Skill Profiles and Portability of Credentials for the Technical Workforce

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Why the Skilled Technical Workforce?

- The National Science Board estimates the US will have 3.4 million unfilled skilled technical workforce (STW) jobs in 2022.
- The U.S. has lost pace in skills strength, 3rd in 2018 to 8th 2019.
- Technical jobs contribute to U.S. competitiveness and growth: 4th main source of competitiveness for the according to the World Economic Forum.

How is the Skilled Technical Workforce Defined?

- Individuals without a bachelor's degree but with a post-secondary nondegree credential or training that provides them with STEM knowledge and skills.
- Technical was defined by Rothwell (2015) using 14 of the 33 Knowledge domains in the O*NET the Content Model.

References: National Science Board (NSB). (2019). The skilled technical workforce: Crafting America's science & engineering enterprise.
Rothwell, J. T. (2015). Defining skilled technical work. *Available at SSRN 2709141*.
https://sites.nationalacademies.org/cs/groups/pgasite/documents/webpage/pga_167744.pdf

Research Questions

How do technical skills and experience shape the salary returns for skill-intensive occupations ?

What are the nondegree credentials that allow skilled technical workers to redefine career pathways in manufacturing?

Data Sources

Emsi | burning glass

33 million job-ads in U.S. (2019)

Approximately 1 million job-ads in Virginia

We used the BGT skill taxonomy

Classification:
Baseline - Specialized - Software

Specialized Skills

Skill Cluster Family (28)

Skill Cluster (657)

Skill (14888)

U.S. BUREAU OF LABOR STATISTICS

- 11-0000 Management Occupations
- 13-0000 Business and Financial Operations Occupations
- 15-0000 Computer and Mathematical Occupations
- 17-0000 Architecture and Engineering Occupations
- 19-0000 Life, Physical, and Social Science Occupations
- 21-0000 Community and Social Service Occupations
- 23-0000 Legal Occupations
- 25-0000 Educational Instruction and Library Occupations
- 27-0000 Arts, Design, Entertainment, Sports, and Media Occupations
- 29-0000 Healthcare Practitioners and Technical Occupations
- 31-0000 Healthcare Support Occupations
- 33-0000 Protective Service Occupations
- 35-0000 Food Preparation and Serving Related Occupations
- 37-0000 Building and Grounds Cleaning and Maintenance Occupations
- 39-0000 Personal Care and Service Occupations
- 41-0000 Sales and Related Occupations
- 43-0000 Office and Administrative Support Occupations
- 45-0000 Farming, Fishing, and Forestry Occupations
- 47-0000 Construction and Extraction Occupations
- 49-0000 Installation, Maintenance, and Repair Occupations
- 51-0000 Production Occupations
- 53-0000 Transportation and Material Moving Occupations
- 55-0000 Military Specific Occupations

O*NET OnLine

sponsored by the
U.S. Department of Labor

- Certifications and Licenses
- Classification of the Manufacturing Career Cluster

USA: Jobs requiring Certifications & Skills in BGT job-ads by Major Occupation Groups

Skills

vs

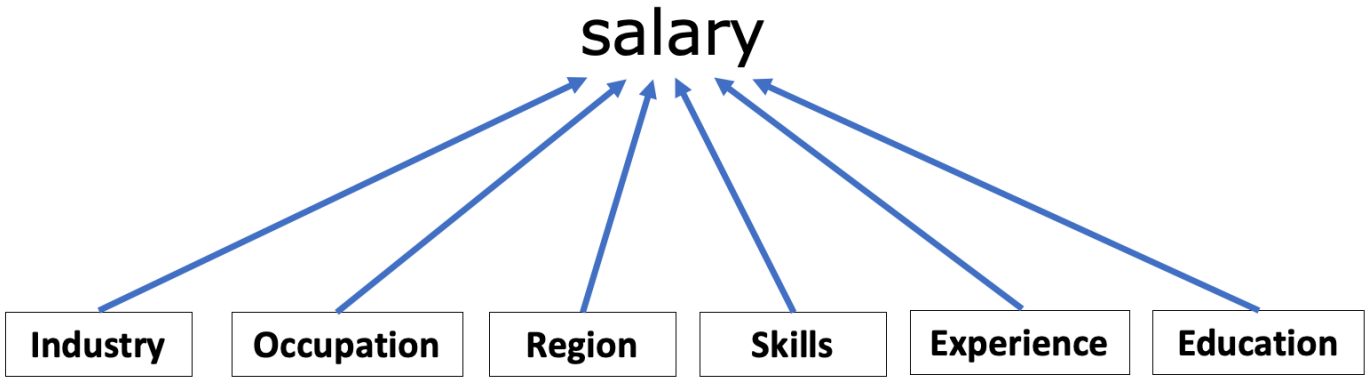
Certifications

SOC Code	Major Occupation Group	BGT Job-ads	Jobs Requiring Certifications	Prop.	Jobs Requiring Skills	Prop.
45	Farming, Fishing, and Forestry	28,474	3,601	0.126	24,631	0.87
55	Military	33,668	3,399	0.101	30,329	0.90
23	Legal	215,703	54,353	0.252	197,280	0.91
19	Life, Physical, and Social Science	306,982	50,812	0.166	298,768	0.97
33	Protective Service	396,027	73,433	0.185	355,951	0.9
47	Construction and Extraction	397,876	54,550	0.137	374,985	0.94
21	Community and Social Service	413,272	150,987	0.365	393,472	0.95
37	Building & Cleaning & Maintenance	588,126	24,099	0.041	544,331	0.93
31	Healthcare Support	719,946	414,460	0.576	695,012	0.97
39	Personal Care and Service	738,181	156,165	0.212	658,413	0.89
27	Arts, Design, Entertain, Sports, Media	762,396	50,493	0.066	721,936	0.95
51	Production	885,630	67,939	0.077	805,620	0.91
25	Educational Instruction and Library	952,099	259,704	0.273	899,598	0.94
17	Architecture and Engineering	952,684	170,016	0.178	925,024	0.97
49	Installation, Maintenance, and Repair	1,083,983	199,003	0.184	1,039,927	0.96
35	Food Preparation and Serving Related	1,562,503	176,238	0.113	1,326,954	0.85
13	Business and Financial Operations	2,154,997	414,333	0.192	2,104,298	0.98
53	Transportation and Material Moving	2,581,280	1,468,830	0.569	1,591,442	0.62
43	Office and Administrative Support	3,473,115	206,055	0.059	3,357,440	0.97
41	Sales and Related	3,491,433	348,038	0.100	3,401,352	0.97
29	Healthcare Practitioners and Technical	3,552,989	2,340,444	0.659	3,348,942	0.94
15	Computer and Mathematical	3,572,232	519,770	0.146	3,523,332	0.99
11	Management	3,624,851	695,197	0.192	3,502,697	0.97
NA	NA	1,371,251	123,025	0.09	1,286,739	0.94
	TOTAL	33,859,698	8,024,944	0.237	31,408,473	0.93

