Summary of Remarks and Supporting Data
Panel I: North Carolina's Changing Economy

By

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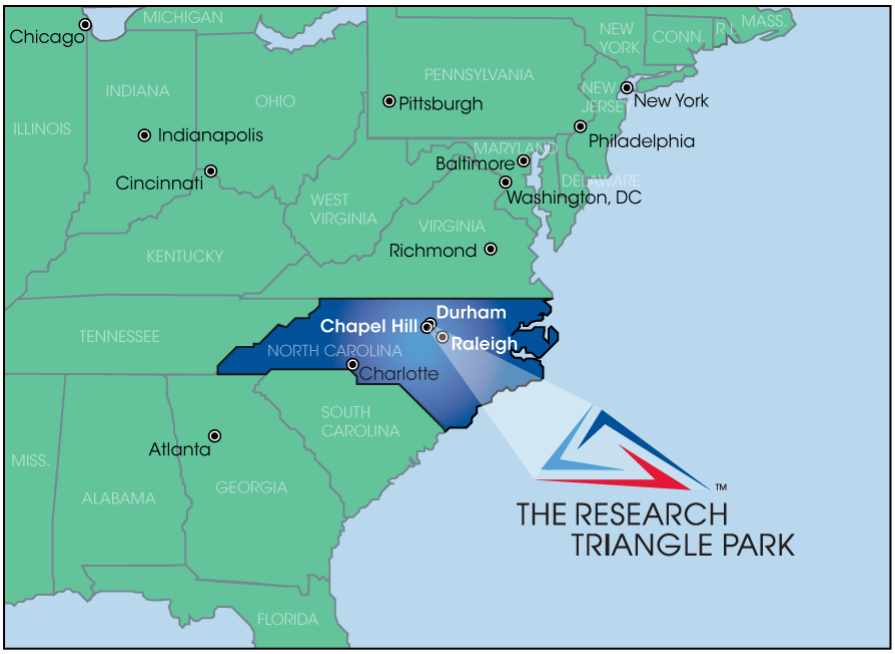
Executive Summary

The Research Triangle Park (RTP) is one of the largest and oldest examples of how strategic investments in education, infrastructure, and business climate can positively impact an economy. RTP's success was built around its first-mover status in the field of science parks; its ability to build a critical mass of technology companies and knowledge workers; and its linkages to the region's universities' research and development strengths.

The business of research parks as an industry is continuing to evolve. Many of the initial research park developments were semi-urban or located in close proximity to a university campus, relatively small in area, and focused in industry sector. With globalization increasing, countries and regions are using research and science parks as a way to jump start knowledge economies. Newer entrants into the research park market such as China are developing research parks on a huge scale that are changing the market dramatically.



RTP and other research parks will need to adapt to changing market conditions. RTP's ability to compete with the Chinese and other global models and its future success will depend on its ability to marshal its assets and to reinvent itself to better address changing global and technology trends. RTP was one of the first movers in research park development and has long been viewed as the model for successful research park formation and development. RTP is well-positioned to respond to the threats of China as a research park competitor.

This following paper is divided into four parts:

A. Overview and history of RTP: What was the genesis of The Research Triangle Park and how did it evolve;

B. Impacts of RTP on the transformation of a regional economy: What role did The Research Triangle Park have in changing the face of North Carolina's economy;

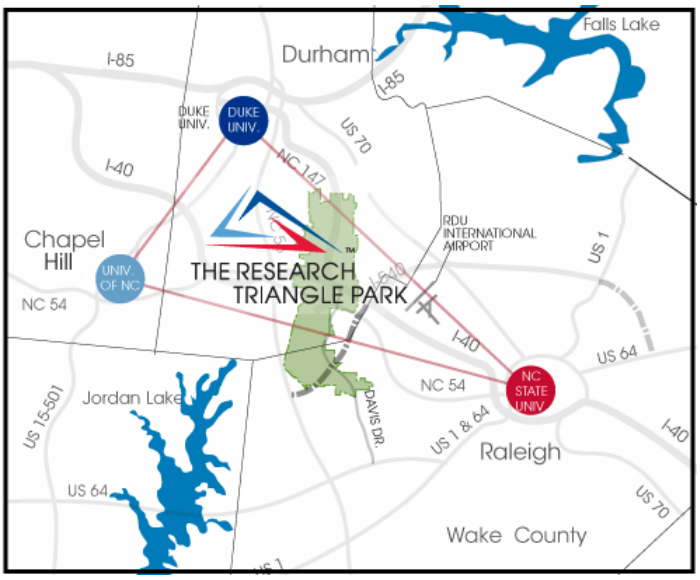
C. RTP's position in the changing landscape of research parks globally: How has The Research Triangle Park evolved to meet the new challenges and demands facing research parks and what has been the competitive impact of China's research parks

D. Summary and conclusions: What can North Carolina and the United States learn from The Research Triangle Park experience?

The lessons to be gleaned from the RTP experience are three-fold:

In a globally driven knowledge economy, even the most competitive regions are challenged from above and threatened from below. It is difficult to displace the top players in regional competitiveness, yet the challengers from below continue to advance. The research park model is a way to meet both threats by cultivating the knowledge assets of a region and attracting a critical mass of high-tech, advanced companies to build the region's base.

Regions have to demonstrate their unique value propositions to be competitive in a world where more and more operations can be located anywhere around the globe. To become or remain a competitive location of choice, regions should play to and enhance their strengths. RTP continues to engage with top-tier research universities and build upon its critical mass of knowledge workers to maintain its position as a top choice for research and development (R&D) operations. In essence the strategy that North Carolina and many regions in the U.S. are using currently to remain globally competitive is the same strategy RTP employed in the 1950s to remake and modernize the state's economy.



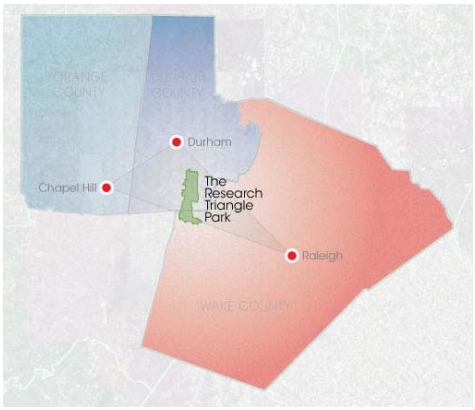
RTP and U.S. research parks have much to learn from the Chinese on what it will take to compete in the future – scale, nimbleness, speed to market, and flexibility – to attract talent and recruit expatriates to return. Just as the manufacturing sector has had to rethink and retool how it works because of the emergence of China and globalization, the R&D sector is being impacted and must respond accordingly. RTP is a microcosm of how regions can respond to globalization challenges.

A. Overview and History of RTP

The Research Triangle Park (RTP) was founded by a committee of government, university, and business leaders as a model for research, innovation, and economic development. By establishing a place where educators, researchers, and businesses come together as collaborative partners, the founders of the Park hoped to change the economic composition of the region and state, thereby increasing the opportunities for the citizens of North Carolina.

RTP is at the center of the dynamic Raleigh-Durham region with a population of 1.3 million within the defined metropolitan area and nearly 3 million within a 60-mile radius of the Park. The "Triangle" from which RTP was named is formed by the geographic location of the region's three highly regarded educational, medical, and research universities—the University of North Carolina at Chapel Hill, Duke University, and North Carolina State University, respectively located in Chapel Hill, Durham and Raleigh (see Figure A). In addition, RTP draws on the intellectual capacity of a host of other community colleges and higher education institutes. Together, these institutes create knowledge assets and provide a steady supply of trained scientists, engineers, managers, and technicians to the region's workforce.

