

CASE STUDY

KOBE CREATIVE RECONSTRUCTION

COMPETITIVE CITIES KNOWLEDGE BASE
TOKYO DEVELOPMENT LEARNING CENTER

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About Tokyo Development Learning Center (TDLC)

The Tokyo Development Learning Center (TDLC) program is a partnership of Japan and the World Bank. TDLC supports and facilitates strategic WBG and client country collaboration with select Japanese cities, agencies and partners for joint research, knowledge exchange, capacity building and other activities that develop opportunities to link Japanese and global expertise with specific project-level engagements in developing countries to maximize development impact.

BACKGROUND AND ACKNOWLEDGEMENTS

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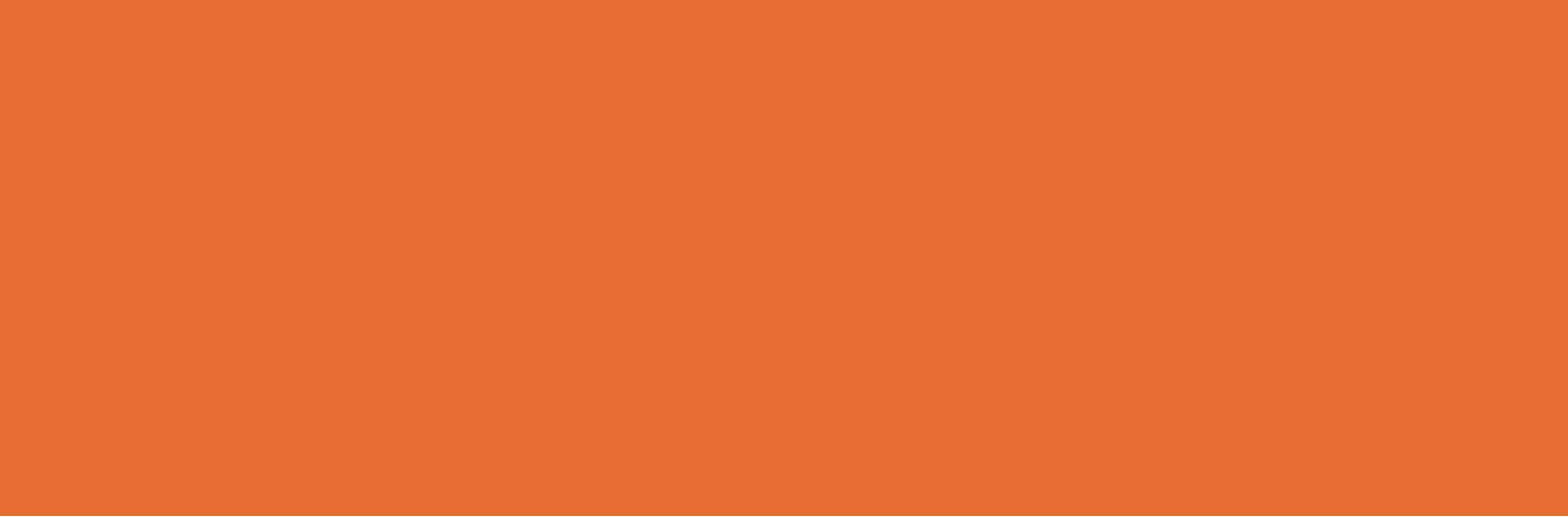


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EXECUTIVE SUMMARY

Kobe's modern history started with the opening of Japan in 1865-70. Built between the mountains and the sea, by the last decades of the 19th century Kobe had established a reputation and self-image as a place of "firsts". It was, with Yokohama, one of the first cities in Japan to build modern public goods, such as suburban commuter railways and first gas then electric street lights. It was an early center of heavy industry, and had an early consumer culture, noted for its jazz and fashion.

After World War II, Kobe's recovery was rapid. Some of its previously dominant companies returned to growth and then rapidly moved up the value chain, as Japan nationally pursued an industrial policy focused on high-quality materials and capital goods. For example, Kawasaki Heavy Industries, which had produced aircraft before the War, produced Japan's first industrial robot after it, and then entered consumer-facing industries with the development of Kawasaki Motorcycles.

In the same decades, the shoe industry grew rapidly. The city's Nagata district became the center of shoe production in Japan. It was in Kobe that Kihachiro Onitsuka founded the shoe company that would become ASICS. In the 1960s, Phil Knight travelled to Kobe to meet him, and was inspired first to sell his shoes in the US, then to found Nike. In later decades, the city attracted the Japan headquarters and R&D offices of several multi-national companies, including P&G, Nestle and Eli Lilly, the city's name also became globally recognized through the branding successes of "Kobe beef", and other campaigns. By the late 1980s the city's economy had diversified significantly. The enormous shipyards of Kawasaki and Mitsubishi, however, remained downtown.

From the 1960s onwards, Kobe built deep expertise in redeveloping existing urban areas. It was particularly skilled at navigating local land markets, harnessing national laws once passed to widen roads for the 1964 Tokyo Olympics. It created and managed a sprawling network of public-private institutions, known as "Kobe, Inc.". During the period however, the great shipyards remained downtown and agricultural interests continued to constrain outward growth. To finance land reclamation activities, the city raised debt at a large scale over the course of this period.

Kobe's catalytic crisis arrived in the early morning of January 17, 1995, with the Great Hanshin earthquake. The city was struck by one of the largest earthquakes on record, which killed 4,600 Kobe residents, displaced hundreds of thousands of people and caused an estimated \$100 billion in damage. The city's rapid response moved in three phases. In the first days and weeks, it triggered and then put to work pre-existing instruments—regulations drafting public servants as relief workers, or authorizing national officials to deploy to the city and make decisions with local counterparts on the spot. A council of executives met twice-daily to make decisions. A "headquarters" was supported by a secretariat formed around the pre-existing disaster recovery bureau, complemented by team-members from line departments. Only decisions that could not be solved by those in the field were referred to the secretariat and council—the latter's role being less to micro-manage than to mobilize.

Within two to three months, much of the city had been able to recover and return to a level of normal daily activity, through the tremendous recovery efforts. The city then pursued a course of "creative reconstruction". It sought to use the earthquake as an opportunity not just to rebuild, but to redress long-term challenges, capitalize on emergent opportunities, and build back better.

In the built environment, it devised ambitious new designs for devastated areas. In doing so, city officials drew deeply on their decades of experience in urban redevelopment. They created real, substantive forums for consultation and attended hundreds of meetings in just a few years. They held firm where they believed it necessary, as in the creation of a big central space for disaster resilience, while yielding elsewhere, as in having more and smaller buildings instead of a few giant ones. Once underway, the rebuilding itself used the city's balance sheet to provide flexibility, such as to avoid forcing residents to engage in one kind of mandatory prior-land for new-apartment swap. Ultimately, the housing project was completed on schedule, in under a decade, at a modest net cost to the city, after much initial expenditure was recouped.

Creative reconstruction also led, from 2000 onwards, to the building of a life sciences cluster in Kobe. Many reasons converged to make this viable. The broader Osaka-Kobe-Kyoto

region had enormous strengths in medical research and pharmaceuticals. Eminent researchers, university administrators, private companies and national officials had all noted Japan lacked a place to bridge its medical research and commercialization. Through previous land reclamation activities, the city had the land and capacity to build such a life sciences cluster. Beginning in 1997 the city developed plans for a globally competitive large scale life sciences cluster. The Chair of the project team and then of the cluster itself, Dr Hiroo Imura, commanded wide respect—he had been President of Kyoto University, and won numerous awards in medical research—and supplied drive to the vision for the cluster.

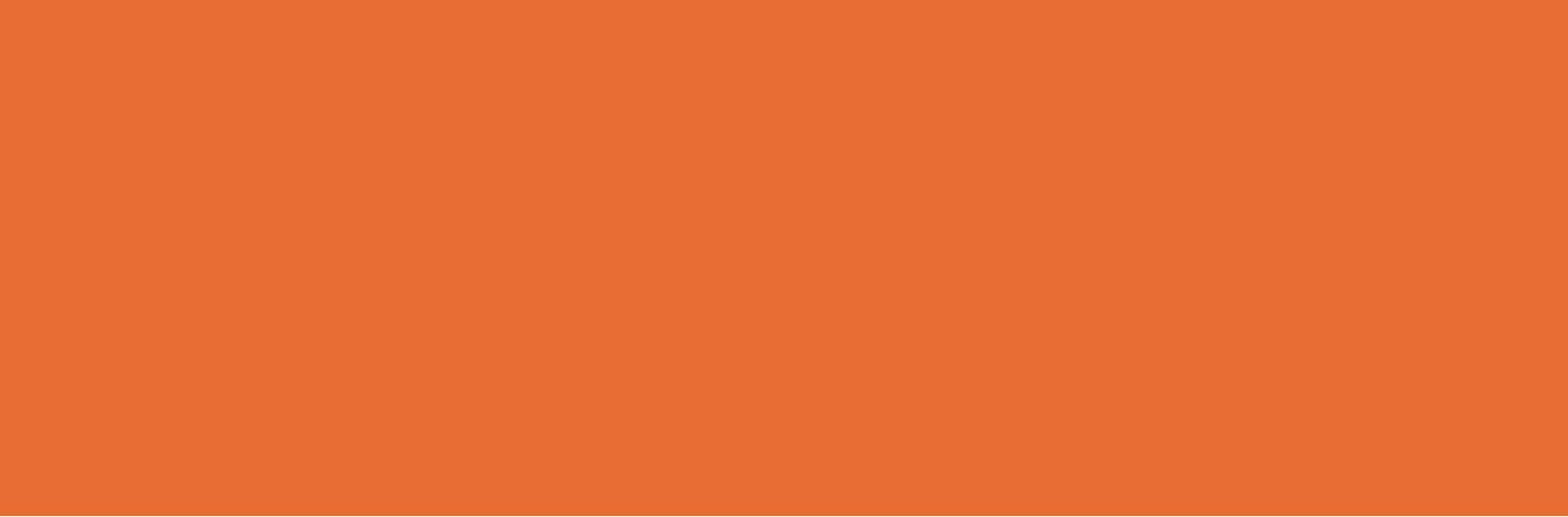
The city first laid its institutional foundations. It created multiple public-private institutions and agencies, each with different tasks, connected in a dense network. The first breakthrough was when Riken, Japan's largest research institute, decided to establish a campus in Kobe. The city then built a research foundation next to the first Riken center, and worked to persuade the institute to add more functions.

Further research facilities followed, while the city focused less on a traditional approach of hunting a handful of big names with bigger and bigger incentives, and more on crowding in a mass of companies. It offered deeply discounted rent lab space for three years as the primal instrument. Over fifteen years it has attracted over 500 companies, of which 344 companies and organizations (as of September 2017), continue to operate, attrition has shown the cluster's discipline in fact as well as in theory. All the time, the cluster organization was adding institutional muscle. Years later the cluster was designated as a "National Strategic Special Zone" with researchers and doctors conducting cutting-edge biomedical research and therapeutic developments here. On job creation, the cluster has created just under ten thousand, but those are high-value and at the technological frontier. The cluster has also outperformed that in Singapore, a city of roughly six times the population and with all the levers of a nation state available to it. Importantly, the cluster today – with a strong focus on research, a critical mass of companies, and endogenous growth – differs markedly from original plans that focused on attracting big multi-national companies. Such adaptation has been a strength, and likely accounts for the vitality of the cluster today.

