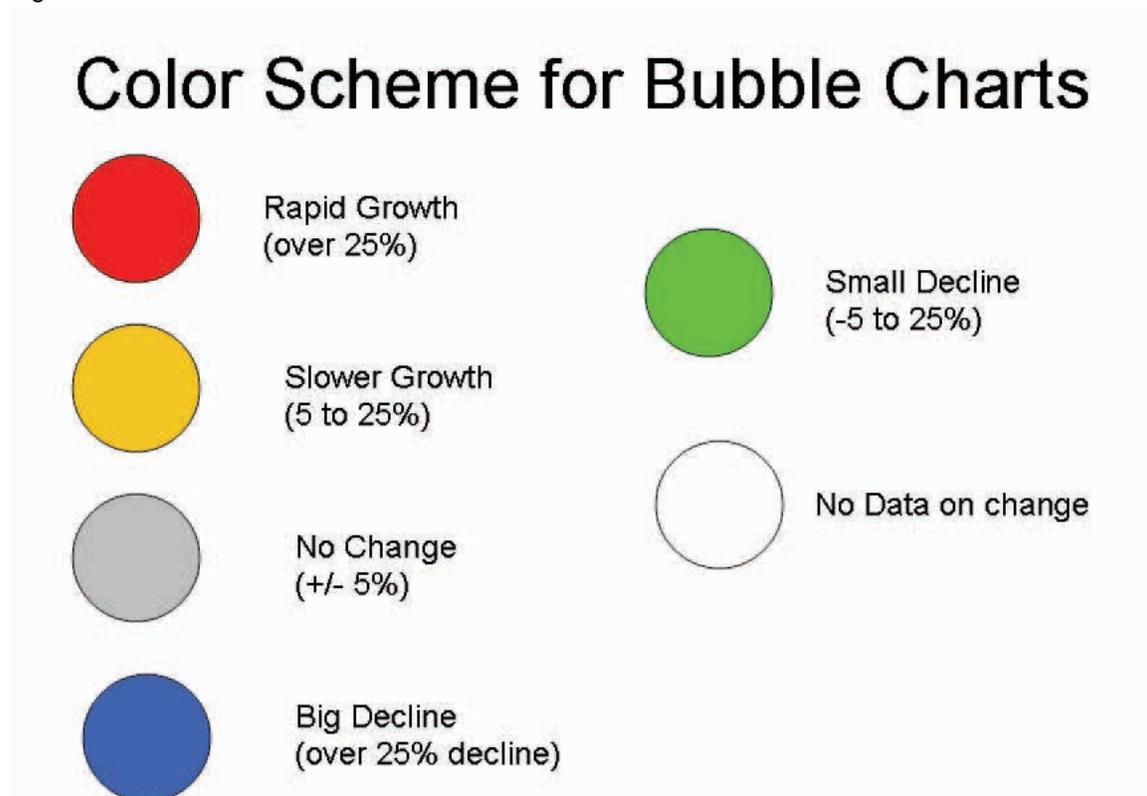
4. Industries with high location quotients;
5. Combinations of industries with high location quotients and industries to which these “core industries” are tied by large sales or purchase coefficients; and
6. Large industries with more modest location quotients greater than 1 but less than the standard “floor” level for that region.

Development of Bubble Charts

Graphic representations of multiple variables for each WDA region were prepared in a set of bubble charts. Data on levels of employment, the value of location quotients, earnings per worker, and percentage change in employment between 2001 and 2007 were developed for each WDA region. Employment data, location quotients, and earnings data were developed from the IMPLAN database, while the change values were estimated from data supplied by the Employment Security Department. The axes in the bubble charts are the location quotients and earnings per worker, while the size of the

bubble is proportional to employment. Colors in the bubble chart follow a scheme, in Figure 3, that indicates growth in employment between 2001 and 2007. The color scheme uses “warm” colors (orange and red) to show growth and “cool” colors (blue and green) to depict employment declines. Regions with no change are depicted with a bubble in gray; no change was defined as +/- 5% in employment between 2001 and 2007. Modest growth is defined in orange bubbles; between 5% and 25%. Over 25% growth is defined in red bubbles. Modest declines in employment are depicted in green (between 5% and 25%), while strong declines are depicted in blue bubbles. In cases where we had no data on change in employment the bubbles are left white.

Figure A2: Color Scheme for Bubble Charts



Distribution of Wages by Occupation

The occupational data available from the Employment Security Department include estimates of wages by occupation, and industry by occupation matrices showing the use of occupations within each industry for each of the 12 WDA regions. In Section III, tables show the mean, median, 25th percentile and 75th percentile wage levels for each region. By combining these two occupational data sources, two measures of the distribution of wages were calculated for each cluster:

- Middle wages wages – the percentage of jobs in each cluster falling within the 25th to the 75th percentile of regional median occupational wages; and

- High wages – the percentages of jobs in each cluster with occupational median wages above the 75th percentile of regional median occupational wages.

These measures are included in the strategic matrix for each region described below.

