XXV IASP World Conference 2008

The Next Generation of STPs: Continuing to Enhance the Triple Helix

Plenary Session 3:
Innovation and business country culture in relation to the development and success of STPs

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March 2008

Proposed for consideration for inclusion in the:
XXV IASP World Conference on Science and Technology Parks
Plenary Session 3: Innovation and Business Country Culture in Relation to the Development and Success of STPs

Executive Summary

When The Research Triangle Park was established, it represented one of the first economic development experiments. The founders set the foundation for the "triple helix" model, drawing upon synergies between North Carolina's academic, government and industry base to attract and grow research and development (R&D) operations.

Throughout the last fifty years, science and technology parks (STPs) as an industry have followed the model and have created value by concentrating knowledge assets and connecting them to other parts of the economy.

Going forward, different demands will drive STP development. Changes in the nature of science, shifts in R&D, the changing nature of work, and the continued global competition for talent will force STPs and other innovation centers to react accordingly. While the key mission of STPs will likely remain, the models through which they add value will change.

This paper provides a context for such change and begins to build a framework for understanding the next model for STPs.

Key words: New models for STPs, Changing nature of R&D, and Continued competition for talent

The Next Generation of STPs: Continuing to Enhance the Triple Helix

When The Research Triangle Park (RTP) was established, it represented one of the first economic development experiments of its time. The founders of RTP set forth on a deliberate effort to change the economic base of the region and state. The model they followed set the foundation for the "triple helix," drawing upon the strengths and synergies between North Carolina's academic, government and industry base to develop a place to attract and grow research and development (R&D) operations.

After more than fifty years, the result has been the formation of an urban land-mass in the middle of what was once unusable farm land. With more than 172 companies employing 40,000 full-time employees and approximately 15,000 contract workers, the Park represents one of the highest concentrations of high-technology industry and knowledge workers in the United States, if not the world. RTP and the core of industrial and commercial development it has sparked have changed the economic landscape of the region and state, establishing North Carolina as a globally competitive platform for knowledge-based industries.

Despite its success, RTP recognizes the need to continue to evolve and transform to meet the changing needs of R&D operations around the world and the demands of the global pool of knowledge workers. It also recognizes that, unlike the early stages of its development, the explosion in the number of science and technology parks (STPs) means that it has several, newer examples from which to learn.

To better understand the context in which it operates, over the past several years, RTP has partnered with groups such as IBM Business Consulting Services and the Institute for the Future (IFTF) to understand these changes and RTP's optimal response to those changes. Through the Triangle Innovation Project and subsequent follow-up work and connections cultivated through the International Association of Science Parks (IASP), RTP has built a solid knowledge base of current and composite/future best practices for STPs around the globe. This work has been supplemented by work by RTI International and a recently released report by the Battelle Memorial Institute on best practices in North American research parks.[1] Finally, through IFTF's Ten-Year Forecast Program, RTP has begun to process what impact global trends such as open innovation, the changing structure of science, and intelligent environments will have on its operations.

The following paper begins to analyze this body of knowledge and draw conclusions as to what they might mean to the future of all STPs. It is divided into four parts:

- Early Models;
- Changing Demands, Evolving Models;
- The View from Practitioners; and
- New Models for STPs: How to Proceed.

[1] For more information on RTI International, please see Figure 4 and note xxi.

I. RTP and Early Models

RTP's land-use model was developed to cater to the prevailing demands of corporate and US federal research at the time. The idea for the Research Triangle came at an opportune time for US business interests, as the American government and business community placed an increased importance on the role of R&D and technology in its post-war world. The guiding assumption behind the initial recruitment strategy for the Park was to attract R&D operations to the region to capitalize on the discoveries and new technologies developed at the region's three research universities. The hope was that the newly attracted, R&D oriented companies would change the economic base of the region and build a culture in which smaller, start-up industries could thrive.

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 with large plots of land appealed to may companies.[2] RTP took advantage of an abundance of land proximate to these research bases to accommodate corporations' desires to conduct their R&D in privacy.

The initial result was a single-use, semi-urban model that provided isolated, stand-alone campuses for large private companies or government research operations. The typical RTP tenant in the early years was a large company that controlled all aspects of its R&D operations, the profile of currents tenant has widened to include smaller companies, many of whose innovation is either a spin off of existing technology or support/feeds into larger research agendas. Whereas RTP began as a development far from the region's existing urban centers in 1950, today it is in the center of a thriving urban metropolitan area with major housing, office and commercial developments abutting its boundaries.

Concurrent to RTP's development, the STP industry was born. In smaller-scales, the RTP model was replicated during the 1960s, 1970s, and 1980s, with changes made to accommodate local characteristics and existing industry bases. In the US, especially, the model was adopted by individual universities to promote university-driven economic development.[3]

In the succeeding 50 years, more than 700 STPs and innovation centers have been formed and many more are planned or in development.[4] Countries and regions are using STPs as a way to jump start knowledge economies by attracting talent and cutting edge companies to fuel their burgeoning knowledge economies. Moreover, newer entrants into the market such as China are developing parks on a huge scale that are changing the industry dramatically. 400 of the parks are outside of North America, with over 50 of these being in China.[5]

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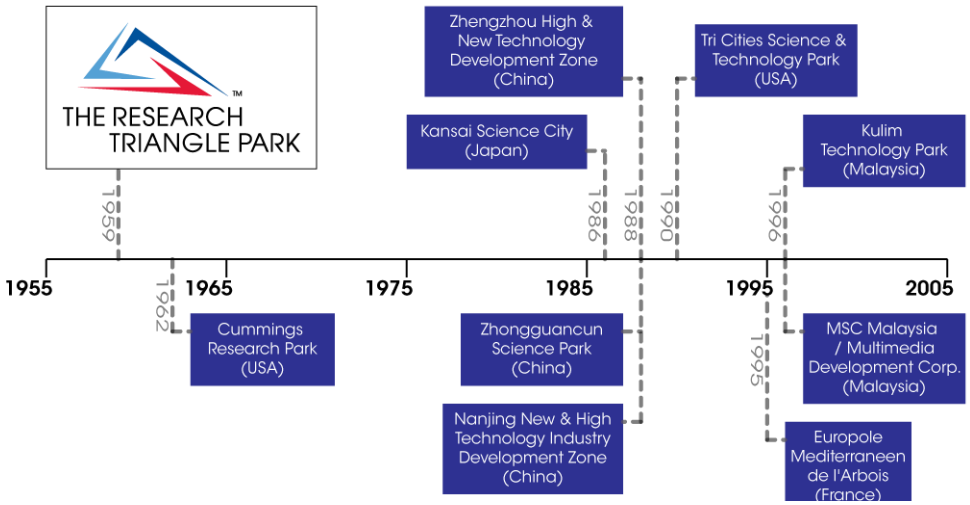
[2] Albert Link. *A Generosity of Spirit: The Early History of Research Triangle Park*. Research Triangle Park, NC: Research Triangle Foundation of North Carolina, 1995, p. 7.

[3] Battelle Technology Partnership Practice, Characteristics and Trends in North American Research Parks: 21st Century Directions, Battelle Memorial Institute, October 2007, p. 1.

[4] Count is based on membership data from the International Association of Science Parks and the Association of Science Parks. It also accounts for research conducted by IBM Business Consulting Services within the Triangle Innovation Project (see note *v*).

[5] IBM Business Consulting Services, *Triangle Innovation Project: Practices & Possibilities for Regional Innovation,* IBM Corporation, February 2006, p.52.

Figure 1: Timeline of Select, Large-Scale Research Park Developments



II. Changing Demands, Evolving Models

Research has shown that various trends are impacting innovation and knowledge creation and that the core-model of STPs has changed. As IFTF explained in a memo prepared for RTP on the "*Shifting Landscape of Innovation*," the basis for R&D and knowledge creation that was prevalent in the latter part of the 20th Century is drastically changing:

> *In today's global knowledge economy, the very nature of innovation is changing. As Henry Chesbrough describes in* Open Innovation: The New Imperative for Creating and Profiting From Technology *(2006), the R&D models that drove post-war economic growth in the United States have broken down. The rise of Indian science and Chinese engineering have created large new sources of highly skilled scientific labor. The fall of traditional scientific and technical journals and the rise of the Web are changing the ways scientists create and share knowledge. Corporate investment in R&D is declining, yet the pace of technological innovation is accelerating.*[6]

Developments in areas such as the movement toward an open economy and/or the need to create more sustainable environments, as well as increased competition among STPs and the need to differentiate unique value-propositions, will likewise affect the STP industry.

The work of IFTF and others such as the aforementioned Battelle Technology Partnership Practice, the IBM Global Centre for Economic Development, the work of Professor Tom Cannon of Ideopolis International, and the National Academies of Science, suggest that the trends can be categorized in three main themes:

1. The shifting nature of R&D and science;
2. The continued global competition for talent; and
3. Connecting in the Internet World.

[6] Townsend, Anthony, Alex Pang, "Planning for the Next 50 Years: Strategic Issues for Research Triangle Park, Institute for the Future, Palo Alto, CA, January 2007, p. 1.

Figure 2: STPs Today

In the US and Canada, the "typical" park is roughly 100 acres. It is situated in a suburban community with a population less than 500,000. The typical US or Canadian park is operated by a university or university-affiliated non-profit. The parks provide a range of services including technology and market assessments, marketing and sales strategy advice, business planning, and links to sources of capital.[7]

According to the 2007 Battelle study, today's parks are "creating an environment that fosters collaboration and innovation, leveraging the talent and expertise of universities to drive technology-based economic development." The report suggests that today's STPs look to "(nurture) entrepreneurs and new and emerging companies and (provide) space for existing companies to expand. At the same time, they seek to attract research anchors and the research operations of major corporations."[8]

The global profile for STPs is slightly different. According to the IASP 2006-2007 General Survey, the majority of parks globally are located in urban areas, with 58% being located in metropolitan areas with populations greater than 500,000. Fifty-three percent of these parks are not located on or near a university. The size of these parks also varies: 40% of IASP's members occupy less than 50 acres (less than 200,000 m2), while 19% occupy more than (1,000,000 m2) 250 acres.[9]

IASP reports that 40% of the respondents to their survey are exclusively owned by public administrations, 25% are owned by local governments, 21% by regional governments, and 18% by public universities.[10]

The Shifting Nature of R&D

In recent years, the scope and pace of change in R&D and the types of ecosystems that stimulate such innovation and creativity thrives has increased exponentially. The rise in open innovation, the changing structure of science, and intelligent environments, are beginning to alter STP operations.

According to IFTF, the greatest force in the breakdown of the traditional STP model is the move away from basic research in corporate R&D. While R&D is still an important aspect of many companies' ability to remain competitive in a rapidly changing marketplace, the way in which such R&D is conducted and its importance as a market driver have changed.[11] In the first part of the 20th century, company R&D was the market driver; today, applications of convergent technologies (from multiple sources) are driving markets and corporate R&D is a tool by which companies remain competitive.[12] While R&D remains important in maintaining market edge, companies no longer necessarily see it as a function that must be done in-house. Increasingly, R&D is being outsourced or obtained from outside sources.

IFTF goes on to note that the kinds of sciences are changing. Along with the continuing abbreviation of timelines of innovation and commercialization, the convergence of heretofore

[7] Battelle, p. ix

[8] Battelle, p. 39

[9] *Facts and Figures of Science and Technology Parks in the World: IASP General Survey 2006-2007,* International Association of Science Parks, 2007, pp. 2 and 21.

[10] IASP General Survey, p. 31

[11] Townsend, p. 2.

[12] *Dirks, Susanne, Mary Keeling and Ronan Lyons,* "Economic Development in a Rubik's Cube World, How to turn global trends into local prosperity," IBM Corporation, Somers, NY, 2008, p.4.

unrelated disciplines are creating areas of science not previously imagined. This is forcing companies to be even more innovative and creative in sourcing new ideas and technologies.[13]

IBM describes this change well, noting the pressures on all companies as they look to return to their competencies to increase their competitive edge. As IBM explains, in the face of increased global competition, businesses are "re-arranging their activities, focusing on core competencies and relying on others for non-core activities." Because of this, partnerships are increasingly more important to take care of non-core competencies (such as niche or specialized R&D) that companies currently do not posses.[14]

The Continued Global Competition for Talent

Whereas corporations with top-down control of all aspects of R&D operations—and the demands of those corporations—drove STP development in the earlier years, increasingly today's drivers are the word-class talented researchers and knowledge workers who staff such operations.

Because technological advances have broken barriers of distance, the scale of mobility is greater and more open than ever. A recent report by the Global Commission on International Migration suggests that the number of international migrants has doubled in the past 25 years.[15] While only a minority of these migrants are highly skilled workers, representing the "workers-to-work" phenomena, those who are can choose where they want to work and often choose places that allow them to nurture their talent. As such, they look for places with clusters of talent like them, where they have access to the resources and connections where they can bring their ideas to fruition. These places, as Professor Tom Cannon points out, share much the same characteristics of today's STPs and innovation centers.[16] Places that do not possess these attributes are hard pressed to attract or retain concentrations of such talent.

As emphasis shifts to catering to *both* the institutions in which R&D takes place *and* the individuals who undertake the research, the services and value provided by STPs has evolved from mere space options to a broader menu of amenities. This, in turn, has resulted in a shift away from single-use real estate developments to developments that emphasize mixed-use, live-work-play environments that are more closely connected to the regional economies in which they exist. These "innovation zones" provide state-of-the-art space options to support R&D with amenities that attract and support highly talented workers.[17]

As IFTF further explained in their memo, "*Shifting Landscape of Innovation*":

> *For decades, the ideal R&D lab was a self-contained, introspective place…These places reflected a faith in the ability of corporations and states to manage or even direct innovation, confidence in supply-driven innovation models that emphasized the ability of corporations to shape markets, and a belief that investment in basic research would readily translate into economic and regional development.*[18]

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[13] Townsend, p. 2.

[14] Dircks, pp 6-7.

[15] The Global Commission on International Migration, "Migration in an interconnected world: New directions for action, Switzerland, 2005, p. 5.

[16] "Science Parks: Helping Companies to Win & Retain Talent: The Special Case of the Inner City," PowerPoint presentation, Professor Tom Cannon, Dean, Buckingham University Business School and CEO Ideopolis International, version circulated March 2008.

[17] Townsend, p. 2.

[18] Ibid, p. 2

Connecting in the Internet World

The above suggest, in short, that the "death of distance" and the greater mobility around the globe—in terms of talent and the knowledge they possess—means that place does not matter as much as the ecosystem the place offers and the connection it provides. Because of this—as IFTF aptly notes—the original, isolated, autonomous STP model is being challenged by a kind of New Urbanism for science and technology that capitalizes on the convergence of these many resources.[19] Similar to the adage that it is not what one knows but who one knows, today's STPs appear to exist in a system in which it is not so much *where* an STP is located but more to *what types* of assets and partners it is *connected* that gives it value (though proximity to some level of knowledge resources continues to be important).

Hence, these innovation zones take on an even greater importance. As IFTF describes further:

> *Companies seek these zones out to collaborate with each other, and to access networks of investors, suppliers, and potential customers. Developers and governments see innovation zones as tools for building local economies, for attracting and retaining world-class scientific and technical talent, and often reinventing older industries for the global age. For scientists and engineers, innovation zones are attractive both for their day-to-day amenities, and for their longer-term intellectual and career opportunities.*

Such innovation zones are beginning to emerge that blend mixed-use R&D complexes with state-of-the-art laboratories and amenities that attract and support highly talented workers. [20]

The result is a movement to the city. As Professor Cannon aptly notes, cities are the most natural location for such zones because they are the place where leading universities, corporations, culture, and knowledge-based ventures congregate.[21] The dense urban base allows for the collaborations to innovate, the population base/concentration for the testing of new ideas (or in the case of cutting-edge biomedical research, the access to large teaching hospitals and medical universities, which provide a population for clinical testing), the clustering of like minds, and a thick job market which are attractive to today's knowledge workers.