Figure A: Geographic Orientation of the Research Triangle



In addition to this academic and research capacity, the region possesses an established network and infrastructure to support a diverse range of companies. Ranging from the Council of Entrepreneurial Development to the North Carolina Biotechnology Center to RTI International, a host of organizations and networks exist to complement and catalyze activities around a number of cluster industries. These institutions and companies work together with Park companies and the universities, reflecting a spirit of cooperation and learning within the scientific and technological community.

Since it was established, the Park has witnessed a steady and stable increase in the number of companies and employees. Currently, there are more than 157 organizations located in RTP. More than 39,000 people work in RTP with combined annual salaries of over $2.7 billion. The average salary in the Park is $56,000 annually, nearly 45 percent larger than the regional and national average.[i]

Companies represented in RTP include IBM, Nortel Networks, GlaxoSmithKline, Cisco Systems, Ericsson, BASF, Eisai, Biogen Idec, Credit Suisse, and Syngenta Biotechnology. In addition, a number of U.S. Federal agencies have a presence in the Park, including the U.S. Environmental

Protection Agency, the National Institute of Environmental Health Sciences, and the U.S. Forestry Service. For a full list of RTP companies sorted by industry sector, see Appendix A.

More than a location and an engine for economic growth, RTP has been a center of innovation. It is home to winners of the Nobel and the 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, including the invention of the Universal Product Code, 3D ultrasound technology, and Astroturf. Among the most significant of RTP accomplishments was the discovery of Taxol, hailed by the National Cancer Institute as the most important new anti-cancer drug of the past 15 years, and AZT, a drug used to fight HIV-AIDS.

The Park is managed by the Research Triangle Foundation of North Carolina, a non-profit organization founded in 1959. The Foundation is responsible for the overall management of the Park as well as ensuring that the regulations developed by the Park's founders to protect the natural environment and aesthetics of RTP are preserved. Under the development regulations governing the Park, a certain percentage of the total area is devoted to green space. In addition, companies in RTP must obey stringent setbacks and land coverage regulations to maintain the natural environment of the Park and its surroundings.

Forming RTP

The idea for RTP stemmed from the need to reverse a number of negative economic trends facing the North Carolina economy. In the mid-1950s, North Carolina's per capita income was one of the lowest in the nation. In 1952, per capita income in North Carolina was $1,049, compared to $1,121 for the eleven state Southeast region, and $1,639 for the continental United States.[ii] In addition the state's economy was dominated by low-wage manufacturing industries such as furniture, textiles, forestry, and small-scale agriculture. The state was facing a serious "brain drain" as graduates in the state were leaving in search of better jobs, and those attending college outside the state were not returning.

Given the expected consequences, leadership within the state sought to reverse these trends. Upon the urging of some private sector leaders such as Robert Hanes, the president of Wachovia Bank and Trust Company, and Romeo Guest, a Greensboro building contractor, and with the help and support of North Carolina State Chancellor Carey Bostian, Governor Luther Hodges commissioned a concept report on the idea of the establishment of a research park to diversify the state's economic base. By the end of 1956, the University of North Carolina and Duke University joined the effort and the Research Triangle Development Council was formed. The vision was to attract research companies from around the nation to locate in a parcel of land surrounded by the state's research universities. The resulting "Research Triangle Park" would be a place where companies could take advantage of the region's intellectual assets in individual campus settings that provided a ready physical infrastructure.

During the next year, various subcommittees were formed. The groups decided that the Research Triangle project idea was a valid concept and should be undertaken as a private effort with engagement of the three flagship universities rather than a state/government sponsored effort. In particular, the Park would be set up to "encourage and promote the establishment of industrial research laboratories and other facilities in North Carolina primarily in, but not limited to, the geographical area or triangle formed by the University of North Carolina at Chapel Hill, North Carolina State College of Agriculture and Engineering of the University of North Carolina at Raleigh, and Duke University at Durham." The Park would also "promote the use of research

facilities" at the universities and "cooperation between the three institutions and industrial research agencies." The end goal was to "increase opportunities of the citizens of this state for employment and to increase the per capita income of the citizens of the state."[iii]

Early Obstacles
While support for the establishment of RTP was growing, the project had several obstacles to overcome. The first was the image of the South in mid-20th century America. In part due to problems of segregation, the region did not have the most progressive reputation. North Carolina—and the U.S. South in general—were not known for innovation or entrepreneurial activity. In addition, companies at that time tended to maintain their research facilities near their manufacturing sites which were predominantly located in the northeast and mid-western parts of the country. The Triangle region did not possess any manufacturing facilities for the types of "new-line" industries the Park was targeting. Finally, the committee needed to raise the funds to acquire, promote and develop the parcel of land that was to become RTP.

To address the latter obstacle, the Committee began to assemble parcels of land to make up the Park. An effort led by Romeo Guest optioned 3,430 of the identified 4,000 acres under the name "Pinelands, Inc." For its part, the State of North Carolina played an important role as organizer—both for political support and support and engagement from the universities.

Initial attempts to sell stock in the Pinelands locally proved difficult. In August 1958, Archibald Davis, an executive with Wachovia Bank and Trust, was enlisted to support the effort. Davis recognized that it would be much easier to raise money from corporations and institutions that were interested in serving the state rather than trying to find private investors. As such, Davis began a fundraising campaign on December 1, 1958, and by January 1959 had raised nearly $1.5 million to purchase the first parcels of land. Contributions came from across the entire state.

Research Triangle Foundation and the Research Triangle Institute
With the contributions secured, on January 9, 1959, the Research Triangle Committee reorganized as the non-profit Research Triangle Foundation of North Carolina and was charged with developing and managing the Park.

In addition to forming the Research Triangle Foundation, the founders set aside $500,000 to establish the Research Triangle Institute (RTI)[iv]. The purpose of the Institute was to do contract research for business, industry and government.[v] It was intended to keep university faculty interested in the Park concept, as well as signal to the corporate community that the Research Triangle leaders had enough faith in the concept to establish the first organization at the Park. RTI sought to provide "industry in North Carolina and the South with research services not available; to encourage the use of research in the state and regional industry; and to extend the Research Triangle's position as a research center."[vi]

Early Park Development
RTP was established as a magnet for research and development in order to transform the region and state's economy. As such, the guidelines for the Park mandated that "eligible occupants of the Research Park be design, research and related operations…or in more general terms, uses that require a high degree of scientific input and which can benefit from a location relationship with the academic community." While it was decided initially that "no manufacturing or processing enterprises" could be conducted within RTP, the decision was later amended to allow for certain manufacturing.[vii]

An important element of the planning of the Park was the commitment to sacrifice the total amount of building space that could be accommodated in order to preserve the natural

balance and integrity of the land. The early planners of the Park used the topography, drainage patterns, and vegetation of the land to create an environment with the highest possible physical quality for the researchers' work experience. The zoning provisions in the Northern (Durham County) section of the Park dictate that "no more than fifteen percent of the total area of a tract shall be covered with buildings."[viii] The provisions are similar in the Southern (Wake County) portion, allowing for up to thirty percent of coverage for buildings, infrastructure and parking surfaces. In addition, development standards and an architectural review board were created to ensure the integrity of the covenants.[ix]

