CHARACTERISTICS AND TRENDS IN NORTH AMERICAN RESEARCH PARKS:

21ST CENTURY DIRECTIONS

Battelle
The Business of Innovation

PREPARED BY:
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Technology Partnership Practice

ASSOCIATION OF UNIVERSITY RESEARCH PARKS

DEVELOPED IN COOPERATION WITH:
Association of University Research Parks

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ASSOCIATION OF UNIVERSITY RESEARCH PARKS

Creating Communities of Innovation

The Association of University Research Parks is a non-profit organization that promotes "the development and operations of research parks that foster innovation, commercialization and economic competitiveness in a global economy through collaboration among universities, industry, and government."

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Battelle is a global leader in science and technology. Headquartered in Columbus, Ohio, it develops and commercializes technology and manages laboratories for customers. Battelle's Technology Partnership Practice includes leading-edge practitioners and analysts who are experienced in conceptualizing and designing research parks built around universities and other research institutions.

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We thank our survey provider Insightrix for its efforts in making sure that the survey documents were distributed and completed in an efficient and timely manner.

We would also like to thank our sponsors:

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In addition to being a driver of highly focused, technology-based economic development in the Research Triangle Region for almost half a century, RTP has been a center of innovation. It is home to winners of the Nobel and Pulitzer prizes, as well as recipients of the U.S. Presidential Award and National Foundation Awards. Just as important, it is the workplace of technical, chemical, and biomedical scientists and patent holders whose discoveries have impacted the lives of all citizens in this country and around the world. Some of the most profound discoveries of the 20th century have been influenced by scientists and researchers working in RTP.

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THE UNIVERSITY FINANCING FOUNDATION, INC.

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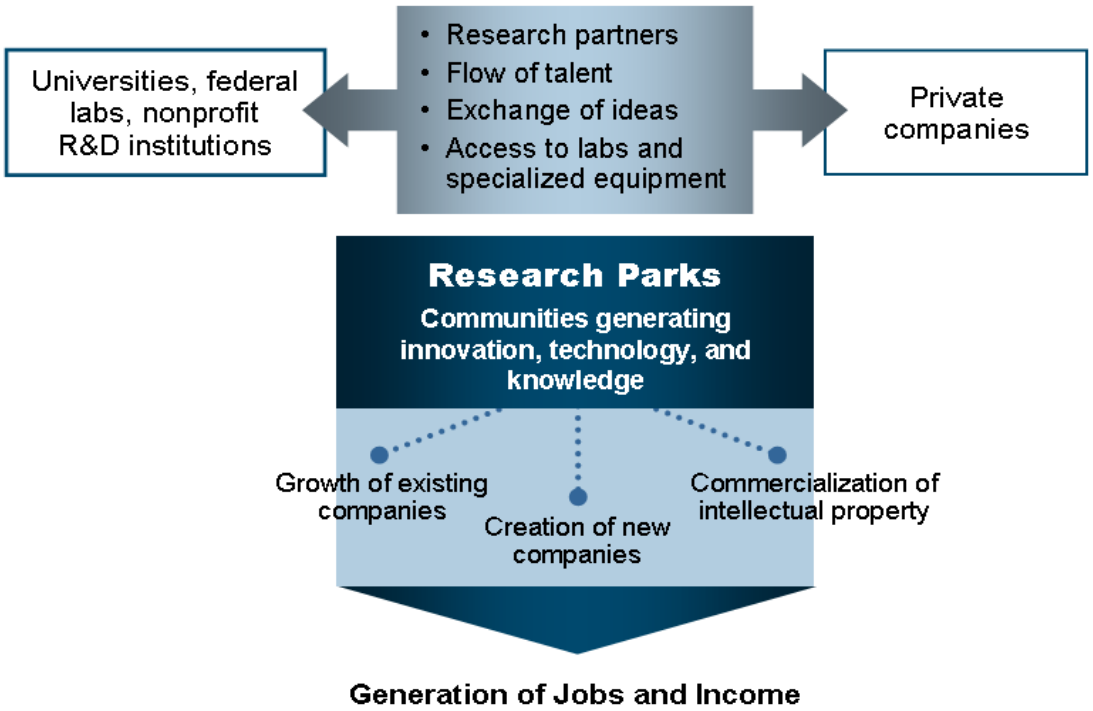
- *More than 300,000 workers in North America work in a university research park*
- *Every job in a research park generates an average of 2.57 jobs in the economy*

Research parks are emerging as strong sources of entrepreneurship, talent, and economic competitiveness for regions, states, and nations. They have become a key element in the infrastructure supporting the growth of today's knowledge economy. By providing a location in which researchers and companies operate in close proximity, research parks create an environment that fosters collaboration and innovation and promotes the development, transfer, and commercialization of technology (Figure ES-1).

To better understand how research parks are changing and their role as drivers of economic development, Battelle partnered with the Association of University Research Parks (AURP) to conduct a comprehensive assessment of research parks in the United States and Canada. This report presents the findings from a survey of research park directors that requested data on park characteristics, input on trends in university research park development, and data to measure the economic impact of research parks. The survey was sent to 174 university research parks; 134 parks (77 percent overall) responded. Key findings of the survey are discussed below.

A total of 134 North American university research parks responded to the Battelle-AURP survey, resulting in a response rate of 77percent.

Figure ES-1. Research Park Concept



Research Parks in 2007

Overview

University research parks in 2007 encompass more than 47,000 acres and include 124 million square feet of space in 1,833 buildings. While parks report that an average of 86 percent of available space is currently occupied, 94 percent of the parks report that they have room for expansion. At full buildout, of the 35,354 acres projected to be developed, approximately 22,000 (62 percent) are currently developed and less than half of the estimated total square feet (275 million) is currently open. Parks range in size from 2 acres to 7,000 acres, with an average size of 358 acres; half of the parks have 114 or fewer acres, suggesting that a number of very large parks are raising the average.

The typical North American research park is located in a suburban community with a population of less than 500,000. Most parks are operated by university or university-affiliated nonprofits. Tenants are primarily private-sector companies; but, parks also include university and government facilities. University research parks provide a range of business services to their client companies, many through incubators. The typical park has an operating budget of less than $1 million a year, and most parks have limited profitability.

The typical park has 750 employees with employment primarily in the following industry segments—IT industries, drug and pharmaceutical firms, and scientific and engineering service providers—accounting for 45 percent of all university research park jobs. The total employment impact for the 107 parks that provided data on industry employment totaled almost 680,000 jobs. Every job in these research parks generated 2.5 additional jobs in the economy. Battelle estimates the total employment impact of all research parks in the US and Canada to be more than 750,000 jobs.

Table ES-1 presents a profile of a typical North American research park.

Today's Research Parks

Today's research parks differ substantially from the model that emerged in the 1960s and 1970s (Figure ES-2). Most early research parks were first and foremost viewed as real-estate development projects. They were often developed on vacant land in proximity to a university or other research institution and provided an attractive, campus-like setting. It was assumed that firms would be attracted by proximity to the research institution. These parks focused on recruiting operations of primarily large, technology-based companies; but, in reality, the companies that located in the parks usually had few, if any, actual ties to the university.

In the 1990s, research parks began to look for ways to be more attractive to technology companies. Many sought to attract research and development (R&D) facilities that could anchor the park and attract other tenants. They also began to provide incubator space and build multitenant space to accommodate entrepreneurs and smaller, start-up firms.

Key Findings

Today's research parks have become key drivers of regional development. Following are key findings regarding today's research parks.

- **Research parks are placing greater emphasis on supporting incubation and entrepreneurship to grow their future tenant base and less on recruiting.** Of the research park directors responding to the survey, 95 percent indicated that creating an environment that encourages innovation and entrepreneurship is a high priority, with 71 percent indicating it as a very high priority for their park.
- **Research parks are more likely to be targeted to particular niche areas.** To compete in technology development, a region or state must differentiate itself and cultivate and sustain specialized areas of expertise where it can be a world leader. As a result, it has become more common

Table ES-1. Profile of a Typical North American Research Park*

	Typical Research Park
Size	▪ 114 acres ▪ 6 buildings ▪ 314,400 sq. ft. of space, 95% occupied ▪ Only 30% of total estimated sq. ft. at buildout currently developed ▪ 30,000 sq. ft. of incubator space
Location	▪ Suburban community ▪ Less than 500,000 population
Governance	▪ Operated by the university or university-affiliated nonprofit
Tenants	▪ 72% are for-profit companies ▪ 14% are university facilities ▪ 5% are governmental agencies
Employment	▪ Typical park employs 750 ▪ Major industry sectors: IT, drugs and pharmaceuticals, and scientific and engineering service providers
Finances	▪ Less than $1 million per year operating budget ▪ Revenues primarily from park operations but funds also come from universities and state, local, and federal government ▪ Limited or no profitability; 75% of the parks have no retained earnings or retained earnings of less than 10%

Services	▪ Provide a range of business and commercialization assistance services, including
	  ▪ Help in accessing state and other public programs
	  ▪ Linking to or providing sources of capital
	  ▪ Business planning
	  ▪ Marketing and sales strategy advice
	  ▪ Technology and market assessment

*Data cited for typical parks are based on median for all research parks responding to the survey.

Research Parks Are Succeeding in Incubating and Growing Companies

- Nearly 800 firms graduated from park incubators in the past 5 years
- About one-quarter of these graduates remain in the park
- Only 13 percent failed
- Less than 10 percent left the region

Figure ES-2. Evolution of Research Park Model

Early Parks: Stand-Alone Physical Space	1990s: Connections	2000 and Beyond: Economic Driver for the Region
▪ Real-estate operations ▪ Campus-like environment, selling single parcels of land ▪ Focus on industrial recruitment ▪ Few, if any, ties between tenants and university or federal laboratories ▪ Little provided in terms of business assistance or services	▪ Anchor with R&D facilities aligned with industry focus of park ▪ Innovation Centers and technology incubators more common ▪ Multitenant facilities constructed to accommodate smaller companies ▪ Some support for entrepreneurs and start-up companies provided directly	▪ More and more mixed-use development, including commercial and residential ▪ Increased focus and deeper service support to start-ups and entrepreneurs ▪ Less focus on recruitment ▪ Formal accelerator space and plans for technology commercialization roles emerge ▪ Greater interest on part of tenant firms in partnering with universities ▪ Universities more committed to partnering with research park tenants ▪ Amenities from day care to conference and recreational facilities added

for research parks to focus on identified technology areas or industry clusters.

- **Research parks are being viewed more as an expression of commitment to economic development.** Two-thirds of respondents indicated closer involvement by university leadership and more emphasis on university involvement in the past 5 to 10 years.
- **Park directors report that the primary reason why tenants locate in a university research park is to access a skilled workforce, including students.** Eighty-five percent of the respondents indicated that access to a skilled workforce was of high or very high importance to tenants.
- **University research parks use various mechanisms to foster university-industry relationships.** The most effective include having partnership-developer staff or others charged with relationship building between industry and departments, availability of university core user facilities open to industry, human resource matching programs such as internships and co-ops, and access to university research labs and university technology transfer and commercialization offices.

University Research Parks of the Future

A new model—strategically planned mixed-use campus expansions—is emerging that includes space for academic and industrial uses. These mixed-use campus developments are designed to create an innovative environment with a free and frequent exchange of information between academic researchers and their industry counterparts. Key features of these mixed-use developments include the following:

- Substantial space for significant future research growth
- Planned multitenant facilities to house researchers and companies

- Housing and other amenities attractive to young faculty, postdocs, and graduate students
- Flexible development options, some led by universities and others led by developers.

Amenities will be an important offering of future research parks. On-site amenities, such as restaurants and retail stores, are considered important in attracting innovation employees. Three-quarters of the respondents indicated a greater emphasis on amenities within the park now than 5 to 10 years ago; yet, the number of parks reporting such development was fairly small. This may be because parks have not yet been able to incorporate amenities or are having difficulty finding the financing to develop them. But, in the future, parks will likely need to include such developments.

The Future of Research Park Development

- A new model—strategically planned mixed-use campus expansions that include space for academic and industrial uses—emerges
- On-site amenities are critical to attract innovation employees
- Research parks serve as an effective tool to spur urban revitalization
- Research parks are used to leverage assets of non-university R&D organizations
- Research parks become leaders in sustainable design
- Research parks embrace global focus

Research parks are being developed in urban areas as a component of neighborhood revitalization plans, such as the park under development adjacent to Johns Hopkins University in Baltimore; the Center of Research, Technology and Entrepreneurial Exchange (CORTEX) in St. Louis; and Piedmont Triad Research Park in Winston-Salem. But, nearly half the respondents indicated that they did not think there was more emphasis on parks being built as part of a revitalization effort rather than as a greenfield development.

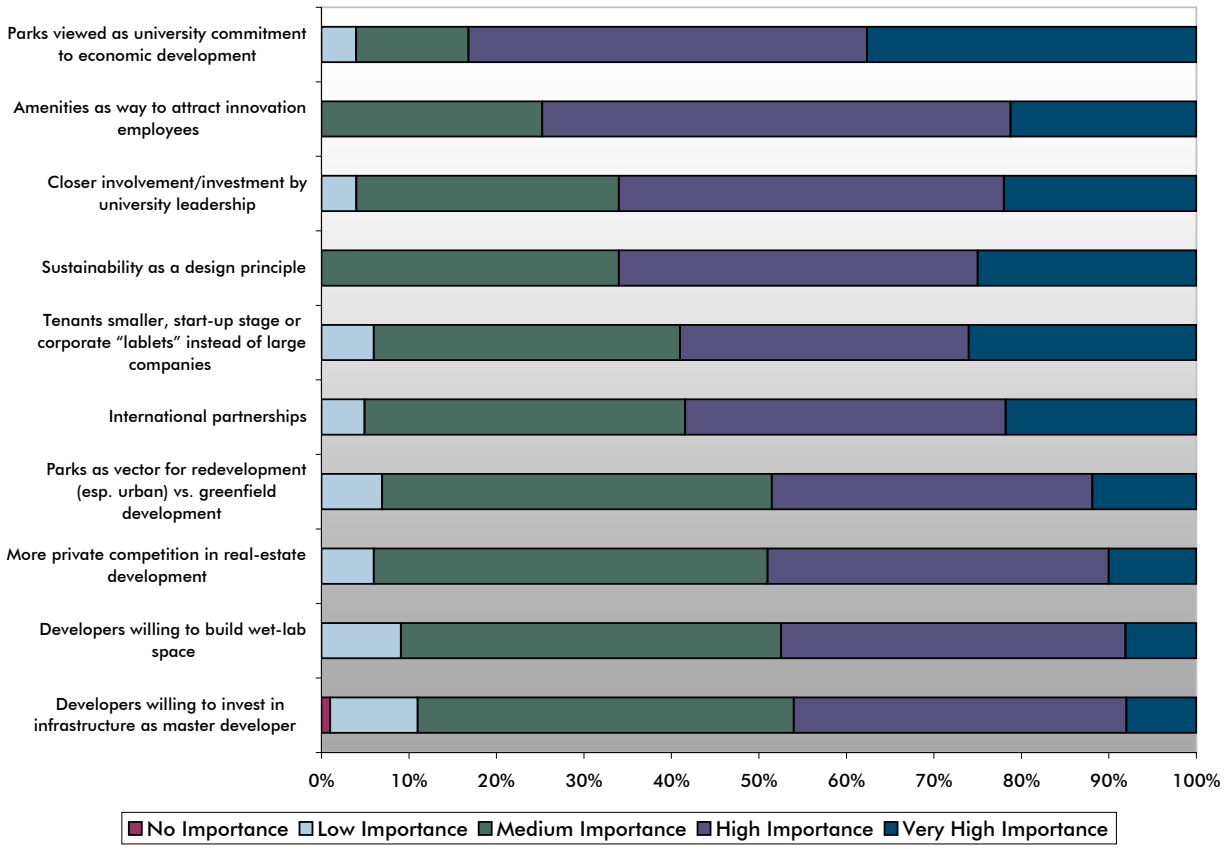
Research parks are being developed to leverage the assets of non-university R&D organizations such as federal laboratories. In addition to universities, major medical research centers and public and private research organizations can be key drivers of technology-based economic development (TBED). It is becoming increasingly common for communities in which a federal laboratory is located to create a research park to leverage laboratory resources to realize economic development.