Source: Burning Glass Technologies, 2019

Methods

Skill-Salary formation:
Weighted least squares (WLS) model with fixed effects



Model

$$s_{ijm} = \theta + \alpha_j exper_j + \sum_{i=1}^{J} \beta_j skilltech_j + \sum_{m=1}^{M} \gamma_m \text{region}_m + u_i$$

where,

s_{ijm}: salaries per individual i and occupation j within region m

$exper$: years of experience

$skilltech$: share of technical skills

$region_m$: VA GO region, $m \in \{1, ..., 9\}$

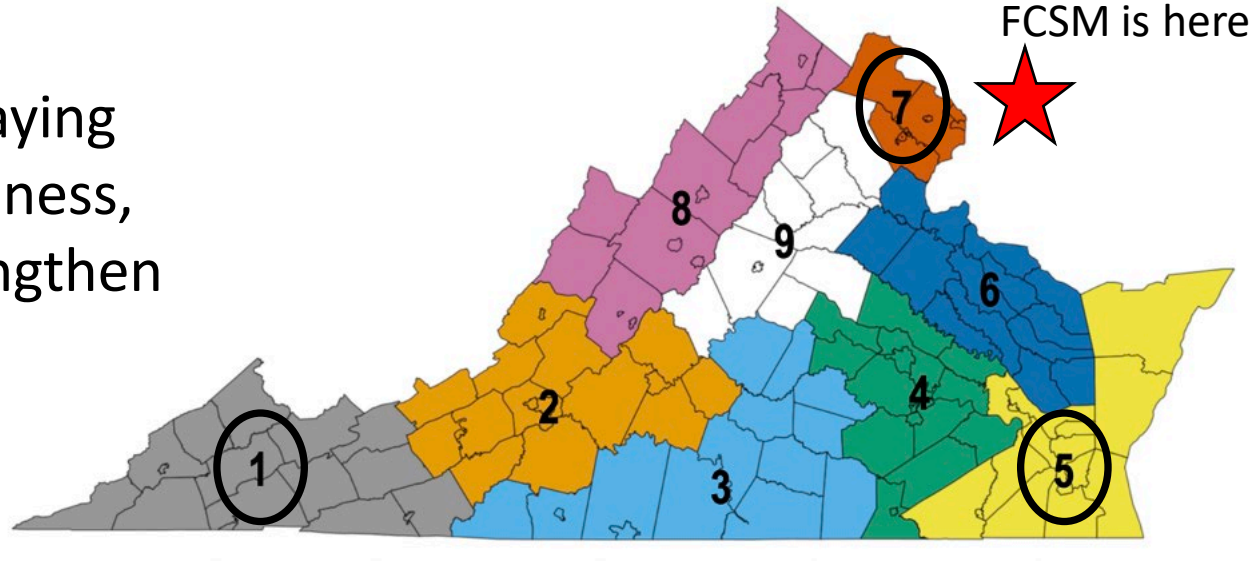
For WLS model, we weight the observations proportional to the reciprocal of squared residuals, to estimate the parameters by minimizing $V_w()$,

$$V_w(\theta, \alpha_j, \beta_j, \gamma_m) = \sum_{i=1}^{I} w_i \left(s_{ijm} - \theta - \alpha_j exper_j - \sum_{i=1}^{J} \beta_j skilltech_j - \sum_{m=1}^{M} \gamma_m \text{region}_m \right)^2$$

Case Study

Virginia Growth & Opportunity Regions

GO Virginia is an initiative to create more high-paying jobs by incentivizing collaborations between business, education, and government to diversify and strengthen the economy.



Regional Priority Industry Clusters for VA GO Regions 1, 5, and 7

VA GO 1	VA GO 5	VA GO 7
Energy	**Shipbuilding and Repair**	**Computer Services**
Minerals	**Logistics**	**Cybersecurity**
Advanced Manufacturing Ag	**Port Operations**	Consulting
Food Manufacturing	Advanced Manufacturing	Finance and Engineering
Beverages	Water Technologies	Research Organizations

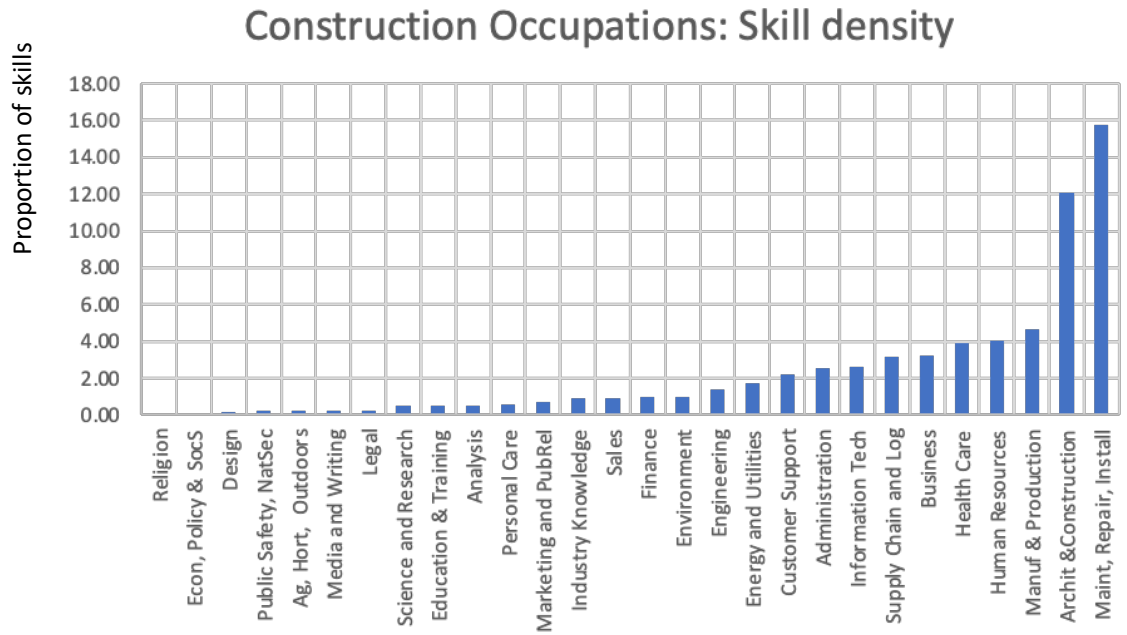
Source: Virginia Growth and Opportunity Board