However, the city's economy overall has struggled since 2000. When the quake struck in 1995, city debt was already high; it then borrowed heavily to frontload spending on reconstruction. The wave of capital and demand from 1995-2000 buoyed up growth and kept alive almost all firms, both efficient and inefficient. From 2000 onwards, the city had to implement significant austerity measures. The local economy struggled with a demand deficient, and the city administration was fiscally constrained in its ability to undertake new projects. Compounding economic challenges the city's age profile, like most of Japan, was also shifting towards a greater percentage of elderly. In the last few years it has regained its fiscal headroom, but, like all of Japan, aging demographics challenges present significant challenges to the cities competitiveness.

The city retains many strengths with which to combat that looming crisis. At present, it is attempting multiple approaches to harness or complement those strengths. Some of its attempts are locally generated, as responses to problems it has identified and analyzed. Others are undertaken to seek to capitalize on available national programs. Still others are routine active labor market interventions, such as job fairs, demand-supply matching, and accelerator and incubator programs.

It may, though, still need to build processes or institutions to provide space for and learn from problem-driven iteration. The city has a quite remarkable set of capabilities, from design through robotics to biotechnology, and a reputation for a highly attractive lifestyle that attracts high-end technical talent. Overcoming defensiveness, learning to learn, and being ambitious enough and inclusive enough in its vision for youth development, may then be the key challenges ahead of it.



BEFORE THE QUAKE: 1865-1995

A spirit of seeking new challenges

Kobe's modern history started with the opening of Japan in 1865-70. A town had stood where Kobe is today for some time prior to the 19th century, but it had remained quite small and entirely dwarfed by Osaka nearby. Then in 1865, just as Japan was entering the political turbulence that would give birth to the Meiji restoration, one of the future Meiji leaders established one of Japan's early naval training schools.¹ It was then established as an open port in 1868, at the same time as Yokohama, and grew rapidly. The first Meiji-era governor of the prefecture surrounding Kobe, Hyogo, later became the first Prime Minister of Japan. In its first decades as a port, Kobe attracted an influx of capital and foreign investment and grew rapidly. Large European firms established branches around its port, such as HSBC and Jardine Matheson, and a range of domestic industrial activity began, including shipbuilding.

"The first in Japan to try new things". By the last decades of the 19th and first decades of the 20th century, Kobe had established a reputation and self-image as a place of "firsts". It was, with Yokohama, one of the first cities in Japan to build modern public goods, such as suburban commuter railways and first gas then electric street lights. It was an early center of heavy industry. The Kawasaki and Mitsubishi shipyards, which still exist, employed tens of thousands of workers by the 1920s. In that decade, it was also the first center of radical politics and labor organizing, including a massive strike of tens of thousands of shipyard and dockyard workers in 1920-21. There was also, early, a consumer culture, with the city noted for its music, such as jazz, and fashion.

Postwar entrepreneurialism, from turbines to shoes. Kobe's recovery after World War II was rapid. Some of its previously dominant companies both returned to growth and, as Japan nationally pursued an industrial policy focused on high-quality steel production and capital goods, rapidly moved up the value chain. Kobe Steel (KOBELCO) began integrated steel production, later expanding into the research and production of alloys, and then further into machinery, in particular through its subsidiary in construction machinery.

Kawasaki Heavy Industries, which produced aircraft before the War, produced Japan's first industrial robot after it. In the 1960s, Kawasaki entered consumer-facing industries with the development of Kawasaki Motorcycles. In the same decades, the chemical shoe (i.e. non-leather shoe) industry grew rapidly, with Nagata district of Kobe becoming the center of shoe production in Japan. It was also in Kobe that Kihachiro Onitsuka founded the shoe company that would become ASICS. It was also in the 1960s that Phil Knight travelled to Kobe to meet Onitsuka, and was inspired first to sell his shoes in the US, and then to found Nike. In later decades, the city's name became globally recognized through the branding success of "Kobe beef", and it attracted the Japan headquarters and R&D offices of several multi-national companies, including P&G, Nestle and Eli Lilly. In all, by the late 1980s the city's economy had diversified significantly. The enormous shipyards of Kawasaki and Mitsubishi, however, remained downtown.

Repeated redevelopment, the city as a "public developer"

The development of "Kobe Co., Ltd". From the post-war period onwards, Kobe built deep expertise in urban development projects. Many of these were executed at a profit, through affiliated organizations. These affiliates, including a dozen wholly owned entities and many more with partial city investment, spanned the gamut from railway companies to hotel developers. In the post-War period, the city purchased the land parcel of an abandoned factory using a national land adjustment program for post-war recovery, raising the money through intricate financial engineering involving national and prefectural subsidies and a discount offer on local public bonds. Such development accelerated after the first major reclamation project in 1966, and the city came to be known as a "public developer".²

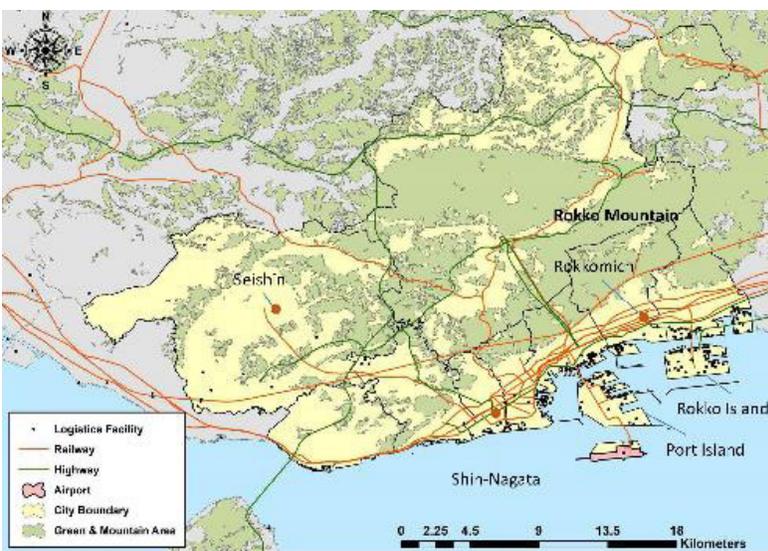
Land readjustment, harnessing the national space opened by Tokyo's Olympics. In the lead up to the 1964 Olympics, Japan's national government passed the "Land Re-

¹ (Jansen, 2002) p. 305

² Tatsuo Miyazaki, *Watashi no Rirekisho* [My personal history], 1989, Kobe Institute of Urban Research

adjustment Act of 1954". The law enabled local governments to slice portions off existing land owners' plots and swap the plots if this were deemed necessary to upgrade or build new infrastructure. The prototypical case was the widening of roads through dense urban areas. For example, landowners give up and reserve percentages of each plot to make space for the additional road width or land sales for public investment. In return, the landowners benefit from an increase in values of their land by the infrastructure development. The reduction rates and land sale prices are assessed by licensed land appraisers.³ Though the law was motivated by Tokyo's needs for the Olympics, it was passed with general applicability. Kobe became a particularly active user of such "land readjustment", given its rapid growth and structural change, concentrated in the narrow strip of land between mountains and the sea (Figure 1).

FIGURE 1: MAP OF KOBE



Source: Produced by authors based on data from National Land Numerical Information download service.

A slow and steady accumulation of expertise and some surplus. Over the subsequent decades, the city built up a successful urban development department with more than a hundred officials, with extensive tacit knowledge in how to negotiate with landholders to execute adjustment. As well as land readjustment, the city also orchestrated the purchase of as many land parcels as possible, as the then Mayor believed strongly in public development that returned profits to the city budget. In 1965, the city even developed a large underground shopping center, called Sanchika, because it believed there was no land left around the city center (although many large above-ground malls would later be built in the area). The city was so successful in public development that it was able to accumulate a public surplus of JPY 122 billion (roughly USD 1 billion) by 19934. During the reconstruction

³ Land Readjustment Act of 1955

⁴ "Han-shin Awaji Great Earthquake and Finance of Kobe City", April 28, 2017

of the city following the Great Hanshin-Awaji earthquake of 1995, these surplus funds would eventually become completely depleted.

Running out of land, except all the other land. In the mid-1960s, heavy industry and the shipyards booming, but containerization was on the horizon, requiring deep sea berths. In contrast to Yokohama, which used this technological change to move the port and heavy industry away from the city center, Kobe decided to reclaim a new "port island" that was connected by a narrow land bridge directly to the heart of the city. The administration had not sought to remake the city's relationship with the port, shipyards, heavy industry, or other entrenched interests. The Kawasaki and Mitsubishi works continued to occupy 103 ha in the land-constrained city.⁵ At the same time, city did not build outwards onto adjoining agricultural land.⁶ Naturally, it might be argued that having some of the old heavy industry remain downtown had long-term benefits in maintaining connective tissue, and uncontrolled sprawl or the elimination of agriculture would have been far from desirable. But these are simplistic and unrealistic options, and avoiding them would not preclude some balance, for example with some parts of the heavy industry works relocating and some modest portion of agricultural land developed. There is no evidence that such balance was pursued.

The decision to build a new island, and then make it larger. By the mid-1980s, Kobe had a thriving economy and a repeatedly remodeled and upgraded built environment, at least in residential and some commercial areas. But it was also competing intensively in "kigyō yūchi", a Japanese term for the act of "competing for companies". The 1980s overall are sometimes referred to by officials as "the era of kigyō yūchi". Land was needed for this competition, land which was scarce in Kobe, constrained by geography, the vast industrial works, and agricultural land. By 1985, with asset prices starting to boom, the city triggered a massive expansion of reclaimed land as "phase two" of the "Port Island", which had opened in 1981.

Foreign borrowing puts mountains on conveyor belts into the sea. Since its initial reclamation projects, the city had used soil gathered from cutting Mount Rokko (Figure 1, above). To transfer the vast quantities from the mountain to the sea, the city constructed underground belt conveyers. The tunnels built for these conveyor belts were later used for sewage pipes. The eventual size of reclaimed land for phase two of Port Island was 390 Ha, in addition to 443 Ha in the first phase, so that new port island was eventually four and a half times larger even than Minato Mirai in Yokohama (833 vs 186 Ha). So much mountain was removed that an industrial park, the Seishin area, could be built in the newly

⁵ Mitsubishi: 669,100m², Kawasaki: 360,000m². Sources: Mitsubishi: https://www.jstage.jst.go.jp/article/jime/47/2/47_141/pdf; Kawasaki: Company brochure

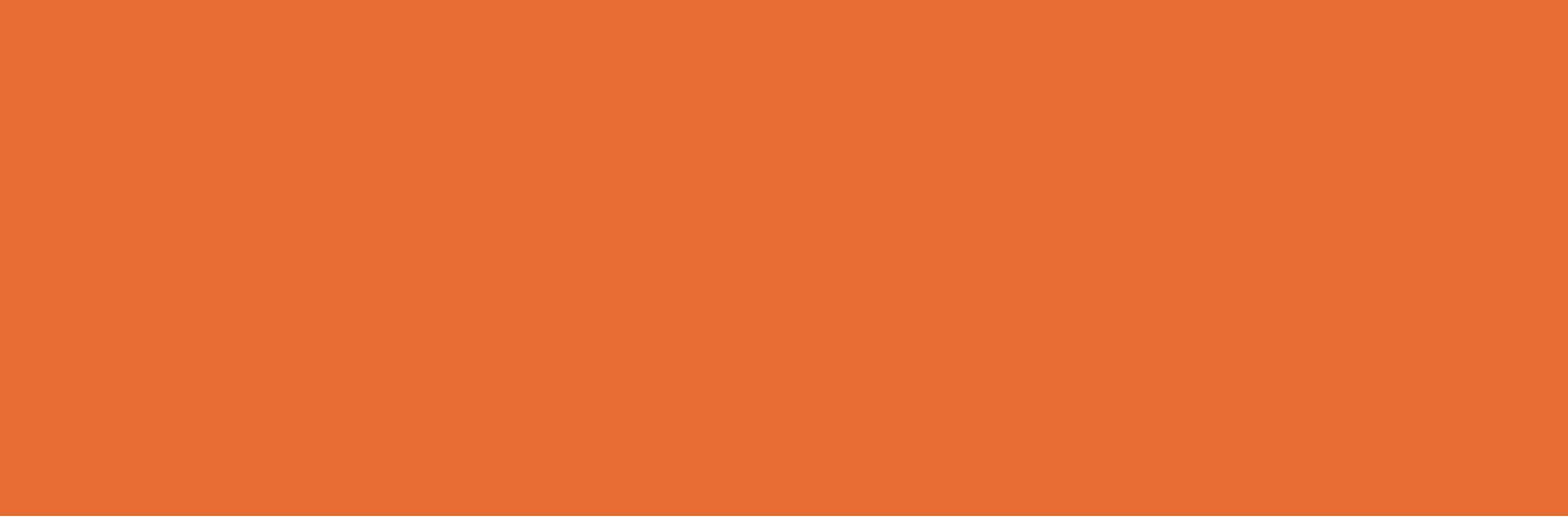
⁶ Reportedly because of the weight of agricultural interests in the city.

