2019 EMPLOYMENT PROJECTIONS

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WASHINGTON STATE

Labor Market and Economic Analysis

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Contents

About the employment, industry and occupational projections

Employment projections provide a general outlook for industry and occupational employment in Washington state. They provide job seekers, policy makers and training providers an idea of how much an industry or occupation is projected to change over time and show the future demand for workers.

On an annual basis, the Employment Security Department (ESD) produces industry employment projections for two, five and 10 years from a base period. For this annual projections report, the base period for the two-year (short-term) projections is second quarter 2018. The base period for the five-year (medium-term) and 10-year (long-term) projections is 2017.

Staffing patterns show proportional compositions of occupations within industries and are used to convert industry projections into occupational projections.

Industry classifications are based on the North American Industry Classification System (NAICS). However, they have been modified to match industry definitions used by the U.S. Bureau of Labor Statistics' (BLS) Occupational Employment Statistics (OES) program. These modified industry definitions are called Industry Control Totals (ICTs). The Standard Occupational Classification (SOC) system is used to group occupations. *Appendix 4* contains frequently asked questions relating to projections. *Appendix 5* provides a glossary of terms.

Data sets used to develop projections

The following data sets are used to produce projections:

1. Historical employment time series, consisting of U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) data.
2. Employment not covered by the unemployment insurance system from the U.S. Bureau of Labor Statistics' Current Employment Statistics (CES) program.
3. Occupational employment by industries (staffing patterns) based on an OES survey.
4. National data for self-employed ratios, change factors, etc.
5. Independent variables (predictive indicators), which help to project the future direction of the economy, from IHS Global Insight's national forecast.

Use of employment projections

Employment projections are intended for career development over time, not as the basis for budget or revenue projections, or for immediate corrective actions within the labor market.

Employment projections are the basis of the Occupations in Demand (OID) list covering Washington's 12 workforce development areas (WDAs) and the state as a whole. This list is used to determine eligibility for a variety of training and support programs, but was created to support the unemployment insurance Training Benefits Program. *Appendix 2* contains a technical description of the OID list.

The full OID list is accessible through the "Learn about an occupation" tool located at: https://esd.wa.gov/labormarketinfo/learn-about-an-occupation#/search

Executive summary

This report highlights findings on specific aspects of Washington's employment outlook. In the first section, industry projections results, we describe changes in employment by industry from 2017 to 2027. In the next section, occupational projections results, we look at:

- Major occupational groups
- Specific occupations

Detailed information on the projected demand for industry and occupational employment is available in the Employment Projections data files at:
https://esd.wa.gov/labormarketinfo/projections

In addition, detailed skill projections information is available in *Appendix 3* of this report.

The formal description of industry and occupational projection processes is presented in the *2019 Employment Projections Technical Report*. The technical report can be found at the data files link above.

Key findings

The 10-year average annual growth rate for total nonfarm employment for the 2017 to 2027 period is projected to be 1.51 percent. This is a decrease from the 1.59 percent average annual growth rate predicted last year for 2016 to 2026.[1]

Industry projections

- The largest increase by share of employment is projected for the information sector.
- The largest decreases by shares of employment are projected for the natural resources and mining sector.

Occupational projections

Major occupational groups

- The largest increases by shares of employment are projected for the computer and mathematical occupations.
- The largest decreases by shares of employment are projected for the production occupations.
- The largest employment shares in 2027, from largest to smallest, are projected for the office and administrative support occupations, sales and related occupations and food preparation and serving-related occupations. As was the case in last year's projections report, the first two occupational groups are projected to have declining employment shares.

[1] See: *"2018 Employment Projections,"* Washington State Employment Security Department, Workforce Information and Technology Services, *Figure 2*, page 7. Also, please note that all tables contain values that are calculated and then rounded. As a result, details might not always add up to totals.

Two approaches to occupational job openings

A *separations* approach is based on BLS national rates. An *alternative* approach is based on job opening rates specific to Washington state. The *separations* method does not track job openings created by turnover when workers stay within an occupation, but change employers, while the *alternative* method does track these openings.

The *separations* and *alternative* data are available in the Occupational Projections data files at: **https://esd.wa.gov/labormarketinfo/projections**.

Information about the *separations* methodology is available at: https://www.bls.gov/opub/mlr/2018/article/occupational-separations-a-new-method-for-projecting-workforce-needs.htm. Information about the *alternative* methodology is available on our projections landing page at: **https://esd.wa.gov/labormarketinfo/projections**.

- For both methods, the combined food preparation and serving workers, including fast food occupations, are projected to have the largest number of average annual total openings.
- Last year, in only one *separations'* occupation, chiropractors, growth openings exceeded turnover openings. However, this year for both *separations* and *alternative* occupations, no growth openings exceeded turnover openings.
- Totals of job openings caused by *alternative* turnover are about 23 times greater than openings due to growth, while totals of job openings caused by *separations* turnover are about eight times greater than openings due to growth.

2019 industry projections results

Figure 1 presents 2017 estimated employment, and 2017, 2022 and 2027 employment shares, as well as changes in employment shares from 2017 to 2022, 2022 to 2027 and 2017 to 2027 by industry for Washington state.

Through 2027, the three industry sectors with the largest increases in employment shares are projected to be professional and business services, health services and social assistance and information.[2]

For this same time period, the industry sector with the largest decrease in employment shares is manufacturing. The second and third largest decreases are retail trade and state and local government (including education).

Figure 1. Base and projected nonfarm industry employment
Washington state, 2017, 2022 and 2027
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

Industry sector*	WA state est. empl. 2017	WA state est. empl. shares 2017	WA state proj. empl. shares 2022	WA state proj. empl. shares 2027	WA state percentage point change in employment shares 2017-2022	WA state percentage point change in employment shares 2022-2027	WA state percentage point change in employment shares 2017-2027
Natural resources and mining	6,200	0.19%	0.17%	0.16%	-0.02%	-0.01%	-0.03%
Construction	199,700	6.02%	6.31%	6.12%	0.30%	-0.20%	0.10%
Manufacturing	283,700	8.55%	8.01%	7.58%	-0.54%	-0.42%	-0.97%
Wholesale trade	134,400	4.05%	3.89%	3.76%	-0.16%	-0.13%	-0.29%
Retail trade	384,400	11.58%	11.16%	11.02%	-0.42%	-0.14%	-0.56%
Utilities	4,800	0.14%	0.14%	0.13%	0.00%	-0.01%	-0.01%
Transportation and warehousing	102,000	3.07%	3.24%	3.29%	0.17%	0.04%	0.21%
Information	126,300	3.81%	4.16%	4.48%	0.36%	0.31%	0.67%
Financial activities	152,800	4.60%	4.52%	4.40%	-0.09%	-0.12%	-0.21%
Professional and business services	414,400	12.49%	12.85%	13.25%	0.36%	0.40%	0.76%
Education services	59,900	1.80%	1.86%	1.93%	0.06%	0.07%	0.13%
Health services and social assist.	414,500	12.49%	12.81%	13.25%	0.32%	0.45%	0.76%
Leisure and hospitality	331,300	9.98%	10.19%	10.16%	0.20%	-0.03%	0.18%
Other services	120,200	3.62%	3.58%	3.58%	-0.05%	0.00%	-0.05%
Federal government	74,800	2.25%	2.07%	1.96%	-0.18%	-0.12%	-0.30%
State and local gov. (incl. educ.)	509,200	15.34%	15.03%	14.94%	-0.31%	-0.10%	-0.41%

**The sectors presented in the table are based on CES definitions*

The largest growth sectors for the state are projected for professional and business services and health services and social assistance.

