BUILDING INNOVATIVE COMMUNITIES: LESSONS FROM JAPAN'S SCIENCE CITY PROJECTS

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Japan's Science City projects are examined in this paper to find the extent that they promote catalytic mechanisms within their communities. It is arguable that the concept of a Science City is little more than a theme for funneling public funds into infrastructural development in support of select high-technology industries. Is this the situation in Japan? Attention focuses on cumulative causation, resource sharing and the shifting mix of private sector initiative and public policy in the evolving cases of Tsukuba and Kansai Science Cities. Regional technopolis projects are also discussed. Can we expect any of these areas to fulfill the promise, detailed in the Kansai Science City Second Stage Plan Report, of being a "pilot model city" deploying "innovative and experimental community development"?

keywords: technopolis; regional planning; development; cumulative causation; catalytic mechanisms

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Introduction

This research seeks to discover ways in which Japan's Science City projects have made successful steps toward developing synergies among their constituent parts. Both Tsukuba and Kansai Science Cities claim the aspiration of being a "pilot model city" (see *Appendices*), and among the stated aims of the newer Kansai has been the goal of deploying "innovative and experimental community development." It is important to question how the city planners propose meeting the stated goals, and the extent of their progress. On examination, we find that the path to these greater goals is often ill-defined, and both cities are incomplete in key areas. It may be that more can be learned from the mistakes than from the successes of these cities. Nonetheless, Japan's Science Cities have realized some cooperative benefits, and more potentially exist.

What has been achieved by the Science Cities? We can look most usefully at these cities as experiments only if we understand what has happened, what is desired to happen, and whose opinions for improvement merit attention. We specifically look for possible

synergies and agglomerative benefits, while noting that it is often difficult to measure and compare such benefits due to lack of standard formulas.

Considerable sums of money have been spent on the Science Cities and other technopolis projects, and it is important to evaluate funding outcomes. This is all the more necessary as a newer plan is being drawn-up for moving the national capital functions out of Tokyo, a plan where new cities are expected to be built at substantial cost.

The present state of this research is an effort to draw together disparate threads into a typology of conditions, with focus on positive and negative factors that might be used as guidelines for deliberate creation, funding and support of a Science City. Documentation used here includes primary data from Japanese Science City planners, combined with interview results and personal experience (the author lived six years in Tsukuba). This paper's theoretic underpinnings reflect valuable work by Saxenian (1996) and Alexander et al. (1977) that have isolated catalytic mechanisms for regional development and prosperity.

City building is expensive

Construction in Tsukuba Science City to 1998 has cost approximately ¥ 2.4 trillion overall (approximately US$21.7 billion at todays ¥110 per dollar) according to data from Tsukuba Information Center and the National Land Agency.

Many local areas have spent considerable sums seeking to put together high-technology clusters of industry, R&D and education. Other major national projects in addition to Kansai are still in the wings. The biggest is a planned relocation of Japan's capital functions (首都機能移転) to a newly developed area at least 60 km from Tokyo. The Act for Relocation of the Diet and Other Organizations (国会等の移転に関する法律) was passed by the Diet in 1992, and a 'Council for the Relocation of the Diet and Other Organizations' has been deliberating over location and timetable; at present they claim to be seeking input and understanding from the public for the project. According to Japan's National Land Agency, total cost for the relocation is estimated to be 12.3 trillion yen (US$112 billion):

> "Relocating the Diet and related facilities will cost a total of over four trillion yen by the end of phase 1 in about ten years. This cost includes a government expense of 2 to 2.5 trillion yen. The annual government expense is 2 to 2.5 hundred billion yen which is about 2% of the government's current expenditures for public works."
>
> "After phase 1, a cluster of small cities will be built step-by-step, as required, for a period of several decades. If all of the current administrative organizations are relocated, the total cost for the relocation is estimated to be 12.3 trillion yen, including a government expense of 4.4 trillion yen." (NLA, undated)

History of Japan's Science Cities

Japan's first Science City was envisioned in 1961 as a central government project to relocate government offices from out of Tokyo, Japan's densely-populated capital. Tsukuba, a rural region situated 50 km northwest of Tokyo, was selected as the site in 1963, and the Academic New Town Construction Promotion Headquarters was established in the Prime Minister's Office by Cabinet decision in 1964. In 1970 the Tsukuba Academic New Town Construction Act (筑波研究学園都市建設法) came into force. The main aims set out by Tsukuba's Construction Promotion Headquarters in their 'Basic Principles for Planning the Construction of Tsukuba Science City' were that:

> "The Science City shall be developed in such a way as to make it possible for institutions to carry out high-level research and educational activities by maintaining mutual organic connections, while at the same time, the preservation of the natural environment and historical heritage shall be promoted so that the new Science City may be planned in such a way as to enable the residents to maintain a wholesome and cultural living." (Academic New Town Construction Promotion Headquarters, 1971)

