

Building Holistic Resilience: Tokyo's 2050 Strategy

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Abstract: The paper examines Japan's capital city of Tokyo's "Zero Emission Tokyo Strategy." Our work shows that Tokyo's strategy is particularly important in light of the 2030 Agenda's emphasis on greenhouse-gas emissions reduction, equitable sustainability, and building holistic resilience against all hazards. The data indicate that Tokyo's ambitions are built on a track record of global leadership in resource efficient water systems, transit networks, and other critical infrastructure. Moreover, Tokyo is part of Japan's zero-emission communities, smart cities, all-hazard resilience, and other multilevel and silo-breaking collaborative platforms. Our analysis also makes recommendations for bolstering Tokyo's strategy, to enhance co-benefits from integrating climate change mitigation and adaptation, in addition to strengthening pandemic response.

Introduction

On December 27, 2019, Japan's capital city of Tokyo committed itself to a "Zero Emission Tokyo Strategy."¹ The strategy aims to achieve net zero greenhouse gas emissions by 2050. Like all other climate strategies, Tokyo's is a work in progress. It has yet to adequately detail co-benefits from integrating climate change mitigation and adaptation, notably in the area of human health. But Tokyo's example is important for a host of reasons. First, Tokyo is the world's largest megacity. What it does influences other Japanese municipalities and indeed other global cities. Second, Tokyo's

strategy is multi-sectoral and pragmatic, rather than overly reliant on idealistic energy visions. Third, Tokyo is investing heavily in the people and critical infrastructure essential to realizing its ambitions. Its increasingly aggressive and smart fiscal policy affords a benchmark for an age of economic and ecosystem disruption coupled with accelerating technological innovation. As many unprepared cities and nations are discovering, well-targeted preparatory investment is particularly essential in the face of COVID-19 and future pandemics. Fourth, Tokyo emphasizes integrated and inclusive governance, which enhances the prospects for implementation and continued policy evolution. Fifth, studying Tokyo's strategy opens windows on the platform collaborations that Japanese "silo-breakers"² have been building since 3-11, to maximize holistic resilience. In this paper, we review the evidence and make three key points. We argue that Tokyo's ambition is credible, in large part because it already deploys resilient and decarbonizing critical infrastructure networks that simultaneously mitigate and adapt to climate change, resource crises, and other challenges. We also argue that Tokyo's integrated and well-funded strategy offers a model, not just for melding the Paris Agreement, Sustainable Development Goals (SDGs), and the Sendai Framework for Disaster Risk Reduction, but also keeping them on track in the face of unprecedented uncertainty. And in our conclusions, we urge Tokyo to adopt several recommendations to bolster its strategy in light of emerging needs and opportunities.

Tokyo's 2050 strategy

Key to Tokyo’s zero emission strategy (hereafter “TMG 2050”) is integration. TMG 2050 builds on an institutional legacy of metropolitan governance and a multiplicity of past and present initiatives in energy, disaster risk reduction, waste, transport, and other areas. Tokyo Metropolitan Government’s (TMG) transport, sewerage, and other planning successes have made it one of the world’s most energy- and material-efficient city-regions. What is new is TMG 2050’s integration of climate mitigation and adaptation towards achieving zero emissions. TMG 2050 thus differs from previous sector-specific environmental initiatives. It puts cross-sectoral initiatives at the heart of comprehensive city planning by focusing planning, finance, and collaboration on zero emissions.

2050 target. The first sector is energy (electricity and heat), globally responsible for just under a third of greenhouse gas GHG emissions. Yet note that TMG 2050 does not rely on glib promises of achieving 100% renewable energy in power and heat in a decade or even by 2050. Such bold pledges are common, according to the American Council for an Energy-Efficient Economy, but generally not monitored for progress or actual GHG reductions.³ Incredibly, even Boston, the top-ranked US zero-emission city, does not have a “quantitative municipal energy goal.”⁴ And the city of Berlin, the heart of Germany’s “energy transition,” is ostensibly committed to 100% renewables by 2050, but is evidently doing little to get there. The most current data from the German Federal Renewable Energies Agency show that by 2016 Berlin had achieved only 4% renewables in primary energy (2.5% in gross electricity consumption), only a marginal increase from 3.7% in 2013. And Berlin’s per-capita CO2 (not GHG emissions in total) emissions had only declined from 5.3 tonnes in 2013 to 4.7 tonnes in 2016.⁵



Figure 1: TMG 2050 and Tokyo Metropolitan Government (Click to enlarge)

Figure 1 shows that TMG 2050 also melds the “hard” infrastructure of technology with the “soft” infrastructure of inclusive governance. The figure outlines the six main sectors involved in reducing emissions towards the

It therefore seems commendable that TMG 2050 does not rely on 100% renewables to achieve decarbonization commitments, but instead aims at achievable, cross-sectoral goals that link technology and inclusive governance. The figure shows that TMG 2050 positions renewable energy as a “major energy source” rather than the only source. In fact, the details of TMG’s energy planning show that reliance on renewable energy is to be roughly doubled, from 14.1% in 2017 to 30% by 2050.⁶

Simultaneously, looking at the second and third sectors outlined in figure 1, TMG 2050 plans a drastic cut in emissions from the building and transport sectors. These sectors are major sources of GHG emissions, not just through consumption of liquid fuels but also the use of power for lighting, thermal comfort, and other building operations. TMG 2050’s aims in these two sectors are a significant acceleration of the

GHG reductions it has already achieved since 2015, which marks TMG's post-Fukushima peak of GHG emissions.⁷ In other words, TMG's ratcheting-up of ambitions credibly builds on demonstrated prior performance.