III. The View from Practitioners

The impact of these trends on STPs is just beginning to be felt. To understand the context in which it is beginning its efforts to evolve to its next model for success, RTP undertook a survey of peer STPs and innovation centers around the world. The survey looked to gather input on whether others are noticing the trends described above and if so, what they plan or think STPs should do to counteract them.

The survey begins to build a common knowledge base that catalogs what STPs and technology-based regions around the world—of differing sizes, concentrations, and stages of development—believe will be impacting their futures. More importantly, it begins to frame the types of common questions and issues facing STPs as they look to enhance the triple helix model.

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[19] Ibid, 2.

[20] Ibid, p. 2.

[21] Cannon, slide 9.

Survey Structure and Respondents
Through a series of multiple choice and open-ended questions, the survey collected data from 39 STP managers and economic development professionals. The survey tested assumptions along three major topics:

1. STP and Innovation Center Characteristics Going Forward (physical attributes and key contributions managers expect to see in their developments in the next 5-10 years);
2. Future Trends in Science (Trends that will affect STPs and innovation hubs); and
3. Potential Models (Ways in which STPs expect to network/collaborate globally or within their own regions).

Respondents represent a cross section of parks/regions along size, geographic dispersion and focus areas. Forty-seven percent of respondents represent European locations; 34% of respondents represent developments in North America; 11% represented parks in Asia; and 8% are from other countries in the Middle East and Latin America. The size of STPs responding to the survey range from ones having 6 companies to ones with more than 400. Twenty-four percent of respondents are based in regions with populations under 500,000; 18% represent areas with populations between 500,000 and one million; 26% represent areas with populations between one and three million; and 32% represent areas with populations above three million.

The survey instrument and full results are included in Appendix A and B, respectively. Highlights of the responses are as follows:

- **Characteristics**
  The survey suggests overwhelming agreement among STP managers that one of the most important roles going forward is the ability to attract world-class talent. In addition, they believe that STPs will be measured on their ability to create economic impact for their surrounding regions, provide places for collaboration, and attract and retain cutting-edge companies.

  In terms of the future, optimal location of STPs and innovation centers, the top three settings chosen by respondents were: (1) innovation zones—34%; (2) separate developments proximate to a university campus—28%; and/or (3) within a university campus—13%.The consensus view held that STPs will continue to be located proximate to universities or other R&D centers and/or within a city center.

  Respondents also believe that STPs' ability to attract talent, access capital, and leverage their relationships with universities are among the three most important success factors going forward.

- **Trends in Science**
  In regard to future trends in science: respondents agreed that heightened competition for talent, the growing importance of energy sustainability, and the faster spread and convergence of technology are among the top trends currently affecting or likely to affect STPs going forward. They were split as to their opinion on the affect (if any) of trends in decreased government-sponsored research funding on STPs and increased global capital flows; and the majority feel that open innovation/science will have a minor effect on STPs.

When asked the likelihood of certain scenarios occurring within the next 5-10 years, respondents believe:

- Corporations potentially and are likely to move away from basic research and will source such research from others;
- Corporate R&D is likely or very likely to be outsourced and corporations will look for external partnerships to help fund their R&D efforts; and
- Product development and market demand will drive corporate R&D.

Respondents were divided in their belief on whether universities would take a larger role in managing/driving research agendas and whether local and state/regional governments would replace national governments in shaping science/R&D policy.

- **Models: Networking and Collaboration**
  Going forward, the types of relationships and collaborations STP managers would like to cultivate are very closely aligned with the areas identified as future success factors for STPs, namely their ability to attract talent, leverage their relationships with universities, and provide access to capital. In particular:
  - Respondents overwhelmingly believe that future STPs should provide common spaces for tenants to congregate and meet as well as mixed-use developments that provide live-work-play amenities.
  - The large majority of respondents believe that future STPs should maintain eco-friendly practices and continue to maintain close relationships with universities and knowledge centers.
  - Respondents were split as to the importance of STPs being pedestrian friendly and/or limited only to R&D operations, although most believed being proximate to similar industries is somewhat important;
  - Of current or future relationships, respondents identified catalyzing knowledge creation, creating business leads, reaching global partners/potential tenants, and attracting talent as the most important outcomes.

IV. How to Proceed

While the above responses are interesting, perhaps what is even more instructive are the questions raised by both the commonality and divergence of the opinions provided. The results of the survey suggests that while STP managers recognize the need to be aware of trends in science and the nature of work and to be proactive in addressing them, their primary concern is developing the capacity and relationships to counter and/or leverage those trends. For example, respondents appeared less concerned over the extent to which open science/collaboration or changes in R&D expenditures will have than whether they have the connections and talent in place to counter whatever the results of these trends might be. Similarly, managers seemed less concerned about the actual "setting" of future STPs and more interested in the overall ecosystem STPs will be able to provide—the setting, amenities provided, and connections to similar and complementary operations.

In short, rather than a new *raison d'être* per se, the analysis of the current conditions for science and talent attraction (with the survey results as validation) suggests that the original mission and objectives of STPs are not radically different from when the movement began nearly fifty years ago. What differs is the focus of their efforts, the tools used to answer the demands, the span of time STPs are given to respond, and the menu of best practices and real world examples they can draw upon to orchestrate their response.

Going forward, these survey results should serve as a common knowledge base that catalogs what STPs around the world believe will impact their futures. Such knowledge will better equip STP managers to begin identifying appropriate policies and value-added services for current and future tenants.

For RTP, the next step in this research agenda is to work more closely with IFTF on custom work to identify a comprehensive view of key trends that may influence and shape STPs in the coming years. This research will be designed to demonstrate thought leadership on the future technology, economic, and business trends that are likely to impact STPs around the world, with a particular emphasis on disruptive shifts that open up new opportunities or necessitate substantial changes in strategy.

To execute the project, IFTF will begin by mapping future trends and developing a vision of the future of STPs, and over the course of the project, convert these foresights into concrete strategies. Some of the trends and potential strategies will be tested with a focus group of experts prior to the XXV IASP World Conference on Science and Technology Parks, 2008 and a summary of the resulting strategies and map will be unveiled at the XXVI IASP World Conference on Science and Technology Parks, 2009.

Concurrent to the work with IFTF, RTP is working with the newly created North Carolina Research Parks Network to begin mapping a number of activities/projects around which the group can collaborate to impact the evolution of the next STP model in the state. The network will also work to better leverage its individual strengths to support efforts to better the competitive position of North Carolina in attracting and retaining the types of industries that are natural STP inhabitants. Members of the network include Centennial Campus (NC State University), Carolina North (University of North Carolina at Chapel Hill), Charlotte Research Institute; Gateway University Research Park (a joint-venture between North Carolina Agricultural and Technical State University and the University of North Carolina Greensboro); North Carolina Research Campus; and Piedmont Triad Research Park (Wake Forest University).

V. Conclusion

As was the case nearly fifty years ago, at the birth of the STP industry, STPs have the opportunity to present a unique value proposition in an increasingly competitive global marketplace. In addition to catering to business needs, STPs must now adapt to address the demands of talent and knowledge workers that are vital to a region's economic success. In doing so, STPs will need to look at new tools and new ways to connect disparate centers of similar innovation.

The above discussion has only begun to analyze the growing body of knowledge that will inform such decisions. From it, others can draw conclusions as to what these changes and trends will mean to the STP industry.

Figure 3: Past, Current and Future STP Demands

	Early Models	*Current Models*	*Models Going forward*
Overall Mission	Improve the regional economy by bringing together knowledge and research with entities that can bring those ideas to market.		
Key Client(s)/ Drivers	• Corporations and governments	• Researchers and knowledge workers • Companies and/or R&D divisions within corporations	• Researchers/knowledge workers • Organizations that connect assets • Companies and/or R&D divisions within corporations
Eco-system Players	• Corporations • Universities • Companies that support R&D operations	• Knowledge Workers • R&D Companies • Knowledge creators/ Universities • Entrepreneurs • Venture Capitalists	• Knowledge Workers • R&D Companies • Knowledge creators/ Universities • Entrepreneurs • Venture Capitalists • Partnerships among actors/Park tenants • Urban re-vitalizers
Demand to be addressed	• Linking corporations with knowledge creators (universities) • Building clusters of industry that can draw upon one another	• Attracting/retaining talent • Connecting talent to the market • Helping to commercialize ideas • Maintaining concentration of knowledge-based industries	• Attracting/retaining talent • Catalyzing and connecting talent • Partnering with appropriate global entities • Attracting new industries at the center of the knowledge-based economy
Location	Driven by company preference	Driven by ability to spark collaboration among individuals and attract talent	
Amenities	Hard infrastructure (e.g., access to markets, proximate to like companies, and company demanded resources)	• Hard infrastructure • Soft infrastructure that promotes connections	• Soft infrastructure that promotes connections • Infrastructure that promotes collaboration across STPs • Amenities that attract and retain mobile global talent • Infrastructure that promotes growth/dynamism of new industries at the center of the knowledge-based economy

Figure 4: Lessons Learned: Success Factors and Guiding Principles for STPs

More recent entrants to the STP industry have increasingly been able to learn from a core model, drawing upon the lessons of others to create systems tailored to their specific needs and resource base. The following is drawn from the work of RTI International—the first organization and anchor tenant of RTP—and its almost fifty-year experience of translating the RTP experience to other countries. From this long experience has come a number of "lessons learned." Many of these lessons are valid for both the developed and developing economies; others are more valid for one but not the other. All will be relevant and helpful in whatever model of STP emerges.

Comparative Advantage – The most successful STPs around the world are those that are built around unique combinations of human resources, market demand and quality-of-place location factors that must be identified, fully understood, maintained and constantly re-nourished.

Target Clusters - Successful parks focus on a subset of technology clusters that respond to existing local and regional demand and build on the area's comparative advantages and research strength. Increasingly, STPs (especially smaller ones) succeed by cultivating core competencies in a niche market and developing a clear value proposition for a target group of industries/ activities.

Institution Building - Successful STPs develop the supporting institutions, and not just physical infrastructure, such as university linkages, business incubators/accelerators and training facilities. This is critical in attracting a sophisticated labor force and in developing businesses in the target clusters. Successful STPs proactively build and nurture their entire ecosystem.

Phased Strategy - In addition to identifying the appropriate types of activities that will be present in a new STP given the park's unique assets, the designers must also identify the appropriate sequencing for introducing these activities to the park. Many parks may have to start by targeting existing demand in the region—such as training facilities or consulting firms—rather than cutting edge R&D facilities. Those may develop later. The physical development of a park should also follow a phased strategy so that the infrastructure and facilities can be tailored to tenant demands in a scalable fashion.

Collaborative Spirit - The most successful STPs are those that build local, regional, and international partnerships in order to utilize fully the resources available. Local public services, especially infrastructure and education, are key to attracting and retaining the scientific talent that will make any high technology park a success.

Business Culture - Every country has its own set of cultural identities and unique business practices. In a global economy, these differences can translate into a comparative advantage, or can sometimes serve as a disadvantage. With today's hyper-internationalization of scientific inquiry, technological development, innovation, competition, and market demand, the most successful STPs will be those that effectively marry local comparative advantage with international practices—thereby creating a unique, multi-cultural, international environment.

Government Support - A critical success factor common to numerous STPs internationally is the role of government to generate demand to support the businesses being targeted by the park. For example, government influence (through existing projects and technology needs) can be used to attract anchor tenants and develop flagship projects. Increasingly some governments are focusing their attraction efforts on individuals, as well as companies. One prime example is the government of China's efforts to lure back *hai gui*—overseas Chinese entrepreneurs—to Zhongguancun and other STPs in the country.[22]

[22] As reported at the XXIV IASP World Conference on Science and Technology Parks, 2007, by Zhang Qian in "A World Top-Class Science Park to Attract World Top-Class Human Resources—How Zhongguancun Science Park Becomes a Magnet for Overseas Returnees" (Plenary session three).

Note on RTI: RTI International was created as the Research Triangle Institute in conjunction with the founding of RTP by the three major research universities—Duke, University of North Carolina and North Carolina State. It is a non-profit research corporation which undertakes applied research and consulting on a contract basis. Examples of RTI work include: RTI staff worked with the founders of the Daeduk Science Park and the Korean Institute of Science and Technology in the design and start up of those two institutions. Similarly, RTI senior staff worked on the startup of the Hsinchu Science Park in Taiwan, which along with Daeduk has become a model for high technology development in Asia. More recently, RTI has worked with locations as different as Poland and Dubai to design research and technology parks to stimulate high valued-added economic growth.

Appendix A: Future Trends Survey

The nature of research and development (R&D) and the physical environment in which innovation and creativity thrives has changed. For most of the history of the industry, science and technology parks (STP) have been a suburban phenomena. Increasingly, such activities have been more urbanized, relying on multi-use arrangements that are more closely aligned with the regional economies in which they exist and that increase the opportunity for interaction. Given these trends, the traditional model of STPs and the way that they interact with their regions will necessarily change.

To better anticipate the changes to come, The Research Triangle Park (RTP) is conducting the below survey to solicit input from a broad range of participants, including members of the International Association of Science Parks and the Association of University Research Parks and other related economic development organizations. The survey results will be used to verify and augment analysis currently being undertaken by RTP. The survey consists of 15 questions and is organized around three topic areas:

- Characteristics Going Forward – physical attributes and key contributions
- Future Trends in Science
- Potential Models - networking/collaboration

Feedback from the survey will be integrated into research to be reported at the XXV IASP World Conference of Science and Technology Parks, 2008 in Johannesburg, South Africa.

Characteristics Going Forward

1. In the next 5-10 years, which of the following will be the most sought after characteristics of STPs and innovation centers? (Choose as many as three)

1. Offer places for cutting-edge resources
2. Attract and retain highly-talented workers
3. Provide places for collaboration
4. Catalyze the development of social and professional networks
5. Create economic impact for the surrounding region
6. Attract and retain cutting-edge companies
7. Use technology-based economic development to help their region reinvent/strengthen existing industries
8. Other

2. Of the following physical characteristics, which are the most likely to define the next generation of STPs or innovation centers? (Choose as many as three)

1. Located within a university campus in a defined area
2. Separate, defined development proximate to a university or R&D Center
3. Mini-STPs integrated within a city center within defined boundaries
4. Nodes within an urban setting, no set boundaries
5. Innovation zones- mixed-use R&D complexes with state-of-the-art labs/amenities to promote collaboration
6. Other

3. Going forward, please rank the following based on their relative importance to the future success of your park or region: (Please rank in order of importance, using 1 to denote the most important aspect and 5 to denote the least important)

- Relationship with universities or other knowledge creators
- Network/formal relationships with other STPs
- Providing environment that attracts talent
- Availability of non-traditional amenities (places to congregate, live/work/play options)
- Access to capital

Future Trends in Science

4. Will the following trends cause you to change the way things are done at your STP or within your region?

	Will have no effect	Will have minor effect	Will have major effect	Already Affecting STPs/regions
Evolution of open science/open innovation	☐	☐	☐	☐
Growing importance of energy sustainability	☐	☐	☐	☐
Heightened competition for talent	☐	☐	☐	☐
Decreases in government-sponsored research funding	☐	☐	☐	☐
Increasing global capital/investment flows	☐	☐	☐	☐
Faster spread and convergence of technology	☐	☐	☐	☐

5. Of the below scenarios, what is the likelihood of each occurring within the next 5-10 years?

	Very unlikely	Unlikely	Possible	Likely	Very likely
Corporations will move away from basic research and will source such research from others	☐	☐	☐	☐	☐
Corporate R&D will be outsourced just as other functions are being outsourced	☐	☐	☐	☐	☐
Corporations will look for external sources/partnerships to help fund their R&D efforts	☐	☐	☐	☐	☐
Corporate R&D will drive markets and product development	☐	☐	☐	☐	☐
Product development and market demand will drive corporate R&D	☐	☐	☐	☐	☐
Universities will play a larger role in managing/driving research agendas	☐	☐	☐	☐	☐
Local and state/regional governments will replace national governments in shaping science/R&D policy	☐	☐	☐	☐	☐

Potential Models

6. Traditionally, the relationship between STPs and innovation centers and universities or other institutes involved in R&D have been an important element of an STPs or regions attractiveness. Going forward, which of the following will be the most important partners for STPs and innovation centers? (Choose all that apply)

1. Research Universities
2. Start-up/entrepreneurial companies
3. Diverse mix of creative industries
4. Anchor companies; STP tenants and their suppliers
5. Concentration/clusters of similar or related industries
6. Networking organizations
7. Other

7. In addition to a space to innovate, STPs are becoming increasingly important as places that draw talent and collaboration. How important are the following attributes in the future success of STPs and innovation centers?