flattened area. Since the national government at the time was unwilling to subsidize this project, Kobe engaged in foreign borrowing (including in German Marks and Swiss Francs). Although the island would one day provide a home for Kobe's biomedical cluster, large expanses of it remain unused today, in 2017.⁷

In all, a great deal of expertise, but also a significant amount of debt. By the mid-1990s then, the city had built institutions with deep expertise in handling the intricacies of land markets and executing development projects at small, medium and large scale. Its private sector had several firms at the global technology frontier, with especially strong clusters in capital goods and footwear. Through the city's affiliated development organizations, and the many urban development projects, the public and private sector had experience working together, and the city administration had long experience in building and managing developmental coalitions.

On the other hand, the city had (like most cities) entrenched interests, and a tendency to opt first for large-scale capital projects rather than risk confrontation. The shoe cluster faced a rising threat from low-cost production, and overall the city's economic structure looked much the same as it had several decades earlier. With the bursting of the asset price bubble in 1991-1992, and the subsequent years of depressed demand, the city entered the mid-1990s with JPY 800 billion (~ USD 8 billion) in city bonds outstanding. Against this, it had municipal tax income of JPY 295 billion, and total expenses (including transfers) of JPY 930 billion. The debt burden was small compared to what it would become, but already several times the city's tax revenues.

⁷ Direct observation.



THE EARTHQUAKE AND ITS AFTERMATH: 1995-

Vast damage is met by mobilizing a response, more than directing a response

All the buildings were gone. The earthquake struck Kobe in the early morning of January 17, 1995. It was among the most damaging natural disasters in history. Economic damage was estimated at JPY 10 trillion (\$100 billion).⁸ Approximately 6,400 people died, with 237,000 displaced.⁹ Within Kobe itself, one fifth of firms were destroyed, and more than two thirds suffered damage and disruption.¹⁰ The damage was particularly severe on the seaward side of the city,¹¹ and even more so around the port, and the Rokomichi and Shin Nagata areas. Outside the city, arterial infrastructure such as highways and gas lines were damaged, interrupted or even collapsed. Some people received water from rationing trucks, while other had to use washing facilities in relatives' homes in unaffected areas; workers had to reconfigure their commutes, taking hours each day to get to work; and elderly or sick people had to be moved out of hospitals and lodge with their families until services were restored.

First response: preexisting instruments triggered.

When the quake struck, Kobe quickly drew upon a range of pre-existing laws, regulations, and practices. A pre-existing national law automatically raised the ceiling of national funding for local action, from 66% up to 90% (depending on a formula stipulated in the law) by designating the earthquake as

disaster of extreme severity.¹² National officials could also be deployed to affected areas, not only increasing manpower but also enabling decisions that would have needed national approval to be made on the ground. As described in interviews, a local disaster prevention plan had also been formulated that authorized the immediate and automatic drafting of public servants, including schoolteachers—who are closely involved with the local community—as relief workers in the event of an earthquake with an intensity of 5.0 or greater.¹³ A mobilization plan, specifying by district where the teachers would gather for instruction, had been drawn up in advance, so that it was not necessary to decide and communicate this on the day of the quake. On the morning itself the teachers gathered and were ready to be deployed for relief. A notable feature of these instruments is that they did not predetermine what the leaders of the response would do, but rather ensured that those leaders would have a range of instruments available to them almost immediately.

Rapid decision making through a secretariat and twice-daily council meetings.

On the day of the quake the city established an organizational structure for decision making. Soon after, a disaster countermeasures headquarters was set up, composed of the Mayor and the heads of department. It met twice a day to clear blockages and make any decisions needed by those in the field. It was assisted by a secretariat formed around the handful of staff in the pre-existing department for Disaster Management, plus many officials drafted from line departments involved in the headquarters. The secretariat prepared the agenda to keep the council efficient enough to ensure it could meet at such high frequency without overwhelming the city executives' time or swamping their line work.

“We didn't direct, we mobilized.” Importantly, neither the decision-making council nor the secretariat attempted to direct or control the recovery efforts in detail. Doing so, though a natural temptation and frequent pitfall of such structures, would have been paralyzing in the face of so vast

⁸ Hyogo Prefecture Government, Hyogo Prefecture Government (2010). Status of Recovery and Reconstruction After the Hanshin-Awaji Great Earthquake (in Japanese); City of Kobe.

⁹ Hyogo Prefecture Government. 6,405 deaths were in the Prefecture as a whole, and 4,573 in Kobe. The number of initial evacuees was 316,678 at peak, and the number of damaged houses was 640,000. (Okuyama, Long-Run Effect Of A Disaster: Case Study on the Kobe Earthquake, 2016), p.4.

¹⁰ Industrial Department, Economic Bureau, City of Kobe, interview and source materials.

¹¹ Due to Kobe's principal urban areas being near the sea, not from a tsunami.

¹² Act on Special Financial Support to Deal with the Designated Disaster of Extreme Severity

¹³ On the Japanese scales of one to seven, according to interview with KIUR, April 2017

a scope of activity. Instead, by drafting in officials from the line departments, the secretariat created informal channels through which issues from the field could be raised quickly. By keeping off the agenda issues that the draftees could tell might be solved lower down, it kept the decision-making councils streamlined, but also signaled to staff in the field that they could and should try to resolve issues themselves first. This principle could apply even in cross-jurisdictional matters, in which national officials deployed to the city and city officials themselves would at times simply decide and proceed. This is sometimes referred to as an ‘Incident Command System’, in which roles and responsibility are shared based on decision-making, information operation, and processing cases corresponding to sites.

Energy with inefficiency, versus micromanaged centralization. This method naturally led to some instances of inefficiency, but it is not clear, at best, that more centralized or more bureaucratically rigorous processes produce less inefficiency in a disaster. On the other hand, as Franklin Roosevelt is said to have remarked in mobilizing America for World War II, “in a crisis an excess of energy at the price of a little inefficiency is better than no energy with efficiency”. Overall, in Kobe, the restoration of most parameters of ‘normal life’—people able to go to work on time, back in shelter and able to go about daily activities, the elderly back in care—was accomplished within a couple of months. While that fits within “normal” parameters, it does so for a quake of extraordinary scale.¹⁴

Three responses for firms. Turning Turning to the economic aspects of the recovery, the Bureau of Industrial Promotion quickly held its first planning meeting within two days after the quake. It was decided to focus on three priorities: first, helping firms ensure they had access to working capital to ride out the disruption; second, helping firms maintain access to labor, which meant helping their employees; and third, helping companies access the physical space needed to maintain their operations. The second and third involved programs to provide rental space for firms and, where necessary, temporary shelter for employees, though technically this exceeded the department’s mandate the Bureau was proactive in acting on the need. The first program—targeting working capital—had by far the largest reach. It involved the provision of emergency loans, subsidies for interest payments, and, in some instances, the arrangement of loans from domestic development finance providers. The program would eventually provide JPY 422.2 billion

(from both prefectural and city governments) in assistance to 33,551 recipients, over a period of 17 years.¹⁵

Short term recovery, though possibly with a long-term price. Overall, the programs limited the immediate damage to the city’s landscape of industrial firms. By 2000, the number of industrial firms was roughly equivalent to what it had been in 1990. On the other hand, total production had dropped by roughly 20%. It may then be that the flood of capital and demand during the early reconstruction had kept many firms afloat that were not competitive in the long-run, and hence may have restricted some of the restructuring that otherwise might have occurred. Following the onset of fiscal austerity in the city in 2000, and then Japan’s banking sector reforms in 2002-3 that focused on eliminating not performing firms, the number of industrial firms fell steeply. By 2005, the number had fallen by 20%, and by 2010, after the global financial crisis, by another 10% (Table 1).

The importance of eventual withdrawal. However, levels of industrial output and employment stabilized and then climbed during the 2000s, indicating the surviving firms were growing and becoming more productive. The reduction in the number of firms was also concentrated in the footwear industry, which had a perilous competitive position versus low-cost manufacturers in China and South-East Asia in any case. The industry registered a 75% decline in the number of firms and 60% decline in shipment values over the period (Figure 2). On the other hand, while machinery and metal firms declined in number by 60%, their production rose—indicating a significant reallocation of resources to more productive firms. The problem of non-viable “zombie firms” was also by no means unique to Kobe in the late 1990s, but a phenomenon afflicting the Japanese economy in general in the 1990s. Finally, it would be methodologically aggressive to assume that, in the wake of so large a catastrophe, perfect targeting would have been possible, by the city or by any financial institutions. It would be as aggressive to assume that, in the same circumstances, the firms would immediately have put any such resources to work. The more realistic counterfactual might then be, at best, a wide swathe of firms, productive and unproductive, shutting down as lumbering programs and poorly informed private financial institutions attempted, through the rubble, to find out who exactly was deserving of credit support. What seems more important is that ultimately the programs were wound down, and five years after the disaster the restructuring of the city’s industrial ecosystem began.