In the resource/industry sector, 4th in figure 1, TMG aims to ramp up its already aggressive policies of reduce, reuse and recycle (3Rs), particularly in plastics, food waste and fluorocarbons. These latter two - food waste and fluorocarbons - are especially important for any viable strategy of drawing down GHG emissions.⁸

The fifth sector in the figure is "climate change adaptation." TMG 2050 positions adaptation as an explicit part of achieving zero emissions. Indeed, green infrastructure and myriad other adaptation initiatives also enhance mitigation, thereby multiplying co-benefits, reducing per-unit costs, and maximizing societal agreement on action.⁹

Finally, figure 1's sixth sector of "engagement and inclusion" outlines a programme of working with civil society, other levels of government, and international subnational governments and non-state actors. This institutional and societal collaboration is embedded in TMG's role as a metropolitan government, integrating 23 special wards and 39 municipalities. It is also evident in the multiple collaborative platforms - SDG cities, smart cities, national resilience - we describe later below.

TMG 2050 and Tokyo Resource-Efficiency

We suggested earlier that TMG 2050 is not mere virtue-signaling, but rather builds on TMG's strengths. A few examples shall suffice. TMG's per-capita energy, water and waste flows are considerable below the average of such peers as Shanghai, New York City, London, Paris, and others.¹⁰ TMG also installed

Japan - and the world's - first urban cap and trade scheme that includes the commercial and industrial sector, "including office buildings, which are often concentrated in megacities."¹¹ TMG and other large Japanese cities - notable Fukuoka - are generally built in a compact manner that fosters efficient resource use and limits urban sprawl.

The importance of TMG-style resource-efficiency is seen in the UNEP's International Resource Panel (IRP) 2018 report on "The Weight of Cities: Resource Requirements of Future Urbanization." The IRP calculate the historic trajectory for urban sprawl to be about 2%/yr, a pace that - if continued - would see urban land use expand from 1 million km² at present to 2.5 million sq² by 2050. That extra 1.5 million sq² of urban space would be approximately 3 times the 506,000 km² area of the entire country of Spain. In tandem with that, urban material consumption is on track to grow from 40 billion tonnes in 2010 to 90 billion tonnes by 2050.

Those numbers are daunting. But the IRP argue that "compact, resource-efficient cities" could reduce these totals by 36-45%. As a benchmark for better performance, the IRP report notes that "Japanese cities have the densest and most connected street patterns," with Tokyo's "level of transit connectivity and intensity of use" being the highest in the world. These structural factors give Japan "the highest world energy productivity (ratio of energy consumption to added value), close to three times the global average."¹² Zooming in on TMG, we see one clear example of this resource-efficiency. The Tokyo Metro transit network's 382 kilometers of track is far less than Shanghai's 639 kilometers, and even New York's 401 kilometers; but in 2018 its annual ridership of 3.463 billion was the world's largest, dwarfing that of second-ranked Moscow (2.369 billion), 3rd-ranked Shanghai (2.044 billion), and 6th-ranked New York City (1.806 billion).¹³

TMG's water supply is another area of demonstrated resilience and resource-efficiency. As in any city, TMG's water-related systems (e.g., sewerages) are energy-intensive and crucial to public health. Moving around huge volumes of water (for TMG, a daily average of 4.13 million cubic liters in 2018), whether for consumption or for waste-treatment, requires prodigious amounts of energy. And poorly designed or badly managed water systems pose enormous health and disaster risks, in addition to wasting precious resources.¹⁴ TMG's replacement of its leaky lead and iron pipe network with stainless steel brought its water loss down from 17% in the 1970s to an incredibly low 2% in the 2010s. At present, TMG's rate of water loss is well under the double-digit leakage rates that OECD reports on "Water and Cities" indicate are common even in developed countries.¹⁵ TMG's capacity to plan and operate its water networks on a metropolitan scale - coupled with institutionalized consultation with its special wards and cities - allows expert information and other scarce resources to be focused on the macro-level management challenge. Rather than leaving each local actor to - as it were - reinvent the wheel on its own, strong metropolitan governance affords the capacity to devise and deploy best-practice solutions.

The importance of collaborative governance needs to be underscored in light of global sustainability challenges. Experts on urban systems argue for a 'one-water approach.' Key to this approach is integration of governance and technology, as it "seeks to integrate various water supply, treatment and management infrastructures into a single infrastructure system perspective that considers the full life cycle of water provisioning in urban areas, [that] can simultaneously deliver livability, resilience and sustainability benefits."¹⁶ TMG does this with its water networks and other critical infrastructure, scaling up the "system of systems" cross-sector integration that is core to

TMG 2050.

TMG 2050 and Public Finance

TMG also puts its money where its mouth is, so to speak. Its commitment to TMG 2050 is seen in the scale and focus of its multi-year funds and annual budgets. As to the former, since FY 2017 TMG has adopted a triad approach to rolling out modernized urban amenities: "safety city," "smart city," and "diver-city" (the latter a combination, in Japanese script, of "diverse" and "city"). To support these initiatives, TMG amalgamated its multi-trillion yen funds,¹⁷ under these three rubrics of safe, smart and diverse. Well before the unfolding global pandemic, TMG had targeted roughly JPY 1 trillion in spending on these initiatives, outside of the annual budgets, between 2017 and 2020.