Kansai Science City is also a national project, though much more recent. The Kansai Science City Construction Promotion Act (関西文化学術研究都市建設促進法) was enacted in 1987; later the same year Prime Minister Yasuhiro Nakasone adopted the 'Basic Policies on Construction of Kansai Science City.' The early motive force and vision came from Dr. Azuma Okuda, former president of Kyoto University who chaired the Kansai Science City Study Committee formed in 1978. In contrast to Tsukuba, where the central government has been the main institutional actor, in Kansai industry and local governments have been strongly involved from the start, founding the Kansai Research Institute in 1986. Among the goals of this organization is to "put forth proposals regarding the construction plan" and "planning and forming consensus regarding construction of Kansai Science City." It is headed by the Chairman of the Kansai Economic Federation (the big business group), and includes among the directors the regional Governors of Kyoto, Osaka and Nara (see Kansai Research Institute, undated). Their main logistic liaison in the central government bureaucracy is the National Land Agency.

Both Tsukuba and Kansai have grown tremendously since their respective inceptions as Science Cities. Tsukuba now has about 300 major research, education and scientific

exchange facilities; Kansai has over 70. Both have populations of about 200,000 of which approximately 8% (Tsukuba) and 5% (Kansai) are research professionals.

It is strongly emphasized in Japan that due to limited resources, "education and science & technology must be key national resources for prosperity." (Johnson 1997, p. 2)

But Japan's Science City projects can be said to have descended from lofty goals to more mundane concerns. Now, though the visitor can enjoy wide boulevards uncommon in Japan, for the most part they are lined with gaudy strip malls. The greenfields portions of both Tsukuba and Kansai have attracted hundreds of standardized chain restaurants & retailers, while many independent neighborhood family-owned shops have closed. Each city might be labeled heartless both in terms of urban design and in the breadth of social interaction.

Tsukuba originally got bad press as being an isolated and inconvenient place. As the city steadily developed, many transplants still yearned for the excitement of Tokyo or for the variety of more established cities. Even now many who live and work in Tsukuba return to their families elsewhere on the weekend, which of course is somewhat undesirable and lonely. Emotional imbalance took hold of more-than-a-few highly driven analytic researchers, and Tsukuba in the early 1980s became associated with suicide.

How does one measure the success of a city?

- size or stability of population
- relocation rate of those employed in city
- land prices
- tax base
- corporate registration
- bankruptcy rate
- suicide rate
- benefits elsewhere from reused premises vacated by relocated institutions
- publications, patents or major prizes by researchers or academics
- surveys of resident satisfaction / quality of life
- reputation of the city in the wider society and internationally
- etc…

Geographically-amorphous Silicon Valley, California, is not a political administrative unit, and shows that planning emphasis need not focus on a single city. Silicon Valley is often cited as a great success story, but in which ways is it a success? And what mix of ingredients has made it so? Princeton University, Bell Labs, and production centers for RCA and IBM were in close proximity in New Jersey on the US East coast, but

these did not produce a technology cluster of high innovation or great economic impact; Quandt (1999) considers that this was due to corporate policies of isolation.

The importance of regional cooperation was stressed by Annalee Saxenian (1996) in contrasting the development of Silicon Valley and a high-tech region along Route 128 in Massachusetts, USA. The high concentrations of skills and technology in both areas developed from university-based research fueled by postwar defence spending. Silicon Valley's success is due to its being a regional, network-based industrial system, which Saxenian (1996) highlights as having strengths in terms of the following variables:

- flexible, loosely-linked organizational structure with porous functional boundaries (in contrast to rigidities of integrated centralized authority, corporate loyalty and isolation / secrecy)
- strong horizontal communications between divisions and among firms, their suppliers and customers, with substantial informal face-to-face information sharing (in contrast to a top-down, vertical and self-reliant information flow)
- open labor markets: changing jobs is greatly tolerated and labor is educated, experienced, and readily available (as are consultants, capital and technical suppliers)
- high speed of change with ability to respond quickly
- dense social networks open to knowledge spillovers, venture capital and the surrounding economy and community
- multiple local strategic relationships with dynamic outside links to pools of expertise that spread risk and help to maintain global competitiveness; able to broach narrow fragmented political jurisdictions to forge wider collaboration

Tsukuba and Kansai Science Cities are highly modern, but as we enter the twenty-first century both are weak in many of the above areas; neither have Japanese conditions changed much in the above dimensions over the past twenty years. But it should be recognized that in some ways the development processes and plans of the Science Cities have differed fundamentally from Silicon Valley. Tsukuba was first envisioned as a public project to alleviate some of the pressures of crowded Tokyo. The Science Cities have also focused rather strongly on precompetitive basic research as compared with applied research.

Innovative showpiece: of central planning or of cooperation?

Building a Science City is an activity demonstrating bold effort and ambition. But the ideals are often developed by science policymakers, bureaucrats, politicians, marketers, and businesses with an interest in construction or logistics support. Ideology has been weak

at the grass-roots level, and the people already living in the areas to be developed are often consulted as an afterthought. This oversight is compounded when government provides imperfect information so as to avoid land speculation.

