Clusters and the Design of Innovation Policy for Developing Economies

Edward Feser
University of Illinois at Urbana-Champaign

Abstract

This paper argues there are two broad ways policymakers might use industry cluster concepts to inform the design of regional innovation policy. The first, and clearly dominant approach, is to view identified technology-based clusters as targets for growth strategies, i.e., to nurture the growth of selected groups of innovative industries and research strengths in a limited set of regions as a means of increasing levels of innovation economy-wide (termed the cluster building approach). The second is to use cluster ideas to reorient development strategies so that they leverage synergies among businesses and non-market institutions, thus improving innovation rates (termed the synergy leveraging approach). The second perspective de-emphasizes clusters as entities and focuses attention on clustering as a dynamic process. Therefore it is more useful for policymaking in developing and transitioning economies where existing regional innovation clusters are small to non-existent. It also holds lessons for heavily industrialized economies, as the pursuit of clusters often confuses means and ends in development policy making.

Contact:
Edward Feser, Department of Urban and Regional Planning & Regional Economics Applications Laboratory, 111 Temple Buell Hall, MC-619, 611 Taft Drive, Champaign, IL, 61829, USA, feser@uiuc.edu.
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I Introduction

The design and implementation of innovation policy is major concern in both developed and developing countries. In Europe and the United States, exploitation of the innovation capabilities embedded in human capital and advanced infrastructure are viewed as an essential source of global competitive advantage as standardized, labor intensive activities migrate to least cost locations in Asia, Latin America, and Africa. Addressing the needs of industry clusters are viewed in many quarters as a necessary element of innovation strategies:

‘Clusters of Innovation’, the title of a project on regional clusters in the United States, has become a particularly popular term among private and public sector leaders. This reflects increasing pressure many U.S. and European companies and locations face to compete on innovation rather than productivity alone. Clusters turn out to provide particularly fertile ground for innovations because they are well aligned with modern innovation processes (Ketels 2004, p. 1).

Europe and the U.S. are not alone. Many developing economies, motivated by clear instances of technology-oriented development success in India, China, Brazil and elsewhere, are also beginning to use cluster concepts to both motivate and inform innovation policy making (Melo 2001a, 2001b; Mani and Romijn 2003; Feser 2005). This reflects a rejection of implicit stages views of development that assign to less developed countries the role of satellite production centers to knowledge-based, highly industrialized economies. The literature identifying technology-based clusters in developing economies is growing rapidly, along with policy applications designed to foster cluster growth (Quandt 1997; Voyer 1997a, 1997b; Altenburg and Meyer-Stamer 1999; Quandt 1999; Bortagaray and Tiffin 2000). In the midst of all this activity,
however, there remains considerable uncertainty about what cluster oriented innovation strategies involve, what kinds interventions are likely to be most effective, and how such policies should be evaluated (Benneworth, Danson et al. 2003; Boekholt and McKibbin 2003).

There is certainly substantial writing on innovation and technology policy, most of which pre-dates the modern fascination with clusters. The innovation policy literature is chiefly concerned with evaluating a wide range of interventions designed to boost basic and applied innovation and ultimately growth in incomes. The influence of regulation, standards setting, infrastructure investments, research subsidies, risk financing, technology transfer, and public sector procurement on the rate of business innovation have all been subject to considerable research (Justman and Teubal 1986; Markusen 1993; Simons 1993; Malecki 1997; Shapira, Klein et al. 2001). More recently, innovation policy discussions, particularly the concept of National Innovation Systems (NIS), have come to be dominated by perspectives in neo-Schumpeterian evolutionary economics. NIS emphasizes the non-linear process of innovation, including feedback effects between stages of innovation and various innovation actors, as well as between the public policies and noncommercial institutions that constitute the framework in which innovation and learning occur. The Regional Innovation Systems (RIS) concept, or “reduced-NIS” as described by Hertog, Bergman et al. (2001), asserts that a decentralized regional approach to innovation policy is likely to be more effective than a centralized national model (Asheim and Isaksen 1997; Cooke, Uranga et al. 1997; Cooke and Morgan 1998; Moulaert and Sekia 1999; Morgan 2004). It is fair enough to ask what unique policy insights the concepts of industry clusters and clustering bring to this already rich innovation debate.

This paper argues that there are chiefly two. The first is that businesses in regional clusters are likely to innovate more, and therefore enjoy higher levels of productivity and
sustained growth, than firms in peripheral locations. At the core of most cluster theories is the thesis that businesses compete not as isolated units but rather within complex webs of interdependence that include both market and non-market institutions, and that there are certain advantages when those interdependencies are localized. It is fairly widely accepted that clusters are groups of interdependent firms and related institutions (such as universities, labs, and industry associations) and that regional clusters are geographic concentrations of such groups (Boekholt and Thuriaux 1997; Rosenfeld 2002). Porter (2002) has argued quite explicitly that regional clusters are the principal engines of innovation in an economy. This implies that governments should actively concentrate public science and technology investments, as well as other innovation programs, both by sector and location where possible, a regional innovation cluster building view. Note that I include under the rubric “building” what some authors describe as “activating.” For example, Ketels (2004) argues that lacking sound analyses of cluster composition and characteristics, policy officials will be tempted to “create” clusters where they do not exist:

Cluster development, however, should not aim to create clusters, but to activate them.

Activating an existing base of companies and institutions to jointly upgrade their cluster is much more effective than investing huge sums in the risky business of creating clusters from scratch (p. 4).