In 2019, TMG further sharpened the focus on categories critical to TMG 2050. It created three new special purpose funds in 2019, totaling JPY 110 billion. Of this total, JPY 50 billion is devoted to realizing a Society 5.0-type¹⁸ smart city, JPY 30 billion to zero emissions projects such as fuel-cell vehicles, and JPY 30 billion to greening of TMG. Moreover, these new financing vehicles bring the cumulative total (at end of FY 2020) of the relevant funds to JPY 1.77 trillion. Of this JPY 1.77 trillion total, fully JPY 733.2 billion is to be spent within FY 2020 alone for modernized critical infrastructure (waterworks, transport, communications, medical, and other areas), disaster resilience, pandemic response, and other public goods. These investment areas are all pertinent to achieving TMG 2050's cross-sectoral goals.¹⁹

The annual spending in TMG's general account is JPY 7.3 trillion. As in previous years, spending from the FY 2020 general account also features the triad of "safety city," "smart city," and "diver-city." But in comparison to

previous years, the FY 2020 investments show dramatic increases.²⁰ The summary details are as follows:

1. The safety-city budget overall is JPY 328 billion (versus JPY 300 billion in FY 2019) centred on disaster-resilient water networks and bolstering structures against seismic threats and risks of cascading fires.
2. The smart city component of the FY 2020 budget totals JPY 654.8 billion, double the JPY 326 billion total in 2019. Much of this spending focuses on building up transport efficiency by integrating telework, transit-demand management and other smart initiatives. The most striking aspect is the 8-fold increase over the previous year in spending on 5G wireless transmission and other core technologies of a “Smart Tokyo.”
3. The diversity-city aspect totals JPY 550.5 billion, a dramatic increase from 353 billion in 2019. Significant investments are focused on foreigners, the disabled, and other potentially vulnerable members of the community. And fully JPY 174 billion is devoted to augmenting the national government’s initiatives providing free child-care and kindergarten education. To some observers, these items may seem extraneous to climate objectives. But relieving child poverty, increasing women’s opportunities, enhancing work-life balance are in fact crucial elements of emissions reduction and sustainability.²¹

TMG has also been quick to fill in safety-city gaps in pandemic response. As the COVID-19 pandemic threat emerged and then worsened

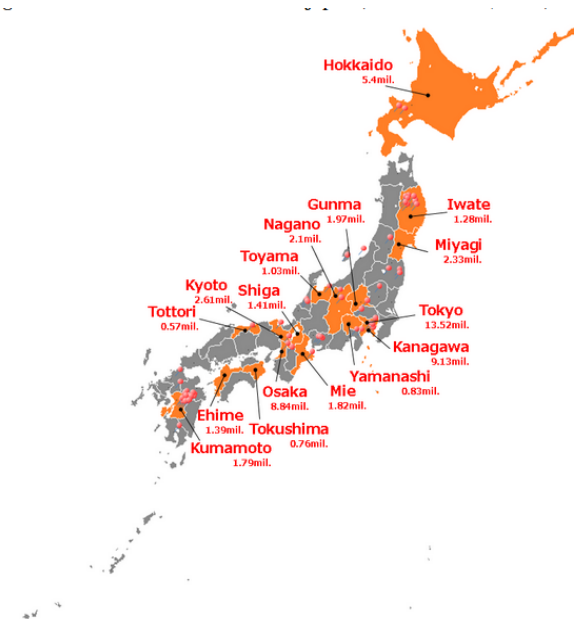
from January of 2020, TMG responded rapidly with supplementary budgets. On February 18 of 2020, TMG announced that an initial JPY 6.4 billion in countermeasures, added to the FY 2019 budget, would be more than quintupled to JPY 33.7 billion as a special addition to FY 2020. Both of these spending packages are directed at a spate of measures, including tests and other supplies in addition to alleviating the economic impact on small firms. Comparing these two supplementary spending measures, we see that the largest increase is the JPY 10 million to JPY 2.6 billion rise for stockpiling medical supplies, readying medical facilities, and other measures.²²

In summary, TMG’s investments belie the hoary depiction of Japanese public works as “bridges to nowhere.” They also provide an important model. In the face of COVID-19, most countries have moved rapidly towards very activist fiscal policy. As of this writing, the G-20 total for fiscal countermeasures is USD 5 trillion, which is roughly the size of the Japanese economy.²³ In many countries, the initial focus on supporting businesses and households in the face of simultaneous supply and demand shocks will almost inevitably move to infrastructure investment. For example, analysts indicate that the broad range of categories encompassed by smart cities are likely to become an even strong focus of public and private investment.²⁴ TMG’s fiscal data suggest that it already offers multiple yardsticks of how to invest so as to achieve multiple decarbonizing co-benefits simultaneously.

TMG 2050 and Other Japanese Cases

In pursuing zero-emissions, TMG is not alone among Japanese subnational governments. Indeed, one prominent area of collaboration in Japan is its national alliance for 2050 zero carbon cities (with the Ministry of the Environment, but as part of larger

horizontal/vertical collaboration). As of March 24, 2020, 86 of Japan's subnational governments - representing 48.5% of the country's population - had adopted the strategy. Figure 2 displays most of the 26 prefectures (of Japan's total 47 prefectures) that have adopted the strategy, and also shows that many large and small cities are acting independently of their prefecture. One example is the city of Koriyama's commitment to the strategy, in advance of any announcement by the prefecture of Fukushima. At nearly the opposite end of the archipelago, the prefecture of Kumamoto has essentially organized 18 of its 45 municipalities into a coordinated bloc.