Historical Growth—Chronological timeline

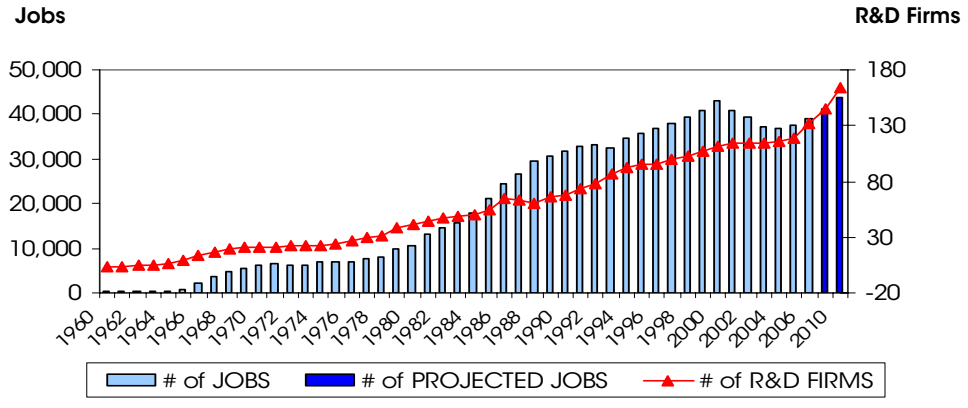
The first five years of the Park's existence were relatively slow. While Chemstrand, a company jointly owned by Monsanto Corporation and America Viscose, announced its decision to come to the Park in 1960, it was not until 1965 that growth in the Park took off. In 1965, IBM announced that it would locate a 400 acre, 600,000 square foot research facility in the Park. Also that year, the U.S. Department of Health, Education, and Welfare decided to locate its new $70 million National Environmental Health Science Center at the Park. With the location of a substantial government presence and private sector company, the Park gained credibility as a place for research and development.

Due in part to the existence and extension of road, water, and sewer infrastructure in Durham County, the early growth of the Park was in its Northern section. In addition, major highway improvements, including the building of North Carolina route 147 to connect Duke University and downtown Durham to the Park (1973), the construction of Interstate 40 from the Park to Chapel Hill (1985), and improvements to the region's Raleigh-Durham International Airport helped to improve the Park's competitive position.

In the following 40 years, growth in the park has averaged six new companies and an addition of roughly 1,800 employees per year.[x] The original parcel of land that made up RTP in 1959 consisted of 4,400 acres. Through the years, the Foundation acquired more land, surpassing 5,500 acres by 1979 and totaling 6,971 acres presently. In the same period, the Park's developed space has increased from only 200,000 square feet in 1960 to more than 20 million square feet in 2005.

Mirroring the information and communications technology boom in the late 1990s, the Park reached a peak employment level of 45,000 in 2001. Although the number of employees declined slightly in the ensuing recession, the number of companies in RTP has increased steadily as demonstrated in Figure B.

Figure B: RTP Growth Trajectory



Large companies continue to make up the majority of the Park's employment numbers. The guiding assumption behind the initial recruitment strategy for the Park was to attract larger, more established companies that would build a culture in which smaller, start-up industries could thrive. The theory has proven accurate, as a number of smaller, spin-off companies have emerged. The trend is further reflected within a close proximity to the Park and near the university labs.

Beginning with the first planning session in 1956, North Carolina's leadership took deliberate and rather ambitious steps to make a positive change in the state's economy. In the fifty years that have elapsed, the vision and commitment of that group has been carried forward and has resulted in the development of a unique parcel of land that is home to one of the greatest critical masses of knowledge workers and intellectual activity. With RTP as its driver, the Triangle region has emerged as one of the top five high technology regions worldwide.

B. Impacts of RTP

With widespread national appeal and significance due to its positive impact to society, RTP has been and continues to be a model for innovation, education, and economic development that has been applied around the world. The research conducted by institutes and universities has directly shaped policies and funding for research on education, substance abuse, air quality, infectious disease, and health care.

Of the several hundred research and science parks operating in the United States today, RTP is the only one that ranks among the largest and successfully growing parks along a number of leading indicators, including the total size of the park, number of employees, buildings/square footage available, employee and company growth.[xi] RTP has been established the longest and ranks among the largest when compared to science parks around the world. See Appendix B.

As noted below, the effect of the Park over the last 48 years has worked to transform the region and the state. This impact has resulted in a change in the composition of the region's industries, an upgrading of the capacities at the three flagship universities—as well as throughout all institutes of education throughout the region and state, and a global brand that has built the reputation of the region and state as one of the leading areas for high-technology innovation.

In addition to the quantitative results of the Park, RTP has succeeded in raising the level of involvement of the corporate, political, and academic communities in the region and state as they work together toward a common cause. In the words of former University of North Carolina president, William Friday, "Research Triangle Park is the most significant economic and political manifestation of will in the state in the last century."[xii]

Changing an Economy

RTP is highlighted as the exception to the rule in terms of science parks' positive impacts on regional economic development. Though it took more than 30 years to see evidence of the cluster development attributed to the Park, the development of RTP has been able to change the economic make up of the region.[xiii] RTP has had a more significant impact on the Research Triangle area's regional economy than any research park individually or research parks in general as a category. A key element in RTP's success was its ability over 30 years to actually spur clusters that led to a change of the region's economic composition.

For example, before the Park was established, fewer than 15 percent of the businesses in the three counties surrounding the Park—Orange, Wake, and Durham—were in what was defined as

"new-line" industries. This included businesses involved in chemicals, electronics, communications, business services, educational services, and engineering and management services.[xiv] As more companies came to the Park and created other benefits, the share of new-line industries increased. By 1966, nearly 30 percent of businesses in the three counties were in new-line industries, by 1995, nearly 47 percent were new-line and by 2005, the percentage had reached 51 percent.[xv] As Figure C suggests, this change has had a significant impact on the state and region, especially when compared to the national growth in employment in these industries over time.

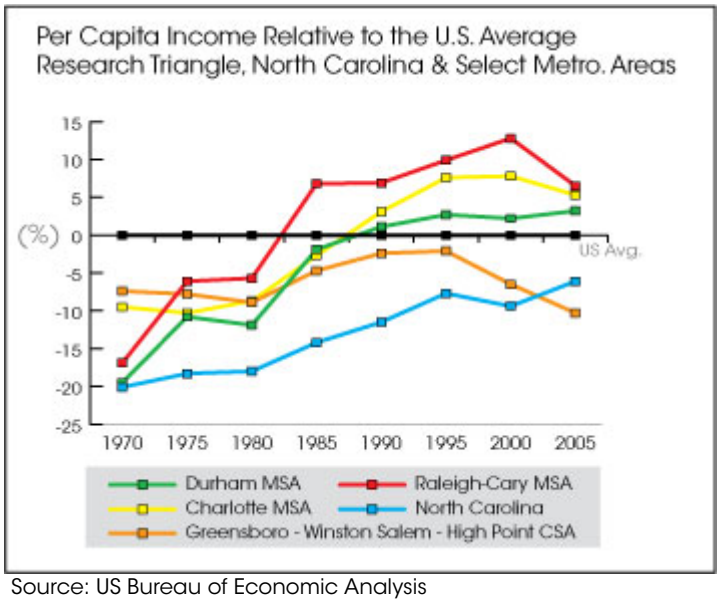
Figure C: National Percent Share of Technology Employment

	1956	1966	1976	1986	1996	2003
National Index	100	100	100	100	100	100
North Carolina	45.4	55.9	66.2	71.3	81.0	89.3
Research Triangle Region	57.3	87.2	103.8	115.3	115.5	125.3

Source: US Census, 2003

As Figure D suggests, it can also be inferred that growth in new line industries and the economic impacts of the Park have positively contributed to the Triangle region's (as represented by the Durham and Raleigh-Cary MSAs) growth in per capita income from well below the national average in 1970 to above the national average in 2006 and the leader among North Carolina metro areas.