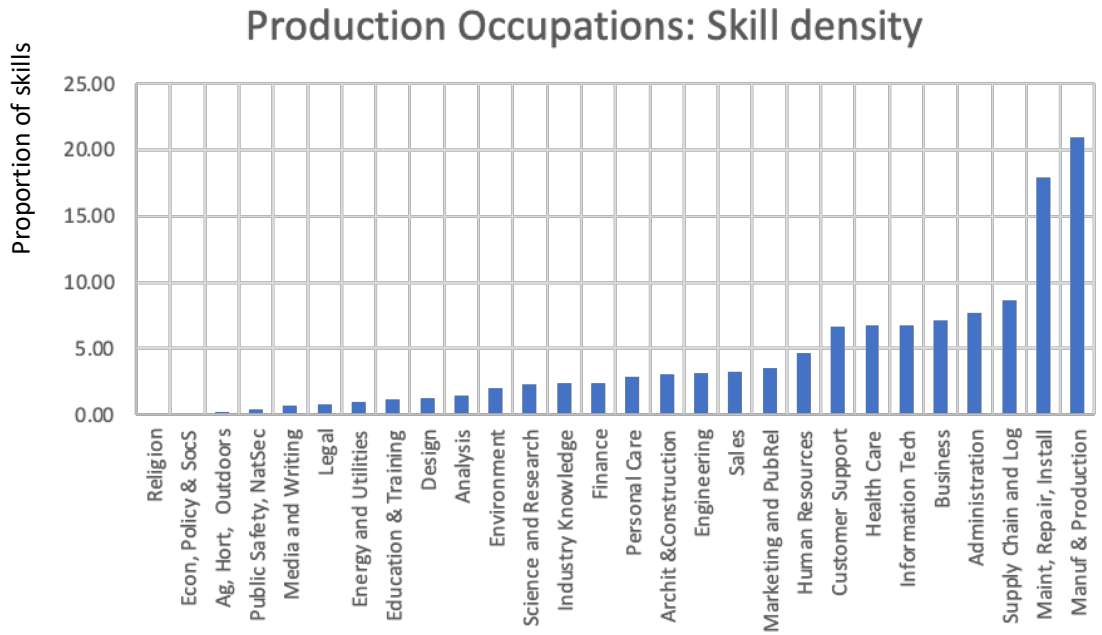
1. BGT skill hierarchy

- Skill Cluster Family (28) — Information Technology
- Skill Cluster (657) — Web Development
- Skill (14,888) — Active Server Pages

2. Technical skills are defined by linking STW occupations to BGT skill cluster families

3. Identify technical skills of the Major Occupation Groups Construction and Extraction (62 of 65 occupations are in the STW) and Production all 114 occupations are in the STW



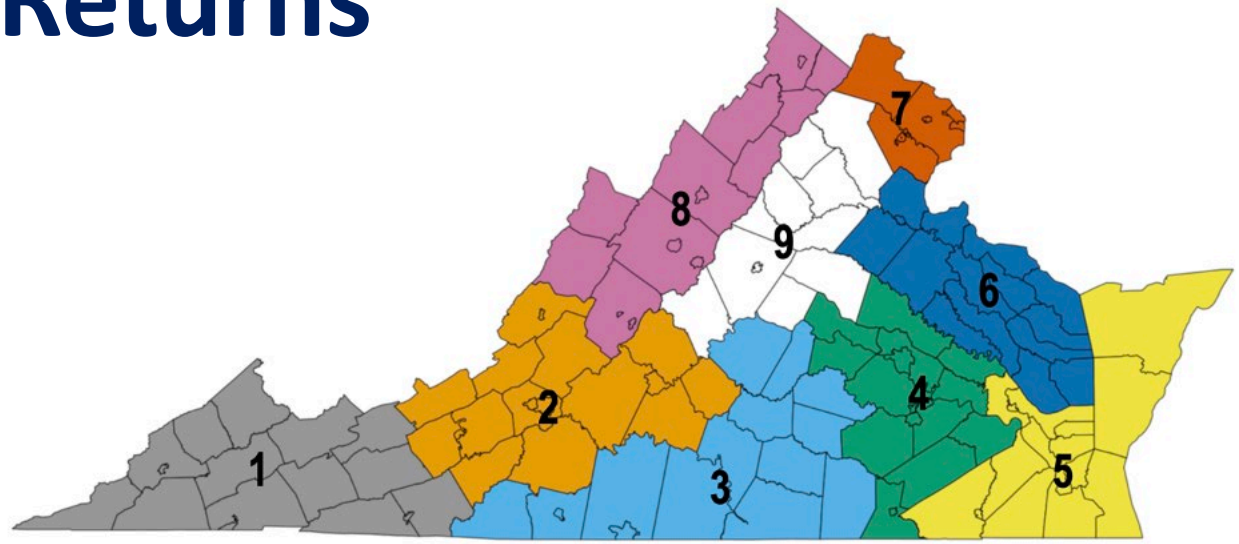


Source: Burning Glass Technologies, 2019

Salary Returns

	WLS Model
(Intercept)	10.42 (0.02)***
experience	0.06 (0.00)***
skills technical	0.36 (0.01)***
VA Region2	−0.06 (0.02)***
VA Region3	0.02 (0.02)
VA Region4	−0.06 (0.02)***
VA Region5	−0.14 (0.02)***
VA Region6	0.17 (0.02)***
VA Region7	0.22 (0.02)***
VA Region8	0.06 (0.02)**
VA Region9	0.07 (0.02)***
R^2	0.24
Adj. R^2	0.24
Num. obs.	110307