**Figure 2: 2050 Zero Carbon Cities in Japan
(as of March 24, 2020)**

Source: MoE, 2020²⁵

Within this nexus of collaboration, increasingly ambitious but doable targets are emerging. For example, on December 25 of 2019, Gunma Prefecture announced a 5-zero by 2050 programme.²⁶ The goals include the following:

1. zero deaths due to disasters
2. zero emissions, especially through hydro and forest biomass
3. zero blackouts due to disasters, via use of microgrids and other smart infrastructure
4. zero plastic waste, through recycling and reduction of use
5. zero food loss, particularly by repurposing food that currently goes into the waste stream

Like TMG 2050, Gunma's goals build on multilevel collaborations detailed below, including SDGs, smart city, and national resilience.

Other Multilevel Collaborations in Japan

TMG has been a global first-mover on implementing the UN's Sustainable Development Goals (SDGs), a major part of the 2030 Agenda.²⁷ But so has the national government, via the cabinet office and other agencies. Developed countries tend to view the SDGs as a template to guide assistance to developing countries. However, Japan's Cabinet Office has quite deliberately²⁸ built a platform for subnational (prefectural and municipal) models of "local revitalization" SDGs.²⁹ Since 2017, the multi-level collaboration has been using the 17 goals and 169 targets of the SDGs as means to focus Japanese initiatives to cope with myriad domestic challenges while simultaneously enhancing opportunities for overseas engagement and contributions. Within the Cabinet Office's facility, Japan's subnational governments compete to be one of

the 100 designated SDG initiatives. The Japanese platform distills the multiplicity of SDG goals into 8 areas: inclusiveness and gender-equality, health and longevity, economic growth with innovation, sustainable and resilient critical infrastructure, resilient and decarbonizing energy, biodiversity and ecosystem conservation, global peace and security, and global engagement for promoting the SDGs. In tandem, the national government has linked its Society 5.0 industrial policy and related initiatives to the SDGs as a means of fostering silo-breaking policy coherence in tandem with expanded global collaboration.³⁰

A related multi-level platform approach applies to Japan's smart city collaboration. Since its creation in 2019, Japan's Smart City platform has grown to 570 members and 170 industrial policy initiatives. The members are composed of 113 local governments, 356 firms and research institutes (including universities), 11 central agencies, and 2 economic associations. Like the SDGs platform, the Smart City platform is a locus for integrating governance and technology, a venue for facilitating collaborative learning and diffusion of best-practice solutions to domestic and global challenges. TMG's projects are prominent in the platform, and are thus well-positioned as models for other local governments.³¹

Perhaps most importantly, the national government, TMG and other subnational governments are also closely linked in an expanding portfolio of national and subnational "National Resilience Plans" (NRPs) that have legal precedence over other plans.³² This platform has several years of institutionalization. Japan's NRP is based on the National Resilience Law passed by the Diet on December 4 of 2013.³³ The NRP is comprehensive, inclusive and transparent. It is aimed at bolstering the country's resilience to natural disasters and other hazards, as well as fostering the capacity to recover from such disasters when they occur. It is also explicitly

addressed to demographic and other challenges. Based on national and international evidence, it evaluates risks and vulnerabilities, selects and prioritizes countermeasures, and then monitors progress on these measures. As shown in figure 3, the NRP are umbrella plans: as of 2019, 46 other national plans refer to the NRP. These plans include energy, environmental, city-planning, ageing society, forestry, space, and other plans. An additional 18 plans are slated to be added to the list, including the Comprehensive Innovation Strategy, the Global Warming Counter-Measures Plan, and the Basic Plan on Ocean Policy.³⁴ The broad reach of the NRP allows it to address disaster, demographic and other hazards. Comprehensive and integrated planning also allows the NRP cycle to emphasize cost-effective, cross-sectoral adaptation to multiple risks while also achieving broader socio-economic sustainability and decarbonization.

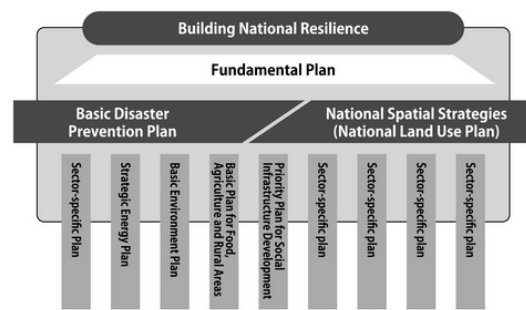


Figure 3: Planning and Japan National Resilience
Source: Japanese Cabinet Office (Click to expand)

As figure 4 indicates, the NRP is also a "whole of government" approach to planning. In 2014, the NRP was worked up into a plan by the governing LDP politicians and disaster-resilience technocrats in the Cabinet Secretariat's National Resilience Promotion

Office (NRPO). It was also studied by the National Resilience (Disaster Prevention and Reduction) Deliberation Committee (NRDC). The NRDC first met on March 5, 2013 and had its 53rd meeting on March 23, 2020. It has played a prominent role in overseeing 2 iterations (2014, 2018) of the NRP Basic Plan as well as 6 annual action plans that decide and then monitor the PDCA planning cycle and the achievement of Key Performance Indicators (KPI). These KPIs include hard measures, such as reinforcing water-treatment systems, and soft measures, such as skill-building and means to break down governance silos. In the 2019 revision of the original 5-year NRP basic plan, the number of KPIs had increased to 179. These KPIs cover a very broad range of hard and soft measures to secure holistic and inclusive resilience.

