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The Great East Japan Earthquake, Tsunami and Nuclear Meltdown

Towards the (Re)Construction of a Safe, Sustainable, and Compassionate Society

Japan's Shrinking Regions

By

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The Great East Japan Earthquake, Tsunami and Nuclear Meltdown

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Abstract

Japan's rural regions have been shrinking for the entire postwar period, and successive efforts to revitalize rural society have failed. This article asks whether the Great East Japan Earthquake and tsunami, and the subsequent meltdown at the Fukushima Daiichi nuclear power plant, present the Japanese state and society with a watershed opportunity to rethink regional revitalization and national energy procurement strategies. The article begins by summarizing the events of March and April 2011, examines possible approaches to the reconstruction of communities in the Tōhoku region, and critiques problems of governance in postwar Japan that the disaster reveals. The article concludes by pulling together the information and analysis presented into a discussion of the prospects for achieving the three point vision for a safe, sustainable, and compassionate society that Prime Minister Naoto Kan set the Reconstruction Design Council.

Keywords: rural revitalisation; disaster reconstruction; Tōhoku Earthquake; Japan's shrinking regions; sustainability

The Great East Japan Earthquake, Tsunami and Nuclear Meltdown

Towards the (Re)Construction of a Safe, Sustainable, and Compassionate Society in Japan's Shrinking Regions

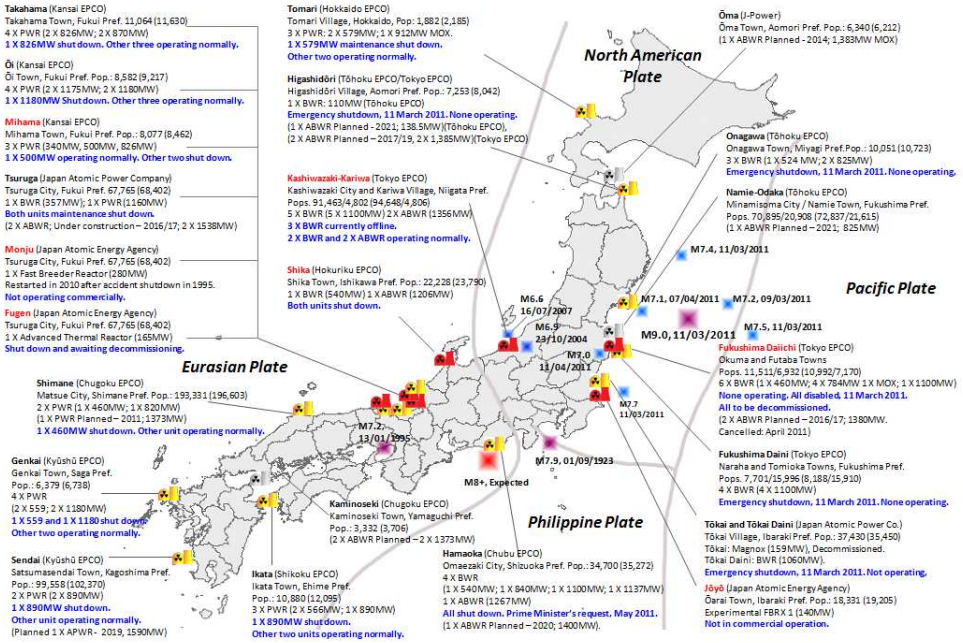
The Great East Japan Earthquake, Tsunami, and Nuclear Meltdown

