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REGIONAL CLUSTER STRATEGY AND SUCCESSFUL SCIENCE AND TECHNOLOGY PARKS

By James O. Gollub

New Rule 3: Economic Input Advantage Enables Cluster Competition

What makes an S&T park different from another location within the same region is the degree to which the tenants can derive distinguishing advantages for their operations. It is for this reason that S&T parks are truly metaphors for the management of regional economic development (just as an incubator is a metaphor for the environment in which new business formation takes place in the surrounding economy). As has been discussed in part one of this article, the new rules for competition first point to the importance of focusing on the region as the unit of analysis for S&T park development (as with economic development). Further, if the region is the unit of analysis, then it is the set of industry clusters within each region that drives the economy. For this reason, clusters are an appropriate focus for the development of S&T parks—for targeting recruitment, attracting expansion as well as fostering new enterprise development. That being the case, a third new rule for competitiveness naturally follows, which is that the growth of competitive clusters is due to the ability of regions to provide their clusters with distinctive sources of economic input advantage. In other words, clusters will not form, expand in or come to regions that do not provide them with one or more form of input advantage—whether for design, production or distribution, An S&T park, therefore, is a vehicle for organizing and delivering strategic types of input advantage to one or more clusters, just as an effective collaborative regional economic strategy can help achieve the same for the surrounding economy.

Finding the Focus for SAT Park Advantage

How does a science park (or a region) determine what types of advantage a cluster requires to form, expand or be attracted to a park? Over the past 15 years, case studies and analysis of regional input indicators to cluster growth patterns have shown that different clusters require different forms of input advantage to grow. What works for one cluster at one stage does not work for another. This has the effect of rendering much of the S&T park marketing material produced, their marketing strategies and recruitment practices less effective than desired because they are over general. Our work has identified seven fundamental categories of economic input factors that can vary in how they respond to cluster needs. While these categories of input are all important as a set of

James O. Gollub is vice president of lCF Consulting, Inc, and based in their San Francisco offices (headquarters are in Fairfax, VA). Mr. Gollub and his colleagues developed cluster-based economic strategy and implementation initiatives worldwide. The author has applied the cluster based strategy framework to eight S&T parks globally, as well as for R&B institutions and technology commercialization programs. The subject of this article is also found in "Cluster-based Economic Development: A Key to Regional Competitiveness" prepared for the VS Department of Commerce, Economic Development Administration (1997) and "America's Regions in the Global Economy: A New Framework for Metropolitan Economic Strategy" prepared for the Office of Policy Development and Research, US Department of Housing and Urban Development (1998).

Building Collaborative Advantage to Grow Successful S & T Parks

This article is the second of a two part series on using regional cluster strategy to build successful science and technology parks. Part one of this article introduced two of four rules essential for achieving successful market-driven S&T parks. These two rules or principles were for developers and their partners to "think regionally" and recognize that "clusters drive regional economic performance." Part two introduces the third and fourth principles. The third principle is that a S&T park must offer access to sources of distinctive economic input advantage to prospective tenants belonging to existing or emerging industry clusters in order to effectively attract or foster growth. The fourth principle is that achieving these sources of input advantage requires a collaborative culture. The key for effective S&T park strategy is to recognize that high performance occurs most often in regions where institutions–public or private–know how to collaborate. This collaboration focuses on use of existing regional assets in new ways and the ability to make investments that generate new sources of advantage to regional clusters–specifically serving current and future S&T part tenants.