Whether one describes this perspective as cluster building or activating is irrelevant for my purposes. The key feature is the conceptual linkage between clusters as entities and macroeconomic outcomes such as innovation, productivity and growth. The Council on Competitiveness in the United States perhaps characterizes this connection most clearly when it links national economic performance to regional cluster formation and growth: “Future U.S.
competitiveness will hinge not just on policies and investments at the national level, but on the capacity to foster clusters of innovation in regions across the country.1

The second fundamental implication of clusters is that an understanding of business interdependence should be embedded into the design and implementation of innovation programs, as well as most other kinds of economic development interventions, to improve their impact and success. This more nuanced perspective is what I call a synergy leveraging view, where the target outcome is not any particular cluster’s expansion and competitive performance, but rather the greater efficacy of programs or policies which are themselves motivated by clearly identified sources of market failure and, therefore, theoretically sound connections to regional macroeconomic welfare. Re-designing policies to leverage clustering synergies removes cluster policy from the realm of traditional industrial policy—i.e., the use of public resources to promote selected industrial strengths—while still taking advantage of the most persuasive insights in the microeconomic theories of Porter and his adherents. It also emphasizes that clusters are less informative about what we should do in regional economic development than how we should do it, a view expressed already by several scholars in one fashion or another but one which is invariably lost in the face of the seemingly powerful intuitive logic of cluster building (Nauwelaers 2001; Raines 2001; Benneworth, Danson et al. 2003).

Note that both the cluster building and synergy leveraging perspectives are essentially hypotheses that deserve serious empirical investigation. While they need not be mutually exclusive, they may occasionally contradict one another, such as when efforts to boost inter-firm synergies and collective learning can be best achieved by strengthening linkages with distant partners rather than regionally-based firms. Such contradictions are likely to be more common in developing and transitioning economies than highly developed ones.
While both approaches could be used in tandem, this paper argues that attempts to build discrete regional technology clusters as a means to promote innovation economy-wide are likely to meet with very limited success in most developing and transitioning economy contexts. The fact that some industries and/or innovations cluster—either in abstract space as described by DeBresson (1989) or in geographic space as in Porter (1990)—is not a sufficient guide for policy, the vast descriptive literature notwithstanding. The case for exploiting interdependencies to improve the effectiveness of innovation programs and policies is much stronger conceptually, and regional technology-based clusters may very well emerge naturally as a result. It follows that policy makers in less developed countries and the eastern European transition economies should not view clusters as offering a distinct model of technology-based economic development, but rather as providing a set of useful insights and analytical frameworks for improving the design and implementation of a wide variety of innovation strategies. The distinction is not a trivial one, especially for less favored regions where existing innovation clusters are nonexistent or very shallow and the potential for wasting scarce resources is great.

II Building Clusters versus Leveraging Cluster Synergies

The cluster building view holds that an important route to raising rates of innovation is to nurture the expansion of discrete spatial agglomerations of technology-related activity, including formally and informally linked businesses, university research competencies, government laboratories, colleges and technology training institutes, and private sector contract R&D houses. This is accomplished with the application of broad portfolio of policy interventions, some of which aim to build the science base, some of which enhance the general framework conditions in which firms operate, and some of which seek to expand the technology sector directly via
recruitment or entrepreneurship programs. Examples of such interventions are listed in Table 1, which was derived from several well-cited papers offering practical guidance to policy makers. The process usually involves conducting an analysis to identify strengths and weaknesses among a set of related businesses (industry cluster analysis), together with an assessment of the regional science and technology base, the results from which drive the selection of focus clusters and the prescription strategies for cluster growth.

The perspective differs from the synergy leveraging view in that its explicit aim is to develop a discrete technology-based specialization that can capture increasing returns to scale and foster collective learning and innovation. Conversely, the perspective implicitly asserts that a broad-based S&T strategy (e.g., one that is largely sector-, technology-, or location-neutral) will generate less net innovation overall than one that is focused on building specific, localized S&T competencies. Its most persuasive theoretical logic derives from theories of spatial externalities and knowledge spillovers, the basic principles of which are documented extensively elsewhere and need not be recounted here. However, it is Michael Porter’s *Competitive Advantage of Nations* (1990), subsequent writings (Porter 1998, 2000; Porter 2002), and prolific international consulting practice that have by far exerted the greatest influence on the application of clusters to development policy. Therefore, understanding how cluster concepts are being used in policy making requires careful consideration of Porter’s ideas and how they have been absorbed and applied.

There are two ways that Porter’s work might be interpreted: first, as a treatise on clusters as geographically localized concentrations of industrial activity; and, second, as an explanation of *clustering* (Clancy, O'Malley et al. 2001). Although Porter’s most useful contributions in the *Competitive Advantage of Nations* relate to hypotheses about business interdependence (or
clustering irrespective of geography), particularly the roles of cooperative competition and non-market institutions (Cooke, Uranga et al. 1997), his empirical approach has encouraged an heavy focus on localized clusters as geographic phenomena. With regard to innovation, Porter is explicit that regional clusters—not just clustering dynamics—are the key: “Strong and competitive clusters are a critical component of a good business environment and are the driving force behind regional innovation and rising productivity” (Porter 2002, p. 9, emphasis added). A result is that devising recipes for building clusters according to ideal-types—the process of singling out for special policy attention those localized groups of industries in a country or region that appear to conform to pre-set criteria—has become a multi-million dollar consulting business.