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$



Key take-aways

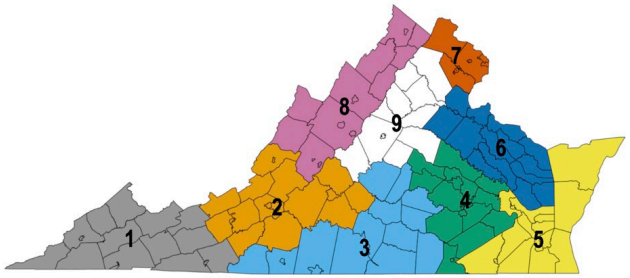
- Technical skills have the potential to increase salaries by 36% in Virginia
- 1 year of additional experience increases salary by 6%
- VA GO Region 7 has the largest salary premium at 22%

Source: Burning Glass Technologies, 2019

GO Region by Major Occupation Group

	VA GO 1	VA GO 5	VA GO 7
(Intercept)	10.11 (0.26)***	10.15 (0.02)***	10.48 (0.03)***
skills tech	0.45 (0.15)**	0.35 (0.02)***	0.41 (0.02)***
experience	−0.06 (0.01)***	0.04 (0.00)***	0.02 (0.00)***
Healthcare	0.28 (0.23)	0.24 (0.02)***	0.13 (0.03)***
Maintenance-Repair	0.40 (0.24)	0.08 (0.02)***	−0.02 (0.03)
Production	0.05 (0.27)	0.02 (0.02)	−0.15 (0.03)***
Transportation	0.52 (0.23)*	0.21 (0.02)***	−0.12 (0.03)***
R^2	0.18	0.10	0.10
Adj. R^2	0.17	0.10	0.10
Num. obs.	637	7652	6309

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

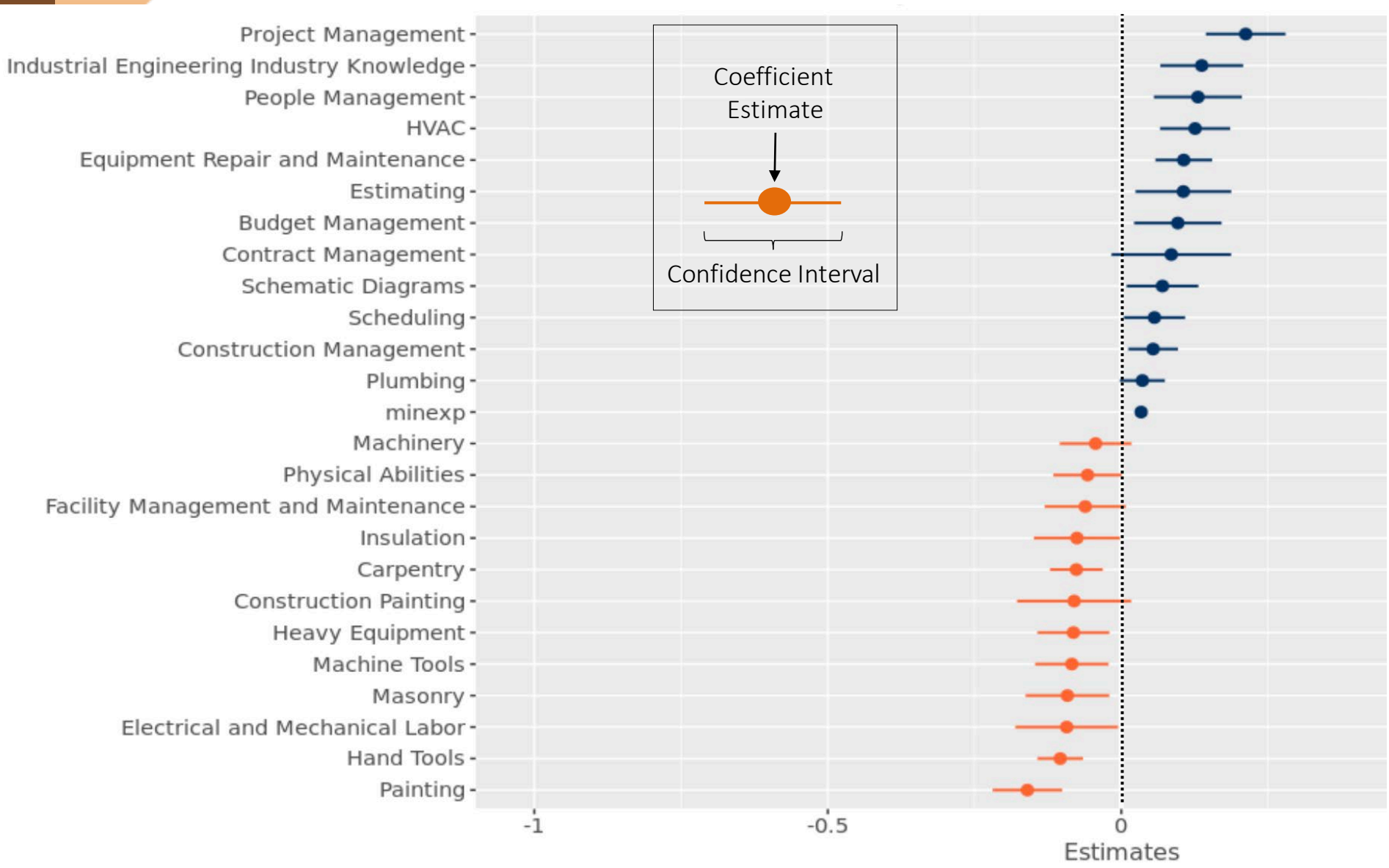


Key take-aways

Source: Burning Glass Technologies, 2019

- Experience provides a premium for technical skills in VA GO Regions 5 and 7 this is not the case in Region 1 where technical skills due to the skills needed for the mineral and energy sectors.

Construction: Salary Returns & BGT Skills clusters in VA



Key take-aways

Significant returns reflect the progression from blue-collar skills (carpentry and plumbing)

↓

more management skills (project and people management).