One further note is necessary about wage and earnings data presented in the charts and tables below. Each regional section includes wage distribution tables drawn from the Employment Security Department's occupational data files. These tables show the mean and median level of wages for the occupations in each of a region's clusters. In addition, the 25th and 75th percentile levels of occupational wages are shown; these variables are described above. The data for mean, median, 25th percentile and 75th percentile come from the occupational wage surveys conducted by Employment Security, and they are subject to confidentiality rules that result in significant data suppression since the confidentiality rule is applied to each individual occupation. Thus coverage of total employment in the cluster is lower than for a final measure, earnings per worker. The earnings per worker measure is derived from the IMPLAN database, and consists of both employee and proprietor's earnings divided by cluster employment. Inclusion of proprietor's earnings gives a better measure of the income generation of each cluster since in some industries proprietors are a relatively high proportion of the total workforce (e.g., construction contractors, doctors, dentists, lawyers and other professionals). Because the measure is constructed with totals for each industry, less data suppression is present. However, the inclusion of proprietors' earnings produces earnings per worker levels that may seem quite high in some industries if one is more accustomed to use of occupational wage data that do not include proprietors' earnings.

Development of Indices

The RFP requested that we develop a matrix of factors that may make clusters "strategic," and to develop an index measure based on those factors. The meaning of strategic was not specified in the RFP, leaving the analysts to decide which factors to include. Based on many contacts with economic development and workforce development/education agencies over many years, we decided to include as many characteristics of these clusters as is reasonably possible given the two datasets we rely on in the analysis, the IMPLAN data and the industry and occupation employment data from ESD. Our experience in working with these agencies in the past suggests that economic development and workforce/education agencies have quite different legislative mandates, and that they consequently focus on different factors in deciding what makes working with a particular industry or cluster of strategic value in achieving the agency's mission. Therefore, it is useful to include a wide range of variables that may signal strategic value for a particular agency or organization using our research results.

Some of the data in the strategic matrices below come from the IMPLAN database, while other variables were extracted from very detailed data provided by the Washington Employment Security Department (ESD). ESD must comply with federal rules designed to protect the confidentiality of firms who respond to the employment and occupational surveys ESD administers as part of the federal Bureau of Labor Statistics employment statistics program. When the entry "n/a" is shown in the strategic matrices below, it indicates that data have been suppressed by ESD or the authors of this report in

compliance with the confidentiality rules. Particularly in very rural regions of the state, the clusters are quite small and in a number of cases have too few firms to meet the confidentiality rules.

In addition, in the tables below we include an index calculated from a ranking of the clusters in each region on each variable. The highest ranked cluster on each variable is assigned a rank of 1; the second highest a rank of 2; and so on. The sum of these scores across all variables is subtracted from 100, resulting in an index score in which high values show clusters of greater strategic value since such clusters score relatively high on a wide variety of measures included in the index. Users of this report can experiment with alternative indices based on our methodology by dropping variables from the index if some factors are judged to be of lesser importance for a particular agency or organization's mission, or by weighting the variables in some manner.

Two wage distribution measures defined above are included in the strategic matrices, middle wage jobs and high wage jobs. However, these two variables are not included in the rankings or index for the region because there is a great deal of missing data. Due to the federal confidentiality rules, we are able to present complete wage distribution data for all clusters in only one region, King County.

Since all of the publicly reportable data on the variables used to construct the index is included, readers can experiment with alternative indexing procedures such as dropping some variables or weighting the variables differentially. Some agencies might want to include the wage distribution variables despite the missing data problem, while others might put greater emphasis on research and development potential or export orientation of clusters.

The factors included in the strategic matrices below are:

- Output or total sales
- Employment
- Average wage level
- The percent of jobs in the cluster falling within the middle wage range
- The percent of jobs in the cluster falling within the high wage range

Note that the 100 – the sum of the middle wage percentage and the high wage percentage is the percent of jobs at wages below the 25th percentile of occupational median wages in the region; the percent of low wage jobs is not included in the matrix since it is implied by the other two wage distribution measures.

- Changes from 2001 to 2007 in employment, wage levels, and number of establishments
- Projected growth of the cluster²²

²² Growth projections were derived from the ESD's long term occupational projections, which rely on a long term industry forecast from a base year of 2006 out to the year 2016. These projections for the 12 WDA regions are available under the label "[Long-Term Industry Control Totals](#)" at

- Percentage of sales from total exports

The first three factors were calculated from the IMPLAN database, as was the measure of exports. The change variables were calculated from ESD data and matched to the IMPLAN industry sectors using the correspondence table provided in the Appendix.

In addition, there is a growing interest in the potential for innovative regional clusters that demonstrate increasing competitive strength over time, thereby creating many economic benefits within a region.²³ Therefore, we created a measure of innovation potential consisting of the proportion of each cluster's employment in engineering and science occupations. This measure was created for each cluster in each WDA using industry by occupation tables created by ESD for their 2006-2016 occupational forecasts.²⁴

The export sales percentage consists of sales to the federal government plus sales to U.S. customers located outside Washington plus sales to customers in other countries. This broad concept of exports is often used in regional economics, specifically in economic impact analysis, since all three of these forms of exports involve sales to customers outside the region and such sales therefore bring in money to the region that may have multiplier impacts on other industries in the region.