_The Competitive Advantage of Nations_ (Porter 1990) seeks to explain, _ex post_, the source of competitiveness of leading export-oriented industries in selected industrialized countries. Failed industries are not part of the study. The methodology used therefore includes no serious evaluation of competing hypotheses. But more fundamentally, the inductively derived diamond model of competitiveness, perhaps the most well-known and applied concept in the book, is static. What works for globally competitive, export-oriented industries today—or in the late 1980s, as the case may be—may not be what accounted for their initial rise. That the present sources of competitiveness of Silicon Valley’s information technology industry conform to the diamond framework does not constitute sufficient evidence of the adequacy of the model as an explanation of how Silicon Valley got to be the way it is. Yet clearly for many policy makers, the most compelling message in the _Competitive Advantage of Nations_ is that one can use the diamond, or some other similar descriptive model, to devise ways to replicate the current conditions of globally competitive industrial complexes in advanced economies.
Unfortunately, the Porter diamond offers few realistic policy handles for less developed nations and lagging regions in developed ones. How exactly does a government build sophisticated home demand or a culture of competition that exemplifies just the right balance of rivalry and cooperation in a place with limited economic activity to begin with? Porter (1990, pp. 675-76) does offer some guidance for developing nations: “To progress, the developing nation faces the daunting task of upgrading all four parts of the national ‘diamond’ sufficiently to reach the threshold necessary to compete in advanced countries.” He suggests the first step is to improve education, information, technology, and modern infrastructure. But he remains confident that clusters are central: “As a starting point, a nation must identify those industries where its factor advantages today provide some competitive advantage but where other determinants of national advantage are also actually, or potentially, present” (p. 677, emphasis in original).

At issue here is not the messenger but the method. The new industrial districts and related literature on flexible specialization also spawned a considerable amount of reasoning and policy prescription by ideal-type (e.g., the ideal Italianate district), probably not the intention of Piore and Sabel (1984) and other early contributors such as Brusco (1982) and Bellandi (1989; see also Goglio 2002). Arguments about what is and is not truly a cluster, as well as the proliferation of typologies of clusters and industrial districts (e.g. Courlet and Pecqueur 1991; Markusen 1996; Rosenfeld 1997; Capello 1999; McCormick 1999; Enright 2000), reflect efforts by subsequent researchers to acknowledge the variety of territorial production systems that operate quite competitively. Note that the fundamental thesis that business interdependence is an important element of competitiveness is not disputed by these typologies. Rather, the concern is
the form—both functional and spatial—that that interdependence takes at a given point in an industry’s life cycle and a region’s development trajectory.

Unresolved even as differing types of “Porterian” and “Italianate” clusters are identified and documented are absolutely fundamental questions related to direction of causality, the relative significance of various competitiveness factors in different development contexts, and the feasibility of alternative policy interventions. Reliance on ideal-types limits serious consideration of such issues and as a result may generate lessons that are not grounded in a careful analysis of the history of leading clusters, even if that is the basic intention. For instance, UNIDO’s Cluster Development Program aims to draw lessons “from the experience of successful clusters and [implement] them through technical cooperation projects in various developing countries” (Russo, Clara et al. 2000, p. 2). One specific objective is to help cluster actors “develop a consensus-based vision of the cluster as a whole” (p. 6). Yet we have no evidence whatsoever that such a consensus was instrumental in establishing the most successful technology clusters in the world today. Consider Intel co-founder Gordon Moore’s view of the semiconductors business in Silicon Valley in the late 1950s:

> What ‘works’ right now in this dynamic, regional, high-technology economy tells us little of how precisely Silicon Valley came to be just such a place, or how any such place comes into being. The potential disaster lies in the fact that these static, descriptive efforts culminate in policy recommendations that resemble recipes or magic potions (Moore and Davis 2001, p. 3).

One might argue that working to establish a collective vision among firms and related institutions in a set of industries cannot hurt, *ceterus paribus*. But in the world of development policy, *ceterus paribus* never applies. Every intervention exacts an opportunity cost in human, financial, and political capital. Porter’s model does not constitute an explanation of causes of localization, grounded in any theory of industry location or externalities. It is at heart an
empirical observation of a tendency toward spatial co-location of competitive, exporting firms. This observation has proven highly convincing to policy makers and many analysts, so that building regional clusters—as opposed to raising productivity, boosting innovation, redressing market failures, or other objectives directly related to regional welfare—has become a common goal of development policy. Regional welfare improvements are viewed as a natural outcome of cluster building efforts.

A synergy leveraging view of clusters, in contrast, holds that innovation policies should aim to nurture and exploit innovative synergies between interdependent firms and institutions, regardless of whether a discrete spatial cluster emerges as a result. The difference in perspectives therefore hinges largely on the nature of the policy objective: in the building view, it is the cluster itself; in the leveraging view, it is the synergies that presumably drive clustering. Existing theory and empirical research on clusters emphasizes that businesses operate not in isolation, as postulated by the standard neoclassical model of competition, but rather as part of larger formal and informal networks (Best 1990). Those networks jointly constrain and offer opportunities to enhance businesses’ competitive positions. They also influence processes of joint learning and innovation. The process of clustering, whether viewed from the perspective of strategic management (Porter), industrial districts (Marshall), new growth theory, or NIS/RIS, suggests industrial policy can be made more effective by exploiting networking dynamics. With regard to technology policy, this implies that cluster linkages—whether they are regional, national, or global in scope—are the conduits through which innovative impulses flow.

As an example of what is meant by leveraging synergies, consider a typical innovation strategy: attempts by government to increase the rate of advanced technology adoption among small firms. One possible mechanism for increasing adoption rates is the provision of publicly
subsidized industrial extension programs targeted toward small and medium sized enterprises in specific sectors and regions identified as existing or potential clusters (Shapira 2001). Alternatively, a synergy leveraging approach to industrial extension might attempt to exploit pressures within extended buyer-supplier chains, which most likely span a wide range of sectors and locations, to maximize limited extension program resources. Technology surveys indicate that among the most important influences on firm adoption behavior are the production systems of end-market customers that require close integration with supplier systems (Bergman and Feser 2001). Thus, industrial extension programs might begin by encouraging or aiding the adoption of best-practice technologies among major buyers within extended supply chains, many of which will be large firms, coupled with assistance to local SME suppliers as pressures for upgrading begin to build. Ultimately, the issue is the means by which the same basic strategy—industrial extension—is implemented.