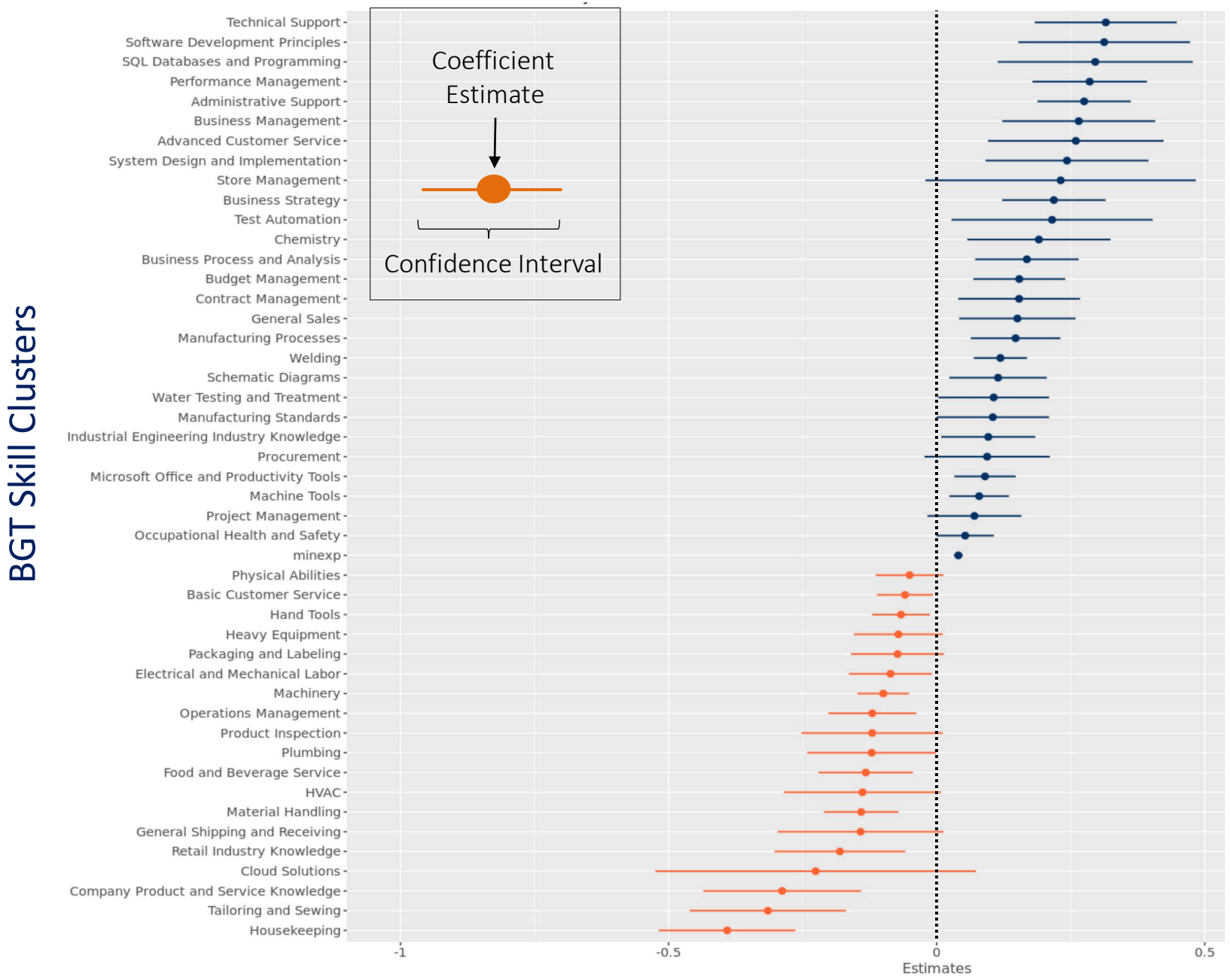
Source: Burning Glass Technologies, 2019

Production: Salary Returns & BGT Skills Clusters in VA

Key take-aways

There is a clear distinction between cognitive skills, especially IT and management related skills, which provide significant salary returns than traditional blue-collar skills.

Since none of the 114 production occupations require a bachelor's degree these IT skills require just a non-degree credential.