Silicon Valley seems to owe something to a relatively less regulated governmental and legal structure than that existing in most of Europe and Japan.

In terms of origins, Kansai avoided at least some of the 'top-down' rigidities of Tsukuba, but both share (with all Japan) a 'look to Tokyo' attitude where it is vital to involve the central government in strategy and assistance with logistics. Development in both these areas has been marked by ministerial infighting. There have also been frictions and inefficiencies because both Tsukuba and Kansai Science Cities are superimposed over numerous village, town and city administrative boundaries.

Tsukuba was the site of Tsukuba Science Expo '85 (国際科学技術博覧会), an international exposition that highlighted some of its promise. The six-month Expo attracted 20.33 million visitors, but was also responsible for considerable short-term displacement and environmental destruction. Local people's attitudes (according to this author's experience) ranged from glee at rising land values, to frustration at the extreme congestion; some people were simply bewildered.

A problem that has dogged Tsukuba and Kansai, and Hsinchu in Taiwan as well, is transport. Reliance on private vehicles has led to traffic jams, problems with parking and the environment, and the problem of semi-social researchers becoming more solitary.

A key question is the form for desired development, which stem from realistic goals. A Science City can be developed on a greenfield site or around / within existing cities or towns. How much planning should be directed at supporting lifestyle and community? Should developers rely upon the market and cumulative causation taking place naturally? In any case it is only reasonable to plan for the populace developing both unexpected requirements and their own solutions. From a planning point of view this might include leaving unimproved land or facilities for evolving possibilities.

These special cities attract a much more diverse range of people to a locality. The new residents may change the direction of regional development and the nature of the countryside, buying picturesque homes and pressing for the institution of new regulations such as zoning restrictions or anti-hunting ordinances.

Information technology (IT) allows collaboration with colleagues anywhere in the world. Science Cities bring people together physically, and sometimes accidentally. Open

communication is a creditable goal, but world-class experts working in narrow specialties often have difficulty explaining their work to laypeople, who in any case are often uninterested. Scientists can of course be coaxed to discussing local logistics: schools, housing, hobbies. The typical technopolis project contrasts with Science Cities in avoiding involvement in the intricacies of community development, focusing rather on the dimensions of innovation and technology, manufacturing engineering, or research & development. Might laissez-faire be better than prodding various people together for intellectual or cultural improvement? Dearing (1995) has done survey work on these key questions among those active in some Tsukuba informal groups.

It is important to question the proper extent of public funding for research and for research infrastructure. A Science City project can be simply a method for funneling direct public subsidies to private enterprise; zoning restrictions imposed on industrial parks and building sites can allow narrowly selected industries and individual firms to be targeted and supported.

National economic considerations

These types of mega-projects focused on city development are increasing. The Multimedia Super Corridor CyberJaya in Malaysia is one example, as are Singapore's Science Hub and Hong Kong's Cyberport.

As already mentioned, electronic networking offers a cost-effective alternative to research centers being in physically proximate communities. But there are many benefits that innovative local clusters of researchers can develop. The Tsukuba Research Consortium offers members joint library and information services, a shared database for local information, joint facilities such as meeting rooms and a restaurant, along with club and leisure facilities. The Science City is also a focal location for sometimes fabulously expensive research equipment. Many small organizations have seen the benefits of such a combine in generating a critical mass for professional training and attracting in specialists for seminars. The administration of Hsinchu in Taiwan (SIPA) organizes training in the science park for about 5000 workers per year, in courses such as intellectual property rights, accounting, and basic knowledge of semiconductor technology. They find that speed is essential for stimulating the energies of their constituency and generating critical mass.

If similar organizations are clustered together it becomes more likely that key suppliers might locate nearby, offering faster service and reduced transaction costs. The

possibility of resource sharing exists - jointly using library, dining, or measurement facilities, or sharing the cost of specialized equipment. Public administrative functions can also operate more efficiently with clusters: it becomes easier to monitor effluent and environmental impact, and to oversee safety. Synergy benefits are primarily limited by lack of imagination and by administrative costs.

Firms siting themselves at either Science Cities and technopolis projects must face special security considerations, including the notable possibility of being targeted by competitors looking for proprietary information. The contrary position of being based at an isolated site may make those gathering competitor intelligence more conspicuous, but isolation brings added costs and inconveniences to suppliers, employees and customers.

Science Cities can be an organized effort at cumulative causation, virtuous spirals generating not only new ideas and technology, but also an increased demand for local support services, quality schools and public facilities. Regardless of the extent that a government pre-plans an innovative community, public services must respond to subsequent local population growth and evolving citizen demands.