At 14:46 local time on 11 March 2011 a magnitude 9.0 reverse fault megathrust earthquake struck 100 kilometers east of Miyagi Prefecture in Japan, along the subduction zone under the north-western Pacific Ocean where the Pacific and North American tectonic plates meet (Map 1)(JMA, 2011a). It was the most powerful earthquake ever recorded to have hit the country and the fourth most powerful to have occurred anywhere on earth since 1900 (JMA, 2011a; USGS, 2011a). The resulting upthrust and subsidence generated a huge tsunami with a maximum recorded height of 17 meters (Asahi Shinbunsha, 2011a, p. 74) that swept over the low-lying coastal areas of the north-eastern seaboard of Honshu, flooding more than 507km^2 of land and leaving 26.7 million tons of debris in its wake (Asahi Shimbunsha, 2011a, p. 74-75). As of 5 June 2011 the National Police Agency had registered 15,365 deaths, 8,206 missing, and 5,364 people injured across 20 prefectures, and 111,044 destroyed and damaged buildings (NPA, 2011). Miyagi, Iwate and Fukushima Prefectures were the worst hit, with 9,184, 4,524, and 1,592 deaths respectively (NPA, 2011). Aerial television footage showed entire towns being swept away and many residential areas, fishing ports, and industrial and commercial zones have been severely damaged or even completely destroyed.

The tsunami breached the protective walls at the Fukushima Daiichi nuclear power plant located in Okuma and Futaba Towns, Fukushima Prefecture, and knocked out the mains electricity supply and backup generators that supply the six reactors' cooling systems. The loss of cooling led to the meltdown of nuclear fuel in reactors 1, 2 and 3, breaches in the reactors' pressure vessels, 'melt-through' of nuclear fuel into the outer containment vessels, hydrogen explosions that tore apart the buildings housing reactors 1, 3, and 4, and the uncontrolled leak of radioactive materials beyond the vicinity of the plant (Asahi Shimbunsha, 2011a; Kyodo News, 2011a; Yomiuri Shimbun, 2011). A 3km

evacuation zone was immediately established, which was widened to a 10 and then 20km radius, while residents 20-30km from the plant were urged to remain indoors. By 11 April 59,310 persons had been evacuated, of whom 39 had died during evacuation (Asahi Shinbunsha, 2011a, p. 98). On 21 April the government declared the 20km zone a no-go area and those caught 'trespassing', including residents without official permission, faced fines of JPY100,000 or 30 days detention (Japan Times, 2011a). Residents of Kawamata and Iitate Towns, located 40km from the plant, and parts of Katsurao Village, Namie Town and Minamisoma City which lie beyond the 20km radius, have also been evacuated due to unsafe radiation levels being detected (BBC, 2011a; NISA, 2011a).

Map 1: Map of Japan showing the 11 March 2011 Earthquake plus M7+ foreshock and aftershocks, other significant earthquakes, and the locations and details of Japan's nuclear power stations.



Sources: Asahi Shinbunsha (2011b); Electric Power Company websites; JAIF (2011a); JMA (2011b); Shinchōsha (2011); Statistics Bureau (2011a); USGS (2011b).

Note 1: Population data are from the 2010 (and 2005) national census.

Note 2: Power plant graphics courtesy of Wikipedia under Creative Commons license.

Note 3: Power plants in red (online version) or with darker symbols (print version) are where serious safety breaches or accidents have occurred.

The Japan Self Defense Force (JSDF) dispatched 100,000 personnel to provide emergency aid, while the United States military lent support, including 18,000 personnel, 20 naval vessels, and 140 aircraft (Fujioka, 2011; Sankei Shimbunsha, 2011, p. 77). The Royal Australian Air Force also laid on relief flights (Oldaker, 2011), China donated 20,000 tons of gasoline and heavy fuel, South Korea sent boron to stabilize Fukushima Daiichi's reactors, and many countries sent food supplies and search and rescue teams (Reuters, 2011; Sankei Shimbunsha, 2011, p. 77). Although Sendai airport was submerged and the terminal building flooded, US soldiers cleaned away the sludge and it re-opened on 13 April (Fackler, 2011). East Japan Railways is also restoring rail services and by 29 April full service on the Tōhoku Shinkansen had resumed (Asahi.com, 2011), links though some local lines remain closed (JR East, 2011). Thousands of volunteers have contributed too, and money has been collected from around the world. However, the disaster has been overwhelming and the authorities have not attended to all needs. Furthermore, restrictions around the Fukushima Diaichi power plant inhibit efforts to recover bodies and clear debris.