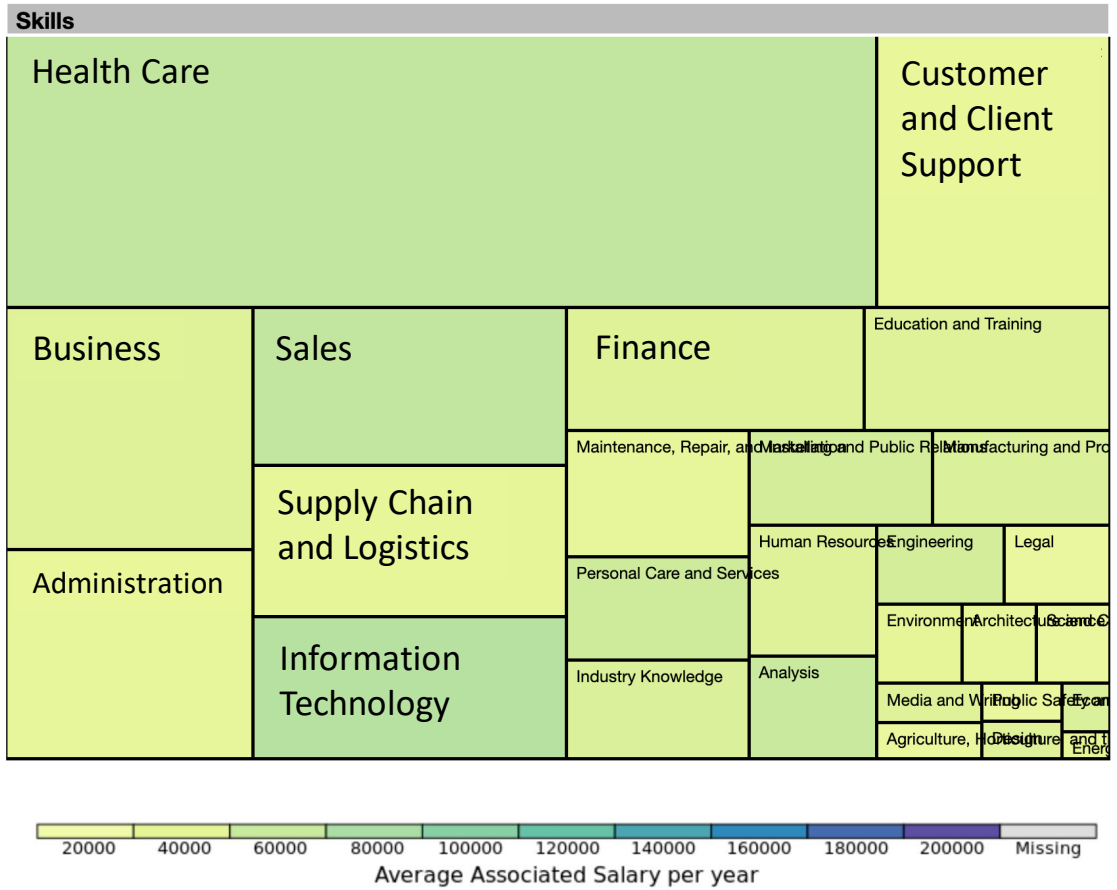


Source: Burning Glass Technologies, 2019

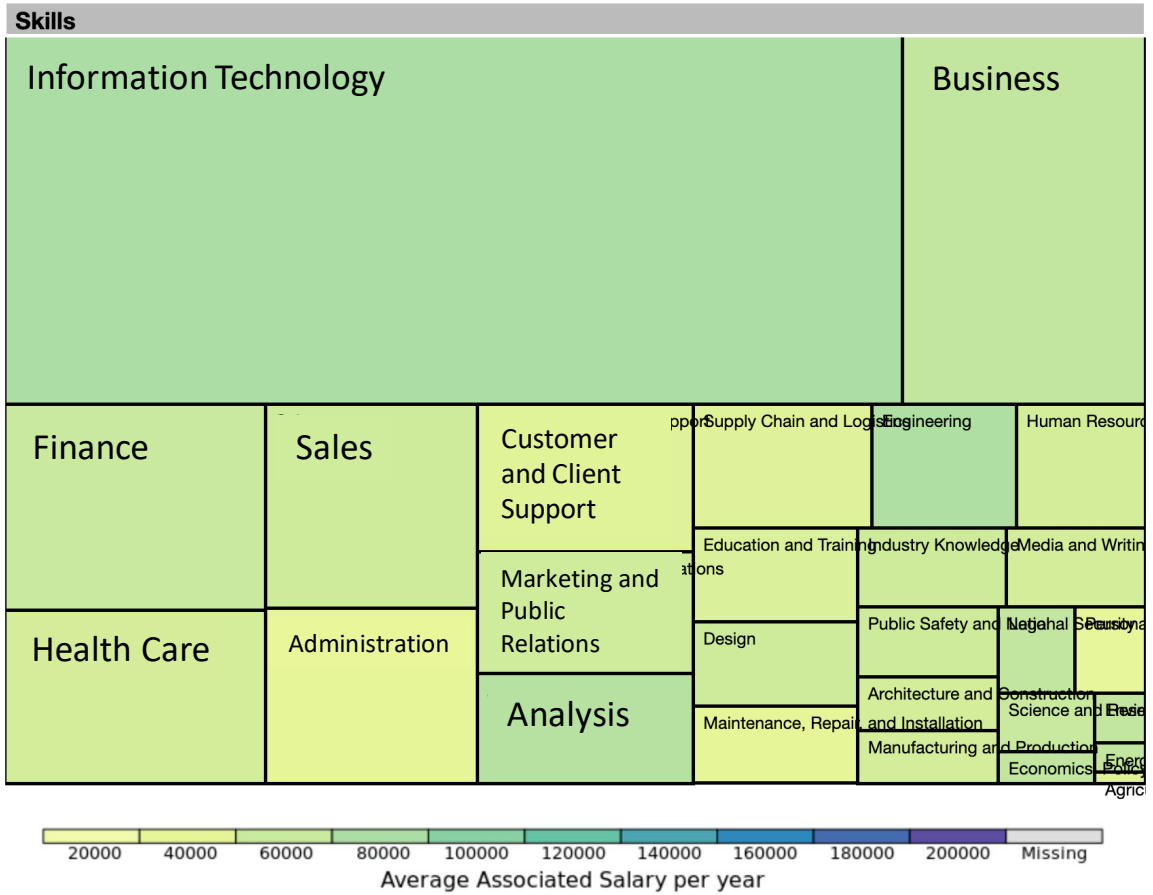
Skill "Genome" Visualization

Skill Cluster Family

Skill density in VA GO Region 1



