Cluster-Based Economic Development: What Have We Learned

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DTI
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Additional information may be found at the website of the Institute for Strategy and Competitiveness, www.isc.hbs.edu
Why the Interest in Clusters?

- Clusters are becoming increasingly popular as a policy tool to boost economic development and competitiveness.

- The interest in clusters is at least partly a response to the weaknesses of economic strategies pursued in the past:
  - Strategies based on market opening and macroeconomic stabilization alone have over time tended to exhibit falling returns.
  - Strategies based on market intervention and industrial policy have fared even worse, undermining prosperity over time.

- Clusters are seen as a market-based approach to economic policy that develops new roles for government and companies, as well as for universities, research institutions, trade associations, and others.
Cluster Policy in the UK

• UK competitiveness is entering a new phase

• The focus is shifting towards building stronger microeconomic foundations to take better advantage of open markets and stable macroeconomic conditions

• Competitiveness and clusters have become an established element of DTI’s strategy to upgrade UK competitiveness

• New institutions, especially the Regional Development Agencies (RDAs), have been created that push the agenda on the regional level

• Significant investments have been made in collecting performance indicators, mapping clusters, and evaluating cluster policy
Cluster Research Entering a New Phase

• Research on clusters has made significant progress, developing a **consistent conceptional framework** over the last decade

• Economic development practitioners increasingly look at the cluster concept as a **promising new policy approach**

• Clusters are moving from being an experimental, innovative idea to the **mainstream** of research and policy

• The increased exposure puts new demands on the field
  – Moving from case studies to large scale data bases and **empirical** tests of theory-based hypotheses
  – Moving theory development from the focus on clusters as an empirical phenomenon to clusters as a **policy** approach
Drivers of Sustainable Prosperity

- **Prosperity**
- **Productivity**
- **Innovative Capacity**

*Competitiveness*
Determinants of Productivity and Productivity Growth

Macroeconomic, Political, Legal, and Social Context for Development

Microeconomic Foundations of Development

- Sophistication of Company Operations and Strategy
- Quality of the Microeconomic Business Environment

- A sound macroeconomic, political, legal, and social context creates the potential for competitiveness, but is not sufficient
- Competitiveness ultimately depends on improving the microeconomic capability of the economy and the sophistication of local companies and local competition
Business Competitiveness Index 2003
Relationship with GDP Per Capita

\[ y = 2002.2x^2 + 8427.7x + 9514.9 \]
\[ R^2 = 0.8266 \]

Source: Global Competitiveness Report 2003
Cluster-Based Development 03-10-04 CK

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Successful economic development is a process of **successive economic upgrading**, in which the business environment in a nation evolves to support and encourage increasingly sophisticated ways of competing.

- **Factor (Input) Conditions**
  - Presence of high quality, specialized inputs available to firms
    - Human resources
    - Capital resources
    - Physical infrastructure
    - Administrative infrastructure
    - Information infrastructure
    - Scientific and technological infrastructure
    - Natural resources

- **Context for Firm Strategy and Rivalry**
  - A local context and rules that encourage *investment* and *sustained upgrading*—e.g., Intellectual property protection
  - Meritocratic incentive systems across all major institutions
  - Open and vigorous competition among locally based rivals

- **Related and Supporting Industries**
  - Access to capable, locally based suppliers and firms in related fields
  - Presence of clusters instead of isolated industries

- **Demand Conditions**
  - Sophisticated and demanding local customer(s)
  - Local customer needs that anticipate those elsewhere
  - Unusual local demand in specialized segments that can be served nationally and globally
The Boston Life Sciences Cluster

Health and Beauty Products
Surgical Instruments and Suppliers
Medical Equipment
Dental Instruments and Suppliers
Ophthalmic Goods
Diagnostic Substances
Containers
Analytical Instruments

Biological Products
Teaching and Specialized Hospitals

Biopharmaceutical Products
Research Organizations

Cluster Organizations
MassMedic, MassBio, others

Specialized Business Services
Banking, Accounting, Legal

Specialized Risk Capital
VC Firms, Angel Networks

Specialized Research Service Providers
Laboratory, Clinical Testing

Educational Institutions
Harvard University, MIT, Tufts University,
Boston University, UMass
Levels of Clusters