On 12 April 2011 Japan's Nuclear Industrial Safety Agency (NISA) raised the seriousness of the nuclear accident to 7 on the International Nuclear Event Scale, placing it alongside the catastrophe at Chernobyl in Ukraine in 1986. Initially, the two accidents appeared very different, with Fukushima Daiichi reportedly releasing 'only' one tenth of the radiation of Chernobyl thus far (JAIF, 2011b; NISA, 2011b), however, subsequent reports paint a more ominous picture (Yomiuri Shimbun, 2011). Radioactive leakage continues, and on 17 April Tokyo Electric Power Company (TEPCO), owners of the plant, estimated that it will take nine months to bring the plant under control (TEPCO, 2011a).

Alongside Fukushima Daiichi, all 15 reactors at the Fukushima Daini, Tōkai Daini, Onagawa, and Higashidōri nuclear power plants either went into emergency shut down or remain offline, while three reactors at the Kashiwazaki-Kariwa plant in Niigata Prefecture are offline for inspection, totaling 18 out 22 reactors in the 50Hz region[1] of north-eastern Honshu at a standstill, and representing 76.3 percent (15.74GW) of the nuclear generating capacity of the region (Map 1)(JAIFa, 2011; TEPCO, 2011a;

Shinchōsha, 2011, p. 64). Engineers from Toshiba and Hitachi, two of the three companies that built the reactors and turbines at Fukushima Daiichi (the other being General Electric), estimate that it will take between 10 and 30 years to complete decommissioning Fukushima Daiichi (NHK, 2011a; Nikkei.com, 2011), which will likely cost in excess of JPY1 trillion (USD12 billion) (Tamaki and Toyoda, 2011). Currently, the government and TEPCO are considering converting it into a repository for the plant's spent fuel and debris (Sato, 2011). The wider consequences for nearby communities of a continued reminder of what took place there, as well as forever being compared with Chernonyl, should not be underestimated.

Seismic activity continues. The main earthquake was preceded by a magnitude 7.2 foreshock, and by 3 June there had been more than 500 aftershocks of M5+, with 81 of these being M6+, and five M7+ (JMA, 2011b). These have caused further damage, hindered debris clearance and the restoration of services, and resulted in continuing anxiety. It is an unavoidable fact that Japan sits atop the densest seismic network in the world at the north-western edge of the Pacific Ring of Fire (USGS, 2011c), and the Sanriku coast of Iwate has endured many destructive tsunami. In 1896 the M8.5 Meiji-Sanriku Earthquake generated a tsunami some 30 meters in height, killing 20,000 people and destroying nearly 9,000 homes (Nakao, 2005). On 2 March 1933 the M8.4 Shōwa-Sanriku earthquake caused a tsunami of up to 28.7 meters, destroying 5,000 houses and killing 3,000 people (USGS, 2011b). And in 869AD the Jōgan-Sanriku earthquake, with an estimated magnitude of 8.6, probably generated a huge tsunami that inundated the coastal plain south of Sendai up to four kilometers inland, killing 1,000 people (Satake *et al*, 2007). Indeed, Satake *et al* predicted that there was a 99 percent chance of an M8.1-8.3 earthquake occurring off the coast of Miyagi within the following 30 years that would probably generate a large tsunami. Although the 11 March 2011 quake measured 9.0, it is no surprise that people question the protective measures adopted by TEPCO at Fukushima Daiichi, such as the height of the sea wall (5.7 meters) and the poor location of the backup equipment, as well as lax government regulations which guided TEPCO's disaster planning.