Figure 1

foundations for competitiveness, each will vary in terms of competency, capacity and growth. Moreover, while quantity is often an important dimension of any resources (e.g., the number of college engineering graduates, or number of patents produced), our experience is that responsiveness is the most crucial measure of value to a cluster in any aspect of economic input (e.g., the match between skills being trained and needs of industry). For this reason our labels of economic input categories reflect this "customer focus." We have identified and routinely used seven measurable categories and sources of input advantage in any region:

- ***Accessible Technology:*** The set of "discovery" (basic and applied research), "development" (technology creation and commercialization) and "deployment" (technical assistance/ extension) resources in a region. These include universities, national and independent research laboratories, and corporate R&D facilities. They are measured in terms of fields of technical competency (personnel in microelectronics, biosciences, computer science, advanced materials, manufacturing and so on), levels of R&D expenditure, technology transfer (patents, licenses, industrial liaison, contract research), and facilities (user laboratories, extension centers, incubators, etc.). The key focus of accessible technology (as the name implies), is on two variables, distinctive competency and responsiveness to users in the marketplace.
- ***Adaptable Human Resources:*** The set of labor force skill "preparation" (K-12, vocational/occupational), "advancement" (colleges and universities), and "renewal" (continuing education and retraining) institutions and programs that produce workforce capabilities in a region. These are measured in terms of numbers of graduates produced annually by field or discipline, workforce occupational skill by category, enrollment capacity. The key focus of adaptable human resources is on the ability of a region to produce a greater and more responsive supply of skills for a cluster than a competitor (since many regions "export" most of their graduates).
- ***Available Financing:*** The set of institutions that provide capital to the commercial marketplace from "initiation" (seed capital and venture capital), to "expansion" (commercial lending and later round investment or IPO), to "renewal" (industrial loans, M&A). This capacity is measured in terms of the dollar value and number of transactions at each level and change over time by category of source (as feasible). The key focus here is on securing financing, not simply having capital in a region. Many regions have little capital but secure financing through identification, screening and brokering of deals.
- ***Adequate Physical Infrastructure:*** The continuum of systems for "facilities" (industrial, commercial and S&T park sites), "operations" (water, power and waste disposal), and "mobility" (transportation and distribution systems) needed to conduct business. Again, measured in terms not simply of costs of land, utilities and transportation, but responsiveness to the specific characteristics of target clusters.
- ***Advanced Communications:*** The choice of communication "pipeline" (copper, cable, fiber, cellular, satellite),

"high speed/broadband" services (DSL, digital cable, etc.), and information service providers (including access to localized eCommerce, application specific providers and "smart" public systems). Many regions have capabilities that are either underdeveloped or underutilized relative to what a given cluster might expect or desire.

- ***Acceptable Business Climate:*** The set of tax, regulatory and administrative requirements and services in a region. Taxation can be measured in terms of our concept of "return on taxation" (advantage or value in public utility per dollar of tax paid per employ). Regulation can be assessed in terms of transaction volume and complexity (number of permits, time required to complete). Administration can be measured, albeit more qualitatively, in terms of customer centered features of public operations and information access (e.g., on-line services, quality control).

- ***Achievable Quality of Life:*** Key features include housing, health care, recreation and culture. These can be measured by average prices and availability of new and previously owned homes and apartments; health insurance costs, hospital daily rates and child care availability; rankings in recreational amenities (park acreage, theme parks, professional sport teams, cultural institutions and facilities), crime rate and infant mortality. (See figure 1: Economic Foundation Stories)

Competency Mapping: Linking Assets to Park Design

The need to provide a clear understanding of the assets to which access might be provided is an important feature of cluster-based science and technology park strategy. The UC MBEST Center (former Fort Ord), the University of Idaho Research and Training Park, the Alameda Science & Technology Center, and many other parks have used a highly focused process of competency mapping to identify, prioritize and structure how science and technology resources would be linked to their parks. In each case the initial steps employed a careful analysis of statistical data on the competencies of the faculty by discipline, the levels of research expenditure by field and type of activity, the intellectual property strengths and facilities available for users. These were then used to guide a process in which scientists and engineers from the faculty of the universities and surrounding laboratories were brought together to identify: (a) the core competencies they believed they could offer the marketplace; (b) their experience with industry; (c) the industry markets they believed they could provide advantages to; and (d) the requirements for building new and improved bridges to the commercial marketplace. These insights were used to identify science and technology competencies that could be brought directly to the attention of industry clusters, through participation in the collaborative design of the science and technology park. Moreover, the competency mapping and the collaboration in the S&T park design process with each cluster was used to guide the specification of new institutions, programs and intermediary mechanisms to ensure that the right form of access to these resources was built into the park operations.