Adjacent State Analysis

We developed estimates of location quotients for two areas adjacent to Washington State WDAs. These were for counties in Oregon located in proximity to Clark county, and for Kootenai county in Idaho which is east of Spokane County. Data from U.S. County Business Patterns for the year 2006 were used to develop the measures of employment in Oregon and Idaho, while the IMPLAN estimates of local and national employment were used to calculate the location quotients for Washington counties. Location quotients for these adjacent regions were calculated only for sectors showing strong concentrations in Washington counties. The findings from this analysis are included in the results sections for Clark and Spokane counties.

<http://www.workforceexplorer.com/cgi/dataanalysis/?PAGEID=94&SUBID=149>. The industry data were assembled into cluster categories; detailed notes on adjustments made given the different level of industry aggregation are contained in the tables in the text on the following pages.

²³ Porter, Michael E. (August/October 2003) The Economic Performance of Regions. *Regional Studies*, 37(6&7): 549–578.

²⁴ These industry by occupation tables are available at:

<http://www.workforceexplorer.com/cgi/dataanalysis/?PAGEID=94&SUBID=149>.

R&D occupations are engineering and science occupations coded in the industry by occupation tables as occupations with the first two digits 15 (Computer Science and Mathematical Occupations), 17 (Engineering Occupations) and 19 (Scientific Occupations). Measurements of innovation capacity in this manner has been used to identify high tech industries by Beyers (2008) in a report for the Technology Alliance (http://www.technology-alliance.com/documents/economic_impact_2008.pdf) and by the U.S. Department of Labor in defining high tech industries (Hecker 2005).

Development of Maps

For each region the Employment Security Department was asked to provide data on the geocoded location of establishments in sectors identified as clusters. The data provided by ESD included the coordinates of the establishment, as well as monthly and average employment. Because of ESD rules regarding confidentiality of establishment level data, we cannot show both employment level and establishment location on these maps. Therefore, the maps presented in this report show only the locations of firms by cluster. These maps are presented for each of the 12 WDA regions. At the statewide level, a “heat” map showing the location of selected clusters of establishments weighted by employment was produced.

For the 12 WDA regions, some clusters are grouped to keep the maps legible. The term “Manufacturing Specialties” refers to an aggregated category of all manufacturing clusters not shown separately on a map even though they may be shown separately on bubble charts or in data tables. Likewise, the term “Service Specialties” refers to an aggregation of service industry clusters on the regional maps.

One other note about the maps must be mentioned. The maps show data only for private sector firms. This state has many significant public sector enterprises that employ thousands of people. These publicly owned enterprises include federal, county and municipal owned electric utilities, a Navy shipyard, and 6 large military bases located in 5 different regions. These publicly owned enterprises are not depicted on the maps on the following pages. A single point on a regional map could not convey the economic significance of Ft. Lewis in Pierce County, nor would 4 or 5 points represent the large influence of the Navy in Kitsap County. The tables and bubble charts below demonstrate the role these public enterprises play throughout the state.

References

Alexander, J. & J. Lindberg (1961) "Measurements of Manufacturing: Coefficients of Correlation," *Journal of Regional Science*, Vol. 3, No. 1, pp. 71-81

Beyers, William B. (2008) *The Economic Impact of Technology-Based Industries in Washington State*. Seattle: report for the Technology Alliance, Department of Geography, University of Washington.

Czamanski, S. (1974) *Study of Clustering of Industries*. Institute of Public Affairs, Dalhousie University, Halifax, Nova Scotia.

Czamanski, S. (1976) *Study of Spatial Industrial Complexes*. Institute of Public Affairs, Dalhousie University, Halifax, Nova Scotia.

Hecker, Daniel E. "High-technology employment: a NAICS-based update." *Monthly Labor Review*, [July 2005, Vol. 128, No. 7](#).

McDonald, Frank, Qihai Huang, Dimitrios Tsaglis, and Heinz Josef Tüselmann (2007) "Is there evidence to support Porter-type Cluster Policies," *Regional Studies*, Vol. 41, No. 1, pp. 39-49.

Porter, Michael E. (August/October 2003) "The Economic Performance of Regions." *Regional Studies*, 37(6&7): 549-578

Appendix II: Correspondence Between IMPLAN Industry Codes and NAICS Codes

IMPLAN Sectors	IMPLAN Sector Name	NAICS
1	Oilseed farming	1111
2	Grain farming	1111
3	Vegetable farming	1112
5	Fruit farming	1113
6	Greenhouse and nursery production	1114
7	Tobacco farming	1119
8	Cotton farming	1119
9	Sugarcane and sugar beet farming	1119
10	All other crop farming	1119
11	Cattle ranching and farming	1121
12	Poultry and egg production	1123
13	Animal production, except cattle and poultry and e	1122
13	Animal production, except cattle and poultry and e	1124
13	Animal production, except cattle and poultry and e	1125
13	Animal production, except cattle and poultry and e	1129
14	Logging	1133
15	Forest nurseries, forest products, and timber trac	1131
16	Fishing	1141
17	Hunting and trapping	1142
18	Agriculture and forestry support activities	115
		1151
		1152
		1153
19	Oil and gas extraction	211
20	Coal mining	2121
21	Iron ore mining	2122
22	Copper, nickel, lead, and zinc mining	2122
23	Gold, silver, and other metal ore mining	2122
24	Stone mining and quarrying	2123
25	Sand, gravel, clay, and refractory mining	2123
26	Other nonmetallic mineral mining	2123
27	Drilling oil and gas wells	2131
28	Support activities for oil and gas operations	2131
29	Support activities for other mining	2131
30	Power generation and supply	2211
31	Natural gas distribution	2212
32	Water, sewage and other systems	2213
33	New residential 1-unit structures, nonfarm	23
34	New multifamily housing structures, nonfarm	23
35	New residential additions and alterations, nonfarm	23
36	New farm housing units and additions and alteratio	23
37	Manufacturing and industrial buildings	23
38	Commercial and institutional buildings	23
39	Highway, street, bridge, and tunnel construction	23