[2] All tables contain values that are calculated and then rounded. As a result, details might not always add up to totals.

Historical and projected growth rates

Figure 2 shows the historical and projected growth rates for the state and Washington's 12 workforce development areas (WDAs). Figure data are sorted on the projected growth rate 2017-2027 column.

Four of the 12 WDAs have projected growth rates greater than the previous 10 years' growth, and eight have projected growth less than the previous 10 years' growth. Seattle-King County has the highest projected growth rate of 1.83 percent with Statewide coming in second at 1.51 percent. The statewide projected growth rate is 0.19 percentage points less than the historical growth rate.

The four WDAs with projected growth greater than the past are: Northwest, Pacific Mountain, Spokane and Olympic.

As was the case last year, the largest positive difference between historical growth rates and projected growth rates is in the Olympic WDA. For this area, the difference between the historical and projected rates is 0.43 percentage points. Spokane came in second place with a positive increase of 0.36 percentage points.

Even though Benton-Franklin has the largest negative difference between projected and historical rates, of all WDAs and the state, it has the fifth highest projected growth rate of 1.36 percent.

The last column in *Figure 2* represents the long-term growth rate on the historical linear trend line on all available history. Variances between long-term trend line rates and projected growth rates show the effects of the most recent changes in local employment trends. These variances may reflect differences in cyclical behavior.

Figure 2. Historical and projected total nonfarm employment growth
Washington state and workforce development areas, 1990 to 2017 and 2017 to 2027
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

Workforce development area[1]	Historical growth rate[2] 2007-2017	Projected growth rate 2017-2027	Historical trend line growth rate[3] 1990-2017
Seattle-King County	2.01%	1.83%	1.30%
Statewide	**1.70%**	**1.51%**	**1.48%**
Pierce County	1.58%	1.40%	1.73%
Southwest Washington	1.86%	1.39%	1.80%
Benton-Franklin	2.75%	1.36%	2.28%
Northwest	1.12%	1.35%	1.76%
Pacific Mountain	1.17%	1.34%	1.31%
Spokane	0.93%	1.28%	1.27%
North Central	1.60%	1.27%	1.38%
Snohomish County	1.68%	1.14%	2.15%
Olympic Consortium	0.68%	1.11%	1.12%
South Central	1.36%	1.10%	0.88%
Eastern Washington	1.18%	0.82%	0.99%

[1]Workforce development areas are regions within Washington state with economic and geographic similarities.
[2]Historical growth is based only on covered employment.
[3]The Historical trend growth is defined as the growth rate of the linear trend line.

Eight of the 12 WDAs have projected growth less than the previous 10 years' growth.

2019 occupational projections results

The number of publishable occupations varies from year to year due to survey, reporting and statistical processing. This year the detailed state level occupational projections cover 794 occupations, 782 which are publishable. Also, at the state level, twelve occupations were suppressed due to confidentiality or due to one of the employment estimations being less than 10. This publication however, provides only a summary of the top occupations. For a complete list of occupations and projected employment, see the 2019 Employment Projections data files available at: https://esd.wa.gov/labormarketinfo/projections.

Major occupational groups

Figure 3 shows occupational employment estimates and employment shares for Washington state.

At the state level, as was the case in last year's report, one occupational group stands out with increases in employment shares from 2017 to 2027. Computer and mathematical occupations are projected to increase employment shares by 0.71 percentage points. The next highest increase in shares is projected for personal care and service occupations, with an increase of 0.28 percentage points.

The three largest decreases in employment shares at the state level are: sales and related occupations, 0.52 percentage points, production occupations, 0.49 percentage points and office and administrative support, 0.38 percentage points.

By 2027, the top three state occupational groups for shares of employment are projected to be:

1. Office and administrative support occupations (11.61 percent)
2. Sales and related occupations (8.88 percent)
3. Food preparation and serving related occupations (7.99 percent)

By 2027, combined, these three major groups are projected to represent 28.48 percent of total employment shares for the state.

Figure 3. Base and projected occupational employment
Washington state, 2017 to 2027
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics

