# SCIENCE: INNOVATION IN THE CITY

**For decades, the ideal R&D or science center was a self-contained, introspective place. IBM's Yorktown laboratory, Japan's Tsukuba Science City, and Xerox's Palo Alto Research Center were all intellectual hothouses that reflected a commitment to advancing science, a faith in the ability of corporate or state funders to direct innovation, and a belief that investment in basic research would readily translate into regional economic development. But today, ambitious ventures around the world are building more integrated urban spaces to foster new kinds of science and R&D, and to revitalize neighborhoods and local economies at the same time.**

**Changes in the location and practice of R&D will create new environments for innovation, novel forms of research, and vibrant new urban spaces**

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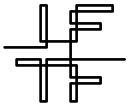


INSTITUTE FOR THE FUTURE

## INNOVATION ZONES: FROM SCIENCE CITY TO SCIENCE IN THE CITY

The concept of the *science city*—a city built from the ground up to house scientific and technical research—emerged during World War II. Allied and Axis powers created isolated R&D facilities. The British concentrated cryptography researchers in Bletchley Park; German rocket developers were centered at Peenemude; and most spectacularly, America's Manhattan Project built remote complexes dedicated to atomic bomb research and production in Washington and New Mexico.

After World War II, science cities and regions grew around the world. California's Silicon Valley and France's Sophia Antipolis were outgrowths of existing urban regions. Others were located in sparsely inhabited regions: Korea's Taedok Science Town and Russia's Akademgorodok were meant to be engines of regional economic development to counterbalance scientific metropoles. Military research was often located in remote areas for security reasons.

Today, this isolated, autonomous model is challenged by a new model: the innovation zone. Innovation zones stand at the intersection of the state, industry, academia, and civil society. They harness diverse scientific, financial, and managerial skills and play upon a variety of interests. Many, including Seoul's Digital Media City and Denmark's Katrinebjerg, are adjacent to universities and serve as homes for academic–industrial joint research projects or incubators for startups commercializing academic research.

But innovation zones are not just about commercializing science and technology; they are also knowledge-intensive urban renewal projects. They promise to create new local industries by nurturing the social and intellectual networks that allow cities to thrive in the high-tech global economy. Innovation zones are often joint ventures involving national and local governments, real estate developers, and academic institutions. Such complex alliances exert a natural pull toward underdeveloped land in or on the edges of existing cities.

## GLOBAL SCIENCE: FROM ELITE PRACTICES TO THE THIRD WORLD

Two important trends will shape how science and technology evolve in the coming decades. First, innovation zones will have deep implications for the structure and practice of science. As Martina Hessler puts it, the ideal of the isolated scientist focused exclusively on his work "has been replaced by an ideal of integrating science into society. ... Scientific research is not thought of as an autonomous project any more."

Second, new innovation zones are likely to emerge in and around cities in rapidly developing countries like India, China, Korea, and Brazil, as firms in these countries move up the economic value chain. While state policy, military contracts, and R&D investments will continue to be enabling factors, these clusters will emerge through local interactions among universities, large corporations, entrepreneurs, and the urban workforce.

—Alex Soojung-Kim Pang & Anthony Townsend

# INTERVIEW: MICHAEL JOROFF

**Mike talks about the growth of "new century cities" that are designed to bring together scientists, engineers, entrepreneurs, and government officials.**

**Q | You've been talking recently about new century cities. Can you tell us what they are and how you got interested in them?**

I went to Seoul, Korea about six years ago to a conference about science cities. The Koreans were planning Digital Media City, and they wanted to learn from the science cities that were built in Asia and Europe in the 1970s and 1980s. I realized that while they were talking about science cities, what they were planning was really something radically different from what had come before.

**Q | Why was it different?**

The circumstances had changed since the 1970s and 1980s, when science cities were first planned.

First, there's globalization. It was once possible to have a place that was fairly self-contained; now you find everything interlinked, including R&D. Technology has also changed a lot. It's possible now to have places that are linked continuously even though they're not physically connected. There have also been generational changes. Most of the people who planned science cities in the 1970s were familiar with television and maybe computers; today's planners have grown up with wireless, which gives you a very different sense of place and how people connect to each other and how you concentrate activities. In fact, today you have four generations in the workforce with different skills and different ways of working.