Tendler and Amorim (1996) describe a similar approach with respect to government procurement in Brazil, where a key feature of the program was not just the injection of demand via public spending in specific regions, but also the establishment of appropriate incentives for the local business support agency to provide the right kinds of assistance to local producers; that is, the way that demand was injected. One result was a competitive regional furniture cluster comprised mostly of small and medium sized enterprises (SMEs). More important was the job creation in a less favored region that the carefully designed procurement strategy produced. In the case of synergy leveraging, the focus shifts from the cluster itself to the effective design of institutions and strategies of policy implementation given a model of economy-wide interdependent competition.
A third useful example is the provision of business development services (BDS) for SMEs in peripheral European regions, as described by Lagendijk (2000). BDS programs have had a history of limited effectiveness. Support agencies often have difficulty attracting clients, probably because they have been too focused on technical rather than organizational and managerial deficits facing client companies. Whatever the reason, BDS programs often suffer from a mismatch between the kinds of services supplied and the kinds in greatest demand. Lagendijk argues that the problem can be corrected by understanding how businesses operate in relational or associational economy. Clusters are an important mechanism for interactive learning among and between businesses, public agencies, and other key regional institutions: “To improve the way business support can contribute to regional development, policies need to adopt new perspectives that are especially geared to improving relational assets in the region” (Lagendijk 2000, p. 173). Instead of technical problem solving:

linear and unfocused forms of business support need to be complemented, if not replaced, by more interactive forms of support framed within a strategic context. Interaction here refers to the role of brokering. . .it may also included focused ‘intelligence gathering’ that provides firms with new strategic insights and improves the articulation of business needs. These processes can be focused, framed and facilitated. . .by adopting a cluster perspective (Lagendijk 2000, p. 189).

The key here is that the focus is on using a theoretical and empirical understanding of business clustering to better implement BDS programs and policies. This is consistent with Nauwelaers’ (2001) thesis that cluster strategy does not entail new development instruments but rather a new “mode of intervention of the public actor” (p. 100). Development organizations may reorient strategies away from a top-down model focused on provision of basic inputs and infrastructure to a more facilitative role where the goal is to involve private sector actors in the formation of regional policy. With
respect to evaluation and impact, the target outcome is not growth of a cluster, but rather 
a better fit between the needs of SMEs and the kinds of programs offered by BDS support 
agencies. The value of the cluster concept is then evidenced by whether programs are 
more efficacious when informed by cluster ideas, not whether a specific cluster emerges 
or grows in a given region.

III Available Evidence

These two perspectives—building clusters versus leveraging synergies—are not necessarily 
mutually exclusive, though they may occasionally contradict one another in certain respects. It is 
possible to imagine both approaches informing innovation policy in significant ways. However, 
there may be empirical and conceptual arguments that suggest that one approach or the other is 
likely to be more efficacious in the long run from the point of view of effective knowledge-based 
economic development, particularly in developing or transitioning economies where deep, 
localized clusters of technology-oriented firms are rare. This section considers the question of 
empirical work, focusing on research relevant to the innovation question.

First, there have been a number of attempts to explain the causes of localized clustering 
itself (Dumais, Ellison et al. 1997; Ellison and Glaeser 1997; Sweeney and Feser 1998; Feser and 
Sweeney 2000; Sweeney and Nagle 2004). If knowledge spillovers explain why enterprises seek 
proximate locations, that would lend some support to the cluster building view as well as verify 
an important consequence of firm interdependence. The challenge for any empirical work on co-
location, however, is that most economic activity is localized given the generally concentrated 
pattern of human settlement. Spillovers are only one reason that businesses might cluster. 
Others include access to markets, labor, infrastructure, suppliers, natural resources, historical
lock-in, and even chance. In developing countries, businesses often concentrate near administrative centers because the public sector accounts for a high share of demand and because government bureaucracies often heavily influence the mix and distribution of business opportunities (Lall, Shalizi et al. 2001). Existing studies are hampered by very weak measures of spillovers (e.g., patents), a dearth of appropriate methodologies for controlling for competing location factors, and a lack of suitable time series for addressing questions of causality. It is fair to say that the empirical study of the co-location of innovative businesses is still fairly rudimentary.

Second, there is a body of work that finds some evidence that innovations, as opposed to firms, tend to cluster geographically and that knowledge spillovers are often localized (Jaffe 1986; Griliches 1992; Jaffe, Trajtenberg et al. 1993; Feldman 1994; Adams and Jaffe 1996; Breschi 1999; Feldman 1999; Lall, Shalizi et al. 2001; Wallsten 2001; Koo 2002). While findings vary, collectively the research offers modest evidence of the spatial clustering of innovations, at least as measured mainly by patents and patent citations. We might therefore draw the tentative conclusion that an active strategy of developing high tech specializations in particular regions would yield higher rates of innovation. However, we cannot be sure because few of the studies consider whether the specific mix of S&T resources, industrial activity, and other basic factors such as infrastructure and basic education are critical to the result. It is also important to note that all of the research on knowledge spillovers is confined to the developed country context and much of it considers innovation trends in a fairly narrow group of sectors. A related literature finds that rates of innovation and productivity tend to be higher among businesses that are proximate to research universities (Jaffe 1989; Acs, Audretsch et al. 1992, 1994; Anselin, Varga et al. 1997; Anselin, Varga et al. 2000). Aside from firms, the role of
universities in technology clusters has received the most attention. But again, analysis of the developing country context is limited.

