

2. Overview of Cluster Concepts and the Two-Project Framework

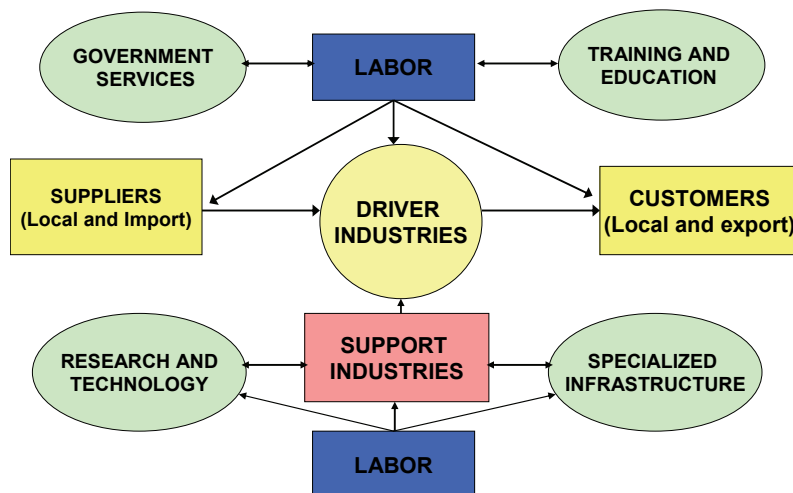
2.1. Key Concepts in Studying Clusters: Geographic and Operational Definitions

Over the last 15 to 20 years, cluster analysis has emerged as a new way of looking at economic development, integrating regional differences in development and economic specialization (Porter 1990, 2003; Sweeney and Feser 1998; Feser 2004, Cortright 2006). An increasing number of states and regions in the United States and overseas have modified their economic development strategies to focus and capitalize on the business and industry clusters where they have, or would like to have, a competitive advantage. In adopting a cluster strategy, states and regions hope to maximize their competitive advantage in existing industries and to build new strengths in the emerging industries that will replace older, declining sectors (Nolan 2003).

There is surprisingly little disagreement over the formal definition of a 'cluster.' Most experts define it as a geographically bounded concentration of similar, related or complementary businesses, with active channels for business transactions, communications and dialogue that share specialized infrastructure, labor markets and services, and that are faced with common opportunities and threats. (Rosenfeld 2002).

Figure 2 below provides a generalized example of the cluster concept as used in this project.

Figure 2. Generalized Example of Cluster Concepts



Source: Purdue Center for Regional Development

Close geographic proximity and engagement in similar or related economic activities are the key factors leading to development of clusters. These characteristics enhance the likelihood of exchanges among cluster firms, facilitating mutual support, and economic growth. "When members of a cluster are located in close proximity, they can capture synergies that increase