Finally, business models have evolved over the last 30 years. Companies are more interested in open R&D networks than closed R&D processes. Business models assume that companies have to be fast, lean, and agile. They also assume that no matter what your technology is now, it's going to change.

**Q | What is driving corporations and R&D managers to enter into these projects and these partnerships?**

For some, it's just a reasonable piece of real estate. Others see an opportunity to position themselves and link with other companies—and to find other people who can help them to leverage their own interests and build long-term capability. For example, in Seoul Digital Media City, you get different kinds of companies that have similar activities. By being together, they make links that will be very beneficial for their business. BBC in London is seriously considering moving its digital media activities—about 2,500 jobs—out of London to Manchester, which they believe has the potential to develop into a major media center for Europe. BBC will go there in force, but they want that whole area to develop in a way that helps them. That means not only bringing other companies of a similar nature there, but also building the social institutions and the educational institutions that will improve the larger environment.

Very few companies believe now they can do anything on their own. Increasingly, they see the benefits of being in open-source networks, of being physically collocated, or virtually collocated. At one extreme, the Western Governors' Association—the governors of the western United States—wants to create these kinds of places in a region where there are few cities and no possibility of large-scale aggregation. It hopes to use electronic means to connect.

But collocation doesn't automatically generate benefits. Something that is not so successful is Canary Wharf in England. It provides an aggregated place for financial institutions, and it places England in a good place by attracting these people and companies, but it doesn't go beyond that, and it's not building long-term capability.

**Q | Are there differences in the way that cities view these science areas?**

Cities have realized two big things. More of them are thinking long-term and doing what I call future-proofing. If you're a city, you want to make sure that, as the technology changes and the focus changes or the competitive environment changes, you've got the muscle, the strength, and social capital to move on. In a place that you want to become a digital media city, it's not just bringing in the hot new technology company, but making sure that they are either physically or virtually associated with those companies that are going to use that technology.

When I started working at MIT in the 1960s, the area around MIT was very successful in missile guidance systems, mainframe computers, and minicomputers. None of these industries is there any longer, but because MIT was successful in building the basic social capital and human capital that could take it to the next generation, the area is still vibrant. One of the very positive things about MIT is it has a new president who's a life scientist, and that's an area of the future. She's not saying that we should do away with engineering—MIT is all about engineering—but she's saying, in effect, how does engineering change, given the rising importance of life sciences? That's future-proofing.

**MICHAEL JOROFF** is Senior Lecturer in the School of Architecture and Planning at MIT and a worldwide consultant in corporate real estate strategy and "workplace-making."

I also think that, as cities have matured, they're realizing that not everybody can be world-class in everything. The ones that are finding success really look hard at what local strengths they have and build upon them. It doesn't preclude you from going in new directions, but if you have nothing that connects to stem cell research, you're not going to just build it from scratch. But figuring it out is still a challenge. For example, York, England was designated a science city by the British government this year. I visited there recently, and people are talking about how, "we want to be world class, world class, world class." Well, they have one of the most historic cities in the world, right? Every American student spends a few days studying English history sometime, but they study from very boring textbooks. Well, if York used technology to deliver its cathedrals and monuments to classrooms in America, it would be an enormous business. It's not as glamorous as stem cell research, but it really could be significant for them to do it using technology.

**Q** | **You've done a lot of research over the last couple of decades on how the corporate workplace is changing. Is there any connection between what's happening in these streetscapes and public places and what's going on inside the buildings where the work's getting done?**

Absolutely. Driving both these things are really basic changes in how we live, how we connect, and big changes in the business and social environment. It's not just the technology.

In the workplace, we're really redefining the place of work. It's no longer an activity confined to a fixed place; corporations now recognize that people spend relatively little time in a formal office, and they support people wherever they are. Likewise, at the city level, we're redefining where value gets created.

**Q** | **Where are the Helsinkis or the Seouls of the future? How do you find them?**

Who would have guessed five years ago that Florianopolis, Brazil, or Seoul would develop as they have? Florianopolis' university created the first innovation park in Brazil, the world's first electronic voting machine, and the whole ATM network for Brazil. Seoul is heavily wired, and it's got all of these startup companies around that. They saw they had a world position in digital media because of how wired they are and how they're using it but also the role they play in transmitting culture from the west to China.