Table 1: Industrial Firms in Kobe

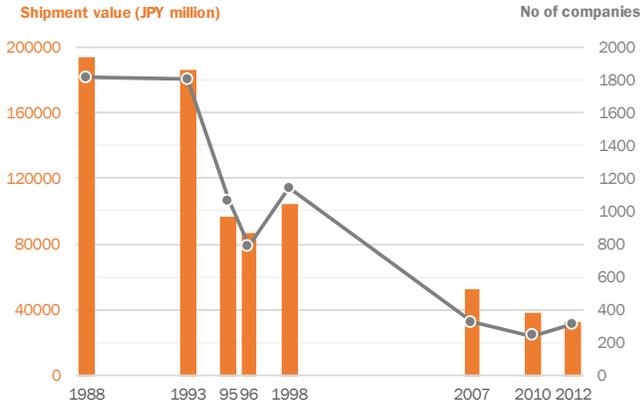
| | 1990 | 2000 | 2005 | 2008 | 2011 |
|--------------------------------------------|--------|--------|--------|--------|--------|
| Number of firms | 4,542 | 4,498 | 3,767 | 3,620 | 3,164 |
| Number of employees (1000 people) | 109.1 | 76.6 | 70.5 | 75.4 | 71.6 |
| Amount of shipment value (JPY 100 million) | 32,809 | 26,722 | 25,724 | 31,164 | 29,922 |

Source: Industrial Survey Statistics of Kobe (all offices), City of Kobe

¹⁴ (World Bank, 2008)

¹⁵ (City of Kobe, 2011)

Figure 2: Leather, rubber and plastic shoe manufacturing



Source: Produced by authors based on data from Industrial Survey Statistics of Kobe

Dealing with land markets and residents during reconstruction

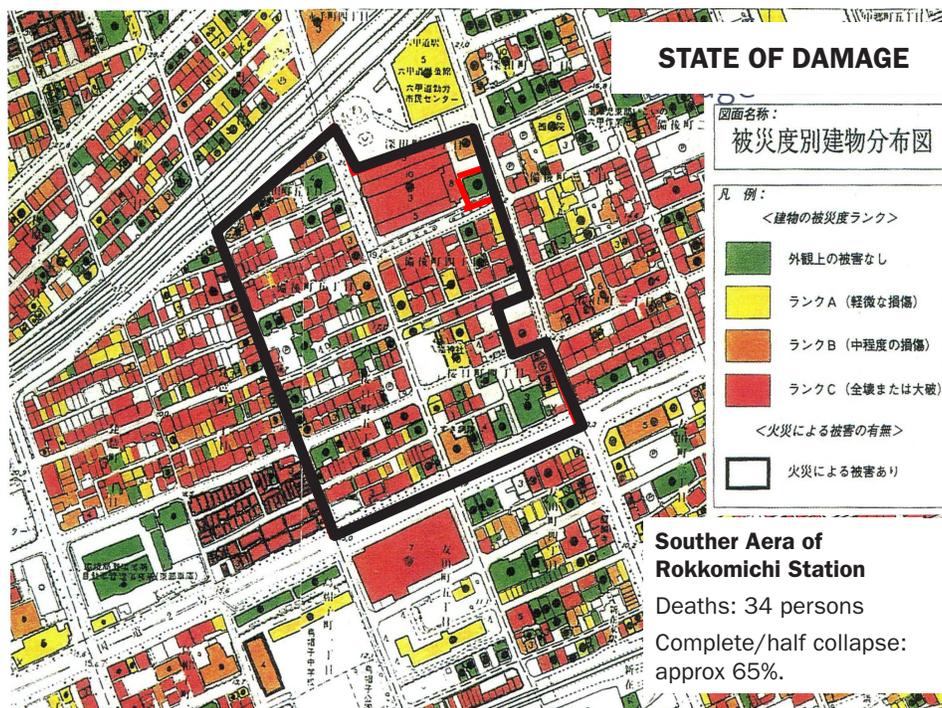
Creative reconstruction of the built environment.

Once reconstruction began, the city declared its intent to use the process to accelerate changes in the built environment and the economy. It called this process a “creative reconstruction”. In the economy, this meant primarily the development of the biomedical cluster, which is described in detail below. In the built environment, such “creative reconstruction” applied above all to the Rokkomichi and Shin-Nagata areas, which had seen some of the most extensive damage. The southern half of Rokkomichi was almost entirely destroyed,

the north suffered extensive damage, and Shin-Nagata suffered similar damage (Figure 3).

A similarity to redevelopment projects and land swaps in “normal” times. The reconstruction of the southern area involved its wholesale transformation, from an area of dense streets with low-rise houses to one with large open areas and high-rise housing. The area had a relatively valuable location, and so it was believed that the rehousing of existing residents, as well as small business owners, could be funded by building and selling new apartments and commercial facilities in the high-rise buildings. Existing residents would be compensated for giving up their prior land with apartments in the new development, by fair exchanging. The scheme then has a striking resemblance to forms of city center redevelopment that have grown in popularity in recent years, especially redevelopment projects that are funded through capturing future potential increases in property value.¹⁶ In such programs, areas where theoretical land values have risen significantly, but which have low-quality housing or few public goods such as roads and parks, are targeted for redevelopment. The underlying land is provided to real estate developers, using one of a variety of legal instruments, who then construct high-value residential or commercial space. The value generated and monetized by this development is used to provide new housing or facilities for the prior residents who are displaced. That is the theory. In practice, however, these abstract propositions run aground when encountering the realities of land markets and existing residents’ preferences.¹⁷ How Kobe managed to execute a complex program of this nature in under a decade, from initial concept through to completed buildings, may contain useful lessons, even in non-disaster contexts.

FIGURE 3: DAMAGE TO ROKKOMICHI



Source: Distribution Map of Buildings by Degree of Damage, The City Planning Institute of Japan and Architectural Institute of Japan

¹⁶ See, for example, (Huxley, 2009)

¹⁷ See for example, (Bezdek, 2009)

A first and top-down attempt runs into resistance.

The city's initial approach was to rapidly conceive a design for the reconstruction that embodied what it thought would be best for the community. The design had an enormous new park which becomes an evacuation and recovery base in case of disaster at its center, with all the building stock concentrated in six very tall buildings around the edge of the park (Figure 4). When presented to residents, however, this plan caused a sharp and severely negative response. Residents, who had been used to a rich communal life in their dense neighborhoods, thought the park far too large to encourage association and the tower blocks unsightly and likely to lead to anonymity. The residents themselves then self-organized and made a counter-proposal that involved much smaller and more walkable areas. At this point, an inexperienced reaction could have been to become defensive, or engage in formulaic consultation while insisting on the original plan. A common result of that approach elsewhere is a spiral of confrontation and delay. Officials in Kobe, however, took a very different approach.

Establishment of “Community Development Conferences”. Drawing on their accumulated experience in citizen negotiations, Kobe's officials believed that overly prioritizing consensus building in community development might cause initial delays, but would be more efficient and effective in the long run. They therefore divided the area into four large blocks, and initiated in each a “Community Development Conference”.¹⁸ These Conferences were organized to consider

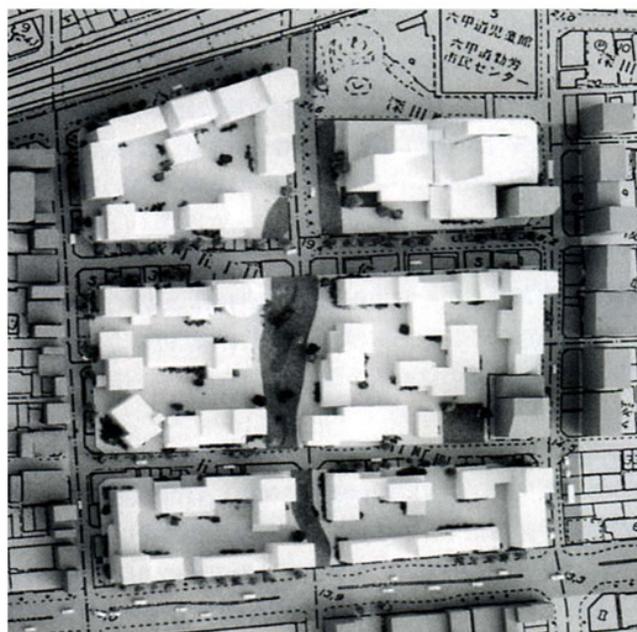
the varying plans and their rationale, to gather additional resident inputs, build consensus and jointly modify the plans until a common and accepted blueprint was developed. The Conferences developed general meetings and officers' meetings to structure deliberations and decision making. Importantly, the officials did not merely set up these structures and then assume they would work on their own, disappearing except to return once a quarter and bemoan a lack of progress. Rather, they saw facilitating the Conferences as one of if not their primary tasks, and hence engaged in a grueling schedule of repeated engagement and discussion—by one officials' estimate, they met “hundreds” of times over 18-24 months. The process resulted in substantive modifications to the original plans from both sides, though one slightly closer to the city's original vision than the residents', since the city persuaded them of the need for a large open space in case of future disaster. The residents then acceded to the concept of a central space surrounded by buildings, while the city significantly reduced the size of that space and the height of the buildings, producing a more in-filled and close-knit design (Figure 5). As well as coming to agreement on the plans, the Bureau used the conferences to deliberate on and put in place the specific transfer agreements and pricing mechanism necessary for implementation. Once all four blocks had signed off on the revised plans in early 1997, reconstruction proceeded rapidly, marked by an absence of disputes that often characterize these projects. The building work was then completed by September 2005.

FIGURE 4: ORIGINAL CITY AND RESIDENT PROPOSALS FOR RECONSTRUCTION

City proposal



Counterplan by volunteer residents



Source: Comprehensive Strategy for Recovery from the Great Hanshin-Awaji Earthquake, City of Kobe

¹⁸ These were enabled by a ‘community development ordinance’ (Machizukuri Jyourei).

An emphasis on preserving choice and flexibility.

Throughout the process, existing residents were provided with extensive choices in their involvement in reconstruction programs. . For example, in the conversion of their preexisting land rights to ownership of floors in the new buildings, they were not forced to accept a specific type or size of apartment. Instead, the value of their prior land was converted into a certain proportion of new building floors, which they could then choose how they converted into a mix of apartment and cash. For example, if their prior land entitled them to X square meters, they could select an apartment larger than X, and pay in a specified amount to make up the difference, or choose one smaller and receive a cash amount in return. They could also, if they chose, take the full value as cash and move somewhere else. Such allowance for individual choice reduced the possible sources of conflict between individual land holders and the city. The emphasis on choice was also applied more generally, with step in the reconstruction characterized by an interplay between the city setting framework parameters and then community structures selecting within them. For example, the city set aside space in each of the four blocks for common service areas, and then referred the decision of what to do with the space to the Community Development Conferences. The city also proactively assisted the community to attract tenants for those services, such as a supermarket in one block, a health club in another, and so forth.

An emphasis on relocation in place. Another source of potential conflict was removed by stipulating that none of the residents would be relocated or displaced outside the original area, unless they wanted to leave (as in principle 1 above). Even during construction of the new buildings, the temporary shelters were built in parks or other areas close to where the residents originally resided. This dramatically alleviated some of the chained social impacts brought by displaced residents, whether ensuring their children go to the same schools before the quake or preserving social capital in a connected community.

Three necessary ingredients: prior expertise, public funds, and enabling legislation. These principles are easier stated than implemented. What made them feasible in Kobe were:

1. The expertise in negotiation and consultation that had been built up in the municipal bureaus over the prior forty years. Such expertise must be built slowly and steadily, and is often only refined through frequent application at the local level.
2. The ability to use public funds to absorb externalities. The preservation of individual choice and the emphasis on relocation-in-place were and still would be costly. Even after selling the new apartments at market prices, the overall reconstruction netted a loss of approximately JPY 1 billion (roughly USD 10 million). This is a modest amount, but the project required large amounts of capital

FIGURE 5: FINAL DESIGN FOR ROKKOMICHI SOUTH



Source: Comprehensive Strategy for Recovery from the Great Hanshin-Awaji Earthquake, City of Kobe

to be tied up for many years—any commercial rate of return would have required vastly more than a nominal break-even. So it required not only the public sector's ability to absorb this small loss, but it's ability to absorb the cost of capital over those years.

3. The prior legislation, from that on urban development to disaster recovery. As described above, when the disaster struck the city could draw on legislation on urban development and disaster recovery that already existed. Moreover, on issues such as hold outs, resettlement and asset disposal or procurement, that legislation was more permissive than may be the case in many countries or “best practice” frameworks today. For example, rules on the buying and selling of land were relatively permissive, with cities able to choose among multiple methods, including auction and/or fixed price sales at a level set by licensed experts.

Scope of replicability and selection criteria, including for private sector projects. These criteria are unlikely to be present in many contexts. They will likely be absent from the private sector, most obviously because of the need to fund externalities. Yet it also suggests a selection criteria, where the private sector is involved—that it have many decades of experience in complex negotiations with many small-holders, this being more important than experience in large-scale greenfield or single-site brownfield development. Even with such expertise, the funding remains necessary, and abstract models that depend for their financial logic on the avoidance of relocation-in-place or resident choice are, even leaving aside normative considerations, likely to simply exchange a public funding constraint for a reality constraint deriving from inevitable conflict.