	Not Important	Somewhat Unimportant	Neutral	Somewhat Important	Very Important
Provide common spaces for tenants from different companies to congregate and meet	☐	☐	☐	☐	☐
Mixed-use development with live, work, play amenities	☐	☐	☐	☐	☐
Pedestrian friendly	☐	☐	☐	☐	☐
Limited only to R&D or knowledge intensive activates	☐	☐	☐	☐	☐
Proximate to similar/supporting industries	☐	☐	☐	☐	☐
Eco-friendly practices	☐	☐	☐	☐	☐
Strong ties to and/or presence of a major research university	☐	☐	☐	☐	☐

8. If your STP or region could form a partnership with any entity to best further your goals over the next 3-5 years:

a. With what type of entity would you form such a partnership?
b. What would be the outcomes of the partnership?

9. Do you currently have any relationships such as those described in Question 8? If you answered yes, please name and describe the relationship.

1. Yes
2. No

Your Park or Region

10. To help us better understand the survey results, please tell us about your STP or region.
    a. Respondents Name
    b. Title
    c. Park Name or Company
    d. E-mail
    e. Country
    f. For STPs or innovation centers: How many companies do you have within your formal boundaries?
    g. For STPs or innovation centers: What is the total number of employees for operations within your formal boundaries?

11. If you represent a STP, please answer the following two questions. If you represent a region or other entity, please skip to question

13.Please describe some of the activities in which your STP or innovation center is currently involved. (Choose all that apply)
1. Official relationship with a university
2. Informal relationship with similar developments
3. No relationship with other entities
4. Formal relationship/network with similar, proximate developments
5. Informal partnership with non-proximate STPs or other entities
6. Formal relationship with non-proximate STPs or other entitles (e.g. fellow parks in a different country)
7. Other

12. Of your typical tenants, please indicate the rough percentage break-down of a sample companies operations within your Park:
- Research
- Product development
- Marketing
- Corporate affairs
- Human resource development

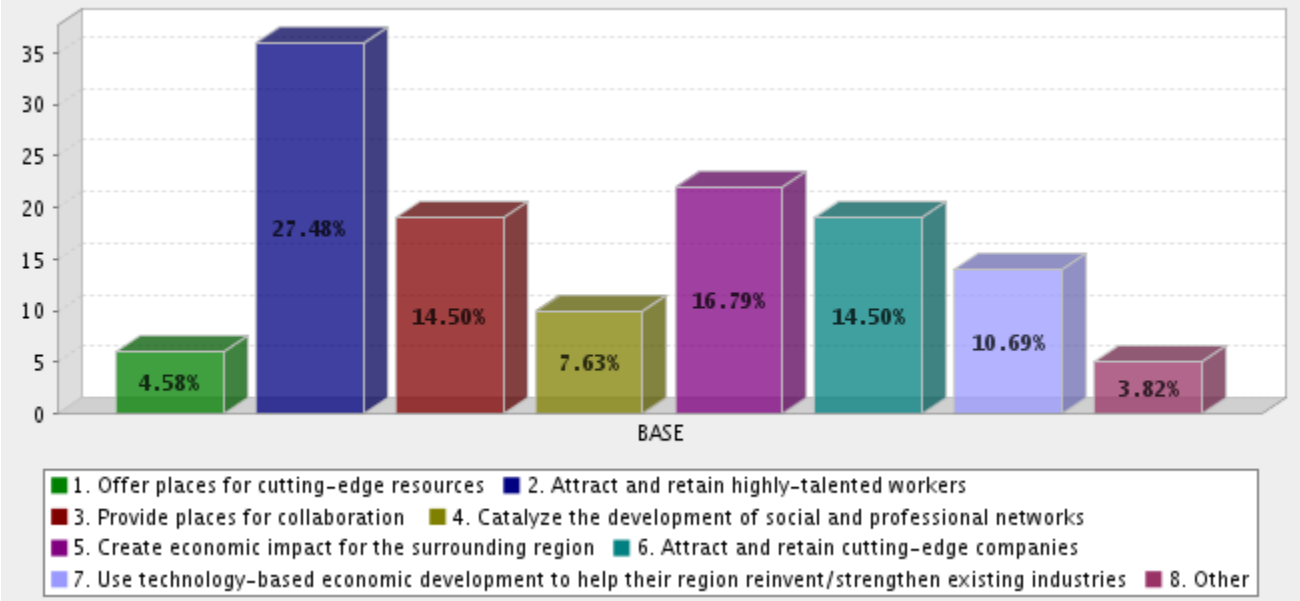
13. What is the population of your region
1. less than 100,000
2. 100,000 - 500,000
3. 500,000 - 1 milliion
4. 1 - 3 million
5. more than 3 million

14. How many research universities are in your region?
1. 1
2. 2
3. 3
4. 4
5. 5
6. More than 5
7. There are no research universities in my region

15. In addition to this initial survey, RTP will be undertaking a more detailed research project on potential future models for STPs and innovation centers. Would you or someone from your organization be interested in learning about this research project?
    1. Yes
    2. No

Appendix B: Future Trends in Science Survey Results

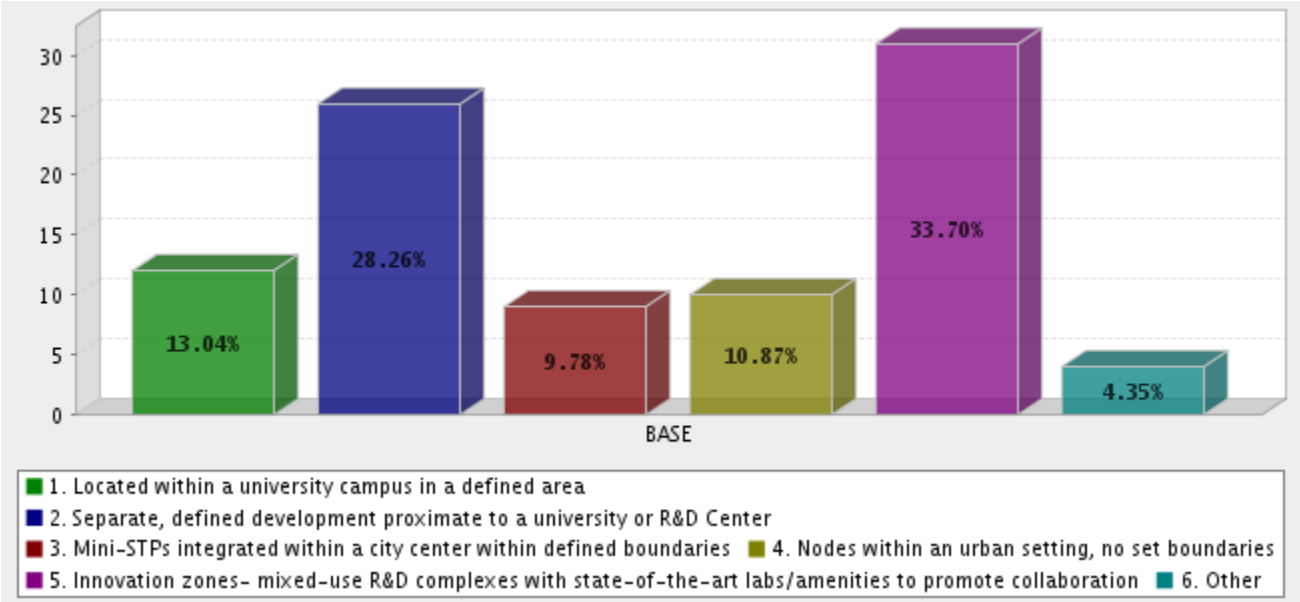
1. In the the next 5-10 years, which of the following will be the most sought after characteristics of STPs and innovation centers? (Choose as many as three)



Other (write-in) responses:

- Proximity to world-class science
- Catalyze the interaction between first world and developing countries
- Leveraging research dollars for multiple initiatives
- Attract funded "star" scientists.
- Foster cooperative research between acdamecic labs , large and small companies ; facilitate creation of cutting-edges companies

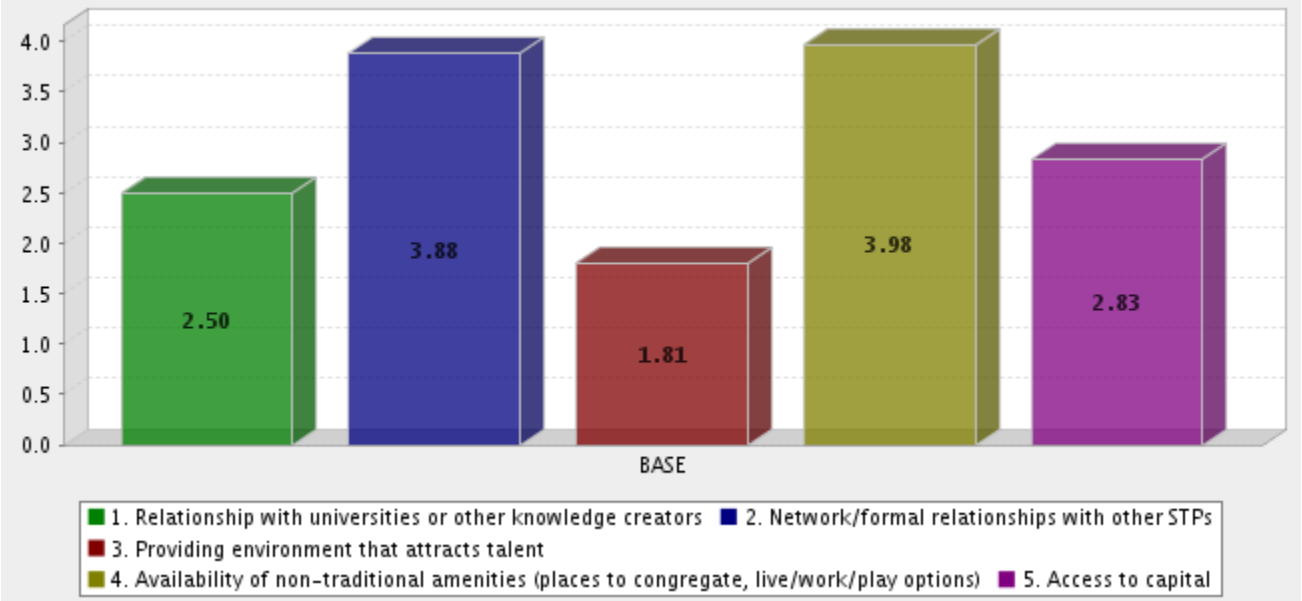
2. Of the following physical characteristics, which are the most likely to define the next generation of STPs or innovation centers? (Choose as many as three)



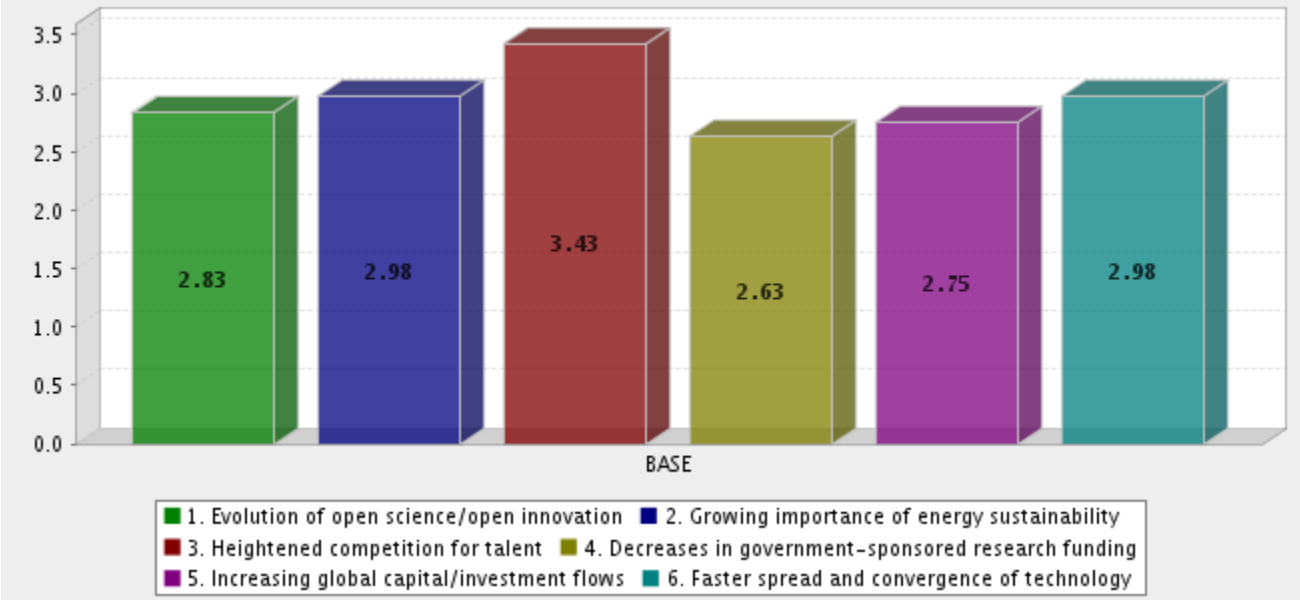
Other (write-in) responses:

- proximity to university/academic research
- co-located with a major R&D private firm
- Green, sustainable design
- technopole concept = network of innovative companies , labs , cutting-edges resources , in a metropolitan area

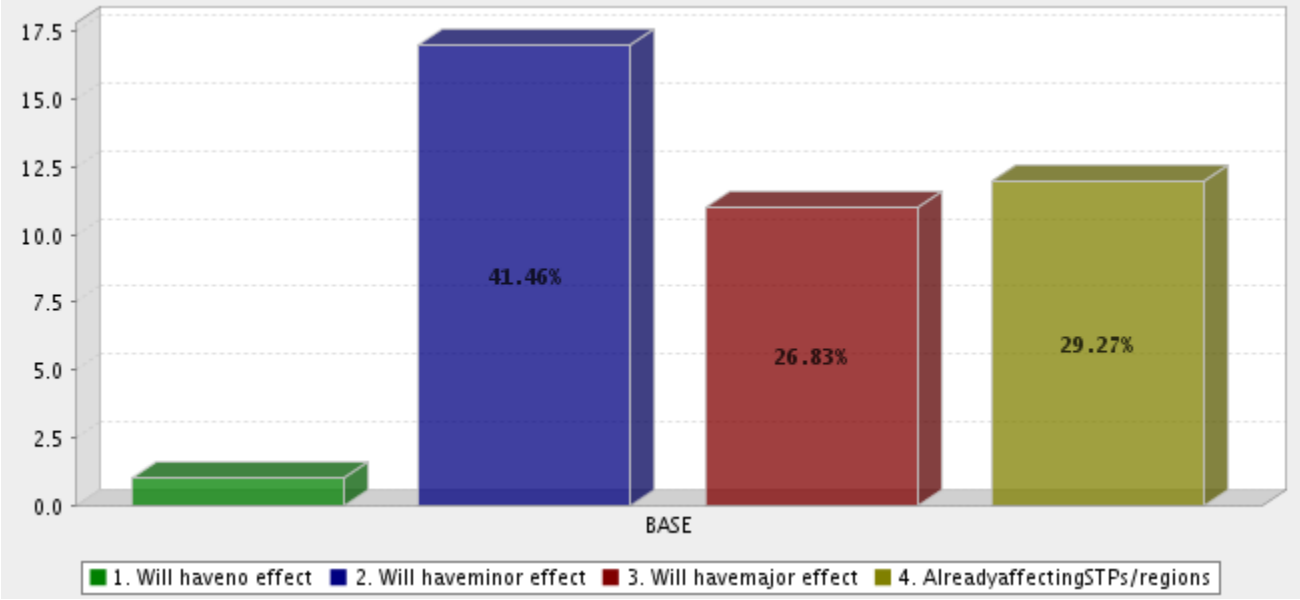
3. Going forward, please rank the following based on their relative importance to the future success of your park or region: (Please rank in order of importance, using 1 to denote the most important aspect and 5 to denote the least important)



