Industry Cluster Concepts in Innovation Policy: A Comparison of U.S. and Latin American Experience

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1 Introduction

The increasing knowledge-intensity of production and the progressive elimination of barriers to trade have led many to conclude that a strong base of science, technology, and innovation is essential for sustained economic prosperity (Mytelka and Farinelli, 2000). Advanced industrialized countries are responding to increasingly open markets by seeking competitive advantage in general knowledge infrastructure: universities and colleges, public and private laboratories, educated workers, advanced physical infrastructure, and comparatively stable social, political, and market institutions. Interest in innovation is also heightened by fears of an emerging "two-tiered economy," that two sectors will come to dominate long-term employment growth prospects in industrialized countries: high skilled technology-intensive activities that are dependent on advanced knowledge infrastructure and low-skilled basic consumer services that serve immediate local market needs (Mowery, 2001). In developing or transition countries, fears of falling further behind the highly industrialized world as well as optimism borne of widely publicized examples of high technology success provide the principal motivation to designing ways to boost innovation and technology-related activity.

In this context, of growing interest are the phenomena of high technology industry clusters and their potential value as an innovation policy focus. Mainstream economic theory argues that technology-related activity often agglomerates in specific regions because knowledge spillovers are localized (Glaeser, 2000). Knowledge spillovers – the primary engine in the most recent theories of long-run economic growth – are the ability of economic agents to utilize a new technology or innovation without fully compensating its original source or owner (Grossman and Helpman, 1991). Innovations initially occur in companies, universities, and laboratories located in specific places. The subsequent spread (or diffusion) of such innovations, as well as the spillovers they generate, may occur more readily among economic actors located in close proximity, either because the innovation is tacit in nature or because its successful utilization requires an element of hands-on learning-by-doing. Increasing returns to innovation, coupled with a localized diffusion effect, imply that technology-oriented activity and R&D are likely to concentrate geographically. Technology businesses lo-

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cate near other high tech companies and R&D performers in order to share in the spillovers, further enhancing the attractiveness of the growing cluster for still more high tech enterprises. The cluster may then expand through a process of cumulative advance.

The emergence of new growth theory more or less coincided with Michael Porter's (1990) research on clustering and national competitiveness as well as an exploding literature on industrial districts. Early on, there was comparatively little cross-fertilization of ideas from these perspectives. However, they all emphasized the tendency toward localization of economic activity and the critical role of knowledge spillovers (albeit described differently by each perspective). The concurrent development of the literatures, all offering varying perspectives on a similar story, contributed strongly to the rise of industry clusters as a concept in development policy debates.

Such debates have been bolstered by stylistic qualitative analyses in highly industrialized economies that suggest that a combination of geographically co-located private sector producers of R&D, related manufacturing and services industries, linked or related suppliers and producer services providers, leading research universities and teaching institutions, and government sponsored labs and technology programs can combine to create powerful spatial clusters of technology-related activity that continue to expand through initial market leadership (often called "first-mover effects") and economies of scale (Saxenian, 1994, Porter, 1990, 1998, 2000, den Hertog et al., 2001a, b). Well-known examples in the United States are California's Silicon Valley and Boston's Route 128 (in information technology and biotechnology), greater Seattle (in software and aircraft), and North Carolina's Research Triangle region (in electronics, pharmaceuticals, and biotechnology). Such clusters have contributed to substantial increases in the local economic prosperity while also supplying the innovations that drive national and, in some cases, global economic growth. Such clusters are not restricted to the U.S. or other advanced industrialized countries, although they tend to be smaller and have much less depth in less developed countries (e.g. see den Hertog et al., 2001b, Melo, 2001a, Chairatana and Vorrakitpokartorn, 2001, Voyer, 1997b). Recent studies of Latin America have identified innovation clusters of differing varieties and size in Argentina, Brazil, Costa Rica, Cuba, Peru, and Mexico (Quandt, 1997, Voyer, 1997a, Altenburg and Meyer-Stamer, 1999, Bortagaray and Tiffin, 2000).

An important issue is what clusters imply for the design and implementation of innovation policy, particularly in newly industrializing countries and lagging regions in developed ones where technology-intensive activity and basic knowledge infrastructure are limited. Innovation policy constitutes strategies designed to build basic and applied research capabilities, raise the rate of advanced technology adoption and product innovation among home country firms, and generally increase the complement of higher wage knowledge- and technology-intensive industries in a country or region.[1]

[1] Temple (1998) identifies five determinants of technological change that may be the focus of innovation policy: the generation of new knowledge; the translation of new or existing knowledge into products and processes; the diffusion of innovation; the exchange of knowledge-intensive goods and services; and the absorption of knowledge or learning. All of the processes are subject to market failure. Therefore, the more knowledge- intensive an economy becomes, the more important institutional (i.e. policy) mechanisms for

The strategies might include, among others, the provision of R&D subsidies and incentives, the development of university research competencies, the improvement of basic education, the supply of training, the promotion of business development services, the encouragement of firm networks, the provision of industrial extension, the facilitation of technology transfer, and the targeting of public sector procurement (Leyden and Link, 1992, Malecki, 1997, Gambardella and Malerba, 1999, Tidd and Brocklehurst, 1999, Conceição et al., 1998, Geroski, 1990).