So you look for places where people are thinking hard about "what are we, what's our niche?" You look for places that have some degree of innovation (technologically and organizationally); that have companies that are very innovative; or a government that's trying to do something new.

You also need leaders who are willing to experiment with innovative ways of financing these projects, bringing together the development industry, academic institutions, and government. A good example is University Park at MIT. MIT actually bought the land and put up half the development money, which significantly reduced the risk. They can use the good name of the university to help borrow money at better rates. Finally, they brought in a development partner who was attracted to the project because MIT was an active partner that would create a good, long-term environment. So MIT actually took that risk, put the money in, eventually took their money out, and now have a 75-year land lease on the property.

I think you're going to find new kinds of financing packages that will bring universities, developers, and corporations together in ways they've never done before. Universities have an enormous amount of money and power tied up in their land that they haven't learned how to release yet. They're beginning to. This whole movement is just beginning.

**Anthony Townsend, IFTF Research Director, asked Mike about the new role of the cityscape in the practice of science and technological innovation.**

## FROM SCIENCE CITIES TO INNOVATION ZONES

Innovation zones differ from science cities in some fundamental ways. Here are some key comparisons.

| SCIENCE CITIES | INNOVATION ZONES |
|---|---|
| **Single developer and tenant**<br>Science cities were often developed by single agencies or companies. Even government-funded science cities like Japan's Tsukuba or Korea's Daedock were built by single agencies, or at most, partnerships between national and local governments. In many cases, corporate developers were also the primary—or even sole—resident of a science city. Xerox PARC, and the work that went on within it, was the property of Xerox. | **Multiple developers and tenants**<br>Innovation zones are the result of partnerships that can include real estate developers, national and local governments, universities, state-owned enterprises, and multinational corporations. They attract lots of companies and combine academics, entrepreneurs, corporate managers, venture capitalists, and government officials. The presence of collaborators, suppliers, partners, and even competitors is one of the key attractions. |
| **Isolated**<br>Science cities tended to be located on undeveloped land, often removed from city centers. Government-run science cities were situated in remote states, sometimes to promote economic growth in underdeveloped areas, sometimes to protect facilities from espionage. | **Urban**<br>Innovation zones are often located within or on the edge of cities. Some are part of urban redevelopment projects—the high-tech equivalents of shopping malls or downtown baseball parks. |
| **Managed innovation**<br>Science cities were efforts at managing innovation. For much of the 20th century, R&D was dominated by large corporations that wanted a steady supply of improvements to their product lines. Many labs were founded to provide those improvements. Companies were also able to control disruptive technologies produced by R&D staffs. However, the downside was that the rigid management of science cities could not exploit disruptive innovations effectively. | **Disruptive innovation**<br>The R&D landscape has become much more complex in the last 20 years, and innovation zones reflect that complexity. The innovation zone is not a space organized around a single, overarching research program; it is designed to be more like a trading zone where diverse players meet, collaborate, and trade. Occupants of innovation zones take for granted that disruptions are part of technological and economic life—better to be creative here than elsewhere. |
| **Company town**<br>Science cities were the intellectual equivalent of the company town, dominated by a single firm—or even a single division of a large corporation. | **Long-term capital**<br>Innovation zones are designed to attract people from a variety of companies and industries. Ideally, they generate a reservoir of intellectual and social capital that can move from company to company (or start new companies) and build global links, but still contribute to the local economy. A successful innovation zone is self-sustaining and can be productive despite technical and economic disruptions. |
| **Lab space**<br>Science cities were collections of laboratories: spaces in which nature and new technologies could be isolated and studied without the distractions of the marketplace. | **Space as lab**<br>Some innovation zones are showcases and test beds for new products and services and include a substantial population of ethnographers who study how people use both the space itself and the products it generates. |