Figure D: Growth in Per Capita Income Relative to the U.S. Average



Source: US Bureau of Economic Analysis

In addition to transforming the economic base, the Park has had a number of direct and indirect impacts on the counties surrounding it. Direct impacts include construction, real estate tax yields, sales tax yields and income tax yields. Indirect impacts include spin-off companies and off-site businesses in addition to multiple expenditures of corporate and personal incomes.[xvi] An ongoing study to inventory the number of spin-off companies created by the university and Park

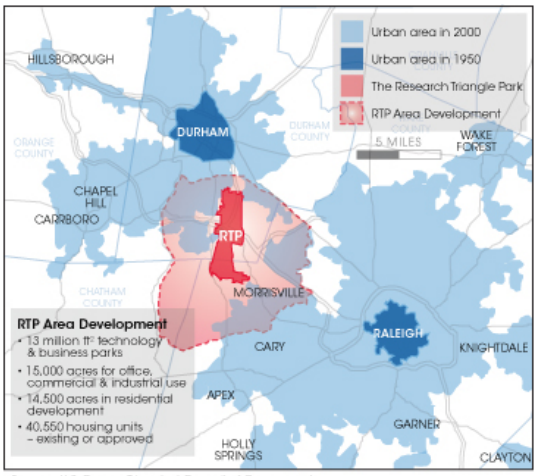
company activity in the region suggests that more than 1,500 such enterprises have been stimulated by activity in the Park and the universities since 1970.[xvii]

Beyond the boundaries of the Park, a core area of similar industries and office parks has developed; including the country's largest privately held software firm and the world's largest pharmaceutical contract research organization. In many cases, these businesses partner with Park tenants to provide services or manufacturing facilities.

As the region has grown, a host of amenities has developed around RTP. As RTP prepares to enter its next 50 years, major initiatives are underway to re-develop older Park properties and encourage retail and residential development in parcels directly surrounding the Park.

Within a 4-mile radius of the boundaries of the Park (see Figure E), there are 13 million square feet of built space and 15,000 acres 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. Thanks to the region's growing transportation infrastructure, a number of significant retail and entertainment areas are within easy reach of RTP. The developments around RTP have contributed to a unique urban landmass that has a tremendous impact on the economic vitality and dynamism of the region and state. No other campus location in the Triangle region has comparable access to such a broad mix of housing and retail opportunities.

Figure E: RTP Area Development and Urban Growth from 1950-2000



Sources: U.S. Census, Triangle J Council of Governments

Beyond the immediate area of the Park, RTP has influenced the innovation culture of the region and state. This phenomenon is best exemplified by the organizations and other research parks/innovation centers that have developed. These include the North Carolina Board of Sciences and Technology, the Triangle Universities Computation Center, MCNC, the North Carolina Biotechnology Center, and the First Flight Venture Center. See Appendix D for descriptions of these efforts.

Another outgrowth of RTP's success is the spread of university infrastructure to catalyze innovation and economic growth. In 1984, Centennial Campus was established on the grounds of North Carolina State University to provide a place where university, industry, and government partners can interact in multidisciplinary programs directed toward the solution of contemporary problems. Consisting of 1,334 acres, the campus provides office and lab space for more than 1600 corporate and government employees. To date, more than $620 million has been invested

to create 2.7 million square feet of space in 25 major buildings. Centennial is touted as one of the leading examples of urban, "green door" research park developments.

Building on the successful translation of the RTP model to Centennial, in 2000, the North Carolina State General Assembly enacted the Millennial Campus Act. The Act authorized the UNC Board of Governors to designate real property held by, or to be acquired by, one of the university campuses to be developed to encourage university/government/industry collaborations in research and development. The campuses will capitalize on North Carolina's considerable research strengths and history of investment to spark high-quality economic development. The Greensboro Center for Innovative Development – a joint initiative of UNC-Greensboro and North Carolina Agriculture and Technical State University, is the most recent addition to the Millennium Campus roster, and a campus at Western Carolina University is in the planning process. Additionally, leaders at UNC-Chapel Hill continue to work through the development of Carolina North, a proposed site that will enable public-private partnerships, public engagement and flexible new spaces for research and education. Carolina North is envisioned as more than a technology park or overflow space, but also a campus for "living and learning," with planned multi-use components.

Success Factors

Given the aforementioned analysis on the effectiveness of research parks and RTP's legacy of success in transforming the region, the Park has long been studied as a model for economic development and change. Especially as other countries have joined the movement to create science cities and centers, many have looked to the experience of RTP to identify potential, replicable success factors.

Unlike the organic successes in developing and nurturing clusters of industry in California and Massachusetts, the genesis and growth of RTP was the result of a well-formed planned vision and strategy. Led by the active long-term commitment given to RTP by the state and region's business, government, and academic communities, a number of factors have been critical to the Park's success.

Timing. The idea for the Research Triangle came at an opportune time for U.S. business interest. Following the end of World War II, the American government and business community placed an increased importance of the role of research and development and technology. In the shadow of Route 128's development in Massachusetts and the Stanford Research Institute in California, the idea of being in a location in close proximity to three strong research universities appealed to may companies.[xviii] The ability to develop isolated, stand-alone campuses nestled within the environmental beauty of central North Carolina was also a strong draw to industries at the time.

Connection to universities. In addition to its good-timing, the Park was able to draw upon the strength and cache of three prominent universities—Duke University, North Carolina State University, and the University of North Carolina at Chapel Hill. These universities and the other universities, colleges, and community colleges within the region provide a steady supply of trained scientists, engineers, and technicians to the region. In turn, the universities and community colleges have been substantially strengthened by the environment and interactions with the industrial and governmental research activities. Moreover, the ability of the universities to attract high levels of Federal funding further strengthens the region's innovative capacity.

Critical mass. A third factor of the Park's success is the critical mass of companies and knowledge workers it has been able to build. The critical mass affords the Park and the region a sought-after labor pool that is both broad and deep. This enables the region to draw more high-quality employers and companies that not only provide jobs but also increase the sophistication

and expertise of the region's workforce through their research, use of technology, investment in employees and high standards. It also provides an environment in which company researchers, knowledge workers, and university professors can interact around ideas, creativity and entrepreneurship, thereby creating more knowledge, more innovation, and economic growth.

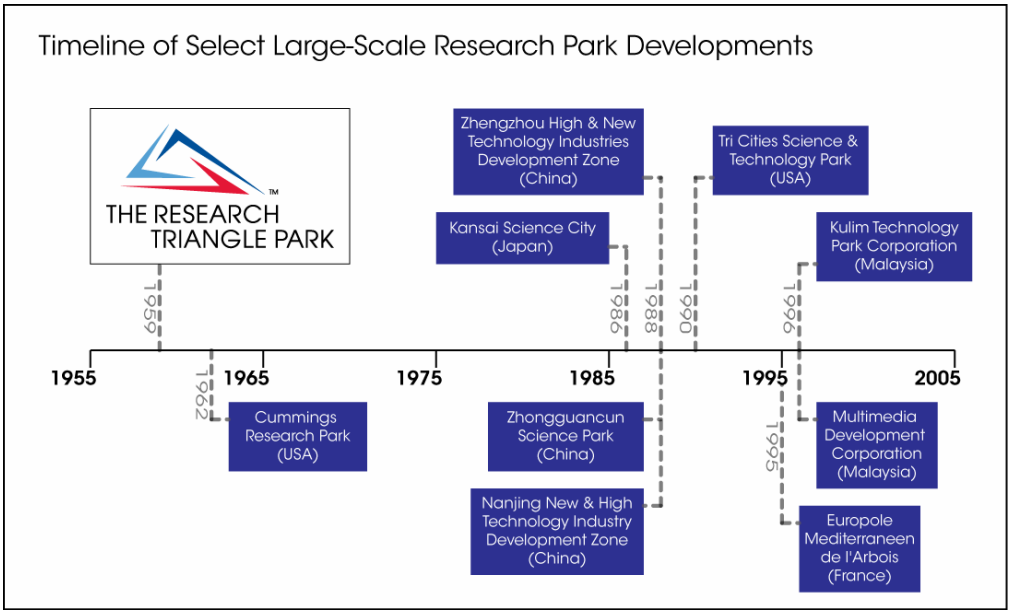
Long-term commitment. A final, and less quantifiable, factor contributing to the Park's success has been the long-term commitment of leadership at all levels. When the Park's founders established the Park, they recognized that the benefits of their investment could take decades to come to fruition. They also recognized that the many of the investments they made would spur secondary and tertiary effects that would also strengthen the state and region. Throughout its existence, the Park's leadership, local elected leadership, and populace as a whole, have understood that the vision of the Park's success was a long-term one. Especially in the fast pace of change of today's global market, few localities have RTP's luxury of a long-term implementation horizon.