Many of those same interventions have been described, at one time or another, as industry cluster policies (Jacobs and de Jong, 1992, Jacobs and de Man, 1996, Rosenfeld, 1997, Enright, 2001, Rosenfeld, 2001). What unique insights, then, does the cluster concept bring to the innovation policy debate? Is an industry cluster policy merely the application of a conventional development initiative, such as an R&D incentive or procurement strategy, to a geographically concentrated group of firms? Does the process of clustering, as opposed to the phenomena of clusters, imply a specific and unique kind of policy intervention? Have governments formed an alternative model of intervention that utilizes findings from research on clusters but does not force them to pick favorite sectors, research concentrations, or regions? Those fundamental questions are raised from the explosion of literature on clustering and closely related sister concepts and perspectives such as learning regions, innovation systems, networks, districts, and innovative milieux.

This paper does not attempt a general discussion of the wide range of definitions, views, and theories of industry clusters. Such generalized reviews are already numerous.[2] Instead, it focuses on the empirical question of how cluster concepts are being utilized in economic development policy making, especially related but not limited to innovation, at least as could be determined with a review of secondary sources, government documents, and expert opinion. The focus is on Latin America and the United States, with one important aim being to consider how different institutional frameworks and stages of development link to differences in the way cluster concepts are applied in the policy arena. While the Latin American and U.S. cases are examples of the developing and developed economy contexts, respectively, I make no claim that they are representative of those contexts.

2 Industry Clusters and Innovation Policy Making

Examining how governments around the world are actually invoking cluster concepts in economic development planning and policy making, especially with regard to innovation, is no easy task. The active or at least nominal use of cluster ideas in policy making at all levels – local, regional, national, and international – continues to grow. Clusters have been debated at the national and regional levels in the U.S., Canada, Australia, New Zealand and most of the European Union since the mid 1990s (Roe-

resolving failures will be.

[2]The most relevant theoretical literatures include endogenous growth theory, new industrial districts, technology districts and technopoles, innovative milieux, industrial location and agglomeration economies, strategic management and industrial organization, and innovation systems. See McCann (1995), Feser (1998a, b), Bergman and Feser (1999), and Moulaert and Sekia (1999), and Gordon and McCann (2000).

landt and den Hertog, 1999, den Hertog, Bergman et al., 2001b). Enright (2001) claims that cluster initiatives have been pursued in ten countries in Latin America, as well as in Malaysia, Singapore, Morocco, South Africa and Senegal.

International organizations have been particularly important players in the evaluation, dissemination, and utilization of cluster ideas. The OECD, the World Bank, UNIDO and UNCTAD have all been engaged in considering, developing, funding, and/or evaluating cluster or networking policies of one form or another. For example, the World Bank organized a workshop of cluster practitioners in Chihuahua, Mexico, in November 1997, which helped inspire the founding of The Competitiveness Institute, a non-profit international association of practitioners that aims to disseminate best practices via a website, newsletter and annual conference. The OECD has considered clusters as part of its National Innovation Systems (NIS) project since 1996, an effort that has resulted in several international workshops and two edited volumes of best practice (Roelandt and den Hertog, 1999, den Hertog, Bergman et al., 2001b). UNIDO considers clusters part of its small and medium-sized enterprises (SME) programs (Ceglie and Dini, 1999, Fisher and Reuber, 2000, Russo, et al., 2000, UNIDO, 2001, Nadvi, 1995). UNCTAD has also focused on clustering and networking as modes of competition for small firms (UNCTAD, 1998).

A simple Internet search on the phrase "industry clusters" turned up over 10,000 references at the time of this writing, a huge figure considering that common estimates of the share of web content that current search engines are capable of tapping is about 15 percent (Reich, 2002). Yet at least some efforts are being made to understand broader trends in how the concept is being interpreted and applied. Claas van der Linde and Michael Porter have assembled a collection of over 350 studies that examine some 700 clusters in roughly fifty countries. The majority of those studies have been conducted or commissioned by public agencies interested in applying clusters to policy. Classifying studies of clusters is, however, very different from documenting the utilization of clusters in policy making, since industry clusters have been the subject of far more study than practical action. More apropos in the present context is a recent study by Sølvell et al. (2003).