More emphasis is being placed on sustainability as a design principle. Sustainable development involves balancing development needs against protection of the natural environment. In the future, it is likely that research parks will be developed to minimize impact on the environment and to use renewable energy sources and "green" building practices. Two-thirds of the respondents indicated that there has been an increase in the emphasis on sustainability in the past 5 to 10 years and this trend is likely to continue.

International partnerships are becoming more important in university research parks. Sixty percent of the research parks surveyed indicate that there was more emphasis on international partnerships in the past 5 to 10 years than previously, and park directors said that they expected to see parks attracting more international tenants and having more of a global focus in the future.

Figure ES-3 summarizes respondents' views on the importance of changes occurring in research parks during the past 5 to 10 years.

Figure ES-3. Importance of Changes in Research Parks in Past 5 to 10 Years



The 21st Century University Research Park: Challenges and Opportunities

Research parks are an important component of the innovation infrastructure needed to support today's knowledge economy, much as roads, bridges, and rail were critical to yesterday's industrial economy. Research parks have evolved and matured to become more integrally related to their higher-education partners and technology-driven tenants. ***But, there is still an unfinished agenda:***

- The multidimensional components of a business–higher-education partnership have not fully developed.
- Research parks face challenges as they continue to try to respond to the demands placed on them.

Challenges

Among the key challenges facing research park directors and institutions developing a research park are the following:

- **Overcoming commercialization challenges.** While university research parks can lead to commercialization of new technologies by promoting relationships between researchers and companies, moving innovation into the marketplace does not happen naturally or easily. A challenge for research parks will be to provide support services to ease the commercialization process.
- **Bridging cultural barriers between the academic and business communities and facilitating true partnerships.** Parks must

Challenges

- Overcoming commercialization challenges
- Bridging cultural barriers between the academic and business communities
- Achieving integration with the university
- Obtaining funding for operations and buildings
- Responding to increased competition owing to globalization and the changing nature of corporate R&D

continue to serve as an intermediary that understands both cultures and innovatively fosters integrated, collaborative efforts.

- **Achieving greater integration with the university.** Research park directors must continue to integrate the research park and its tenants into the fabric of the university.
- **Obtaining funding for operations and buildings.** Most research parks have very few resources in their early stages and do not generate sufficient revenue to be self-supporting. The need for capital will become even greater as research parks try to implement live-work-play models.
- **Responding to increased competition owing to globalization and the changing nature of corporate R&D.** Research parks in North America will be challenged to attract the operations of foreign companies and to retain the R&D operations of U.S. companies.

Opportunities

The challenges noted above also suggest opportunities for research park development. Research park managers will need to devote more attention and time to the following 10 areas as they evolve the 21st century research park model:

1. **Industry-university partnerships.** Research parks will need to expand the relationships and deepen the partnerships between industry and educational and medical institutions.
2. **Financing and support for commercializing intellectual property.** Research parks will need to offer funding and support for technology commercialization, including proof-of-concept funding.
3. **Retention and attraction of talent.** Research parks may be in a position to do more to retain, attract, and grow talent, from establishing advanced training facilities to partnering with community colleges to ensure a supply of skilled technicians.
4. **Speculative and surge space development.** In the old economy, local economic development agencies offered "speculative" (spec) space, paid for from community and federal funding sources, to fast-track recruitment prospects. In the knowledge economy, firms come and go more quickly, space needs change constantly, and flexible space will increasingly become the norm. Parks may be able to offer the equivalent of 20th century spec space in a 21st century innovation model, through a staged program of expanded multitenant space.
5. **Collaboration among firms and with other partners.** It is likely that technology tenants want more opportunities to network among each other and with sources of knowledge in labs, research organizations, and elsewhere. Parks will, in partnership with trade and other associations, need to increase their focus on tenants' networking needs and requirements.
6. **Safety and security.** Research parks may have a role to play in offering safe, secure environments for technology development. The post-9/11 world suggests the need for controlled access to key strategic technology assets, whether in education or industry. Parks may be well positioned to test, demonstrate, and pilot approaches to address secure and safe environments for replication in the world economy.

7. **Ongoing financial support.** For research parks to be drivers of economic development, they must continue to invest scarce resources in their quality attributes. As a result, most parks will continue to have limited retained earnings. Parks need diversified funding sources, and investments in research parks need to be considered as investments in a region's or nation's economic development infrastructure.

8. **Urban community revitalization.** Recently, a number of universities located in urban settings have begun to apply the research park concept not only to provide needed R&D space for academics and their industry collaborators, but also to stimulate the redevelopment of neighborhoods. Research parks may have a role to play in cities seeking to grow their technology industry base.

9. **Performance and accountability.** Accountability in public and private sectors requires that research parks continue to monitor their impacts and results. This survey was an important first step in developing baseline data on the economic impact of university research parks. Working collaboratively through organizations such as AURP, research parks should continue to develop and refine a set of appropriate metrics and explore various mechanisms to measure their impacts and successes.

10. **Value-added tenant services.** Parks in recent years have substantially increased tenant services, particularly to small, growing technology firms. But, the nature and portfolio of services desired in the future are likely to change. Research parks—because they are off campus—can do the applications work that complements the research focus of the medical center, lab, or higher-education institution. Parks may become a test bed for new ideas and approaches in building technology-driven firms and their products and processes.

Conclusion

Today's research parks differ significantly from their predecessors. A new model is emerging that includes

- **Planned mixed-use campus expansions** that provide shared space in which industry and academic researchers can work side by side. These developments embody a commitment by universities to partake in broader activities, offering companies high-value sites for accessing researchers, specialized facilities, and students and promoting live-work-play environments.
- A **strong focus on entrepreneurship and start-up and emerging companies.** Research parks are being used as a tool to spur homegrown business retention, expansion, and creation.
- **Comprehensive developments that offer** not only sites for companies and research institutions but provide **a full range of on-site amenities**, such as services, restaurants, retail stores, and, in some cases, housing.

Today's parks are creating an environment that fosters collaboration and innovation and leverages the talent and expertise of universities to drive TBED. Research parks have the potential to

- Translate discovery into application;
- Develop talent;
- Commercialize technology; and
- Integrate government, higher-education, and industry interests.

Achieving this potential, however, will require enlisting institutional leadership and community support, accessing sufficient capital for park development, and recognizing the long-term nature of this endeavor.

INTRODUCTION

Background

University research parks are not a new phenomenon. Some of the early parks, such as Stanford Research Park, Purdue Research Park, and Research Triangle Park (RTP), were established in the 1950s and 1960s. University research parks became popular tools to promote university-driven economic development during the 1970s through the 1990s and into the new century. Parks have never been instant successes, but many have succeeded after many years of patient development. This report describes the changes in these parks over the past several decades and suggests their continuing evolution as the 21st century unfolds.

Recently, interest in university research parks has resurged for a number of reasons:

- First, there has been a key shift in how industry approaches research and development (R&D). Rather than rely on internal research labs to generate innovative ideas, companies are seeking strategic alliances with other companies, universities, and federal laboratories. It is becoming increasingly common for large technology companies to open research centers or "lablets" next to major research universities.
- Second, there has been a shift in the nature of research itself. More and more, the most important scientific questions and advances require interdisciplinary research teams, often across multiple institutions. Thus, companies are seeking proximity to such institutions.
- Lastly, there is a growing recognition that a state's or region's competitiveness for technology-based growth depends, in part, on its ability to create physical environments that are attractive and facilitate industry and university interactions. Research parks and mixed-use campuses have therefore become attractive locations for technology companies to establish and remain as they grow and expand. The traditional case of offering a location to attract firms into a region is no longer the primary focus. Serving as a location for business retention and expansion is also a focus.

The university research park model is evolving to respond to these needs.

Surveys

In 2002 and 2005, the Association of University Research Parks (AURP) surveyed both member and nonmember research parks throughout the United States and Canada to profile the size and scope of the industry. In 2007, AURP partnered with Battelle's Technology Partnership Practice (TPP) to conduct a much more comprehensive assessment of university research parks.

> A total of 134 North American university research parks responded to the Battelle-AURP survey, resulting in a response rate of 77percent.

During spring 2007, Battelle and AURP conducted a Web-based, 31-question survey of university research parks in North America. The survey requested data on park characteristics, input on trends in university research park development, and data to measure the economic impact of park development. The survey was sent to 174 university research parks in the United States and Canada; 134 parks (77 percent overall) responded. The number of respondents varies somewhat from question to question because every park did not respond to every question. Eighty-one percent of the respondents were in the United States, with the remainder in Canada. Survey services were provided by Insightrix Research Services.

This report summarizes the results of the survey and provides information on the development of the university research park model and suggested trends for future development.

Project Team

AURP is a nonprofit organization that promotes "the development and operations of research parks that foster innovation, commercialization and economic competitiveness in a global economy through collaboration among universities, industry, and government."

Battelle is a global leader in science and technology. Headquartered in Columbus, Ohio, it develops and commercializes technology and manages laboratories for customers. Battelle's TPP includes leading-edge practitioners and analysts who are experienced in conceptualizing and designing research parks built around universities and other research institutions.

Insightrix Inc., established in June 2001, offers research-related services (such as online survey capabilities, traditional data collection, focus groups, personal interviews, strategic planning, and management consulting) via the Internet and helps clients develop, administer, and manage data collection and information strategies to achieve their informational needs.

OVERVIEW OF UNIVERSITY RESEARCH PARKS

What is a University Research Park?

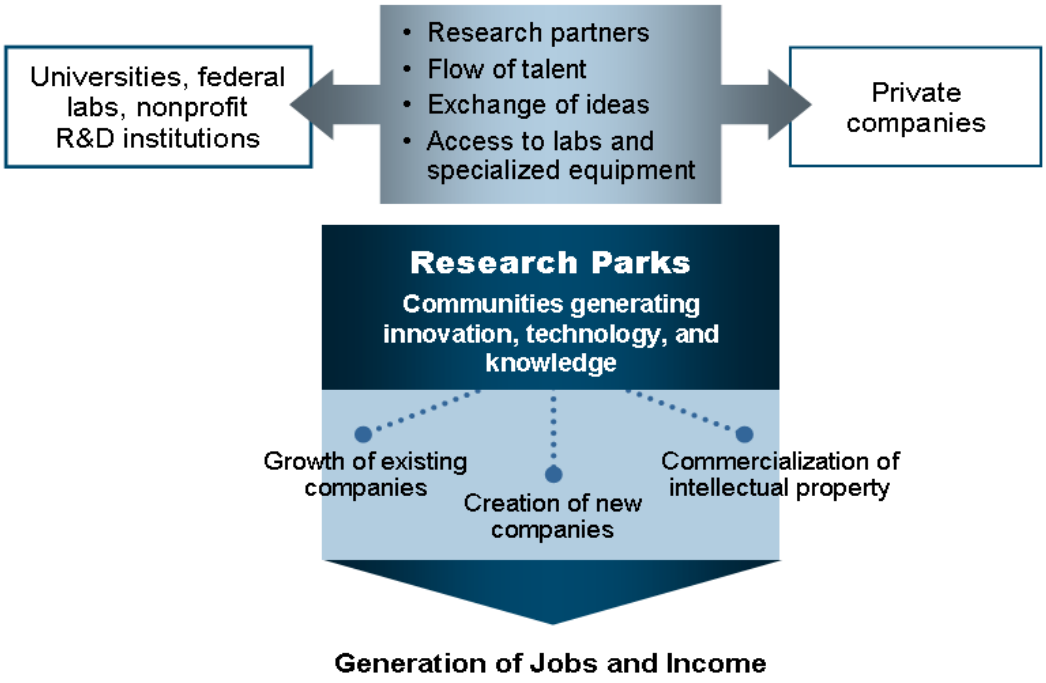
Research parks are real-estate developments in which land and buildings are used to house public and private R&D facilities, high-technology and science-based companies, and support services. By providing a location where researchers and companies operate in close proximity, research parks create an environment that fosters collaboration and innovation and promotes the development, transfer, and commercialization of technology.

As shown in Figure 1, ideas flow between the technology generators and the companies located in the research park. In addition, the innovations, technology, and knowledge generated by the companies and research institutions lead to the creation of new start-up companies, the retention and expansion of existing firms, and the attraction of firms new to the region. Most research parks are affiliated with one or more universities; however, research parks have also been developed close to national laboratories or other sources of technology and innovation.

AURP defines a university research park as a property-based venture, which has the following:

- Master-planned property and buildings designed primarily for private-public R&D facilities, high-technology and science-based companies, and support services
- A contractual, formal, or operational relationship with one or more science-research institutions of higher education
- A role in promoting the university's R&D through industry partnerships, assisting in the growth of new ventures, and promoting economic development
- A role in aiding the transfer of technology and business skills between university and industry teams

Figure 1. Research Park Concept



- A role in promoting technology-led economic development for the community or region.

The key factor differentiating a university research park from technology or industry parks is the meaningful interaction of the firms in the park with the university. This interaction can include providing internship and employment opportunities for students, sharing facilities and equipment, or conducting collaborative research. In addition, most university research parks have a university presence within the park, which can include research labs, test beds, education and training offerings, or technology transfer offices. Research park tenants, unlike technology or industry park tenants, undertake R&D within their premises in the park; employ greater concentrations of scientific, technical, and professional workers; and generate products or processes that incorporate a significant technological quotient. While the development community tends to classify many technology and industry parks as research parks, they usually do not meet the above criteria.

Size of the University Research Park Industry

University research parks in 2007 encompass more than 47,000 acres and include 123.9 million square feet of space in 1,833 buildings (Table 1). While parks report that an average of 86 percent of available space is currently occupied, 94 percent of the parks report that they have room for expansion. At full buildout, of the 35,354 acres projected to be developed, approximately 22,000 (62 percent) are currently developed and less than half of the estimated total square feet (275 million) is currently open. Parks range in size from 2 acres to 7,000 acres, with an average size of 358 acres; half of the parks have 114 or fewer acres, suggesting that a number of very large parks are raising the average.

Research parks include a mix of single-tenant and multitenant buildings, with 57.5 percent of the total number of buildings characterized as single-tenant and 42.5 percent as multitenant.

Park Characteristics

Table 2 presents a profile of a typical North American research park. Specific park characteristics are discussed below.

Governance

Slightly less than half (43 percent) of the research parks surveyed are directly managed by a university or a university-affiliated nonprofit entity. Twenty-six percent are operated by independent, private nonprofits that may or may not include university representation. Very few parks are managed by either government or a for-profit developer (Table 3).