The NRDC's membership is drawn primarily from the top ranks of Japanese academe, business, and subnational government. Its specialists advise on ageing, primary industries, local communities, local administration, risk communication, industrial structure, the environment, disaster prevention, finance, national lands, and information services. These people and institutions are silo-breakers, in that their collaboration brings together often balkanized sectors. Their silo-breaking role is clear from studying the plans they have built and continue to refine. Indeed, in a laudable exercise in transparency, the minutes from NRDC meetings and the materials it deliberates are uploaded to its dedicated web site, generally within a week of its 7-9 meetings each year.³⁵

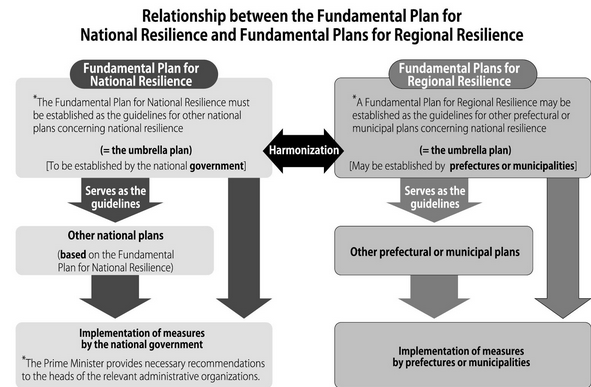


Figure 4: Whole of Government and National Resilience
Source: Japanese Cabinet Office (Click to expand)

A key test of any such ostensibly collaborative initiative is how well it diffuses and how purposefully engaged the actors are. By that measure, national resilience is even more successful than the SDGs and Smart City platforms described earlier. By March 1 of 2020, all of Japan's 47 prefectures had adopted their own regional versions of the NRP. Moreover, 1,355 of Japan's 1741 cities and towns had either adopted their own local versions of the NRP or were formulating plans. This number of cities, towns and villages doing NRPs was more than a quintupling of the 196 total from June of 2019.³⁶ That startling rate of increase, in well under a year, was testament to the rapid spread of risk-awareness in Japan. Recent years of repeated typhoons, floods and other disasters have led to a consensus on the need for comprehensive planning and integrated counter-measures.

As to subnational engagement, that is evident in the content of their planning and implementation. All the prefectural and local plans are formulated on the basis of local risk assessments, built on the advice of local experts, open meetings, and responsiveness to public comments on planning proposals. In other words, the local plans are not "cookie-

cutter” versions of the national plan, mere passive compliance with central-government directives in order to maximize public works. Japanese resilience is certainly well-funded, at roughly JPY 5 trillion per year. But the investments finance soft and hard measures in addition to training and international engagement. The national and subnational plans, budgets, committee representation, and other aspects are all open to inspection and input from civil society. Spending categories and performance indicators are presented in graphic and tabular formats.³⁷

In addition to the above platforms on SDG cities, smart cities, and resilience, we could have outlined Japan’s platforms for compact cities, green infrastructure, and other elements of holistic resilience. But we think the examples suffice to show that TMG’s policymakers work in a variety of multilevel collaborations. Most of these platforms include all levels of government and reach deeply into civil society.

TMG’s Broader Significance

Japan seeks to export its collaborative, resilient and resource-efficient urbanization. One indicator of this is seen in Japan’s cooperation with the World Bank on disaster-resilient urban “lifeline” infrastructure. The World Bank has long argued that compact design affords more green space, enhances the efficiency of material use, and reduces disaster and other risks. In June of 2019, the World Bank quantified the benefit of this kind of urbanization, in low and middle-income countries, as potentially USD 4.2 trillion in avoided costs from damage and disruptions. The ratio of initial investment cost versus avoided costs was calculated at 1:4, meaning investment in resilient infrastructure more than paid for itself over the lifecycle.³⁸

Japan’s active collaboration with the World Bank came in tandem with its securing G20

agreement, in June of 2019, to Principles for Quality Infrastructure Investment that include comprehensive quantification of lifecycle costs. These principles are non-binding but meld environmental, societal, fiscal and other modes of sustainability. Close observers of G20 processes regard them as one of the key developments in 2019.³⁹ Indeed, it is difficult to exaggerate the significance of bringing the 2030 Agenda into the highest levels of decision making on global infrastructure, which is routinely assessed to represent a cumulative USD 80 trillion in investment by 2040.

One example of the prodigious body of research highlighting the importance of resilient infrastructure is the October, 2018 collaboration between Oxford University and the United Nations Office for Project Services, in their report “Infrastructure Underpinning Sustainable Development.”⁴⁰ They place infrastructure investments in a broader mix of critical public goods. These latter include investments in health, education and food security, underpinned by sustainable management of water resources. Like TMG 2050, these integrated initiatives offer no-regret pragmatism: in the face of climate, geopolitical and business uncertainty, there can be no doubt that providing children with clean water and other public goods will improve their health and alleviate pandemic risks.

Further Integrated Resilience and the TMG Paradigm

We have seen that TMG 2050 is part of a larger paradigm of platforms. Japan offers lessons in governance and the integration of technology, to help cope with multiple challenges simultaneously. Climate change is a wicked problem and very likely an existential crisis. Assessing and addressing climate change is always fraught with disagreements and distractions, because short-term thinking is so greatly advantaged over long-term planning.

The unfolding pandemic and economic crisis seem likely to worsen that structural problem by impeding “super year” 2020’s multiple important negotiations over biodiversity, the oceans, and COP 26.⁴¹ But Japan’s example suggests powerful coalitions can be built by including a variety of no-regret “solutions” framed in terms of the 2030 Agenda.