C. RTP's Position in the Changing Landscape of Research Parks Globally

The research park industry has evolved dramatically during the last 30-40 years and has witnessed even more marked changes in the last decade with the entrance of mega-scale parks in Asia. Increasingly, countries and regions are seeing the value of using research parks and the attraction of R&D and related operations to jump start economies and elevate their global competitiveness.

From the mid 1950s to the 1970s, the U.S. was among the first movers in development of the research park concept, evidenced by the formation and growth of The Research Triangle Park and Cummings Research Park in Alabama (see Figure F).

Figure F: Historical Timeline of Select Large-Scale Research Park Developments



Source: International Association of Science Parks 2005-2006 World-Wide Directory of Science Parks & Innovation-based Business Incubators

Early parks were characterized by campus-like settings, located outside a city or proximate to a university campus. RTP and Cummings were established for over twenty years before the next major wave of global research park development was fully underway.

The Research Triangle Park operates on a much larger scale when compared to the average research park in North America and is more in parallel with the scope of newly established global research parks. The following statistics were extrapolated from 2006 data from the Association of University Research Parks (AURP) and show the comparison of RTP vs. all North American research parks combined[xix].

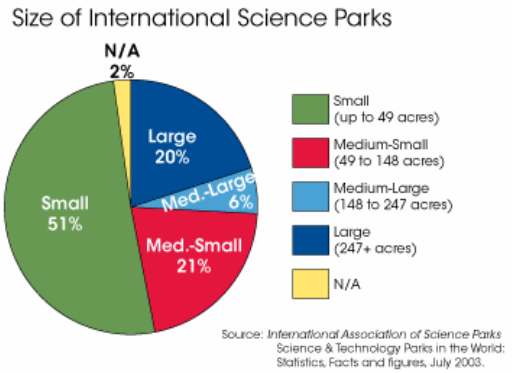
- RTP contains 4% of the total number of companies of all North American research parks
- RTP is 17 times larger in number of full time employees than the average research park (2,300 employees)
- RTP is 14 times larger in land area than the average research park (505 acres)
- RTP is 18 times larger in total built space than the average research park (1.1 million ft^2)
- RTP is 18 times larger in capital investment than the average research park ($158 million)

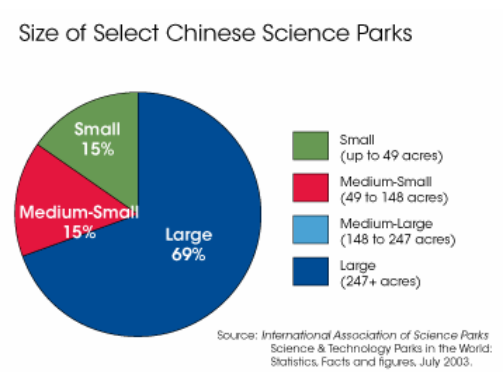
Known worldwide, RTP has long been viewed as the model for successful research park formation and development and has been visited by numerous international government delegations seeking to create a similar research park concept in their home countries.

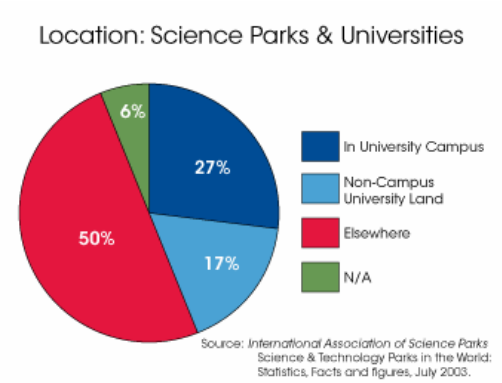
Since 1970, there has been a seventeen fold increase in the number of parks in the U.S. Globally, there are more than 700 research parks in existence, with 400 of those located outside the U.S.[xx] Many of these large global research parks were initiated in the late 1980s and 1990s, and often under government sponsorship. The research parks of today predominantly follow one of two modes: urban phenomena with a trend toward "science in the city" and "knowledge cities" not necessarily tied to a university campus;[xxi] or mega-scale developments that are financed by governments and depend on economy of scale and critical mass to attract world-class operations and talent.

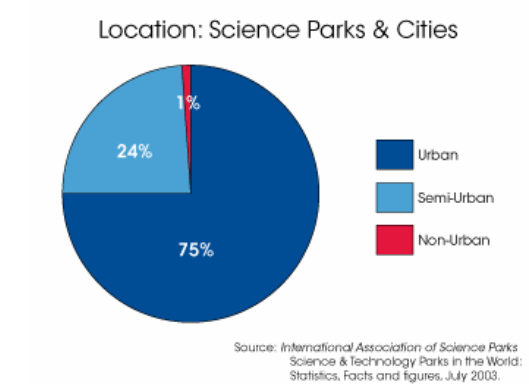
The following charts (Figure G) represent the different profiles and characteristics of global research parks today, based on data collected by the International Association of Research Parks (IASP). The majority of research parks today are small in scale, urban, and not necessarily associated with a university. The exceptions to this trend are the large-scale research parks developing in China.

Figure G: Comparative Data of International Science Parks, Based on Size and Location









Immediate and real impact of China

The development of mega-scale, government-sponsored research parks in China is one example of how the U.S. is challenged by increasing global competition for new jobs and capital investment. See Appendix C for a table of select Chinese science parks in operation today. Chinese research parks are changing the characteristics of the global research park marketplace. Just as the manufacturing sector has had to rethink and retool how it works because of the emergence of China and globalization, the R&D sector is being impacted and must respond accordingly.

Research parks are one way China and other developing regions are jump starting knowledge economies and attracting high end R&D investments. Multinational R&D Investment in China continues to be strong, with China and India leading in investment flowing into the Asia-Pacific region. China and India together account for nearly 25% of the global capital investment, as indicated by Figure H, illustrating data from a 2005 IBM-PLI GILD study.