Life in Tōhoku will never be the same. People have lost loved ones, homes, farmland,

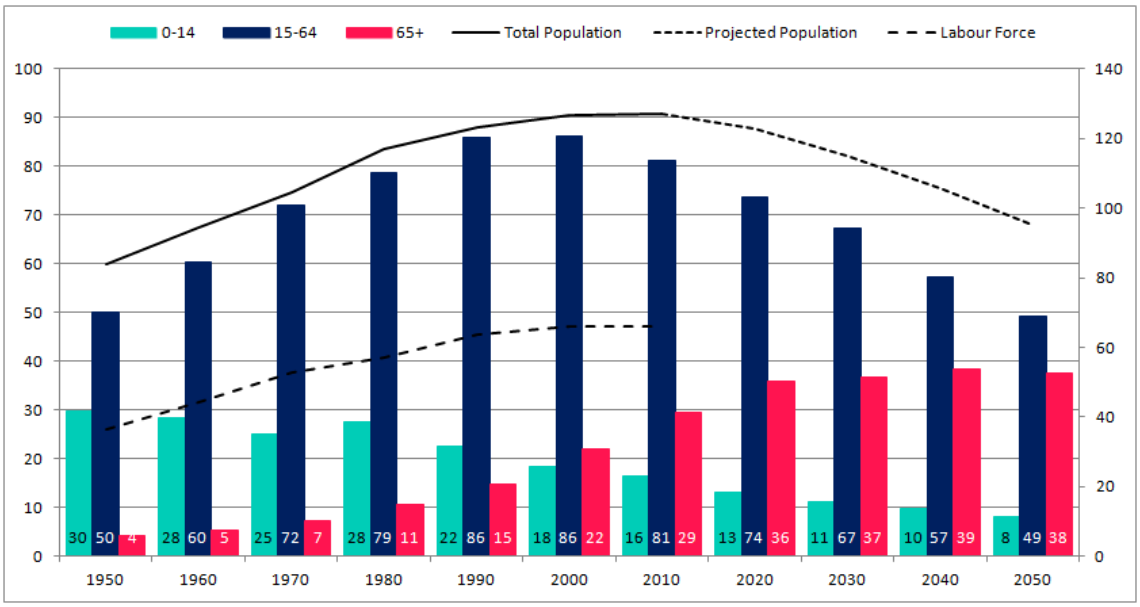
treasured possessions, livelihoods, and cherished family pets (Bayer, 2011). This article is a snapshot of conditions in Japan in early June 2011, approximately 90 days after the quake, and is gathered from a broad range of sources while resident in the country; from reading and watching press and television reports, to personal experiences and discussions, a small number of which were with volunteers and those affected. What the article lacks in completeness, therefore, it gains in immediacy and relevance for future disaster planning in Tōhoku and beyond. But, for our purpose here, we must now review conditions in Tōhoku immediately prior to the earthquake.

Japan's Shrinking Regions

Regional Japan, meaning non-metropolitan areas including Tōhoku, had already been in the grip of a long-term crisis of ageing and depopulation for more than 50 years prior to March 2011. Its emergence had coincided with the formation of the postwar '1955 system' and the consensus around economic expansion which became entrenched under the 'iron-triangle' of a Liberal Democratic Party (LDP) led government, the state bureaucracy with the Ministry of International Trade and Industry (MITI – now METI) at its core, and the nation's industrial elites (Author, 2011; Johnson, 1982; Masumi, 1988; McCormack, 2002). The combined effects of chronic population out-migration and low fertility have left nearly every regional settlement in Japan shrinking in size, and weakening in its socioeconomic vitality. Now that the nation's population has also begun to shrink, the few opportunities that remain for regional communities to build resilience are disappearing as urban centres compete to become Japan's 21st century 'creative cities' (Author, 2011; Landry, 2008; Lim, 2008; Sasaki, 2007).

Figure 1 shows demographic data from 1950 to 2010 and population projections from 2010 to 2050. Maps 2 and 3 present population change in Japan by prefecture and prefectural capital between 1990 and 2010 (Map 2), with present population trends projected to 2030 (Map 3). From the data we can observe three major demographic outcomes facing Japan and Tōhoku in the 21st century.