Table 1. Acreage and Space Available in University Research Parks

Size Metric	Total for All Parks	Average	Median
Total acreage	47,274	358	114
Acreage currently developed	21,961	179	30
Total number of buildings open	1,833	16	6
Total square footage of open buildings	123.9 million	1.09 million	314,410
Estimated percentage of space currently occupied		86%	95%
Projected acreage at full buildout	35,354	283	114
Estimated total square feet at full buildout	274.8 million	2.43 million	1.10 million

Table 2. Profile of a Typical North American Research Park*

Typical Research Park	
Size	▪ 114 acres ▪ 6 buildings ▪ 314,400 sq. ft. of space, 95% occupied ▪ Only 30% of total estimated sq. ft. at buildout currently developed ▪ 30,000 sq. ft. of incubator space
Location	▪ Suburban community ▪ Less than 500,000 population
Governance	▪ Operated by the university or university-affiliated nonprofit
Tenants	▪ 72% are for-profit companies ▪ 14% are university facilities ▪ 5% are governmental agencies
Employment	▪ Typical park employs 750 ▪ Major industry sectors: IT, drugs and pharmaceuticals, and scientific and engineering service providers
Finances	▪ Less than $1 million per year operating budget ▪ Revenues primarily from park operations but funds also come from universities and state, local, and federal government ▪ Limited or no profitability; 75% of the parks have no retained earnings or retained earnings of less than 10%

Services	▪ Provide a range of business and commercialization assistance services, including
	  ▪ Help in accessing state and other public programs
	  ▪ Linking to or providing sources of capital
	  ▪ Business planning
	  ▪ Marketing and sales strategy advice
	  ▪ Technology and market assessment

*Data cited as averages are based on median for all research parks responding to the survey.

Table 3. Park Governing Structures

Park is Governed by	Number of Parks	Percentage of Total
Independent, private nonprofit	35	26%
University-affiliated nonprofit	30	23%
Affiliated university	27	20%
Government agency, quasi-public corporation, or public authority	18	14%
For-profit developer	8	6%
Formal joint venture including diverse organizational types	5	4%
Other	10	8%

Role of Private Developers

The common approach to financing and constructing buildings in university research parks is to hire private developers on a per-building or per-project basis. Ninety-nine of 131 parks reported that they use developers on a case-by-case basis. It is less common to use private, for-profit developers to develop the entire acreage in a park or for a park to do the development on its own. Only 15 percent of the parks reported using a private-sector master developer to develop the entire park acreage. An even smaller percentage of the parks, 5 percent, are managed and financed by private, for-profit developers. Only 11 percent of the parks do all their own development.

Tenants and Their Employees

One hundred and twenty-two research parks reported a total of approximately 4,380 tenants. It should be noted, however, that 12 parks reported no tenants (these parks are still in planning or other initial stages). On average, the parks reported 40 tenants; the median was 24, suggesting that many parks have a small number of tenants, but a few parks have very large numbers of tenants.

Not surprisingly, park tenants are overwhelmingly private-sector firms. Of the total number of tenants, approximately 72 percent were private-sector corporations. Fourteen percent of tenants were university-related operations, 5.4 percent were government facilities, and 4.5 percent were retail or service establishments (Figure 2).

One hundred seven North American research parks reported total employment of 271,366 at the time of the 2007 survey. Each of the seven largest research parks employ more than 10,000; together, they make up 54 percent of the total 271,366 park jobs. The median university research park employs 750 individuals.

Approximately 80 percent of research park workers are employed in the private sector. An additional 11 percent are employees of colleges and universities (both public and private institutions); 6 percent are government employees; and 3 percent are employed in businesses supporting other park tenants, such as retail stores, restaurants, daycare centers, banks, health clubs and other on-site support services and amenities[1] (Figure 3).

The distribution of research park jobs across the public and private sectors generally reflects the composition of park tenants. Private sector tenants comprise a somewhat lower share of tenants than jobs—72 and 80 percent, respectively. Government tenants (5.4 percent) and employment (5.7 percent) are essentially the same shares of the total. College and university tenants make up a slightly greater share of all research park companies (14 percent) than jobs (11 percent).

The survey of North American research parks was designed to analyze an important subset of the total 271,366 park jobs. By subtracting the "support" jobs within university research parks, one can examine the full breadth and economic impact of those nonsupport or "core" technology-based jobs that make these parks unique. This subset currently totals 264,413 jobs.

Core employment in university research parks reflects the array of tenants across a variety of technology-based industry sectors.[2] Widely represented across university research parks are the two major IT industries, software with 13.5 percent of all park jobs and computer hardware with an 11.0 percent share (Table 4).

[1] The survey question regarding this detailed employment breakdown by major sector or type (private, government, university, and supporting) was not answered by every research park providing total employment; thus, this employment composition reflects completed sector responses only.

[2] Industry detail shown here reflects specific responses to the core industry employment items. As with other questions in the 2007 survey, some respondents elected not to provide industry detail or indicated that they did not know. A specific "Other core employment, not classified" industry was created to capture this total core employment and to allow the industry detail to sum to totals.

Figure 2. Composition of North American Research Park Tenants by Sector

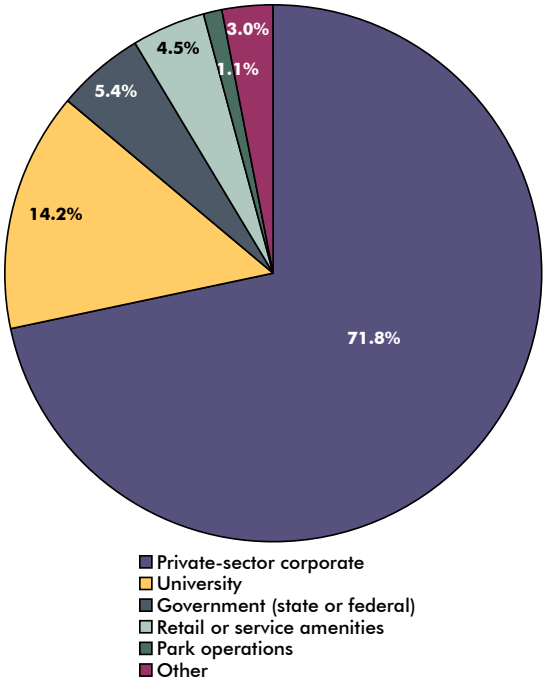
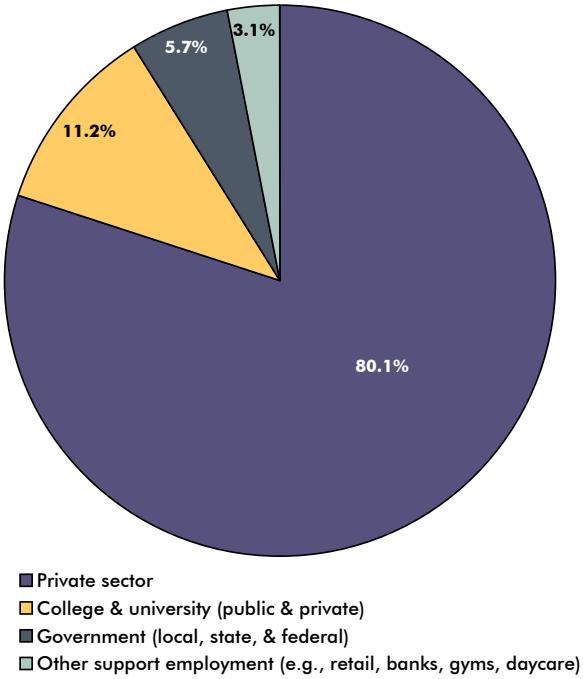


Figure 3. Composition of North American Research Park Employment by Sector



Drug and pharmaceutical firms employ just over 28,000 or 10.6 percent of all research park jobs. Scientific and engineering service providers round out the top four industries with 25,747 jobs representing 9.7 percent of total core park employment. Taken together, these four industries represent 45 percent of all university research park jobs.

Firms that locate operations within a university research park tend to be especially involved in research and development activities. In the survey, special efforts were made to capture whether each specific firm/tenant is primarily engaged in R&D. Separate columns in Table 4 present the number of jobs and overall share of each sector engaged in R&D.

Overall, more than 125,000 or 47 percent of core research park jobs are with companies primarily engaged in R&D activities. This share is especially high in drugs and pharmaceuticals firms located in research parks (90 percent), as well as in computer hardware (86 percent), the agricultural biosciences (86 percent), science and engineering services (78 percent), instrumentation and sensors (76 percent), and, not surprisingly, laboratories (76 percent). The R&D-specific activity within these industries is particularly revealing about the truly innovative nature of corporate, government, and university activity within research parks.

Services and Amenities

University research parks often provide tenants with access to a variety of university services, including university recreational facilities, animal-care facilities, hazardous material handling, library-information services, parking, and bus or transportation systems. Some parks also allow employees to serve as adjunct faculty. However, when asked which of these were of the highest importance to tenants, the research parks responding identified as high or very high importance only library-information services and parking and, to a lesser extent, adjunct faculty status and animal-care facilities.

Park managers, when asked which of these benefits were currently offered tenants, showed the greatest availability was for parking,

Table 4. Research Park Employment by Detailed Industry

Industry	Current Core Park Employment	Percentage of Total Core Employment	R&D Employment Within Core	R&D Employment as Percentage of Core
Total core park employment	**264,413**	**100.0%**	**125,280**	**47%**
Software	35,734	13.5%	21,841	61%
Computers and Related Hardware	28,969	11.0%	25,050	86%
Drugs/Pharmaceuticals/ Diagnostics	28,007	10.6%	25,110	90%
Scientific and Engineering Services	25,747	9.7%	20,059	78%
Healthcare Services	11,357	4.3%	2,754	24%
Centralized Business Support Services	11,134	4.2%	-	0%
Communications Equipment	9,204	3.5%	4,155	45%
Laboratories (medical, biological, environmental testing)	8,344	3.2%	6,340	76%
Management/General Business Consulting/Services	8,021	3.0%	211	3%
Aerospace/Defense	7,540	2.9%	1,123	15%
Advanced Materials	5,773	2.2%	1,823	32%
Instrumentation and Sensors	4,853	1.8%	3,694	76%
Other Scientific R&D	4,295	1.6%	4,295	100%
Medical Instruments and Devices	3,275	1.2%	1,380	42%
Other Bioscience R&D	3,272	1.2%	3,272	100%
Ag/Plant Biosciences and Related Chemicals	2,680	1.0%	2,300	86%
Colleges/Universities	1,772	0.7%	-	0%
Environmental Consulting/ Services	1,180	0.4%	417	35%
Alternative/Renewable Energy	1,166	0.4%	864	74%
Insurance	913	0.3%	-	0%
Other Government	815	0.3%	-	0%
Other Electronics	744	0.3%	592	80%
Misc. Manufacturing	36	0.0%	-	0%
Other core employment, not classified	59,583	22.5%	N/A	N/A

library-information services, and access to and use of recreational facilities and privileges. These responses were consistent with the list of benefits that managers feel tenants wanted, with the exception of one item—adjunct faculty status—which is apparently much more desired than offered.

Most university research parks also offer a range of business and commercialization services to entrepreneurs and start-up and emerging companies. More than three-quarters of the parks reported helping entrepreneurs and firms to access capital by linking them with both private and public sources. A majority of the parks also provide assistance with business planning, marketing and sales strategy advice, and technology and market assessments (Table 5).

Business Incubators

Sixty-eight percent of the parks report having one or more business incubators located in their park that are targeted at serving the needs of university spin-offs and other start-up companies. A business incubator is an organization that supports the entrepreneurial process, helping to increase survival rates for innovative start-up companies. Entrepreneurs with feasible projects are selected and admitted into the incubators, where they are offered a specialized menu of support resources and services. Eighty-two parks reported a total of 3.59 million square feet of incubator space, with an average of 44,907 square feet per park. Among parks housing community entrepreneurs, more than half (55 percent) of the incubator square footage is allocated to them, on average. An average of 38 percent of square footage in incubator space is reported to house university spin-outs.

Park Budgets

The parks varied greatly in the size of their annual operating budgets; but, the majority of the parks (56 percent) reported an annual operating budget of less than $1 million, with 40 percent of the total reporting a budget of less than $500,000. Approximately one-fifth of the parks reported operating budgets of between $1 million and $3 million, 16 percent reported budgets of $3 million to $10 million, and 7 percent reported budgets of more than $10 million (Table 6). The median operating budget lies in the range of $500,000 to $1 million.

Operating funds are derived from a number of sources, with the most important contributor being park operations. Forty-eight parks reported that 100 percent of their operating budget comes from park operations. Figure 4 shows an average composition of sources that fund research park budgets.

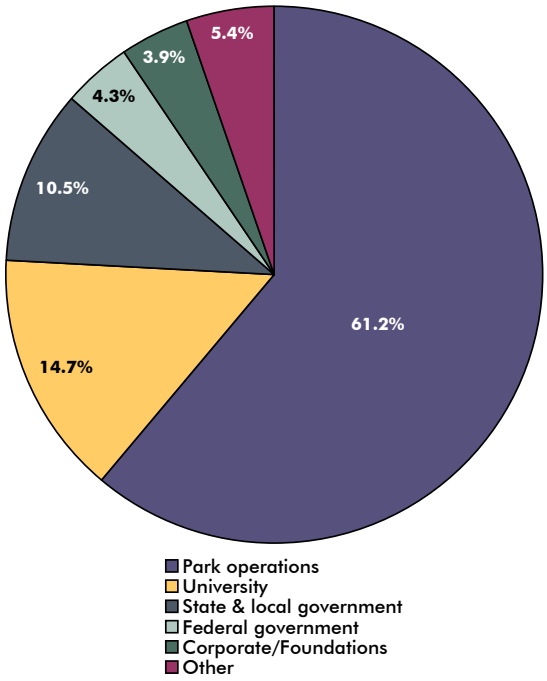
Table 5. Business and Commercialization Services

Service Offerings	Number of Parks Providing the Service	Percentage of Total Parks
Help access state and other public programs	94	81%
Link to or provide sources of capital	87	76%
Business planning	77	68%
Marketing and sales strategy advice	70	64%
Technology and market assessments	69	62%
Assist with human resource issues	48	45%
Provide proof-of-concept funding	40	38%

Table 6. Current Annual Operating Budgets

Current Annual Operating Budget	Number of Parks	Percentage of Total
Less than $500,000	49	40%
$500,000 to $999,999	20	16%
$1,000,000 to $2,999,999	26	21%
$3,000,000 to $4,999,999	10	9%
$5,000,000 to $9,999,999	9	7%
$10,000,000 to $14,999,999	4	3%
$15,000,000 or more	4	4%

Figure 4. Average Composition of Research Park Funding Sources for Operations



More than half of the research parks surveyed reported that they had generated retained earnings during the past 5 years. One-quarter of the parks reported average annual retained earnings that equaled 10 percent or less; 25 percent reported average annual retained earnings of 10 percent or greater; but, 48 percent reported no retained earnings whatsoever (Table 7).

It must also be recognized, however, as reported in Table 6, that park annual operating budgets tend to be small; 56 percent of the parks have an operating budget of less than $1 million. This suggests that where retained earnings exist, with a few exceptions, the amounts are very small. Thus, research parks, which are undertaken to diversify local economies and build stronger industry–higher-education partnerships, usually require, at least in the short term, cross subsidization by their partners, communities, and higher-education sponsors.