Cutting-edge Science Cities attract the international spotlight, and if successful can fuel national competitiveness. Private firms are attracted to Science Cities in order to become informed about (and possible early adopters of) substantial new development and marginal innovation, and to gain technological foresight. There is value and prestige in working at or having corporate facilities at a high-technology center; a reputational benefit derived from having a prestige address from which to work.

Tsukuba's has had a substantial positive effect on leisure in Tokyo, which is not widely recognized. With the development of Tsukuba, national research and educational organizations moved from the capital, freeing-up 64 sites of 359 hectares in Tokyo that are now used for public and community facilities such as parks (Study Group on Tsukuba Science City Development in the 21st Century, 1997).

Communication patterns and collaboration

A simple and desirable formula of synergy has two actors, where **1 + 1 = 3**. But proprietary concerns or passivity can cause poor communication and isolation, which lead to unnecessary duplication and waste, such that **1 + 1 = 1**.

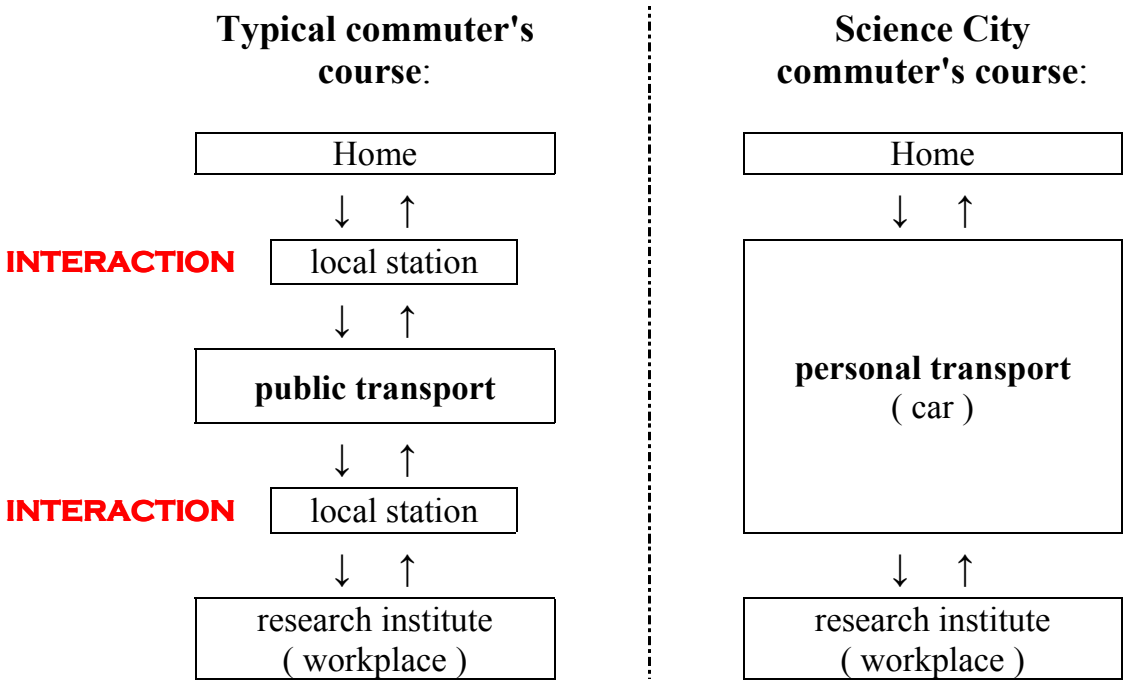
The catalytic mechanism can thus be important, but what is poorly charted is the form it should take on a local level. It is important that the locality or workplace provide tools to identify information and to communicate.

Cases have been found in Tsukuba (Dearing 1995, p. 26) of researchers working virtually across the street from each other and investigating the same phenomena but choosing not to meet. Rivalry and competition were cited as only partially explaining the absence of communication; Dearing leaves the other factor(s) unstated, but they may include poor face-to-face communication skills (hesitance to introduce one's intimate research passion to strangers), and bad work habits disguised as sloth.

Top level researchers may be circumspect about information release due to secrecy concerns, but at the same time be extremely keen to monitor developments in their field. Their reach for information is worldwide, and with improved electronic communication services, increasingly quick. Science City institutions are typically provided with a better-than-average information infrastructure, some of which is due to provision of joint backbone services and tools -- a highly useful benefit to agglomeration. It is ironic that information and scientific news generated locally often first becomes known through national or international channels. Generally only the big news bureaus have the specialized staff to find and interpret scientific findings, and top journals are published far away (though in contact with a worldwide network of editors and reviewers). Researchers often learn of developments relevant to them via their worldwide acquaintance network, and electronic communications have significantly shortened notification lag times.