Third, there is a small but expanding literature that examines the relationship between clusters and economic performance using quasi-experimental rather than case study methods. For example, Baptista and Swann (1998) use a database of innovations in the UK to examine whether companies proximate to other enterprises tend to innovate at higher rates. They find evidence that those in the same lines of business do: “Using regional employment as a measure of a cluster’s strength, it was found that a firm is more likely to innovate if located in a region where the presence of firms in its own industry is strong. The effects of the proximity of firms in other industries do not appear to be significant. . .” (Baptista and Swann 1998, p. 538). In related work, Bapista (2001) finds that technology adoption rates are higher in clusters, mainly because proximity helps to reduce the uncertainty of technology upgrading and increases information about the availability and utility of new technologies, a conventional diffusion effect. Porter (2002) conducted a six-city analysis in the U.S. that claims to demonstrate, among other things, that clusters of technology-related activity generate higher rates of innovation, entrepreneurship, and growth. However, since the study considered only successful technology agglomerations, it cannot speak to the relative advantages of clustered versus unclustered industrial development.

Finally, there is an enormous case study literature, the review of which could easily consume another paper or two. The richest of such studies investigate clustering dynamics using industrial districts and flexible specialization concepts. In a recent review of the literature pertaining to Latin America, Altenburg and Meyer-Stamer (1999) drew the following conclusions: 1) while clustering is widespread in Latin America, clusters in the region are rarely propelled by competitive small and medium sized firms (SMEs), as is common in Europe; 2)
addressing the weakness of SMEs must therefore be a major focus of LAC cluster strategies, particularly the establishment of connections between transnational corporations and small firms; 3) because most clusters in Latin America are centered on the production of standardized commodities, innovation policy will have the most success by encouraging the diffusion of technologies from TNCs to local firms, rather than attempting to grow an indigenous R&D presence; 4) because there is a decided lack of cooperation among firms in LAC clusters, the promotion of networking via the use of brokers and other incentives is critical to encouraging interfirm synergies.

Some of these conclusions echo the findings of Schmitz and Musyck (1994), who review the general industrial district literature in Europe to derive lessons for developing countries. They argue that the European experience shows the value of an industrial policy that is decentralized to the local and regional level and is implemented by both governmental and non-governmental units. They also conclude that the “emergence of the industrial districts does not result from consciously pursued local or regional industrial strategy” (p. 904). Indeed, in the cases they reviewed, they found that growth first occurred spontaneously and then was enhanced by local institutional support structures (including development policy). An important trend in the industrial districts literature is a shift from a focus on purely local connections between businesses to a more sophisticated consideration of interfirm innovation dynamics within global commodity chains (Humphrey and Schimitz 2000; Schmitz 2000). The shift is motivated by recognition that full-scale clusters of the Italianate or Porterian variety are rarely found in developing countries and that external linkages are often more important to the competitiveness of developing country firms than internal ones.
One particular piece of case study work warrants special mention. Swann, Prevezer et al. (1998) attempt to identify the specific conditions—in terms of size, diversity, linkages between agents, and so forth—under which biotechnology and information technology clusters begin to attract new entrants and generate increasing returns and spillovers. They also focus on clustering over time, finding that the “forces that influence the growth and entry of firms in clusters are not simply related to the stage of each technology: they depend also on the stage of the cluster in its own life cycle” (p. 2). Clusters eventually become “congested” and cease growing. They may even fail to regenerate themselves as their underlying technology strengths wane. This theme of cluster sustainability has received little attention in the literature (though see Bergman 2002 and Pouder and St. John 1996), largely because so many definitions of clusters are normative in character (e.g., “a cluster is a concentrated agglomeration of highly competitive firms”). In the view of Swann, Prevezer et al. (1998, p. 306), policy makers should “consider the creation of powerful and visible magnets for industrial location.” They find that universities and laboratories are among the most important institutions driving the success of innovation clusters. Thus government should promote “promising points of intersection” between technology industries and university research competencies as a way to boost innovation rates. Swann (1999) finds that clusters are competitive only when they have a high level of internal sectoral diversity, a serious implication for the more narrow and underdeveloped innovation clusters in less favored regions.

Given this diverse empirical literature, what can be said about the relative value of clusters as an innovation policy focus, whether from the point of view of building clusters or leveraging innovative synergies? Clearly S&T agglomerations are common in highly industrialized countries, there is mounting evidence that knowledge spillovers tend to be
localized and are therefore a source of regional scale economies, and a deep case study literature argues that there are significant innovation effects derived from formal and informal networking among local firms and support agents (labs, universities, government agencies, business development services). The literature on the relationship between presence in a cluster and economic performance is relatively weak, but based on what we know now, developing and transition economy governments should clearly consider the role of clusters and clustering in the design of innovation policy. But what is the right approach: to aggressively attempt to build specific regional innovation clusters or to adopt the more conservative strategy of using clusters as a way to redesign conventional innovation policy? Or, put differently, is aiming to build innovation clusters among specific businesses in selected locations as a strategic policy objective the best way to harness the benefits of clustering? There are several reasons to suggest that it may not be, especially in less favored regions.