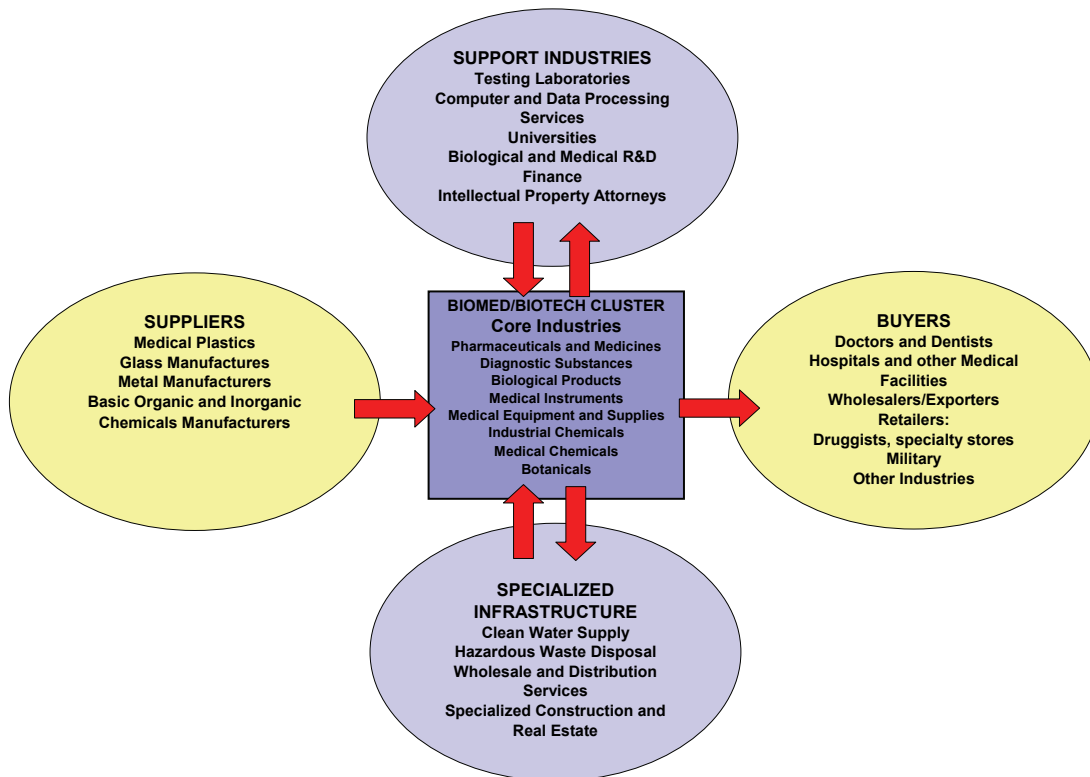
productivity, innovative capacity and new business formation.” (Porter 2001, p. xv). The linkages between spatial proximity and innovation potential are particularly important from a regional development perspective. In particular, supportive policies and a nurturing business environment may further strengthen the innovative milieu and thus enhance regional advantages.

Although Cortright (2006) rightly points out that “clusters” cannot be a precisely defined term and should be understood as an umbrella concept, a national or statewide analysis cannot be performed without a clear definition of which industries belong to a cluster. There are a number of very promising approaches to identifying clusters. For example, Porter (2003) distinguishes among 41 clusters, with relationships between firms (sectors and subsectors) “tested” by using statistical correlation and input-output (I-O) matrices. Feser and Bergman (2000) developed what they call a template of U.S. clusters based on a case study of North Carolina, using factor analysis to distinguish 23 manufacturing clusters.

The Porter group at Harvard Business School further differentiates its cluster list into three types of clusters: traded clusters (exporting industries), local clusters (products and services mainly consumed or traded within the region, such as construction and retail) and resource-based clusters (clusters based on natural resources, such as coal, oil and forestry – note that these can also be classified as traded clusters because of their export potential). Feser and Bergman’s cluster template does not explicitly include service-based clusters (what Porter calls local clusters).

It is important to understand that economic clusters are not mutually exclusive in terms of the industries that comprise them. The driver industries are the target and provide the name for the cluster, while the supporting industries may span the typical categories of economic sectors. These sectors are united in their foundational support of the driver industries.

For example, in the biomed/biotech cluster, the driver or core industries include pharmaceuticals and medical equipment manufacturing (see **Figure 3**). These core industries, among others in this cluster, are supported by testing laboratories, financial services, and intellectual property attorneys. Infrastructure needs such as water, hazardous waste disposal, roads and telecommunications are needed and provided by other industries. Their suppliers include businesses that provide plastics and other necessary materials and their customers include doctors, dentists and hospitals. Many of these customers, suppliers, infrastructure providers and support industries also serve other clusters.

Figure 3. Breakdown of the Biomed/Biotech Cluster

Because of its versatility, the cluster approach to economic development is both useful and popular. Used to its full extent, a cluster strategy can potentially hit many targets at once and address different issues at the same time. For example, a cluster does not just include a set of driver industries, but a host of other input and support industries, as well as potential customers for the products of the driver industries. Furthermore, such a cluster strategy will typically call for action in several areas such as workforce training and education curricula, as well as infrastructure, communications and energy issues. Additionally, a cluster strategy can serve as a vehicle for collaboration and increase the cohesiveness of public policy initiatives.