The hazards of trying to move too quickly—the reconstruction of Shin Nagata. As noted above, there was one other area in Kobe that needed full reconstruction. Shin Nagata was a somewhat larger area, with a slightly less favorable location than Rokkomichi (Table 2). The reconstruction project there was more rushed than at Rokkomichi, however. This was reportedly caused by the presence of many small business owners that wanted to be able to operate again as soon as possible. As a result, the careful deliberative processes undertaken in Rokkomichi were sidestepped. Although its reconstruction has been complete, it is sometimes described as ‘struggling’ in contrast to Rokkomichi.¹⁹ It may, then, be a case of short-term haste jeopardizing long-term progress, or of yielding too quickly to the demands of one interest. The balance between fast and slow, and between deliberating and yielding, is then not infallibly struck, even by the same

Table 2: Progress of redevelopment projects

| Redevelopment Project | Area | Date of urban planning decision | Decided operation plan | Area completed |
|---------------------------|--------|---------------------------------|-----------------------------------------|-----------------------------------------------------|
| Rokkomichi Station South | 5.9ha | March 17, 1995 | 10 work zones 14 buildings 5.9 ha | 10 work zones 14 buildings (915 households) |
| Shin Nagata Station South | 20.1ha | March 17, 1995 | 41 work zones 44 building 19.8 ha | 33 work zones 37 buildings (2,585 households) |

Source: Progress and efforts for post-earthquake reconstruction in the past 20 years, City of Kobe

administration. Striking that balance cannot be taken for granted, even when the conditions described above—or their near approximation—are present.

From creativity to austerity, and the “80% recovery”

~\$10 billion in new bonds resulted in a highly-indebted city. To finance recovery and reconstruction, Kobe issued almost JPY 1 trillion in municipal bonds in the 20 years starting in 1995 for the general account.²⁰ That represented roughly a half of the total JPY 2.2 trillion in reconstruction costs, the remainder coming from a mix of national treasury, the prefecture, drawing down prior surplus funds, and municipal tax income. The debt issuance brought total city bonds outstanding to JPY 1.8 trillion (~USD 18 billion) in 1997, against JPY 250 billion (USD 2.5 billion) in municipal income tax post-quake (down from JPY 295 billion in 1993). By 2000, on almost any measure the city was deeply indebted and debt service costs were 18% of the city's budget.²¹

“Wringing a dry towel for its last drops”: fiscal retrenchment. From 2000 onwards—and for some bureaus well before it—the city cut costs aggressively. It eliminated all new projects that were not related to the recovery & reconstruction. It imposed a strict mandate on all departments to reduce expenses wherever possible. It reduced city headcount by 300-600 officials per year, every year, so that the total number fell from ~22k in 1995 to ~18.5k in 2005 and 16k in 2010, primarily through natural attrition, but also some investment in IT systems and process improvement. The city's fiscal deficit swung from ~JPY 120 billion in 1995 to JPY 30 billion in 2000 and effectively zero in 2011. Large parts of this adjustment impacted domestic demand directly, not only since much reconstruction work involved direct purchases of local goods and services, but also indirectly, for example as reduced numbers of public officials spent less locally.

¹⁹ (Okuyama, The Rise and Fall of the Kobe Economy from the 1995 Earthquake, 2015) p. 638-9

²⁰ These and subsequent figures from “Han-shin Awaji Great Earthquake and Finance of Kobe City”, April 28, 2017

²¹ Debt service cost (including interests and repayment) were JPY 154.0 billion, out of a total expenditure of JPY 876.9 billion.

Deficient demand followed, significantly crimping the recovery. From 2000 onwards, Kobe's economy entered a period of deficient demand. Although the national economy was struggling with deflation at the time, it was particularly severe in Kobe—technical work indicates that local price inflation, which had tracked national levels prior to the quake, had tracked lower than the national average by 2001 and remained so until 2003. While it would be a stretch to claim that the retrenchment undid recovery, it has been identified as a likely candidate for Kobe never recovering to its pre-quake trend, or indeed to other, comparable cities. Low demand in the early 2000s is also a likely candidate for the city's demographic skew, as the young and particularly graduates left the city for job prospects elsewhere.²² More qualitatively, but perhaps as damaging, while a demographic crisis came ever close, while the global and national economy changed, the city had no fiscal capacity to respond, and at worst had its energy distracted by managing the process and consequences of retrenchment. This period has only recently come to an end, as the large bonds for recovery have been repaid and the city's debt to revenue ratios have recovered to be close to the median among Japanese cities.²³

The “80% recovery”. Among observers in Kobe, the common phrase to describe the economy after the quake is the “80% recovery”—the economy is mostly whole, but not quite as it was. Perhaps the most lasting consequence of is Kobe's skewed demographic profile today. As one proxy for dependence, 25% of households in Kobe do not receive a wage or salary, compared to 18-19% in Tokyo and Yokohama.²⁴ Further, there is evidence that the proportion of people over 65 has increased more in Kobe since the quake than in other cities, even those neighboring it.²⁵ It would be inaccurate to characterize a “good” period (1995-2000) of rapid recovery and then a “bad” period (2000-2005) of retrenchment, since the periods are interrelated. The swiftness of the first period of recovery may not have been possible without so swift and significant a buildup of debt to make later retrenchment necessary. Nevertheless, by 2005 it appears as if an output gap of 19-28% against Kobe's pre-trend growth had become entrenched, and would persist until today.²⁶ If anything, the result demonstrates how a coherent and large-scale process of restructuring can become severely limited if the macroeconomic context of a city becomes a severe headwind.

Possible counterfactuals in pace, prior debt, and value capture. Abstract “what ifs” a few decades later are tempting but suspect. Nevertheless, it might be asked if the sheer pace of debt issuance and spending was necessary—as described in several sections above, some of the programs that evolved over years were more effective than those

executed in a rush. While services had to be restored, and immediate recovery conducted quickly, the “life support” and “immediate recovery” categories of spending were only a third of total spending—two thirds was “reconstruction”. Such spending may have been smoothed over a few more years, reducing the sharpness of fiscal retrenchment. A second question mark must be the debt overhang entering the quake. As noted above, it was incurred in the boom years, for the second phase of the new port island, a troubled and perhaps questionable project. So that debt was perhaps the weakest element of pre-quake readiness. Finally, the city may have been able to recover some more of the value created in the reconstruction and land adjustment. Rokkomichi South ended with the city almost at breakeven because of such value capture, through the sale of apartments, but it is not clear how other projects performed. Interviews suggest that where post-quake readjustment significantly increased land values, much of the value may have gone to private landowners.²⁷

An achievement nonetheless. After destruction of such magnitude, “80% reconstruction” within a decade, and only a minor long-term impairment in trend growth, is not to be sniffed at.²⁸ The city did refresh at least one part of its economic structure, becoming massively less dependent on the footwear industry (as described above).²⁹ Once the older firms began to drop off, the city's industrial sector did become far more productive (at least in terms of labour productivity). And in at least one area, “creative reconstruction” does seem to have succeeded, in one of the most difficult of tasks. That was the creation of a new cluster at a global technology frontier, the Kobe Biomedical Innovation Cluster [KIBC].

²⁷ The city captured value from the apartments that it owned or took ownership of as the excess units built, but did not, to our knowledge, have policy instruments to obtain a share of the increase in private land, except to some extent through property taxes. Source: Interviews with former officials, Kobe City.

²⁸ As a comparison, after the 2011 New Zealand Christchurch earthquake, its city council published growth projections for the next 30 years, comparing Christchurch's growth with pre-quake projections. Even under “quick recovery scenario”, it was estimated that Christchurch can only attain 76% of pre-quake projected growth in the next 10 years. This number dropped down to 58% and 40% under moderate to slow recovery scenarios. All these highlight the difficulty of economy returning to its projected growth path post disasters. Source: <http://resources.ccc.govt.nz/files/homeliving/goaheadbuildingplannings00/feesandcharges-s08/dcpgrowthmodel-summaryofpostearthquakegrowthprojections.pdf>

²⁹ See also (Edgington, 2011) and (City of Kobe, 2012).

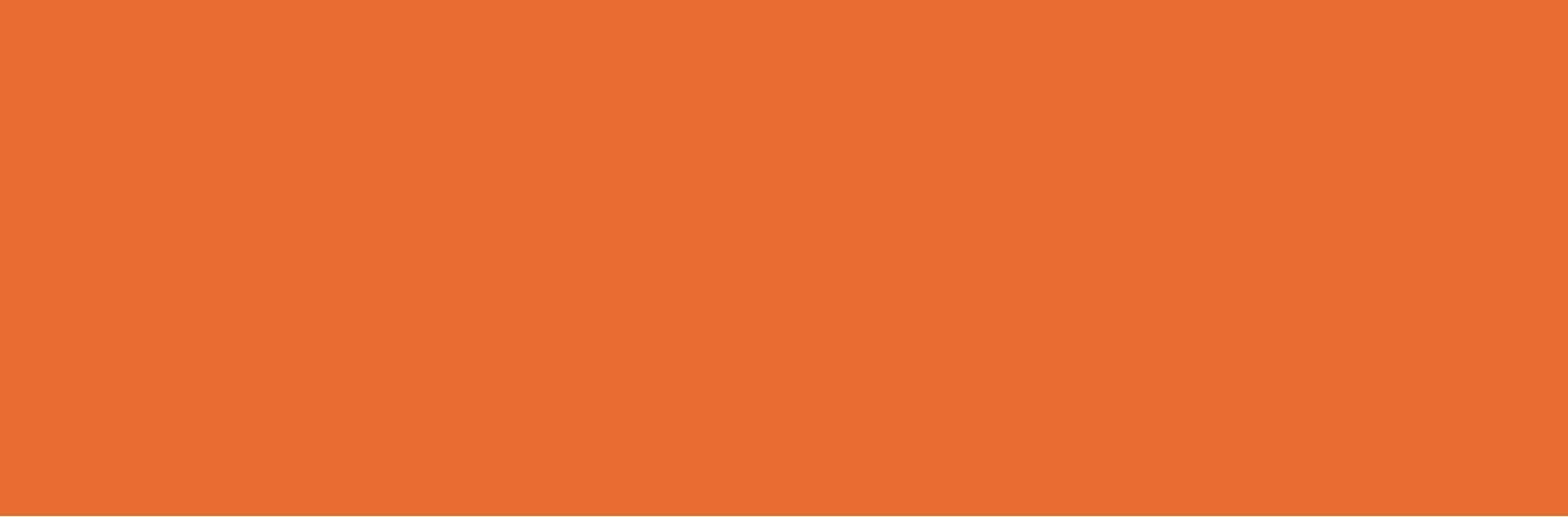
²² (Okuyama, *The Rise and Fall of the Kobe Economy from the 1995 Earthquake*, 2015)

²³ Technically, the median among “ordinance-designated Japanese cities”.

²⁴ Employment Status Survey, October 2012

²⁵ (Okuyama, 2016)

²⁶ (Okuyama, 2016)



CLUSTER: 1995-

Multiple processes converge

A new, but on most evidence, a thriving cluster. Located on Port Island, Kobe Biomedical Innovation Cluster (KBIC) was one of the “creative reconstruction” projects proposed by Kobe city government after the 1995 earthquake. At a total project cost of 420 billion Yen (~3.8 billion USD at 1995 exchange rate), including national and prefectural funds, Kobe city played a major role in putting together all the necessary infrastructure to build up the island, as well as establishing a biomedical cluster department within the city government to promote and attract firms, research institutes, and hospitals to locate to this island. Within twenty years of development, KBIC today is a large and thriving biomedical cluster, with 344 companies and organizations (as of September 2017). It has been designated as a “National Strategic Specialty zone” with researchers and doctors conducting cutting-edge biomedical research and surgery procedures here.