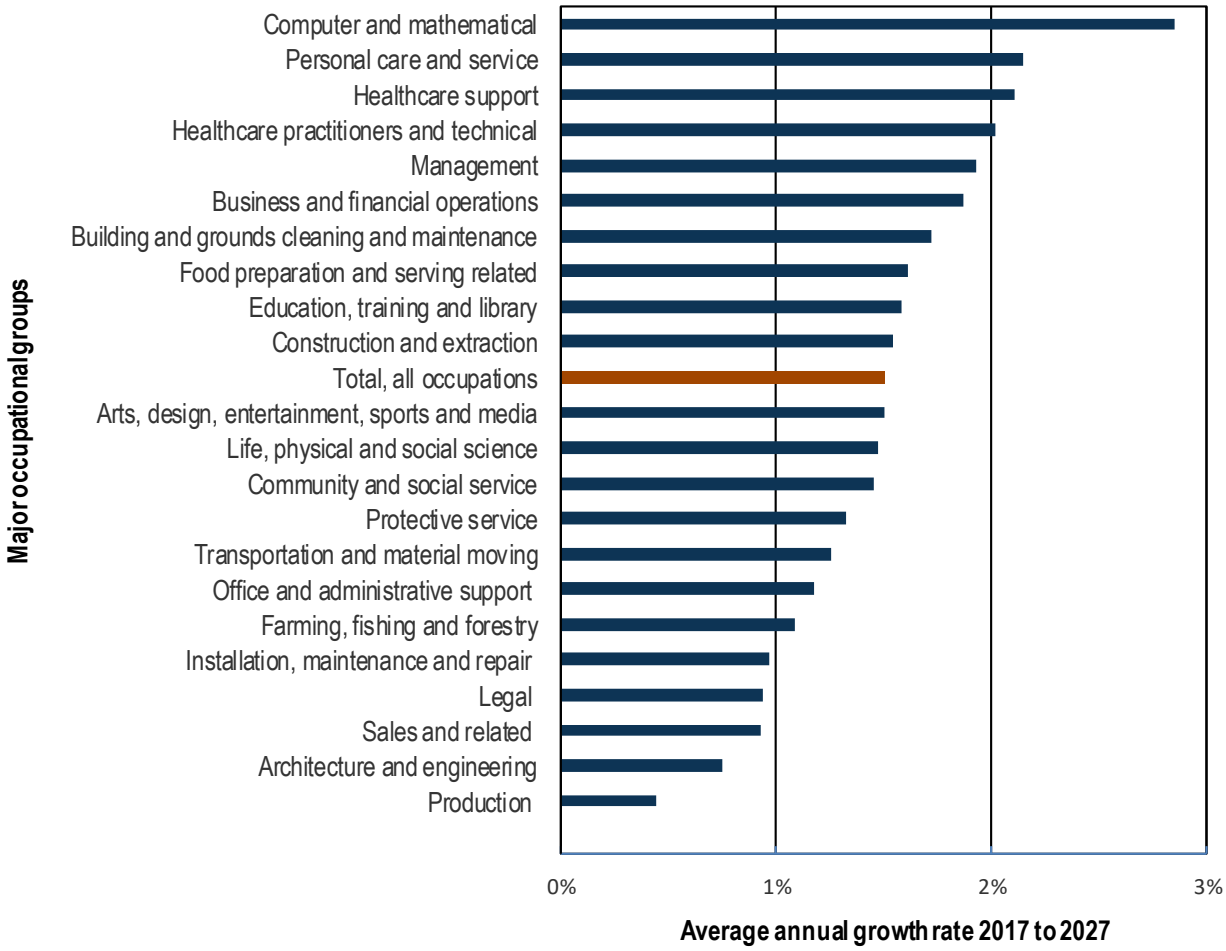
2-digit SOC	Major occupational group	WA state est. empl. 2017	WA state est. empl. shares 2017	WA state proj. empl. shares 2022	WA state proj. empl. shares 2027	WA state percentage point change in empl. shares 2017-2022	WA state percentage point change in empl. shares 2022-2027
11-0000	Management	224,350	5.95%	6.07%	6.21%	0.12%	0.13%
13-0000	Business and financial operations	241,139	6.40%	6.48%	6.63%	0.09%	0.15%
15-0000	Computer and mathematical	187,884	4.98%	5.33%	5.69%	0.35%	0.35%
17-0000	Architecture and engineering	82,113	2.18%	2.09%	2.02%	-0.09%	-0.07%
19-0000	Life, physical and social sciences	39,770	1.06%	1.05%	1.05%	0.00%	0.00%
21-0000	Community and social services	57,591	1.53%	1.52%	1.52%	-0.01%	0.00%
23-0000	Legal	28,769	0.76%	0.74%	0.72%	-0.03%	-0.01%
25-0000	Education, training and library	221,855	5.89%	5.87%	5.93%	-0.02%	0.07%
27-0000	Arts, design, entertain., sports & media	68,631	1.82%	1.81%	1.82%	0.01%	0.01%
29-0000	Healthcare practitioners and technical	176,137	4.67%	4.76%	4.92%	0.08%	0.16%
31-0000	Healthcare support	95,546	2.53%	2.59%	2.69%	0.05%	0.10%
33-0000	Protective service	68,347	1.81%	1.79%	1.78%	-0.02%	-0.01%
35-0000	Food prep. and serving related	298,128	7.91%	8.01%	7.99%	0.10%	-0.02%
37-0000	Bldg. and grounds cleaning and maint.	118,787	3.15%	3.18%	3.22%	0.02%	0.04%
39-0000	Personal care and service	160,464	4.26%	4.38%	4.54%	0.12%	0.15%
41-0000	Sales and related	354,334	9.40%	9.08%	8.88%	-0.32%	-0.20%
43-0000	Office and administrative support	451,914	11.99%	11.77%	11.61%	-0.22%	-0.16%
45-0000	Farming, fishing and forestry	97,092	2.58%	2.55%	2.47%	-0.03%	-0.07%
47-0000	Construction and extraction	230,106	6.10%	6.32%	6.13%	0.22%	-0.19%
49-0000	Installation, maintenance and repair	145,177	3.85%	3.75%	3.65%	-0.10%	-0.10%
51-0000	Production	184,298	4.89%	4.62%	4.40%	-0.27%	-0.22%
53-0000	Transportation and material moving	236,870	6.28%	6.25%	6.13%	-0.03%	-0.12%

At the state level, computer and mathematical occupations stand out for their increase in employment shares.

The projected average annual growth rates for the major occupational groups in Washington state are presented in *Figure 4*. Computer and mathematical occupations (2.85 percent), personal care and service occupations (2.15 percent) and health support occupations (2.11 percent) are projected to grow faster than other occupational groups from 2017 to 2027.

In the long term, five occupational groups are projected to fall below a 1.00 percent average annual growth rate: production (0.44 percent), architecture and engineering (0.75 percent), sales and related (0.93 percent), legal (0.94 percent) and installation, maintenance and repair (0.97 percent). Only installation, maintenance and repair was not in the bottom five last year. Last year it was the sixth lowest.

Figure 4. Projected average annual growth rates for major occupational groups
Washington state, 2017 to 2027
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics



Computer and mathematical, personal care and service and health support occupations are projected to experience the largest growth rates from 2017 to 2027 (2.85, 2.15 and 2.11 percent, respectively).

Separations and alternative job openings

The Bureau of Labor Statistics (BLS) *separations* method measures job openings created by workers who leave occupations and need to be replaced by new entrants. In this method, workers who exit the labor force or transfer to an occupation with a different Standard Occupational Classification (SOC) are identified as generating separation openings at the national level. This method does not track turnover within occupations. Turnovers within occupations occur when workers stay in occupations, but change employers. This also means that under the BLS method, jobs filled by interstate movement when workers stay within occupations, are not identified as new jobs.

Beginning with the 2017 projections cycle, ESD created a new Washington state specific *alternative* occupational method to the BLS *separations* method. The objective was to track job openings that occur when workers transfer within occupations. For simplicity, we refer to this method as the *alternative* method and to the rates as the *alternative* rates. While the *alternative* method can be used for any states that have useable wage files, the *alternative* results are based on Washington state wage records, making them specific to Washington state.

The *alternative* rates track openings created by turnover within occupations (i.e., workers stay within occupations but transfer to different companies) and when workers leave one occupation for another or leave the workforce.

The method consists of three major steps:

1. Estimating the total number of annual industry transfers that include:
    a. Transfers between industries
    b. Transfers inside industries
    c. New individuals in Washington state wage records (wage file)
    d. Exits or individuals who are no longer in the wage file
2. Converting industry transfers to occupational transfers using occupation-to-industry staffing patterns (shares of occupations for each industry).
3. Calculating *alternative* rates as total transfers, minus growth or decline, divided by estimated occupational employment for a base period.