A major problem with efforts to describe "cluster policy" is that many types of development interventions are targeted to specific sectors, regions, or both, and thus could be loosely interpreted as cluster-oriented strategies. For example, the establishment of research parks and technopoles could be considered cluster strategies, even though many such efforts around the world preceded the modern cluster literature. In the United States, North Carolina's development of Research Triangle Park in the 1950s, which subsequently became the anchor of substantial information technology and bioscience clusters, is sometimes viewed (and cited favorably) as a cluster strategy (Rosenfeld, 2001), even though it was initially designed as an industry recruitment tool. Melo (2001b), referencing Quandt (1999), describes Brazil's establishment of thirteen innovation centers in 1982, as well as a subsequent science park program in 1984, as among the earliest cluster strategies in Latin America. Business incubators, industrial parks, targeted recruitment, enterprise zones, foreign trade zones, and a large variety of other common economic development interventions could similarly be assessed as cluster policy if they aim to foster growth in specific industries or regions.

As a way of limiting the scope of the analysis, this section focuses strictly on U.S. and Latin American trends in the explicit use of cluster ideas. Only efforts that directly reference the concept of clusters, even if they do so in only a nominal way, are therefore considered. The assessment is based on existing literature, Internet searches, and personal communication with experts and policy makers. While it is invariably non-exhaustive, hopefully it is representative. The aim is to gain an empirical sense of how public officials are drawing on the notion of clusters. Given the highly malleable nature of the concept, it is to be expected that the utilization of clusters in policy making tends to reflect industry characteristics and mix, views of economic development, prevailing institutional frameworks, and political and economic constraints in the jurisdiction at hand. More specifically, it appears the most common use of cluster ideas is as a way to organize and undertake strategic planning exercises that yield a flexible set of policy options, a clear target group of beneficiaries, and a logical set of private sector partners to planned interventions.

2.1 Clusters and Innovation Policy in Latin America

In Latin America, views of innovation are influenced by a general debate about industrial policy. In a recent survey of economic policies in the region, Melo (2001a) documents two phases in the reforms that have followed the import substitution era. In the first phase – from roughly the late 1980s to the mid 1990s – Latin American countries sought to implement basic structural reforms related to export trade, privatization, domestic market liberalization, and regulation. At the same time, they curtailed explicit (sector targeted) industrial policies. The logic was that government intervention in liberal market economies is necessarily very modest and that industrial policy is generally prone to distortion and corruption. Yet Melo finds that by the mid-1990s many Latin American states had already begun to abandon that strictly hands-off philosophy in favor of explicit public sector strategies aimed at enhancing the competitiveness of particular sectors, value chains, and firms. This second phase, which is ongoing and still without definitive results, reflects a view of government intervention that is more nuanced, particularly as it pertains to technology. Latin American countries are recognizing that global competitiveness ultimately implies continuous learning and innovation, processes on which the public sector might exert considerable positive influence through its role as catalyst, source of demand, and supporter of research, basic education, and training. It is in this context that there is growing interest in Latin America in the phenomena of industry clusters and their potential value as an innovation policy focus.

Early interest in clusters and clustering focused overwhelmingly on advanced industrialized countries. That is no longer the case. Clusters, districts, and networks are now being systematically studied all over the developing world. Latin America, in particular, has been the subject of considerable research, with Brazil and Mexico receiving most of the attention. Among the clusters (or districts) studied in the former are leather shoe producers in the Sinos Valley (Nadvi, 1995, Schmitz, 1995a, b, 1999), various high technology sectors in Campinas (Quandt, 1997), the wood furniture industry of Ceará (Tendler and Amorim, 1996), and the textiles and clothing,

metal engineering and electromechanical, and ceramic tiles clusters in Santa Catarina (Meyer-Stamer, 1998). Rabellotti (1999) analyzes the footwear sector in Guadalajara, Mexico, and Visser (1999) describes the results of a case-control study of clustered and dispersed garment producers in Lima, Peru. None of the aforementioned studies are focused specifically on innovation or technology. In contrast, Bortagaray and Tiffin (2000) attempt a systematic identification of innovation clusters across the region, concluding that while firms in clusters seem to grow faster and generate more profits than those outside of clusters, no Latin American innovation clusters can be reasonably described as mature in the sense of a Silicon Valley. The authors do identify a number of significant developing and potential innovation clusters, including two in Argentina, twenty-seven in Brazil, two in Costa Rica (both in San Jose), one in Cuba (biotechnology), six in Mexico, and one in Uruguay (wine). Unsurprisingly, most of the clusters are in heavily urbanized areas. A lack of investment capital, weak inter-firm and inter-institutional networking, and an absence of adequate business development services are cited as the primary impediments to the further development of innovation clusters in the region.

