Updating Industry Clusters/ Economic Clusters for the U.S.

A Three Clusters Framework for Regional Economies

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Regional Clusters

UEDA Webinar | Aug 27th, 2026

Outline

- Why economic clusters?
- How to define occupational and industry clusters?
- Exploring competitiveness
- Demo of Regional Clusters website (https://pcrd.purdue.edu/regionalclusters/)
- Regional Clusters website - Use cases and scenarios
- Conclusions and Q&A

Why economic clusters?

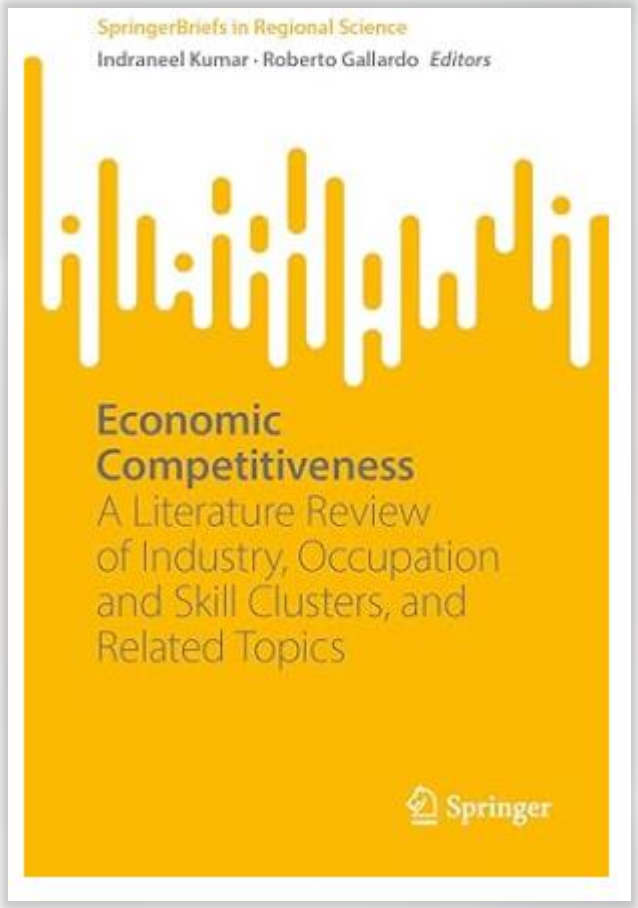
- Rules of engagement for regional economic development are evolving.
- Not only the regions need to know about their **competitive industries**, but also **competitiveness** in the regional **labor force** and **human capital**.
- Industry clusters can reveal **competitive industry sectors** or **economic drivers** for the regions and help align the strategy development.
- Skilled labor force, **low**, **middle to top skills**, and **knowledge workers** can complement clusters of competitive industries.
- The project duration was from late 2023 to early 2026.
- Mixed methods approach- Qualitative + Quantitative

What we learned from interviews? (Qualitative)

- PCRD interviewed more than 30 national-level academic scholars and practitioners on various topics such as emerging views on competitiveness, importance of skills and knowledge, business ecosystems, etc.
- PCRD published an insights report: “Industry and Occupation Clusters: A Synthesis of Experts’ Interviews” here: https://pcrd.purdue.edu/wp-content/uploads/2025/04/Industry-and-Occupation-Clusters-A-Synthesis-of-Experts-Interviews.pdf.
- Industry clusters are **diagnostic framework;** however, both industries (**value chains**) and occupations (**labor chains/networks**) need to be analyzed.
- Emphasis on “**skills.**” Focus should be on developing **“ecosystems”** to create **positive-sum environment.**
- Both, industry and occupations are needed to inform regional strategies.