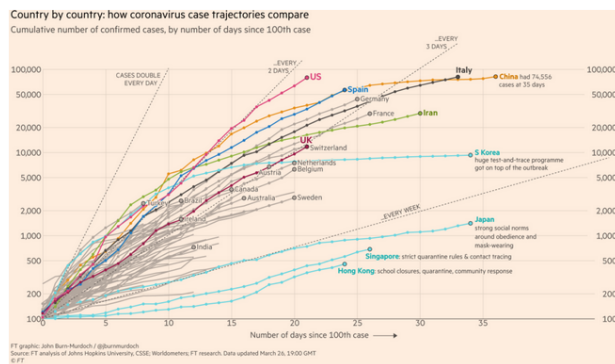


Figure 5: Global Spread of Coronavirus (as of March 26, 2020)

Source: *Financial Times*, March 26, 2020 (Click to expand)

Yet in light of COVID-19, it is imperative that there be tighter integration of pandemic risk-reduction and response in TMG 2050 and other multilevel collaboration. Though Japan’s response to COVID-19 has generally been derided in international and domestic media reports, the country appears – as of this writing – to have minimized COVID-19’s spread. This result is unexpected, particularly because Japan’s aging, population density and other important variables exceed those of heavily impacted Italy. Figure 5 shows that after the 10th recorded death from the coronavirus, Japan seems to have nearly flattened the upward curve of infection. The figure suggests that South Korea is leading in flattening the curve, with Japan, Hong Kong and Singapore not far behind. Japan may be in a much better position than most of Europe and North

America, not to mention Brazil, India, Indonesia and other populous countries. The US appears to be in particularly dire straits, which is especially surprising in light of its 2019 ranking as the world’s most advanced case of health security.⁴²

Whether Japan’s current comparatively low levels of COVID-19 infection, hospitalization, and mortality are due to good policy, good luck or simply poor data cannot yet be conclusively determined. In any event, there are many areas for improvement. On this, Japan’s 26 national resilience working groups include a high-level “STOP Pandemics 2020 Strategy Committee.”⁴³ The Committee is chaired by highly respected Professor Kaku Mitsuo of Tohoku Medical and Pharmaceutical University and lead author of the February 25, 2020 “Citizen’s Handbook” on avoiding COVID-19 infection.⁴⁴ In a February 10, 2020 forum, the working group made a number of recommendations concerning better integration of pandemic risks into all-hazard National Resilience. It also made recommendations on risk-communication, preparedness, and related items.⁴⁵ It is slated to provide further recommendations in April, with presumably more specific protocols in addition to how to better integrate pandemic risk-reduction into Japan’s resilience paradigm.

But requisite reforms go beyond Japan’s domestic protocols, platforms and paradigms. We have argued elsewhere⁴⁶ that the pandemic response could be bolstered by greater use of the WHO framework on health-emergency disaster-risk management (Health-EDRM). The WHO describes Health-EDRM as the “systematic analysis and management of health risks, posed by emergencies and disasters, through a combination of (1) hazard and vulnerability reduction to prevent and mitigate risks, (2) preparedness, (3) response and (4) recovery measures.”⁴⁷ WHO’s current technical guidance has not incorporated the Health-EDRM.

Also, one would have expected the pandemic to have galvanized the international disaster-risk reduction (DRR) community. Certainly the UN Office for Disaster Risk Reduction (UNDRR) issued a March 12 press release exhorting disaster management agencies to “prioritize biological hazards.” The UNDRR duly observes that natural hazards are the focus for national disaster management agencies. It encourages them to include health emergencies as a top priority, because they clearly lead to cascading systemic breakdown in such critical infrastructure as health care and financial services. Yet we are now 5 years out from 2015 adoption of the Sendai Framework on Disaster Risk Reduction, in tandem with the Paris Agreement and the SDGs. Sendai explicitly incorporates climate change, health risks, and the urgency of acting in advance rather than waiting and then responding. Surely the present crisis should produce a more

substantive response, particularly in such an important year for further institutionalizing and integrating the 2030 Agenda.

We argued that TMG’s example, and its TMG 2050, suggests that robust and integrated governance can help cities maximize mitigation and adaptation. TMG 2050 deserves close attention because it is a very democratic, collaborative benchmark built on impressive results, smart industrial policy, aggressive fiscal policy, and an emphasis on equity and inclusivity. We also pointed out that TMG 2050 is not acting on its own, but rather in an “all of government” array of platforms and through international engagement. Japanese silo-breaking is leading to substantial progress in integrating the three key elements - Paris, SDGs, and Sendai - of the 2030 Agenda. We can only hope Japan contributes to keeping the 2030 Agenda on track in this potentially distracting, disruptive and divisive year.