Challenges Facing University Research Parks

The research park directors were asked to indicate the level of significance they would assign to the following challenges in the next few years:

- Capital for park development and operations
- Competition from other sources
- Equity capital for tenants
- Identifying, growing, and supporting a sufficient tenant base
- Decreasing demand for office space as companies move to operate virtually
- Financing for multitenant space
- Financing for wet-lab space

Table 7. Average Annual Retained Earnings Generated During the Previous 5 Years

Average Annual Retained Earnings Generated	Number of Parks	Percentage of Total
Less than 5% of operating budget	18	16%
5% to 10% of operating budget	12	11%
10% to 15% of operating budget	5	4%
15% to 20% of operating budget	8	7%
More than 20% of operating budget	16	14%
No retained earnings	54	48%

- Insufficient customer use to expand retail/commercial components of the park
- Loss of developer interest in partnering with research parks
- Limitations on the use of tax-exempt financing for buildings within the park.

Respondents indicated that they thought the greatest challenges facing them would be funding the development and operation of the park, accessing capital for client firms, obtaining financing for multitenant buildings and wet-lab space, and attracting a sufficient tenant base. These factors are discussed below. Figure 5 shows the level of importance assigned to each challenge.

Funding

Developing a research park is a significant, long-term investment that can require millions of dollars over several years. This funding is likely to come from multiple public and private sources, including the following:

- Bond issuances (both general obligation [GO] and revenue bonds)
- State appropriations
- Land contributions
- Rental of space by sponsoring institutions
- Cross collateralization of early successes
- State investments in research, commercialization, and other technology-based economic development (TBED) programs.

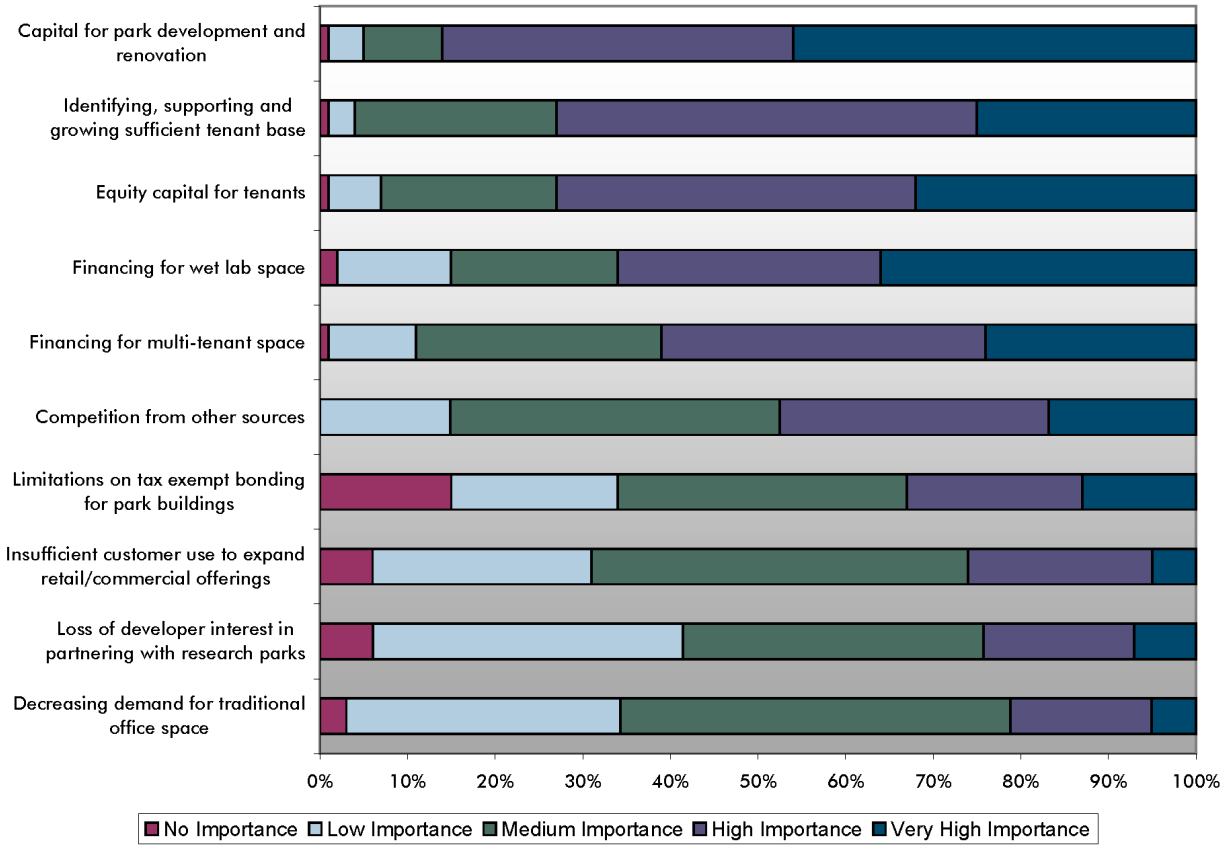
Eighty-six percent of the research park managers indicated that obtaining capital for park development and renovation was of high or very high significance. About two-thirds of the park managers indicated that obtaining financing for wet-lab space was a significant or highly significant challenge. Sixty-one percent indicated that obtaining financing for multitenant facilities would also be a challenge.

Sources respondents reported tapping to construct buildings included private developers, government grants, and bonds. The park managers reported finding few sources of operating funds with the exception of some government programs.

Capital for Tenants

Park directors responding to the survey indicated that helping tenants access capital will be a significant challenge during the next 5 to 10 years. As parks focus more on entrepreneurial start-up and emerging companies, the ability of these companies to access capital will greatly affect whether they are able to grow and expand in the park or in the community. Seventy-three percent of the respondents indicated that this was a significant or highly significant challenge facing their park in the future.

Figure 5. Importance of Challenges Facing University Research Parks



Despite expressing concerns about this issue, the respondents reported having undertaken few activities designed to assist firms with accessing equity capital, although 35 parks did report some involvement in supporting the development of angel funds and in promoting networking.

Tenants

The respondents expressed concerns about their ability to identify, support, and grow a sufficient tenant base in the next few years. Seventy-two percent of the respondents indicated that this will be a significant or highly significant challenge.

Keys to Success

The respondents were asked to indicate the importance of various factors in determining success of a university research park. They identified both external and internal factors that contribute to the success of university research park development.

External Factors

Key success factors in university research park development include first and foremost the **commitment of university leadership** and **acceptance by the local economic development community**. More than 90 percent of the respondents indicated that these factors were of high or very high importance in determining success in university research park development. Other factors considered of high importance to success include **access to capital to construct buildings, a good match between core competency of university and cluster strategy in tenant recruitment, access to equity capital sources for park tenants,** and **capacity to assist early-stage companies in commercialization.** Interestingly, many of these factors could be summarized in these key

words: leadership, commitment, and capital (Figure 6).

Internal Factors

University research park directors indicated the most important internal attribute to the success of a research park as being able to **offer space that is cost-competitive with privately developed alternatives** in the region. The **availability of multitenant space for incubator graduates, availability of a formal business incubator,** and **physical proximity to main university campus** were cited as of high or very high importance to success. Other factors also considered important include the **ability to manage inventory and hold vacant space for expansion**, having **full-time staff independent of the university**, having **in-house capacity for partnership development** in addition to real-estate development, **presence of a corporate or government anchor tenant** in the park, **presence of university research anchors,** and **availability of amenities**. The Virginia BioTechnology Research Park exemplifies the role research anchors can play in establishing a park (see text box). Figure 7 shows that 80 percent of the park directors indicated that every one of these factors is of medium to very high significance.

Summary

University research parks are clearly part of the infrastructure needed to support today's knowledge economy. But, how successful have they been in promoting technology-based growth? The next section of this report examines the economic impact of research parks.

Figure 6. Key External Determinants of Success of University Research Parks

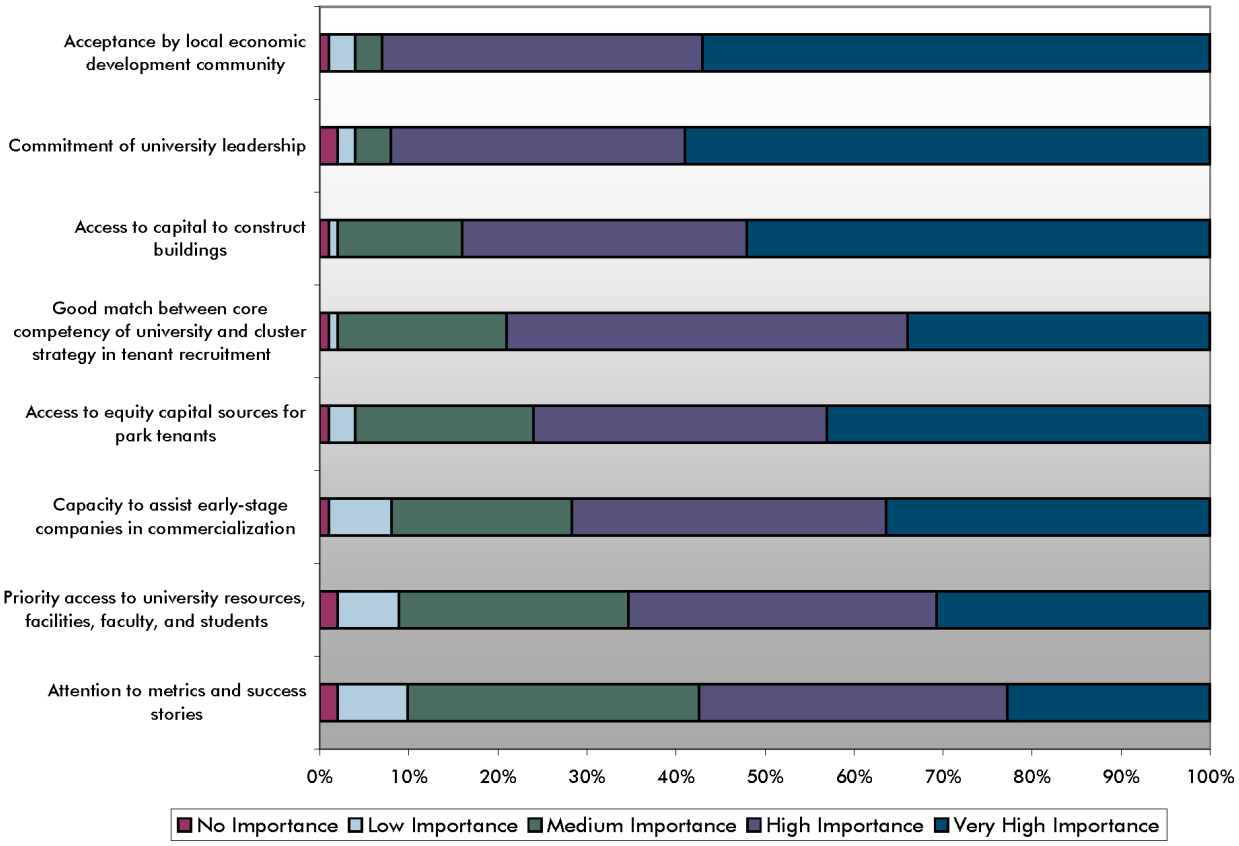
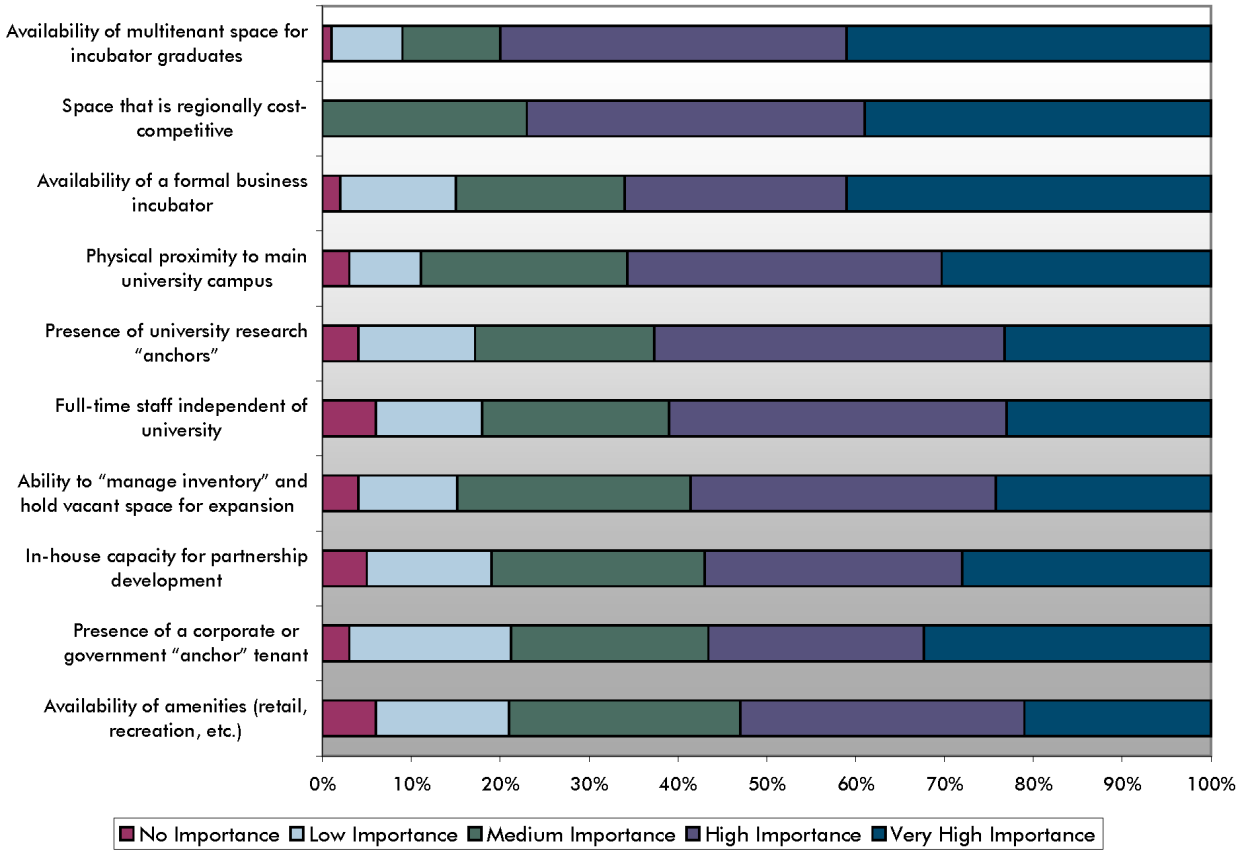


Figure 7. Key Internal Determinants of Success of University Research Parks



Research Parks Are Leveraging Anchor Tenants: Virginia BioTech

Virginia BioTechnology Research Park, situated on 34 acres in downtown Richmond, leveraged the space needs and credit capacity of its academic and government partners to finance the earliest buildings in the park.

Virginia Commonwealth University (VCU) guaranteed the master lease of the park's first multitenant laboratory building, using it mainly for research institutes associated with the VCU Medical Center. The university also leases two adaptively reused older buildings for back-office uses.

The second multitenant lab building was developed for tenancy by the Virginia Division of Forensic Science and Office of the Chief Medical Examiner, and the sixth structure was leased solely to the Virginia Division of Consolidated Laboratory Services.

All these uses were compatible with the bioscience thrust of the park, which also includes a wet-lab incubator, and helped it attract the 450,000-square-foot Philip Morris Research and Technology Center now under final development.

MEASURING THE IMPACT OF UNIVERSITY RESEARCH PARKS

Why Universities Should Care About Research Parks

Park directors indicated that university research parks benefit the university in a number of ways. The most important, with 75 percent of the parks identifying it as of high or very high importance, was the ability of parks to attract research anchors, such as major national laboratories, major corporate tenants, or centers of excellence. Other important ways in which parks benefit the university are (1) park facilities help to attract research faculty, (2) sponsored research agreements often increase as a result of the interactions of faculty and companies in the park, (3) students obtain employment, and (4) the university is given opportunities to commercialize its intellectual property (Figure 8).