Some local activity prior to 1995, but real strength in the region. Kobe had only a small life sciences industry prior to the earthquake. Sysmex, a firm specializing in instruments and reagents for in vitro diagnosis, had been established in 1968, was a world leader in hematology and reagents, and had been growing rapidly. In pharmaceuticals, Eli Lilly had chosen Kobe as its Japan headquarters in 1975. It had a manufacturing facility in the Seishen area and an office for managing clinical trials, which had slightly expanded in the wake of Japan joining the international regulatory regime for global trials. However, these were the only firms of note, and there were few to no local academic centers or research institutes in the sector. On the other hand, the broader Kansai region had and still has several world-class research universities and institutes in life sciences. This is particularly true of Kyoto, where the University of Kyoto is a global leader, and Osaka, which by some estimates is home to 30% of Japan’s pharmaceutical industry.³⁰

Figure 6: AERIAL VIEW OF THE KOBE CLUSTER



Source: Provided by the City of Kobe

³⁰ (Schlunze, 2007)

Some discussions just after the quake, drawing on multiple sources. Some of the city's policy documents had mentioned health-related industries as early as 1993.³¹ However, serious discussion began in autumn 1997, when a few ruling party members proposed a project to attract the medical industry. The city had previously heard about a medical cluster plan in Hokkaido Prefecture, the 'HIMEX' plan, which was abandoned in 1998. At the same time, in the early 1990s the national government had identified the life sciences as a potential industry of the future,³² and was encouraging local governments to develop it. In April 1998, the City assigned an official to be in charge of coordinating partners for the project. The city councilors' initial idea for the cluster was focused on attracting multi-national companies, particularly US medical technologies firms. As a result, it was called a "Kobe Medical Industry Development Project", and the city started visiting US firms and trying to attract them.³³

Convergence of research, application and manufacturing. In the early 1990s, it was believed that Japan's strengths in basic research in medicine, clinical application and pharmaceutical manufacturing were not complementing each other as they should, because there was no effective bridge between the two. Basic research remained in the universities, while industry concentrated on incremental innovation. An opportunity emerged in the intersection of the national government's desire to support Kobe, the city's goal of "creative reconstruction", and pre-existing plans to develop a biomedical cluster somewhere in Japan.

Selection was not deeply analytical, but the result of multiple capabilities intersecting. In late 1998, the city announced that an unused part of the New Port Island would be designated for a medical cluster. Officials outside the main departments involved considered it a surprise, and the area in question had, prior to the quake, been designated for attracting a theme park. The city's decision at the time was focused on medical activities, and in general the city argues that its planning for large MNC attraction was the motive force. On the other hand, the subsequent development was less typical

³¹ (Okuyama, *The Rise and Fall of the Kobe Economy from the 1995 Earthquake*, 2015), p. 638

³² Kobe disputes that the National Government ever prioritized the life sciences, prior to the city's plan. However, from 1990-1996, government spending on the life sciences increased by almost 10% per year, each year, even as the national economy entered recession. As early as 1987, Prime Minister Nakasone initiated the Human Frontier Science Program, to fund both local and international teams doing basic research in the life sciences. Finally, the "Basic Plan for Science and Technology", introduced in 1996, reallocated significant research funding from energy to the life sciences. The national priority on life sciences in the 1990s is indisputable.

³³ "Hanshin-Awaji Daishinsai 10 Nen Tobe Phenix" [10 years after the Great Hanshin-Awaji Earthquake, Fly Phenix]. Published by The Great Hanshin-Awaji Earthquake Memorial Research Institute, January 2005.

of other cities, and contains more useful lessons, than such a standard plan would have been. What is clear is that the selection resulted from the combination of several institutional drivers, emergent needs, capabilities, and opportunity:

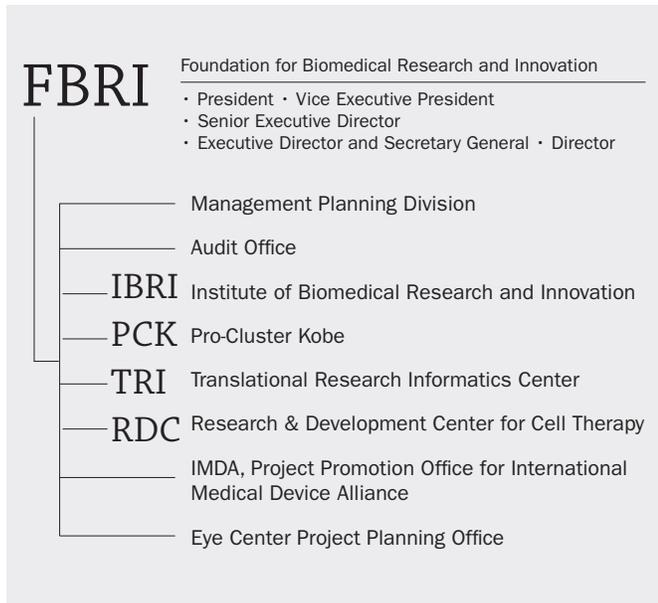
1. The research networks in the Kansai area.
2. Municipal and institutional leadership in pursuing a unique opportunity in an emergent area.
3. The city's availability of land and pursuit of "creative reconstruction", and
4. The national government's desire to help Kobe and to grow the life sciences industry

Institutional foundations and anchor tenants

The establishment of strong institutional foundations as the first step. The city's first step was to create a public-private-academia council, chaired by Dr Imura, to set the basic parameters and institutional form of the cluster. That became an enduring "triple helix" organization, the Foundation for Biomedical Research and Innovation (FBRI), with Dr Imura as its first president. The concept of the cluster, and the mission of the FBRI, had three parts: to revitalize Kobe's economy, provide health care for the local community, and support the development of medical technology in Asia. That focuses on three areas, decided by its round-table gathering: support clinical trials of pharmaceuticals; promote research on regenerative medicine; and conduct and support research on medical technology.

A range of complementary institutions and divisions. The FBRI has evolved to include a set of child or affiliated organizations (Figure 7). The Institute of Biomedical Research and Innovation (IBRI) facilitates (or conducts) clinical research. The "Translational Research Informatic Centre", which has supported almost two hundred clinical trials and maintains various information portals to disseminate research information. Other divisions attract companies to the cluster, host networking events and provide consulting on commercialization, among other activities. The Foundation admits, however, to still evolving its approach to intellectual property (IP), given the natural tensions in managing and sharing sensitive research results among companies in an industry where value creation is heavily tied to IP. It does not have any IP lawyers on standby, although it has relationships with some who are external. Among the various divisions and affiliate organization, the staff have a mix of research, commercial and official backgrounds. Building on the success of the FBRI, it is highly conceivable that further investments into patent process streamlining and the expansion of intellectual property related partnerships will continue.

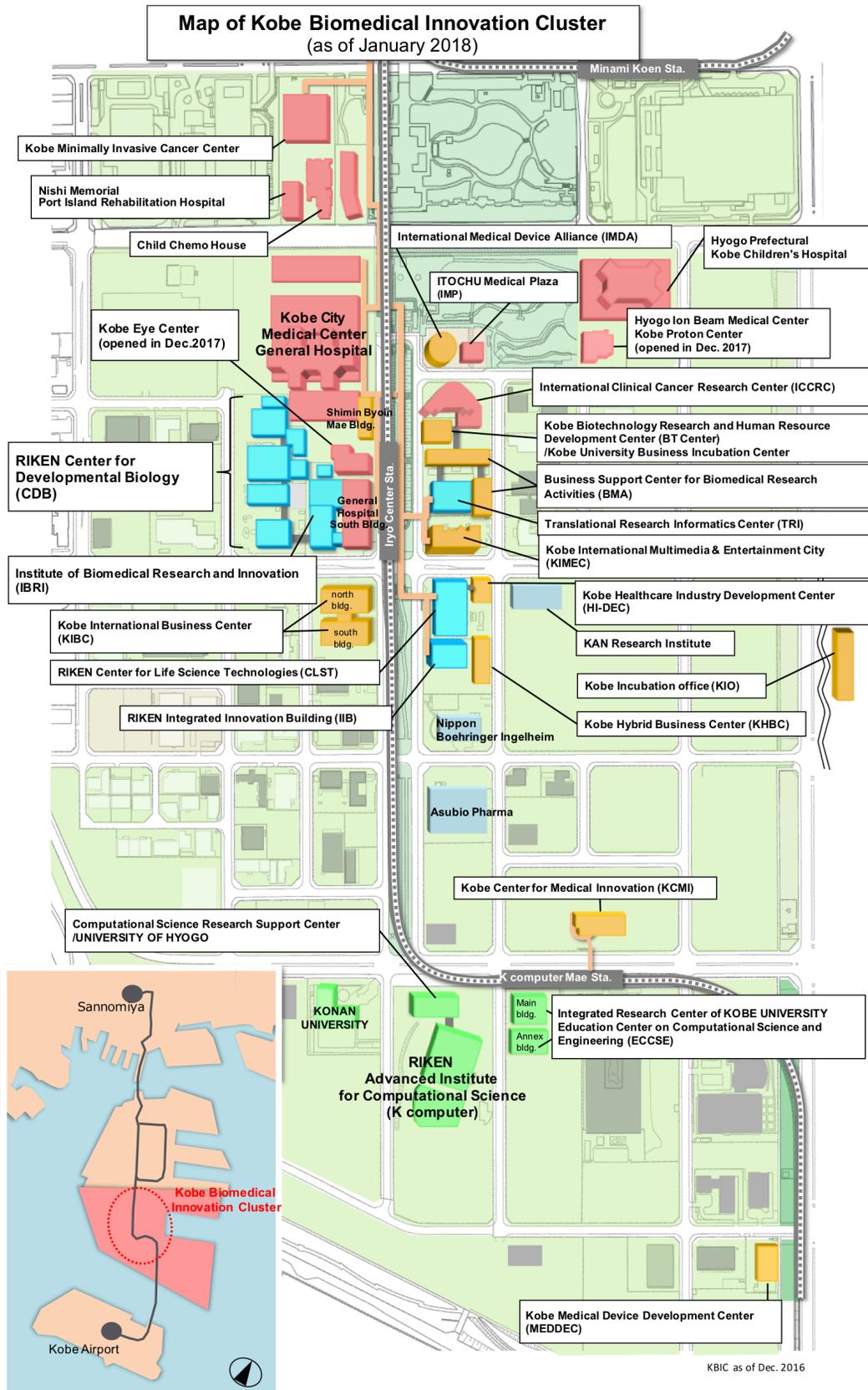
Figure 7: INSTITUTIONAL COMPONENTS OF CLUSTER FOUNDATION



Source: FBRI brochure

The early, organic attraction of a world-leading research center. Perhaps the most crucial event in the cluster's early development was the decision in 2000 by RIKEN, Japan's leading basic research institute, to establish a Centre of Developmental Biology (CDB) in the cluster. The institute and the city seem to have been approaching each other in parallel, with the reputation and networks of Dr Imura and other prominent actors being important. RIKEN's initial impetus to create the CDB derived from the national government's "Millennium Project", launched in early 1999. The city desired the CDB to be located in the city as its basic principles match the cluster. RIKEN was also convinced that placing the CDB in Kobe would enable its research to be commercialized more quickly than elsewhere.

Figure 8: Map of Kobe Biomedical Innovation Cluster



Source: KBIC

Building complementary institutions around the anchor.