Measuring Responsiveness of Assets

While a region needs to be assessed in terms of its performance on each of the seven dimensions of economic input advantage, the task typically also requires two further steps. The first step is to assess the responsiveness of the region's economic inputs to its existing set of clusters. Despite what numbers may suggest, the developers of an S&T park need to determine whether or not the advantage is perceived as being strong by representatives of each cluster. From this, it is possible to also define in greater detail the specific assets that can be lever aged in outreach to target clusters. For this purpose, we use a number of different analytic procedures. These range fom extensive interviews within each cluster to identify "what they derive in the way of advantages from this region" to convening a series of "competency work sessions" or in-depth focus groups with a cross section of specific elements of the region's technology infrastructure or other elements. The second step, benchmarking the region's performance on these dimensions to competing regions, requires performing a parallel analysis of the unique sources of advantages that major centers of a given cluster, such as biotechnology, information technology, or microelectronics might have. This analysis which can be focused on specific dimensions of advantage rather than a comprehensive assessment will provide substantial insights into what your technology park will need to be able to equal or distinguish itself from other competing regions and parks. At the end of the day, the insights arising from the analysis and benchmarking of your region's economic input advantages (or what we often refer to as "economic foundations" or "economic infrastructure") will become the focus for the design as well as marketing of your science and technology park. Without these insights, a park will be selling, as most do, a familiar story about the distinctiveness of its site and community, with little evidence to make the case and limited ability to get a specific message across to prospective tenants about how a given type of industry cluster would gain a competitive advantage from locating and growing at this particular park.

New Rule 4: Collaboration Achieves Economic Advantage

This article has discussed how regions are the center of action in the global economy, and how their performance is driven by the competitiveness of their portfolio of clusters. We have presented the case for why cluster growth and competitiveness depends on each region being able to provide a distinctive and responsive source of input advantage to each cluster and stated that a science and technology park is a geographic and political location that can be the focus for delivering that advantage. The final question then must be asked, which is "how do regions create their distinctive

advantages and what does it take for a science and technology park to become the center for their delivery?" The answer, and fourth new rule for competitiveness, is that it is each region's capacity to collaborate that determines how advantage is built and sustained. This capacity to collaborate extends down to the level of conceptualizing and building science and technology parks—using the park as a focus for regional economic innovation.

Collaboration is a term as ancient and familiar as the word community and as fundamental as the exchanges we make everyday in the market economy. A marketplace is a community of exchange in which buyers and suppliers agree to trade based on acceptable values for goods and services. Regions that have been able to form and grow industrial clusters have a history of collaborating to create advantages and continue to collaborate to adjust and create new ones.

When the citizens, public and private institutions, of a region have identified and agreed to make investments in regional systems of education, research, physical infrastructure and quality of life over time, the distinctive features that this investment will have created will in turn attract private sector investments. Private sector growth in personnel, knowledge and capital will, in turn, strengthen the region as a platform for economic growth. This desirable condition has been called a "vital cycle" (as compared to a vicious circle). In the next generation economy that regions are seeking to build, the hallmark of vitality will be the agility of institutions and their leaders to recognize and collaborate in the improvement of existing or creation of new sources of economic input advantage—whether it is in accessibility of technology, adaptability of human resources, the availability of financing, the adequacy of physical infrastructure or capacity to achieve quality of life.