Figure H: Destination Countries by Share of Capital Investment, 2005

Source: IBM-PLI – Global Investment Locations Database, GILD

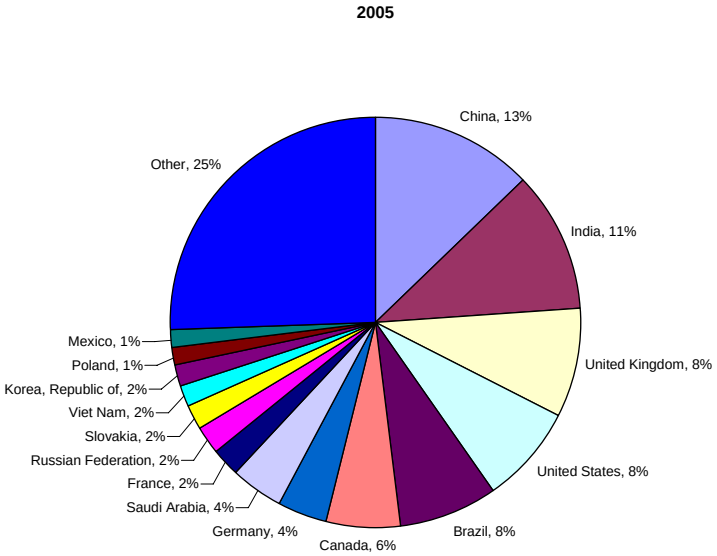


Figure I: Worldwide Investment Flows & Comparative Rankings of US, China & North Carolina

Top Countries for R&D Projects (2004)		
Rank	Countries	Projects
1	India	28
2	**China**	**13**
3	**United States**	**10**
4	Japan	7
5	Taiwan	5

Source: IBM-PLI's Monthly Global Investment Alert, July 2004, Global Investment Locations Database (GILD)

Top Fifteen Countries (2005) *Inward* Investments	
1	India
2	**United States**
3	**China**
4	Poland
5	Viet Nam
6	United Kingdom
7	Philippines
8	Malaysia
9	France
10	Slovakia
11	Canada
12	Czech Republic
13	Brazil
14	Thailand
15	Germany

Source: IBM-PLI Global Investment Locations Database (GILD) 2005 data cited in IBM Global Business Services publication "Corporate Location Strategies in Response to Global Business Environment Dynamics," presented June 18th, 2007.

Top Fifteen Countries (2005) *Outward* Investments	
1	**United States**
2	Japan
3	Germany
4	Korea
5	United Kingdom
6	France
7	Italy
8	Canada
9	Singapore
10	Finland
11	Switzerland
12	Netherlands
13	India
14	Russia
15	**China**

Source: IBM-PLI Global Investment Locations Database (GILD) 2005 data cited in IBM Global Business Services publication "Corporate Location Strategies in Response to Global Business Environment Dynamics," presented June 18th, 2007.

Top Ten Regions (2004) *Inward* Investments	
1	**Shanghai, China**
2	**Guangdong, China**
3	Karnataka, India
4	Tamilnadu, India
5	**California, USA**
6	**Jiangsu, China**
7	Adhra Pradesh, India
8	**North Carolina, USA**
9	New South Wales, Australia
10	**Zheijang, China**

Source: IBM-PLI's Monthly Global Investment Alert, July 2004, Global Investment Locations Database (GILD)

The above and following charts (Figure I) illustrate recent rankings by IBM-PLI's Global Investment Location Database (GILD) study. GILD is a database developed by IBM-PLI that records corporate location decision announcements around the world on an ongoing basis. GILD monitors corporate investments at the project level. It records announcements and openings of new and expansion projects by companies globally. M&As and other forms of investment are not included, except if they lead to a new or expansion project. The U.S. is challenged from below as countries such as China and India continue to gain high end R&D projects and impact the flow of inward investments.

D. Summary and Conclusions

The impact of China on the world economy due to its low-cost, mass produced goods and economic dislocations has been well-documented. In the globally integrated economy of today, the impacts of China and India go even further. All of the U.S. is under threat. The issues RTP faced five decades ago are eerily similar today – only on a global playing field. The competition for higher end R&D is fierce. In today's fast-paced marketplace, states do not have the luxury of time as RTP did in the slower-paced era of the 1950s. Regardless, the economic development "experiment" of The Research Triangle Park has endured as a successful model for nearly 50 years. There are many important lessons to be learned.

RTP has evolved from a mere vision for changing a region's economic base to the manifestation of the how strategic investments in education, infrastructure, and business climate can positively impact an economy. With a critical mass of technology companies and knowledge workers and linkages to three world-class universities' research and development strengths, RTP's future success will depend on its ability to marshal these assets and reinvent itself to better address coming global and technology trends.

RTP is committed to remaining a place where companies and academic talent can come together. Just as it seized "first-mover" advantage at the beginning of the science park industry's development, RTP will take a leadership position in forging a new, "next generation" model to ensure it remains a place where world-class, knowledge workers and R&D operations will congregate.

RTP exists today as a model for North Carolina and a best practice lab and model for America's future competitive position. A living laboratory with a history of five decades of economic transformation, RTP has the "triple helix" formula for success – the collaboration of business, government and academia working together to nurture technology based economic development. The success of this model has been replicated throughout the state in Centennial Campus at North Carolina State University, the Greensboro Center for Innovative Development at UNC-Greensboro and North Carolina Agriculture and Technical State University. It is also being employed in plans for the Millennium Campus at Western Carolina University and at Carolina North at the University of North Carolina – Chapel Hill.

States and regions around the country would benefit from demonstrating their unique value propositions to be competitive in a world where more and more operations can be located anywhere around the globe. To counter the challenges posed by China and other rising global economies, regions around the country can become or remain a competitive location of choice, by playing to and enhancing their unique strengths.

Finally, RTP and other regions in the U.S. can learn from the Chinese example of nimbleness, speed to market, and flexibility. Just as the country evolved modern manufacturing to take advantage of its economies of scale and abundant labor, the R&D industry can learn much from its model of mega-scale developments and creating an economic engine through research-oriented and higher-end economic activities.

In the end, the RTP experience can serve as a microcosm of how U.S. regions can respond to globalization challenges and protect their competitive position in the international economy.

Appendix A: RTP Companies by Industry Sector

Biotechnology/Agricultural Biotechnology/ Biological Agents

- AlphaVax, Inc.
- BASF Corporation Agricultural Product Corporation
- Bayer CropScience
- BioAbility, LLC
- Biogen idec
- Botanics Integrated, LLC
- Civatech Oncology
- Diosynth Biotechnology
- Entegrion, Inc.
- Humacyte
- North Carolina Biotechnology Center
- Nufarm Americas, Inc.
- Precision Bioscience, Inc.
- Qualyst, Inc.
- Syngenta Biotechnology, Inc.
- Zen-Bio

Chemicals

- Chemiceuticals
- Reichhold, Inc.
- Southcot, Inc.

Electronics/Nanotechnologies

- Accurate Electronics, Inc.
- BOC Edwards
- Cree, Inc.
- Delta Products Corporation
- Discover Technologies Inc.
- DuPont Electronic Technologies
- Good Technology
- JMC (USA), Inc.
- Microelectronics Assembly Technologies
- Nextreme Thermal Solutions
- Sumitomo Electric Lightwave Corporation
- Troxler Electronic Laboratories, Inc.
- Xintek, Inc.

Environmental Science

- Alion Science and Technology
- General Engineering and Environmental of NC, Inc.
- Integrated Laboratory Systems, Inc.
- National Institute of Environmental Health Sciences
- National Toxicology Program
- Tetra Tech, Inc.
- The Hamner Institutes
- USDA-Forest Service Southern Research Station

Financial Services

- Credit Suisse
- Fidelity Investments

IT/Informatics/Telecommunications/ Pervasive Computing

- Aten Inc
- BrandPort, Inc.
- Caspian Networks
- Chorus Systems
- Cisco Systems, Inc.
- Collaborative Studio, Inc.
- Computer Sciences Corporation
- Customized Technology Services Corporation
- Device Solutions LLC
- Ericsson, Inc.
- Extreme Networks
- Geomagic, Inc.
- GretagMacbeth, LLC
- i5, Inc.
- International Business Machines Corporation (IBM)
- Learning Machines, Inc.
- Management Information Systems Group, Inc.(MISG)
- Mi-Co
- Network Appliance
- Network Development Group
- Nortel Networks
- OC3 Entertainment
- Pocket Science LLC
- RadarFind Corporation
- SnowFin, LLC
- Software Development Europe, Inc.
- STG, Inc.
- The Wireless Technology Group, Inc.
- Triangle Research Collaborative