A common way Japanese people interact and relax outside the workplace is to go for a drink with co-workers, with other friends, or by oneself. Many in Japan commute from home to work by public transportation due to traffic congestion and parking limitations, so common nodes of interaction are around the train station, either near the workplace or near home. The two Science Cities have had problems with this as neither has a central train station, and many commute individually through the semi-rural surroundings by private vehicle. This is convenient but circumvents interaction, as displayed in the enclosed figure. The private vehicle commuting pattern in these Science Cities also has a time dimension. Researchers often must work substantial overtime, but work hours in most locales are in practice limited by a need to catch the last commuter train or bus. Those in the Science Cities with a private commuting vehicle have no commuting deadline, and some researchers

personally known to the author complain that this means longer work hours and a more monotonous workweek schedule.



Long work hours combine with narrow institutionalism in most of Japan's public research centers. External liaison, when it takes place, is chiefly aimed at government departments: especially each institution's Tokyo main ministry complex (all public organizations and foundations are aligned with a ministry). Most large private firms have their head office in Tokyo, though some are headquartered elsewhere. The manufacturers have production facilities in various parts of Japan, but not often very near to either Tsukuba or Kansai Science Cities. Venture capital would similarly need to be drawn out to Tsukuba or Kansai Science City from one of the major cities

Public organizations and private firms do spend considerable effort in cultivating affiliations with their networks of clients, suppliers, auditors, etc., but these relationships are again much more likely to be located in Tokyo than in Tsukuba.

The World of Work

When firms combine, they can generate economies-of-scale in:

- transportation
- less need to move people (worker, spouses, families)
- supply and servicing of equipment (including possible joint use)

- lower cost / quicker deliveries of supplies and subcomponents
- measurement / instrumentation
- standards development
- emissions monitoring and control
- cross-fertilization
- educational efficiencies

There are systems of cross-posting from industry to government, and many researchers in Japan receive guidance as well from universities in order to complete 'ronbun-hakase' programs (doctorate awarded for thesis to unenrolled researchers from industry or government). Increased interaction has the potential to compromise proprietary boundaries. This may involve outside employers as well, leading to competition for, and potential loss of employees.

Tsukuba has many married women, especially wives of researchers, who are underemployed on short-term contracts due to having left the workforce at some point to raise children or to accompany their spouse to a distant posting. These part-time female workers are forced to change workplaces periodically (otherwise employers must pay more in benefits). They circulate from one office to another, and many become important informal information nodes and points of contact for personal introductions.

As elsewhere in Japan, job migration is complicated by difficulties of school transfers for children. Movement from one employer to another within the Science City is attractive if such difficulties can be bypassed.

Community building

It is desirable that links be developed between the original inhabitants, mostly farmers, and new residents. All residents are important to these cities; researchers will always be a minority.

It is difficult to integrate transplanted people. Will they gain pride in local traditions and products? How quickly will they feel at home? Or will they instead contribute to a quicker dissolution of local character and customs?

In both Tsukuba and Kansai, people for the most part are open to others and the shared experience of living in a new city. A sense of local cohesiveness has developed (especially in relation to the schools, and somewhat with shrines, churches & temples), but places for general interaction remain undeveloped. There is no need to look at human

contact purely in instrumental terms: repeated meetings over time might lead solely to easier communication and friendships - not bad things!

Alexander et al. (1977) developed a series of basic formats for the design of living and work spaces. Some of the forms most useful in the Science Cities might be: city / country fingers and mosaic of subcultures (pp 21 and 42), differentiated with physical subculture boundaries and with identifiable neighborhoods (pp 75 and 80). Many of today's housing tracts seem grim and remote because they offer nothing to draw visitors from outside.

Local carnivals and open block parties can help break the population from isolationism. A promoter needs only take some initiative to start something. One popular activity in Tsukuba is the annual Open House Day, when the entire city is offered entrée to the research centers and public service buildings. A shortcoming to this, however, is with the people who must stay at their workplace to assist visitors, leaving them unable to visit and discover things elsewhere.

Infrastructure

In the 1970s it was said that those moving to Tsukuba needed three things: high boots for the mud, a flashlight (as there were few streetlights), and a stick to beat away the wild dogs.

It was similarly not a good sign in March 2000, when on my way to visit Kansai Science City for the first time, I asked in the Kyoto station office for the name of nearest station to the Science City; none of the staff was sure of how to read the Japanese characters (祝園駅 - Hôsono Station).

The Study Group on Tsukuba Science City Development in the 21st Century (1997) detailed both results and problems of Science City development, scientific accumulation and research activities. Tsukuba still has many workers commuting from elsewhere, or living alone in Tsukuba and not relocating their families there. Among the problems cited are high land prices, problems with children's education, and job scarcity for retirees.

In both Tsukuba and Kansai, the families of most national government workers live in subsidized housing exclusive to government employees. These monotonous housing blocks generally show little imagination in design or siting, and it seems that a chance to

generate inspiration has been overlooked. Future planned cities should learn from such shortcomings.

There are many ways that a municipality can attract press attention and resident loyalty. The Science Cities might concentrate somewhat more on promoting commitment among pioneering new residents to the area, for instance through housing lot lotteries. The cities can also devise public education mechanisms to recognize and reward key researchers or innovators, such as a program identifying "Treasure in our Midst" within the city.