The absence of collaborative activities in a region is certainly a sign of either decline or immaturity. Regions that consist of institutions that are not continuously negotiating and trading with their surrounding marketplace tend to not create local advantages, despite often possessing profound technological or human assets. For example, regions with national laboratories and state universities that are headquartered outside the region have historically tended to be less flexible and less responsive to the needs and opportunities in their regional markets by virtue of their mission and structure. They are certainly less responsive than companies whose decisions are driven by the marketplace they serve. By the same token, regions with clusters whose companies are headquartered outside the region face a similar challenge in adapting to regional needs—even when they are important to their own competitive survival. The history of a region's past style of transacting with one another will determine the difficulty with which they confront the need to be agile in their use of their institutional or corporate assets to adapt to build new advantages that enable cluster competitiveness, None the less, history does not foreclose the prospects for collaboration. A vital region has a history of at least four basic forms of collaboration, though by no means limited to these categories:

Figure 2

- **Business-to-Customer:** The most familiar, but often taken for granted, is business to customer collaboration. This relationship—the core of the market economy—motivates businesses to build extensive advertising, customer service and corporate communications programs. The extent to which these activities can be linked to the economy and to a specific region will depend on the corporate culture and ability to make the connection between market leadership and regional competitiveness.
- **Business-Workforce-Community:** The community of exchange between business, its workforce and the community—"corporate culture" and "corporate citizenship"—will often lead to a strong commitment by firms to engage in efforts to strengthen the competitiveness of the surrounding regional economy with public or other private partners. Many corporations are active corporate citizens and recognize that their relationship with their workforce and region requires strong engagement in business collaboration, not simply participation in chamber committees or charities.
- **Business-to-Business:** Collaboration is essential to the conduct of business, whether it is between a major producer and its many suppliers along the value-chain (a key aspect of a regional cluster), between a business and strategic partners for product development or as part of a consortium for pre-competitive technology development. The aspect of business to business collaboration most commonly recognized, as it relates to the regional economy, is through participation as members of a chamber of commerce, or regional employer or business leadership group. In this latter capacity, companies have often worked to define agendas for meeting shared training, housing or transportation needs. While quite often the initiatives of such groups have emphasized encouraging public agencies to be more responsive to industry needs, these business to business forums have also resulted in important changes in corporate practices with respect to internal hiring, training, promotion and compensation, as well as investment in regional institutions crucial to achieving their business objectives.
- **Public-Private:** This term was given birth in the late 1970s during the era of inflation and declining public budgets, a time during which the challenge of solving community problems was daunting and new approaches that used existing resources in new ways were called for. During this time period, and since then, businesses participation with government as a partner in studying and addressing community challenges, harnessing business acumen—management, accounting, logistics,

Case: Collaborative Design of a Science and Technology Park

Collaborative design of science and technology parks brings together the stakeholders of a region's clusters with the stakeholders of the region's distinctive competencies in a structured process that yields realistic market-driven concepts and prospective tenants. The strategy for Alameda Science & Technology Center provides a good illustration of how this process can work,

The cluster analysis for the former Alameda Naval Air Station, an 1800-acre portion of Alameda Island, defined four major clusters where regional growth and real estate demand merited development of one or more science and technology parks focusing on biotechnology, communications technology, new media and environmental technology. A series of three collaborative design sessions were held with members of each of the four clusters to shape the parameters for a series of technology communities. The cluster teams included industry leaders from major companies in each cluster—such as film, television, multimedia, publishers, special effects and Internet firms for new media—and counterparts from the University of California Berkeley, Lawrence Livermore Laboratories, Lawrence Berkeley Laboratories, and California State University at Hayward.

The results of each set of collaborative design processes was a user-driven "technology community" concept—four in total. These were prioritized on the basis of growth prospects, including readiness of prospective tenants. Of the four concepts, the biotechnology community was proposed as number one priority. A more detailed cluster-based anchor concept was prepared with prospective tenant guidance for this technology community. The anchor vehicle proposed was a multistage biotechnology market focused lease project ("The Biocollaboratory") that would provide an initial 50,000 square feet of wet lab space, growing to 250,000 over time. Concepts for the other three communities were also completed, including a multimedia focused technology community, an environmental technology and services center and digital communications complex.