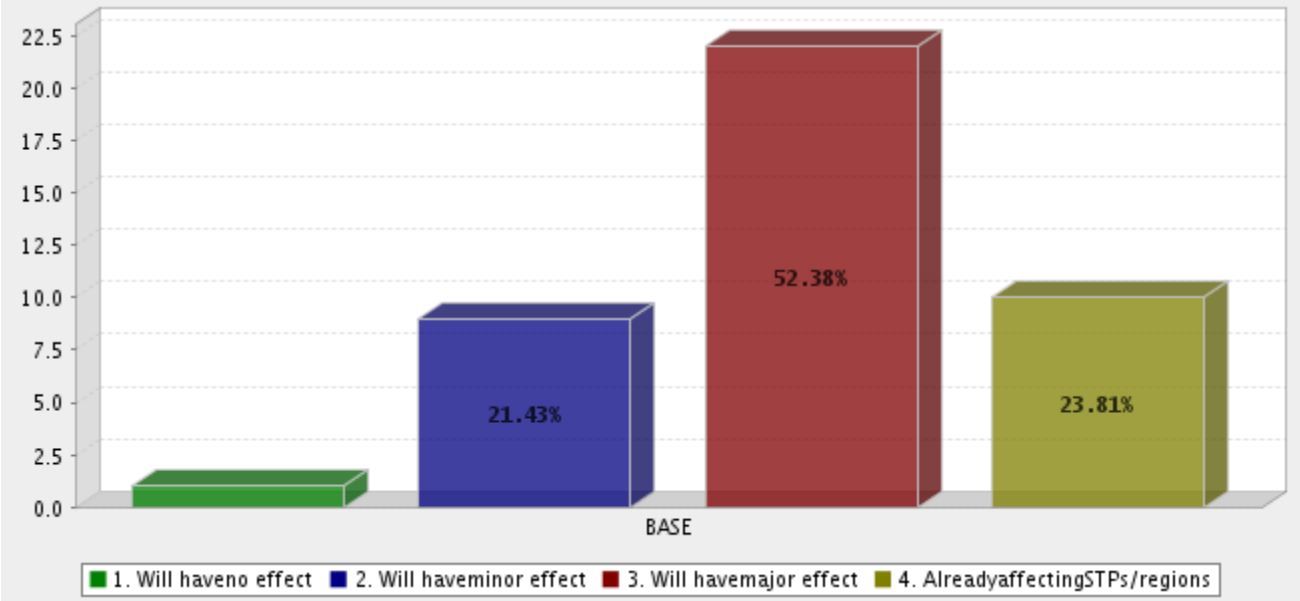
4. Will the following trends cause you to change the way things are done at your STP or within your region?



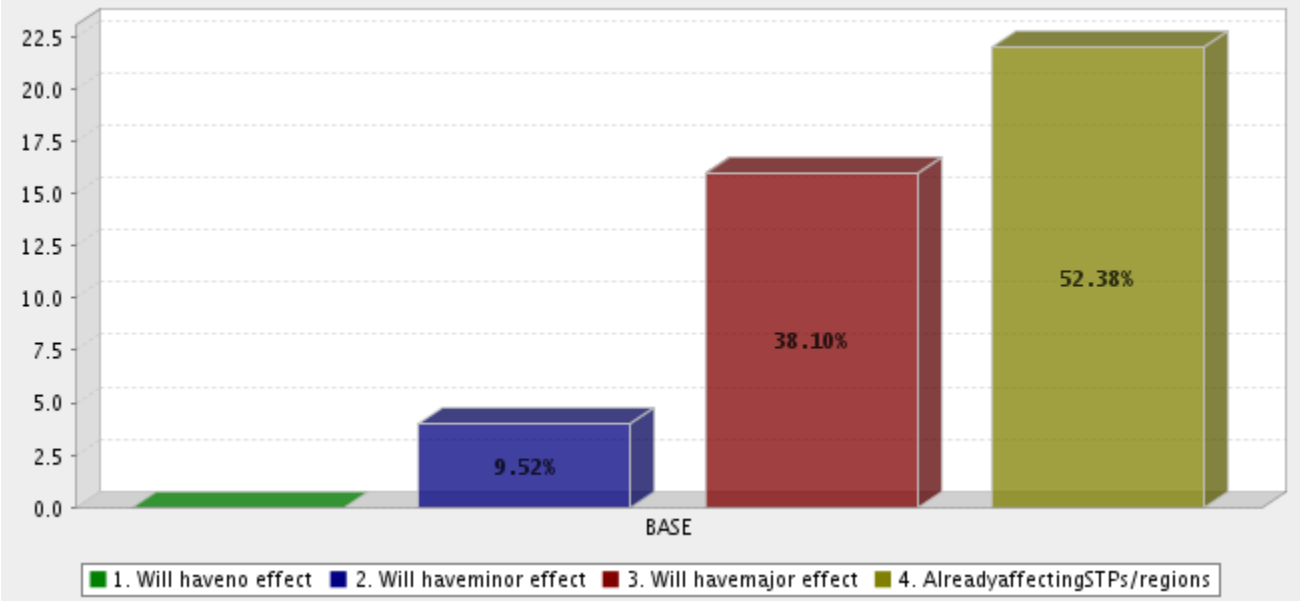
4a. Evolution of open science/open innovation



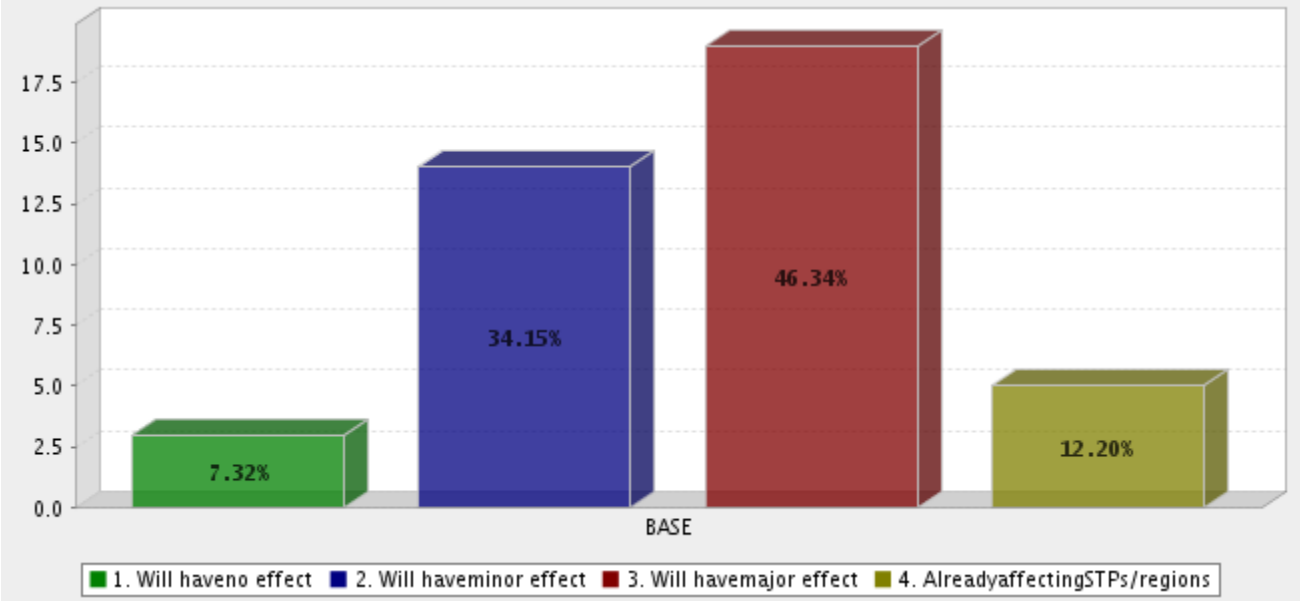
4b. Growing importance of energy sustainability



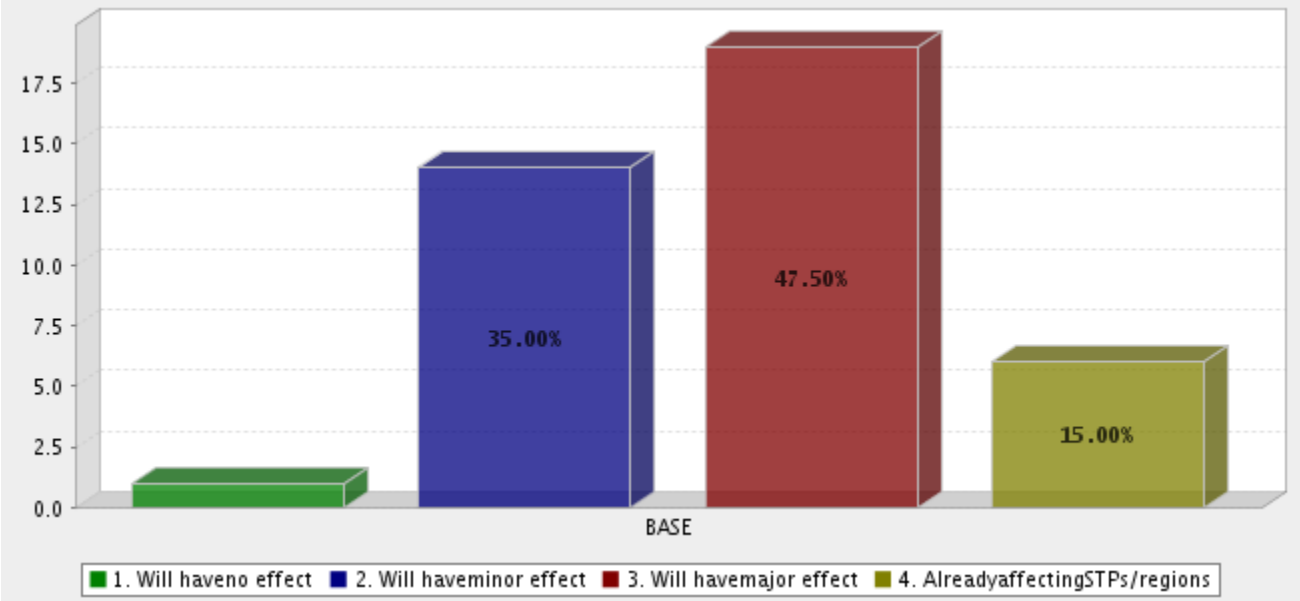
4c. Heightened competition for talent



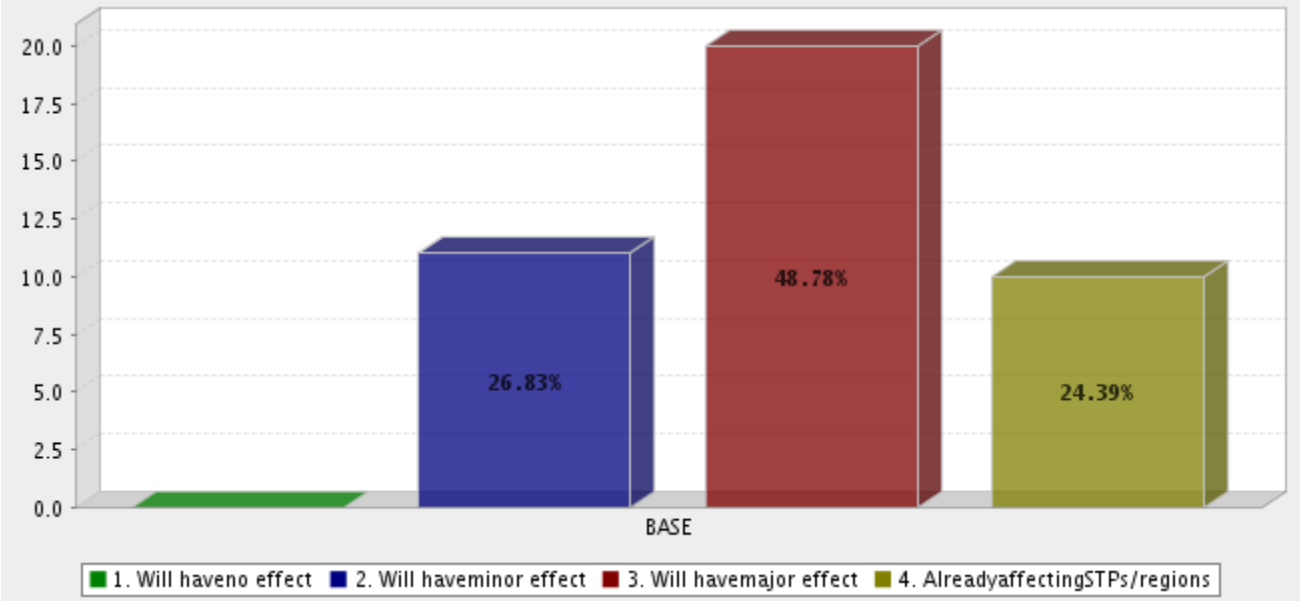
4d. Decreases in government-sponsored research funding



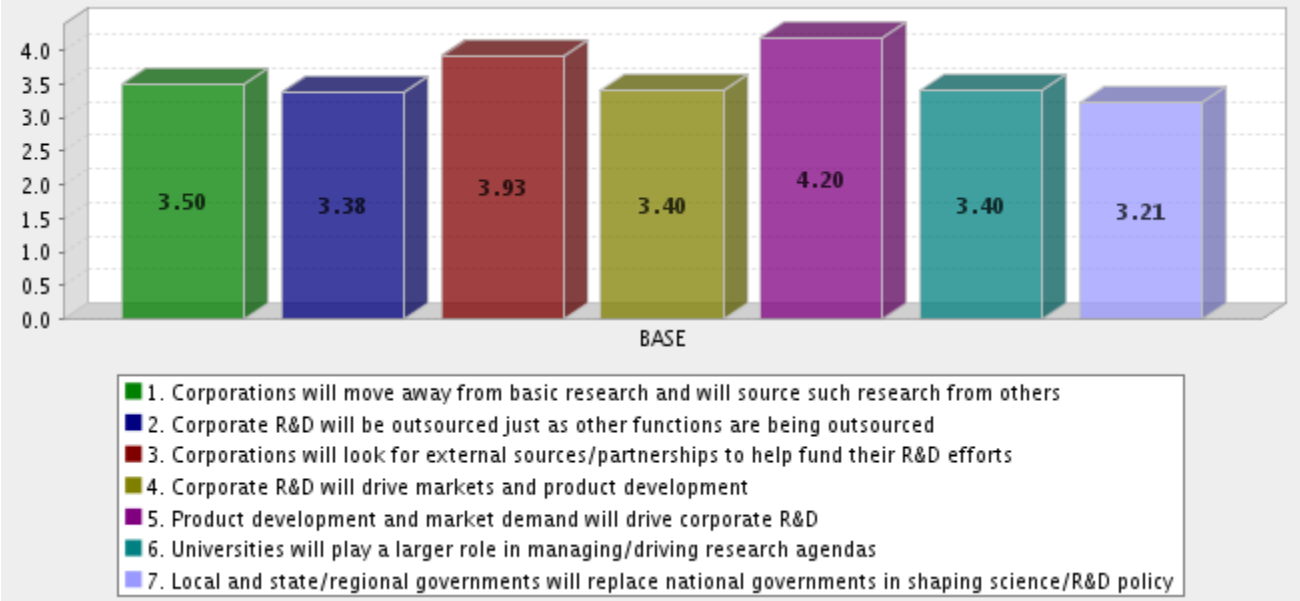
4e. Increasing global capital/investment flows