Information about the *separations* methodology is available at: **https://www.bls.gov/opub/mlr/2018/article/occupational-separations-a-new-method-for-projecting-workforce-needs.htm** and information about the *alternative* methodology is available at: **https://esd.wa.gov/labormarketinfo/projections**.

For a complete list of *separations* and *alternative* projected employment, see: **https://esd.wa.gov/labormarketinfo/projections**.

Figure 5 presents a comparison between *separations* and *alternative* methodologies. Average annual total openings are compared at the two-digit SOC level. *Alternative* openings are on average almost two and a half times larger than *separations* openings. The *alternative* method increase makes sense since it measures openings not tracked by BLS. The *alternative* method measures turnover within occupations, while the BLS method does not. Also, BLS labor force exits measure national exits, but do not track exits from states.

The average ratio for *alternative to separations* is 2.56. A ratio above this average means that a worker is more likely to change jobs within a given occupation than to transfer to another occupation.

In *Figure 5*, the three largest *alternative-to-separations* ratios are for construction and extraction (3.48), healthcare practitioners and technical (3.46) and legal (3.23) occupations.

Figure 5. Comparison of alternative and separations methodologies on total openings
Washington state, 2017 and 2027
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

2-digit SOC	Major occupational group	Estimated employment 2017	Estimated employment 2027	Alternative average annual total openings 2017-2027	Separations average annual total openings 2017-2027	Ratio alternative to separations
11-0000	Management	82,113	88,446	86,630	28,373	3.05
13-0000	Business and financial operations	68,631	79,680	82,514	33,275	2.48
15-0000	Computer and mathematical	118,787	140,859	72,084	26,296	2.74
17-0000	Architecture and engineering	241,139	290,196	20,023	7,216	2.77
19-0000	Life, physical and social science	57,591	66,531	11,464	5,001	2.29
21-0000	Community and social service	187,884	248,896	18,976	8,379	2.26
23-0000	Legal	230,106	268,250	7,712	2,391	3.23
25-0000	Education, training and library	221,855	259,663	58,121	28,799	2.02
27-0000	Arts, design, entertain., sports and media	97,092	108,156	25,835	9,321	2.77
29-0000	Healthcare practitioners and technical	298,128	349,738	61,551	17,777	3.46
31-0000	Healthcare support	176,137	215,201	41,270	16,297	2.53
33-0000	Protective service	95,546	117,687	20,850	9,899	2.11
35-0000	Food preparation and serving related	145,177	159,858	147,459	65,804	2.24
37-0000	Bldg. and grounds cleaning and main.	28,769	31,585	53,927	20,547	2.62
39-0000	Personal care and service	39,770	46,035	77,837	33,193	2.34
41-0000	Sales and related	224,350	271,558	131,147	56,040	2.34
43-0000	Office and administrative support	451,914	508,074	157,893	65,142	2.42
45-0000	Farming, fishing and forestry	160,464	198,474	50,515	17,308	2.92
47-0000	Construction and extraction	184,298	192,552	112,706	32,431	3.48
49-0000	Installation, maintenance and repair	68,347	77,947	50,680	17,179	2.95
51-0000	Production	354,334	388,517	52,419	22,614	2.32
53-0000	Transportation and material moving	236,870	268,343	94,725	37,144	2.55
00-0000	**Totals**	**3,769,302**	**4,376,246**	**1,436,338**	**560,426**	**2.56**

On average, alternative openings are more than two and a half times larger than separations openings.

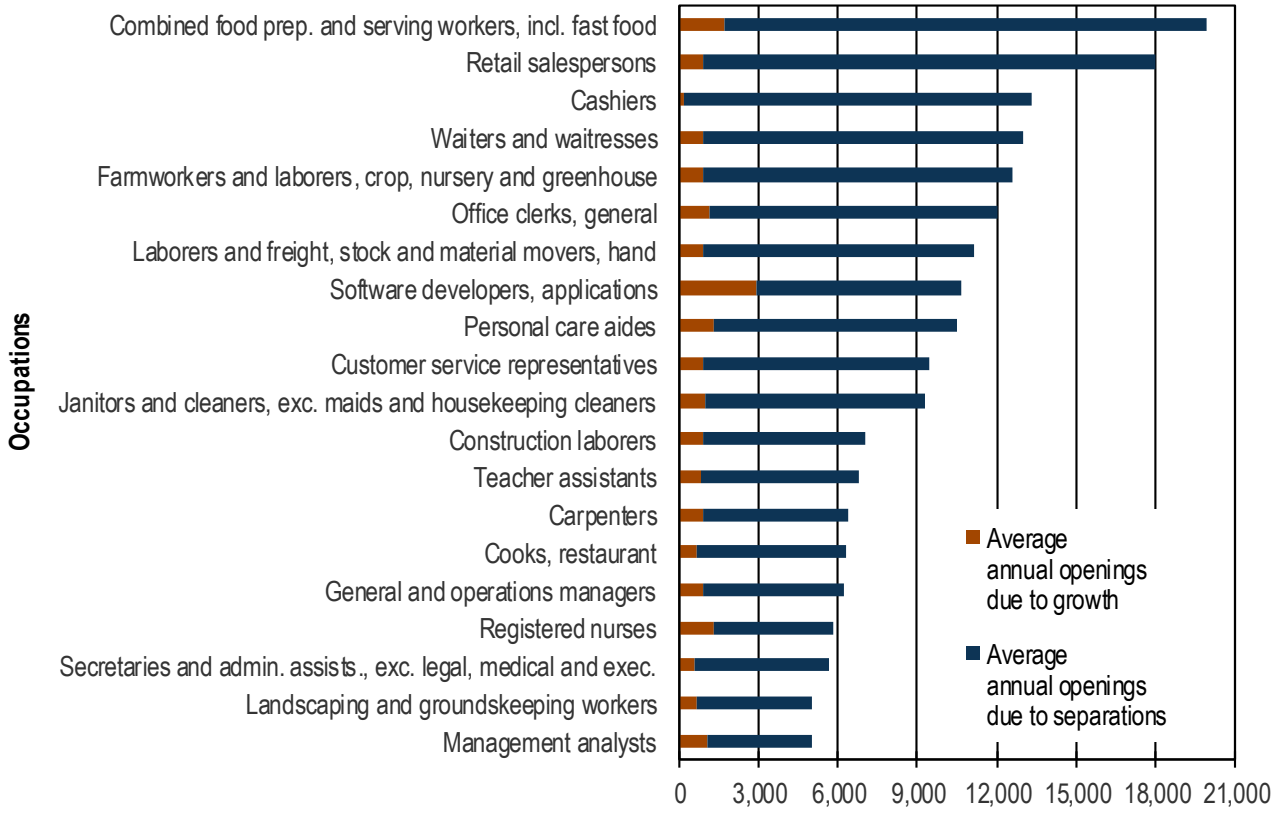
Specific occupations

Figure 6 shows the top 20 specific occupations by total openings based on the *separations* methodology. *Figure 7* shows the top 20 specific occupations by total openings based on the *alternative* methodology.