2.2. Overview of the Two-Project Framework

Research Project 1 relied exclusively on secondary data and included two distinct components. The first component involved the development of a comprehensive database suitable for cluster studies and the analysis of regional development issues for the state of Indiana, its counties and its regions. The second component involved the development of a database and analytical approaches for use by rural regions anywhere in the nation as a starting point in evaluating their economic clusters and support economic development strategies. This latter database also enabled the research team to address issues outlined in the Introduction:

- The linkages between cluster structure, degree of rurality and economic performance
- The spatial concentration of industrial clusters and the interface between rural and metropolitan regions

- Growth trajectories for counties that are differentiated by cluster makeup, degree of rurality and distance to metropolitan areas

The first component of Research Project 1 relied upon Indiana's unsuppressed Covered Employment and Wages (CEW) data at the six-digit NAICS level.¹

Because a public source of unsuppressed county-level data for the rest of the nation was unavailable, regular CEW data for all other U.S. counties and states were used.² These data contained varying degrees of suppression at the four-, five- and six-digit NAICS levels, especially for thinly populated areas, which are usually rural in nature.³

To minimize the problems caused by data suppression, the research team revised cluster definitions to use three-digit NAICS sectors wherever possible for the nationwide county analysis, minimizing reliance upon more-detailed NAICS levels as much as possible. With this approach, data suppression problems were reduced considerably; but even at the three-digit level, not all counties were able to be included in certain parts of the analysis.

The database is enhanced with information on basic demographic and social indicators to provide users with a more comprehensive understanding of regional challenges and opportunities for growth.

The database contains data sets from the following sources:

- **Quarterly Census of Employment and Wages (CEW)** from the U.S. Bureau of Labor Statistics. The Indiana Business Research Center (IBRC) administers the confidential research version of this file for the state. Additionally, the IBRC maintains public data for all U.S. counties by NAICS back to 1990 for establishments, wages, and jobs.
- **Longitudinal Employment and Household Dynamics (LEHD)** from the Census Bureau. This file is used to help determine longitudinal birth, death, and transition demographics of businesses in the selected county or region. This dataset also provides important information on the age and sex of workers by industry, wages of new hires versus existing workers, turnover rates and more. The research versions of these data were used for this study.
- **Demographics, educational attainment, occupation, housing, and income data from the national decennial census**
- **County data on occupation and commuting** contained in the 1990 and 2000 Equal Employment Opportunity (EEO) special tabulations compiled by the U.S. Census Bureau.

¹ NAICS, the North American Industry Classification System, is the standard system for classifying establishments according to their principal business activity. Detailed information is available at <http://www.census.gov/epcd/www/naics.html>.

² We have excluded Hawaii and Alaska, focusing our research on the 48 contiguous states. The economies of Hawaii and Alaska are sufficiently different from the rest of the nation that the team felt that inclusion would skew the benchmark analysis, and their great distances from other states would complicate analysis of spatial effects in clustering.

³ To protect establishments' confidentiality, the federal government suppresses disclosure of data when there are very few establishments, or when one establishment accounts for 80 percent or more of employment or wages in a given sector. Thus, suppression is more likely in cases involving small local areas or finely-differentiated sectors (e.g., those classified by six-digit NAICS codes).

- **Rural-Urban Continuum Codes and Urban Influence Codes** from the USDA's Economic Research Service.

Research Project 2 targeted Indiana's Economic Growth Region 8. The research team engaged the local stakeholders in this eight-county region and made extensive use of the data and analysis generated in the first component of Research Project 1. Project 2 also involved considerable primary data collection and stakeholder organization and mobilization to initiate a comprehensive planning effort in this pilot region. Subsequent sections of this report describe the primary data and local engagement processes, providing a detailed example for similar studies to be conducted in other regions.