Literature review (Qualitative)

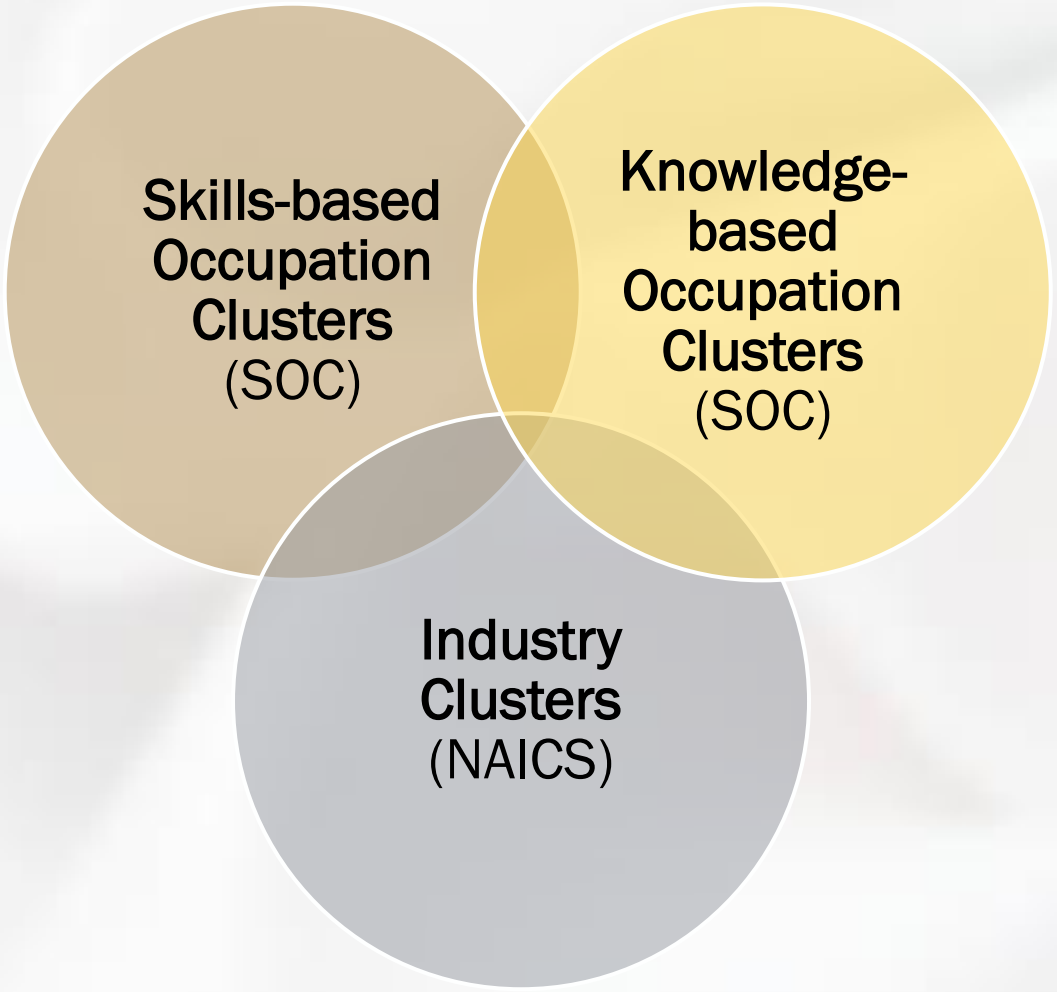
- A literature review covered the following topics:
  - Origins of the industry cluster concept and a scan of early and contemporary efforts to define benchmark industry clusters in the U.S.
  - Economic geography of knowledge and innovation
  - Occupation and skills clusters; and
  - Social networks
- Literature review is available at: https://pcrd.purdue.edu/wp-content/uploads/2025/04/Literature-Review_04-21-2025.pdf
- Springer Nature has published the revised manuscript as a book: https://link.springer.com/book/9783032203588



Economic clusters Project overview:

- **38 Skills-based occupation clusters**, covering all **857 occupations** in the U.S. labor market.
- **21 Knowledge-based occupation clusters**, covering **64%** (557 out of 873) of total occupations requiring medium, considerable and extensive preparation through education and training.
- **21 primary industry-based clusters** with **68 subclusters.** Focus on basic or export-oriented industries.