At almost the same time when the decision on the CDB's location was made, the City decided to establish the Institute of Biomedical Research and Innovation (IBRI), which began building in 2000 and fully opened in April 2003. The CDB's research campus and the IBRI were then located in proximity to each other, enabling research and clinical trials to take place in rapid succession and frequent interaction. Both opened in the period 2002-3. Thereafter, a new RIKEN research unit was established in the city every few years, such as the Advanced Institute for Computational Science (AICS) in 2007, and the Quantitative Biology Center (QBiC) in 2011. Then in late 2011, the city moved a general hospital, the Kobe City Medical Center General Hospital, in the cluster. Other hospitals were also set up, such as the Kobe Minimally Invasive Cancer Center, Child Chemo House, and Hyogo Prefectural Kobe Children's Hospital. This interplay of advanced research institutes and medical facilities was complemented by a growing number of private companies, from less than 20 in 2001 to over 200 by 2010 and over 300 by 2016. These components of the innovation system remain tightly located, most along a central axis that runs from RIKEN facilities in the south to Kobe Minimally Invasive Cancer Center.

Careful, thorough embedding in local and regional research networks.

Today, the cluster is embedded in regional research networks. In terms of personnel, as one example, the heads of the Riken centers are also professors at Osaka. The most prominent research breakthrough from the cluster, the use of induced pluripotent stem (iPS) cells for regenerative retinal treatment. This research has the potential to make a significant impact on vision loss among the elderly, and has been led by Dr Masayo Takahashi at the CDB. The latest phases of the research have been conducted as a joint effort with the University of Kyoto's Center for iPS Cell Research and Application (CiRA), the CDB, the Kobe City Medical Center, and Osaka University Hospital. Such research links extend into private companies—for example, Eli Lilly's R&D department in Kobe keeps abreast of results in the cluster and, where relevant, discusses them with the company's global R&D network. A regular rhythm of seminars, "open days", networking events and matchmaking services are offered by institutes and companies themselves, as well as facilitated by the arms of the FBRI. This density of links was important in the city's successful bid to host the "K" supercomputer, Japan's most powerful and one of the top ten in the world. The supercomputer, hosted in the AICS in the cluster, serves the complex quantitative biological modeling conducted by companies there, but has found wider application as well. For example, it is used by the ASICS Sports Science center to conduct rapid modelling of complex new chemical compounds. The ability of the supercomputer to find uses among a wide variety of researchers and companies, through the networks built by the cluster and the city more broadly, was one of the primary factors that led the national "location selection" committee to choose Kobe.

Companies have crowded in, but two big questions remain

A strictly enforced, narrowly targeted subsidy program with a strict sunset clause.

The primary instrument for company attraction has been a rent subsidy. Companies that move into the cluster can rent lab space and other facilities at deeply discounted rates of 50% reduction of rent for the first three years. The discount applies for 3 years, after which full market rates apply. By subsidizing access to lab facilities, this instrument reduces the risk of moving into the cluster for biomedical companies. To some extent, this reduces the risk of free-riding or capture by companies that would have operated anyway, or having more interest in subsidies than research (a common risk with subsidy programs). Over fifteen years it has attracted over 500 companies, of which 344 companies and organizations (as of September 2017), continue to operate, attrition has shown the cluster's discipline in fact as well as in theory. While some of those that left did so for other business reasons, some could not survive after the subsidy expired. That might help mitigate the common risk of cluster programs propping up weak companies. Companies are physically located in a dense strip along the main axis of the cluster, and cover a wide range of subsectors.

High-end jobs, if low in total number, and wide spill-over effects.

One critique of the cluster may be the relatively low number of direct jobs it has created. Even now, this remains at the relatively small number of 8,000 people (~10,000 people if including biomedical firms located in Seishen). That is only a fraction of Kobe's total workforce, and a small amount compared to the top clusters in the US. On the other hand, the jobs are in high-wage sectors, which makes it possible that they have significant multipliers through local consumption and other indirect effects. The cluster has also outperformed the one in Singapore, a city of roughly six times the population and with all the levers of a nation state available to it. The FBRI itself claims that its total economic value is JPY 161.5 billion (USD ~1.6 billion). If anything, given the momentum in the cluster's growth, the wide gap to clusters in the US might be taken as an indication of potential, and a motivation for sustained city priority.

Cost and returns, to city and nationally.

The total public cost of the cluster is estimated at JP 420 billion (USD ~ 4-5 billion), which works out to approximately JPY 52 million (~USD 520k) per job. Again, that may seem somewhat high, though this should be seen from the perspective of other likely uses of such money at the time. Japan in the last few decades has repeatedly conducted large infrastructure builds with questionable, if much, long-term economic returns.³⁴ The city itself bore only JPY 70 billion of expenditure, and there is little evidence that the national share of costs crowded out other national funding. At a direct cost to the city of

³⁴ Reviews of spending in the 1990s showed that national investment in infrastructure had positive but limited and declining effects, and were less effective than local social spending. (Bruckner & Tuladhar, 2010)

JPY 9 million (~USD 90k) per job, the returns do not seem paltry. Last, the full long-term benefits of the cluster, including with other parts of the city economy, are still developing. In addition to the examples of ASICS and Eli Lilly described above, Sysmex and Kawasaki Heavy Industries have recently formed a joint venture to pursue surgical robotics. Both companies long predate the cluster, but in interviews both reported that they would have been unlikely to pursue the JV had it not been for the development in the city of so strong a concentration of knowledge.

Table 3

| Location of the Bio-pharma clusters | Estimated number of direct job creation in 2015 |
|-------------------------------------|-------------------------------------------------|
| Boston-Cambridge | 54,000 -57,000 |
| San Francisco Bay Area | 50,000 |
| New York/New Jersey | 77,000 |
| San Diego | 46,000 |
| Maryland/DC Metro Area | 36,000 |
| Singapore | 6,000-7,000 |

Source: GEN; Department of Statistics, Singapore³⁵

Promising research, many small companies—but few promising start-ups. A final point is that the biomedical industry is prone to a “superstar economy” type structure. While large numbers of firms may achieve partial success or fail, firms that achieve a decisive breakthrough in treating a widespread condition can achieve extraordinary growth. It would require only one such firm in the Kobe cluster for evaluations of it to change dramatically, both in economic returns and social benefit, and there is good cause to believe that this is not impossible. It is, at the least, possible to identify plausible candidates for such breakthroughs, most notably the iPS cell technique currently going through safety trials. But there is one striking lack in the cluster, and this points to a weakness in Kobe more generally—an absence of significant density of startups. There is great opportunity for the cluster to stimulate the startup ecosystem within Kobe building on its success with large and medium sized enterprises but many challenges exist. Almost all interview subjects mentioned high barriers in the “risk aversion” and “cultural attitudes” among young researchers. It does not appear as if these barriers have been the subject of a concerted or large-scale and aggressive public program. For example, available funding and the deep links to academia have not been used to construct a program that would offer the best young researchers both the capital and career security (through guaranteed reabsorption) that might, for some of them, overcome or mitigate risk aversion. Such programs have existed elsewhere—as in Changsha, China, which with a much more limited endowment has attracted world-leading researchers (from diaspora networks) to create startups in the city. While such programs involve risk, and will undoubtedly require patience over many years, it seems unlikely that the capabilities assembled in the cluster will truly play a role in transforming the city without some similarly bold effort. These challenges are in no way unique to Kobe, or even Japan for that matter, bold action to overcome these challenges may see great return for the cluster, city and country.

³⁵ Source: GEN (Generic Engineering & Biotechnology News), job figures estimated by JLL and crossed checked by GEN using workforce figures: <http://www.genengnews.com/the-lists/top-10-us-biopharma-clusters/77900393>; Department of Statistics, Singapore: <http://www.tablebuilder.singstat.gov.sg/publicfacing/createDataTable.action?refId=1754>

RISKS, DEFINITE AND UNCERTAIN: 2017-

A demographic crisis

An aging demographic across Japan. Against this background of impressive and enduring capabilities must be set the steeping and rising challenge of the city's demographics. All Japan is facing a crisis of aging, and Kobe is not an exception. It has fairly high number of households without a wage or salary, and its elderly population has increased disproportionately since the quake. Over the next ten years, those over 65 will grow to 30% of the population, and then reach a full third in 2030.³⁶ It is therefore a persistent and daunting challenge of Japanese cities to remain competitive while ensuring significant tax revenues necessary to meet the welfare and other social service cost of an aging population.³⁷

The continued quest for high quality jobs. Underneath the headline data the employment scenario is somewhat mixed. In common with the rest of Japan, many of the jobs being created are not permanent, especially for lower value-added roles that do not require specialized technical skills and experience. Wages for such roles are relatively low in Japan, compared to some of the peers such as Germany, France, or the UK. In the Japanese economy overall, much of the increase in net jobs in the last 15 years has been in "non-regular", temporary contracts, through labor agents. The most recent national data has indicated there may finally be a shift underway to permanent jobs, with those making up over 60% of the jobs created in 2016.³⁸ The city also faces similar challenge although some data indicates Kobe's employment situation is improving. Over the past several years³⁹ the city's unemployment rate is much lower than its neighboring metropolitan city.⁴⁰ For young people who are not highly skilled (even if possessing undergraduate degrees),

temporary jobs may at least be an option, but are unlikely to be desirable—it has been reported that they may then leave to seek employment in Osaka or Tokyo, where stable and diverse jobs may be considered more plentiful. Kobe city is geared toward attractive and creative employment opportunities in order to make sure to capture young citizen to the city.

The allure of Tokyo for marketing and management.

Finally, some of the same companies that report a relative ease in attracting technical and research staff to Kobe report some difficulties in attracting marketing and management staff away from Tokyo. The capital is often considered to have greater opportunities for advancement in those fields, particularly given the concentration of financial services, consulting and other business services. On aggregate, the city has a net outflow of people in their 20s, amounting to just under a thousand per year. Many are young people who had studied in the city and are then moving elsewhere to work, but the city's inability to retain them may be worrying, particularly given its demographic profile. Similar to the discussion of firm capabilities and the absence of start-ups above, the city here appears to have enduring strengths—in developing, attracting and retaining high-skilled labor—but alongside weaknesses to be addressed—in retaining young people, those out of college, and those seeking permanent jobs or jobs in certain creative industries.⁴¹

Attracting youth is at the core of the city's "Vision 2020".

The city is aware of this, and attracting youth is at the core of the current mayor's vision for its future. It aims to do so by redeveloping the area around the central train station (Sannomiya), with the stated aim to develop it into a walkable cultural area (it already has a vibrant culinary sector and nightlife). It is said that a few other cities in the Kansai region have created similar areas in recent years, and many of the shops and buildings do not meet current regulations for seismic safety. The city can pursue the project because it has finally regained some fiscal capacity in the last few years, with the paying down of most of the earthquake-related debt.

The temptations of hard infrastructure, national projects and policy fads.

Faced with the looming demo-

³⁶ Population projection by region, National Institute of Population and Social Security Research

³⁷ Population projection by region, National Institute of Population and Social Security Research

³⁸ (Bloomberg, 2017)

³⁹ (Monthly report from the labor bureau of Hyogo prefecture, Kobe branch of Bank of Japan, 2017)

⁴⁰ (Labor survey by the Ministry of Internal Affairs and Communications, 2016)

⁴¹ (City of Kobe, 2015 [tbc])

graphic crisis, and the hard-won restoration of fiscal capacity, it is natural that the city will turn to urban construction and capital investment. The temptation to default to such hard infrastructure is certainly not unique to Kobe among Japanese cities, or even to Japanese cities among cities everywhere. Naturally, some hard infrastructure investment is doubtless necessary. But given the high quality of the existing building stock, the existing vibrancy of central Kobe, the attractiveness to high end young technical staff, and the contrasting absence of start-ups, an emphasis on aggressive human capital development and startup programs may be more central to meeting the city's future challenges. Another risk is to allow priorities to be set by whatever national programs are available, in place of deciding on strategic priorities and seeking to leverage national support (a common approach among Japanese cities). A third and final risk will be to focus less on its distinct comparative advantages in favor of more fashionable sectors. The city has deep strengths in biotech, medical devices, and apparel and design, and few in software development. The former call for very different models of start-up facilitation than the capital-lite model of Silicon Valley. If the city wishes to retain "500 startups", declaring that it is open to other sectors will be a useful start, but is unlikely to be enough—rather, it will have to modify the funding, content and processes of the program fundamentally.