A review of government documents and web sites gives a sense of how cluster ideas are either informing or being incorporated into economic policy in the region, both within and outside the area of innovation (see Table 1). Immediately noticeable is the breadth of interventions that Latin American governments themselves describe as cluster policy. They range from marketing and business networking to targeted export assistance, infrastructure development, and training. Overall, public agencies in the region tend to be invoking or actively applying cluster concepts mainly in three broad policy areas: export promotion and attraction of inward investment, value chain integration, and networking/SME policy. Those emphases reflect views of what is appropriate given the current industrial structure and stage of development in much of Latin America, including the continued dependence on the location of the manufacturing concerns of large multinational companies, a desire to diversify existing industry by filling out supply chains, and a predominance of uncompetitive small and medium-sized producers (particularly in peripheral and lagging areas). Notable is the lack of many innovation programs based on cluster concepts. That does not mean that Latin American governments are not targeting S&T investments to specific sectors, research competencies, and/or regions, but rather that there is only modest evidence that cluster ideas are being used explicitly to guide such initiatives. Current cluster interventions in the region seem to be focused on traditional sectors for the most part.

So exactly what value-added are clusters bringing to economic policy making in the Latin American region, even if their role in innovation policy has been limited? The answer appears to have less to do with the identification of specific interventions than with the defense of general approaches and setting of strategic priorities. First, as mentioned above, many Latin American governments are attempting to identify the right balance between the implementation of free market structural policy and activist (often local and regional) strategies designed to promote the competitiveness of strategic sectors and potential strengths in science and innovation. The region's move to open its markets to international competition while dismantling the protection of inefficient domestic industries has not yielded the gains initially anticipated (Melo,

Table 1: Latin America: examples of cluster policy initiatives by country

Country	Source	Policy Type	Example
MEXICO	Online information and document (SE, matrix by State)	Promotion of bus. associations	Creation of the Mexican Council of Cotton Production (Durango).
		Export promotion	Establishment of the Export Development Center (Chiapas).
		Infrastructure development	Construction of a fire station (Hidalgo).
		Direct investment	Development of a silver processing/refinement plant (Guerrero).
		Training	Training workshop for lime producers (Colima).
		Marketing	Trade shows, promotion, marketing, etc.
	Altenburg and Meyer-Stamer (1999)	Networking	Empresas Integradoras Program: private corporations owned by groups of small firms that provide demand aggregation, purchasing, and marketing services. Firms are lured to participate with tax deductions, loans, and training programs.
	Melo (2001a), Altenburg and Meyer-Stamer (1999)	Production chain integration	Eight broad sectors targeted: high-tech industries, automobiles, light manufacturing, petrochemicals, mining, agribusiness, forestry, and public sector. Aims to coordinate private-sector efforts with the following goals: formation of clusters; rationalization of internal corridors; identify supplier opportunities and customer technical requirements (through compilation of information sources such as directories and organization of supplier and export promotion conventions; subcontracting exchange schemes or SES).
PARAGUAY	Online document (STP)	Export promotion	Establishment of international production standards (e.g. animal feed processing (supporting grains cluster in Itapua y Alto Parana).
		Promotion of bus. association	Establishment of food production committee (grains cluster in Itapua y Alto Parana).
		Investment catalyst	Promotion of public-private partnerships for vegetable production.
		Support for suppliers/producers	Support existing agriculture cooperatives through credit (Caaguazu Dept.).
		Marketing	Carry on studies to identify potential export products (vegetable cluster).
		Infrastructure development	Development of highways to transport exported products (oranges in Itapu).
		Applied research, extension	Enhance productivity of sector by introducing new varieties of cotton.
		Training	Training for metal mechanics sector; promotion of tech. specialization, etc.
		Other strategies suggested	Reduce production costs; set up a revitalization program for the restructuring of the sector; establishment of production of a type of wood
	Farinelli and Kluzer (1998)	SME modernization, promotion, networking	EC supported establishment (1993) of small firm consortia for small firms in the furniture, textiles/clothing and leather goods industries; implemented by Ministry of Industry and Trade (Paraguayan Support Centre for Enterprises).

Table 1: Latin America: examples of cluster policy initiatives by country – cont.