What We Do

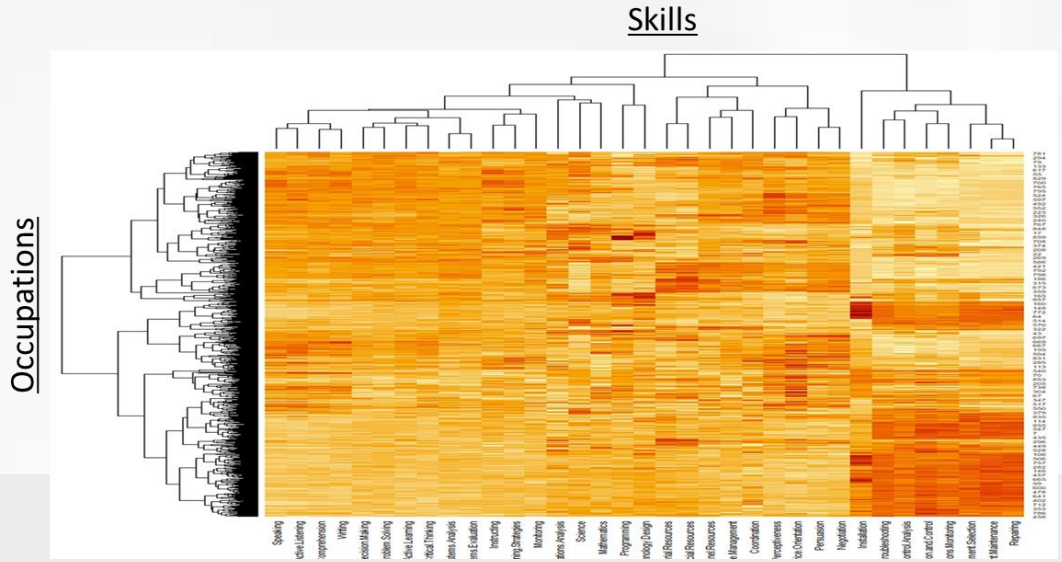


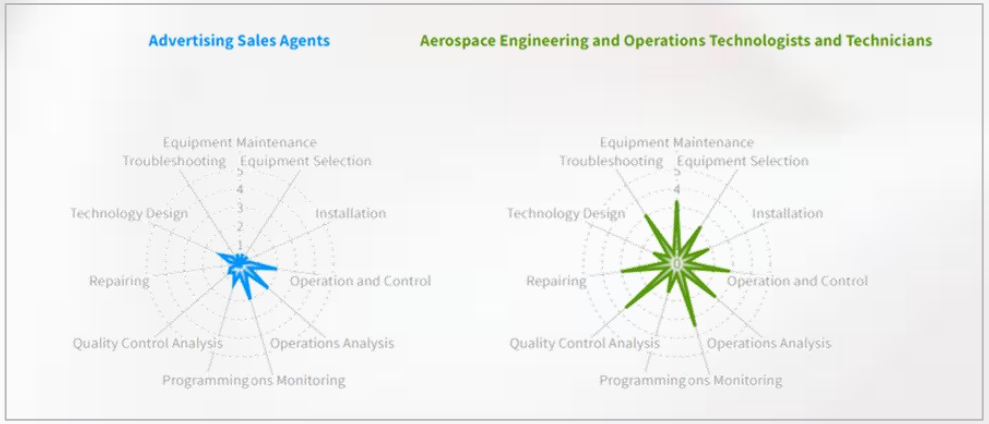
What We Produce

How are skills-based occupation clusters defined?

- Occupational groups based on similarity of skill levels. Cover the **entire labor force**, all 857 occupations in the labor market delineated by O*Net.
- **Career ladder, career pathways, compatible occupations, specialization in skills,** etc.
- **Unsupervised Machine Learning (ML)** methods on matrices from O*Net.

$$Euclidean(distance) + Ward(linkage) + AGNES(clustering) + Gap\ Statistic\ (statistical\ specification)$$



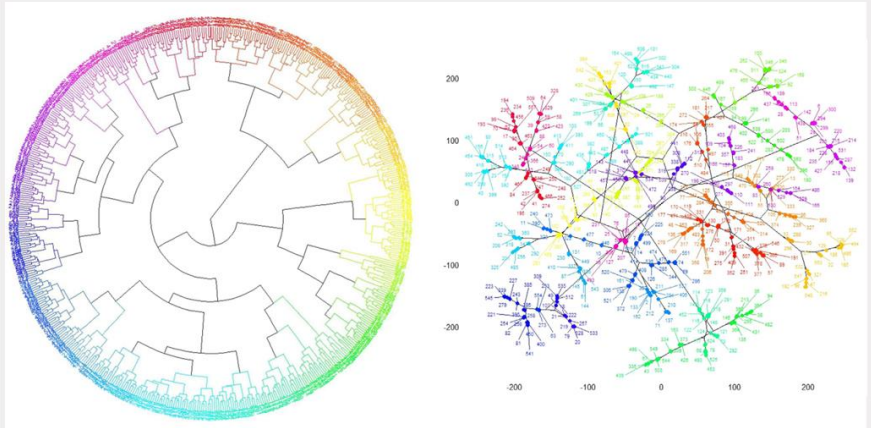


How are knowledge-based occupation clusters defined?