Hsinchu Science-based Industrial Park in Taiwan cast its net wide in seeking to bring back overseas Taiwanese working in Europe or North America, but the benefits offered these people have created friction. One problem is resentment of the fact that Hsinchu's elite special school is closed to local people in the surrounding community. Hsinchu has also had serious problems with the local government being excluded from key decisions and not much involved in the policy process. Many of what would be normal revenues of Hsinchu City cannot be collected, having been signed away at the national level through attractive tax incentives to attract industry, even while the city has to deal with increasing requirements for support and logistics. The local administration has approached manufacturers for 'voluntary donations' with the threat that failure to collect revenues might lead to services such as trash pickup being curtailed, or that future administrative licensing might be delayed, or that environmental audits might cause problems for manufacturers.

Lubman (1999) reports that locals criticize Hsinchu with a Taiwanese proverb: "You raise the hen, but it doesn't give you any eggs, just droppings."

Internationalism and foreigners

The recruitment of top quality researchers involves special logistic preparations. Such people tend to have high expectations for their children and expect good local schools. If coming to Japan from abroad, they may need substantial assistance with basic living logistics. Coordinating organizations take over many logistic responsibilities for visitors (Tsukuba developed a Center for Institutes and the Tsukuba Information Center to assist with this), yet many foreign researchers fail to find fulfilling connections in the wider society and community, and find the city sterile. This is not a personal failing - many Japanese residents complain of the same sterility and urban artificiality.

Given Japan's highly restrictive immigration policies, and the prevalence of social attitudes marginalizing non-Japanese, it is most unlikely that either of these cities will be

international or multicultural in the style of many cities in North America and Europe. However relative to the rest of Japan, both cities have a sizable floating population of short-term foreign students and researchers; these residents make the areas remarkable.

As with elsewhere in Japan, there is extremely low non-Japanese involvement with either city infrastucture - planning, shop ownership, face-to-face contact with service and product consumers. Regardless of their commitment, non-Japanese remain outsiders / guests; for the most part they are ineligible for naturalization (in contrast to Sweden, where 10% of Swedish citizens were born in other nations). This transience plus the language barrier makes life difficult for many foreigners. Japanese institute staff often become blasé and see visiting researchers as just another in a steady stream of short-term foreigners. There are, however, both private and public offices in operation to assist non-Japanese newcomers; one such project in Tsukuba has been the publication of a free English-language local news and information journal aptly named "The Alien Times."

The University of Tsukuba has been a leader in Japan as a base for foreign students, but the Tsukuba faculty has been slow to internationalize. Among the small foreign faculty, some have made the university a prominent target of complaint over unfair dismissals and lack of promotion.

Saxenian (1999) described highly-skilled immigrants in the Silicon Valley as being key catalysts for its success, comprising about a third of the region's scientific and engineering workforce, with immigrant-run firms employing over 50,000 people. Japan has missed such benefits, a loss likely due to a xenophobic attitude toward immigrants. Very few foreigners are able to remain in Japan long-term, and those without a native-born spouse are very seldom able to start businesses. The nation could benefit from being more imaginative in this regard, with a possible bonus being alleviation of Japan's chronic difficulty with the English language.

Promising developments

In the conclusion of the Second Stage Plan for Kansai Science City (Kansai Science City Second Stage Plan Promotion Committee, 1996) one promising point is the claim that "what will be more important than anything else is the gen eration of enthusiasm among citizens over its construction." This seems to recognize that the desires, interests and dreams of the residents are a central and necessary component in the city's success.

With the 1998 advent of Japan's "Law for Promoting University-Industry Technology Transfer" (大学等技術移転法: TLO法) it has been possible to better develop the system of technology transfer from universities to industry. Tsukuba and at least six other universities have developed technology licensing organizations. These TLO firms are expected to provide monetary incentives and other feedback, and breathe new life into the university system by improving the applied dimension of research and serving society more directly (Liaison Office in the TARA Center, undated). Cross-sectoral interaction between university researchers, venture capital and entrepreneurs will likely require a long time to take hold. The Tsukuba Advanced Research Alliance (先端学際領域研究センター: 筑波大学TARAセンター) is another promising initiative for bringing together disparate research groups (with explicitly limited time and budget constraints).

It is still uncertain what monitoring costs will be needed with public and private liaison for R&D. Hopefully, competition might liven-up the pace of innovation. In any case, more diversity in the world of research is welcome. A stronger acceptance of pluralism in Japan generally might also be helpful to break up the complacency with which the nation seems to be afflicted. Much basic work remains to be accomplished if seeking to provide measurable guideposts for future development of high-tech communities.

The main obstacle to further Japanese success is with its rigidity. Creating the physical plant of a Science City is a still a long way from creating an environment in which people create, thrive and dream. Positive steps have been made in educational reform, lifelong learning, deregulation, and developing the dimension of leisure in people's lives. Hopefully this nurturing will allow fresh shoots of talent to increasingly emerge from both Tsukuba and Kansai Science Cities and also from elsewhere in Japan.