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Notes

¹ Tokyo’s Zero Emission Strategy is available at the following URL:

https://www.kankyo.metro.tokyo.lg.jp/en/about_us/zero_emission_tokyo/strategy.html

² Silo-breakers are individuals and institutions that break down the walls - or “silos”- that separate public-sector governance, business management, and other areas. For their role in disaster risk reduction and climate adaptation, see “Silo-breakers: Asia and the Pacific calls for integrating climate adaptation and disaster risk reduction,” United Nations Office of Disaster Risk Reduction, September 6, 2019:

<https://www.undrr.org/news/silo-breakers-asia-and-pacific-calls-integrating-climate-adaptation-and-disaster-risk>

³ On this lack of monitoring, see “US Cities Boost Clean Energy Efforts, but Few on Track to Meet climate Goals,” American Council for an Energy-Efficient Economy, July 24, 2019: <https://www.aceee.org/press/2019/07/us-cities-boost-clean-energy-efforts-0>

⁴ See the US city database and assessments at “State and Local Policy Database,” American Council for an Energy-Efficient Economy, March, 2020: <https://database.aceee.org/city-scorecard-rank>

⁵ The Berlin City data are available (in German) at “Berlin (B),” German Federal Renewable Energies Agency: https://www.foederal-erneuerbar.de/landesinfo/bundesland/B/kategorie/top%2010/auswahl/289-anteil_erneuerbarer_/#goto_289

⁶ Tokyo’s 2017 level of 14.1% renewable energy is displayed (in Japanese) on p. 124 of the Tokyo Environmental White Paper, 2019: https://www.kankyo.metro.tokyo.lg.jp/basic/plan/white_paper/100200a20191031132600879.files/2019zenbun.pdf

⁷ Tokyo’s GHG emissions data can be referenced (in Japanese) on p. 125 of the Tokyo Environmental White Paper, 2019: https://www.kankyo.metro.tokyo.lg.jp/basic/plan/white_paper/100200a20191031132600879.files/2019zenbun.pdf

⁸ On this point, note that “Project Drawdown” has assessed refrigerant management/alternative refrigerants and reduced food waste as among the top actions in effective GHG emissions reduction potential. See their comparative table on the scale of potential cuts: <https://drawdown.org/solutions/table-of-solutions>

⁹ On green infrastructure in Japan, see Andrew DeWit “Is Japan a Climate Leader? Synergistic Integration of the 2030 Agenda,” Japan Focus, February 1, 2020: <https://apjff.org/2020/3/DeWit.html>

¹⁰ These results were reported by what appears to be the first ever comparison of energy and other resource flows in megacities. See Kennedy, C. et al “Energy and material flows of megacities,” Proc Natl Acad Sci U S A. 2015 May 12: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4434724/>

¹¹ See “Creating a Sustainable City: Tokyo’s Environmental Policy,” Tokyo Metropolitan Government, September 2018: http://www.kankyo.metro.tokyo.jp/en/about_us/videos_documents/documents_1.files/creating_a_sustainable_city_2018_e.pdf

¹² See p. 109 “The Weight of Cities: Resource Requirements of Future Urbanization,” International Resource Panel, 2018, available at the following URL: <http://www.resourcepanel.org/reports/weight-cities>

¹³ The data are compiled by the International Association of Public Transport, and published as “World Metro Figures 2018”: [https://www.uitp.org/sites/default/files/cck-focus-papers-files/Statistics%20Brief%20-%20World%20metro%20figures%202018V4_WEB.pdf](https://www UITP.org/sites/default/files/cck-focus-papers-files/Statistics%20Brief%20-%20World%20metro%20figures%202018V4_WEB.pdf)

¹⁴ For example, Project Drawdown assess “water distribution efficiency” as representing an opportunity to halve water loss (currently 30.3 billion cubic liters/yr), reduce GHG emissions by, and save between USD 250-350 billion: <https://drawdown.org/solutions/water-distribution-efficiency>

¹⁵ On these items, see the OECD's work on Water and Cities: Ensuring Sustainable Futures: <http://www.oecd.org/water/water-and-cities.htm>

¹⁶ See p. 109 "The Weight of Cities: Resource Requirements of Future Urbanization," International Resource Panel, 2018, available at the following URL: <http://www.resourcepanel.org/reports/weight-cities>

¹⁷ These kinds of funds (*kikin*) are not peculiar to TMG, and are financed via such measures as accumulated savings from cost-cutting, unanticipated tax and related revenue increases, debt finance, and other items. Japanese subnational governments use these funds to smooth out annual budgeting as well as target special purposes (notably building municipal structures, supporting primary industries, and coping with aging). On these funds, and their striking increase in recent years, see (in Japanese) Tatsuoka Kenjiro, "Why Have Local Government Funds Increased?" JRI Review, 5(66), 2019: <https://www.jri.co.jp/MediaLibrary/file/report/jrireview/pdf/11084.pdf>

¹⁸ On Japanese Society 5.0's integration of cyberspace and physical space, see "Society 5.0," Japanese Cabinet Office, nd: https://www8.cao.go.jp/cstp/english/society5_0/index.html

¹⁹ See (in Japanese) p. 20-21 of "Tokyo Metropolitan Government Budget Summary, FY 2020," Tokyo Metropolitan Government, February: https://www.zaimu.metro.tokyo.lg.jp/syukei1/zaisei/20200124_reiwa2nendo_tokyotoyosanangaiyou/2yosanangaiyou.pdf

²⁰ Concerning TMG's FY 2019 and FY 2020 budgets, see (in Japanese) summaries at Tokyo Metropolitan Government finance website: <https://www.zaimu.metro.tokyo.lg.jp/zaisei/>

²¹ Within an already voluminous literature on these matters, see "Christina Kwauk et al., "Girls' education in climate strategies," Brookings Working Paper, December 10, 2019: <https://www.brookings.edu/research/girls-education-in-climate-strategies/>

²² The supplementary budgets are outlined (in Japanese) in detail "Concerning additions to the FY 2019 and FY 2020 supplementary budgets," Tokyo Metropolitan Government News, February 18, 2020:

https://www.zaimu.metro.tokyo.lg.jp/yosan/20200218_hoseiyosanan_tsuika.pdf

²³ See "G-20 Nations Pledge \$5 Trillion to Spur Global Economic Recovery From Coronavirus," Wall Street Journal, March 26, 2020.