- Occupational groups are based on similarity of knowledge domains needed to perform the jobs.
- Knowledge clusters cover **knowledge workers**, around 64% of the total occupations available in the labor market. These occupations require **medium, high-level, or extensive** preparation.
- Unsupervised ML, but exploring both (1) **Partitioning** (2) **Hierarchical** methods

$$Euclidean(distance) + Ward(linkage) + AGNES(clustering) + Silhouette\ Score\ (statistical\ specification)$$

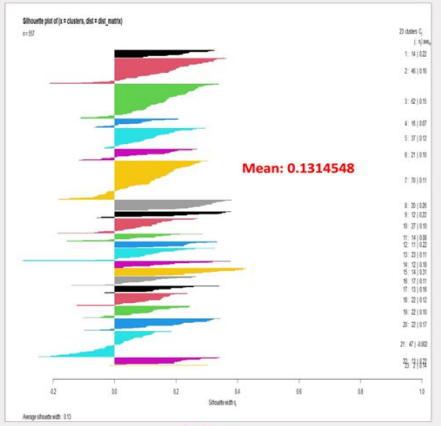
FIGURE 7. Circular and Tree Dendrograms of 47 Occupation Clusters for 557 Occupations

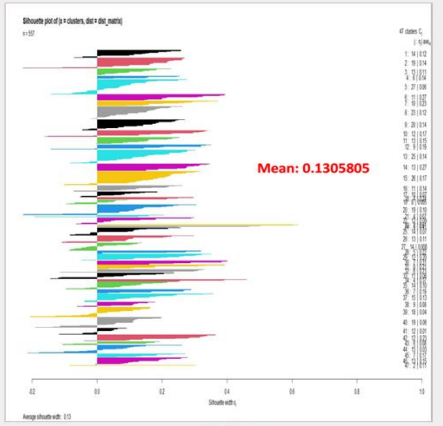


Note: Knowledge-levels squared; Job Zones 3, 4 and 5.

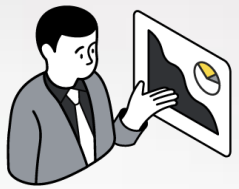
Source: Based on Gap Statistic Method. Processed by PCRD.

FIGURE 8. Silhouette Plots of Knowledge-levels Squared





Source: Based on Average Silhouette Method. Processed by PCRD.



What are industry clusters?

Regional concentrations of **interconnected** firms, businesses, industries, suppliers, service providers, and institutions that **enhance regional competitiveness**:

- Buy and sell from each other (**value chain**)
- Use similar technologies and production processes
- Share a similar skilled labor pool (**labor chains**)
- Share **supply chains**
- Share, leverage and promote **innovation**
- Need supporting **services** and specialized **infrastructure**
- Include both high and low-value added **employment**
- Produce goods and services for **exports** beyond the region
- Drive the **creation of employment, gross regional product and wealth** in a region



How are industry-based clusters defined?

Data Sources

Input-output transactions

Captures inter-industry transactions

Occupations

Measures workforce overlap and shared labor needs between industries.

Locations

Identifies geographic clustering of industries

Clustering Methods

Hierarchical Clustering

Similarity based, generating dendrogram

Principal Component Analysis (PCA)

Keep key relationships and allow overlapping clusters

Network Analysis

Detect industries that share similar occupational/geographical structures

Industries in unique or infrequent groupings are flagged and examined by project team and advisors