Materials Science

- Bekaert Corporation
- Bekaert Flex Circuits

Non-Profit Organizations/Associations

- American Association of Textile Chemists and Colorists (AATCC)
- Burroughs Wellcome Fund
- International Union of Pure and Applied Chemistry (IUPAC)
- ISAF (International Service Assistance Fund)
- Research Triangle Park Headquarters: Future Site
- Kramden Institute, Inc.
- MCNC
- Motor & Equipment Manufacturers Association
- National Humanities Center
- North Carolina GlaxoSmithKline Foundation
- North Carolina Healthcare Information and Communications Alliance
- Research Triangle Foundation of North Carolina
- RTI International
- Sigma Xi, The Scientific Research Society
- Statistical and Applied Mathematical Sciences Institute
- The Instrumentation, Systems, and Automation Society
- Triangle Universities Center for Advanced Studies, Inc. (TUCASI)

Other

- Craig Davis Properties
- EMC Corporation
- Instrumentation Associates
- National Institute of Statistical Sciences
- North Carolina State Education Assistance Authority
- Pappas Ventures
- Radisson at RTP
- Sony Ericsson Mobile Communications (USA), Inc.
- The Enrichment Center by Bright Horizons
- The University of North Carolina Center for Public Television
- Triangle Life Science Center (TLS Center)
- Triangle Service Center, Inc.
- UAI Technology, Inc.
- Underwriters Laboratories, Inc.
- United States Environmental Protection Agency
- United States Postal Service

Pharmaceutical/Biopharmaceutical/ Medical Devices

- Aerie Pharmaceuticals, Inc.
- Alnis BioSciences, Inc.
- BD Technologies/BD BioVenture Center
- BioMarck Pharmaceuticals, Ltd.
- Bioptigen
- Clinipace
- Cognosci, Inc.
- CPKD Solutions, LLC
- Duke Mass Spectrometry Facility
- Eisai Inc.
- Endacea, Inc.
- Eno Research & Development, Inc.
- GlaxoSmithKline
- Howard Associates, LLC
- Invitrox
- Jenken Biosciences, Inc.
- Kucera Pharmaceuticals, Inc.
- Saha Pharmaceuticals
- Stiefel Research Institute
- Synthon Pharmaceuticals, Inc.
- Talecris Biotherapeutics
- Teotten Diagnostics, Inc.
- Tricon Pharmaceuticals, Inc.
- Turrett Labs (Medibeam Health Monitors)
- United Therapeutics Corporation

Professional Business Services

- Arneson & Associates
- B W & Associates
- Bank of America
- Carolina Group Insurance Services, Inc.
- Clean Design, Inc.
- Erevnion, Inc.
- Fiducial-Comprehensive Accounting Services, Inc.
- First Citizens Bank
- First Flight Venture Center
- GSA Defense Logistics
- ICF Consulting
- Liggett Vector Brands, Inc.
- Lineberry Research Associates
- Mechanical Specialties Contractors, Inc.
- New Media Campaigns, Inc.
- Parrish Brian Partners, Inc.
- Practical Management, Inc.
- Southeast TechInventures
- Spratt Financial
- Teer Associates
- Triangle Transit Authority (TTA)
- Wachovia Bank
- Wesinco, Inc.
- MASF, Inc.

Appendix B: Largest Global Science and Technology Parks, Ranked by Land Area

Science park	Year Est.	Area (acres)	# of Tenants	Main Industries
Kansai Science City (Japan)	1986	37,070	72	Cultural creation and exchange, promotion of academic researches
Zhongguancun Science Park (China)	1988	24,710	4400	Biological and medical projects, electronic information, new energy
Zhengzhou High and New Technology Industries Development Zone (China)	1988	16,010	1003	Electronics, ICT, medical sciences, biotechnology
Europole Mediterranean de l'Arbois (France)	1995	11,120	33	Environmental enterprises, research, training, technology transfer
Multimedia Development Corporation (Malaysia)	1996	7,141	250	ICT, biotechnology, telecommunications
The Research Triangle Park (Research Triangle Park, North Carolina, USA)	**1959**	**7,000**	**157**	**Biotechnology, electronics, environmental science, ICT, pharmaceuticals**
Tri Cities Science & Technology Park (Richland, Washington, USA)	1990	4,000	120	Environmental cleanup and restoration, medical technology, energy, advanced materials, and life sciences
Cummings Research Park (Huntsville, Alabama, USA)	1962	3,843	225	Aerospace, technology-based precision manufacturing
Kulim Technology Park Corporation (Malaysia)	1996	3,600	33	High technology manufacturing and R&D activities
Nanjing New & High Technology Industry Development Zone (China)	1988	3,257	2000	ICT, biotechnology, new materials, aeronautic industry resources, modern materials, and photo electricity

Source: IASP Members Directory, AURP Membership Directory

Appendix C: Comparison of RTP and Select* Chinese Science Parks
*Members of the International Association Science Parks (IASP)

Science Park	Location	Year Est.	Area (acres)	# of Tenants	Main Industries	Notable Companies
Zhongguancun Science Park	Beijing, China	1988	24,710	4,400	Biotechnology, Electronics & Microelectronics, Energy and Renewable Energy, Materials / New Materials	Nortel (R&D), Lenovo
Zhengzhou High and New Technology Industries Development Zone	Zhengzhou, China	1988	16,010	1,003	Biotechnology, Electronics & Microelectronics, ICT / Media and Multimedia / Telecommunications, Materials / New Materials	
The Research Triangle Park	**North Carolina, USA**	**1959**	**7,000**	**157**	**Biotechnology, electronics, environmental science, ICT, pharmaceuticals**	
Shanghai Zhangjiang Hi-Tech Park	Shanghai, China	1992	6,178	1,000	Biotechnology, ICT / Media and Multimedia / Telecommunications, Pharmaceuticals	GlaxoSmithKline
Nanjing New & High Technology Industry Development Zone	Nanjing (Jiangsu), China	1988	4,077	2,000+	ICT, biotechnology, new materials, aeronautic industry resources, modern materials, and photo electricity	
Shanghai Hi-Tech Park United Development Co., Ltd.	Shanghai, China	n/a	3,534	1,200	Aeronautics / Aerospace / Astronautics, Biotechnology, Electronics & Microelectronics, Materials / New Materials, Optics / Optoelectronics / Laser, Software	
Shenzhen High-Tech Industrial Park	Shenzhen, China	1996	2,842	2,350	Biotechnology, Electronics & Microelectronics, Materials / New Materials	
Tsinghua University Science Park	Beijing, China	1993	1,704	40	Biotechnology, Energy and Renewable Energy, Environment, ICT / Media and Multimedia / Telecommunications, Materials / New Materials, Software	
Shanghai Hongqiao Linkong Economic Zone	Shanghai, China	n/a	692	2,000	ICT / Media and Multimedia / Telecommunications	GlaxoSmithKline, Ericsson

Beijing Zhong-guan-cun Life Science Park	Beijing, China	2002	628	19	Biotechnology
SDPIM - Macao Industrial Parks Development Co., Ltd.	Macao, China	2003	67	11	Development and management of Concordia Industrial Park, Macao Park of Zhuhai-Macao Cross Border Industrial Zone and other industrial parks in Macao
Hong Kong Science and Technology Parks Corporation	Hong Kong, China	2004	54	80	Biotechnology, Computers and Peripherals, Electronics & Microelectronics, ICT / Media and Multimedia / Telecommunications, Services for the Industry: Industrial Design / Engineering / Maintenance, etc.
Beijing Hi-Tech Business Innovation Service Center	Beijing, China	n/a	2	41	Biotechnology, Electronics & Microelectronics, Energy and Renewable Energy, Environment
Zhenjiang Kuailu Industrial Park	Zhenjiang, China	n/a	2	57	Bio-pharmaceutical. Advanced Materials

Sources: International Association of Science Parks, Ali Baba Manufacturer Directory, U.S. Department of Commerce International Trade Administration (export.gov), and individual company/park websites.