Another important benefit of research parks to the university is that they offer a place for faculty and students to work with industry. Three-quarters of the respondents indicated this was a high or very high priority for their park. Beyond the physical resources that they provide, research parks also foster the type of interaction between industry and universities that is critical for translating research knowledge into new technological inventions. While scientists generate basic research knowledge, other professionals with diverse backgrounds, training, and expertise are required to convert that information into technology and guide its development through various stages. Research parks can bring these varied professionals to a single location and, through shared laboratory space, meeting rooms, and break facilities, provide a forum for efficient communication.

Why Communities Should Care About Research Parks

Communities are most likely to measure benefit from research parks by the number of firms attracted to the park, growth in the total number of existing and new companies, the average salaries of park employees relative to the average wage in the region, and employment growth in the region. The number of people who receive workforce training is considered of less importance than measures of job and firm growth (Figure 9). It was suggested that an additional impact is the effect that the park has on the local tax base.

Measuring Economic Impact

Employment in university research parks has regional economic benefits that extend far beyond a particular job or one individual's salary. These core research and technology-based industries have interdependent relationships with suppliers of other goods and services. Companies in research parks both depend upon and support others locally as well as nationally for various services (e.g., legal, marketing, waste disposal, transportation). As a result, the research park sector as a whole has an impact greater than the number of its total jobs might suggest.

To measure the true, extended reach or impact of jobs within university research parks, a set of state- and industry-specific multipliers must be used. Multipliers quantify the ripple effect discussed here where one industry or group of industries supports or creates additional economic entities including jobs, taxes and public revenues, and spending from the salaries of industry workers.

The Bureau of Economic Analysis (BEA) has developed region-specific factors that enable this impact analysis.[3] The direct-effect employment multipliers from BEA are used in

[3] BEA uses its "Regional Input-Output Modeling System," known as RIMS II, for calculating region- and industry-specific multipliers purchased for this analysis. For additional information on these multipliers, see http://www.bea.gov/bea/regional/rims/. Multipliers were not purchased for Canadian provinces; instead, multipliers for the state or states nearest to these provinces were used.

Figure 8. Importance of Methods for Measuring Benefits of a Park to its Affiliated University

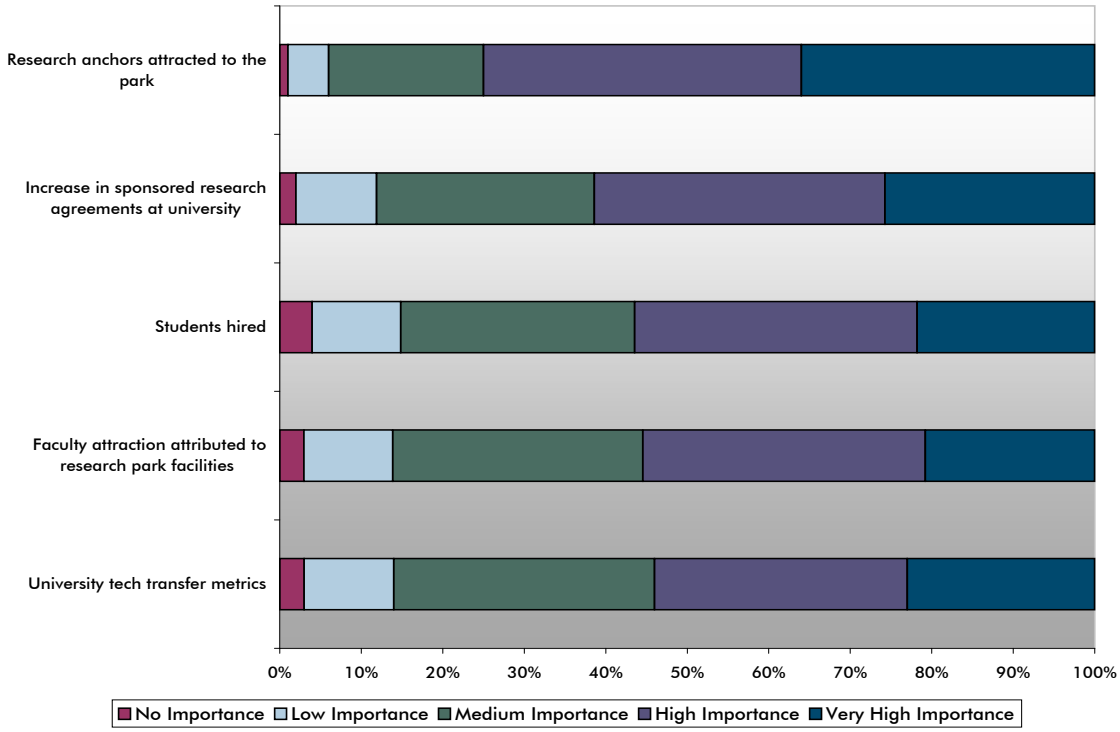
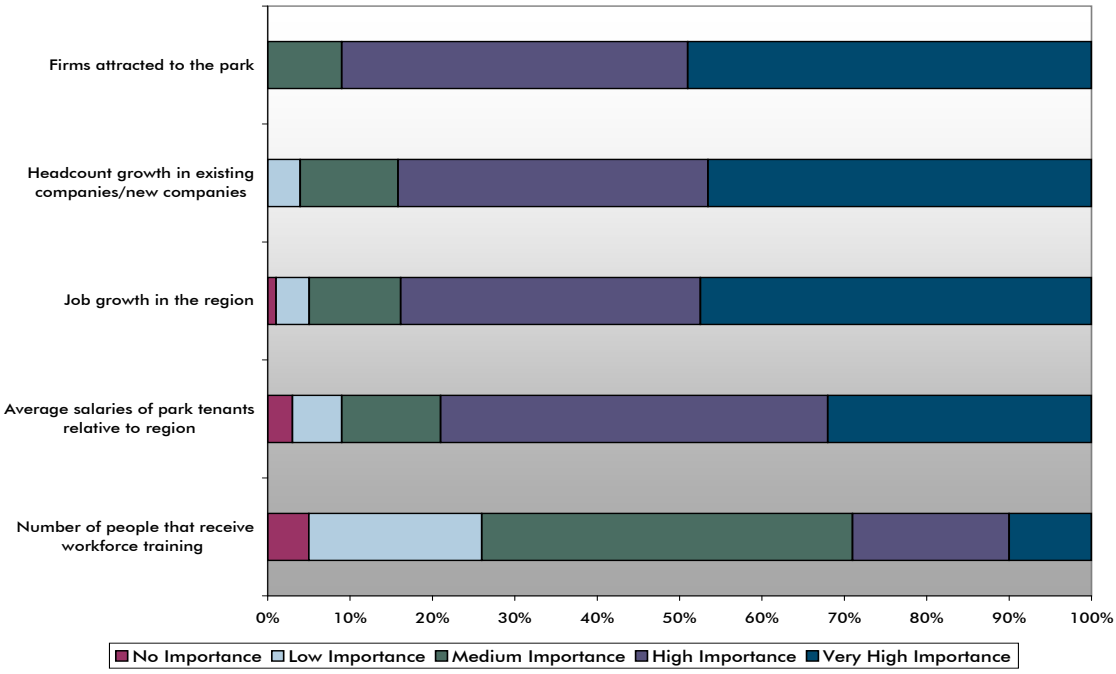


Figure 9. Importance of Methods for Measuring Benefits of a Park to its Community



this analysis to tabulate the unique state and industry impact factors for each major industry of research park tenants. The multipliers represent the total change in number of jobs in all industries (direct, indirect, and induced effects) that result from a change of one job in the corresponding industry sector.

The total indirect and induced employment impact of the 264,413 university research park jobs reported by the parks that provided employment data is an additional 414,738 jobs throughout the U.S. and Canadian economies in all sectors. Taken together, the direct, indirect, and induced research park employment impacts account for a total employment impact of 679,151 jobs (Table 8). This analysis yields a total direct-effect employment multiplier of 2.57.

In order to account for and quantify the full employment levels and impacts of those existing research parks that did not respond to the 2007 survey or did not provide employment detail within the survey, Battelle applied median employment levels (750) and the overall average direct-effect employment multiplier for research parks. The 39 parks that were not accounted for might be estimated to employ an additional 29,250. This boosts the university research park total employment figure to 300,616.

The "core" employment metric does not increase on a full one to one basis as some of these additional 29,250 employees are in "support" or other non-core jobs. Using the core-to-total share against these additional jobs, total core employment rises to 292,914. The overall university research park multiplier (2.57), when applied to this larger core employment figure boosts the total employment impact of all research parks to 752,355.

It is important to note that the multipliers in Table 8 represent a blending of all individual state and provincial responses that were then rolled up into these major industry sectors. Thus, these multipliers represent an overall metric that, for any one specific state, may under- or over-estimate the actual employment impact. For example, the scientific R&D state multipliers range from 1.60 to 2.78. The mix of states and employment levels within this sector contribute to the overall blended 2.43 multiplier shown in Table 8.

To calculate the total employment impacts of each industry and the total for university research parks, it was necessary to collect specific information as to whether a given firm's activities were primarily R&D in nature. The BEA multipliers include a specific scientific R&D industry sector applied to each firm identified as such. Thus, Table 8 details research park employment in industries allocated for these multipliers including a large separate R&D employment total that spans almost every major industry group shown.

For example, overall employment in the drugs and pharmaceuticals sector was 28,007 as shown in Table 4. Research park directors surveyed indicated that, for 90 percent of these jobs, the primary function was R&D in nature. Thus, in Table 8, only 2,897 of that original 28,007 was allocated to the drugs and pharmaceuticals industry; the remainder is allocated to the overall scientific R&D sector.

As shown in Table 8, scientific R&D workers in university research parks number more than 125,000 and their total employment impact is nearly two and one-half times this figure at nearly 305,000 total jobs. The software industry's nearly 14,000 jobs have a total employment impact of almost 44,000. Aerospace and defense companies also have a high relative impact, with their approximately 6,400 jobs having a total employment impact of more than 23,500.

Other research park industries with relatively high employment multipliers include drugs and pharmaceuticals (5.64), computer and related hardware (4.48), agricultural biosciences (4.43), and alternative/renewable energy (4.16). These and other high-impact industries might be strategically targeted in future development efforts of research parks as those providing significant overall economic payoffs at the regional level.

Individual research parks have commissioned studies that have shown significant regional impact (see text box).

Table 8. Research Park Employment by Detailed Industry Allocated for Economic Impact Analysis

Industry Employment Allocated for Multipliers	Current Park Employment	Direct-Effect Employment Multiplier	Total Employment Impact
Total core park employment	**264,413**	**2.57**	**679,151**
Scientific R&D	125,280	2.43	304,691
Software	13,893	3.16	43,964
Aerospace/Defense	6,417	3.68	23,592
Healthcare Services	8,603	2.23	19,156
Centralized Business Support Services	11,134	1.60	17,781
Computers and Related Hardware	3,919	4.48	17,561
Drugs/Pharmaceuticals/Diagnostics	2,897	5.64	16,345
Management/General Business Consulting/ Services	7,810	1.93	15,082
Advanced Materials	3,950	3.81	15,048
Communications Equipment	5,049	2.91	14,696
Scientific and Engineering Services	5,688	2.04	11,587
Medical Instruments and Devices	1,895	3.56	6,751
Laboratories (medical, biological, environmental testing)	2,004	2.28	4,566
Instrumentation and Sensors	1,159	2.67	3,097
Colleges/Universities (nonresearch)	1,772	1.62	2,870
Insurance	913	2.85	2,601
Other Government	815	2.39	1,949
Ag/Plant Biosciences and Related Chemicals	380	4.43	1,682
Environmental Consulting/Services	763	1.72	1,316
Alternative/Renewable Energy	302	4.16	1,256
Other Electronics	152	2.89	440
Misc. Manufacturing	36	2.32	84
Other core employment, not classified	59,583	2.57	153,039

Note: The Other Bioscience R&D and Other Scientific R&D industries shown in Table 4 do not appear in Table 8 as they are included entirely within the overall Scientific R&D industry.

University Research Parks Generate Significant Economic Impacts

A 2003 study of the economic impacts of the Iowa State University Research Park found that the park links directly to almost $88 million in industrial output. Businesses that provide services to park customers and employers generate an additional $46.3 million, for a total impact of $1.34 billion. The park employed 900 Iowans, with an average wage of $40,000.*

A study of the economic impacts of the University of Arizona Science and Technology Park found that the park contributed $1.9 billion to the economy of Tucson and Pima County during fiscal year 2003 to 2004. Total job impact was 13,300 jobs.**

*David Swenson, *The Economic Values of the ISU Research Park and its Tenants,* Department of Economics, Iowa State University, February 2003, http://www.isupark.org/news/pdf/economic_value_study.pdf.

**Vera Pavlakovich-Kochi and Alberta H. Charney, *Economic and Tax Revenue Impacts of The University of Arizona Science and Technology Park During FY 2003–2004,* The University of Arizona, March 2005, http://oepa.arizona.edu/Lib/Media/Docs/2005_uastp_impact_study.pdf.

TRENDS IN UNIVERSITY RESEARCH PARK DEVELOPMENT

Research Parks Today

As stated previously, the research park model has evolved significantly during the past 40 years. This section describes today's research parks and key trends impacting their future evolution.

Research parks have grown at a steady pace during the past three decades. Of the total number of parks that responded to the survey, 6 percent were established in the 1970s; 28 percent in the 1980s; 32 percent in the 1990s; and 30 percent so far in this decade. The majority of the respondents are continuing to construct new buildings. Seventy-four percent of the respondents reported that they had completed a building between 2004 and the present.

The majority of research parks continue to be developed in suburban areas, although activity is increasing in urban areas. Approximately 60 percent of all parks responding to the survey are located in suburban areas. Of those parks established in the 1980s, 54 percent were located in suburban areas; in the 1990s, this number rose to 63 percent. From 2000 to 2003, 73 percent of new parks created were located in suburban areas; however, 53 percent of parks created since 2004 are located in urban areas.

Research parks are considered an effective tool to spur homegrown business retention and expansion. Research parks traditionally were established to recruit R&D and technology companies to locate near a university to build a cluster of high-wage companies. Today, the vast majority of parks report that a primary goal of their park is to serve as a location for existing businesses in the region to grow and expand. Respectively, more than 50 percent and 27 percent of the respondents indicated that growing existing companies is a very high or high priority for their park.

Key Findings

- Research parks have grown at a steady pace during the past three decades
- The majority of parks continue to be developed in suburban areas, although activity is increasing in urban areas
- Research parks are considered an effective tool to spur homegrown business retention and expansion
- Research parks are placing greater emphasis on incubation and entrepreneurship
- Research parks are succeeding in growing new companies that remain in the region
- Research parks are focusing on targeted industry clusters
- Research parks are being viewed as a commitment to economic development
- Tenants locate in research parks to access a skilled workforce
- Research parks use various mechanisms to support university-industry relationships

Research parks are placing greater emphasis on supporting incubation and entrepreneurship to grow their future tenant base. Of the research park directors responding to the survey, 95 percent indicated that creating an environment that encourages innovation and entrepreneurship is a high priority, with 71 percent indicating it as a very high priority for their park. As a result of the focus on incubation, 60 percent of the research parks reported that their tenants are more likely to be smaller, start-up enterprises or corporate lablets rather than the large companies of 5 to 10 years ago. Somewhat surprisingly,

Research Parks are Focusing Increasingly on Incubation of Emerging Companies: Purdue

Begun in 1961 as a conventional office park that buffered the Purdue campus from other uses, the **Purdue Research Park** re-invented itself in the 1990s, focusing heavily on business incubation.