The number of openings due to **job growth** did not exceed openings due to *separations* or *alternative* **job turnover** in any of the top 20 occupations.

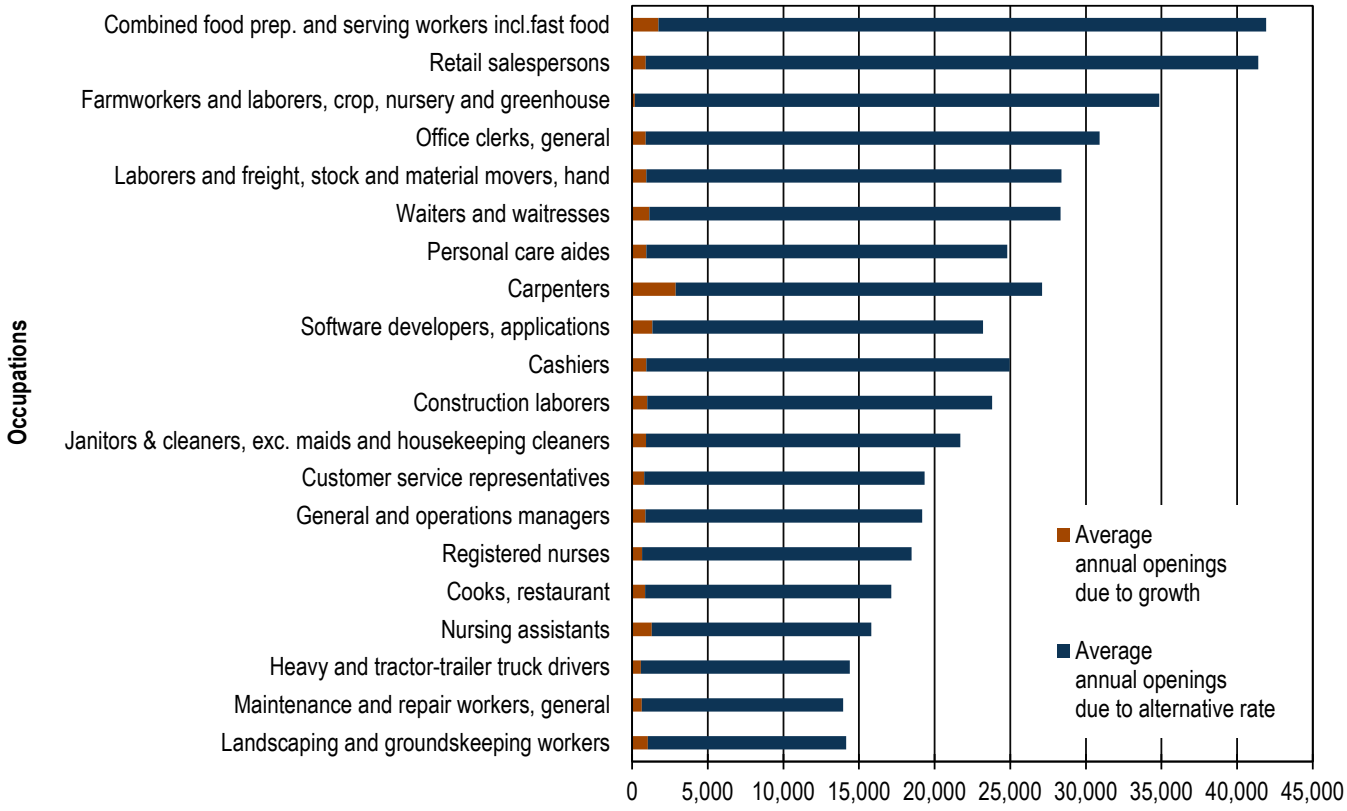
For both methodologies, the combined food preparation and serving workers, including fast food occupation, is projected to have the largest number of total openings. Seventeen of the top 20 specific occupations are the same in both methods.

Figure 6. Top 20 specific occupations by average annual total openings, *separations* methodology
Washington state, 2017 to 2027
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics



In the separations methodology, the number of openings due to job growth did not exceed openings due to job turnover in any occupations.

Figure 7. Top 20 specific occupations by average annual total openings, *alternative* methodology
Washington state, 2017 to 2027
Source: Employment Security Department/LMEA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics



In the alternative methodology, the number of openings due to job growth did not exceed openings due to job turnover in any occupations.

Appendices

Appendix 1: Use and misuse of employment projections

Employment Projections are intended for career development over time, not as the basis for budget or revenue projections, or for immediate corrective actions within the labor market.

Employment projections provide a general outlook for industries and occupations in Washington state. Occupational projections show how many job openings are projected due to occupational employment growth and replacement needs (*separations* and *alternative*). For technical details see: 2019 Employment Projections Technical Report

For the *separations* method, replacement includes openings created by retirements and occupational separations. It does not measure turnover within occupations, i.e., when workers stay within the same occupation, but change employers. For the *alternative* method, replacement includes normal turnover as workers go from one employer to another while staying in the same occupation. *Separations'* total openings from occupational projections do not represent total demand, but can be used as an indicator of demand. *Alternative* total openings for occupational projections do represent total demand. Total demand may be filled by new entrants to the state market. New entrants can be workers from other states or nations, and new entrants can also be graduates from this state, other states or nations. In addition, occupations can be filled by workers already within the market, within a given occupation or from another occupation. Available job openings cannot be reserved for any of these categories since the majority of jobs are open-competitive.

Occupational details for employment (with at least 10 jobs) are presented for the state and all workforce development areas in our employment projections data files available online at https://esd.wa.gov/labormarketinfo/projections.

Observed and predicted extremes in employment growth and other indicators, such as fastest-growing occupations and shortage of skills, can be used for placement and short-term training decisions. However, these should be limited for use when developing long-term education programs. There are two main reasons for this limitation:

1. First, with more education targeting occupations with skill shortages, there is a higher probability that this will cause an oversupply in those occupations and skill sets.[3]
2. Second, the general development of transferable skills is much more productive than trying to catch up with a skills shortage.

In this year's projections cycle, we used the 2010 SOC (one 2018 SOC was used - 53-1049 - First-Line Supervisors of Transportation Workers, All Other). The U.S. Bureau of Labor Statistics cautions on using Office of Management and Budget (OMB) 2010 and 2018 classifications (the warning is the same in both versions): "The 2010 SOC was designed solely for statistical purposes. Although it is likely that the 2010 SOC also will be used for various non-statistical purposes (e.g., for administrative, regulatory, or taxation functions),

[3] Occupational projections are the basis of the Occupations in Demand list. This list is used for determining eligibility for a retraining program (Training Benefits), as well as other education and training programs. See: **https://esd.wa.gov/labormarketinfo/LAAO**

the requirements of government agencies or private users that choose to use the 2010 SOC for non-statistical purposes have played no role in its development, nor will OMB modify the classification to meet the requirements of any non-statistical program.