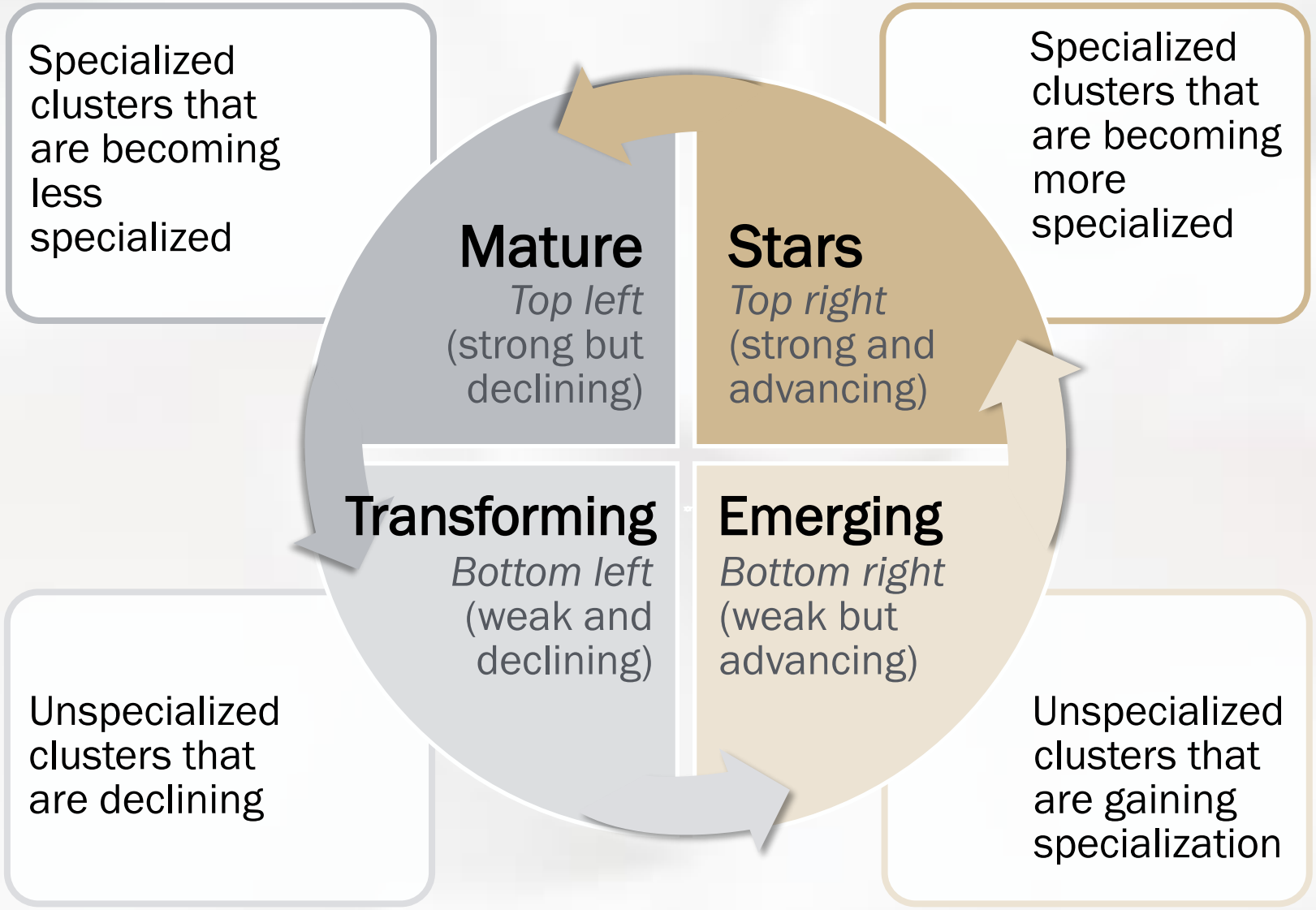
Qualitative assessment

Final Definition

- Economic Linkages
- Workforce Linkages
- Geographic Linkages

- Statistical and ML methods and network analysis
- Quantitative + Qualitative assessment
- Overlapping cluster definitions

Industry/occupation clusters and regional economic competitiveness



How do clusters help?

- **Industry**, **skills**, and **knowledge** clusters reveal the region's competitive industries, workforce capabilities, human capital, and knowledge assets.
- Every region has a **unique portfolio of industry, skills, and knowledge** cluster strengths.
- Interactive cluster data dashboards and maps can help inform **regional economic development strategies**.