• There is often an **array of clusters** at different locations in a given field, each with different levels of specialization and sophistication

• Global **innovation centers**, such as Silicon Valley in semiconductors, are few in number. If there are multiple innovation centers, they normally **specialize** in different market segments

• Other clusters focus on **manufacturing**, outsourced **service functions**, or play the role of **regional** assembly or service centers

• Firms based in the most advanced clusters often **seed or enhance clusters** in other locations in order to reduce the risk of a single site, access lower cost inputs, or better serve particular regional markets

• The challenge for an economy is to move from **isolated firms** to an array of **clusters**, and then to **upgrade the breadth and sophistication** of clusters to more advanced activities
Influences on Competitiveness
Multiple Geographic Levels

- World Economy
- Broad Economic Areas
- Groups of Neighboring Nations
- Nations
- States, Provinces
- Cities, Metropolitan Areas
Evolution of Regional Economies and Clusters

- Regional economies and their individual clusters develop slowly in an **evolutionary, path-dependent process**

- Some of the factors that drive this process are **inherited** or externally given (physical location, natural endowments, chance events)

- However, while these factors are important, they do **not** determine the evolutionary path of a regional economy or cluster

- **Choices**, such as the investment in specific assets or the decision for a particular regulation or policy, are important
  - Institutions are an important factor enabling regions to make and execute choices

- So are **entrepreneurial decisions**
Shifting Responsibilities for Economic Development

Old Model

• Government drives economic development through policy decisions and incentives

New Model

• Economic development is a collaborative process involving government at multiple levels, companies, teaching and research institutions, and institutions for collaboration
Institutions for Collaboration
Selected Massachusetts Organizations in Life Sciences

**Life Sciences Industry Associations**
- Massachusetts Biotechnology Council
- Massachusetts Medical Device Industry Council
- Massachusetts Hospital Association

**General Industry Associations**
- Associated Industries of Massachusetts
- Greater Boston Chamber of Commerce
- High Tech Council of Massachusetts

**Economic Development Initiatives**
- Massachusetts Technology Collaborative
- Mass Biomedical Initiatives
- Mass Development
- Massachusetts Alliance for Economic Development

**University Initiatives**
- Harvard Biomedical Community
- MIT Enterprise Forum
- Biotech Club at Harvard Medical School
- Technology Transfer offices

**Informal networks**
- Company alumni
- VC community
- University alumni

**Joint Research Initiatives**
- New England Healthcare Institute
- Whitehead Institute For Biomedical Research
- Center for Integration of Medicine and Innovative Technology (CIMIT)
Cluster-Based Economic Development

**Key Hypotheses**

- Clusters Exist
  - Extensive case evidence exists
  - Economy-wide, systematic data in Canada, the U.S., and Sweden

- Clusters Provide Economic Benefits
  - Case-based evidence on different dimensions of benefits
  - U.S. data provides evidence on regional economic benefits

- Cluster Development Can Be Influenced
  - Theory and case evidence suggest impact of policy choices

- Cluster Development Has Net Benefits
  - Theory and case evidence suggest potential for net benefits
Cluster Initiatives

- Conceptual Foundations
- Empirical Evidence on Clusters
  - Empirical Evidence on Cluster Initiatives: The Greenbook
  - Implications for Cluster-Based Economic Development
Mapping Regional Clusters
Statistical Definition of Clusters

• Many previous studies have used ad-hoc cluster definitions, in some cases supported by input-output data

• The Cluster Mapping Project set out to delineate the boundaries of clusters statistically
  – Cluster boundaries are based on the actual patterns of co-location of industry employment across U.S. states

• The process of identifying cluster involves two steps:
  – Distinguishing local, traded, and natural-resource dependent industries
  – Grouping 590 traded industries into 41 traded clusters