Consequently, the 2010 SOC is not to be used in any administrative, regulatory, or tax program unless the head of the agency administering that program has first determined that the use of such occupational definitions is appropriate to the implementation of the program's objectives."[4]

Different programs use different SOC coding systems. Combining the employment projections with other data sources generally requires a case-by-case analysis; an understanding of the differences of each program should be clearly explained and properly handled.

[4] See: **https://www.bls.gov/soc/2018/soc_2018_user_guide.pdf**, pages xxv-xxvi.

Appendix 2: Occupations in Demand (OID) methodology

Employment projections are the basis of the Occupations in Demand (OID) list covering Washington's 12 workforce development areas and the state as a whole. This list is used to determine eligibility for a variety of training and support programs, but was initially created to support the unemployment insurance Training Benefits Program.

The full OID list is accessible through the "Learn about an occupation" tool located at: https://esd.wa.gov/labormarketinfo/LAAO.

All occupations in the list have demand indication definitions. The definitions come in three forms; **in demand**, **not in demand** or **balanced**. These definitions indicate the probability of a job seeker gaining employment in a given occupation. The term **in demand** indicates a greater probability of gaining employment. The term **not in demand** indicates a lesser probability and **balanced** indicates an uncertain probability between success and failure in gaining employment.

The definitions are created through a four-step process.

The data sources for the OID list:

The 2019 list is based on projections with state specific *alternative* rates used for turnover openings:

- Five-year projections for 2017-2022, using average annual growth rates and total job openings.
- Ten-year projections for 2017-2027, using average annual growth rates and total job openings.
- A combination of two-year (second quarter 2018 to second quarter 2020) and ten-year (2017-2027) projections, using average annual growth rates and total job openings.

All of these time frames use unsuppressed occupations with employment in a base year (2017), consisting of 50 or more employees, for the state and workforce development areas (WDAs).

In addition to projections, the OID list uses supply and demand data:

- Supply data: annual counts of unemployment claimants for WDAs for the period June 2018 to May 2019.
- Demand data: annual counts of job announcements from Help Wanted OnLine (HWOL) mid-monthly time series for the period June 2018 to May 2019.

***Step one:** Identifying initial "in demand" and "not in demand" categories for each period.*

- For each time frame, occupations with average annual growth rates of at least 90 percent of their respective geographic area's (statewide or WDA), total average annual growth rates *and* a share of total openings of at least 0.08 percent are defined as **in demand**.

- Occupations with average annual growth rates less than 70 percent of their respective geographic area's total growth rates *and* a share of total openings of less than 1.0 percent are defined as **not in demand**.

Step two: *Identifying provisional occupational categories.*

- If within any of the three projection time frames (five-year, 10-year and two-/10-years combined), an occupation is categorized as being **in demand**, it receives the first provisional identification as **in demand**.
- If within any of the three projection time frames, an occupation is categorized as **not in demand**, it receives a second provisional identification of **not in demand**.

Step three: *Create final projections definitions.*

- If an occupation has only one provisional definition, it equals the final projections definition.
- If an occupation has two provisional definitions of **in demand** and **not in demand**, it gets identified as **balanced**.
- All other occupations, without provisional definitions (i.e., not meeting the thresholds from step one), are identified as **balanced**.

Step four: *Create final adjustment definitions.*

The projections definitions are now put through an adjustment process, using current labor market supply/demand data which compares online job announcements to information on unemployment insurance (UI) claimants.

Adjustments are applied when current supply/demand data significantly contradicts the model-based projections definitions.

The adjustment methodology

- Supply/demand data are used for adjustments if they are significant. Significant supply-demand data are those data where the share of the largest value between UI claimants and online job announcements are more than 1 percent of openings, and where the largest values between announcements and UI claimants more than 10, or the largest values between UI and announcements not less than five, for the period 2017 to 2027.
- If the projections definition is **in demand** or **balanced** but the ratio of supply to demand is more than 2.5, then the adjusted definition is **not in demand**.
- If the projections definition is **in demand** and the ratio of supply to demand is not larger than 2.5, but more than 1.5, then the adjusted definition is **balanced**.
- If the projections definition is **not in demand** or **balanced**, but the ratio of supply to demand is less than 0.4, then the adjusted definition is **in demand**.
- If the projections definition is **not in demand** and the ratio is at least 0.4, but less than 0.6, then the adjusted definition is **balanced**.

The final list: Local adjustments

The Employment Security Department's Labor Market and Economic Analysis division uses the methodology outlined above to prepare the initial lists for the state as a whole and by workforce development area. Those lists are then given to local workforce development councils to review, adjust and approve based on their local experience and knowledge.

Appendix 3: Skill projections

In order to project skills, occupational projections are converted into skill projections. To project skills, we rely on the content of employers' job postings rather than predefined, general O*NET skills.

Data sources

The main source for this analysis was a download of the top 100 hard skills for each detailed (six-digit SOC) occupation for Washington state from WANTED Analytics. The downloaded files represent extracted hard skills for each occupation from online job announcements, posted in the last three years (from July 2015 to June 2018).[5] Only a maximum of 100 skills are available for each occupation. Each skill is displayed with the number of job announcements from which it was extracted. The extracted skill numbers constitute a vector, up to a size of 100, for each occupation. A skill drawn from a greater number of job announcements is relatively more important. The number of job announcements is summed for each occupation. Some occupations contain very few, if any listed skill components, and thus the summation value for a given occupation can be very small or nonexistent and are removed in later processes.

For creating skills-to-occupations matrices, we included occupations that satisfy the following conditions only:

1. Total skill counts are not less than five.
2. Total skill counts are not less than two percent of base year employment.
3. Estimated employment for second quarter 2018 are not less than five.

Each occupational vector of skill numbers was normalized (i.e., scaled) to totals of one.

By combining these vectors, we created skills-to-occupations matrices. These matrices were used to convert occupational estimations and projections into comparable numbers expressed as hard skills.

The skills-to-occupations matrices are similar in structure and function to normalized matrices used for occupational/industries staffing patterns. The skills-to-occupations matrices were based on statewide data and were used to convert occupational projections for the state and all WDAs into skills projections.

After conversion, we deleted all records where estimated or projected employment numbers were less than five. We consider estimations below five as unreliable. As a result of excluding missing skill/occupation vectors and removing results below five, only a portion of the occupational employment estimates were converted into skills.

The conversion size of occupational employment to skills employment, calculated on base year employment (second quarter 2018), varies between 95.72 percent for the Tacoma-Pierce WDA to a low of 81.63 percent for the South Central WDA. The combined ratio for all WDAs is 91.95 percent and for the state is 90.02 percent.

[5] In last year's projections report we used a sample for the period July 2014 to June 2017.