²⁴ One recent assessment of the pandemic's implications for the smart city is seen in "Taking Stock of COVID-19: The Short- and Long-Term Ramifications on Technology and End Markets," ABI Research White Paper, March 18, 2020:

<https://www.abiresearch.com/press/covid-19-pandemic-will-force-companies-around-world-radically-rethink-how-they-operate-and-embrace-technological-investment/>

²⁵ The Ministry of Environment "Zero Carbon Cities in Japan" mapping is available in English and regularly updated:

http://www.env.go.jp/en/earth/cc/2050_zero_carbon_cities_in_japan.html

²⁶ The details of Gunma Prefecture's programme are available (in Japanese) at "Gunma Prefecture announces a 5-zeros by 2050 plan," Gunma Prefecture, December 25, 2019: https://www.pref.gunma.jp/04/e01g_00147.html

²⁷ The use of the term "2030 Agenda" derives from the fact that the UN's three landmark agreements - the SDGs, the Paris Agreement and the Sendai Framework on Disaster Risk Reduction - all cover the 2015-2030 period. On the effort to enhance synergies among the

three agreements, see Handmer, et al. “Achieving risk reduction across Sendai, Paris and the SDGs: International Science Council Policy Brief, May, 2019: https://council.science/wp-content/uploads/2019/05/ISC_Achieving-Risk-Reduction-Across-Sendai-Paris-and-the-SDGs_May-2019.pdf

²⁸ On the Japanese Cabinet Office’s strategic approach to using the SDGs, see (in Japanese) Seki Sachiko “Concerning the Promotion of Japanese-Style SDGs,” *Governance*, October, 2019.

²⁹ The platform is described (in Japanese) at: <http://future-city.jp/sdgs/>

³⁰ The categories are described in detail (in Japanese) at “SDGs Action Plan 2020,” Cabinet Office, Government of Japan, December 2019:

<https://www.kantei.go.jp/jp/singi/sdgs/dai8/actionplan2020.pdf>

³¹ The Smart City platform’s website (in Japanese) is here:

<https://www.mlit.go.jp/scpf/index.html>

³² The central government’s National Resilience plans for 2014-2019 are available (in Japanese) here: https://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/kihon.html

³³ The National Resilience Plan and related materials are available (in Japanese) at the following internet URL: http://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/

³⁴ The list of plans is available (in Japanese) at “Concerning other national plans in regard to national resilience,” Cabinet Office, March 25, 2019:

<https://www.cas.go.jp/jp/seisaku/resilience/dai47/siryos3-3.pdf>

³⁵ The membership, minutes and materials studied by the National Resilience (Disaster Prevention and Reduction) Deliberation Committee are available (in Japanese) at the following internet URL: <http://www.cas.go.jp/jp/seisaku/resilience/>

³⁶ Links to Japan’s subnational National Resilience plans are available (in Japanese) here: https://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/tiiki.html

³⁷ The plans, budgets, committee data, and other relevant information are available via the Cabinet Secretariat’s dedicated website: https://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/

³⁸ On this, see “Lifelines: The Resilient Infrastructure Opportunity,” World Bank, June 17, 2019:

<https://www.worldbank.org/en/news/infographic/2019/06/17/lifelines-the-resilient-infrastructure-opportunity>

³⁹ One example is Center for Strategic and International Studies Senior Vice-President Matthew P. Goodman in his “Parsing the Osaka G20 Communique,” Center for Strategic and International Studies, July 3, 2019:

<https://www.csis.org/analysis/parsing-osaka-g20-communiqué>

⁴⁰ The report can be accessed at the following URL:

<https://www.itrc.org.uk/infrastructure-underpinning-sustainable-development/>

⁴¹ On this, see Fermin Koop, “Coronavirus hits crucial year for nature and climate,” *China Dialogue*, March 19, 2020:

<https://www.chinadialogue.net/article/show/single/en/11915-Coronavirus-hits-crucial-year-for-nature-and-climate>

⁴² See the first-ever “Global Health Security Index,” developed by the Economist, the Nuclear Threat Initiative, and the Johns Hopkins Center for Health Security. The Index is the world’s first, and in addition to getting the US wrong, lists Japan as 21st and Singapore as 24th. The

Index is a very important initiative, but clearly needs silo-breaking revision of underlying assumptions and other factors. The Index is available at:
<https://www.ghsindex.org/wp-content/uploads/2019/10/2019-Global-Health-Security-Index.pdf>

⁴³ The working group's membership and other details are (in Japanese) here:

<http://www.resilience-jp.biz/wg/wg24/>

⁴⁴ The handbook (in Japanese) was updated on March 15 and is here:

<http://www.hosp.tohoku-mpu.ac.jp/info/information/2326/>

⁴⁵ These are detailed (in Japanese) in "2020 Committee proposes 7 commitments," Nikkei Medical, February 12, 2010:

<https://medical.nikkeibp.co.jp/leaf/mem/pub/report/t344/202002/564278.html>

⁴⁶ See Riyanti, Djalante, Rajib Shaw, and Andrew DeWit, "Building resilience against biological hazards and pandemics: COVID-19 and its implications for the Sendai Framework," *Progress in Disaster Science*, Vol. 6 April, 2020:

<https://www.sciencedirect.com/science/article/pii/S259006172030017X>

⁴⁷ See "Emergency Risk Management for Health: Overview," World Health Organization, May 2013:

https://www.who.int/hac/techguidance/preparedness/risk_management_overview_17may2013.pdf