Country	Source	Policy Type	Example
HONDURAS	Online information (UNIDO), Altenburg and Meyer-Stamer (1999)	Promotion of business associations	Establishment of networks of firms with common needs, like joint establishment of shops to sell finished products, sharing large orders of products, etc.
		Support for suppliers/producers	A UNIDO program to provide technical support to help SME obtain credit. Establishment of a cluster promotion center (CERTEC).
		Production chain integration	Promote vertical networks between small and large firms.
		Training	Training for metal workers (Tegucigalpa); training for cluster/network "brokers" to diffuse networks.
NICARAGUA	Online information (UNIDO)	Promotion of business associations	Establishment of networks of firms with common needs, like the handicraft hammock production sector.
		Export promotion	Technical assistance to standardize production and pricing systems among a network of firms in the same industry/sector.
		Training	Training for workers as well as cluster/network "brokers" to diffuse networks.
		Regulation assistance	Technical assistance in legal issues to formalize economic activity.
		Brokering, catalyst	Coordination between UNIDO and the National Institute for SMEs.
		Production chain integration	Promote firms' integration along production chains.
BRAZIL	Online information (SEBRAE) Melo (2001a)	Training	Via Brazilian Support Service of Micro and Small Enterprises (SEBRAE). Training for cluster promoters.
		SME support	Technological Support Program for Micro- and Small-size Enterprises (PATME): financing of product and process improvements and equipment upgrades; provision of training; assistance with quality control. SEBRAEtec grants for the purchase of business development services from consultants, universities, and technical institutes.
COSTA RICA	Document (CLACDS-INCAE)	Training	Courses offered by the National Institute for Learning according to the needs of firms.

Table 1: Latin America: examples of cluster policy initiatives by country – cont.

Country	Source	Policy Type	Example
URUGUAY	Document (EU); Farinelli and Kluzer (1998)	Production support and export promotion of SMEs; modernization	EC supported promotion of SME integration in order to share large contracts, as well as manage export activities, etc. (furniture industry); implemented by Comisec
		Promotion of business association, networking	Establish a common strategic vision of the industrial restructuring needed in the textile and clothing industries was agreed among the main trade associations.
COLOMBIA	Online information (MINDESA); Melo (2001a)	Production chain integration, expansion	Targets existing and potential chains. Existing target chains include exporters facing stiff external competition (textiles/apparel, leather goods/footwear, automotive cars/parts, sugar cane/products, oleaginous seeds/oil/soap, aquaculture, tuna, toiletries and cleaning products, and potatoes) as well as chains with significant internal trade and linkages (petrochemicals, plastics, steel, electronics, among others). Potential include IT, biotech, chemistry, and communications, among others. Provision of specialized and general support infrastructure; preparation of "sector competitiveness agreements"; education and training, fostering dialogue between private and public sectors.
VENEZUELA	Online information (MPD)	Production chain integration	
CHILE	Online information (CORFO)	Recruitment, inward investment	Marketing, diffusion of information, financial support for investment studies, etc. (by region)
		Extension	Training for firms on internet usage (on-line).
		Location incentives	Land incentives, wage subsidies; credit support; bonuses for project investment to banks, co-financing of risk studies, etc. (Arica)
		Strategic planning	Comprehensive development plan for the Lota region; includes a wide variety of policies.
	Altenburg and Meyer-Stamer (1999)	Networking	Proyectos de Fomento (PROFOs): Contracts between a small group of small firms' public or private agency network brokers that provide resources for market research, industry studies, and participation in trade fairs.

2001a). The result is a search for interventions that will address the shortfall while also meeting the approval of multinational lending institutions, key trading partners such as the United States and Canada, and international investors. Industry clusters are widely viewed by both public and corporate officials in the developed world as a key feature of international competitiveness, i.e. cluster promotion efforts have attained a level of legitimacy as market-friendly industrial policy that other (differently labeled but sometimes quite similar) perspectives have not. Thus while clusters may hold out the promise of a substantive route toward a more activist competitiveness strategy that does not threaten the region's continued shift toward free markets, it is also significant that they are viewed favorably from a symbolic perspective.

Second, the cluster concept is persuading some Latin American governments to place more emphasis on the diagnosis of problems and prescription of interventions for existing industries, and to avoid focusing exclusively on the attraction of inward investment. Knorringa and Meyer-Stamer (1998) note that industrial diversification continues to dominate economic development thinking in many developed countries, often to the detriment of existing businesses. They argue that "... it is unrealistic to expect local and regional policy-makers to embark enthusiastically on a cluster strengthening policy" (p. 18). They believe that governments are more inclined to try to attract major foreign assemblers in new sectors, even if the probability of success is low, in order to avoid locking into a narrow set of specializations. The result is neglect of the concerns of local businesses and the potential to expand the existing industrial base. Balanced attention to the needs of existing industry is especially valuable even aside from the growth prospects of that industry because it often exposes policy reforms and legitimate investments in infrastructure, education, and other basic factors that could improve the general business climate. The evidence suggests that industry cluster concepts are providing a useful framework for Latin American governments to think about how to address weaknesses and threats to the competitiveness of existing industry and to encourage corporate interests to participate – and even drive – the process. This utilization of clusters as a strategic planning and organizing device in Latin America parallels the experience in many developed countries.