Some results

A uniform skills to occupation staffing matrix is applied to all areas. Due to differences in occupational employment in each area, and the exclusion of employment below five, available skill counts in each area vary. As a result, the largest number of detailed skills were 3,631 for Washington state, followed by the Seattle-King County WDA at 3,114. The lowest number was for Eastern Washington at 1,257 skills.

The top six detailed hard skills for the state and all areas, based on projected numbers of total openings, for all time periods (second quarter 2018 to second quarter 2020, 2017-2022 and 2022-2027), with base year in second quarter 2018, are relatively stable between areas (order may vary). The top six skills based on projected numbers of job openings for all time periods for the state are: **Food preparation**, **Microsoft Office, Bilingual**, **Quality Assurance, Forklifts, Mathematics**. This year **Microsoft Office** replaced last year's **Freight+** in the top six skills. The stability among areas is no surprise since the same statewide matrix was used for all areas. The combined top six skills represent 16.83 percent of total openings for the state.

For the state and Seattle-King County, the fastest skill growth, for all periods, is projected for skills related to information technology (IT). The IT skills are very specific, vary from area to area, and the majority, individually, are not large in terms of employment and job openings.

The top 32 skills at the state level, with annual openings of at least 100, with the largest average annual growth rates, from 2017 to 2027 are related to IT. The top six of these IT skills are: **Docker, Amazon Elastic Compute Cloud**, **RESTful Web Services**, **JavaScript Object Notation**, **Scala** and **Asynchronous JavaScript and XML**.

However, for all WDAs and the state, the combined totals for these fastest growing six detailed occupations represents an insignificant share, less than 0.1 percent of total openings represented in the skill projections.

At the state level only, these fastest growing top 32 skills (all IT related) combined, represent 0.82 percent of total state skill-forecast openings. For all areas and for total job openings, more than 23 percent have IT skills as the primary skill.

The top 20 detailed skills for Washington state based on a combined (average) rank of average annual openings and growth rates for 2017 to 2027 are presented in *Appendix figure A3-1.*

Appendix figure A3-1. Top 20 skills ranked by combined average annual openings and growth
Washington state, 2017 to 2027
Source: Employment Security Department/LMEA; WANTED Analytics

Combined rank	Hard skill titles	Estimated hard skill employment numbers 2017	Projected hard skill employment numbers 2027	Average annual growth rate 2017-2027	Total average annual openings
1	Java	7,876	10,503	2.92%	2,940
2	Amazon Web Services	3,331	4,567	3.21%	1,319
2	JavaScript	3,734	5,058	3.08%	1,441
4	Software development	11,817	15,226	2.57%	4,394
5	C#	4,359	5,806	2.91%	1,609
6	Web services	7,259	9,355	2.57%	2,832
7	Python	7,584	9,781	2.58%	2,675
8	Big Data	4,326	5,693	2.79%	1,673
8	C/C++	5,238	6,853	2.72%	1,846
10	Linux	5,365	6,983	2.67%	1,976
11	Agile Software Development	3,705	4,895	2.83%	1,461
11	Structured query language	18,249	23,146	2.41%	6,704
13	Distributed system	2,251	3,110	3.28%	886
14	Systems Development Life Cycle	3,492	4,643	2.89%	1,351
15	Scrum agile methodology	2,782	3,739	3.00%	1,126
16	Catheters	10,930	13,827	2.38%	5,431
17	Tableau Software	5,911	7,569	2.50%	2,225
18	Cloud Computing	7,071	8,987	2.43%	2,759
19	Machine learning techniques	4,146	5,367	2.61%	1,553
19	Bedpans	6,806	8,586	2.35%	3,489

Eighteen of the top 20 skills are related to information technology.

The top 20 occupations represent 3.9 percent of total openings in the skills forecast. Fifteen of the top 20 skills are identical to last year.

The majority of skills, especially related to information technology (IT) and high-tech, are very specific and their numbers are dispersed among all occupations. As a result, these detailed skills normally do not represent a significant share of total numbers.

Information technology

In the skills forecast, at the state level and for all but one WDA, the largest group of skills, based on *job openings only*, are IT related. Only the North Central WDA had production skills in first place with IT in second place.

At the state level, IT skills represent 23.63 percent of average annual total openings for the period 2017 to 2027 and have the second highest growth rate of 1.78 percent. Healthcare came in first place with a growth rate of 1.84 percent.

It is interesting to note that out of a total of 661 occupations converted to skills at the state level, IT skills are present in 614 occupations. For 336 of these occupations, IT skills comprise more than one quarter of total numbers and for 73 they comprise more than one-half of total numbers.

IT skills naturally dominate shares in computer-related occupations, but also have a very high share in occupations whose primary occupational focus is not computers. The top 15 occupations with high computer skill requirements based on IT shares, are presented in *Appendix Figure A3-2*. New to the top 15 this year are: **Bailiffs**; **Life Scientists, All Other**; **Social Scientists and Related Workers, All Other**; **Media and Communication Workers, All Other**; and **Prepress Technicians and Workers**.

Appendix figure A3-2. Occupations, not primarily computer related, with the largest shares of computer skill requirements Washington state, 2018 second quarter occupational estimations (July 2015 to June 2018 sample, skills/occupations matrices)
Source: Employment Security Department/LMEA; WANTED Analytics

SOC	Occupation	Share of skills that are IT
333011	Bailiffs	0.857
191099	Life Scientists, All Other	0.846
193099	Social Scientists and Related Workers, All Other	0.845
439111	Statistical Assistants	0.815
271022	Fashion Designers	0.803
273099	Media and Communication Workers, All Other	0.800
271014	Multimedia Artists and Animators	0.789
193011	Economists	0.770
515111	Prepress Technicians and Workers	0.750
152011	Actuaries	0.746
191029	Biological Scientists, All Other	0.744
271024	Graphic Designers	0.729
152031	Operations Research Analysts	0.722
152041	Statisticians	0.721
131111	Management Analysts	0.707

Ten of the current 15 occupations are the same as in last year's report.

Skill based related occupations

Skills–to-occupations matrices allow us to create a tool for defining related occupations, based on common skills. To achieve this, we calculated a matrix of correlations based on skills between occupations. The results are presented in the macro-enabled file, **reloccup_skills_2019.xlsm**. The matrix in the file's "main" tab is symmetric around the main diagonal. The main diagonal has all 1s in it. There are two ways of using the file's data when opened with the enabled-macros feature:

1. You can select an occupational title of interest, from a column heading, in the "main" tab and then sort the numbers below the title of interest from largest to smallest. Starting from row 3 in column B you would see the sorted list of related occupations (row 2 will be the same occupation as selected). To restore the original sort-configuration, sort the key-column (column A) from smallest to largest.
2. You can select an occupation of interest, from a column heading, in the "main" tab and then click the **Ctrl** and **A** keys simultaneously. This will execute a macro. The macro opens a table in a "table" tab. In the table, you will find a list of the top 15 occupations related to your occupation of interest.