Purdue Research Foundation, the owner of the park, built on the success of an existing multitenant building, supported by a variety of business-acceleration programs also managed by the Research Foundation, such as the Gateways program for entrepreneurial development and the Trask Fund for precommercialization research.

By investing its endowment funds and leveraging tax-increment financing through the state's Certified Technology Park program, Purdue more than quintupled the acreage of the park and added a new incubator (since doubled in size) as well as a second multitenant building. This growth has brought the space dedicated to small and emerging businesses to more than 200,000 square feet.

Research Parks Are Succeeding in Incubating and Growing Companies

- Nearly 800 firms graduated from park incubators in the past 5 years
- About one-quarter of these graduates remain in the park
- Only 13 percent failed
- Less than 10 percent left the region

the percentage of multitenant buildings being built has decreased as a percentage of total new buildings built. In the 1980s, 53 percent of the buildings constructed in university research parks were multitenant buildings; in the 1990s, 50 percent were multitenant; but, since 2000, only 39 percent of the new buildings constructed have been multitenant. Yet, examples of parks exist, such as the Chicago Technology Park, that are primarily multitenant.

University research parks are succeeding in incubating and retaining start-up firms in the community. Fifty-nine parks reported graduating a total of 759 firms from a park incubator during the past 5 years. Of these, 62.5 percent remain in the region: 156 (20.6 percent) moved to multitenant space within the park, 19 (2.5 percent) moved to their own building in the park, and 299 (39.4 percent) left the park but remain in the community (Table 9). Of the remainder, 15.1 percent were acquired or merged, 12.8 percent are no longer in business, and only 9.6 percent left the region.

Table 9. Incubator Graduates

Number of Graduates Who	Number of Firms	Percentage of Total
Left the park but remain in the community	299	39.4%
Moved to multitenant space within the park	156	20.6%
Acquired or merged; and other outcomes	115	15.1%
Are no longer in business	97	12.8%
Left the region	73	9.6%
Moved to own building in the park	19	2.5%
TOTAL	**759**	**100.0%**

Research parks are more likely to be targeted to particular niche areas. To compete in technology development, a region or state in its economic development efforts must differentiate itself and cultivate and sustain specialized areas of expertise where it can be a world leader. As the National Governors' Association in its *Governor's Guide to Trade and Global Competitiveness* explains: "Each state must exploit the unique advantages it has relative to other states and build on the strengths found in its local "clusters of innovation"—distinct groups of competing and cooperating companies, suppliers, service providers, and research institutions."[4]

Research Parks Are Focusing on Niche Expertise

The 265-acre Clemson Research Park, originally developed by the South Carolina Research Authority in Anderson, 9 miles from campus, was once filled with companies with few clear connections to the university's research strengths.

In 2006, the university and Anderson County announced a reinvention of the park, under which it will be renamed the **Clemson University Advanced Materials Center** and will be anchored by the university's 111,000-square-foot Advanced Materials Research Laboratory.

The park will target global-scale advanced materials companies and will also have a new-business incubator. It complements the Clemson University International Center for Automotive Research (CU-ICAR), another research park being developed 30 miles to the northeast in Greenville. CU-ICAR is also off the main Clemson campus but is being anchored by another specialized university facility, the Carroll A. Campbell Jr. Graduate Engineering Center.

[4] *Governor's Guide to Trade and Global Competitiveness,* National Governors' Association, 2002, p. 5, http://www.nga.org/Files/pdf/AM02TRADE.pdf.

The need to drive economic growth through focus areas is not a new concept in state and regional economic development. Different today, however, is the emphasis placed on technology-based innovation. A region's ability to lead in technology innovation and deployment in specific focus areas is becoming a critical and defining driver of economic competitiveness.

This approach can be seen in the number of research parks focusing on specific technology areas. Bioscience is the most common focus area for specialized research parks; but, examples of parks exist in other sectors, such as Clemson University's Advanced Materials Center and Cornell's Agriculture and Food Technology Park (see text boxes).

Universities Are Developing Very Focused Niche Parks: Cornell's 'Technology Farm'

Cornell's **Agriculture and Food Technology Park** (also known as the Technology Farm) targets the specific strengths of the university's New York State Agricultural Experiment Station in Geneva, a satellite agricultural research center 45 miles from the main campus in Ithaca.

While all animal research takes place in Ithaca, Geneva is home to 50 university faculty members and 250 staff specializing in the basic science and applied-technology needs of New York State fruit and vegetable growers (including the nearby Finger Lakes vintners) and food processors.

Anchored by the planned expansion of a USDA Agricultural Research Service germplasm repository into a major National Grape Genetics Lab, the 74-acre research park is a cooperative effort of the university, the city, the county, and the local utility company.

It includes a 20,000-square-foot multitenant "flex" building for commercial use and upgraded pilot-plant facilities for the food and beverage industries.

Research parks are being viewed more as an expression of commitment to economic development. In the past; many research parks were primarily viewed as a passive real-estate investment with limited university involvement or presence. That is not the case today as the results in this report document. Two-thirds of respondents indicated closer involvement by university leadership and more emphasis on university involvement in the past 5 to 10 years.

Park directors report that the primary reason why tenants locate in a university research park is to access a skilled workforce, including students. Eighty-five percent of the respondents indicated that access to a skilled workforce was of high or very high importance to tenants. Other attributes of a university research park that are important to tenants are the quality of buildings; the prestige of being located in a research park; and access to university faculty, facilities, and equipment (Figure 10).

University research parks use various mechanisms to foster university-industry relationships. The most effective include having partnership-developer staff or others charged with relationship building between industry and departments, availability of university core user facilities open to industry, human resource matching programs such as internships and co-ops, and access to university research labs and university technology transfer and commercialization offices. Pilot plants or demonstration labs open to industry and university educational course offerings available at the park are of lesser importance (Figure 11).

Figure 10. Reasons Why Tenants Locate in University Research Parks

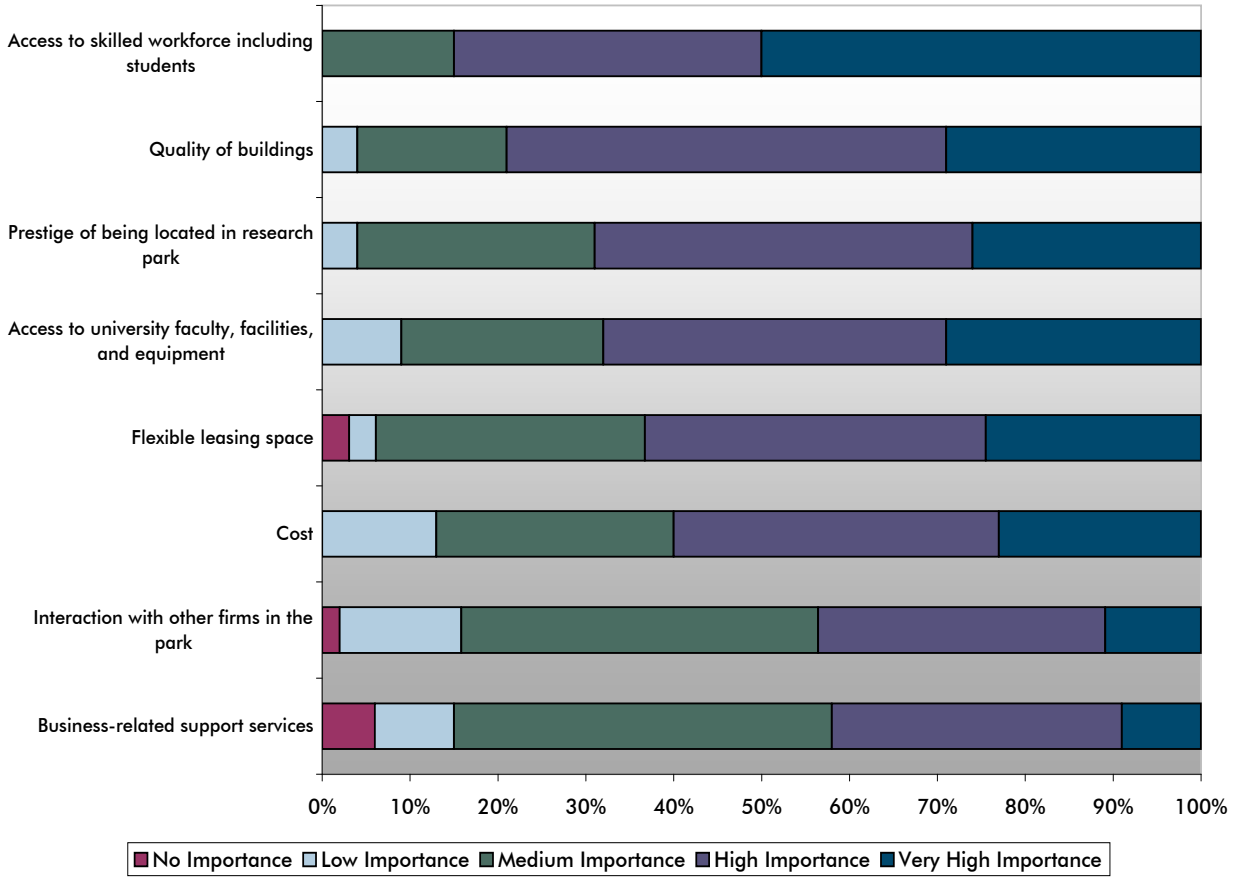


Figure 11. Importance of Various University-Industry Partnership Mechanisms

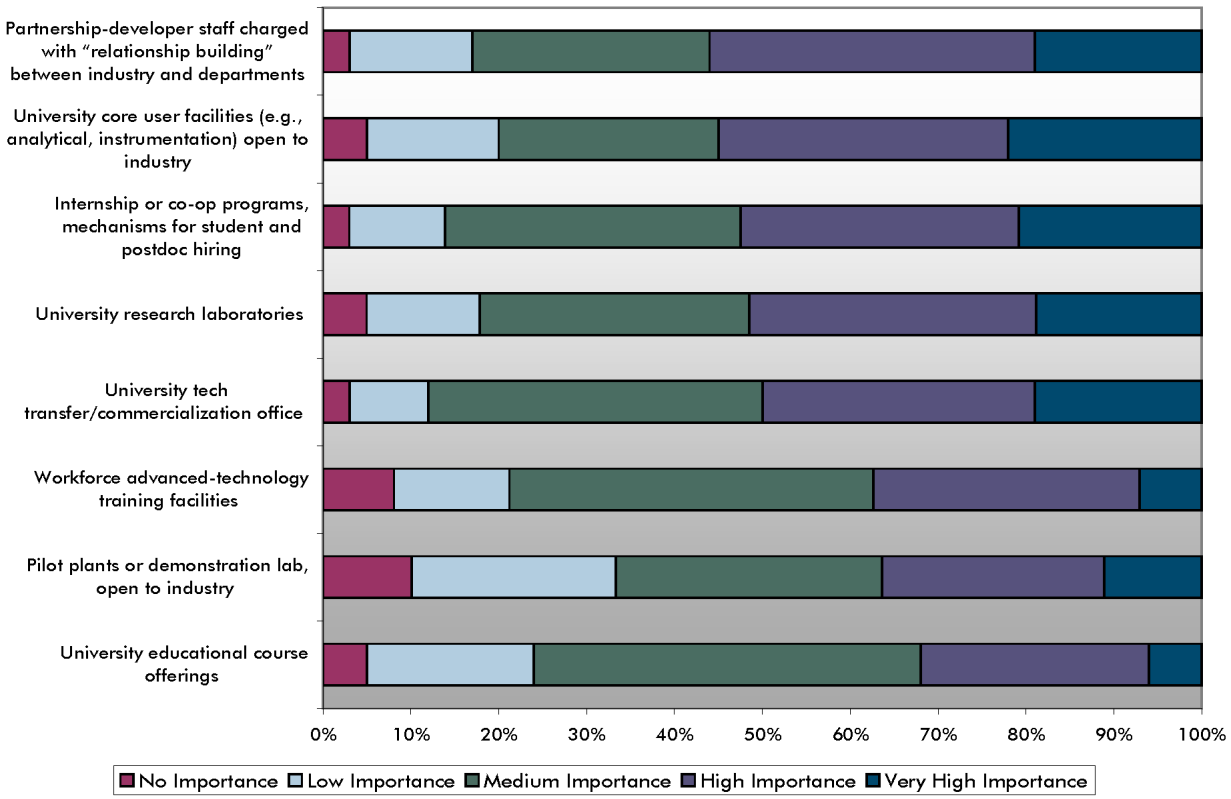


Table 10 shows the number of parks that reported having specific university-industry partnership mechanisms. The large number of responses across the mechanisms for university-industry partnerships suggests that parks, recognizing the differing needs among industries, areas, and firms, are offering not only one but a menu of methods for park tenants to engage and work with higher-education institutions. Universities and research park managers should continue and expand these menus because one size *does not fit* all. No one mechanism is sufficient; a number of mechanisms must be used concurrently. While this will be discussed further in "The 21st Century Research Park: Challenges and Opportunities" section of this report, parks are starting to increase their focus on the talent or workforce issue through internship or co-op programs, but generally have not moved further along the talent continuum of interventions to course offerings or training facilities.

University Research Parks of the Future

A new model—strategically planned mixed-use campus expansions—is emerging that involves shared space in which industry and academic researchers can work side by side. These university-affiliated mixed-use campus developments are not simply real-estate activities. They embody a commitment by universities to partake in broader activities, offering companies high-value sites for accessing researchers, specialized facilities, and students and promoting live-work-play environments. Key features of these mixed-use developments include the following:

- Substantial space for significant future research growth
- Planned multitenant facilities to house researchers and companies
- Housing and other amenities attractive to young faculty, postdocs, and graduate students

Table 10. University-Industry Partnership Mechanisms Offered by Parks

Mechanism	Number of Parks Offering Mechanism
University research labs	78
Partnership-development staff or others charged with "relationship building" between industry and departments	70
University tech transfer/commercialization offices	65
University educational course offerings	64
Human resource matching: internship or co-op programs, mechanisms for student and postdoc hiring	62
University core user facilities, open to industry	58
Pilot plants or demonstration lab, open to industry	44
Workforce advanced-technology training facilities	39

The Future of Research Park Development

- A new model—strategically planned mixed-use campus expansions that include space for academic and industrial uses—emerges
- On-site amenities are critical to attract innovation employees
- Research parks serve an effective tool to spur urban revitalization
- Research parks are used to leverage assets of non-university R&D organizations
- Research parks become leaders in sustainable design
- Research parks embrace global focus

- Flexible development options, some led by universities and others led by developers.

Greater emphasis is being placed on providing a range of amenities in addition to office and lab facilities. North Carolina State's Centennial Campus is a leading example of a mixed-use campus (see text box on next page) . The University of California at San Francisco (UCSF)/Mission Bay development, the University of South Carolina's (USC)/Innovista, and the Piedmont Triad Research Park in Winston-Salem (see text box on page 26) offer additional examples of the research park of the 21st century.