## Composition of Regional Economies

### United States, 2001

<table>
<thead>
<tr>
<th></th>
<th>Traded Clusters</th>
<th>Local Clusters</th>
<th>Natural Resource-Driven Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Share of Employment</strong></td>
<td>31.6%</td>
<td>67.6%</td>
<td>0.8%</td>
</tr>
<tr>
<td><strong>Employment Growth, 1990 to 2001</strong></td>
<td>1.7%</td>
<td>2.8%</td>
<td>-1.0%</td>
</tr>
<tr>
<td><strong>Average Wage</strong></td>
<td>$44,956</td>
<td>$28,288</td>
<td>$33,245</td>
</tr>
<tr>
<td><strong>Relative Wage</strong></td>
<td>133.8</td>
<td>84.2</td>
<td>99.0</td>
</tr>
<tr>
<td><strong>Wage Growth</strong></td>
<td>4.5%</td>
<td>3.7%</td>
<td>2.0%</td>
</tr>
<tr>
<td><strong>Relative Productivity</strong></td>
<td>144.1</td>
<td>79.3</td>
<td>140.1</td>
</tr>
<tr>
<td><strong>Patents per 10,000 Employees</strong></td>
<td>21.7</td>
<td>1.3</td>
<td>7.2</td>
</tr>
<tr>
<td><strong>Number of SIC Industries</strong></td>
<td>590</td>
<td>241</td>
<td>48</td>
</tr>
</tbody>
</table>

**Note:** 2001 data, except relative productivity which is 1997 data.

**Source:** Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School
Broad Composition of Regional Economies
Local versus Traded Wages

Source: County Business Patterns; Michael E. Porter, The Economic Performance of Regions”, Regional Studies, Vol. 37, 2003
Cluster Overlap in the United States Economy
Common Industries Across Broad Traded Clusters

Note: Clusters with borders or identical colors/shading except gray have at least 20% overlap of industries by number in both directions.
Determinants of Regional Prosperity
Level versus Mix Effect, U.S. Regions

Cluster Wage Level Effect
as % of Wage Gap, 2001

Median: 74.2%

Source: County Business Patterns; Michael E. Porter, The Economic Performance of Regions”, Regional Studies, Vol. 37, 2003
Traded Cluster Specialization and Relative Wage Levels
Ohio, 2001

Note: Uses narrow cluster definitions to avoid overlap; bubble size proportional to employment bracket
Source: Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School

y = 0.1902Ln(x) + 0.9874
R^2 = 0.3403
Determinants of Regional Prosperity
Cluster Strength and Wage Levels, U.S. Regions

Average Regional Wage, 2001

Source: County Business Patterns; Michael E. Porter, The Economic Performance of Regions", Regional Studies, Vol. 37, 2003
Determinants of Regional Prosperity
Change in Cluster Specialization and Wage Growth, U.S. States

Source: County Business Patterns; Michael E. Porter, The Economic Performance of Regions”, Regional Studies, Vol. 37, 2003
Explaining Average Regional Wages
Multiple Regression Model

Dependent variable: Regional Average Wage

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total regional employment</td>
<td>Positive, significant</td>
</tr>
<tr>
<td>Patents per capita</td>
<td>Positive, significant</td>
</tr>
<tr>
<td>Patentor concentration</td>
<td>Negative, significant</td>
</tr>
<tr>
<td>Share of strong clusters in regional employment</td>
<td>Positive, significant</td>
</tr>
<tr>
<td>Cluster breadth</td>
<td>Positive, significant</td>
</tr>
</tbody>
</table>

Explained Variation (adjusted $R^2$): 72.8%

Note: Regression uses 2001 data for 172 U.S. economic areas
Cluster Initiatives

- Conceptual Foundations
- Empirical Evidence on Clusters
- **Empirical Evidence on Cluster Initiatives: The Greenbook**
- Implications for Cluster-Based Economic Development
Cluster Initiatives
The Greenbook

• Cluster initiatives are coalitions of companies, government agencies, and other institutions for joint action to upgrade a cluster’s competitiveness
  – Relatively new policy approach
  – Most current evidence is based on case studies

The Cluster Initiative Greenbook

• First ever quantitative look at a 250+ cluster initiatives
  – Sponsored by Vinnova (Swedish government agency) for the 6th Annual Conference of the The Competitiveness Institute

• Collects data on key characteristics of cluster initiatives (CI) connected to performance
  – Objectives; what does the CI aim to do
  – Process; how is the CI organized to achieve its objectives
  – Setting; what are the characteristics of the cluster and its environment

Free download at www.cluster-research.org
Cluster Initiative Assessment

Context of the CI

Categories

• To describe the setting in which the cluster initiative operates, we look at the overall business environment and the characteristics of the cluster served.