An example of a list for software developers, applications is in *Appendix figure A3-3.*

Appendix figure A3-3. Top 15 occupations related to software developers, applications
Washington state, 2019
Source: Employment Security Department/LMEA; WANTED Analytics

SOC	151132-Software Developers, Applications
151131-Computer Programmers	0.802
151199-Computer Occupations, All Other	0.771
151134-Web Developers	0.669
151133-Software Developers, Systems Software	0.639
151111-Computer and Information Research Scientists	0.582
151121-Computer Systems Analysts	0.559
113021-Computer and Information Systems Managers	0.525
251021-Computer Science Teachers, Postsecondary	0.524
439111-Statistical Assistants	0.492
191029-Biological Scientists, All Other	0.457
151142-Network and Computer Systems Administrators	0.393
119041-Architectural and Engineering Managers	0.391
151141-Database Administrators	0.382
172061-Computer Hardware Engineers	0.356
152021-Mathematicians	0.322

Numbers in the table represent coefficients of correlations for normalized vectors of skill shares.

The related occupations tool may be useful for job seekers. The results are specific for Washington state since the skills come from job announcements in this state.

Conclusions

Our view is that it is more important to connect education and training programs with real world skill requirements than with generic occupational skills definitions.

As was noted in last year's report, some skills with large projected numbers of openings are well defined and can be linked to various levels of training. Skills with the largest numbers of projected openings are: **Food preparation**, **Microsoft Office**, **Bilingual**, **Quality Assurance**, **Forklifts**, **Mathematics**, etc.

It is also still true that skills like **Quality Assurance**, **Quality control**, **Risk assessment**, **Lean Manufacturing**, **Lean Six Sigma** and different engineering skills require significant skill acquisition related to information technology. These types of skills are much more dispersed than the first group. Creating training programs for this second skill group presents a more complex challenge for educators.

While primary fields are relatively stable and well defined, IT skill sets are constantly changing. IT skills are concentrated mainly in software, algorithms, some hardware and in web applications.

Some specific skills, like those in *Appendix figure A3-1,* are important and help graduates enter the labor market or move to higher paid jobs. However, in the long run, it might be worth giving priority to foundational academic subjects like math and formal logic, multidimensional design, and foundational concepts in object oriented programing. In other words, foundational abilities to learn, develop and implement new knowledge and technology in the long run should take priority for career preparation.

Future possibilities

Skill forecasts continue to be in an experimental phase. Improvements in skill extraction and clustering techniques would allow us to improve our skills products. As always, it will also continue to be important to establish a direct connection between specific skills required by employers and education and training programs.

Appendix 4: Frequently asked questions

Q: What are the steps in industry projections?

A: There are two major steps in industry projections. The first step is developing aggregated statewide industry projections using Global Insight national forecasts. The second step produces detailed industry projections. The principal data source for industry projections is a detailed covered employment time series of four-digit NAICS data for all Washington counties, specifically, the U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW).

Q: Why are the detailed industry projections not comparable with U.S. Bureau of Labor Statistics, Current Employment Statistics (CES) definitions?

A: Industry projections are classified according to U.S. Bureau of Labor Statistics, Occupational Employment Statistics (OES) definitions, which are somewhat different from CES.

Q: What is the source for occupational/industry ratios?

A: The primary source for occupational/industry ratios is the OES survey. However, this survey uses different area designations than the state's workforce development areas (WDAs) and has limited industry coverage (agriculture, non-covered employment, private households and self-employment are excluded) necessitating the use of other staffing patterns as well.

Q: Why can the ratio for industry and occupational projections differ from the OES survey outputs?

A: We use raw sample and limited numbers of imputations while standard OES processing using significant share of imputations. We also use extra information from WEB job announcements. In cases when sample is weak or missing, we use substituted area (state staffing patterns) or combined areas (King and Snohomish counties).

Q: Why can occupational/industry ratios differ between the base year and projected years?

A: This is due to the use of change factors, which predict changes in the occupational shares for each industry over time.

Q: Why can't occupational projections be benchmarked or verified?

A: There are no administrative records for employment by occupation; therefore, the data cannot be reliably benchmarked or verified by non-survey means.

Q: How are occupational projections used?

A: Occupational projections are the only data source for statewide and WDA-specific occupational outlooks. Projections are also the foundation for developing the Occupations in Demand list, which is used to determine eligibility for a variety of training and support programs, but was created to support the unemployment insurance Training Benefits Program.

Q: How are industry projections used?

A: Industry projections can be used by policy makers, job seekers, job counselors and economic analysts. For any policy decisions, the projections should be supplemented with other available data sources (e.g., unemployment insurance claims, educational data, job announcements, etc.).

Q: Which occupational codes are used?

A: The 2010 Standard Occupational Classification (SOC) system was used for this round of projections.

Q: Can the SOC be used for administrative purposes?

A: According to BLS, the 2010 SOC was designed solely for statistical purposes. To use SOC for administrative programs, the head of an agency considering using SOC must first determine if the use of SOC definitions is appropriate for a program's objectives.

Q: Why don't the occupational totals by WDA equal the state total?

A: The totals are not additive due to the use of local staffing patterns for projections by WDA, which differ from the statewide staffing pattern.

Q: What is the difference between the Bureau of Labor Statistics *separations* rate and *alternative* state specific rate methodologies?

A: The separations method measures job openings created by workers who leave occupations and need to be replaced by new entrants. In this method, workers who exit the labor force or transfer to an occupation with a different Standard Occupational Classification (SOC) are identified as generating separations openings at the national level. This means that jobs filled by workers within the same occupations, are not identified as new jobs.

The alternative rates track openings created by turnover within occupations (i.e., workers stay within occupations but transfer to different companies) and when workers leave one occupation for another or leave the workforce. In contrast to separation methodology, alternative openings represent total job openings and are specific for Washington state.

Appendix 5: Glossary of terms

Industries

A classification of business establishments based on similar production processes.

North American Industry Classification System (NAICS)

North American Industry Classification System (NAICS) is the system used by federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing and publishing statistical data related to the U.S. business economy. NAICS was developed under the authority of the U.S. Office of Management and Budget.

Occupation

A job or profession, a category of jobs that are similar with respect to the work performed and the skills possessed by the workers.

Occupational projections

Industry projections converted to occupations, based on occupational/industry ratios.

Standard Occupational Codes (SOC)

Standard Occupational Classification (SOC) is the system used by federal statistical agencies in classifying workers into occupational categories for the purpose of collecting, calculating or disseminating data. All workers are classified into their occupational definitions which are structured at four levels of aggregation. SOC was developed under the authority of the U.S. Office of Management and Budget.

Total occupational estimations and projections

Total occupational estimations and projections are calculated to describe employment in base years and future time periods.