# DETAILS

## THE GEOGRAPHY OF INNOVATION ZONES

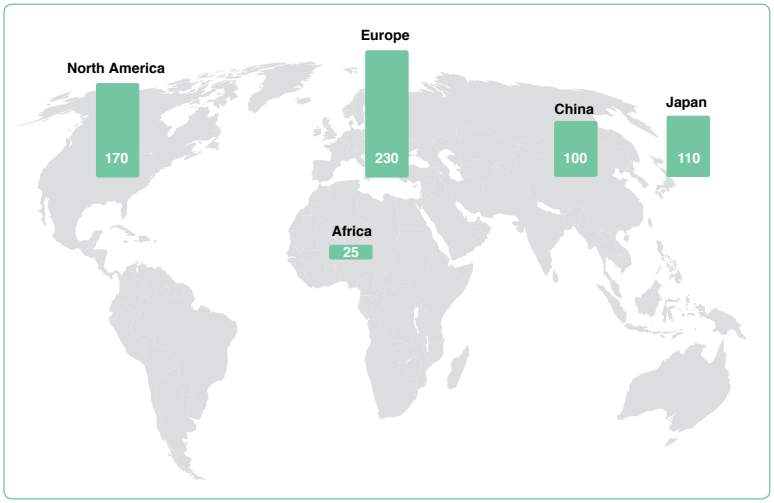
Innovation zones appear throughout the world, and not surprisingly, they concentrate in industrialized nations and regions. European and North American countries—the birthplaces of the science-cities movement in the 20th century—have the largest number of science and technology parks, incubators, and other facilities. Japanese corporations and government agencies have also built a large number of parks since the 1960s.

The most rapid recent growth in science parks, incubators, and innovation zones has been in Asia. In the 1980s, the examples of Silicon Valley and Tsukuba Science City led a number of Asian governments to launch science parks as catalysts for regional and national development. China announced 52 "new high-tech development zones" in the early 1980s. India planned 19 "science and technology entrepreneur parks." Korea and Japan planned significant expansions of their science-city projects, and Malaysia, Thailand, Singapore, and other countries developed science parks.

These early efforts tended to be state-driven enterprises and often did not feature universities as major partners. Some were also marginal successes or outright failures: even Japan couldn't replicate the success of Tsukuba. By the mid-1990s, observers noted a shift away from top-down, centralized efforts toward partnerships between local and city governments, real estate developers, and corporations. Some older science parks were privatized. For example, in 1990, Technology Parks PTE Ltd. took over management of the Singapore Science Park, which had been founded by the government in the previous decade. Further, many science parks began to look beyond major corporate tenants, and incorporated incubators, offering special facilities and services to new companies.

These newer, more robust innovation zones are also attracting expatriate Asian scientists and engineers back to their home countries. Beijing's Zhongguancun Science Park, for example, is now host to thousands of small high-tech companies. Roughly 1,800 of them were started by Chinese expatriates lured home from the United States and Europe in the late 1990s and 2000s. India's Bangalore has likewise become a magnet for Indian engineers and entrepreneurs from Silicon Valley.

**1 University- and Government-Based Science Parks Worldwide, c. 1995**




Source: UNIDO Technology Park Survey (Africa) and UNESCO Technology Park Survey (all others). Neither survey includes corporate and military facilities.

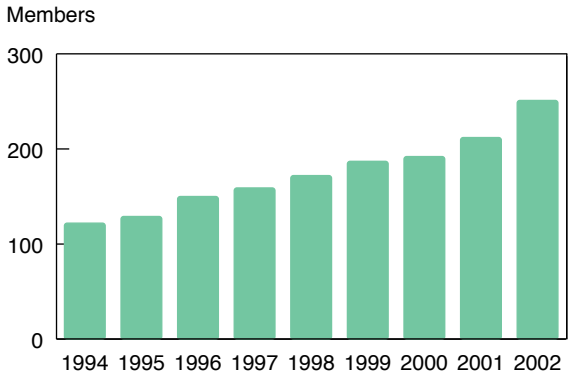
## ASSOCIATIONS SUPPORT "PRACTICE" OF INNOVATION ZONES

Over the last decade, a number of organizations have emerged to help science parks and innovation zones develop best practices, attract additional funding and tenants, and brand the regions, cities, and even neighborhoods they occupy.

The International Association of Science Parks, for example, is an eclectic group of long-time practitioners, newcomers, and hopefuls in the science park community. In the last decade, their membership has more than doubled. And their statistics reflect the trend toward more heterogeneous urban parks—the average distance to city center is just over six miles. On average, members are within 12 miles of a university and share services and infrastructure with universities.