- **UCSF/Mission Bay.** Mission Bay comprises *layers* of mixed uses, all surrounding a new research campus for UCSF built on 43 acres donated to the university as part of the overall redevelopment of a 303-acre former rail yard. The UCSF campus itself is mixed use, including four major bioscience laboratory buildings; housing for more than 800 faculty, students, and staff; a community center; a childcare center; two garages; and a central green space.

  That institutional core is adjoined by an additional 14.5 acres set aside for a planned 289-bed hospital center and by space for commercial bioscience uses being developed by both nonprofit and for-profit owners. Finally, both areas are buffered from downtown by a larger area for general office and retail development, along with thousands of more housing units (many affordable). The live-work population of the entire redevelopment district is projected to reach 9,000 by 2020.

- **USC/Innovista.** USC is collaborating with private developers on a 200-acre, mixed-use, live-work zone in downtown Columbia called Innovista. Connecting the city's arts district to the riverfront, Innovista will have several "neighborhoods" that parallel faculty cluster-hiring initiatives supported by the state through its Centers of Economic Excellence program, and infrastructure financing through the state's Life Sciences

Centennial Campus at North Carolina State in Raleigh NC

Example of a university-affiliated research park development as part of larger-scale mixed-use developments:

In the 1980s, pressure for space at the main North Carolina State University (NCSU) campus in Raleigh led to exploration of nearby options, including substantial holdings by the state mental-health system and the Diocese of Raleigh on 1,000 acres surrounding the old Lake Raleigh Reservoir. Starting in the 1980s, the land was conveyed to NCSU in stages, and serious planning began with the appointment of a former dean of the university's School of Design to the position of campus coordinator. At the outset, Centennial was conceived as a "smart growth" community that would incorporate a live-work environment and minimize the need for driving through its envisioned light-rail connector to the main campus. (The connector is still not built, but its functions have been assumed by the campus bus system.) The plan for Centennial evolved into a unique combination of institutional and commercial space side-by-side in a dual-use "campus of the future." The campus is divided into "neighborhoods" serving diverse high-tech sectors, each focusing on programmatic strengths of the university. First to move was the College of Textiles, followed by the research (and now the instructional) components of the College of Engineering and selected units of other colleges. In 2002, some 200 additional acres already owned by the university and home to its College of Veterinary Medicine were renamed "Centennial Biomedical Campus" and will be developed using the Centennial Campus model. In all, 1,334 acres will be developed, and the campus is still at less than 20 percent of its anticipated total square footage.

Act. Each neighborhood features at least one academic building owned by the university and one building for commercial research partners financed by private developers. The currently planned neighborhoods serve "future energy," public health, and biomedical uses.

Amenities will be an important offering of future research parks. On-site amenities, such as restaurants and retail stores, are considered important in attracting innovation employees; yet, the number of parks reporting such development was fairly small. Three-quarters of the respondents indicated a greater emphasis on amenities within the park now than 5 to 10 years ago. But, while 45 parks indicated that their parks included university-only and specialized facilities, only 35 indicated that their park contained a conference center, 21 reported the presence of a hotel, 21 have retail shops, and 20 include on-site housing. These small numbers may indicate that parks have not yet been able to incorporate amenities or are having difficulty finding the financing to develop them. It may also be easier to address some elements in an urban rather than a suburban setting.

University Park at the Massachusetts Institute of Technology exemplifies a park including various amenities. In addition to 1.5 million square feet of wet-lab facilities in nine buildings and 674 residential units in five buildings, the park includes the following:

- A 210-room hotel and conference center
- Two restaurants
- A health club
- A full-service grocery store
- Banking services
- A childcare center.

Research parks are being developed in urban areas as a component of neighborhood revitalization plans, such as the park under development adjacent to Johns Hopkins University in Baltimore, the Center of Research,

Research Parks and Urban Redevelopment: Piedmont Triad

Some 200 acres of historic downtown Winston-Salem NC are being transformed by **Piedmont Triad Research Park**, anchored by a new biomedical research campus for Wake Forest University Health Sciences and other educational facilities.

The park, divided into three districts, has a master plan calling for ultimate buildout to 5.7 million square feet. In addition to research facilities for the university and commercial tenants, the park will include office buildings, retail shops, restaurants, and some residential housing.

Complementing other downtown revitalization initiatives, the park will honor the urban street grid, connecting new buildings and surrounding "urban park" open space to existing historic structures and retail clusters in the city's core.

Both bioscience and IT tenants occupy several new multitenant buildings. The park also includes space for a satellite office of the North Carolina Biotechnology Center and for a node on the state's network of biomanufacturing training facilities at community colleges and state universities.

Technology and Entrepreneurial Exchange (CORTEX) in St. Louis, and Piedmont Triad Research Park in Winston-Salem (see text box). But, nearly half the respondents indicated that they did not think there was more emphasis on parks being built as part of a revitalization effort rather than as a greenfield development.

Research parks are being developed to leverage the assets of non-university R&D organizations such as federal laboratories. In addition to universities, major medical research centers and public and private research organizations can be key drivers of TBED. It is becoming increasingly common for communities in which a federal laboratory is located to create a research park to leverage laboratory resources to realize economic development.

Federal laboratories attract companies that wish to leverage the expertise of the laboratory researchers and to gain access to highly specialized, and often unique, facilities and equipment. Research parks can also provide a location for start-up companies that are created to commercialize technology developed in the lab and for lab contractors.

Sandia Science and Technology Park, the National Aeronautics and Space Administration (NASA) **Research Park @ NASA Ames**, and the **Tri-Cities Science and Technology Research Park** located close to the Pacific Northwest National Laboratory are examples of research parks that have been developed by or adjacent to federal laboratories. Another example, the East Tennessee Technology Park at Oak Ridge National Laboratory, is described in the text box on the next page.

More emphasis is being placed on sustainability as a design principle. Sustainable development involves balancing development needs against protection of the natural environment so that needs can be met now and in the future. Such development takes into account economic, environmental, and social considerations. In the future, it is likely that research parks will be developed to minimize impact on the environment and to use renewable energy sources and "green" building practices. "Green" building practices refers to the design and construction of buildings in such a way that it increases the efficiency of the building and its use of energy, water, and materials while at the same time reducing the building impacts on human health and the environment through better design, construction, operation, and maintenance. Two-thirds of the respondents indicated that there has been an increase in the emphasis on sustainability in the past 5 to 10 years and this trend is likely to continue. Vancouver Island Technology Park exemplifies

Research Parks Are Developing in Partnership with Federal Labs

As Oak Ridge National Laboratory (ORNL) reduces the amount of land needed to carry out its missions for the U.S. Department of Energy (DOE), the park contractor (a joint venture of Battelle and the University of Tennessee [UT]) is focusing on the research park model to reuse land and contribute to regional economic development.

Several related initiatives are under way or proposed. For several years, the Community Reuse Organization of East Tennessee (CROET) has been marketing East Tennessee Technology Park, comprising 7,000 unneeded acres at both the historic gaseous diffusion plant and a greenfield site nearby.

Last year, the DOE lab announced it would lease 40 additional acres on the active ORNL research campus to CROET for Oak Ridge Science and Technology Park, which will provide programmatic support for substantive interaction between companies and ORNL researchers. Two 100,000-square-foot buildings are under construction by private owners, one an engineering services contractor and the other a developer of multitenant space.

These developments have spurred complementary research or technology-park initiatives at the UT Knoxville campus and on private land elsewhere in what is now being branded as the "Oak Ridge Innovation Valley."

Vancouver Island Technology Park Achieves LEED Gold Certification

The University of Victoria created the Vancouver Island Technology Park in 2001 to promote academic, industry, and government collaboration designed to lead to the establishment and maintenance of research and technology-based facilities in British Columbia. The park was developed on 35 acres and used a former hospital as its first building. This building, developed as a "green building," has since been certified as the first Leadership in Environmental and Energy Design (LEED) Gold Certified Building in Canada. (LEED is a rating system developed by the U.S. Green Building Council.)

Some of the actions taken to make the park green included the following:

- Reduce overall potable water use by using waterless urinals, dual flush toilets, and Sensor Flush.
- Limit the use of potable water for landscaping irrigation by planting native plant species.
- Recharge the water table with storm water filtered through grass and gravel parking.
- Filter polluting substances and sediments out of storm water run-off from vehicle parking and roads before it leaves the site by using Water Filtration.
- Create moderate microclimate with vegetative cover. Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.
- Conserve and/or create native plantings and wildlife habitat through appropriate landscaping strategies.
- Minimize potentially harmful chemical pollution in managing indoor and outdoor plant and structural pests by not using pesticide products on landscaping.
- Reduce disposal of waste materials in landfills by providing on-site recycling facility.

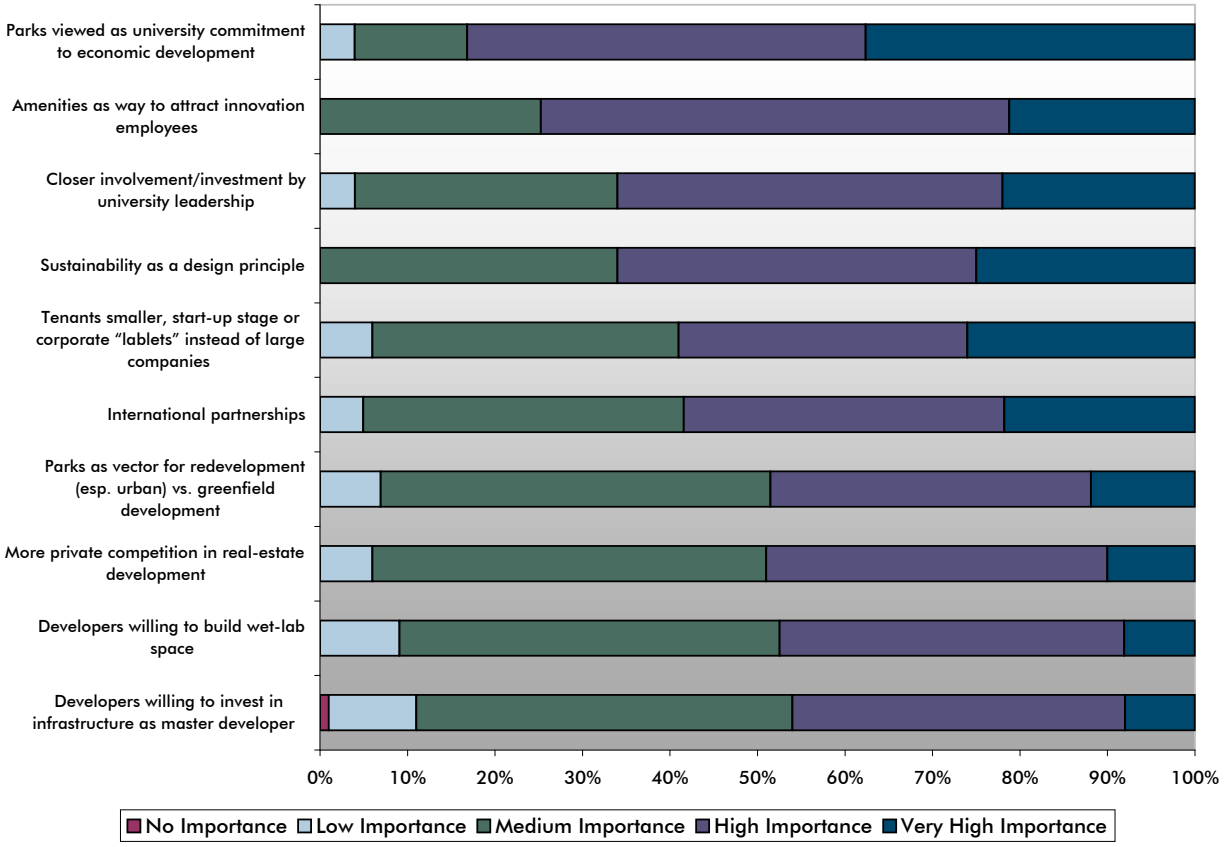
a park that has adopted sustainability as a design principle that would attract tenants, which has proved to be the case according to park management (see text box on page 27).

International partnerships are becoming more important in university research parks. Sixty percent of the research parks surveyed indicate that there was more emphasis on international partnerships in the past 5 to 10 years than previously, and park directors said that they expected to see parks attracting more international tenants and having more of a global focus in the future. Forty-five percent of the respondents replied that serving as a landing pad for the recruitment of both national and international industry to a region is a very high priority; another 34 percent indicate that it is a high priority.

University Research Park in Madison WI has signed a formal agreement with the Biotechnology Innovation Center in Frankfort, Germany. The purpose of the agreement is to encourage strategic collaborations between researchers and companies in each of the parks. It is anticipated that the companies in each park will be made aware of the capabilities and expertise of the companies in the other park. The parks will also share information on research park operations and best practices in areas such as workforce development, technology transfer, venture capital, and business incubation.

Figure 12 summarizes the respondents' views on the changes that have occurred in university research parks during the past 5 to 10 years.

Figure 12. Importance of Changes in Research Parks in Past 5 to 10 Years



Summary

Today's university research parks seek to create meaningful linkages between the university's resources and capabilities and the companies located in the research park. Providing a physical location that promotes such interaction can effectively stimulate innovation and generate economic activity. But, as tenants and sponsoring institutions require more of university research parks, the parks are challenged to meet both rising expectations and the demands being placed on them, such as providing amenities, services, and live-work-play environments.

THE 21ST CENTURY RESEARCH PARK: CHALLENGES AND OPPORTUNITIES

These survey results show the emergence of a new recipe for research park development—much different than the model that emerged in the 1960s and 1970s (Figure 13). Most older research parks focused on recruiting firms as tenants; but, these firms interacted very little or not at all with researchers at the nearby university or federal laboratory. Most parks were developed as "green space," and few included university facilities. The 21st century model evolving today is based on the following:

- Building a strong entrepreneurial development focus that seeks to recruit and support entrepreneurs from the university and community in a "grow-our-own" approach.
- Offering tenants multiple ways to interact with a university, such as providing access to specialized labs, employing students as interns, using university services and support, and interacting with researchers at university facilities located in the park.
- Adding amenities, such as service support, retail and commercial establishments, and, in some instances, residential housing nearby as part of the development scheme.
- Tailoring more varied approaches to development, including working with developers on a per-parcel or per-site basis and addressing demands for both single-tenant and multitenant facilities.

The University of Maryland–College Park M Square Research Park is an example of a park being developed along these lines (Figure 14).

RTP is evolving to respond to today's needs (see text box on page 33).

Figure 13. Evolution of University Research Parks

Early Parks: Stand-Alone Physical Space	1990s: Connections	2000 and Beyond: Economic Driver for the Region
▪ Real-estate operations ▪ Campus-like environment, selling single parcels of land ▪ Focus on industrial recruitment ▪ Few, if any, ties between tenants and university or federal laboratories ▪ Little provided in terms of business assistance or services	▪ Anchor with R&D facilities aligned with industry focus of park ▪ Innovation Centers and technology incubators more common ▪ Multitenant facilities constructed to accommodate smaller companies ▪ Some support for entrepreneurs and start-up companies provided directly	▪ More and more mixed-use development, including commercial and residential ▪ Increased focus and deeper service support to start-ups and entrepreneurs ▪ Less focus on recruitment ▪ Formal accelerator space and plans for technology commercialization roles emerge ▪ Greater interest on part of tenant firms in partnering with universities ▪ Universities more committed to partnering with research park tenants ▪ Amenities from day care to conference and recreational facilities added

Figure 14. M Square, University of Maryland Research Park

The Research Triangle Park—Building on a Legacy for Future Sustainability

RTP was founded in 1959 by government, university, and business leaders as a model for research, innovation, and economic development. By establishing a place where educators, researchers, and businesses could collaborate as partners, the RTP founders hoped to change the economic composition of the region and state, thereby increasing opportunities for North Carolina citizens.

