Linking Industry and Occupation Clusters in Regional Economic Development

Charting the Course for Regional Development:
First Annual EDA Economic Development Research Symposium

Clarion Hotel Morgan
Morgantown, West Virginia
October 21 & 22, 2009
Linking Industry and Occupation Clusters in Regional Economic Development

• Research to date suggests that occupation clusters may be at least as important as industry clusters in driving regional competitive advantage.

• Regional “brainpower” – embedded in regional industry clusters – provides the basis for innovation, which in turn provides the basis for growth in the long term.

• Developing a nationwide mapping of occupation clusters, with county-level data available for every U.S. county and the capability to aggregate counties to a regional level, serves as a powerful complement to an understanding of regional industry clusters, which was a major focus of a previous (2007) EDA-funded project conducted by partners in this research team.
Industry Clusters

Local and regional concentrations of competitive firms that

– Buy and sell from each other
– Use similar technologies
– Share a labor pool
– Share supply chains
– Include supporting services and specialized infrastructure
– Include both high and low-value added employment
– Produce for export outside the region
– Drive the creation of wealth in a region
Occupation Clusters

• Groups of occupations that share similar knowledge, skills and other characteristics such as formal education levels, wage levels and availability of benefits.

  – These occupation clusters are concentrated differentially by industry and geographic location according to regional specializations.

  – Due to shared characteristics, it may be easier to transition workers between levels in the same cluster (“career ladders”).
What’s so Important About Occupation Clusters?

- It is generally accepted that U.S. regional economies must transition to a knowledge-based economy so as to remain competitive in the global context. Significant innovations are unlikely to occur without knowledge.

- Experts such as Feser and Markusen have both made the case for targeting occupations as well as industries in regional economic development efforts.

- Insight into occupation clusters is critical to creation of a knowledge economy in both metropolitan and rural regions—it is as important to identify and map occupation clusters nationally as it is to identify and map regional industry clusters.
Defining Occupation Clusters

- Occupations can be classified according to 5 “job zones,” each one requiring more and more specialized knowledge and training.
- We built our occupation cluster definitions around these job zones, concentrating on zones 3 to 5 which require more specialized training.
- Using statistical techniques, we assigned all occupations (except those in job zones 1 and 2) to 15 clusters, on the basis of similar knowledge requirements.
- A brief technical explanation is available in Appendix Slide 1.

### O*Net Job Zones

<table>
<thead>
<tr>
<th>Job Zone</th>
<th>Types of Occupations</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Occupations that need little or no preparation</td>
<td>Cashier, waitperson</td>
</tr>
<tr>
<td>2</td>
<td>Occupations that need some preparation</td>
<td>Retail Salesperson, Teller</td>
</tr>
<tr>
<td>3</td>
<td>Occupations that need medium preparation</td>
<td>Electrician, Legal Secretary</td>
</tr>
<tr>
<td>4</td>
<td>Occupations that need considerable preparation</td>
<td>Accountant, Teacher</td>
</tr>
<tr>
<td>5</td>
<td>Occupations that need extensive preparation</td>
<td>Surgeon, Physicist</td>
</tr>
</tbody>
</table>
Fifteen Occupation Clusters

- Agribusiness and Food Technology
- Arts, Entertainment, Publishing and Broadcasting
- Building, Landscape and Construction Design
- Engineering and Related Sciences
- Health Care and Medical Science (Aggregate)
  - Health Care and Medical Science (Medical Practitioners and Scientists)
  - Health Care and Medical Science (Medical Technicians)
  - Health Care and Medical Science (Therapy, Counseling, Nursing and Rehabilitation)
- Information Technology
- Legal and Financial Services, and Real Estate
- Managerial, Sales, Marketing and HR
- Mathematics, Statistics, Data and Accounting
- Natural Sciences and Environmental Management
- Personal Services
- Postsecondary Education and Knowledge Creation
- Primary/Secondary and Vocational Education, Remediation & Social Services
- Public Safety and Domestic Security
- Skilled Production Workers: Technicians, Operators, Trades, Installers & Repairers
Advantages and Disadvantages of Occupation Cluster Analysis

Advantages
• Determine how well occupation and knowledge cluster strengths match the region’s business and industry cluster strengths
• Diagnose how well positioned the region and its communities are to participate effectively in a knowledge-based innovation economy
• Understand the local workforce and education situation within the broader regional economic development context
• Bridge the gap between workforce and economic development when constructing a regional economic development strategy

Disadvantages
• There is a lot of disagreement over different clustering techniques and methods (see Appendix Slide 2)
• There is no general agreement over the composition of particular industry OR occupation clusters, which can lead to lack of comparability between studies
Determining occupational clusters is a very different procedure from that used to determine industry clusters, but many of the same analytic methods may be used to generate further information. Some examples of simple descriptive measures include:

- Location Quotients (compared to the nation): can be calculated for each cluster and for major occupations within the clusters.

- Changes in LQs over time: can be calculated for each cluster. Bubble charts will show the relative strength and direction of change for each cluster in each of the study regions.