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Appendix 1: Report Summarizing Tsukuba Concerns (Table of Contents):

Tsukuba Science City Development Program in the 21st Century Proposal: People/Science/City Proposals for the 21st Century from Tsukuba

http://www.info-tsukuba.org/english/what/after/vision1.html

November, 1997
Study Group on Tsukuba Science City Development in the 21st Century

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Appendix 2: Report Summarizing Tsukuba Concerns (excerpts)

Tsukuba Science City Development Program in the 21st Century Proposal: People/Science/City Proposals for the 21st century from Tsukuba

http://www.info-tsukuba.org/english/what/after/vision1.html

November, 1997
Study Group on Tsukuba Science City Development in the 21st Century

Chapter 1: Outline of Tsukuba Science City Development
http://www.info-tsukuba.org/english/what/after/chp1.html

...
2. Results and Problems of City Development

(1) Results

a. Well-ordered streets and Advanced urban service facilities

Tsukuba Science City is one of a few full-scale planned cities in Japan. Infrastructure has been systematically laid out such as arterial roads in north-south and east-west directions, parking lots, multi-purpose parks, condominiums, the Tsukuba Center Building, and various public and community facilities of elementary, junior high, and high schools. Public utility tunnels have been constructed to house a community central heating and air-conditioning system, a vacuum refuse collection pipe line and a CATV system. Exclusive pedestrian walkways have been constructed for the pedestrian's safety and convenience. The experiences in these advanced urban service facilities have been put to good use in the development of other big new towns.

b. Good living and Research Environment

A good living and research environment close to nature has been realized in Tsukuba Science City. Wooded areas and the green belts along streets are examples of how the city is becoming richer in nature. Urban sprawl phenomena caused at a developmental stage have been prevented under the well-executed Land Readjustment Project and other projects. In the surrounding suburban district, flatland forests and pastoral environment have been preserved.

c. Development of Well-balanced Metropolitan Area

In order to construct a fully-functioning and self-sufficient metropolitan area, a basic plan to construct the business areas of the cities of Tsuchiura, Tsukuba and Ushiku, which are deepening their relations and communication, is being promoted. In Tokyo, there are 64 sites (359ha) which were formerly used as sites for national research and educational facilities. These sites are now effectively used as public and community facilities such as parks.

(2) Problems

a. Place to Settle In

The planned population of the Research and Education District was 100,000, but the District population is currently only 60,000. Reasons such as children's education, job scarcity for retirees, and high land prices have discouraged many people from settling in Tsukuba. As a result, they are commuting to Tsukuba from other places or living alone apart from their families. Because of this, residential development in the land readjustment areas has been delayed.

b. Lack of Urban Functions

Public transport is far from sufficient, which is inconvenient for those without cars such as children, senior citizens and short-stay visitors from overseas countries. Recently, traffic congestion, parking lot shortage, and traffic accidents have come into question. Urban service infrastructure such as hotels, commercial and business facilities, cultural and recreational facilities are not enough.

(Appendix 2: page 1 of 3; *cont.*)

Appendix 2 (cont.): Report Summarizing Tsukuba Concerns

2. Results and Problems of City Development: Problems (*cont.*)

c. Maintenance of Advanced Urban Service Facilities

Proper maintenance and renewal of advanced urban service facilities, parks, wooded areas and exclusive pedestrian walkways is a focal point, although the costs are high. The half-finished construction of public and community facilities and the limitation of CATV service areas are also problems to be overcome.

d. Disparity between the Research and Education District and the Surrounding Suburban District

Infrastructure in the Research and Education District has been developed as planned by the Housing and Urban Development Corporation. Its development standard surpasses the national standard. In the Surrounding Suburban District, on the other hand, development of water supplies, sewage systems, and roads has been less advanced. Residents in the Research and Education District show less interest in municipal administration than residents in the Surrounding Suburban District, which shows a sense of solidarity between them.

3. Results and Problems of Scientific Accumulation and Research Activities

(1) Results

a. Japan's Largest R&D Centerpiece with industrial, educational, and governmental research institutions

Tsukuba Science City is Japan's largest R&D centerpiece. 26 national research institutions are located in Tsukuba, equivalent to about 27% of all the national research institutions and about 44% of all the personnel of national research organizations in Japan. 45 research and educational institutions are concentrated in Tsukuba including the University of Tsukuba. The Research and Education District and the Surrounding Suburban District have in total about 300 research institutions and companies, both national and private.

b. Core City of International Research Exchange

Tsukuba Science City has become the core city of international research exchange activities, and Tsukuba boasts of the world's highest level of the scientific and technological achievements, active international research exchanges, frequent international conferences. In addition, foreign researchers have increased in number every year.