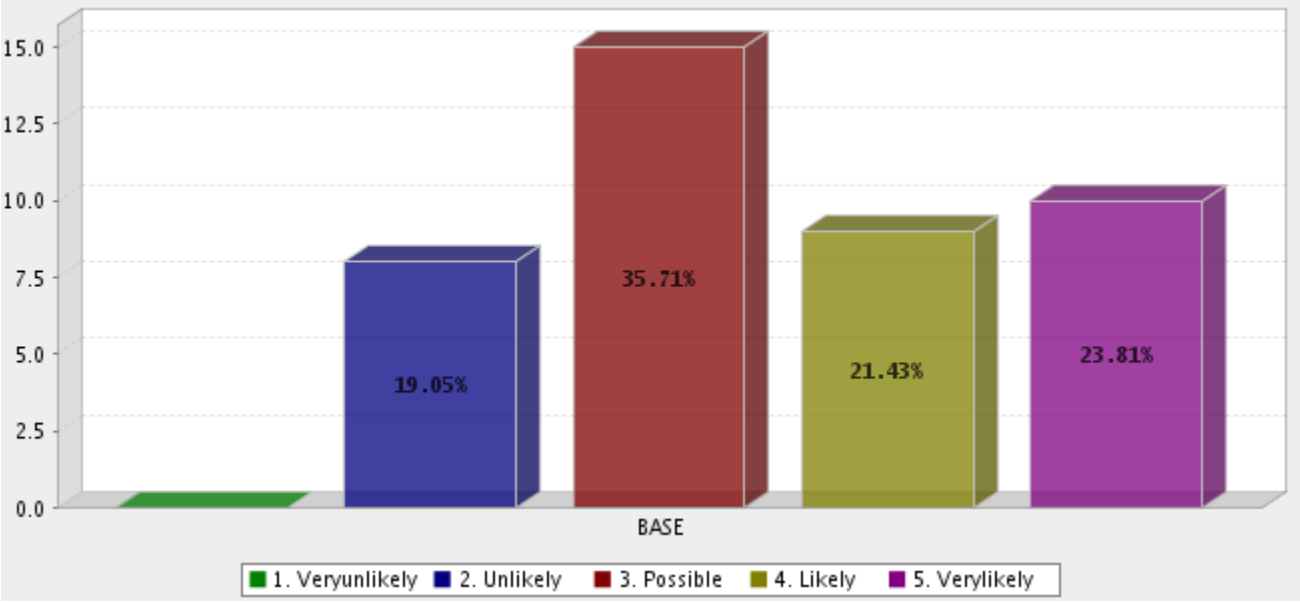
4f. Faster spread and convergence of technology



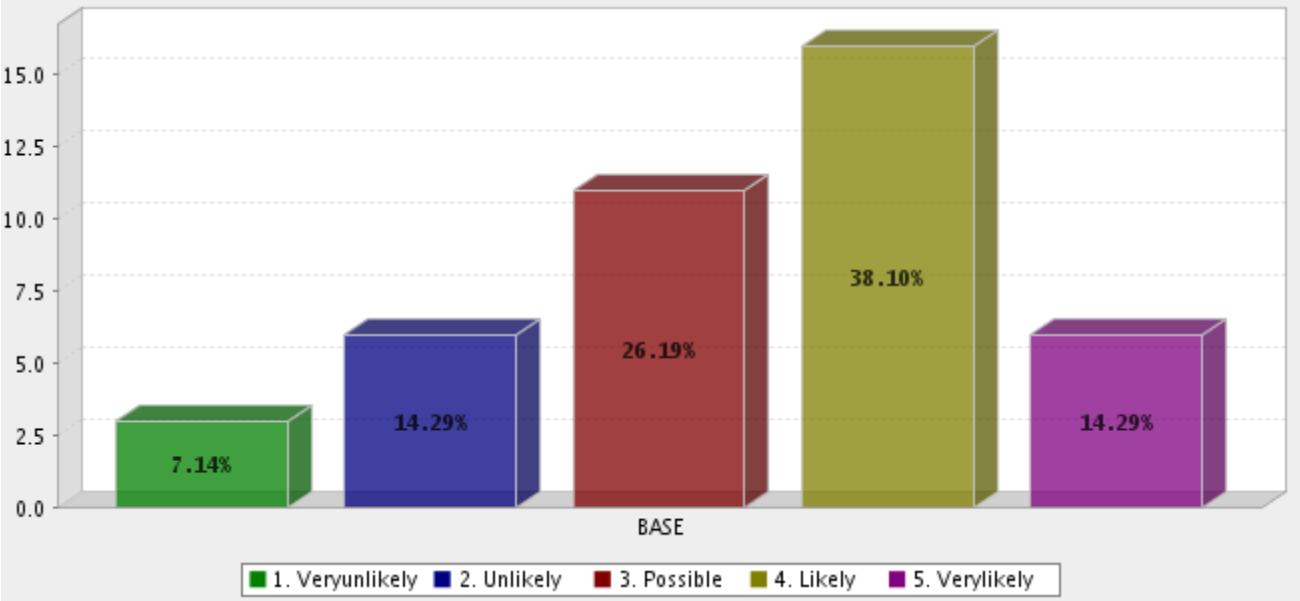
5. Of the below scenarios, what is the likelihood of each occuring within the next 5-10 years?



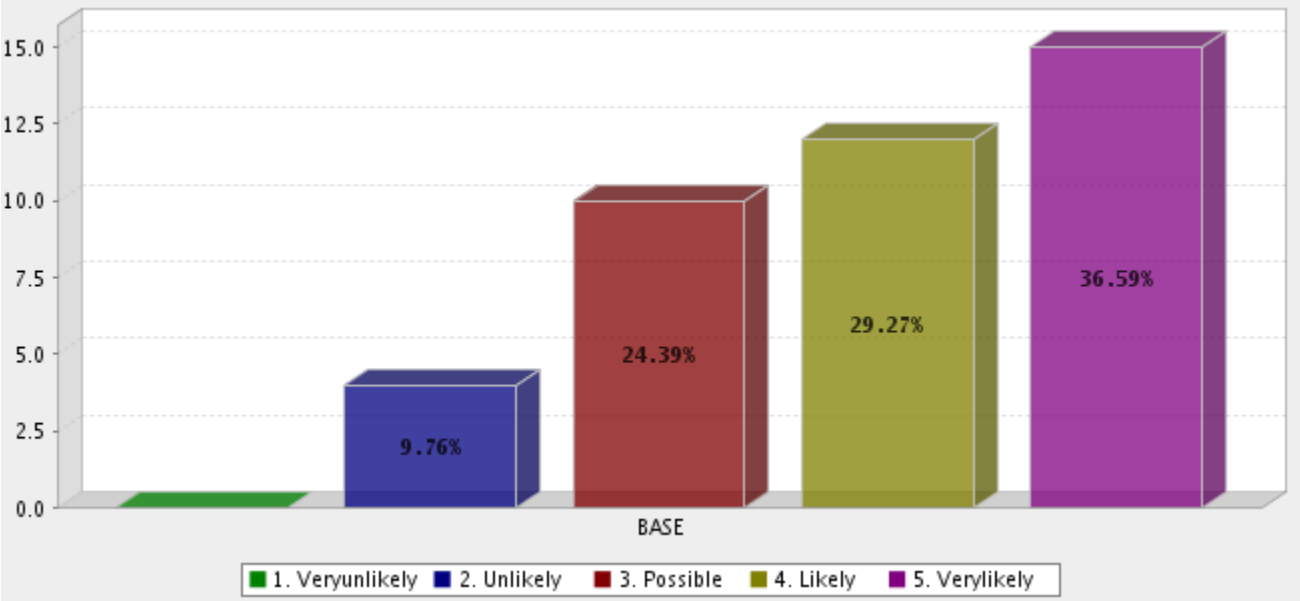
5a. Corporations will move away from basic research and will source such research from others



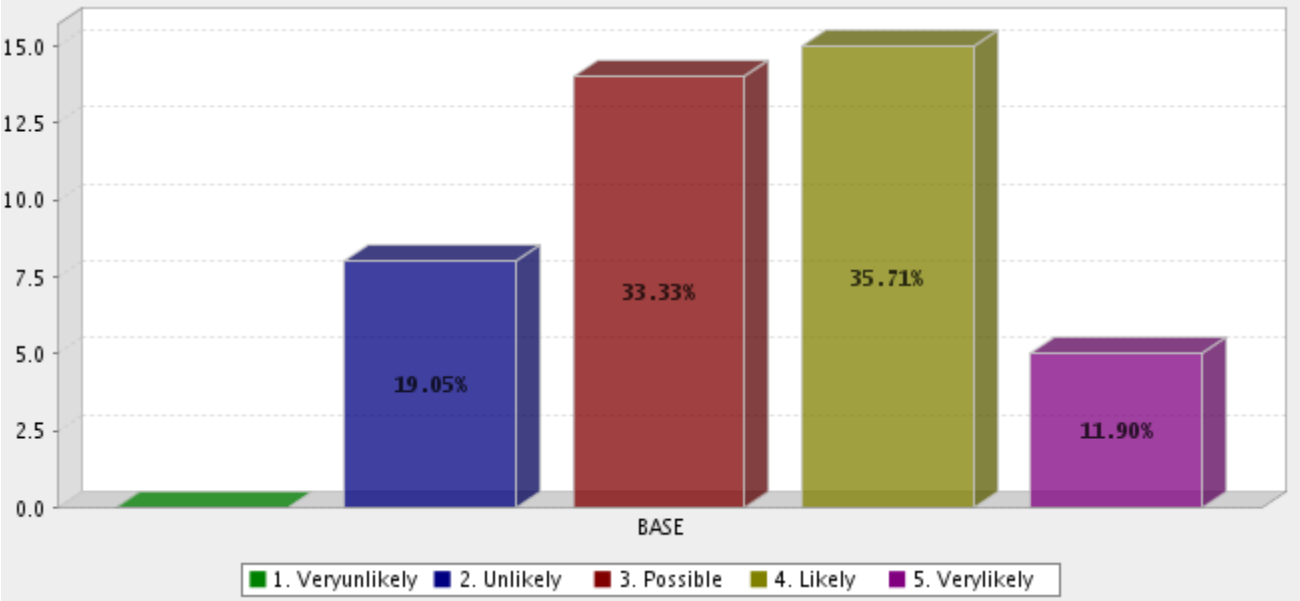
5b. Corporate R&D will be outsourced just as other functions are being outsourced



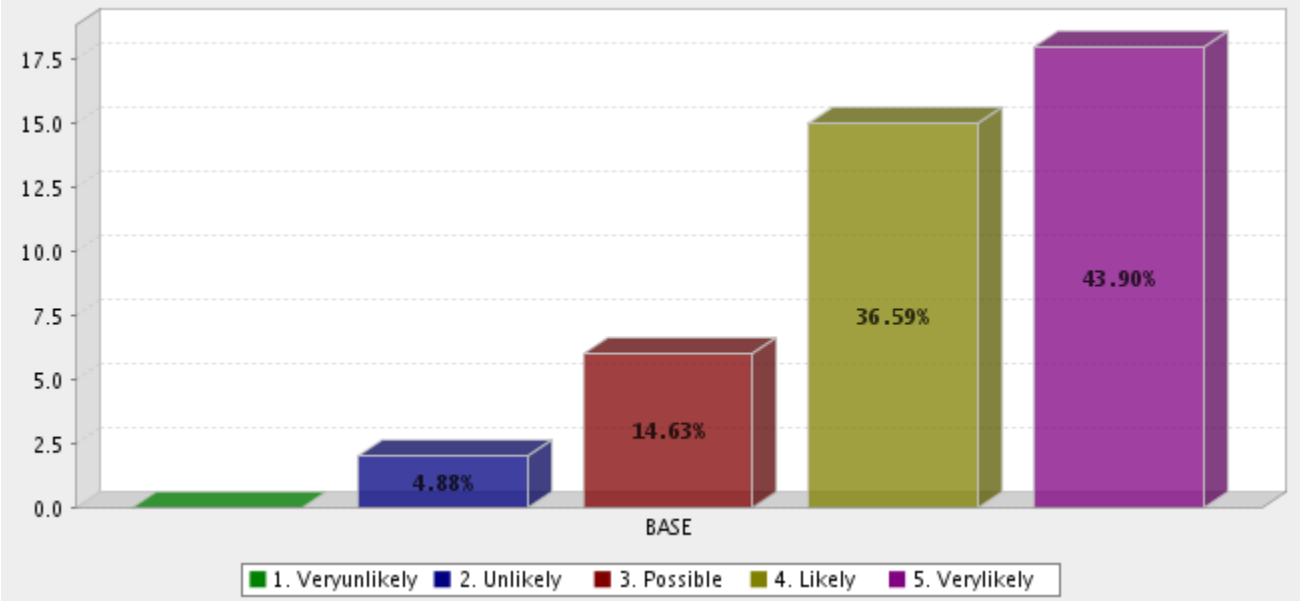
5c. Corporations will look for external sources/partnerships to help fund their R&D efforts



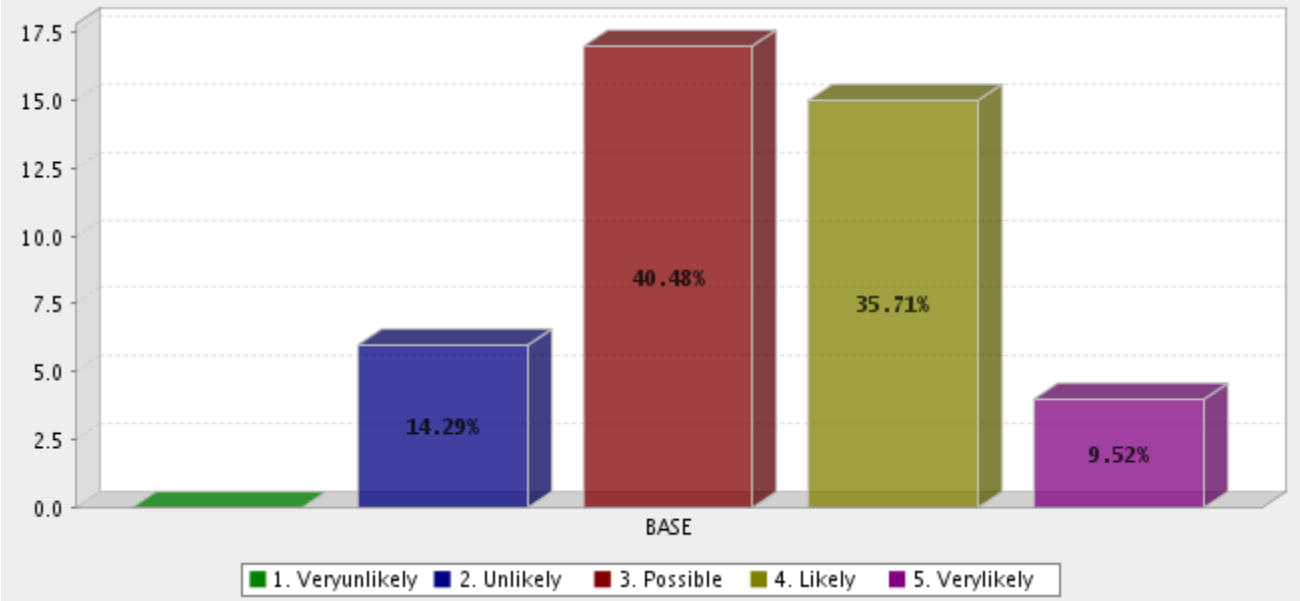
5d. Corporate R&D will drive markets and product development