2.2 Clusters and Economic Policy in the United States

As in Latin America, the utilization of cluster concepts in economic policy making in the United States reflects local economic conditions as well as views of appropriate industrial policy. In the U.S., since there is no explicit domestic economic development strategy at the federal level, industry cluster strategies have chiefly been a concern of states, regions, and metropolitan areas. Four different trends can be detected in U.S. cluster practice, some of which are represented in the selected illustrative examples in Table 2.

First, economic development at the state level in the U.S. remains dominated by business recruitment strategies coupled with the provision of location incentives in the form of direct grants, tax credits, and loans. Many states have therefore used industry clusters primarily as a means of promotion and marketing, often of highly desired technology-oriented sectors such as information technology, electronics and biotech-

Table 2: United States: selected examples of cluster policy initiatives by state

State	Background	Intervention	Source
Arizona	Development of Arizona Strategic Plan for Economic Development in 1992, resulting in adoption of state cluster strategy. Renamed Governor's Strategic Partnership for Economic Development (GSPED); administered by Arizona Department of Commerce. Public-private partnerships represent each cluster.	Analysis. Strategic planning. Targeted marketing for recruitment, tax policy (incentives).	Waits (1992), Morfessis (1994), Vieh (2002)
Connecticut	In 1998, established Connecticut's Industry Cluster Initiative under the Department of Economic and Community Development. Also established Governor's Council on Economic Competitiveness and Technology to monitor cluster progress.	Strategic planning. Creation of lead organizations. Biotech facilities fund. Workforce training in metalworking.	CDECD (2001)
Iowa	Legislation in December 2000 creates the New Economy Council to develop strategic planning and mobilize public and private resources in three clusters: life sciences, advanced manufacturing, and information solutions.	Analysis. Strategic Planning. Marketing. Workforce development (planned). Telecommunications Infrastructure (planned). Establishment of Plant Sciences center at U. of Iowa.	Iowa Governor's Office
Kentucky	Office of the New Economy established five research area clusters as priorities for development.	Strategic planning. Coordinated effort to obtain federal research dollars. Grants and loans for high tech industries.	KIC (2002)
Massachusetts	Massachusetts Technology Collaborative, an independent organization (organized in present form in 1994), coordinates technology policy for the state. Industry cluster concepts used in ongoing economic analysis and strategic planning.	Strategic planning. Economic analysis (tracking of tech sector growth).	MTC (2001)
Mississippi	In 2000, private sector commissioned study of communications and information technology cluster by Michael Porter. Subsequently, state funded follow-up studies of automotive and plastics/polymers industries. Effort managed by Mississippi Development Authority.	Analysis. Strategic planning. Establishment of cluster organizations. Workforce development planning (in progress).	RTS (2001)

nology, but also of advanced manufacturing sectors that promise substantial wage increases. For example, in the U.S. south, Mississippi, Alabama, and South Carolina have invoked clusters as a rubric for identifying and recruiting vehicle industry suppliers. In many states, the term cluster is synonymous with "industry" and economic development practice is little different in any substantive way.

Second, as is the case in some Latin American countries, clusters are commonly used as an organizational and analytical device for implementing a model of collaborative strategic planning and public-private engagement. Arizona's cluster initiatives are the earliest example of this trend (Ffowcs-Williams, 2000). In the early 1990s, Arizona used basic descriptive techniques to identify nine clusters around which it set up advisory groups, working groups, and town meetings to develop growth strategies (Rosenfeld, 2001). Private sector "buy-in" is a major feature of the state's approach, in contrast to the usual top-down implementation model characteristic of most states' development efforts. At the same time, Arizona has tended to apply a standard set of policy interventions to the clusters, some of which lack a strong central logic. An example is the state's "senior living" cluster. The value for the state seems to be the way cluster concepts are used to motivate the coordinated effort of multiple public agencies and private sector stakeholders and not as a means to design unique policy interventions. The utilization of cluster concepts in California and North Carolina provide similar examples (Feser and Luger, 2003), while a recent survey of California economic development practitioners by that state's Trade and Commerce Agency found that the cluster concept is being used mainly as part of a broader effort toward comprehensive economic development planning, interagency collaboration, and public-private partnership building: "a systems change is underway in how people conceive of and perceive economic development. To stay competitive in this 'global' information economy, better economic information is needed. The fast pace of change and global competition make timely, accurate information critical. The industry cluster analytical process, regional outlook and regional collaboration are tools assisting in this knowledge gain process" (Kawahara, et al., 2000, p. 8).

Much of the power of clusters as a strategic planning device derives from the traction the concept has in the corporate sector. Thus economic policy makers are able to gain more legitimacy with business leaders when using the language and logic of clusters than with more conventional sector-based approaches and esoteric development theories. This legitimizing function of the cluster concept compares with the Latin American case where the concern is with convincing lenders and multinational financial organizations of the appropriateness of certain industrial policies that once might have been viewed as protectionist but now are keyed toward enhancing local competitiveness. Either way, governments are using cluster ideas extremely effectively to bridge the difficult divide between public and corporate imperatives.