c. Promoter of Japan's Technology

As the technological hub and the core research base (Center of Excellence, or COE), Tsukuba Science City has contributed to raising the standard of Japan's technology, and has promoted Japan's motivation to catch up with and surpass other industrialized nations.

d. Releasing the Scientific and Technological Achievements to Benefit Society

Tsukuba Science City has held the "Science and Technology Expo '85", standing exhibitions, "Science Week" in every April, and science festivals, through which Tsukuba has expanded people's understanding of science. Through this, Tsukuba has released the scientific and technological achievements to benefit society. The Center for Tsukuba Advanced Research Alliance (TARA) and the Tsukuba Juku (a study group) have recently been established with the purpose of creating new industries. Ibaraki Prefecture has promoted to send techno-experts to the small and medium-sized enterprises.

(Appendix 2: page 2 of 3; *cont.*)

Appendix 2 (cont.): Report Summarizing Tsukuba Concerns

3. Results and Problems of Scientific Accumulation and Research Activities (*cont.*)

(2) Problems

a. Problems of Research Exchanges and Technology Transfer

An inactive research exchange is often pointed out in Tsukuba as well as in Japan, which is caused by lack of interdepartmental cooperation, inflexible administrative system of public research personnel, and barriers between the government and the people. Technology has not completely been transferred to industrial fields. The advanced research achievements and intellectual information from national organizations have not been directly connected with the technological development of private companies, and have not been put into practical use. In Silicon Valley and other science cities overseas, there have been established venture businesses for using the basic research achievement practically as well as the various supporting services for fostering venture businesses. In Tsukuba, however, both venture businesses and supporting services have not been fully prepared yet.

b. Decrepitude of Research Facilities and Lack of Research-Supporting Services

In Tsukuba Science City, it has been about 20 years since national research facilities were constructed. Their decrepitude and crampedness have come into question. Renewal and extension to research facilities are indispensable in order to carry out highly advanced and diversified research. Also, there are shortages of the research-supporting services and staff which aid technical consulting, information processing, analyzing, and calculating.

c. Preparations to Host Foreign Researchers

The number of foreign researchers has been increasing every year in Tsukuba Science City. About half of them are full-time researchers at public and private research institutes. Many foreign researchers and students stay in Tsukuba for a long period of time with their families. However, the system to host foreign visitors is insufficient, and accommodation and language training services are inadequate as well. Newcomers are unfamiliar with Japan's medical care, educational systems, and various local services, all of which sometimes discourage foreign researchers from staying in Tsukuba.

Appendix 3: Report Summarizing Kansai Concerns (excerpts)

Policy for Future Construction of the Kansai Science City (Report): Second Stage Plan

http://www.nla.go.jp/daikan/ssp-3_e.html

25 April 1996
Kansai Science City Second Stage Plan Promotion Committee

Evaluation of the Current State of the Kansai Science City

…when looking at the present situation in reflection of the initial concept of the city, there are lofty hurdles to be overcome due to the lofty nature of those ideals, and there are many issues that remain to be solved...

Present State of Community Creation

(1) City Development Status

Cluster-Type Development

…city creation that takes advantages of the merits of cluster-type development, such as harmony between cluster individuality and the natural environment, has yet to be realized. In addition, the shortcoming of a lack of a unified image is also unable to be overcome.

Formation of a City Center

...for establishing the framework of the city and ensuring urban convenience has yet to be realized. Although the construction of the city is only partially completed, the lively activity of a city and urban appeal is still inadequate at the present time.

Construction and Preservation of Peripheral Areas

…cannot be said to be adequate.

(2) Construction Status of Transportation Infrastructure

A wide-area transportation network … is insufficient.

(3) Construction Status of Functions Supporting Living & Research

Residential Functions

…a housing plan for the entire city does not exist. As a result, efforts regarding housing, the most basic condition for city life, cannot be said to necessarily be adequate. In addition, …there is the problem of the formation of urban areas being uniform and homogeneous.

Living Convenience Facilities

…there is a growing need for the providing of service functions that support the lives of residents and the research and exchange activities of researchers.

(4) Status of Efforts as a Pilot Model City

…cannot be said to be adequately implemented.

(5) Status of Planning & Adjustment Relating to Community Creation

…have not always been sufficient.

(Appendix 3: page 1 of 2; *cont.*)

Appendix 3 (cont.): Report Summarizing Kansai Concerns

Status of Cultural and Scientific Research Activities

(1) Cultural Fields

…in terms of contributing to the creation of culture, the construction of cultural facilities is not adequate and there are expectations for further enhancement.

In addition, …taking advantage of the rich cultural and historical stockpile has not necessarily been sufficient.

(2) Scientific Research Fields

… although new seeds for industry are being developed, core facilities to serve as the brain of these activities are still insufficient in quantity, and activities leading to the creation of new industries are not being sufficiently deployed.

(3) Information Transmission and Exchange

…expertise & accumulation of regional appeal and so forth remain inadequate.