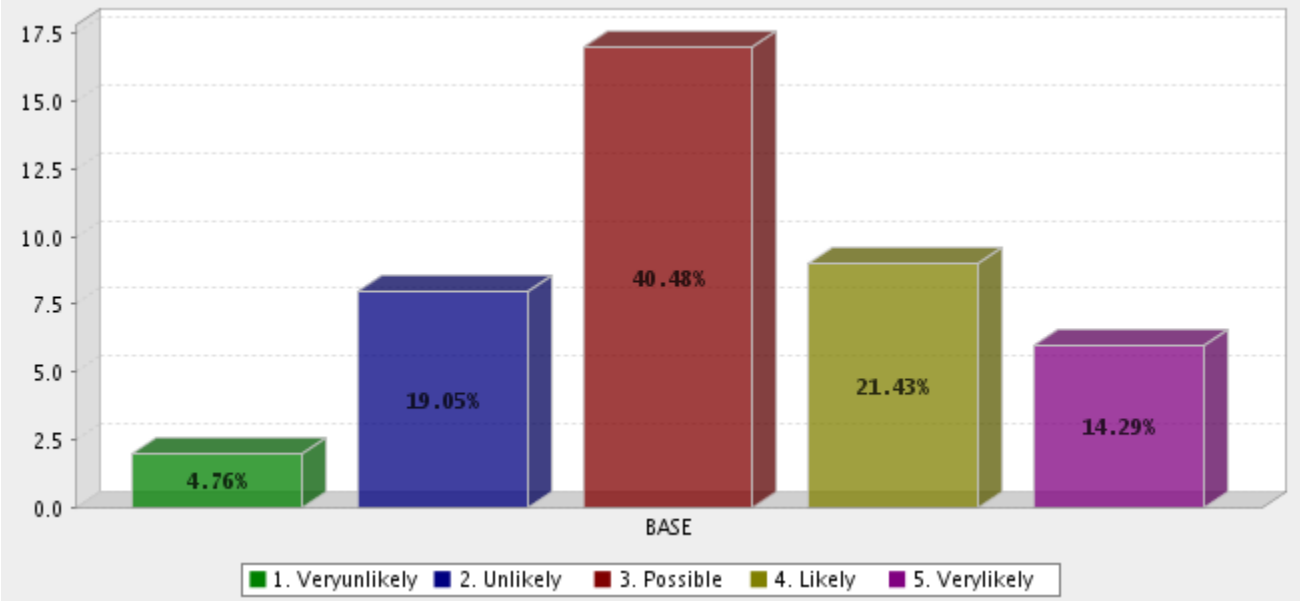
5e. Product development and market demand will drive corporate R&D



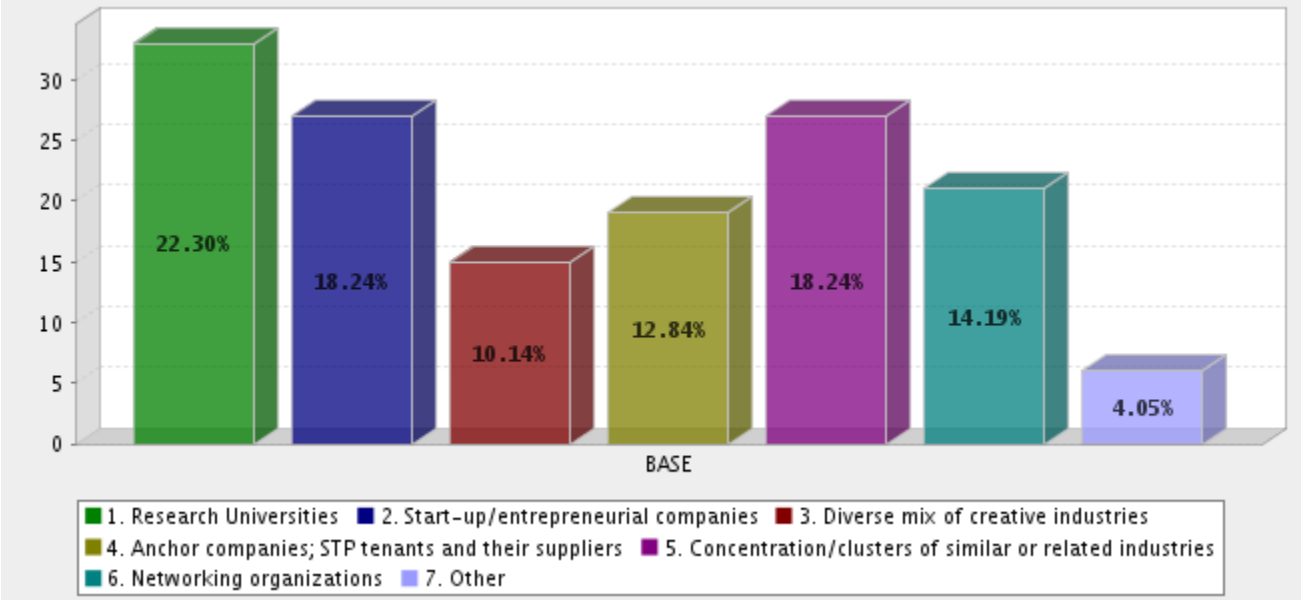
5f. Universities will play a larger role in managing/driving research agendas



5g. Local and state/regional governments will replace national governments in shaping science/R&D policy



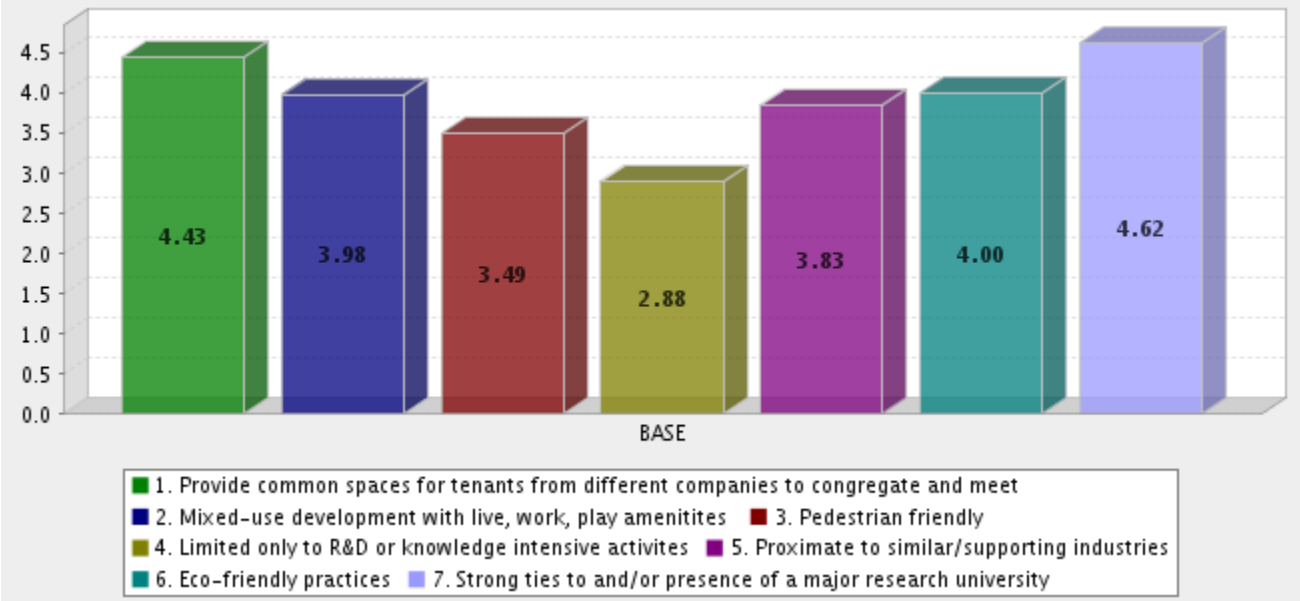
6. Traditionally, the relationship between STPs and innovation centers and universities or other institutes involved in R&D have been an important element of an STPs or regions attractiveness. Going forward, which of the following will be the most important partners for STPs and innovation centers? (Choose all that apply)



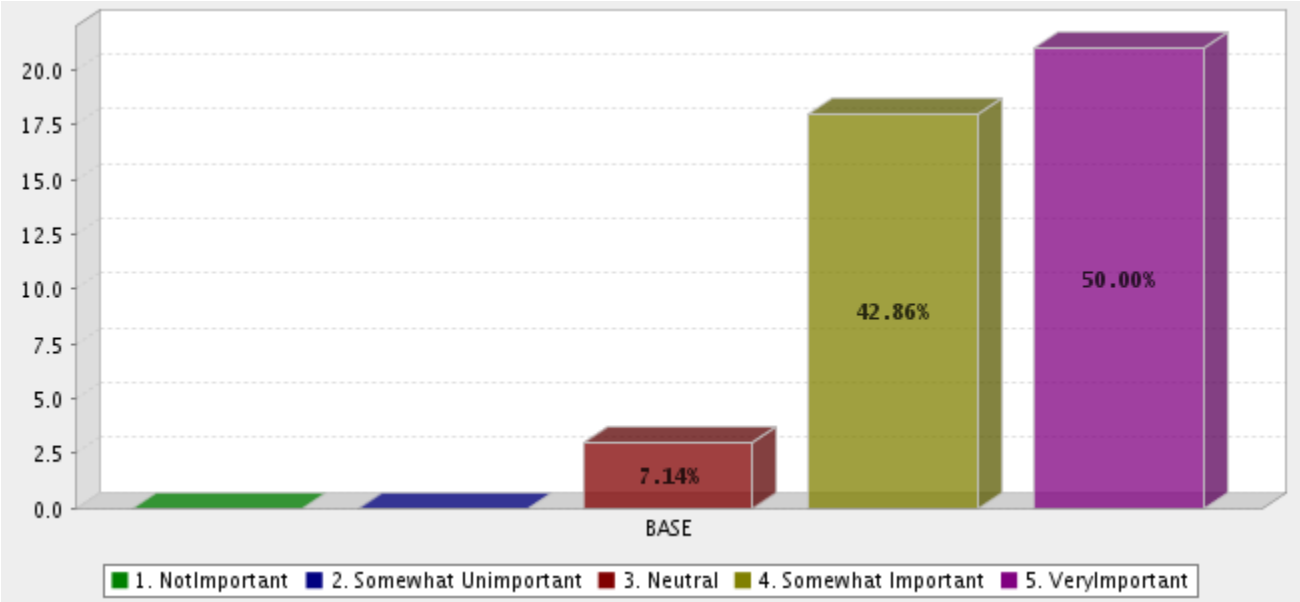
Other (write-in) responses:

- Access to capital
- Strong International Culture
- Companies along the value chain of biopharmaceutical industry
- Developers providing physical design, ammenities, opportunities of collaboration, work and play
- Capital investors
- Networking organizations and Networking internet system

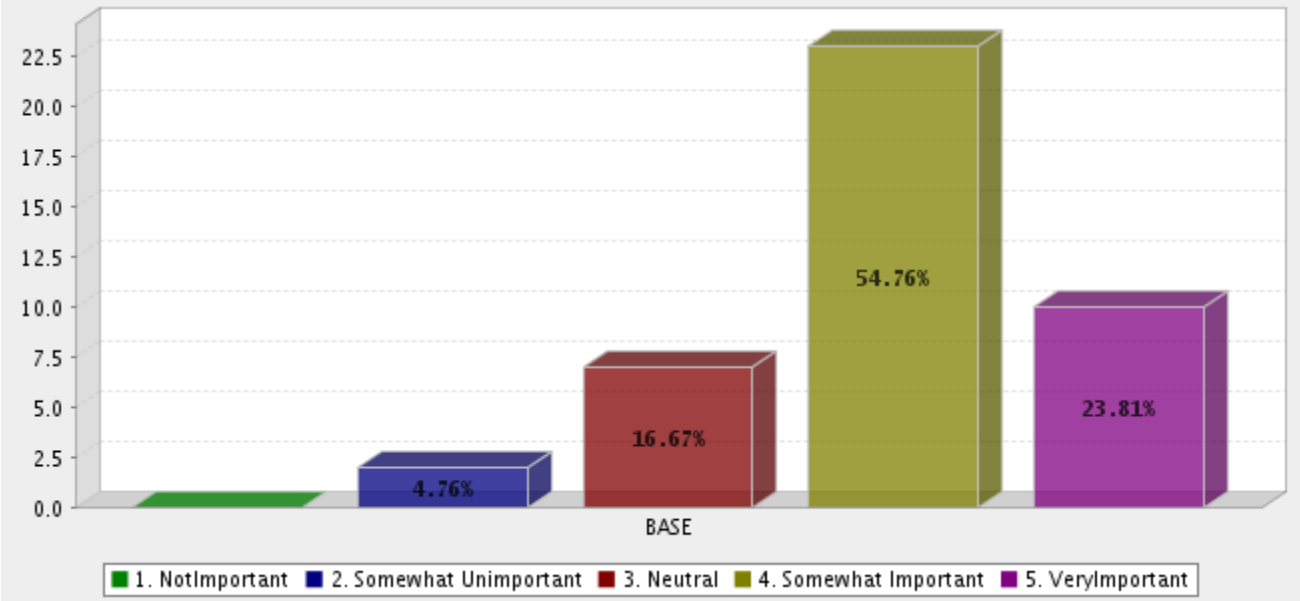
7. In addition to a space to innovate, STPs are becoming increasingly important as places that draw talent and collaboration. How important are the following attributes in the future success of STPs and innovation centers?