These development concepts were unanimously approved by both the Alameda Reuse and Redevelopment Board and by the City Council when presented. As of this writing, the city, however, is just in the midst of the competitive bid process for selecting a master developer. The site is likely now to be developed in phases, emphasizing reuse of existing structures and incremental development where new development is feasible. Environmental cleanup will be an important factor in the speed and form of development. This initiative is an example of the downside of mobilizing substantial interest in a science and technology park or innovative technology community before site ownership is resolved and cleanup is accomplished. None the less, the technology community concepts remain valid and their potential remains within a window of feasibility. As evidence of this, considerable cluster-driven growth is taking place in the developments surrounding the former Alameda Naval Air Station.

marketing— has become well established. After all, businesses serve markets and customers, govern their domains of production and provide benefits to their employees. The private sector, therefore, has a considerable stake in the performance of the economic environment surrounding their operations.

Initially, public-private collaboration was an experiment in which businesses delivered services, often funded by public programs (Department of Labor, Small Business Administration) or mandated by law (Community Reinvestment Act) or enabled by matching grants (Department of Commerce). Overtime, industry began to view the question of improving the performance of the surrounding economy as a logical and essential priority business agenda. As a result, business leader ship has in the past 15 years moved from being advisors sitting on committees to being activists, directly involved in the design, engineering and production of inputs to their regional economies. This has encompassed businesses designing and implementing a wide spectrum of initiatives including school to work training programs, modernizing schools (wiring for the Internet), establishing investment funds for workforce housing, creating pre competitive R&D initiatives, forming venture capital funds at universities, participating in business incubators, and supporting science and technology parks. Business leaders have now more examples from other regions to learn from and are becoming accustomed to using their own resources in new ways to enhance the performance of their region's capacity to deliver advantages in economic inputs that they need to compete. (See Figure 2: How Well Does Your Region Collaborate)

Despite the by now extensive inventory of collaborative solutions to regional economic challenges, there remains the overarching need to mobilize stakeholders and bring them together to take action—whether for development of a regional economic strategy or to inform design and participate in the shaping of a science and technology park. To accomplish this, every set of stakeholders—in the case of a science and technology park, a mixture of universities, development corporations and real estate developers—needs a catalytic tool.

In our work in the past 18 years, we have found that (as this article continually implies) making a strong linkage between the mission of a science and technology park and the competitiveness of the region is a logical point of departure. Like it or not, a science and technology park is a metaphor and laboratory for the surrounding economy's competitiveness. A science and technology park will be the best that a region can offer, but also depend upon the surrounding region to provide an important context for development. Therefore, if the surrounding region is not able to pro vide the advantage a science and technology park needs and wants to offer, then the S&T park needs to become the vector for innovation in creating advantage.

Build Strategy Before Building the S&T Park

The process of developing a science and technology park should essentially be one of collaborative strategy that has the region's economic performance as its ultimate objective, the development of clusters as its focus, and the creation of new and improved regional advantage as its means. The steps in shaping S&T part strategy are all fundamentally collaborative—between the park and the region's economic stakeholders, the park and its prospective tenants and regional sources of advantage. The strategy process includes completing these following, interdependent and developmental steps:

- ***Diagnose the competitive position o fits portfolio of clusters.*** This will identify priority targets with in the region and in competitive centers that the science and technology park can best service.
- ***Assess and benchmark the economic input advantages that the region has to offer each cluster.*** This will specie assets available for use in marketing, and the missing ingredients that might be offered at or through the S&T park.
- ***Convene the region's clusters one at a time to shape the priorities for building advantage at the SAT park.*** This includes each cluster's industry members, their suppliers and corresponding public and private institutions—to determine the potential shape that the science and technology park could take.
- ***Develop cluster-focused design concepts and initiatives with regional partners.*** By convening each cluster group to participate in the shape of the design of all part elements, the S&T park developers will have important parameters to guide the design of a the overall S&T park—which may comprise multiple clusters as a series of "next generation technology communities". Moreover, the solutions called for—the needed sources of advantage—may be able to be developed with partners who participate in the cluster working group process, such as universities, laboratories, financial institutions, and utilities. When carried out optimally, the participants in the cluster work sessions are likely to identify themselves as prospective tenants for the site.
- ***Reach out to new clusters.*** To reach beyond the market of the immediate region, the science and technology park team should develop a cluster-specific marketing plan. This plan that will include a list of the major prospective tenants in each cluster in their major region of concentration, a profile of the competitive advantages offered by the home region of the S&T park, and an offer to include their company in the collaborative design of the park. At a suitable point in time, a target set of companies are invited to participate in a collaborative design process held either at the S&T park locale (best) or as a high level focus group in the home community of the target cluster company members (in limited number).