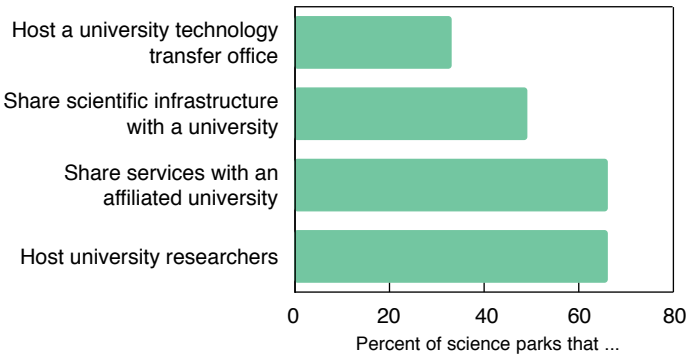
Biospace is another association that helps biotechnology and bioscience organizations develop regional identities and brand them as "hotbed communities." A Biospace map of the tri-state area around New York City, for example, provides an at-a-glance view of the knowledge and commercial infrastructure of bioscience in the region.

**2 International Association of Science Parks' Membership Growth**



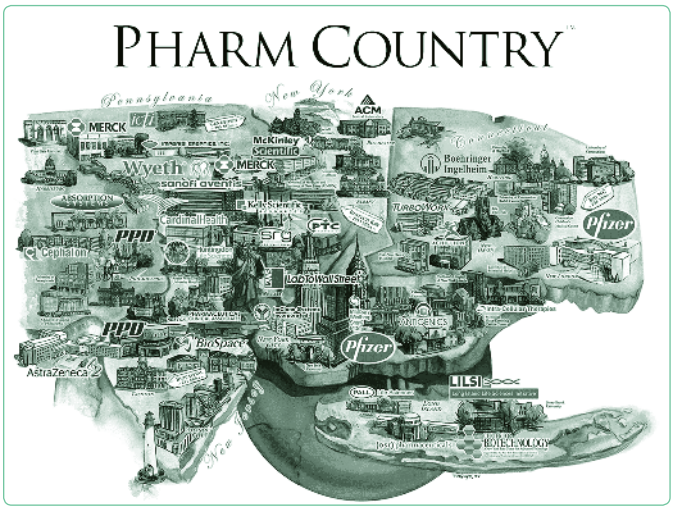

Source: International Association of Science Parks, www.iasp.ws.org, 2002.

**3 How Science Parks Work with Universities**




Source: International Association of Science Parks, www.iasp.ws.org, 2002.

**4 Biospace's Map of New York City and Its Surrounding Area**



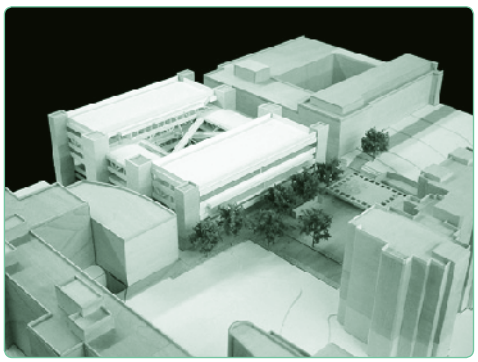

Source: www.biospace.com, 2005.

## PROTO-INNOVATION ZONES: UNIVERSITY–INDUSTRY NANOTECHNOLOGY CENTERS

The global market for nanotechnology products in 2004 was approximately $180 billion and growing at a rate of 30% annually. Worldwide, some 4,000 companies are active in this sector, many with strong growth potential—some 200 nanotech IPOs are expected in the next few years.

These companies all need space to innovate and grow, and in the United States, nanotechnology has set off something of an arms race between states eager to establish an early critical mass of researchers, firms, and facilities. Because nanotechnology applications are so closely tied to existing areas of science and engineering such as biology, medicine, and information technology, the innovation zone approach allows localities to leverage their university research assets through targeted investments in facilities that can serve as the hub of an emerging cluster. These facilities will bring together state funding, university talent, and business acumen to develop highly effective pipelines for commercializing R&D output in regionally distinctive cross-disciplines.