A combination of enduring strengths

Attractive to high-skilled talent. Kobe has a remarkable set of strengths. It is home to companies with impressive capabilities, pursuing innovative, high-tech work in a broad range of sectors—from robotics to shoes, pharmaceuticals to haircare. ASICS, for example, is pursuing the equivalent of rapid iteration, agile development in a fiercely competitive and high technology industry—running shoes (in which Nike is the world's largest user of 3D printers, and ASICS itself at times employs the Spring-8 particle accelerator). Proctor & Gamble's Kobe R&D office led the development of SK-II, now one of the company's single best performing brands. Firms in the city are installing leading edge 8-axle robotic machinery and connecting them to the "industrial internet" to improve productivity through big data. Japan's economy has long been characterized by a deep bench of specialized, highly capable SMEs, and Kansai is particularly known for this. Some of these medium sized enterprises are now supplying both the type of robotics described above and the services that enable them.⁴² At the high end, there is little evidence of any difficulty in recruiting high skilled labor. None of the companies interviewed mentioned much if any friction attracting young engineers, technicians and researchers to Kobe. If anything, it was the reverse, with several mentioning Kobe as a strong attraction. "We say Kobe and the hands go up", one R&D head mentioned, described the reaction at recruiting events even in Tokyo itself.

⁴² Kyoto Seisakusho, which is said to have begun by manufacturing machines for packaging cigarettes.

Strong networks of companies at the frontier. These companies are also forming networks of collaboration at the technological frontier. Such collaborations are focused on two poles: the KBIC, but as if not larger, the Seishin area. The latter is built on the area of the mountain cut away to build the new port island, and is home to a concentration of large firms' R&D activity. It likely has more activity than in KBIC, though more focused on incremental within-company innovation and with a lesser observed density of collaboration. The companies that are present also lobby together, and it was repeatedly stated that the various chambers of commerce (local and foreign) wield strong influence. As noted in the introduction, in the past such strength may have restricted the city's development options, and it was reported that "vested interests" have remained prevalent and influential even in recent years. Overall, whether in such joint action, in cross-industry joint-ventures such as that of Kawasaki or Sysmex, or private-public-academia, as in ASICS' use of "K" and Spring-8, there appears to be little lack of social capital or the capacity for joint action necessary to combine existing firm-level or institution-level capabilities into network-level capabilities.

These capabilities are not in software start-ups, but hardware, biotech, consumer. The most glaring absence, however, is that of new firm creation. The absence of start-ups noted in the KBC is, if anything, much more severe in the rest of the city's economy. One large firm active in robotics reported not even worrying about its best researchers leaving to create new companies—the prospect seemed too remote. ASICS has recently created a fund to invest in startups active in sports-related technology, but the fund is looking in the US and Tokyo to source sufficient opportunities. The company is considering the establishment of an accelerator linked to the fund, but is more likely to place that accelerator in Tokyo. The city has undertaken some initiatives, such as a "500 startup" program that developed in Silicon Valley for incubating low-capital, short lead time software start-ups. The city's strength in industry meant that non-software companies applied to the program, with the question being whether a different type or model might be better suited to the city's strengths. The city also has put together a demonstration project in self-driving cars, another area with at best a thin relationship to the city's strengths. The city also attempted to put together a demonstration project in self-driving cars, another area with at best a thin relationship to the city's strengths.⁴³ In all, the city may find benefit in looking for sources of ideas not as much to Silicon Valley, and more to cities more like it in the combination of industrial, medical and consumer capabilities—cities like Boston, or Portland, or combinations thereof.

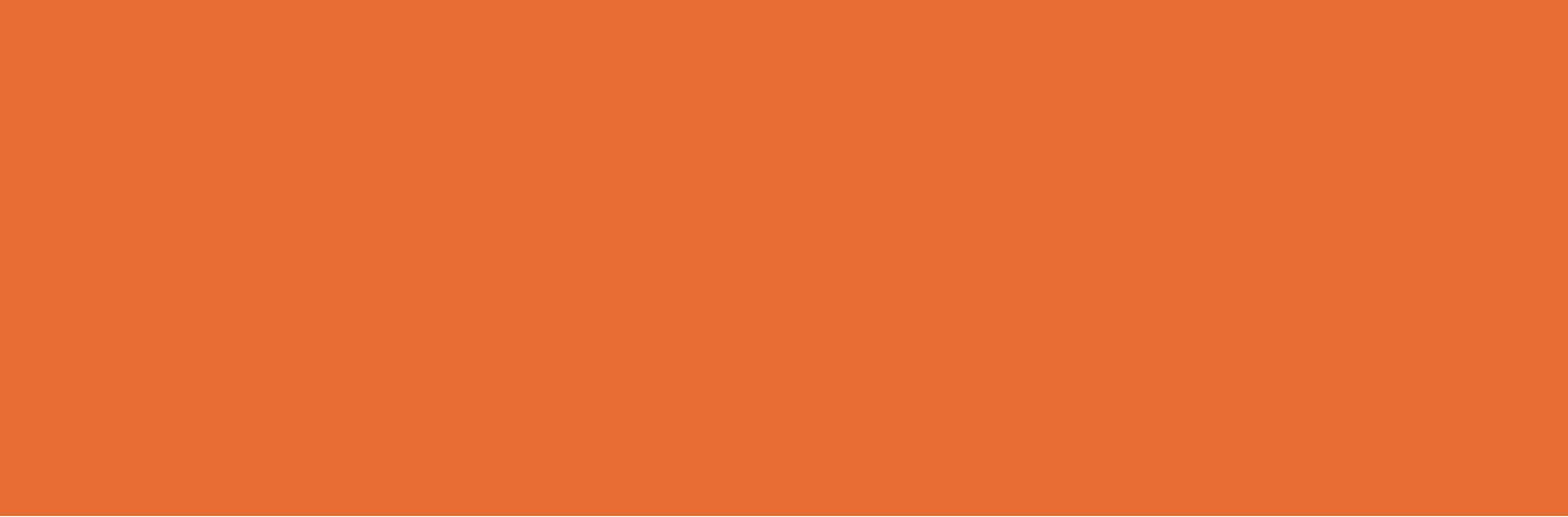
⁴³ The project did not get off the ground, but was attempted, according to interviews with officials.

A need for thorough experimentation, boldness and learning. It is always easier to say what should be avoided than should be done. The city is at the frontier, and has many strengths, but for those to be realized its innovation system must become much stronger, or those strengths may fade away. That will require aggressive and likely quite risky programs, focused on soft infrastructure, on two fronts:

- First, supporting the islands of high productivity that exist in the city's big companies and R&D centers to spawn significant, rapidly growing new companies, or to help scale up existing small companies. In doing so the city will need to approach risk-aversion among researchers not as a natural law, but as an acutely difficult problem to be solved through purposeful experimentation. As illustrative examples, the city might consider forming a partnership with regional universities to guarantee a researcher who leaves to pursue a start-up can return to their post, and provide once-off but significant upfront housing or other subsidies to the researcher and any initial employees. The city might also institute large, but again once-off, competitive cash grants to new start-ups (an approach found to be far more effective than consultant-heavy "technical assistance", even in developing countries).⁴⁴
- Second, supporting the spread of those islands of high productivity to encompass more of the workforce, particularly the young. While vocational training is under responsibility of Hyogo Prefecture and the National Government, Kobe City could complement their initiatives in the form of workforce development and training programs, particularly focused on women and youth. At present, the city has decided not to intervene in vocational labor programs except some training programs for SMC, as these are the responsibility of the National Ministry of Health, Labor and Welfare. The city also believes that there is little necessity to prepare vocational training with a focus on non-regular young employees, since the young can easily get jobs, and are not willing to obtain training (although young technical workers are earning wages below other developed countries' minimum wages in R&D centers in Seishin).

Becoming the place where it's easiest to fail. None of the above is a simple task, and to find answers to these challenges the city will need to systematically experiment and learn. It has the example of the KBIC, with its network of public-private-academic institutions and range of programs, including incipient ones in fostering start-ups. A return to being the "first in Japan to try new things", and to accept new challenges may provide the necessary catalyst for the next wave of Kobe growth. Kobe may have to become the first Japanese city to try something fundamentally new in the country: somewhere both the young and mid-career come to risk failing at.

⁴⁴ (McKenzie, 2015)



CONCLUSION

In its first century as an open port, from the late 1850s to the period after World War II, Kobe followed a clear substantive vision. It sought to be the city in Japan most open to the world, and most open to trying the new. From the 1960s onwards, it shifted to the vision of “Kobe, Inc.,” a city that constantly remade itself. After the earthquake, the city chose to pursue a vision of rapid and creative reconstruction.

Along the way the city recorded some notable successes. It shifted its economic structure into shipbuilding, then into machinery and advanced materials, then into consumer goods from footwear to agriculture, then into the life sciences. It built deep institutional expertise in one of the hardest tasks in urban management, the repurposing or upgrading of urban areas to unlock and capture implicit value. It deployed many of these strengths to make a rapid and substantial recovery from one of the most devastating natural disasters of the last century, without any demographic tailwind and in the face of a national economy caught in a “lost decade”. In at least one neighborhood, the city not only responded substantively to citizen concerns, but harnessed citizen engagement to execute a significant urban renewal program at a rapid pace, with minimal eventual costs, and with enduring value to all stakeholders. In one sector, life sciences, it has largely succeeded where many fail—the initiation of a frontier technology cluster—and has outperformed Singapore, six times its size and more feted.

There is much that developing world cities can learn from this experience. But there were also cautionary elements. In the decades after the 1960s the pursuit of self-remaking, and institutional self-confidence, seems to have become somewhat untethered from a sense of scale and proportion. A city that had carted mountains into the sea could simply keep doing

so, especially if the alternative was a difficult confrontation with entrenched interests. By the 1980s an already massive land reclamation project was almost doubled in scope, saddling the city with a huge debt that shadowed it into the 1990s and hobbled its recovery from the quake. While the very first months of the quake recovery had to be rapid—to restore some measure of normal life—and some aspects of the reconstruction proceeded deliberately, overall the reconstruction was to some extent rushed. That resulted in a steep demand fall off after 2000, and may have delayed industrial restructuring, a flood of capital buoying up poor firms as well as good ones. The austerity after 2000 then restricted the city’s freedom to experiment or devise new programs, even as a demographic crisis drew ever closer.

The city today retains strengths with which to combat that looming crisis. At present it is attempting multiple approaches to harness or complement those strengths. Some of its attempts are locally generated, a response to the problems it has identified. Others are generated more by a sense of what programs are available nationally, constructed by the national government’s sense of pressing problems. Still others are routine active labor market interventions, such as job fairs and demand-supply matching, or typical accelerator and incubator programs.

It may, though, still need to build processes or institutions to provide space for and learn from problem-driven iteration. The city has a quite remarkable set of capabilities, from design through robotics to biotechnology, and a reputation for a highly attractive lifestyle that attracts high-end technical talent. Through bold vision and being ambitious enough and inclusive enough in its vision for youth development and innovation, may then be the key challenges ahead of it.

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