Conclusion: Creating a Next Generation Community

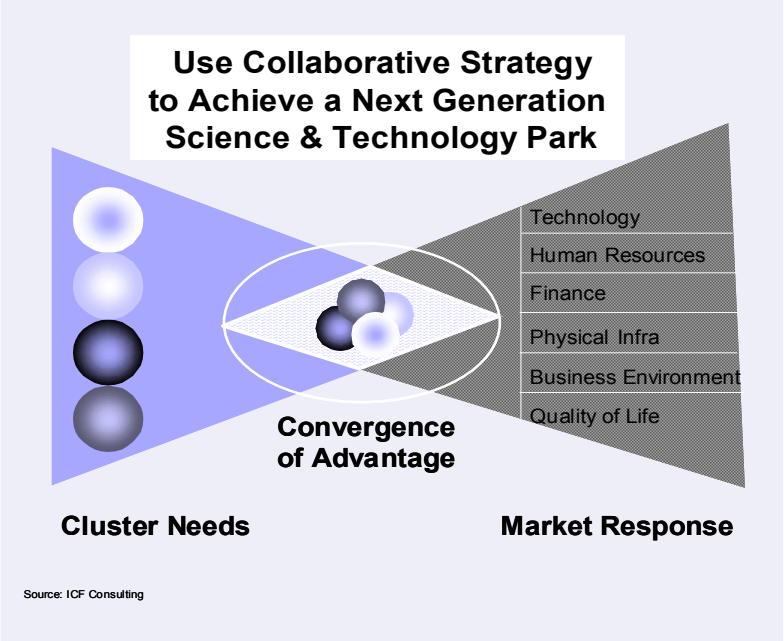
Science and technology parks are not a rigidly defined product. Every science and technology park is different. And they are becoming more and more different all the time. Ultimately, from an economic development perspective, good science and technology parks should be leading edge, next generation communities, and not simply highly controlled land developments.

There is no one "perfect" development model for science and technology parks. Moreover, definitions of what is "right" for a park will always differ. What is important to a developer may not be important to a city, state or university. Yet a convergence of interests is essential to success...whether in tenant leases or job generation. The tensions between the goals and methods used to develop a park will be minimized by collaborative strategy processes. By focusing on S&T parks as integral to and consistent with regional economic development, effective harnessing of resources can be achieved.

Often, a science and technology park grows along with its surrounding region. Early successes, such as Stanford Research Park, coincide with the historic success of the surrounding Silicon Valley region. The park did not create the valley but was part of it...even if it was a ground zero for some business developments. Over time, the park's presence has merged into the surrounding economy with each benefiting the other.

In certain cases a science and technology park can define a region and what it may become. Research Triangle is an example of this. Research Triangle was a deliberate expression of state economic policy and purposefully used to redefine a region characterized by textiles and tobacco, not contemporary industries. The park took decades and many resources to grow. Parks can be the focus of aggressive public policy or laissez fair practices. Both can be done well, but in either case the S&T park should grow as complementary development, if not as an accelerator for regional evolution (See Figure 3).

Figure 3



In the United States we tend to often draw from international examples to guide our thinking about what a science and technology park can or should be. This may need to be rethought given the differences in our political and economic environment.