Skill density in VA GO Region 7

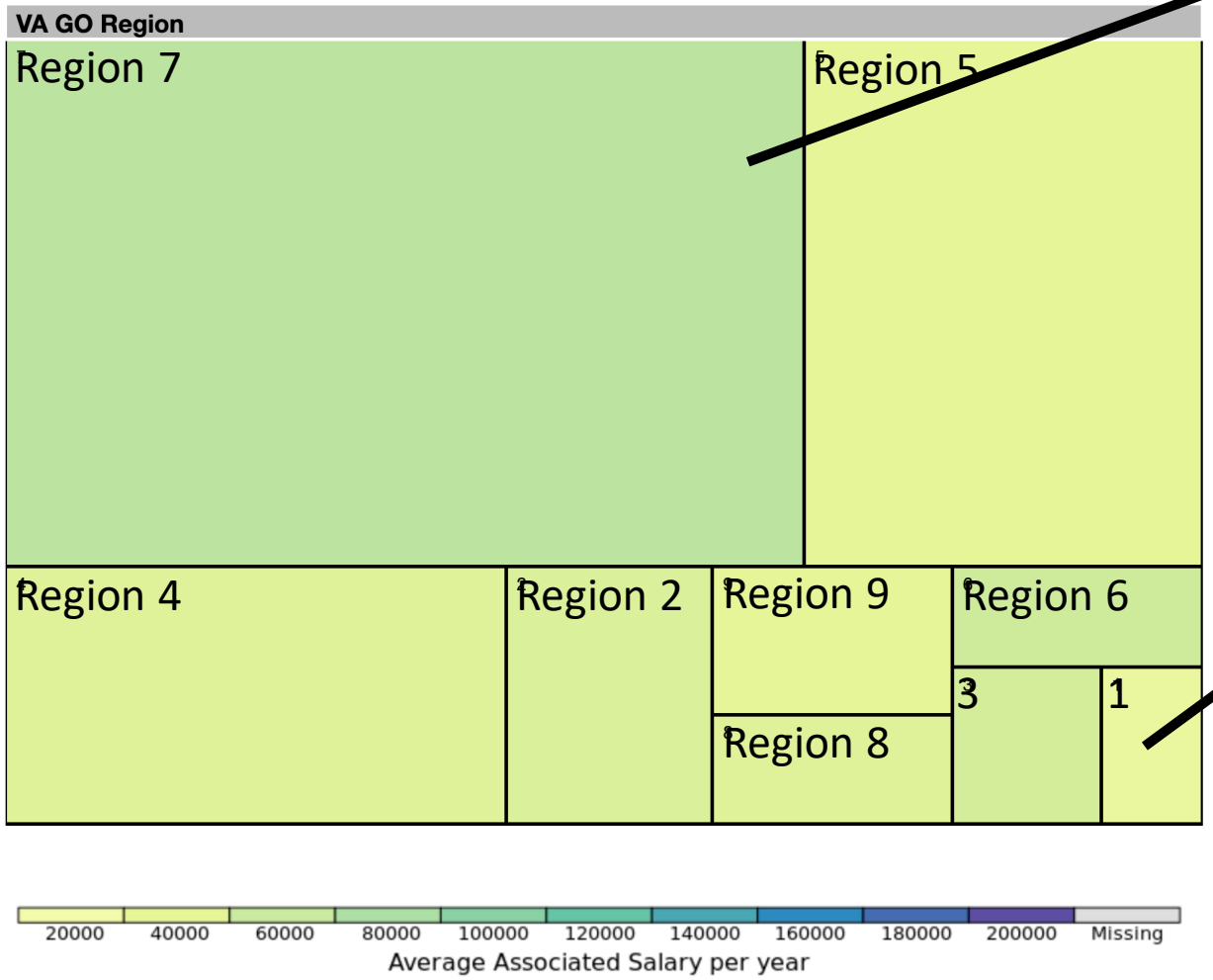


Source: Burning Glass Technologies, 2019

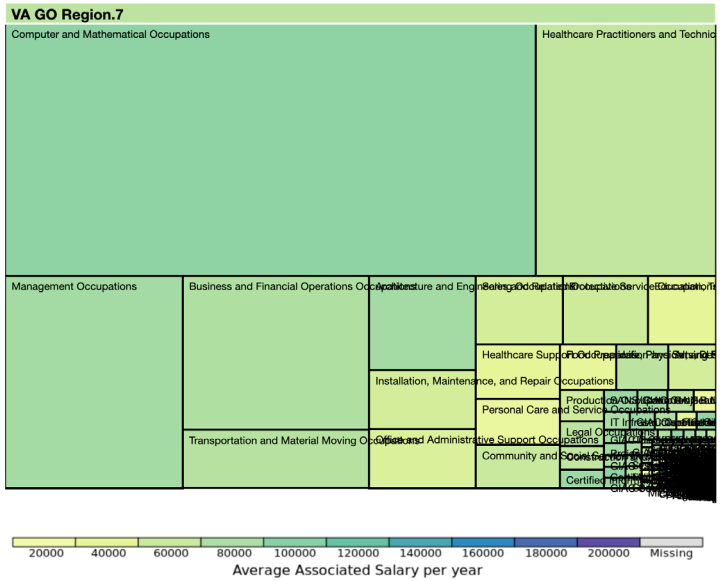
Dashboard
uva-bi-sdad.github.io/stw-website/