First, it is widely accepted in the literature that the public sector’s capacity to build innovation clusters from scratch (or even “catalyze” them, to employ a common euphemism) is severely limited, even in highly industrialized economies. Obviously the problem is of particular significance in the developing country context, where innovation activity is often modest to nonexistent. Ironically, it is not uncommon in the literature to find detailed recipes for cluster promotion juxtaposed with cautious pronouncements that innovation clusters cannot be created from nothing and that policy accounts for only a small part of most competitive clusters’ success. Making “policy flexibility” an ingredient in the recipe is the usual tack for finessing the contradiction. But the real problem is in making the notion of a spatial cluster—rather than innovation, income, growth or other direct economic outcome—the relevant objective.
Second, researchers have shown convincingly that there is no single model of a competitive localized cluster. This implies not that more typologies of innovation clusters with attendant guides for growth need to be developed, but rather that the objective of strategically growing a full-scale regional cluster with a host of coordinated interventions is probably too broad to be useful in any practical sense. Clusters are groups of businesses and related support institutions such as universities, colleges, government laboratories, and development agencies linked in various ways and at various levels of geography: local, regional, national, international, global, or combinations thereof. The linkage, which may be formal or informal (traded or untraded), might derive from buyer-supplier ties, shared labor pools, codified transfer of knowledge or technologies, tacit transfer of knowledge, shared social and cultural norms, and the like. Theoretically, there are a great many dimensions on which businesses might be related, and each dimension may manifest itself at different spatial scales, such as labor pools at the regional level, shared knowledge at the global level, etc. A single firm may be a member of one cluster defined as an industrial district and another cluster defined as a global trading network or value chain. Focusing policy on only the local or regional dimension of business linkages necessarily leaves out key dimensions of interdependence that have real implications for innovation and competitiveness.

Third, cluster building is full of political risks. It may overstate the public sector’s capacity to develop coordinated, multifaceted development strategies, given the size of the challenge in developing countries as well as political and ethical pressures to diffuse resources across sectors, institutions, and regions. Publicly laying out a goal to nurture a regional biotechnology, information technology, automotive or other cluster is also a highly visible act that will be judged, several years hence, at its face value: that is, did the professed innovation
cluster materialize? There is an appreciable risk of unmet expectations that have real costs in terms of garnering political, financial, and leadership capital for subsequent development initiatives. Few would dispute that the size of the risk is inversely related to the existing size of the S&T base at the start of the intervention.

Fourth, cluster building often focuses attention away from basic needs and toward interventions that promise immediate impacts on the size and scope of the innovation cluster itself. Those include investments in research competencies in the universities, the development and placement of government laboratories, the supply of venture capital financing, the provision of R&D and other incentives to existing firms, and the recruitment of high technology enterprises. Such strategies may make sense in developed economies where the advanced infrastructure and institutional capacity are already in place. However, in developing economies many basic needs remain to be fulfilled, including the provision of good roads, airports, public transportation, schools, basic telecommunications, and accountable and efficient government. Most such needs benefit multiple sectors, not just those in target clusters.

Finally, highly specialized cluster building initiatives could unintentionally help lock a region into an industrial specialization or innovation competency that will eventually face decline. As Poudre and St. John (1996) note, “Once a super nova for state-of-the-art innovation, the hot spot quickly becomes an industry black hole.” Analysts typically caution against “picking winners,” but that concern usually references the possibility of inadvertently targeting a low growth or declining sector. The more significant but less appreciated problem is a kind of policy lock-in effect; that as active cluster building efforts reorient economic policy from the basic approach of providing and maintaining a level playing field to one of tailoring institutional structures to particular industrial specializations, the public sector’s ability to adapt to changing
economic circumstances declines. The very process of carrying out the objectives of funding
selected research competencies rather than meritorious research in general, encouraging
specialized venture capital sources, building dedicated rather than general incubators, developing
targeted business incentives, and so on specializes public sector government and administrative
competencies just as it aims to specialize the industrial base. An economic policy regime with a
narrow set of competencies is less nimble when economic and technological conditions change,
as they inevitably do.

Given these problems, the more conservative approach of viewing cluster concepts as a
tool for leveraging innovative synergies among businesses to improve the implementation of
innovation policy has distinct advantages. First and foremost, the leveraging view shifts
attention away from generalized cluster building, an impractical strategy where the existing S&T
base is modest. Second, it is more agnostic with respect to the level of geography in which
business linkages manifest themselves. Rather, it allows that key formal and informal linkages
occur at all spatial scales and between different kinds firms (large and small, branch
manufacturers and headquarters, buyers and suppliers, etc.). The goal is to look for ways to
strengthen and use those linkages to increase innovation and growth rates. Third, it can help
inform a wide range of interventions which themselves can be legitimated using conventional
and theoretically sound policy analytic tools such as concepts of public goods and market failure.
Fourth, it places emphasis on the most important insights of the cluster literature—the notions of
cooperative competition and collective efficiency—without biasing policy away from strategies
that are not aimed at immediate growth and expansion of a selected group of industries. Fifth, it
reduces the burden on applied cluster analysis, which due to a variety of data and methodological
limitations, can realistically offer only a general impression of overlapping science, technology,
and industry strengths in most regions (Feser and Luger 2002). Finally, it probably most closely matches current policy practice in most places, where clusters are being used to inform existing policies rather than as separately conceived development strategies implemented with substantial targeted investments.

IV Summary and Guides

The tendency of economic activity in general, and innovative and knowledge-intensive activity in particular, to concentrate functionally and geographically suggests to policy makers that an effective S&T strategy might be to target groups of related high technology sectors in specific regions for development attention. The goal is to replicate elements of successful innovation clusters from around the world. As a result of that interest, 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 involves identifying or “mapping” groups of sectors that qualify as clusters by some definition (whether Porterian, Italianate, etc.); assesses strengths, weaknesses, or impediments to growth in said clusters; prescribes and implements policies to rectify weaknesses, maximize strengths, and spur growth in the clusters; and evaluates policies for overall impact on subsequent cluster expansion and performance (Ketels 2004). The view has led naturally to the question: what policies are most effective for generating and sustaining innovation clusters as engines of regional growth?

This paper argues that policymakers in developing and transitioning economies would be better off viewing cluster concepts and cluster analysis as offering insights on how to improve the design and implementation of conventional innovation policies. This shifts the policy objective from building clusters per se to increasing rates of innovation by implementing
development strategies in ways that leverage interfirm synergies and connections to nonmarket institutions, even when firms are not part of concentrated regional agglomerations. It also shifts the perspective of policy evaluation from cluster expansion as an outcome to innovation as an outcome. The following are a series of specific policy guides that follow from this view.