France and Japan for example, have used S&T parks to achieve economic decentralization goals from their capitol regions. They used heavy national subsidy to achieve their initial developments, with firms receiving tax incentives to relocate and regions receiving as well as providing grants and low interest loans for preparing physical infrastructure and for construction of facilities. There was little market logic guiding the direction of these "technopoles" at the start. Most had overly developed visions of same archetypal technology industries (microelectronics, information technology, biotechnology, telecommunications, environmental technology, and multimedia) with no regional advantage to support or attract growth in those areas. The result was that there were many sites established (S&T parks, technopolises and so on), few with major successes; most gradually developing with a mix of regional or district company offices and operations. While a few have become

Profiles of Parks from Regional Cluster Perspective

Central Florida Research Park, Orlando
Developer/Managers: County R&D Authority
Size: 1000 acres, suburban location
Occupancy: Over 80 companies, 5000 employees
Cluster Focus: Electronics, Simulation (consortia), light manufacturing
Regional Assets: Central Florida University, Institutes for Simulation & Training; Electro Optics & Lasers; Space Education & Research

Northwestern University/Evanston Research Park
Developer/Managers: JV company (city-university)
Size: 24 acres, four buildings, downtown Evanston, expanding locally
Occupancy: 80 firms, 1000 employees, 130k DOE facility
Cluster Focus: No specific cluster, diverse industries—microbes to media
Regional Assets: NW School of Engineering, Graduate School of Management, Research Park Technology Incubator, 500 Area Industrial Labs, 5 university hospitals nearby
Near Argonne and Fermi Labs

Iowa State University Research Park
Developer/Management: Nonprofit
Size: 235 acres, 6 buildings
Cluster Focus: Animal, biotechnology
Regional Assets: Iowa State U ofS&T Technology Transfer Center & Innovation System, Program support and space via Small Business Center

Massachusetts Biotechnology Research Park
Developer/Manager: Not for profit
Affiliation: U of Mass Medical School Tufts School of Veterinary Medicine, Worcester Polytechnic Institute
Size: 105 acres, 8+ buildings
Cluster Focus: 250 biomedical companies, 1,500 employees
Regional Assets: Mass Biotech Research Institute coordinates R&D activities

North Carolina Centennial Campus
Management: North Carolina State University
Size: 1000 acres, 9+ buildings
Occupancy: 10+ firms, 2000 employees
Cluster Focus: 5 Themes: physical, biological, environmental, textiles, IT
Regional Assets: North Carolina State directly at site

highly visible communities, the majority of these S&T parks have essentially become redevelopment areas or simply planned developments. In many cases the science and technology park concept simply became a means for planning and ordering new growth. A few of these parks were able to establish or relocate significant technological institutions, such as a university or national laboratory to the site, or attract a major regional operation of a high technology company as an anchor, often at great cost to the sponsoring government agency. These settings were better able to compete among their peers for tenants, but still often faced a difficult challenge to accelerate growth,

Our work in Osaka Prefecture in the late 1980sapplied the logic of cluster-based economic strategy as the organizing principle for both regional technology policy and technology park planning. By working from the regional market down to the level of the park the project team was better able to both determine which industries should be the focus and identify and plan the specific technological advantages that needed to be located at the site in order for it to attract and serve key clusters. Moreover, the development plan was able to specify how national, state and local R&D institutions could link to the region's clusters independently and through the park (lzumi Cosmopolis).

US advocates for science and technology parks often admire the well-planned and large-scale science and technology parks of small Southeast Asian countries. They should. These projects have been used by their nations to build a platform of best practices and competitive advantages. As flagships, these centers receive tremendous national attention as a locus for placing investment in innovative institutions and programs. The governments of Singapore and Taiwan, for example, have concentrated on providing their best facilities, training, R&D facilities and financing at their sites. Their heavy investment approach enabled them to attract industry and grow clusters. This planning approach, which emphasizes the nation-state as the major partner in development, is harder to apply in a nation of over 300 metropolitan regions, such as the US.

Whether or not a S&T park has the backing of a major national or state agency in building the sources of advantage that will define a park's attractiveness, every park—whether established or in the planning stage—needs to realize that they are economic laboratories in which the best practices in regional economic strategy can and should be put to work. Every S&T park can be the leading edge demonstration of a next generation economy for their region. The challenge that all parks will face will be to live up to this exciting potential.