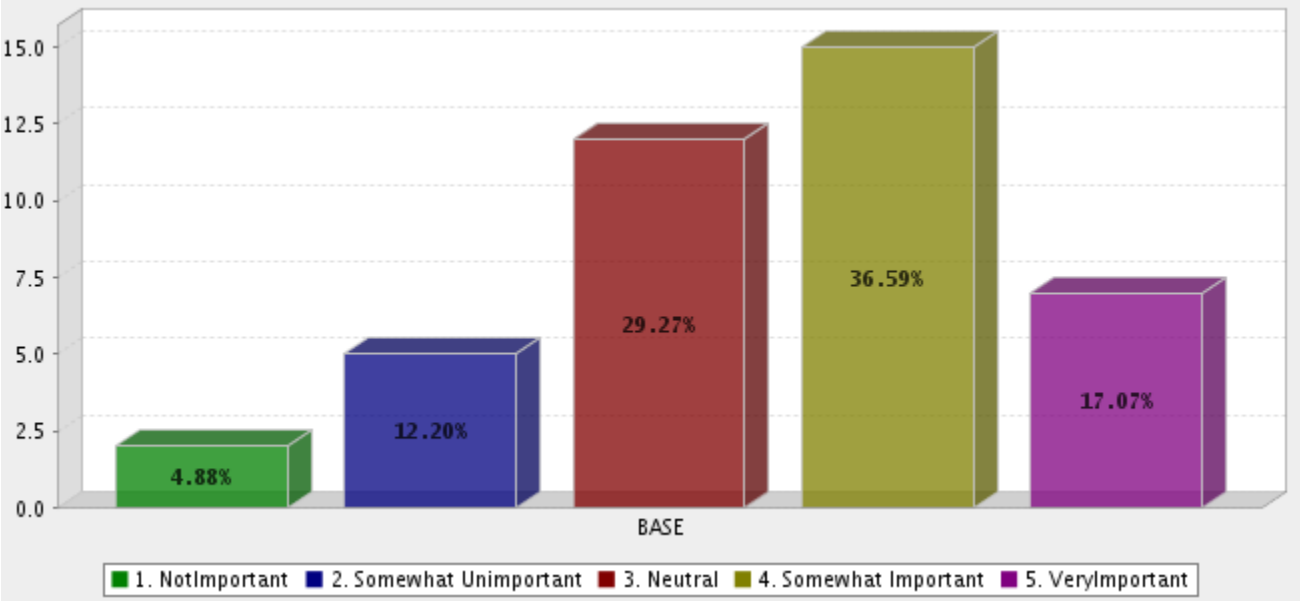
7a. Provide common spaces for tenants from different companies to congregate and meet



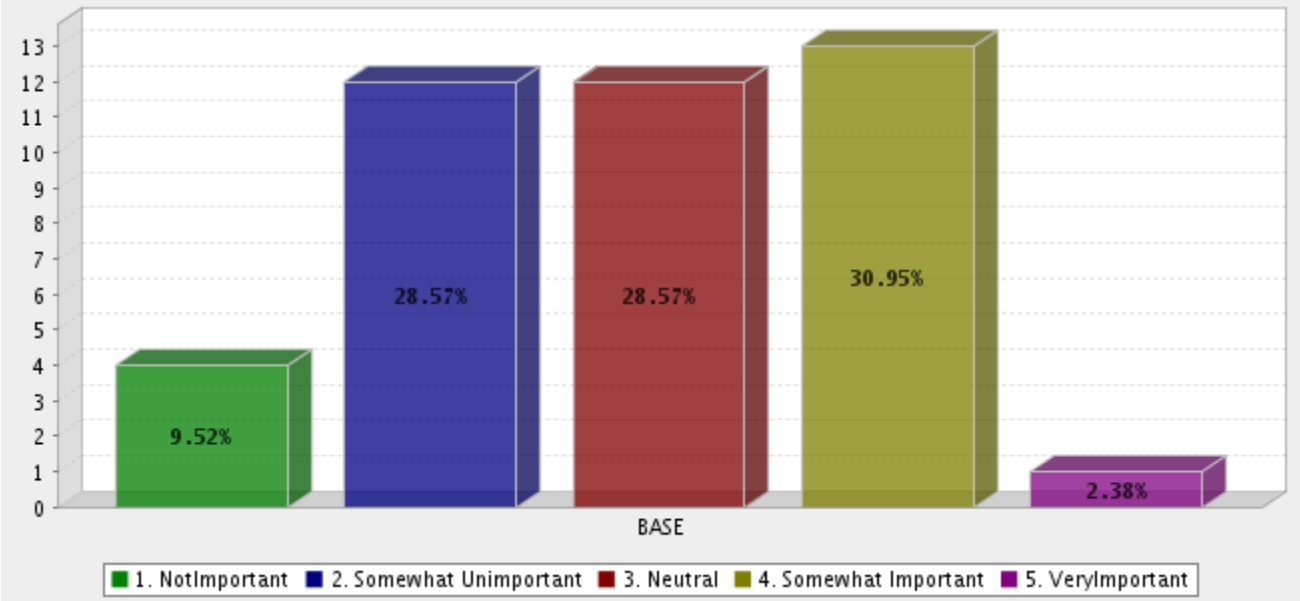
7b. Mixed-use development with live, work, play amenitites



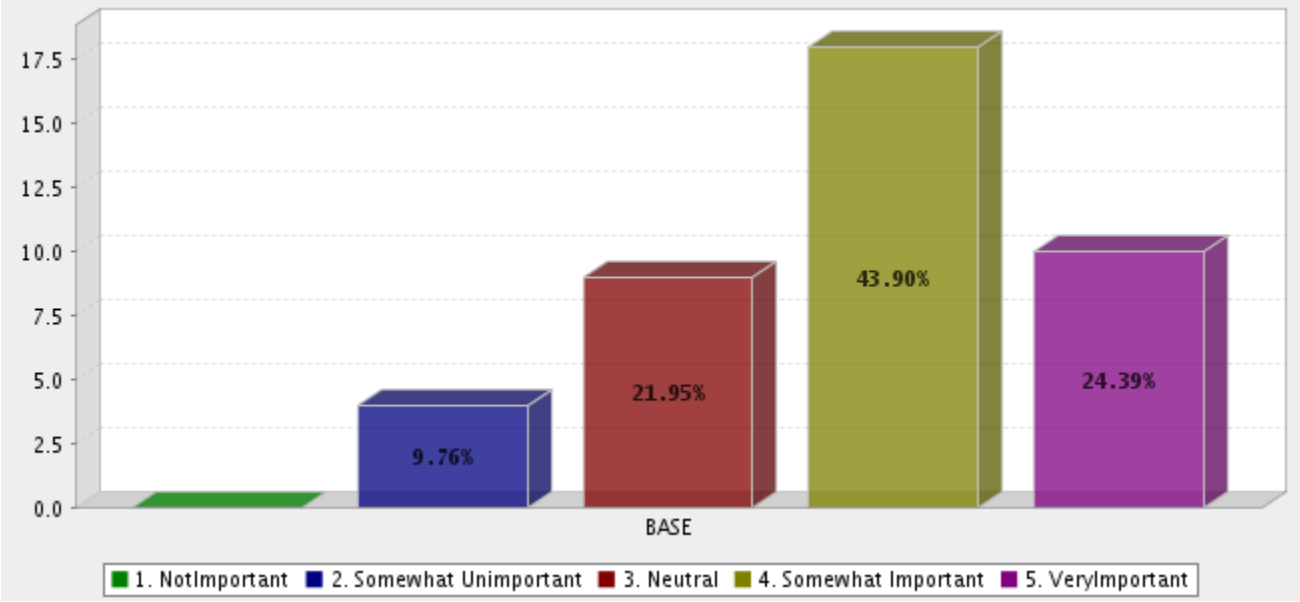
7c. Pedestrian friendly



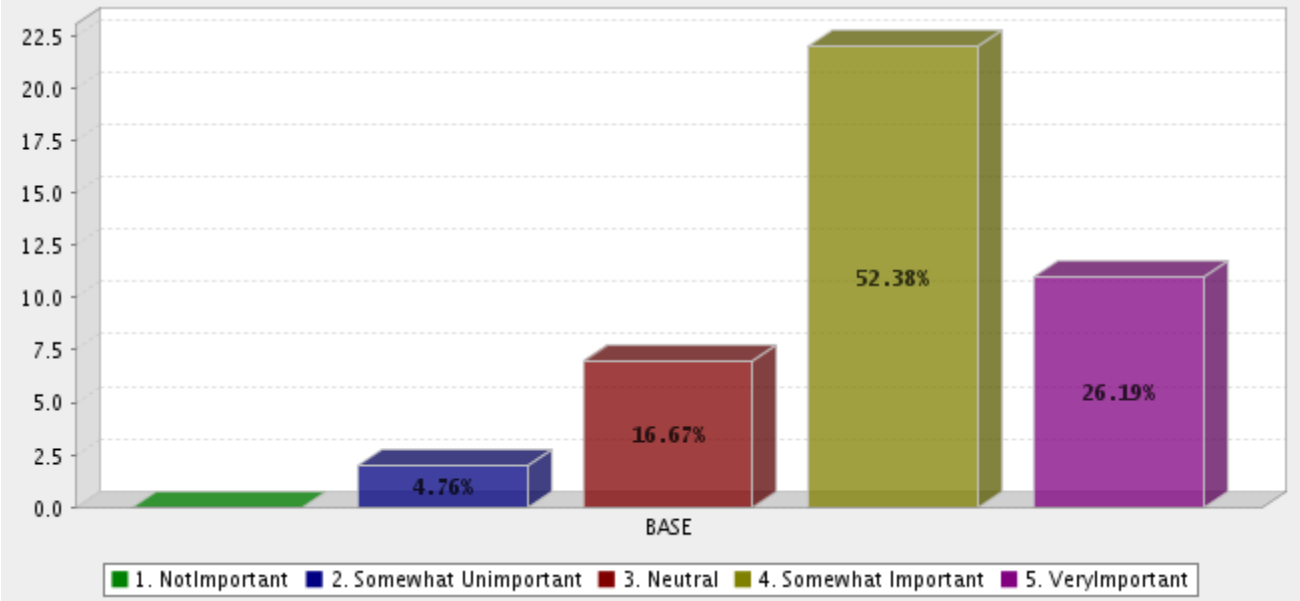
7d. Limited only to R&D or knowledge intensive activites



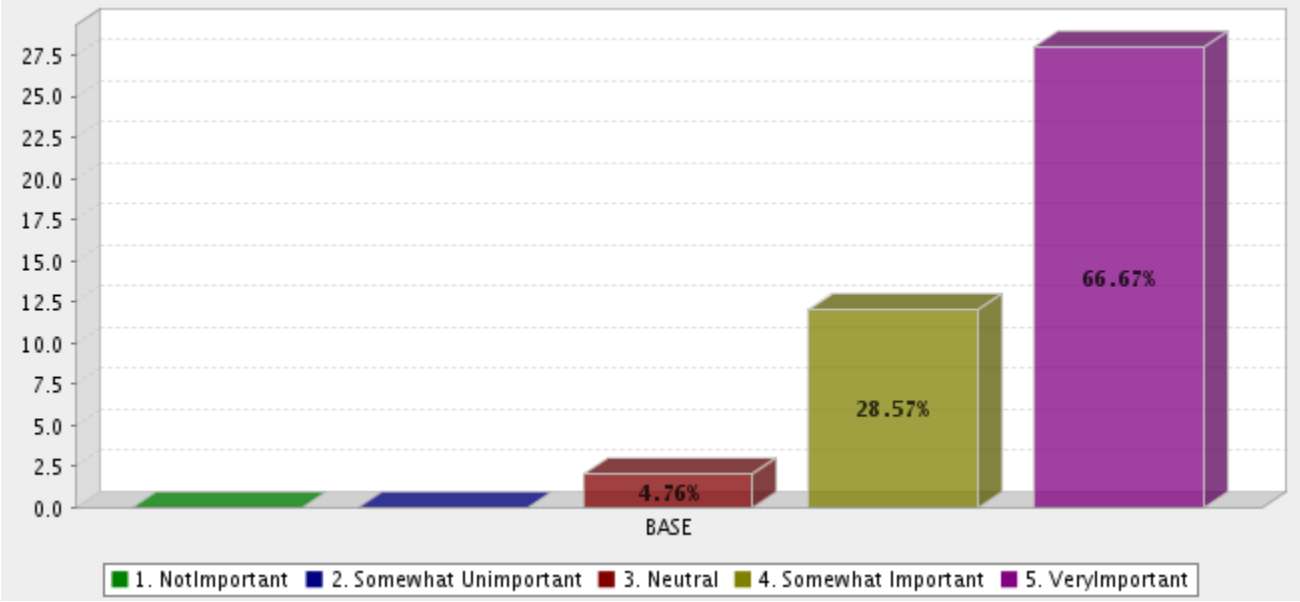
7e. Proximate to similar/supporting industries



7f. Eco-friendly practices



7g. Strong ties to and/or presence of a major research university



8. If your STP or region could form a partnership with any entity to best further your goals over the next 3-5 years:

Respondent	Type	Outcomes	Relationship
2792624	A collaborative association.	Marketing, attraction, and development.	
2794242	Emerging technology providers and organizations that serve as facilitors for support for those entities.	Business growth opportunities.	USAF Research facilities.Major tenant of our STP.A & M and UTSA reserach facilities.Tenant Private company tenants
2796952	cleantech venture capital	local and national companies are able to enter new growthing markets globally	
2796966	International location advisor	new prospects for our park	
2796971			Cooperation with cleantech capital networks
2796973	State Development Agency, Local Municipality	Targeted development programmes	still in the phase of building up
2796997	Local government	Orientation of public economic support to innovation	Some common activities to promote innovation
2797003	Form relationship with trans national large corporations	R&D links with host university, company acqusition of companies that grow out of the Surrey Technology centre	Partnership in some EU level projects
2797016	US university and asian based STP		Both regional and municipal governemnt are members of the company managing th STP
2797027	With other science parks and with supporting and investment organizations.	Attracting foreign parks and their companies to the park i.e. internationalization of our parks and incubators, competeing in global market and attracting investments to our park/.	Microsoft, EA UK
2797076	World-class research university/institute	Knowledge/technology transfer	HKSTP and university contact throw our own university
2797193	International company dedicated to software, electronics, mechatronics, etc.	The company will constitute a node or an anchor in our STP and we will provide the specialized manpower. Results: the crteation of new small companies, in these fields, based in our STP.	Relation with Linköping university, a number of activities together wich support tech transfer and entrepreneurship.
2797246			Federal institute.
2797260	Networks	Benefits for the tennatn companies	
2797272	A succesful international high tech company with a strong brand	It will attract both talents and new startups	
2797394			IASP (Member)
2797396			SonyEricsson and Ericsson Corporation do have R&D departments in the SP.

Question 8, continued

Respondent	Type	Outcomes	Relationship
2797523	University hospital research unit and anchor tenants	New start-ups, new products/services (from university research) being developed within bigger, well established companies	
2797556	A similarly focused STP with common firms and overall objectives.	A more competitive platform in support of successful firms.	
2797575	Stronger ties with Universities and other research centers of the region	Faster and better R&D => better products reaching the market faster	
2797589			Some STP tenants are already using University expertise in their R&D
2797599	Private firm that has a history of spinning out start-up companies and technologies	New business/economic stimulus, populated park with positive churn within the environment	
2797695	- Reference Centres os Knowleadge development (like NPO entities and Univirsities); - Work toward the envoronmental and human development; - Have a mix of Knowleadge and crosculture people	- Technology Transfers; - Other Partnerships; Generation of cluster-type "yeast" concentration areas for talents and young companies	- MIT Leason Program - Work to develop a Knowlage city on Brasil
2797744			- SUN Microsystem - Project focused in Eduteinment as a social inclusion tool
2798276	Anchor-type strong (preferably multinational) companies from 2-3 perspective fields		- Instinct Project (EU) - Digital TV R&D Project
2798462		Win/Win for all parties = Research Income for the University and the right to publish. New markets and great customer bases for the industry partner	Skype, born in and grown out from our park.
2798496		great talent	
2798637	An entity that can provide support for University Research and a channel to global markets		
2798722 2799353	organisation to support talent development - funding, technical	strengthen the collaboration in the cluster to become excellent and get international awareness and therefore international collaborations and opportunties to grow further on	

Question 8, continued

Respondent	Type	Outcomes	Relationship
2799414		The partnership would share basic and applied research in an environment where for-profit businesses could identify anc commercialize market opportunities.	
2800016	with a cluster management organisation taking care for biotech in the whole region to make all partners available for collaboration (university, research institutes, smes, pharma, big pharma, CROs, university hospitals, health care insurances etc)	Increased profits for the Company	
2801383	A partnership with a collaboration of academic, government, and business entities to pull technologies that have market applications and then commercialize those technologies.	New diagnostics and therapeutics that enhance life (human, animal, plant)	international network of collaborating parks
2801967	BioPharm with strong research division.	More cutting-edge science, the basis for new companies	regional network of collaboration
2802686	Federal lab; enlarged university research effort		meeting and comunication platforms in the STP
2803050		Generation of business startups, patent development, technology commercialization, etc.	IDCAST is a collaboration between 6 universities, the AF Research Labs, and more than a dozen for-profit businesses focused on the commercialization of sensor technologies.
2803067	A community college with a technology center model that focuses on collaboration/research partners from private industry.	DIFFICULT TO DETERMINE WHAT ORGAIZATION WOULD BE MOST EFFECTIVE AT ESTABLISHING AND SUSTAINING THIS EFFORT.	A division of Genzyme.
2803097	mORE COLLABORATION AMONG INDUSTRIES THAT CAN SUPPORT MUTUAL NEEDS SUCH AS EMPLOYEES TRAINING AND SPREADING INNOVATIVE PRACTICES	Develop/source technologies and build companies around them so as to make the region more innovation driven.	University-based, not federal lab