National, regional, and local development agencies in developing and transitioning economies should still include applied cluster analysis in their suite of analytical tools. To acknowledge the limited prospects of a government-led “cluster building” effort in developing economies is not an argument against the value of applied regional cluster analysis. Cluster analysis is the process of systematically analyzing strengths, weaknesses, opportunities, and threats facing a set of interrelated existing or potential regional industries (Bergman and Feser 1999). It aims to document key linkages to non-market institutions such as universities and laboratories, identify areas of joint research and industrial strength where possible, evaluate competitive advantages on a global basis, and solicit corporate views of the need for various policy interventions. In highly developed economies, it relies heavily on extensive secondary data on industry linkages (e.g., input-output), innovation (e.g., OECD innovation surveys and matrices), employment, and output. In developing and transition economies where timely secondary data are much more limited, particularly at the subnational level, cluster analysis must utilize primary data collection techniques to a much greater extent. Recently, the collection of data via surveys and focus groups has become more common and a number of model survey instruments and focus group protocols are available. In general, cluster analysis has substantially improved the richness of applied economic studies at the regional scale.

Applied cluster analyses must be flexible in approach and avoid methods based on ideal types that reinforce a solely “cluster finding” mentality. The way that most agencies are using
the results of cluster analyses indicates that the general capability of cluster analysis for exposing co-dependencies among businesses, local support agencies, universities and colleges, and so forth is more useful than its potential for selecting specific sets of specializations for development policy focus. Analyses are most flexible when they utilize a variety of cluster definitions, data sources, and analytical methods and result in indicators and data series that are updated and consulted regularly. Cluster analysis should be viewed not as a one-time exercise but as an ongoing tool for exploring a wide variety of economic questions that formerly were explored using a sector-based logic.

Cluster analyses should be part of broader strategic planning processes that incorporate substantial private sector involvement and public opinion. Another very common use of cluster analysis is as a means of motivating and facilitating public-private discussions about development challenges and goals, both for existing firms as well as potential growth industries. Cluster analysis methods should be designed to maximize corporate and public involvement in the generation and interpretation of results. The formation of corporate steering groups, the organization of public meetings to review and discuss findings, and the utilization of focus groups to collect qualitative information on strengths and weaknesses in the local business environment all help lay the groundwork for subsequent policy initiatives by including the views and motivating the support of the eventual stakeholders of those policies.

S&T policy should remain as sector-, technology-, and location-neutral as is reasonable, letting market imperatives and research competencies drive public resource flows. In both developing and transition economies, interest in clusters should not derail efforts to improve the necessary basic framework conditions for innovation and entrepreneurship. Those conditions are largely sector- and location-neutral and reward scientific and innovative activity on their merits
rather than their fit with pre-determined industrial specializations. Issues such as support for basic university research, technical training and education, intellectual property protections, and anti-trust law are more critical for long-run growth than near term clusters or clustering.

*Any efforts to target specific technology sectors or S&T competencies for growth (cluster building) should be demand-driven and circumscribed in extent.* Most research indicates that the public sector has played a very modest role in influencing the establishment of the leading innovation clusters around the world and only a slightly stronger one in their subsequent competitive success. In less developed economies where the incidence of market failure is greater, government might be expected to successfully exert greater influence on cluster formation and growth. However, cluster building can exact a significant opportunity cost in that it often diverts resources from other general policy initiatives such as the provision of infrastructure and improved basic education. The low risk, low cost approach to cluster building puts local businesses in the driver’s seat by organizing a forum for firms to express joint concerns, engage in collective problem-solving on issues of common concern, and make collective requests for services or policy changes. Porter (2002, p. xvi) argues that major anchor companies in local clusters play a key role in organizing neighboring firms for joint action. Above all, development agencies should avoid pursuing unrealistic objectives, such as creating entirely new industrial or research strengths in the current fashionable industries (e.g., biotechnology). In many developing economies, the clustering of innovation is likely to be tied to more traditional industries.

*S&T investments should be measured for impact on overall innovation rates, not innovation in targeted clusters.* Perhaps the largest pitfall in economic policy making related to clusters is confusion over means and ends. Clusters and clustering are a means to competitive
success, not an end in themselves. Ultimately, attempts to build and support clusters or to leverage synergies among firms are only a route to boosting overall rates of innovation and growth. If a cluster strategy results in a rapid rate of expansion of a narrow segment of businesses and industries but overall net decline in innovation and growth at the macro level (either the nation or region, depending on the level of intervention), it must be regarded as a failure. It is still unclear whether cluster strategies will have an appreciable net positive impact on overall innovation and growth rates in developing countries. Indeed, we should not forget that the relationship between overall innovation rates and the prevalence of regional industry clusters is still unproven in highly developed countries.

Policy evaluations should be undertaken that compare the impact of cluster-informed interventions with the impact of conventionally designed policies. Important proof of the value of the cluster concept is in whether policies and programs designed to exploit cluster dynamics are actually more effective than those that essentially use a traditional, sector-based logic. Conventional policy prescriptions implemented based on a model of clustering must therefore be evaluated against non-cluster-based implementations of the same policy. For example, a number of states in the U.S. have sought to make a very common development strategy—the attraction of inward investment through marketing and incentives—more effective by targeting potential supplier firms to existing local end-market producers. Suppliers and end-market producers are identified via analyses of business linkages, a kind of cluster analysis. What makes marketing and recruitment cluster-based strategies in this case are not the initiatives themselves, but rather the way in which those initiatives are implemented. It follows that we should evaluate whether the level of inward investment generated by cluster-targeted programs is higher than the level for broad-based or untargeted programs, a question that is rarely asked. The focus is typically on
whether cluster-targeted recruitment programs have demonstrated success in filling out local supply chains, an outcome that could occur just as easily with an untargeted strategy as a targeted one. Without comparing different approaches to implementation, it is impossible to gauge if acknowledging this particular version of interdependence—the co-location of firms in value chains—really improved development policy efficacy.