Appendix D: North Carolina Innovation Infrastructure

- North Carolina Board of Sciences and Technology (1965). The first of its kind in the United States, the Board was created by the North Carolina General Assembly to strengthen the science and engineering base across the state through research grants to private and public institutions. The Board encouraged inter-institutional collaborations to create inter-institutional research facilities.

- Triangle Universities Computation Center (1965). Developed with a grant from the North Carolina Board of Sciences and Technology, the Center provided mainframe computer services to the region's three research universities, the Research Triangle Institute, and tenants of the Park. As an outgrowth of the Center, an agency of the UNC System was created to extend the services to other colleges and technical institutes across the state. The Center was dissolved in 1990 as commercial entities emerged to provide such services.

- MCNC (1980). Created as the Microelectronics Center of North Carolina, MCNC began as a state-of-the-art design and computer chip production facility. It included a Class I clean room that networked the three universities and RTI. In its early years, MCNC worked to advance technology-led economic development and job creation through North Carolina. Within this role, MCNC operated the North Carolina Research and Education Network (NCREN) — one of the nation's first and most advanced statewide networks in the country that provides

Internet, video, audio and data network services to the University of North Carolina's 16-campus system, Duke University, Wake Forest University other educational institutions. MCNC also operated the North Carolina Supercomputing Center, which was established in 1986. In addition, through its Grid Computing and Networking Services, it delivers advance communications statewide to more than 180 public and private institutions, including universities, community colleges, K-12 schools, libraries and state government.

- North Carolina Biotechnology Center (1984). The Center was created by North Carolina General Assembly in 1984 to provide long-term economic and societal benefits to the state through the support and growth of biotechnology research, business, and education throughout the state. Since its establishment, the Center has provided about $16 million in financial assistance to 92 early stage biotechnology companies and has invested more than $50 million in North Carolina universities to recruit 46 outstanding faculty members, purchase multi-user research equipment, and sponsor more than 450 research projects. Through its educational efforts, the Center has tripled enrollment in the biosciences at the state's six historically minority universities by granting $8 million in special appropriations to improve the institutions' biotechnology programs.

- First Flight Venture Center (1990). The First Flight Venture Center is a state-of-the-art business incubator managed by the North Carolina Technological Development Authority. The facility offers approximately 15,000 square feet of leasable office and laboratory space for technology companies and research-based entrepreneurs. Services offered range from networking tenants with appropriate contacts in the private and public sectors to the provision of conference rooms, business equipment, receptionist services, and secretarial support. These services are available to both tenant and non-tenant companies that meet criteria for the program.

End Notes

[i] "Regional" in this instance refers to the Raleigh-Durham-Chapel Hill Metropolitan Statistical Area as defined by the US Census Bureau. Data is for 2004.

[ii] Albert Link. A Generosity of Spirit: The Early History of Research Triangle Park. Research Triangle Park, NC: Research Triangle Foundation of North Carolina, 1995, p. 10.

[iii] Ibid, p. 34. Excerpts from the Certificate of Incorporation, Governor's Research Triangle Council (September 25, 1956).

[iv] The Research Triangle Institute later changed its name to "RTI International."

[v] Albert Link and John T. Scott. 2003. "The Growth of Research Triangle Park." Small Business Economics, 20, pp. 167-175.

[vi] Link, Generosity of Spirit, p. 47.

[vii] Ibid, p. 80-81. The amendment to the original guidelines allowed for the acceptance of IBM, Nortel Networks and other companies into the Park.

[viii] Link, Generosity of Spirit, p. 81.

[ix] Hammer Siler George Associates. The Research Triangle Park: The First Forty Years. Silver Spring, MD: Hammer Siler George Associates, 1999, p. 17.

[x] Based on Research Triangle Foundation of North Carolina employment and new company survey data since 1960.

[xi] Link, Seed to Harvest, p. 59.

[xii] Ibid, p. 34.

[xiii] Scott Wallsten. 2004. "Do Science Parks Generate Regional Economic Growth? An Empirical Analysis of their Effects on Job Growth and Venture Capital" AEI-Brookings Joint Center for Regulatory Studies, Working Paper. Washington, DC. Also Bradley Braun and W. Warren McHone. 1992. "Science Parks as Economic Development Policy: A Case Study Approach." Economic Development Quarterly 6, no. 2: 135-147 and Harvey Goldstein and Michael Lugar. Science/Technology Parks and Regional Development Prospects for the United States. Edited by Ulrich Hilpert, Regional Innovation and Decentralization: High Tech Industry and Government Policy. London and New York: Rutledge, 1991a.

[xiv] For the purposes of their analysis, Hammer Siler George Associates defined "New-Line" industries as those falling within the below SIC codes. Data was based on the corresponding year's U.S. Census Bureau data.

SIC Code	SIC Code Description
SIC 28	Chemicals and allied products
SIC 35	Industrial machinery and equipment
SIC 36	Electronic & other electric equipment
SIC 37	Transportation equipment
SIC 38	Instruments and related products
SIC 48	Communications
SIC 60	Depository institutions
SIC 61	Non-depository institutions
SIC 62	Security and commodity brokers
SIC 63	Insurance carriers
SIC 64	Insurance agents, brokers, & service
SIC 65	Real estate
SIC 67	Holding and other investment offices
SIC 73	Business services
SIC 80	Health services
SIC 81	Legal services
SIC 82	Educational services
SIC 87	Engineering & management services

[xv] Hammer Siler George Associates, Research Triangle Park, p. 2. Percentage for 2005 and translation of SIC codes to NAICS codes calculated by the Research Triangle Foundation.

[xvi] Ibid, p. 19.

[xvii] William Little. An Emerging Dimension of the Research Triangle: Technology-based Start-ups and Spin-offs. Presentation to the Triangle Area Research Directors Club, October 2005.

[xviii] Link, Generosity of Spirit, p. 7.

[xix] Association of University Research Parks, 2006 Park Profile Survey, Executive Summary <http://www.aurp.net/about/statistics.cfm>, accessed September 4th, 2007.

Calculations

- *RTP contains 4% of the total number of companies of all North American research parks*
  - 157 companies (RTP) / 4,450 companies (AURP reported total) ≈ 4%
- *RTP is 17 times larger in number of full time employees than the average research park (2,300 employees)*
  - 39,000 employees (RTP) / 2,300 employees (AURP avg.) ≈ 17
- *RTP is 14 times larger in land area than the average research park (505 acres)*
  - 7,000 acres (RTP) / 505 acres (AURP avg.) ≈ 14
- *RTP is 18 times larger in total built space than the average research park (1.1 million ft^2)*
  - 20,000,000 ft^2 (RTP) / 1,100,000 ft^2 (AURP avg.) ≈ 18
- *RTP is 18 times larger in capital investment than the average research park ($158 million)*
  - $2,800,000,000 (RTP) / $158,000,000 (AURP avg.) ≈ 18

[xx] Triangle Innovation Project, Prepared by IBM Business Consulting Services, February 2006.

[xxi] "Planning for the Next 50 Years: Strategic Issues for The Research Triangle Park". Excerpt from a report prepared by Anthony Townsend, Research Director, Technology Horizons Program and Alex Pang, Research Director, Ten Year Forecast Program for Institute for the Future (IFTF), January 2007.