40	Water, sewer, and pipeline construction	23
41	Other new construction	23
42	Maintenance and repair of farm and nonfarm residen	23
43	Maintenance and repair of nonresidential buildings	23
44	Maintenance and repair of highways, streets, bridg	23
45	Other maintenance and repair construction	23
	Residential building construction	2361
	Nonresidential building construction	2362
	Utility system construction	2371
	Land subdivision	2372
	Highway, street, and bridge construction	2373
	Other heavy construction	2379
	Building foundation and exterior contractors	2381
	Building equipment contractors	2382
	Building finishing contractors	2383
	Other specialty trade contractors	2389
46	Dog and cat food manufacturing	3111
47	Other animal food manufacturing	3111
48	Flour milling	3112
49	Rice milling	3112
50	Malt manufacturing	3112
51	Wet corn milling	3112
52	Soybean processing	3112
53	Other oilseed processing	3112
54	Fats and oils refining and blending	3112
55	Breakfast cereal manufacturing	3112
56	Sugar manufacturing	3113
57	Confectionery manufacturing from cacao beans	3113
58	Confectionery manufacturing from purchased chocola	3113
59	Nonchocolate confectionery manufacturing	3113
60	Frozen food manufacturing	3114
61	Fruit and vegetable canning and drying	3114
62	Fluid milk manufacturing	3115
63	Creamery butter manufacturing	3115
64	Cheese manufacturing	3115
65	Dry, condensed, and evaporated dairy products	3115
66	Ice cream and frozen dessert manufacturing	3115
67	Animal, except poultry, slaughtering	3116
68	Meat processed from carcasses	3116
69	Rendering and meat byproduct processing	3116
70	Poultry processing	3116
71	Seafood product preparation and packaging	3117
72	Frozen cakes and other pastries manufacturing	3118
73	Bread and bakery product, except frozen, manufactu	3118
74	Cookie and cracker manufacturing	3118
75	Mixes and dough made from purchased flour	3118
76	Dry pasta manufacturing	3118
77	Tortilla manufacturing	3118
78	Roasted nuts and peanut butter manufacturing	3119
79	Other snack food manufacturing	3119

80	Coffee and tea manufacturing	3119
81	Flavoring syrup and concentrate manufacturing	3119
82	Mayonnaise, dressing, and sauce manufacturing	3119
83	Spice and extract manufacturing	3119
84	All other food manufacturing	3119
85	Soft drink and ice manufacturing	3121
86	Breweries	3121
87	Wineries	3121
88	Distilleries	3121
89	Tobacco stemming and redrying	3122
90	Cigarette manufacturing	3122
91	Other tobacco product manufacturing	3122
92	Fiber, yarn, and thread mills	3131
93	Broadwoven fabric mills	3132
94	Narrow fabric mills and schiffli embroidery	3132
95	Nonwoven fabric mills	3132
96	Knit fabric mills	3132
97	Textile and fabric finishing mills	3133
98	Fabric coating mills	3133
99	Carpet and rug mills	3141
100	Curtain and linen mills	3141
101	Textile bag and canvas mills	3149
102	Tire cord and tire fabric mills	3149
103	Other miscellaneous textile product mills	3149
104	Sheer hosiery mills	3151
105	Other hosiery and sock mills	3151
106	Other apparel knitting mills	3151
107	Cut and sew apparel manufacturing	3152
108	Accessories and other apparel manufacturing	3159
109	Leather and hide tanning and finishing	3161
110	Footwear manufacturing	3162
111	Other leather product manufacturing	3169
112	Sawmills	3211
113	Wood preservation	3211
114	Reconstituted wood product manufacturing	3212
115	Veneer and plywood manufacturing	3212
116	Engineered wood member and truss manufacturing	3212
117	Wood windows and door manufacturing	3219
118	Cut stock, resawing lumber, and planing	3219
119	Other millwork, including flooring	3219
120	Wood container and pallet manufacturing	3219
121	Manufactured home, mobile home, manufacturing	3219
122	Prefabricated wood building manufacturing	3219
123	Miscellaneous wood product manufacturing	3219
124	Pulp mills	3221
125	Paper and paperboard mills	3221
126	Paperboard container manufacturing	3222
127	Flexible packaging foil manufacturing	3222
128	Surface-coated paperboard manufacturing	3222
129	Coated and laminated paper and packaging materials	3222