Certifications Landscape

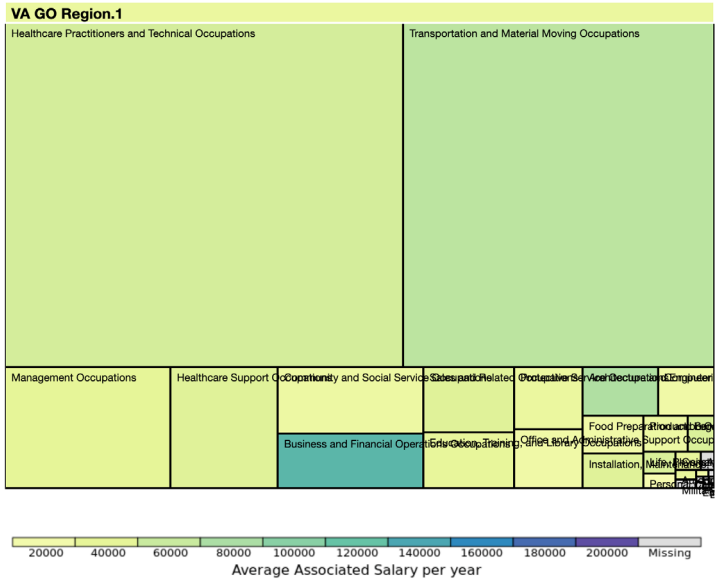
Certification Density in VA GO Regions



Certification Density in VA GO Regions



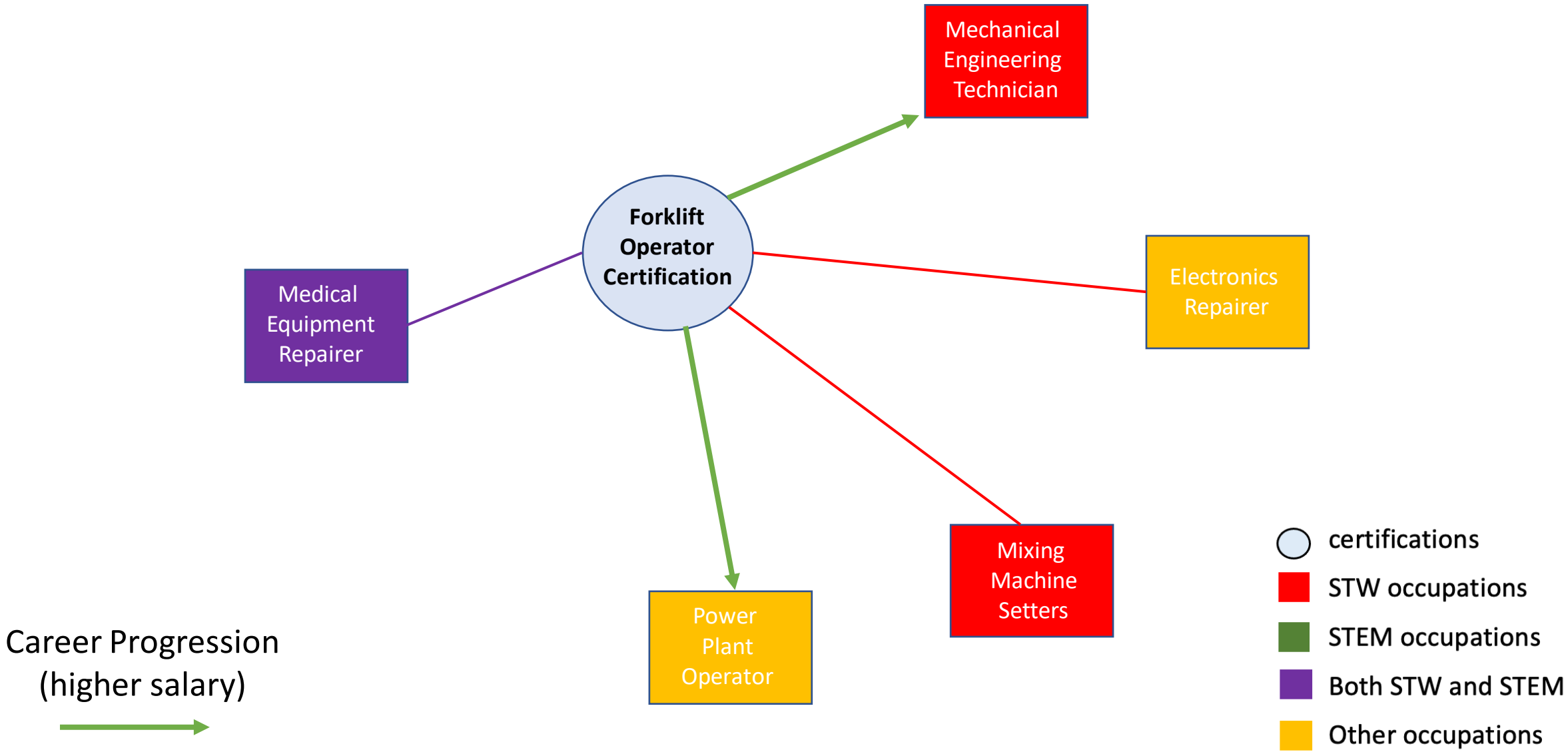
Certification Density in VA GO Regions



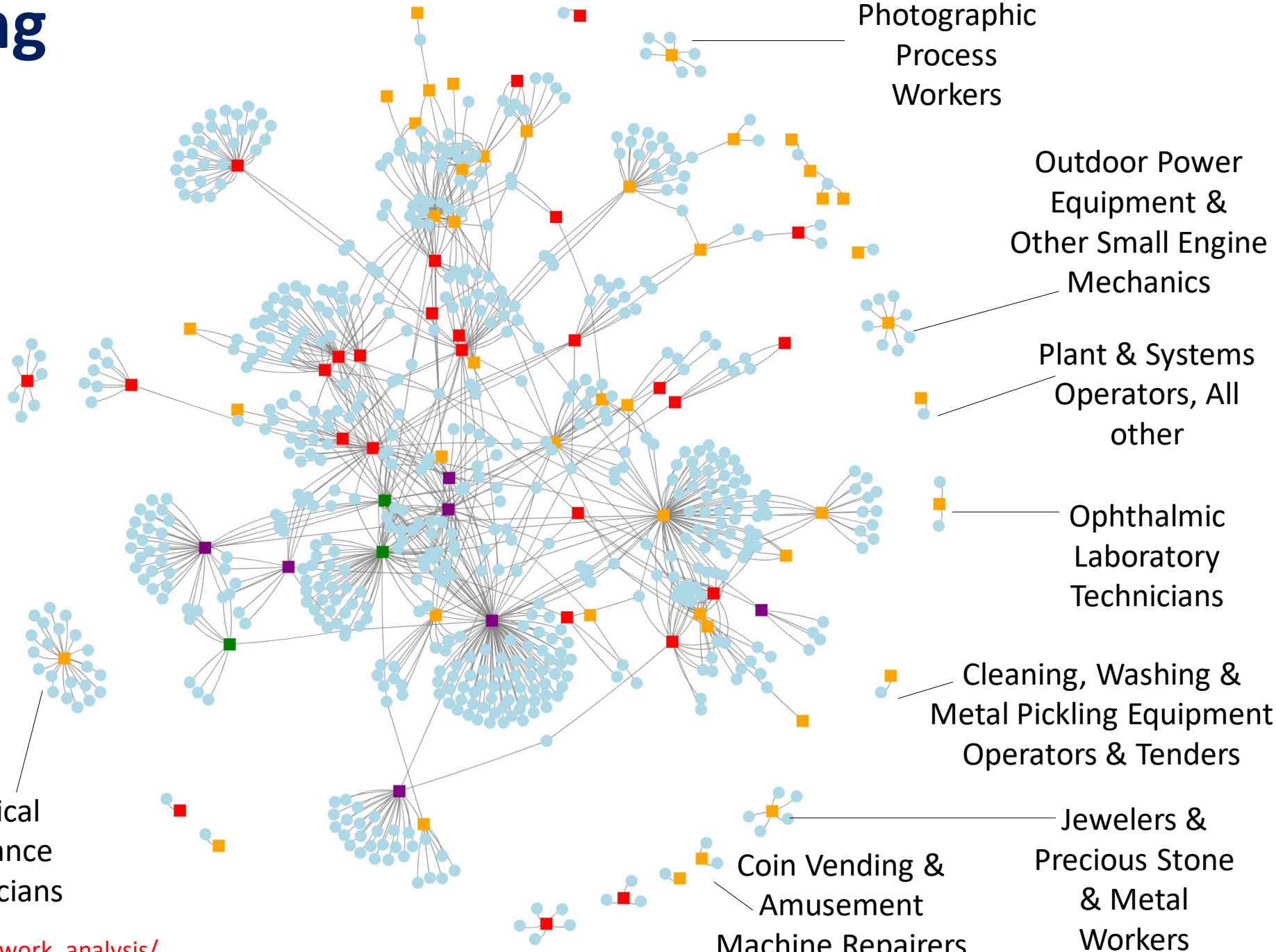
Dashboard
uva-bi-sdad.github.io/stw-website/

Source: Burning Glass Technologies, 2019

Network Analysis: Portability and Career Pathways



Manufacturing Occupation Cluster Certification Network



Dashboard

https://dspgtools.shinyapps.io/network_analysis/

Source: O*NET and CareerOneStop

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