Comprehensive Economic Development Strategies (CEDS)



Competitive Industry Clusters



Competitive Occupation Clusters

Methodology references

- Methodology technical reports are available at “News and Resources” webpage of Regional Clusters website, https://pcrd.purdue.edu/regionalclusters/about/resources.php
- Defining U.S. Industry Clusters: Insights from Network Analysis of Locational and Occupational Correlational Measures, available here.
- Defining U.S. Industry Clusters: Methodological Insights from Inter-Industry Transactions Analysis, available here.
- Knowledge Economy and Knowledge-based Occupation Clusters for the U.S., available here.
- Occupations by Skills Clusters for the U.S.: Methodological Framework and Experiments, available here.
- There are three additional technical reports on the synthesis of interviews, literature review, and spatial machine learning application on industry clusters.

Acknowledgement

U.S. Economic Development Administration (EDA)

We acknowledge the funding support and guidance from the U.S. Economic Development Administration (EDA) for this project. As mentioned in the disclaimer, onus of errors or omissions lie with the project team.

Visit Website

Lightcast, LLC

We acknowledge the data support and agreement provided by the Lightcast, LLC, for the data dashboards.

Visit Website

ACKNOWLEDGEMENTS

We acknowledge the geospatial file of economic development districts provided by the National Association of Development Organizations (NADO). We acknowledge the scholars and practitioners who interviewed with the project team and provided their valuable insights. PCRD sincerely thanks all the partners and participants who supported this project by providing resources, insights and expertise.

Live Demo

RegionalClusters.com



Annie Cruz-Porter, PhD

From Data to Strategy

Capacity vs Capability: The Framework

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Understanding the Capacity vs. Capability Framework

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Capacity

Industries which drive economic growth, respond to structural changes, and implement long-term strategic plans.

→ The Industry Dashboard

What are our region's strengths?



Capability



Says a lot about region's collective workforce potential.

→ The Skills & Knowledge Dashboards

What can our workforce do?
What expertise does our region hold?

It is important to examine a region's industrial capacity along with workforce capability (either/both skills and knowledge clusters) to develop a strategy.

The space between what a region has and what its people can do is exactly where economic & community development strategy develops.

Understanding the Capacity vs. Capability Framework



Capacity

- Industries and anchor sectors present
- Firm landscape (number, size distribution, concentration)
- Supply chain density and completeness
- Physical infrastructure (sites, transportation, utilities, broadband)
- Capital access / investment base



Capability



- Specialized workforce skills (Skills Dashboard)
- Knowledge/expertise embedded in the workforce (Knowledge Dashboard)
- Institutional knowledge – expertise
- Research capacity - research *infrastructure (labs and scientists)*

Capacity is structural: what a region has, and the source of its comparative advantage. Capability is human: what its people know how to do, and the source of its competitive advantage.

A region can have strong capacity and thin capability, or the reverse. Comparative advantage tells you where you could compete; capability determines whether you actually can.

Understanding the Regional Reality

A 2018 Brookings study found that metro areas adding jobs fastest in lower-wage, local-serving sectors like hospitality and health care had more difficulty posting consistent gains in wages and productivity - growth without tradable industry capability is not broad-based. the jobs existed, but the regions hadn't built the workforce capability to turn growth into shared prosperity

What is tradable industry capability?

Developing the conditions that allow a region to host and sustain industries that sell goods and services outside the region: manufacturing. professional services, technology, logistics, agriculture processing. These bring new money into the economy.

It is important to examine industrial capacity (anchor) along with workforce capability (skills and knowledge clusters) to develop a strategy.

Building traded clusters means developing the specific inputs that industries need: specialized workforce, supply chain density, infrastructure, institutional knowledge, and research capacity.

What Each Dashboard Tells You — Strategy Development

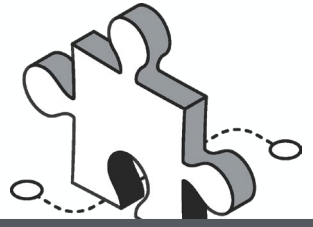
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Find your region's data, determine what is needed by the industry, and build both into your strategy.