Third, the most recent trend in the United States is the utilization of clusters for the implementation of workforce development strategies, an approach almost entirely absent in Latin America. Again, the chief motivator is not extant theories of clustering, but rather pressing public policy issues coupled with the general flexibility of the cluster concept. Welfare reform, the Workforce Investment Act of 1998 (WIA), and the recent recession (resulting in considerable worker displacements and associated

re-training needs) have forced state and local agencies to seek ways to better target training, both geographically and by sector. WIA requires states to streamline workforce development programs by better coordinating the delivery of different kinds of services (e.g. job search and training). In most cases, cluster analysis serves as an analytical tool for detecting the occupational and training requirements of projected growth industries (based on a labor pooling argument), though it may also provide a general framework for strategic planning as noted above. The application of clusters to workforce development issues also reflects an increase in the use of cluster concepts by non-traditional economic development organizations, such as universities and community colleges.

Finally, many states and larger regions are using applied cluster analysis to identify localized concentrations of technology-related industry and research activity, so-called innovation or technology clusters. Such efforts usually motivate the design of innovation policy, although examples of sizable investments in detected clusters are few and specific interventions are largely conventional. One of the reasons for that is that in many states, high tech activity remains modest (at least compared to major concentrations such as Silicon Valley, Austin, and Boston). Therefore, the findings of cluster analyses are often too ambiguous to justify ambitious cluster building efforts. Moreover, the competing interests of various sectors and constituencies in the U.S. (as in most other countries) almost always mean that development resources must be spread relatively thinly across sectors and regions. The result is that clusters again become more of a strategic planning device, helping to reveal strengths and weaknesses facing local businesses and potential interventions that could improve the general business climate, than a rigid guide or model of development.

It is important to realize that the U.S. case is not reflective of the entire advanced industrialized world. Indeed, this should be obvious since by now it should be clear that the institutional and policy context in which cluster initiatives are pursued is central to their design and implementation (Sølvell et al., 2003). In Europe, for example, the experience with clusters reflects the much stronger historical role of national governments in development policy than in the U.S., continuing realignment of national policies in the face of European integration, and the heavy influence of research on famous small firm clusters/districts in Europe itself. More centralized development policy – at least in smaller countries such as the Netherlands, Austria, Denmark, and Finland – has produced cluster initiatives that have been more sustained and of somewhat greater sophistication than in the U.S. Integration is forcing European governments to reorient conventional macro policy. Increasingly, the jurisdictional expansion of the EU and the influence of broader global economic forces are harmonizing the general factors that influence a nation's relative business climate (what are often called "framework conditions," such as inflation, regulation, and product standards). Both national and local/regional governments are therefore focusing on local factors that remain under their control, including research competencies and institutions, educational institutions, financing institutions (e.g. venture capital organizations), and general infrastructure (Dalsgaard, 2001). In some countries, clusters and cluster analysis (or "cluster mapping") has become a means of achieving that policy reorientation. The institutional landscape in which economic development is pursued in Europe remains

complex despite integration. Viesti (2002) provides a discussion of the complexity of coordinating local, regional, national and international (e.g. EU) development policies, particularly those aimed at promoting local externalities. Cluster concepts and related theories are seen as one useful source of guidance.

Unsurprisingly, the literature on industrial districts and flexible specialization has been more influential in Europe than elsewhere. In the 1990s, several European countries undertook substantial experiments in the use of business networking schemes as a mechanism for encouraging collaborative competition and learning economies among small firms (Helmsing, 2001, UNCTAD, 2002). That experience has subsequently influenced the programs of multinational organizations such as UNIDO and the World Bank, which now are active in many LDCs, including Latin America. Indeed, most networking schemes in Latin America were initially pushed by international agencies and not national or regional governments. The findings of subsequent evaluations of business networking initiatives in Europe have been disappointing, with the chief problem being that few firms opt to remain in formalized networks after initial public sector incentives are exhausted (Hallberg, 1999, Lagendijk, 1999, 2000).

3 Discussion

So what can be said in the way of general trends, as well as similarities and differences between the U.S. and Latin American cases? First, a scan of initiatives in both Latin America and the U.S. finds no dominant type of policy intervention that is being used to establish or expand technology-based industry clusters or substantially influence innovation policy, aside from targeting perceived technology strengths or potentials. From the perspective of many public officials, what appears to make a policy a "cluster policy" is not the economic behavior the initiative is trying to influence but rather the target of the intervention as a loosely identified set of related companies and institutions. From this perspective, deregulation and workforce training may be just as much "cluster policies" as establishing business networks or other schemes to boost interfirm cooperation. In Latin America, traditional sectors are easily the most common target of interest, while both high tech and traditional industries have received attention in the United States. There is also some bias toward focusing on SMEs in Latin America, and similarly in the U.S. at the sub-state level.