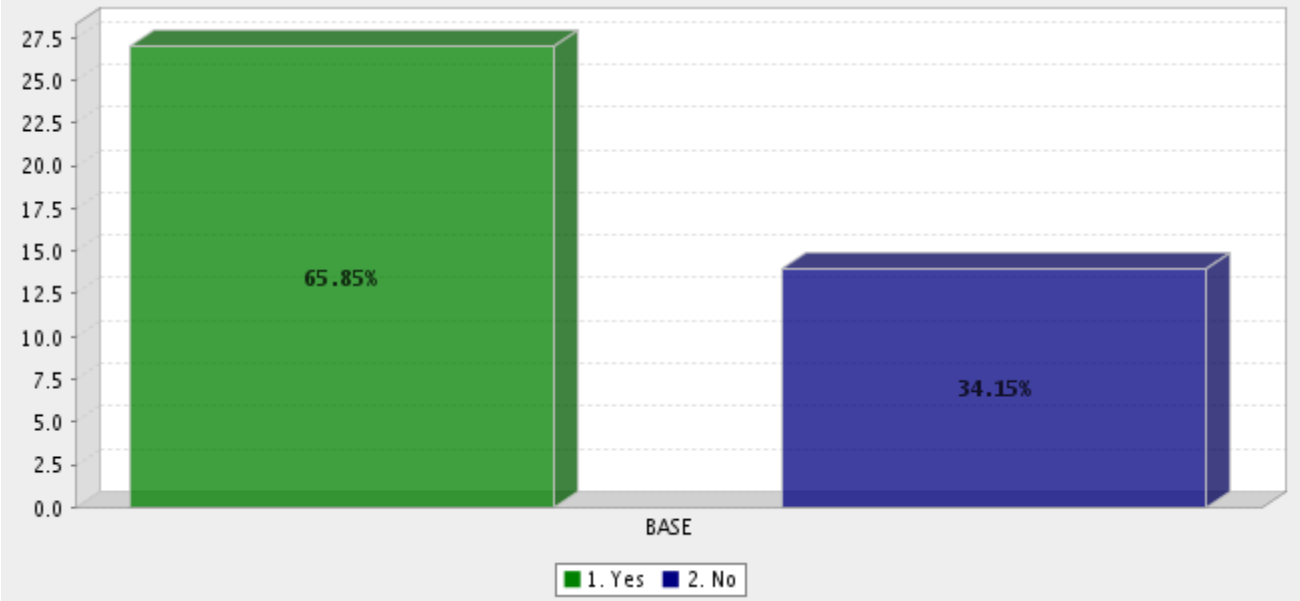
Question 8, continued

Respondent	Type	Outcomes	Relationship
2803252	IP generating organisations (small companies, R&D institutions, research universities, research hospitals)across the globe.	Greater opportunities for cross fertilziation of ideas and access to capital to match complementary resources, opportunities and to mitigate weaknesses or risks.	
2805572	Regional innovation/collaborative partnerships and specific centers of specialized knowledge. Both are needed.		The relationship is presently being developed, but the first step involves engaging a consulting partner to craft the technology center model and strategy to pull together partners from business, education and government.
2806093		Incresase funding of start-up companies and of cooperative research projects	
2806432	Seed Capital Investor		We have just started the work. Need to scout more agressively and map the technologies available in specific domains for expliotation and encourage either the scientists who have developed the technologies to become entrepreneurs or build technology portfolios to help develop products. Would be very happy to work with experienced people/partners in this regard as we have very little experience in this.
2807549	a- mid cap sized GROWTH firms that are research and technology leaning.		Will be chief innovation officer for regional innovation/collaboration/regeneration partnership organization with ability to execute. Will be pursuing collaborative opportunities with other regions around the world.
2807583	b-university with significant research committment and well endowed- history of successfully attracting reserach grants		
2807606	c- supportive and informed political enviorment		agreements with regional venture capital entities . not enough involved in seed capital and risky R$D financing

Question 8, continued

Respondent	Type	Outcomes	Relationship
2814211		contanct with outside at anytime anywhere platform	
2815196		Regional R&D concentration	
2815223	"iBridge" Networking platform	R&D based start-up companies	
2823037		R&D concentration	we are working with some companies of our Science Park and others from other countries by iBridge platform
2823039	With the university and another kind of bussines centers.	R&D based start-up companies	
2823600	With Universities and business concentrations.		
2831019	Manchester Science Park is happy with the partners already involved in the company		
2831442	Manchester Science Park is happy with the partners already involved in the company universities and university alumni associations. Our city government, a large foundation and/or a big bio/pharma company	Networks for attracting innovation and talent; More legitimacy, recognition and resources	Manchester Science Park has 3 groups od shareholders: Public (Manchester City Council), Private sector companies, Universities (University of Manchetsre and MMU). Each group own 1/3 of shares. Universities, WIBS, Career Development Centers, ED groups and business and industry are all working together in a series of iniativies include some WIRED programs to attract and retain talent; Partnership with hospitals and with other STPs

9. Do you currently have any relationships such as those described in Question 8?



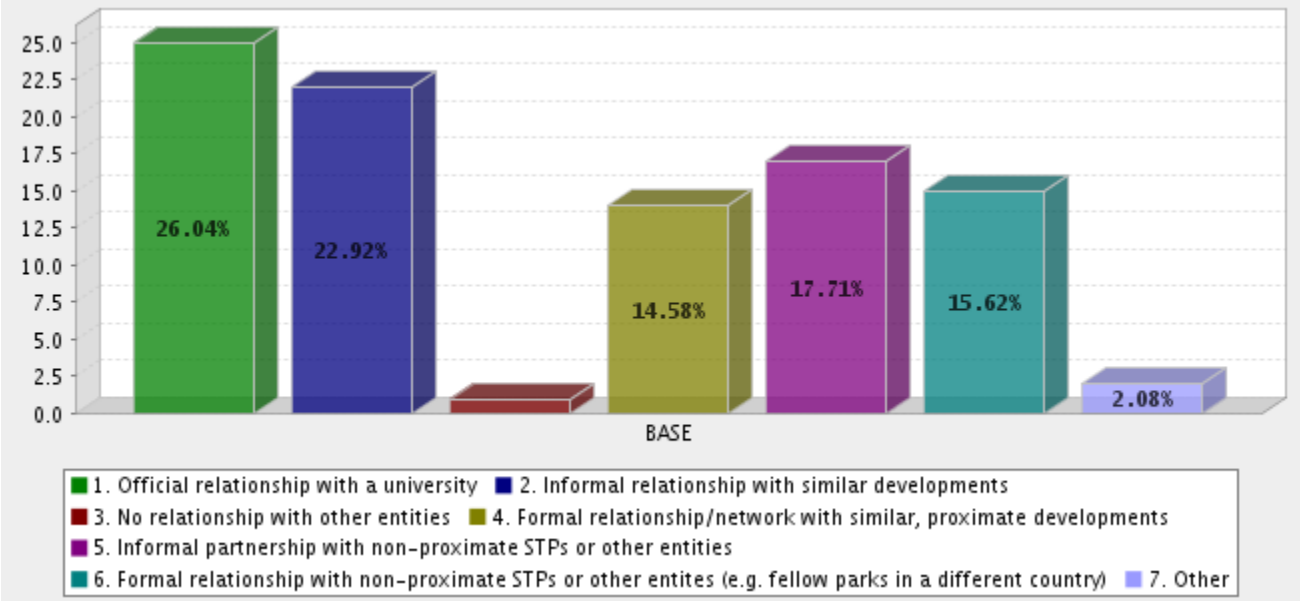
10. Respondents

Name	*Title*	*Park/Region*	*Country*
Marty Vanags	CEO	BNAEDC	USA
Donald E. Jakeway	President & CEO	Brooks Development Authority	USA
lauri ylöstalo	ceo	Lahti Science and Business Park	Finland
Nettie Buitelaar	managing director	Leiden Bio Science Park	NL
Janis Stabulnieks	Dr., Managing Director	Latvian Technological Center	LATVIA
Dr Theologos Prokopiou	Managing Director	i4G SA	Greece
Gabriele ZANETTO	professor	VEGA scarl	Italy
Dr Malcolm Parry (OBE)	Director	The Surrey Research Park	UK
Torben Orla Nielsen	Business Development Manager	Scion DTU	Denmark
Mozhgan Yazdian	Director, international affairs dept	Isfahan Science & Technology Town	Iran
Sten G Johansson	CEO	Mjärdevi Science Park	Sweden
Austin Beggs		Innovation Place	Canada
Gregorio Paluszny	President	Parque Tecnológico Sartenejas	Venezuela
Bernd Juling	Dipl.Ing	Ostfalen Technology Park	Germany
Hans Möller	CEO	Ideon Science Park	Sweden
Charlotte Ahlgren	CEO	Medeon Science Park	Sweden
Rick Weddle		Research Triangle Park	US
Claude Laferriere	Director, Technologies and innovation	Technopole Vallee du Saint-Maurice	Canada
Judy McKinney-Cherry	Cabinet Secretary	State of Delaware	USA
Leandro Carioni	Executive manager	Sapiens Park	Brazil
Raivo Tamkivi	Counsellor	TEHNOPOL Tallinn Technology Park	Estonia
Sue Bell	Director, Innovation & Knowledge Transfer Division	La Trobe University R&D Park	Australia
Nik Nasir		MSC Malaysia - Cyberjaya	malaysia
Marion Kronabel	CSO	Heidelberg Technology Park	Germany

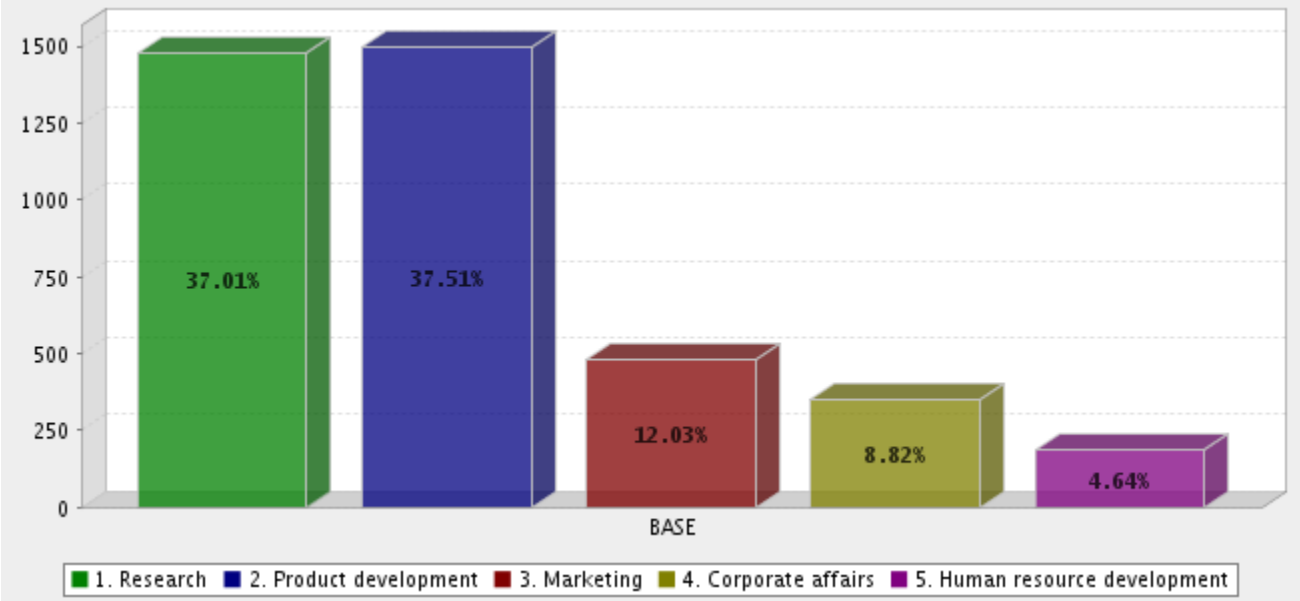
Respondents, Continued

Name	*Title*	*Park/Region*	*Country*
Steve Nutt	Director of Strategic Development	Tech Town - Dayton	USA
Michael Anderson, Ph.D.	President	Presbyterian Health Foundation Research Park	USA
Denny Coleman	President & CEO	St. Louis County Economic Council	St. Louis County, Missouri
Darrell Auterson	President/CEO	York County Economic Development Corp.	USA
Deepanwita Chattopadhyay	CEO	ICICI Knowledge Park	India
Gene DePrez	Chief Innovation Officer	Creative Sheffield City/Region Development Company	UK
J F Balducchi	Managing Director	Atlanpole	France
Dennis R. Burnside	President and CEO	BurnsideAnalytics	US
Joakin Telleria	Director	San Sebastian Technology Park	Spain
zhang xiuying	Division Chief of international Cooperation Division	Administrative Committee of the Zhongguancun Haidian Science Park	China
Alfonso Arriola	General Manager	Alava Technology Park	Spain
Justyna Dabrowska	Executive Assistant to theCHief Executive	Manchestre Science Park	UK
Sharon Ward	Economic Development Director		USA
Joan Bellavista	Delegate of the President	Barcelona Science Park	Spain
Josh O'Brien	Senior Business Development Manager, Bioscience	Greater Oklahoma City Chamber	United States

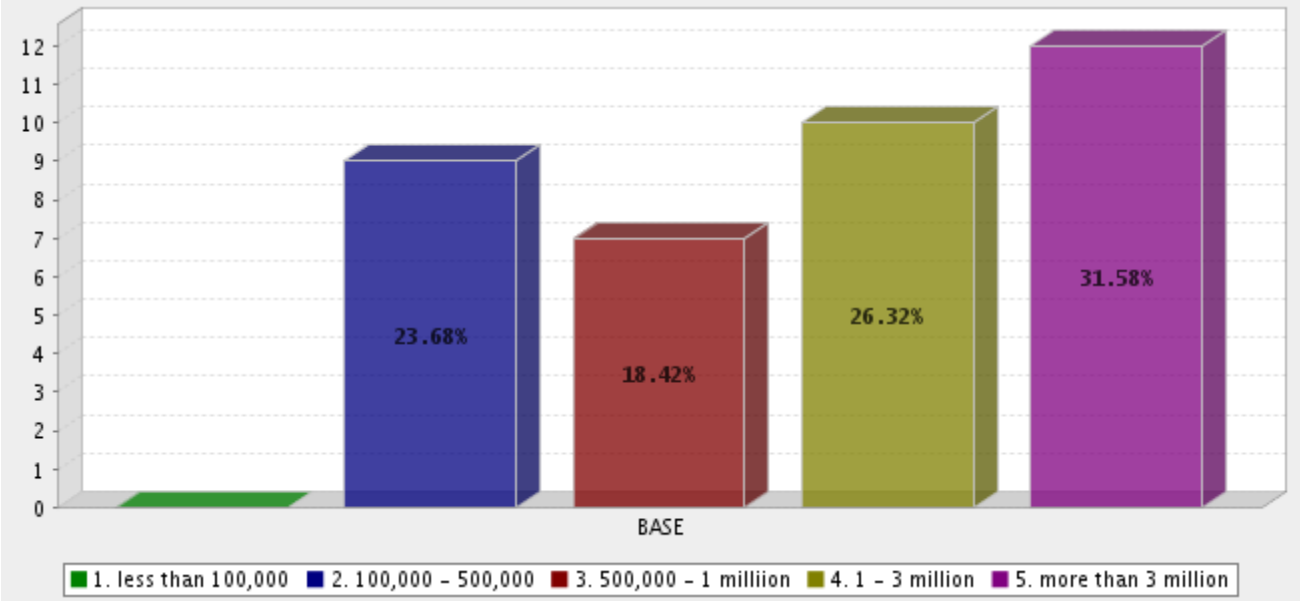
11. If you represent a STP, please answer the following two questions. If you represent a region or other entity, please skip to question 13.Please describe some of the activities in which your STP or innovation center is currently involved. (Choose all that apply)



12. Of your typical tenants, please indicate the rough percentage break-down of a sample companies operations within your Park:



13. What is the population of your region?



14. How many research universities are in your region?