130	Coated and uncoated paper bag manufacturing	3222
131	Die-cut paper office supplies manufacturing	3222
132	Envelope manufacturing	3222
133	Stationery and related product manufacturing	3222
134	Sanitary paper product manufacturing	3222
135	All other converted paper product manufacturing	3222
136	Manifold business forms printing	3231
137	Books printing	3231
138	Blankbook and looseleaf binder manufacturing	3231
139	Commercial printing	3231
140	Tradebinding and related work	3231
141	Prepress services	3231
142	Petroleum refineries	3241
143	Asphalt paving mixture and block manufacturing	3241
144	Asphalt shingle and coating materials manufacturin	3241
145	Petroleum lubricating oil and grease manufacturing	3241
146	All other petroleum and coal products manufacturin	3241
147	Petrochemical manufacturing	3251
148	Industrial gas manufacturing	3251
149	Synthetic dye and pigment manufacturing	3251
150	Other basic inorganic chemical manufacturing	3251
151	Other basic organic chemical manufacturing	3251
152	Plastics material and resin manufacturing	3252
153	Synthetic rubber manufacturing	3252
154	Cellulosic organic fiber manufacturing	3252
155	Noncellulosic organic fiber manufacturing	3252
156	Nitrogenous fertilizer manufacturing	3253
157	Phosphatic fertilizer manufacturing	3253
158	Fertilizer, mixing only, manufacturing	3253
159	Pesticide and other agricultural chemical manufact	3253
160	Pharmaceutical and medicine manufacturing	3241
161	Paint and coating manufacturing	3255
162	Adhesive manufacturing	3255
163	Soap and other detergent manufacturing	3325
164	Polish and other sanitation good manufacturing	3256
165	Surface active agent manufacturing	3256
166	Toilet preparation manufacturing	3256
167	Printing ink manufacturing	3259
168	Explosives manufacturing	3259
169	Custom compounding of purchased resins	3259
170	Photographic film and chemical manufacturing	3259
171	Other miscellaneous chemical product manufacturing	3259
172	Plastics packaging materials, film and sheet	3261
173	Plastics pipe, fittings, and profile shapes	3261
174	Laminated plastics plate, sheet, and shapes	3261
175	Plastics bottle manufacturing	3261
176	Resilient floor covering manufacturing	3261
177	Plastics plumbing fixtures and all other plastics	3261
178	Foam product manufacturing	3261
179	Tire manufacturing	3262

180	Rubber and plastics hose and belting manufacturing	3262
181	Other rubber product manufacturing	3262
182	Vitreous china plumbing fixture manufacturing	3271
183	Vitreous china and earthenware articles manufactur	3271
184	Porcelain electrical supply manufacturing	3271
185	Brick and structural clay tile manufacturing	3271
186	Ceramic wall and floor tile manufacturing	3271
187	Nonclay refractory manufacturing	3271
188	Clay refractory and other structural clay products	3271
189	Glass container manufacturing	3271
190	Glass and glass products, except glass containers	3271
191	Cement manufacturing	3273
192	Ready-mix concrete manufacturing	3273
193	Concrete block and brick manufacturing	3273
194	Concrete pipe manufacturing	3273
195	Other concrete product manufacturing	3273
196	Lime manufacturing	3274
197	Gypsum product manufacturing	3274
198	Abrasive product manufacturing	3279
199	Cut stone and stone product manufacturing	3279
200	Ground or treated minerals and earths manufacturin	3279
201	Mineral wool manufacturing	3279
202	Miscellaneous nonmetallic mineral products	3279
203	Iron and steel mills	3311
204	Ferroalloy and related product manufacturing	3311
205	Iron, steel pipe and tube from purchased steel	3312
206	Rolled steel shape manufacturing	3312
207	Steel wire drawing	3312
208	Alumina refining	3313
209	Primary aluminum production	3313
210	Secondary smelting and alloying of aluminum	3313
211	Aluminum sheet, plate, and foil manufacturing	3313
212	Aluminum extruded product manufacturing	3313
213	Other aluminum rolling and drawing	3313
214	Primary smelting and refining of copper	3314
215	Primary nonferrous metal, except copper and alumin	3314
216	Copper rolling, drawing, and extruding	3314
217	Copper wire, except mechanical, drawing	3314
218	Secondary processing of copper	3314
219	Nonferrous metal, except copper and aluminum, shap	3314
220	Secondary processing of other nonferrous	3314
221	Ferrous metal foundries	3315
222	Aluminum foundries	3315
223	Nonferrous foundries, except aluminum	3315
224	Iron and steel forging	3321
225	Nonferrous forging	3321
226	Custom roll forming	3321
227	All other forging and stamping	3321
228	Cutlery and flatware, except precious, manufacturi	3322
229	Hand and edge tool manufacturing	3322