Second, public officials are using the cluster concept liberally to identify and motivate the participation of key "partners" in the policy process and to legitimate general public sector intervention in the development arena. In the U.S., a focus on clusters is being used to secure corporate support and assistance with policy design (and thus to facilitate a general move toward policy making via public-private partnerships). The modern notion of clusters has its genesis in strategic management theory (e.g. Porter, 1990), a body of concepts that many business people find much more understandable and compelling than academic theories of the firm or the development process. In Latin America, industrial policy as cluster policy finds sanction with key trading partners and lending agencies concerned with promoting a shift toward free markets. Given a world in which industrial policy carries the taint of the protectionist strategies of the past, it appears to be easier to make the case that cluster policy is about

competitiveness, even if the specific interventions retain a certain protectionist flavor.

Third, applied cluster analysis – the detection of the presence of clusters and/or the strengths, weaknesses, and opportunities facing clustered enterprises – probably accounts for most of the current policy effort associated with cluster concepts. In most instances, governments in the U.S. and Latin America are not following up cluster analyses with major cluster building or expansion initiatives reflected in distinct policy changes. Rather, they are using the analyses to identify various problems facing current local or future businesses that could be addressed by interventions of relatively limited scope. The findings of cluster analyses are also occasionally being used to motivate support for general shifts in strategy, such as improvements in education or the provision of advanced infrastructure, that are increasingly viewed as key preconditions for the competitive success of industry in general (not just clusters). At the same time, in other cases the pursuit of clusters may be distracting policy attention from more basic needs. The latter is a particular concern in Latin America, where technology-oriented concepts like clusters can prove much more glamorous to pursue than very necessary basic infrastructure anti-poverty programs (Melo, 2001b).

Finally, despite a major policy implication of Porter's concept of clusters that higher rates of innovation and growth can be achieved by actively nurturing localized concentrations of linked businesses in selected promising industries rather than seeking a more diversified sectoral and spatial distribution of economic activity, it is surprisingly hard to find examples of governments in either Latin America or the U.S. (whether state, regional or municipal) making substantial investments in specific clusters to the exclusion of other local businesses and industries. It is the tendency of economic activity in general – and innovative and knowledge- intensive activity in particular – to concentrate functionally and geographically that suggests to so many that an effective S&T strategy might be to target specific groups of related high tech sectors in specific regions for development attention. The goal is to replicate elements of successful innovation clusters from around the world. It is as a result of that interest that various typologies of clusters and associated guides for how to expand them have been developed. The implication is a model of policy design, implementation, and evaluation that looks like the following: 1) identify or "map" groups of sectors that qualify, by some definition, as clusters; 2) assess strengths and weaknesses (or impediments to growth) in said clusters; 3) prescribe and implement policies to rectify weaknesses, maximize strengths, and spur growth; and 4) evaluate policies for overall impact on cluster expansion and performance. Usually left unsaid is that some sectors lose while others win, but the implication is clear.

Porter's descriptive theory of the determinants of competitiveness came to be interpreted as a narrow model of how to build localized clusters in specific regions. In fact, a careful reading shows that Porter set up a number of intriguing hypotheses that stand apart from the question of geography: namely, the links between sectoral economic growth, on the one hand, and sophisticated home demand, rivalrous yet cooperative competition, and the presence of related and supporting industries, on the other. Porter suggested that many of the industries characterized by such features tend to be localized in specific regions. He did not offer a systematic explanation of causes of localization, grounded in any theory of industry location or externalities, but essen-

tially an empirical observation of a tendency toward spatial co-location of competitive firms. This point is important because merely the observation was sufficient to set in motion a conviction among many analysts that building regional clusters – as opposed to raising productivity, boosting innovation, redressing market failures, or other more conventional objectives – is an appropriate goal of development policy. Indeed, in the cluster building view, innovation, productivity, and growth are an assumed indirect outcome of the expansion of the cluster.

Whether targeted development of identified clusters at the expense of a largely sector- neutral approach is a good idea is an empirical question that has received comparatively little attention in the cluster literature to date. It is also a strategy that has distinct distributional consequences that have to be evaluated as much on ethical as efficiency grounds. But, in any case, a review of the Latin American and U.S. cases suggests that few governments are actively buying into the specialization strategy, at least at present. This may be function of limited resources, lingering concerns about the risk of over-specialization, or, most likely, political realities that lead to the diffusion of development resources even where targeting makes sense. Or, perhaps policy makers have learned that the language and theory of cluster building is more compelling than the actual practice.

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