 **Industry**	What are our **strengths**?	→	Target industry strategy *(Capacity)*
 **Skills**	What can our workforce **do**?	→	Workforce development *(Capability)*
 **Knowledge**	What does our workforce **know**?	→	Educational investment discussions/ Innovations *(Capability)*

SE New Mexico Industry Cluster Story

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Compete

What the Industry Cluster dashboard shows:

- Energy intensive economy
- Recreation, Arts and Tourism is emerging
- Agribusiness



Diversify

Challenges:

- *Workforce capability are imported to meet energy industry capacity*
- *Tourism and recreation growth struggled because of wildfire and flood disasters*



Strategy

What we'll do about it:

- Focus on construction of housing for middle income tiers
- Develop tourism and recreation
- Invest in resilient infrastructure

Capability: Questions to Consider

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Engaging with Skills Clusters

What skills are most prominent in our region?	This is the basic assessment - the skills equivalent of knowing which industries you're strong in.
What's skills are changing in our region?	Are our skill specializations growing or declining?
What skills transferrable between adjacent occupations?	If a major industry declines or an employer closes, what may be an adjacent occupation displaced workers already have the skills to transition into?
Are our training investments aligned?	Are the programs our community colleges and workforce boards investing in match regional skills?
What do wages/salary look like for regional occupations?	Which skill clusters in our region command the highest hourly earnings? Is there a discrepancy between high specialization and low earnings - or low specialization and high earnings?
How do we compare?	How does our EDD's skill profile compare to peer EDDs or to national patterns?
What's the rural story?	Do rural EDDs show different skill signatures than metro-adjacent ones?

Most Specialized Skills Clusters Focus on Energy

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Cluster	LQ	Jobs	Wage
Operators, Technicians and Repairers III	2.11	2,703	$29.41
Finishers, Fitters, Installers and Helpers	1.94	6,252	$20.51
Repairers, Setters, Operators and Technicians	1.89	2,543	$27.14
Production & Operations Mgmt, First-Line Supervision	1.74	4,164	$39.35
Operators and Assemblers II	1.58	3,081	$23.20
Transportation – Air, Road, Railroad, Water Vessels	1.48	4,552	$25.07
Mechanics, Technicians and Repairers IV	1.38	5,129	$25.55
Operators, Tenders and Helpers I	1.28	3,202	$23.10

Local Knowledge Cluster Specialisms

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Cluster	LQ	Jobs	Wage
Architecture, Landscape & Sustainable Energy	**1.67**	**2,402**	**$43.99**
Engineering & Technical Trade Technicians	**1.58**	**8,444**	$31.41
Public Safety & Law Enforcement	**1.55**	**1,822**	$32.65
Legal, Environmental Compliance & Enforcement	1.13	1,746	$36.01
Agriculture, Food & Natural Sciences	1.11	1,016	$30.71
Education, Religion, History & Cultural	1.09	4,102	$33.33
Operations, Production & Safety Management	1.01	4,786	$51.48

Location Quotient – Specialization

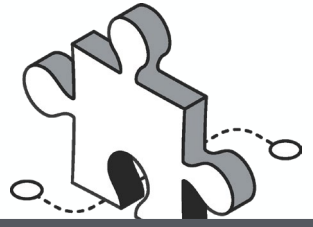
Industry cluster:

- Energy sits at **LQ 4.1** — 4× the national average
- Energy produces **$319,103 GRP per job** — 2.4× the regional average
- Energy employs **27,577 people** — 18.7% of the economy

Dashboard	Cluster	LQ
Skills Cluster Dashboard	Engineers and Project Managers	**0.71**
Knowledge Cluster Dashboard	Engineering & Advanced Technology	**0.67**

Method: Fact → Finding → Strategy (built around capability)

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Facts

What the dashboard shows:

"Operators, Technicians and Repairers III is the most specialized skills cluster — LQ 2.11, $29.41.
The largest is Support Occupations II — 15,494 jobs, LQ 1.14, $15.50, and it's a Star



Findings

What it means for us:

"The workforce aligns with energy - at the operational tier only. Every cluster we're specialized in pays under $40/hour; every cluster over $40 is below LQ 1.0. Engineers and Project Managers is at 0.71 and Transforming



Strategy

What we'll do about it:

"The region is specialized in operating and maintaining ($20–$39) and unspecialized in analytical ($40+). The strategic question is whether it can build on the intellectual and knowledge for the Energy sector. Engineering, geology and computer science happen elsewhere.

Questions?





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THANK YOU

Data

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