230	Saw blade and handsaw manufacturing	3322
231	Kitchen utensil, pot, and pan manufacturing	3322
232	Prefabricated metal buildings and components	3323
233	Fabricated structural metal manufacturing	3323
234	Plate work manufacturing	3323
235	Metal window and door manufacturing	3323
236	Sheet metal work manufacturing	3323
237	Ornamental and architectural metal work manufactur	3323
238	Power boiler and heat exchanger manufacturing	3324
239	Metal tank, heavy gauge, manufacturing	3324
240	Metal can, box, and other container manufacturing	3324
241	Hardware manufacturing	3325
242	Spring and wire product manufacturing	3326
243	Machine shops	3327
244	Turned product and screw, nut, and bolt manufactur	3327
245	Metal heat treating	3328
246	Metal coating and nonprecious engraving	2332
247	Electroplating, anodizing, and coloring metal	3328
248	Metal valve manufacturing	3329
249	Ball and roller bearing manufacturing	3329
250	Small arms manufacturing	3329
251	Other ordnance and accessories manufacturing	3329
252	Fabricated pipe and pipe fitting manufacturing	3329
253	Industrial pattern manufacturing	3329
254	Enameled iron and metal sanitary ware manufacturin	3329
255	Miscellaneous fabricated metal product manufacturi	3329
256	Ammunition manufacturing	3329
257	Farm machinery and equipment manufacturing	3331
258	Lawn and garden equipment manufacturing	3331
259	Construction machinery manufacturing	3331
260	Mining machinery and equipment manufacturing	3331
261	Oil and gas field machinery and equipment	3331
262	Sawmill and woodworking machinery	3332
263	Plastics and rubber industry machinery	3332
264	Paper industry machinery manufacturing	3332
265	Textile machinery manufacturing	3332
266	Printing machinery and equipment manufacturing	3332
267	Food product machinery manufacturing	3332
268	Semiconductor machinery manufacturing	3332
269	All other industrial machinery manufacturing	3332
270	Office machinery manufacturing	3333
271	Optical instrument and lens manufacturing	3333
272	Photographic and photocopying equipment manufactur	3333
273	Other commercial and service industry machinery ma	3333
274	Automatic vending, commercial laundry and dryclean	3333
275	Air purification equipment manufacturing	3334
276	Industrial and commercial fan and blower manufactu	3334
277	Heating equipment, except warm air furnaces	3334
278	AC, refrigeration, and forced air heating	3334
279	Industrial mold manufacturing	3335

280	Metal cutting machine tool manufacturing	3335
281	Metal forming machine tool manufacturing	3335
282	Special tool, die, jig, and fixture manufacturing	3335
283	Cutting tool and machine tool accessory manufactur	3335
284	Rolling mill and other metalworking machinery	3335
285	Turbine and turbine generator set units manufactur	3336
286	Other engine equipment manufacturing	3336
287	Speed changers and mechanical power transmission e	3336
288	Pump and pumping equipment manufacturing	3339
289	Air and gas compressor manufacturing	3339
290	Measuring and dispensing pump manufacturing	3339
291	Elevator and moving stairway manufacturing	3339
292	Conveyor and conveying equipment manufacturing	3339
293	Overhead cranes, hoists, and monorail systems	3339
294	Industrial truck, trailer, and stacker manufacturi	3339
295	Power-driven handtool manufacturing	3339
296	Welding and soldering equipment manufacturing	3339
297	Packaging machinery manufacturing	3339
298	Industrial process furnace and oven manufacturing	3339
299	Fluid power cylinder and actuator manufacturing	3339
300	Fluid power pump and motor manufacturing	3339
301	Scales, balances, and miscellaneous general purpos	3339
302	Electronic computer manufacturing	3341
303	Computer storage device manufacturing	3341
304	Computer terminal manufacturing	3341
305	Other computer peripheral equipment manufacturing	3341
306	Telephone apparatus manufacturing	3342
307	Broadcast and wireless communications equipment	3342
308	Other communications equipment manufacturing	3342
309	Audio and video equipment manufacturing	3343
310	Electron tube manufacturing	3344
311	Semiconductors and related device manufacturing	3344
312	All other electronic component manufacturing	3344
313	Electromedical apparatus manufacturing	3345
314	Search, detection, and navigation instruments	3345
315	Automatic environmental control manufacturing	3345
316	Industrial process variable instruments	3345
317	Totalizing fluid meters and counting devices	3345
318	Electricity and signal testing instruments	3345
319	Analytical laboratory instrument manufacturing	3345
320	Irradiation apparatus manufacturing	3345
321	Watch, clock, and other measuring and controlling	3345
322	Software reproducing	3346
323	Audio and video media reproduction	3346
324	Magnetic and optical recording media manufacturing	3346
325	Electric lamp bulb and part manufacturing	3351
326	Lighting fixture manufacturing	3352
327	Electric housewares and household fan manufacturin	3352
328	Household vacuum cleaner manufacturing	3352
329	Household cooking appliance manufacturing	3352