RTP is one of the oldest and largest examples of positive impact on an economy by strategic investments in education, infrastructure, and business climate. RTP's success was built around its first-mover status in research parks, its ability to build a critical mass of technology companies and knowledge workers, and its linkages to the region's universities' R&D strengths. RTP's future success will depend on its ability to build on its strengths and address global and technology trends.

Over the past 50 years, the vision for RTP has transformed into the leading and largest planned research park in North America, recognized around the globe for its world-class R&D companies and contributions. Spanning 7,000 total acres, with 20 million square feet of developed space, RTP is currently home to over 157 companies employing more than 39,000 knowledge workers in a wide array of industries. RTP is steeped in deep and robust relationships with three world-class research universities in close proximity: Duke University in Durham; NCSU in Raleigh; and the University of North Carolina at Chapel Hill.

As the Research Triangle region has grown both outward and inward toward RTP, a host of amenities has developed around RTP. Currently, major initiatives are under way to re-develop older RTP properties and encourage retail and residential development in parcels directly surrounding the park. Within a 4-mile radius of RTP's boundaries, 13 million square feet of built space and 15,000 acres are under development for office, commercial, retail, and industrial uses. In the same area, there are more than 40,550 housing units, offering executive housing, single-family homes, townhouses, and apartment units. The developments around RTP have contributed to a unique urban landmass with a tremendous impact on the region's and state's economic vitality and dynamism. No other campus location in the Research Triangle region has comparable access to such a broad mix of housing and retail opportunities.

Because of its history of success, first-mover advantage, and grand scale and vision, RTP is uniquely positioned to evolve once again and accomplish first-mover advantage among research parks. Building on historically low-density development and incorporating the best of new urban design standards, RTP is influencing a new urban land form characterized by mixed-use developments close to world-class R&D operations placing increasing importance on green building, carbon neutrality, and environmental sustainability. RTP incorporates the best of historical research park principles with the best of new urban design standards.

RTP is committed to remaining a place where companies and academic talent can come together. RTP's scale makes it possible to be transformational, to maintain its status as a vital economic engine for the region, and to compete on a global level. The opportunity to marshal the collective resources of RTP's world-class R&D firms and research university connections will enable RTP to be a leader in forging a new, "next generation" model to ensure that it remains a place where world-class knowledge workers and R&D operations will congregate and develop the future's great ideas.

Challenges

Research parks are an important component of the innovation infrastructure needed to support today's knowledge economy, much as roads, bridges, and rail were critical to yesterday's industrial economy. Research parks have evolved and matured to become more integrally related to their higher-education partners and technology-driven tenants. **But, there is still an unfinished agenda.** This survey found that all aspects of the multidimensional components of a business–higher-education partnership have not fully developed and research parks face challenges as they continue to try to respond to the demands placed on them.

Among the key challenges facing research park directors and institutions developing a research park are the following:

- **Difficulties experienced in commercializing technology.** While university research parks can lead to commercialization of new technologies by promoting relationships between researchers and companies, moving innovation into the marketplace does not happen naturally or easily for several reasons. First, university-developed technologies often require additional work to determine their commercial potential, but little funding is available for such proof-of-concept activities. Second, even if commercial potential can be demonstrated, investors and customers are often unwilling to assume the risk associated with new technology; small entrepreneurial businesses, increasingly the focus of research parks, generally lack the financing necessary to identify and promote new technologies. Third, academic researchers often do not understand the marketplace and therefore do not know the commercial potential of their discoveries. A challenge for research parks will be to provide support services to ease the commercialization process. While some universities are trying to do this directly, a growing body of evidence reveals that commercialization (as distinct from technology transfer) may require a separate entity. Locating the university's commercialization function at a research park offers the university access, but permits more down-stream application to be developed in a non-academic setting closer to industry.
- **Continuing need to break down cultural barriers between the academic and business communities and to facilitate true partnerships.** Facilitating industry-university partnerships is at the heart of a university research park development. While parks are devoting greater attention to nurturing such partnerships, efforts in this area remain more an art than a science. Parks must continue to serve as an intermediary that understands both cultures and innovatively foster integrated, collaborative efforts.
- **Achieving greater integration with the university.** The survey results indicated that university administrations and leadership have become more supportive and view research parks as a key element of the university's economic development efforts. Still, research parks must vie for resources, and many are viewed as separate from the university campus and its faculty. Research park directors must continue to integrate the research park and its tenants into the fabric of the university. Ways to accomplish this include allowing scientists and technical employees of park tenants to hold adjunct positions and giving park tenants access to the same privileges accorded faculty and students such as parking and transportation systems, exercise complexes, libraries and databases, and athletic and cultural events.
- **Identifying sources of support for both operations and buildings.** Most research parks have very few resources in their early stages and do not generate sufficient revenue to be self-supporting. The need for capital will become even greater as research parks try to implement live-work-play models. Greater involvement by the private sector is likely to be needed; but, additional support from public and university

sources also will be needed to provide the entrepreneurial and commercialization assistance required for parks to succeed as they seek to grow new companies.

- **Increased competition owing to globalization and the changing nature of corporate R&D.** Research parks are being built all over the world, and many of them are populated with operations of U.S. companies. Research parks in North America will be challenged to attract the operations of foreign companies and to retain the R&D operations of U.S. companies.

Opportunities

The challenges noted above also suggest opportunities for research park development. Research park managers will need to devote more attention and time to the following 10 areas as they evolve the 21st century research park model:

1. **Industry-university partnerships.** Research parks will need to expand the relationships and deepen the partnerships between industry and educational and medical institutions. To accomplish this, parks could offer adjunct faculty status to tenants or increase access to core specialized equipment and labs. Parks may also want to develop formal affiliation agreements with their partnering higher-education institutions that spell out tenant services and support, means of access, and other issues of the relationship.
2. **Financing and support for commercializing intellectual property.** Research parks will need to offer funding and support for technology commercialization, including proof-of-concept funding. Universities have invested and improved their focus on technology transfer in the past decade. But, only a few have undertaken comprehensive efforts to commercialize technology, including providing support to develop prototypes, conducting engineering optimization analysis, and supporting firm building. It is generally recognized that much of this work may be appropriately separated from a higher-education institution, federal laboratory, or medical center. Parks may offer a location for performing and operating technology commercialization; but, it must be recognized that external funding from various partners will be required to pay for this function. External financing is critical for most parks that want to play a greater role in commercialization.
3. **Retention and attraction of talent.** Figure 10 showed that access to a skilled workforce is a critical reason for tenants to locate in research parks. Many parks offer internships, co-ops, and other programs to place students and postdocs with companies. It is less common for universities to offer educational courses or workforce advanced training within the park. Just as research parks in the past decade offered space choices—incubator, accelerator, multitenant and single tenant—they may need to consider offering access to graduate, certificate, and short courses on-site. In the future, as the pace of technology makes skills obsolete in shorter and shorter time periods, research parks may also create formal workforce advanced-training facilities to meet companies' needs for technical talent. Partnerships with community colleges and technical institutes may address both technician talent and lifelong learning needs of park tenants and their employees.

   Research parks can also become a locus for building a cadre of managers with experience in starting and growing technology companies. Parks may wish to consider having experienced CEOs serve as "entrepreneurs in residence" or interim CEOs able to advise start-up and emerging companies. Such individuals can also serve as technology scouts, looking for intellectual property with the potential for commercial development.

4. **Speculative and surge space development**. In the old economy, local economic development agencies offered "speculative" (spec) space, paid for from community and federal funding sources, to fast-track recruitment prospects. In the knowledge economy, firms come and go more quickly, space needs change constantly, and flexible space will increasingly become the norm. Parks may be able to offer the equivalent of 20th century spec space in a 21st century innovation model, through a staged program of expanded multitenant space. Designing park financial models to support the development of a certain amount of spec space would allow parks to offer their local communities flexible multitenant technology space, much as industrial parks offered manufacturing flex space in the past. Higher-education partners can, and increasingly will, help address the financial implications of such space by using it as surge space to handle industry- and government-sponsored research peaks and valleys.

5. **Collaboration among firms and with other partners**. While park managers did not rank this desire as high a priority as might be expected, it is likely that technology tenants want more opportunities to network among each other and with sources of knowledge in labs, research organizations, and elsewhere. Parks will, in partnership with trade and other associations, need to increase their focus on tenants' networking needs and requirements.

6. **Safety and security.** Research parks may have a role to play in offering safe, secure environments for technology development. The post-9/11 world suggests the need for controlled access to key strategic technology assets, whether in education or industry. Parks may be well positioned to test, demonstrate, and pilot approaches to address secure and safe environments for replication in the world economy.

7. **Ongoing financial support.** For research parks to be drivers of economic development, they must continue to invest scarce resources in their quality attributes. As a result, most parks will continue to have limited retained earnings. Parks need diversified funding sources, and investments in research parks need to be considered as investments in a region's or nation's economic development infrastructure. Just as their revenues are an inappropriate measure of the effectiveness of technology transfer offices (more appropriate measures would be volume of sponsored research or number of new companies created), similarly, research parks should not be expected to show the same profits as private real-estate development.

8. **Urban community revitalization.** Recently, a number of universities located in urban settings have begun to apply the research park concept not only to provide needed R&D space for academics and their industry collaborators, but also to stimulate the redevelopment of neighborhoods. This surge in urban research parks appears to stem, in part, from development of bioscience parks by medical centers. Because these urban parks are a fairly new phenomenon and in early stages of development, their success in revitalizing distressed neighborhoods remains to be seen. Research parks may have a role to play in cities seeking to grow their technology industry base.

9. **Performance and accountability.** Accountability in public and private sectors requires that research parks continue to monitor their impacts and results. This survey was an important first step in developing baseline data on the economic impact of university research parks. Working collaboratively through organizations such as AURP, research parks should continue to develop and refine a set of appropriate metrics and explore various mechanisms to measure their impacts and successes.

10. **Value-added tenant services.** Parks in recent years have substantially increased tenant services, particularly to small, growing technology firms. But, the nature and portfolio of services desired in the future are likely to change. Whether through boot camps, product development competitions, or other means, research parks—because they are off campus—can do the applications work that complements the research focus of the medical center, lab, or higher-education institution. Working with private-sector service providers, their incubator and accelerator programs, and technology transfer offices, parks may be a test bed for new ideas and approaches in building technology-driven firms and their products and processes. Parks offer the environment for these activities, which likely will be performed and operated by other entities rather than by park management.

Summary

Parks may offer locations where discovery is translated into application. The remarkably strong interest in entrepreneurship by park managers can be built upon by addressing park roles in areas such as collaboration, security, talent, and technology development. Parks can become places to develop talent; commercialize technology; and integrate government, higher-education, and industry interests.

CONCLUSION

University research parks are not a new phenomenon. Some parks are mature, but new parks continue to emerge and much larger capacity is envisioned for the future. Research parks are important contributors to regional economies. Research park tenants employ 270,000 workers; of these, 264,000 are core employees and generate an additional 414,738 jobs in the economy, for a total employment impact of 679,151.

But, today's research parks differ from those of the past. Today's parks are creating an environment that fosters collaboration and innovation, leveraging the talent and expertise of universities to drive TBED. Today's research parks pursue a "grow-your-own" strategy by nurturing entrepreneurs and new and emerging companies and providing space for existing companies to expand. At the same time, they seek to attract research anchors and the research operations of major corporations.

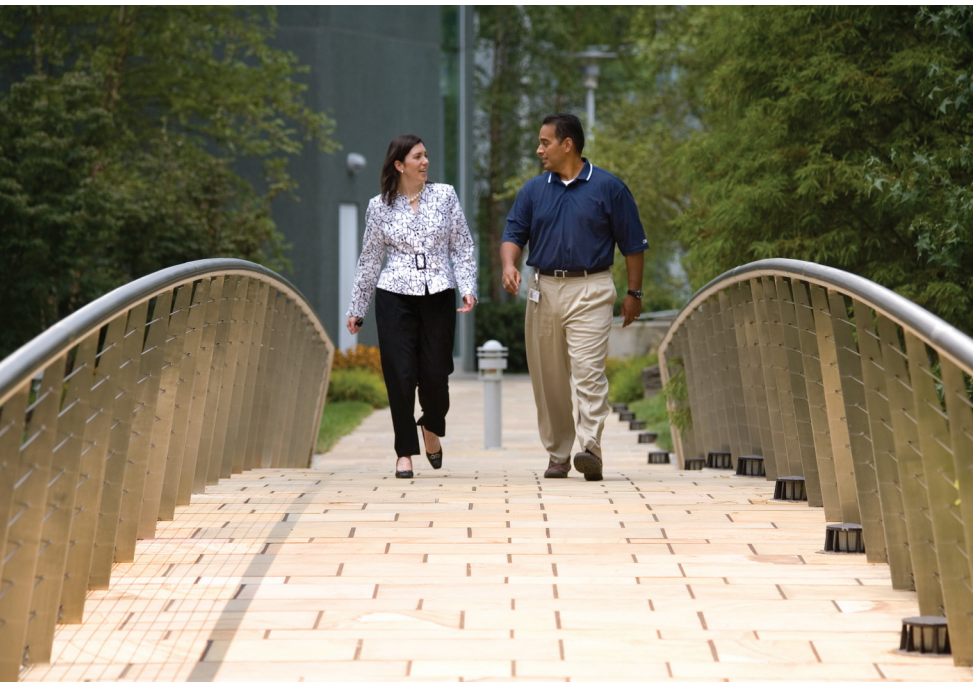
Research parks are emerging as strong sources of entrepreneurship, talent, and economic competitiveness for regions, states, and nations. They have become a key element in the infrastructure supporting the growth of today's knowledge economy. By providing a location in which researchers and companies operate in close proximity, research parks create an environment that encourages interaction and innovation and promotes technology development, transfer, and commercialization.

Research parks, however, also face challenges. They must find methods of more effectively moving research discoveries into the marketplace. They must find ways to break down barriers between the academic and business communities and more closely integrate the research park and its tenants into the fabric of the university. They need to identify sources of support for both operations and buildings and to adapt to globalization and the changing nature of corporate R&D.

Research parks have the potential to

- Translate discovery into application;
- Develop talent;
- Commercialize technology; and
- Integrate government, higher-education, and industry interests.

Achieving this potential, however, will require enlisting institutional leadership and community support, accessing sufficient capital for park development, and recognizing the long-term nature of this endeavor.



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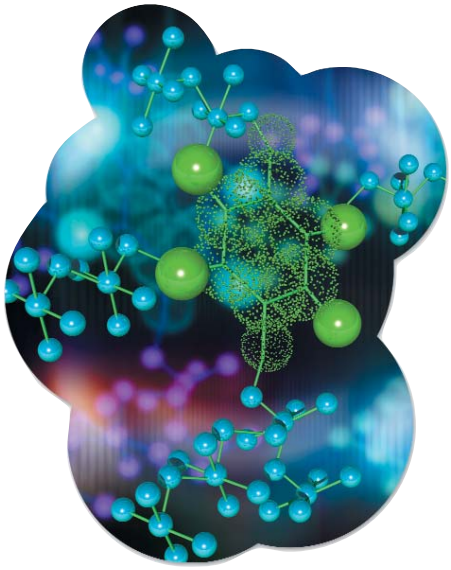

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