- Clusters can be located geographically and compared with the location of industry cluster establishments.

- We can drill down and see what kinds of occupations and knowledge levels predominate in a county or region.
Indiana Growth Region 6 Occupation Clusters

EGR 6 Occupation Cluster Size, Concentration and Percent Change in LQs
2001-2007

Concentration, Decreasing

Concentration, Increasing

Location Quotients

-15% -10% -5% 0% 5% 10% 15% 20% 25%

Not concentrated, Decreasing

Not concentrated, Increasing

Percent Change in LQs

Note: The first number after the cluster name is the location quotient; the second number is the number of jobs.

EDA Research Symposium

October 21, 2009
Sample ICOC Analysis

Concentrations of Occupation Clusters in the Biomedical/Biotechnical Industry Cluster, 2007

- Indiana
  - Health Care and Medical Science (Therapy, Counseling and Rehabilitation) LQ: 0.62
  - Health Care and Medical Science (Medical Technicians) LQ: 1.11
  - Health Care and Medical Science (Medical Practitioners and Scientists) LQ: 0.91

- EGR 11
  - Health Care and Medical Science (Therapy, Counseling and Rehabilitation) LQ: 0.50
  - Health Care and Medical Science (Medical Technicians) LQ: 0.86
  - Health Care and Medical Science (Medical Practitioners and Scientists) LQ: 0.99

- EGR 6
  - Health Care and Medical Science (Therapy, Counseling and Rehabilitation) LQ: 1.02
  - Health Care and Medical Science (Medical Technicians) LQ: 1.23
  - Health Care and Medical Science (Medical Practitioners and Scientists) LQ: 1.90
Mapping the Clusters

As we did in our previous project to study industry clusters, we have mapped the occupation clusters using GIS. This is done to help in showing:

1. Concentrations of different types of occupations, skills and knowledge by geographic location
2. Potential matches or gaps when compared with localized industry cluster data and industry staffing needs.
Geographic Distribution of Cluster Concentration by U.S. County, 2004 Location Quotient “Hot Spots”

Manufacturing Supercluster

Location Quotient > 1.2
National Concentrations in the Engineering and Related Sciences Occupation Cluster

Occupation Cluster Location Quotients and Percentage Change in LQs, 2001-2007, U.S. Counties

C3: Engineering and Related Sciences

Note: The location quotient compares a county’s employment concentration in the occupational cluster to the nation’s concentration in that cluster.
Summary

• Analysis of knowledge-based clusters for all 3,140 U.S. counties.

• Mapped location of the clusters, showing cluster size and concentration (location quotients).

• In-depth study of cluster composition and characteristics for pilot regions, including changes over time.

• Analysis of Industry Cluster Specific Occupation Clusters (ICOC clusters)—a new technique developed to determine the concentration of occupation clusters within a specific industry cluster. This helps determine the functionality of specific industry clusters (for example, R&D vs. production emphasis in a particular geography).
Future Research and Practical Challenges

Potential Research

• Further exploration of linkages between knowledge occupations, industry clusters and the production of innovation
• Research into workforce-education-industry “best practices” that can be transferred between regions
• Effects of differential location of knowledge centers (e.g., Universities) in a region

Major Challenges

• Sustaining, updating and maintaining the databases and GIS analyses on the Projects’ website
• Difficulties of accessing detailed, unsuppressed data for both Industry and Occupation clusters – this is the BIGGIE!!
Appendix Slide 1: Defining Occupation Clusters

• Occupations categorized as belonging to O*Net Job Zones 3 to 5 require more specialized training, and thus demand for the associated knowledge will vary by regional specialization. Assigning these occupations to clusters with similar knowledge requirements was performed in a two-step procedure.

• Using 33 variables describing occupations’ knowledge levels, 19 clusters were formed on the basis of a cluster analysis using Ward’s algorithm (Ward’s Hierarchical Agglomerative Cluster Algorithm). The knowledge variables refer to the squared level scores (note: importance scores were not included in the cluster analysis as they are highly correlated with level scores). Average (squared) knowledge levels for each cluster will be summarized in the report.

• The 19-cluster solution served as a baseline and was subsequently fine-tuned by scrutinizing each cluster for consistency. As a result, 90 occupations were re-allocated and some clusters were merged. Moreover, data constraints necessitated the formation of a cluster that pulls together all post-secondary educators, independent of specialization. The final result has been the identification of 15 clusters containing all occupations within Job Zones 3 to 5.
Appendix Slide 2: Cluster Caveats

- There is no one best way to perform a cluster analysis
- There are many methods and most lack rigorous statistical reasoning or proofs
- Cluster analysis is used in different disciplines, which favor different techniques for measuring the similarity or distance among subjects relative to the variables and the clustering algorithm used
- Different clustering techniques can produce different cluster solutions
- Cluster analysis is supposed to be “cluster-seeking,” but in fact it is “cluster-imposing”

Source: *Cluster Analysis*, Charles M. Friel, Criminal Justice Center, Sam Houston State University