330	Household refrigerator and home freezer manufactur	3352
331	Household laundry equipment manufacturing	3352
332	Other major household appliance manufacturing	3352
333	Electric power and specialty transformer manufactu	3353
334	Motor and generator manufacturing	3353
335	Switchgear and switchboard apparatus manufacturing	3353
336	Relay and industrial control manufacturing	3353
337	Storage battery manufacturing	3359
338	Primary battery manufacturing	3359
339	Fiber optic cable manufacturing	3359
340	Other communication and energy wire manufacturing	3359
341	Wiring device manufacturing	3359
342	Carbon and graphite product manufacturing	3359
343	Miscellaneous electrical equipment manufacturing	3359
344	Automobile and light truck manufacturing	3361
345	Heavy duty truck manufacturing	3361
346	Motor vehicle body manufacturing	3362
347	Truck trailer manufacturing	3362
348	Motor home manufacturing	3362
349	Travel trailer and camper manufacturing	3362
350	Motor vehicle parts manufacturing	3363
351	Aircraft manufacturing	3364
352	Aircraft engine and engine parts manufacturing	3364
353	Other aircraft parts and equipment	3364
354	Guided missile and space vehicle manufacturing	3364
355	Propulsion units and parts for space vehicles and	3364
356	Railroad rolling stock manufacturing	3365
357	Ship building and repairing	3366
358	Boat building	3366
359	Motorcycle, bicycle, and parts manufacturing	3369
360	Military armored vehicles and tank parts manufactu	3369
361	All other transportation equipment manufacturing	3369
362	Wood kitchen cabinet and countertop manufacturing	3371
363	Upholstered household furniture manufacturing	3371
364	Nonupholstered wood household furniture manufactur	3371
365	Metal household furniture manufacturing	3371
366	Institutional furniture manufacturing	3371
367	Other household and institutional furniture	3371
368	Wood office furniture manufacturing	3372
369	Custom architectural woodwork and millwork	3372
370	Office furniture, except wood, manufacturing	3372
371	Showcases, partitions, shelving, and lockers	3372
372	Mattress manufacturing	3379
373	Blind and shade manufacturing	3379
374	Laboratory apparatus and furniture manufacturing	3391
375	Surgical and medical instrument manufacturing	3391
376	Surgical appliance and supplies manufacturing	3391
377	Dental equipment and supplies manufacturing	3391
378	Ophthalmic goods manufacturing	3391
379	Dental laboratories	3391

380	Jewelry and silverware manufacturing	3399
381	Sporting and athletic goods manufacturing	3399
382	Doll, toy, and game manufacturing	3399
383	Office supplies, except paper, manufacturing	3399
384	Sign manufacturing	3399
385	Gasket, packing, and sealing device manufacturing	3399
386	Musical instrument manufacturing	3399
387	Broom, brush, and mop manufacturing	3399
388	Burial casket manufacturing	3399
389	Buttons, pins, and all other miscellaneous manufac	3399
390	Wholesale trade	42
	Motor vehicle and parts merchant wholesalers	4231
	Furniture and furnishing merchant wholesalers	4232
	Lumber and const. supply merchant wholesalers	4233
	Commercial equip. merchant wholesalers	4234
	Metal and mineral merchant wholesalers	4235
	Electric goods merchant wholesalers	4236
	Hardware and plumbing merchant wholesalers	4237
	Machinery and supply merchant wholesalers	4238
	Misc. durable goods merchant wholesalers	4239
	Paper and paper product merchant wholesalers	4241
	Druggists' goods merchant wholesalers	4242
	Apparel and piece goods merchant wholesalers	4243
	Grocery and Related Product Wholesalers	4244
	Farm product raw material merch. whls.	4245
	Chemical merchant wholesalers	4246
	Petroleum merchant wholesalers	4247
	Alcoholic beverage merchant wholesalers	4248
	Misc. nondurable goods merchant wholesalers	4249
	Electronic markets and agents and brokers	4251
391	Air transportation	481
	Scheduled air transportation	4811
	Nonscheduled air transportation	4812
	Support activities for air transportation	4881
392	Rail transportation	482
	Rail transportation	4821
	Support activities for rail transportation	4882
393	Water transportation	483
	Sea, coastal, and Great Lakes transportation	4831
	Inland water transportation	4832
	Support activities for water transportation	4883
394	Truck transportation	484
	General freight trucking	4841
	Specialized freight trucking	4842
	Freight transportation arrangement	4885
395	Transit and ground passenger transportation	485
	Taxi and limousine service	4853
	School and employee bus transportation	4854
	Charter bus industry	4855
	Other ground passenger transportation	4859

	Support activities for road transportation	4884
396	Pipeline transportation	486
397	Scenic and sightseeing transportation and support	487
	Scenic and sightseeing transportation, land	4871
	Scenic and sightseeing transportation, water	4872
	Other support activities for transportation	4889
398	Postal service	4911
399	Couriers and messengers	392
	Couriers	4921
	Local messengers and local delivery	4922
400	Warehousing and storage	4931
401	Motor vehicle and parts dealers	441
	Automobile dealers	4411
	Other motor vehicle dealers	4412
	Auto parts, accessories, and tire stores	4413
402	Furniture and home furnishings stores	442
	Furniture stores	4421
	Home furnishings stores	4422
403	Electronics and appliance stores	4431
404	Building material and garden supply stores	444
	Building material and supplies dealers	4441
	Lawn and garden equipment and supplies stores	4442
405	Food and beverage stores	445
	Grocery stores	4451
	Specialty food stores	4452
	Beer, wine, and liquor stores	4453
406	Health and personal care stores	4461
407	Gasoline stations	4471
408	Clothing and clothing accessories stores	448
	Clothing stores	4481
	Shoe stores	4482
	Jewelry, luggage, and leather goods stores	4483
409	Sporting goods, hobby, book and music stores	451
410	General merchandise stores	452
	Sporting goods and musical instrument stores	4511
	Book, periodical, and music stores	4512
	Department stores	4521
	Other general merchandise stores	4529
411	Miscellaneous store retailers	453
	Florists	4531
	Office supplies, stationery, and gift stores	4532
	Used merchandise stores	4533
	Other miscellaneous store retailers	4539
412	Nonstore retailers	454
	Electronic shopping and mail-order houses	4541
	Vending machine operators	4542
	Direct selling establishments	4543
413	Newspaper publishers	5111
414	Periodical publishers	5111
415	Book publishers	5111