Findings

• There is significant variance in the responses, but some clear patterns emerge.
  – Most of the CI’s operate in a context of strong regional governments focused on innovation.
  – Most of the clusters served have an important role in their region or nation.
  – The level of heterogeneity among the context CI’s face is highest in the level of trust towards government, the level of competition within the cluster, and the age of the cluster.
Cluster Initiative Assessment
Objectives and Activity Areas of the CI

- Common objectives
  - Foster networks among people
  - Establish networks among firms
  - Promote innovation, new technologies
  - Create brand for region
  - Provide business assistance
  - Analyze technical trends
  - Promote formation of spin-offs
  - Provide management training
  - Enhance production processes
  - Improve FDI incentives
  - Provide incubator services
  - Study and analyze the cluster
  - Conduct private infrastructure projects
  - Produce reports about the cluster
  - Promote expansion of existing firms
  - Facilitate higher innovativeness
  - Attract new firms to region
  - Promote exports from cluster
  - Assemble market intelligence
  - Improve firms’ cluster awareness
  - Provide technical training
  - Diffuse technology within the cluster
  - Lobby government for infrastructure
  - Improve regulatory policy
  - Lobby for subsidies
  - Co-ordinate purchasing
  - Establish technical standards
  - Reduce competition in the cluster

- Rare objectives

- On average, CI’s are pursuing 15 objectives/activity areas
- Almost 50% of the CI’s pursue between 13 and 20 objectives
Cluster Initiative Assessment

Roles

- Companies are the most influential participants in 70% of the CI’s
- There is significant heterogeneity in the role of government
While financing patterns change, the objectives tend to remain stable.
Cluster Initiative Assessment
CI Facilitator and Office

Cluster Initiative Facilitator
- 90% of all CI’s responding have a CI facilitator playing a central role in leading the effort
- More than 50% of the CI facilitators come from companies, with the rest equally from government and specialized consultancies

CI Infrastructure
- More than 75% of all CI’s have organized task-forces to address specific issues
- About 70% of all CI’s have relationships to other cluster initiatives in their region or economic field
- Less than 70% of the CI’s have an own office, and the large majority have budget shortages

- A significant minority of about 40% of CI’s report dependence on one key individual and a lack of sustainability without continued outside support
Drivers of Cluster Initiative Success

Setting
- Strong business environment
- Trust in government
- Strong regional government
- Cluster strength

Objectives
- Broad range of objectives
- Objectives selected based on cluster’s specific needs
  - No significant effect of special objectives

Process
- CI Facilitator with cluster insight
- CI has office and significant budget
- CI has clear strategy and measurable goals
  - No negative effect of government financing
  - Negative effect of limiting participation
Ongoing Empirical Research

**Business Environment quality**
- Continuous upgrading of data on national business environments
  - Global Competitiveness Report, [www.weforum.org](http://www.weforum.org)
- Collection of data on regional business environments
  - Studies in selected U.S. regions in the *Clusters of Innovation*-project ([www.compete.org](http://www.compete.org))

**Cluster**
- Develop cluster data at the national level using trade patterns
  - Launch of new data website at [www.isc.hbs.edu](http://www.isc.hbs.edu)
- Roll out of the methodology outside the United States
  - Canada, 2001 ([www.competeprosper.ca](http://www.competeprosper.ca))

**Cluster policy**
- Collection of data on the impact of cluster policies on cluster-specific business environments
  - *Cluster Competitiveness Report* offered by the “Fundacio Clusters I Competitivitat” ([www.clustercompetitiveness.org](http://www.clustercompetitiveness.org))
Cluster Initiatives

• Conceptual Foundations

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• Implications for Cluster-Based Economic Development
Emerging Implications

Implications for cluster initiatives
• Managing the Cluster Initiative Life Cycle
• Professionalizing Cluster Initiatives

Implications for economic development strategies
• Cluster initiatives organize policies; they are not a new policy
• Cluster creation versus cluster activation
• Clusters and regional economic strategy

Implications for UK cluster policy
The Life Cycle of a Cluster Initiative

Antecedence | Formation | CI | Cluster-based IFC

Time
Professionalizing Cluster Initiatives

• The foundations of Cluster Initiatives’ strategies and structures need to be improved as clusters enter the mainstream of economic policy in many regions.