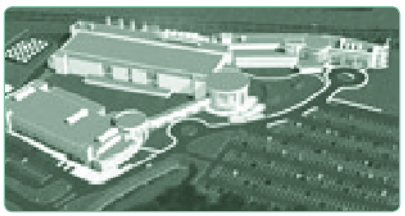
### 5 California NanoSystems Institute



Source: California NanoSystems Institute.

**The California NanoSystems Institute (CNSI) building in Los Angeles is an urban campus that will house researchers from the University of California, Los Angeles and Santa Barbara. Approximately 30 corporate alliance partners will contribute funding and resources to support joint research projects. Corporate partners will share industry researchers, CNSI faculty, and students in precompetitive projects.**

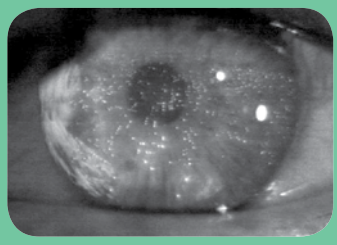
### 6 Center of Excellence in Nanoelectronics, State University of New York at Albany



Source: Center of Excellence in Nanoelectronics.

**In Albany, New York's capital city, the Center of Excellence in Nanoelectronics complex brings together over 100 industry partners on-site and has generated more than $500 million in government support and over $2.5 billion in corporate investments. It is already becoming a vital part of the region's emerging nanoelectronics cluster, where IBM's East Fishkill semiconductor plant is a pioneer in small-scale electronics manufacturing.**

Science pervades the dystopian world of *Blade Runner*, from the Tyrell Corporation to genetic-engineering street vendors.

### RESEARCH & DEVELOPMENT: Support researcher externships—alone or in teams

While protecting intellectual property and tacit knowledge resources is a major priority for any company, industry researchers can become isolated from the cutting edge and lose track of broader trends outside their narrow area of expertise. Locating a research team or new business development group in an innovation zone is one way to expose your team to ambient innovation.

Another is to encourage individual researchers to take a leave of absence or sabbatical in a new innovation zone, perhaps even in another region of the world. Establishing relationships with multiple innovation zones—and working out contractual opportunities for researcher externships in them—will become an increasingly valuable way to refresh in-house scientists and develop partnerships that can be leveraged in future endeavors.

### KNOWLEDGE WORKERS: Exploit open tools and processes to engage the larger community

Innovation zones tend to attract not only scientists and engineers; they attract highly skilled and creative knowledge workers who can contribute substantially to cross-pollinating new ideas and technologies. In fact, an increasing share of new science and technology will emerge from the contributions of the informal economy in science-rich urban areas—knowledge workers who use collaborative tools to contribute, on their own time and in their own ways, to a growing pool of public science resources.

Those engaged in human resource development and policy should pay particular attention to this trend, looking for new models of engagement with the informal sector and tracking new issues that will arise as both formal and informal workers collaborate more openly and publicly at the frontier of science and technology.

### COMMUNITY/POLICY: Anticipate local impacts of science policy debates

Science policy debates have tended to be divorced from local communities—argued in national and international forums that cross institutions and seldom directly touch the day-to-day experiences of local communities.

However, as science moves into communities and as communities tie their fortunes to specific scientific fields of inquiry, expect science controversies to be increasingly local. Just as local industry often spurs local debate about health, environmental quality, and working conditions, urban science may produce surprising new issues at the city or neighborhood level. A proactive, local strategy to recognize and deliberate issues before they become polarized will be good for the community and the science it supports.

### URBAN CULTURE: Monitor artists' use of science as lead indicators

As William Gibson said in *Neuromancer*, the street finds its own use for things. In recent years, companies and cities alike have realized the role that users can play in innovation and product development. Moving R&D to urban innovation zones will allow companies to tap the "wisdom of the crowds."

As innovation zones become firmly enmeshed in cities, they will offer companies opportunities to test prototypes with core customers; conduct ethnographic studies of users; and follow hackers as they find new uses for technologies. For cities, vibrant, challenging user communities will be valuable assets, attracting R&D and investment and future-proofing local economies.

Weak signals of more distant futures may be found by following science-based conceptual art. Groups like Australia's Tissue Culture and Art Project (which uses leading-edge tissue cloning and culture techniques to create art) are already probing the implications of objects that cross the boundaries of art, technology, and nature—precisely the boundaries at which many innovation zones will be located.