416	Database, directory, and other publishers	5114
416	Database, directory, and other publishers	5119
417	Software publishers	5112
418	Motion picture and video industries	5121
419	Sound recording industries	5122
419	Sound recording industries	5122
420	Radio and television broadcasting	5131
421	Cable networks and program distribution	5132
422	Telecommunications	5133
423	Information services	5141
424	Data processing services	5142
425	Nondepository credit intermediation and related a	5222
425	Nondepository credit intermediation and related a	5223
426	Securities, commodity contracts, investments	523
	Securities and commodity contracts brokerage	5231
	Other financial investment activities	5239
427	Insurance carriers	5241
428	Insurance agencies, brokerages, and related	5242
429	Funds, trusts, and other financial vehicles	525
	Insurance and employee benefit funds	5251
	Other investment pools and funds	5259
430	Monetary authorities and depository credit interme	521
431	Real estate	531
	Lessors of real estate	5311
	Offices of real estate agents and brokers	5312
	Activities related to real estate	5313
432	Automotive equipment rental and leasing	5321
433	Video tape and disc rental	5322
434	Machinery and equipment rental and leasing	5324
435	General and consumer goods rental except video tap	5322
435	General and consumer goods rental except video tap	5323
436	Lessors of nonfinancial intangible assets	5331
437	Legal services	5411
438	Accounting and bookkeeping services	5412
439	Architectural and engineering services	5413
440	Specialized design services	5414
441	Custom computer programming services	5415
442	Computer systems design services	5415
443	Other computer related services, including facilit	5415
444	Management consulting services	5416
445	Environmental and other technical consulting servi	5416
446	Scientific research and development services	5417
447	Advertising and related services	5418
448	Photographic services	5419
449	Veterinary services	5419
450	All other miscellaneous professional and technical	5419
451	Management of companies and enterprises	5511
452	Office administrative services	5611
453	Facilities support services	5612
454	Employment services	5613

455	Business support services	5614
456	Travel arrangement and reservation services	5615
457	Investigation and security services	5616
458	Services to buildings and dwellings	5617
459	Other support services	5619
460	Waste management and remediation services	562
	Waste collection	5621
	Waste treatment and disposal	5622
	Remediation and other waste services	5629
461	Elementary and secondary schools	6111
462	Colleges, universities, and junior colleges	6112
462	Colleges, universities, and junior colleges	6113
463	Other educational services	6114
463	Other educational services	6115
463	Other educational services	6116
463	Other educational services	6117
464	Home health care services	6216
465	Offices of physicians, dentists, and other health	6211
465	Offices of physicians, dentists, and other health	6212
465	Offices of physicians, dentists, and other health	6213
466	Other ambulatory health care services	6214
466	Other ambulatory health care services	6215
466	Other ambulatory health care services	6219
467	Hospitals	622
468	Nursing and residential care facilities	623
	Nursing care facilities	6231
	Residential mental health facilities	6232
	Community care facilities for the elderly	6233
	Other residential care facilities	6239
469	Child day care services	6244
470	Social assistance, except child day care services	6241
470	Social assistance, except child day care services	6242
470	Social assistance, except child day care services	6243
471	Performing arts companies	7111
472	Spectator sports	7112
473	Independent artists, writers, and performers	7115
474	Promoters of performing arts and sports and agents	7113
474	Promoters of performing arts and sports and agents	7114
475	Museums, historical sites, zoos, and parks	7121
476	Fitness and recreational sports centers	7139
477	Bowling centers	7139
478	Other amusement, gambling, and recreation industri	7131
478	Other amusement, gambling, and recreation industri	7132
478	Other amusement, gambling, and recreation industri	7139
479	Hotels and motels, including casino hotels	7211
480	Other accommodations	7211
480	Other accommodations	7212
480	Other accommodations	7213
481	Food services and drinking places	722
	Full-service restaurants	7221

	Limited-service eating places	7222
	Special food services	7223
	Drinking places, alcoholic beverages	7224
482	Car washes	8111
483	Automotive repair and maintenance, except car wash	8111
484	Electronic equipment repair and maintenance	8112
485	Commercial machinery repair and maintenance	8113
486	Household goods repair and maintenance	8114
487	Personal care services	8121
488	Death care services	8122
489	Drycleaning and laundry services	8123
490	Other personal services	8129
491	Religious organizations	8131
492	Grantmaking and giving and social advocacy organiz	8132
492	Grantmaking and giving and social advocacy organiz	8133
493	Civic, social, professional and similar organizati	8134
493	Civic, social, professional and similar organizati	8139
494	Private households	8141
495	Federal electric utilities	NA
496	Other Federal Government enterprises	NA
497	State and local government passenger transit	NA
498	State and local government electric utilities	NA
499	Other State and local government enterprises	NA
500	Noncomparable imports	NA
501	Scrap	NA
502	Used and secondhand goods	NA
503	State & Local Education	NA
504	State & Local Non-Education	NA
505	Federal Military	9991
506	Federal Non-Military	NA
507	Rest of the world adjustment to final uses	NA
508	Inventory valuation adjustment	NA
509	Owner-occupied dwellings	NA