• Activities need to be based on a consistent conceptual framework of the drivers of the cluster’s performance, shared across the cluster.

• A CI’s strategy needs to build on the unique circumstances of the cluster, not copying of successful clusters elsewhere.

• A CI needs a sound organizational structure with a sufficient infrastructure and financing.

• Data creation and analysis needs to be a central in supporting decisions about CI activities and in measuring impact.
Cluster – A New Economic Policy Tool?

• In some cases, cluster initiatives are organized as an additional *policy area* within the government’s economic development organization

  However

• Clusters are better understood as an effective *process* to identify, prioritize, and act upon barriers to higher cluster performance
  
  – *Everything matters* for microeconomic competitiveness
  
  – It is not enough for policies too be generically “good”; they need to be the *most appropriate* in the specific situation
## Different Approaches to Cluster Development

<table>
<thead>
<tr>
<th>Cluster Creation</th>
<th>Cluster Activation</th>
</tr>
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<tbody>
<tr>
<td>• Targets areas of perceived <strong>market demand</strong></td>
<td>• Leverages <strong>existing assets</strong>, history, and geographic location</td>
</tr>
<tr>
<td>• Is driven by <strong>public sector intervention</strong></td>
<td>• Builds on <strong>coalition</strong> of private and public sector actors</td>
</tr>
<tr>
<td>• Requires sustained <strong>financial commitment</strong> by the public sector</td>
<td>• Requires sustained <strong>participation</strong> by all actors</td>
</tr>
<tr>
<td>• High <strong>failure rate</strong></td>
<td>• Level of success is increasing over <strong>time</strong>; quick returns are possible</td>
</tr>
<tr>
<td>• Deepens the dependence on public sector intervention</td>
<td>• <strong>Transforms</strong> the roles of private and public sector</td>
</tr>
</tbody>
</table>
The Role of Clusters in Economic Development

Overview

• Clusters are **critical engines** in the economic structure of national and regional economies
• Clusters can **identify fundamental challenges** in the national or regional business environment
• Clusters provide new **roles** for government, companies, and other institutions in economic development

However

• Cluster initiatives alone are less effective, if they are not part of a **overarching approach** to improve competitiveness on the national and/or regional level
• An overall strategy to improve a country’s or region’s **competitiveness** depends on progress in two dimensions
  – Cross-cluster issues affecting the whole economy
  – Clusters
Implications for UK Cluster Policy

Strategy
• Cluster initiatives need to be integrated into consistent regional economic strategies
• Strategies need to reflect the unique circumstances in a cluster or region

Process
• Regional competitiveness efforts need to focus on winning leaders with strong regional positions that can succeed in mobilizing the private sector
  – RDAs are a relatively young institutions and are not led by elected officials; they will need time to be perceived as ultimate decision makers
  – Private sector leaders are, especially in the short run, critical to really drive and direct the efforts

Data
• Cluster initiatives need effective data and expertise to be effective
  – Past cluster mapping efforts in the UK seem to have been insufficient to provide actionable data for cluster identification and evaluation
  – There is lack of consistent data on regional business environments and the impact of existing cluster efforts
UK Competitiveness Entering A New Phase
The Role of Cluster-Based Policies

• The UK is moving from competing as an efficient location to do business in Europe to become a base for competing on innovation

• Cluster-based strategies are an important tool to drive the transition of policy and to establish a new public-private policy process

• The UK can and needs to set more ambitious goals for its cluster-based economic policies
  – Use clusters to gain leverage for a broader competitiveness strategy redefining what this country stands for in international competition
  – Aim to become a leader in the practice of modern cluster-based policies defining their shape and applying and developing new tools