2.2.1. Project 1: Research Questions for National Analysis

This research project draws upon the growing literature on agglomeration economies that have placed regions prominently in the center of discussion (Porter 1990, 2003, 2004; Krugman 1991; Saxenian 1996; Sweeney and Feser 1998; Fujita, Krugman and Venables 1999; Bergman and Feser 2001; Cortright 2002; Carnegie Mellon 2002; Rosenthal and Strange 2003). In an idealized sense, industrial clusters consist of a number of firms that share two characteristics: they are located in close geographic proximity to each other (i.e., within a region) and they engage in a similar economic activity (e.g., electronics industry). These two commonalities set the stage for formal and informal inter-firm information exchanges and thus foster learning, innovation, and ultimately economic growth.

The present study addressed three research issues to enhance understanding of industry clusters and provide a more nuanced perspective on the role of clusters in rural regions.

Linkages between Cluster Structure, Degree of Rurality and Economic Performance

Are there systematic differences in cluster composition, specialization and size as the degree of rurality and remoteness change? Do these differences contribute to differences in economic performance among regions? Our hypothesis is that important differences will occur although it is not easy to specify a priori what the nature of those differences may be. For example, an agribusiness, food processing and technology cluster built around the intensive type of agriculture found in the fruit and vegetable growing regions in California and Florida may very well have a different impact on the local and regional economy than will an agribusiness cluster linked to the sheep and cattle industry in Wyoming and Montana.

Exploring these types of research questions and relationships requires operational definitions and constructs of three concepts: rurality, clusters, and economic performance.

- **Rurality.** An Index of Relative Rurality was constructed to provide a continuous measure of rurality for all U.S. counties along a *rural-urban continuum*. This is a significant improvement over previous classifications that typically place each county in a discrete category.
- **Cluster.** The research team defined 17 clusters at the six-digit NAICS level. One of these clusters, the manufacturing supercluster, was subsequently disaggregated into six more-specialized subclusters.⁴ Although there is no universally defined or accepted set of clusters,

⁴ The term supercluster was given to the manufacturing cluster in order to highlight the fact that it is broken into subclusters.

the basic principles underlying the cluster concept were used to specify the 17 used in this study. **Table 1** lists these clusters and a detailed listing of the industries comprising each cluster is provided in **Appendix I**.

- **Regional Economic Performance.** The research team constructed composite measures of economic performance for counties from five foundation variables: median household income; average wage; unemployment rate; poverty rate; and average annual change in employment.

Table 1. List of Clusters

Clusters	
1	Advanced Materials
2	Agribusiness, Food Processing and Technology
3	Apparel and Textiles
4	Arts, Entertainment, Recreation and Visitor Industries
5	Biomedical/Biotechnical (Life Sciences)
6	Business and Financial Services
7	Chemicals and Chemical-Based Products
8	Defense and Security
9	Education and Knowledge Creation
10	Energy (Fossil and Renewable)
11	Forest and Wood Products
12	Glass and Ceramics
13	Information Technology and Telecommunications
14	Manufacturing Supercluster
	Primary Metals
	Fabricated Metal Products
	Machinery
	Computer and Electronic Products
	Electrical Equipment, Appliance and Components
	Transportation Equipment
15	Mining
16	Printing and Publishing
17	Transportation and Logistics

This measurement scheme for these three constructs allowed for the multi-dimensional classification of all counties, facilitating insights into the linkages between cluster composition, degree of rurality, and economic performance. Mapping the locations of different types of clusters provided additional insights, including the identification of “hot spots” of economic decline or economic growth; and to examine differences in cluster composition and degree of rurality between these two types of hot spots.

Spatial Clustering and the Rural-Metropolitan Interface

Do industry clusters differ in their degree of spatial clustering? What is the nature of the interface between rural and metropolitan regions? Are certain industry clusters more “distance-sensitive” than others? That is, to enhance a region’s prosperity, do distance-sensitive clusters require a shorter distance to large metropolitan agglomerations? Do certain clusters profit from longer distances to metropolitan agglomerations? The research team took a two-pronged approach to tackle these questions.

First, the research team used nearest neighbor analysis to explore the distance dependency of each industry cluster (Boots and Getis 1988). This approach allows differentiation of industry clusters by the degree to which they are clustered geographically. Basing the nearest neighbor analysis on employment-weighted distances permitted differentiation of clusters by their proximity to large metropolitan areas.