Notes


2 Here I ignore the large empirical literature on agglomeration economies since most of it explores the relationships between geography, linkages, and productivity using only very crude measures of clustering (urban and city size as proxies for urbanization and localization economies). Similarly, Glaeser, Kallal et al. (1992) and Glaeser, Scheinkman et al. (1995) use only aggregate measures of concentration to study the links between localization, specialization, and urban growth.

3 “Interpersonal connections and networking play an important role in knowledge transfer, and supply-side factors are often significant in determining diffusion paths. This leads to the need for policy to consider the role of supplier-user relationships, professional and trade associations, academic and public-funded R&D, and organisations manufacturing complementary assets and technologies. The significance of these institutional relationships becomes larger as their geographical scope becomes smaller” (2001, p. 44). Other studies have also found evidence of a relationship between agglomeration (either co-location of similar businesses or location in a highly urbanized area) and technology adoption. Examples are
Harrison, Kelley et al. 1996b; 1996a) and Kelley and Helper (1999). The pattern of causality is unclear in many technology adoption studies, however, due to the heavy use of cross-sectional rather than time series data.

Some authors have argued for additional dimensions. Enright (2001) outlines a total of eleven, two of which relate to geography. Others are density, breadth, depth, activity base, strength of competitive position, stage of development, technological activities, innovative capacity, and ownership structures. In any case, there is no single best typology of clusters.
<table>
<thead>
<tr>
<th><strong>Supply-side interventions</strong></th>
<th><strong>Objectives</strong></th>
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<tbody>
<tr>
<td>Identity</td>
<td>Creation of cluster industry association or similar private sector organization to serve as catalyst and key stakeholder for cluster interests.</td>
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<tr>
<td>Location incentives, recruitment</td>
<td>Attract inward investment by directly reducing business costs through tax and non-tax incentives. Cluster analysis used to identify gaps in supply chains as possible recruitment targets, with objective being to increase business locations per unit of recruitment effort, resources. Cluster analysis may also be used to identify labor skill requirements of related industries in order to “sell” local labor pools to relocating firms.</td>
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<tr>
<td>Business networks</td>
<td>Establishment of forums for information sharing and joint problem solving of firms in selected sectors. Encourage cooperation in areas of marketing, training, sourcing, sales.</td>
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<tr>
<td>Business development services</td>
<td>Identification and articulation of demand of local firms for business development services (development of BDS markets); encouragement of closer alignment between services supplied and firm needs (development of BDS supply). Closely related to provision of industrial extension.</td>
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<tr>
<td>University research competencies</td>
<td>Investment in specific research disciplines that reflect unique strengths of existing faculty or desirable strengths.</td>
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<tr>
<td>Non-university labs, research “catalysts”</td>
<td>Creation or funding of intermediary agencies designed to conduct independent research and/or foster collaboration between university and industry researchers (a brokering or catalyst function); may also seek to leverage national government sources of research funding.</td>
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<tr>
<td>R&amp;D incentives, subsidies, awards</td>
<td>Provision of incentives to increase R&amp;D activity of industry, usually small firms or firms located in peripheral regions.</td>
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<td>Regulatory assistance</td>
<td>Guidance with regulatory compliance issues. Designed to free up engineering and research staff in industry to focus on R&amp;D and innovation activities.</td>
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<tr>
<td>Incubators</td>
<td>Development of facilities to provide subsidized space and services to high tech start-ups.</td>
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<tr>
<td>Industrial extension</td>
<td>Provision of technical and business development services to smaller firms, usually through regional network of extension offices and sometimes based in engineering universities and colleges.</td>
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<tr>
<td>Training</td>
<td>Skill upgrading of workers in identified cluster firms by focused training programs, delivered on demand or available through community colleges. Professional certificate programs for industry specializations (e.g., information technology, networking).</td>
</tr>
<tr>
<td>Basic education</td>
<td>Improvement of primary and secondary education as long-term labor pool upgrading strategy.</td>
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### Table 1. Common cluster building interventions

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<th>Supply-side interventions</th>
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<tr>
<td>Lab space, buildings, parks</td>
<td>Provision of specialized facilities and space (e.g., wet labs in biotechnology) via grants, low cost loans, and other inducements.</td>
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<tr>
<td>Risk-based financing</td>
<td>Attraction of venture capital through creation of venture capital pools (via public sector investing power) and marketing of area firms/industry to traditional venture capital sources.</td>
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<th>Demand-side interventions</th>
<th>Objectives</th>
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<tr>
<td>Procurement</td>
<td>Targeting of public sector purchasing to local firms or firms in target development regions.</td>
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<tr>
<td>Regulation and regulatory</td>
<td>Recognition in regulatory design and enforcement of impacts on markets, particularly in sectors such as environmental controls, electronics, information technology, and media.</td>
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<td>enforcement</td>
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<tr>
<td>Supply chain development</td>
<td>Foster purchasing linkages among firms in product or value chains, via supplier fairs and assistance (BDS or extension) to suppliers with meeting technical or standards requirements of customers, usually larger firms. Help with meeting international standards (e.g. ISO).</td>
</tr>
</tbody>
</table>

Basic categories of interventions are from Enright (2001), Rosenfeld (2001) and De Vol (2000).
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