A second type of analysis used regression models to estimate – separately for each industry cluster – the effect of distance to metropolitan areas on economic performance. The statistical models measured how closely several indicators of economic performance and county characteristics, such as degree of rurality, were related.”

The results of this analysis were used to evaluate hypotheses concerning economic performance. For the most distance-sensitive industrial clusters, the hypothesis was that economic performance peaks in close proximity to metropolitan areas and decays rapidly with increasing distance from the metropolitan area. In contrast, the study group hypothesized that the least distance-sensitive industrial clusters reach their peak performance in remote rural areas.

Growth Trajectories

What is the future growth trajectory of rural counties? The literature suggests rural counties follow a different growth path than metropolitan counties (Porter 2003), yet little is known about the roles of industry clusters, proximity to metropolitan areas and degree of rurality in shaping the different growth trajectories. These issues were addressed by estimating regression models relating change in economic performance to several factors, including economic performance in the base year, dominant cluster types, degree of rurality and distance from metropolitan areas. These types of regression models – also referred to as conditional convergence models and other variations of that theme (Barro and Sala-i-Martin 1992; Chatterji and Dewhurst 1996) – allowed examination of whether differences in the economic performance of urban and rural regions will likely converge (narrow) or diverge (widen) over time.

This information also allows us to assess whether the variation in the economic performance of various rural areas is likely to increase or decrease over time; and to determine which industrial clusters are most likely to contribute to changes in such variation.

2.2.2. Project 2: Applying Cluster Insights in a Rural Region

The Selected Study Region

The region chosen for Project 2 was Indiana’s Economic Growth Region 8 (EGR 8). The region’s population, which was 299,888 in 2005, is growing at a modest rate, expanding by 9.6 percent during the 1990s but expected to gain only 7.2 percent in the current decade. The region is

comprised of eight counties that represent a mix of four metropolitan and four non-metropolitan counties (see **Figure 1** in Section 1.1.2).

Research and Analysis Plan of Work

The research team began Project 2 with a thorough analysis of secondary data—economic, demographic and public administrative records—to develop a solid understanding of the performance of the region’s economy and how it is changing. The database developed in Project 1 was also analyzed to identify existing industries, clusters, and subclusters that have performed well in terms of current levels and growth rates for employment, earnings, establishments, and other indicators, paying particular attention to “emerging” clusters and subclusters. Emerging clusters are those that currently have a location quotient that is less than 1 (where 1 is equal to the national share of the cluster concerned), but where the location quotient has been rising over the study period. These clusters are often thought of as having the potential to become part of the “star” category of clusters.

This analysis was augmented with primary data gathered through surveys, focus groups and interviews with key informants, including existing businesses, local economic development organizations (LEDOs), local and regional plan commissions, and other knowledgeable stakeholders in the eight counties. These data provided insight into the quality of the region’s business environment and generated an inventory of regional assets that could be leveraged to help the region grow, and regional liabilities that may represent barriers to growth.

Economic Development Strategy and Implementation

The research team established an initial group of economic development partners from the region. These partners included elected officials, business proprietors, LEDOs and knowledgeable representatives from the social services, education, and related sectors. The research team was assisted in forming and working with this partnership by the Purdue Cooperative Extension Service and by the Southern Indiana Regional Development Project (SIRDP), which has coordinated a network of organizations and task forces in this region for more than a decade in an effort to strengthen the economy of rural southern Indiana.

The regional partnership assisted the research team in understanding the region’s unique characteristics and assets, gaining cooperation from regional parties with the study’s survey and other data-gathering efforts, providing input into and feedback on the economic development strategies that arose from the study, and implementing recommendations resulting from this research. This buy-in by key regional stakeholders is crucial in ensuring that the study’s findings lead to concerted efforts to enhance the region’s economic growth.

The process for developing the economic development strategy plan in Economic Growth Region 8 followed the normal paths used for any comprehensive or strategic planning exercise—taking account of other plans in and around the region; conducting studies; communicating implications; developing a set of goals and strategies that can result in an implementation plan; and establishing a benchmarking system for monitoring and evaluation of results.

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