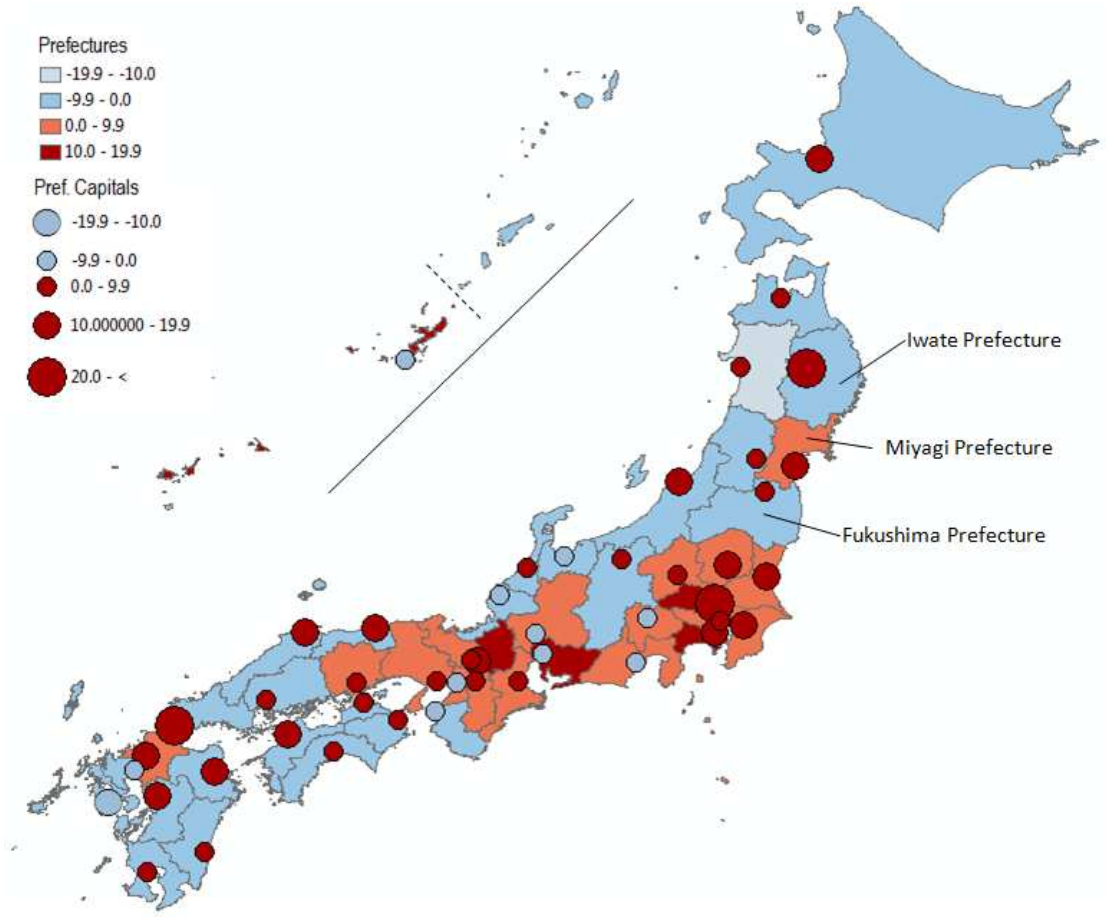
Figure 1: Actual (1950-2000), Estimated (2010), and Projected (2020+) Populations of Japan by Age Group (left hand scale, in millions), and Total Population and Labour Force (right hand scale, in millions).



Source: Statistics Bureau (2011a) and (2011b); NIPSSR (2011) (medium variant projections).

First, the window of opportunity for rapid economic expansion that the 20th century demographic dividend provided Japan has now gone into reverse, as the working age and children's populations shrink in favour of a dramatic expansion in the proportion of older people (Figure 1). Indeed, Japan's demographic decline might itself be seen as a consequence of the rapid expansion that the country experienced in the mid-20th century, producing as it did an equally rapid and sustained slowdown in fertility as living standards rose (see, Bloom *et al*, 2003). The decline of the national population and labour force is expected to continue for three decades at least, reducing socio-economic capacity as well as the state's financial flexibility.

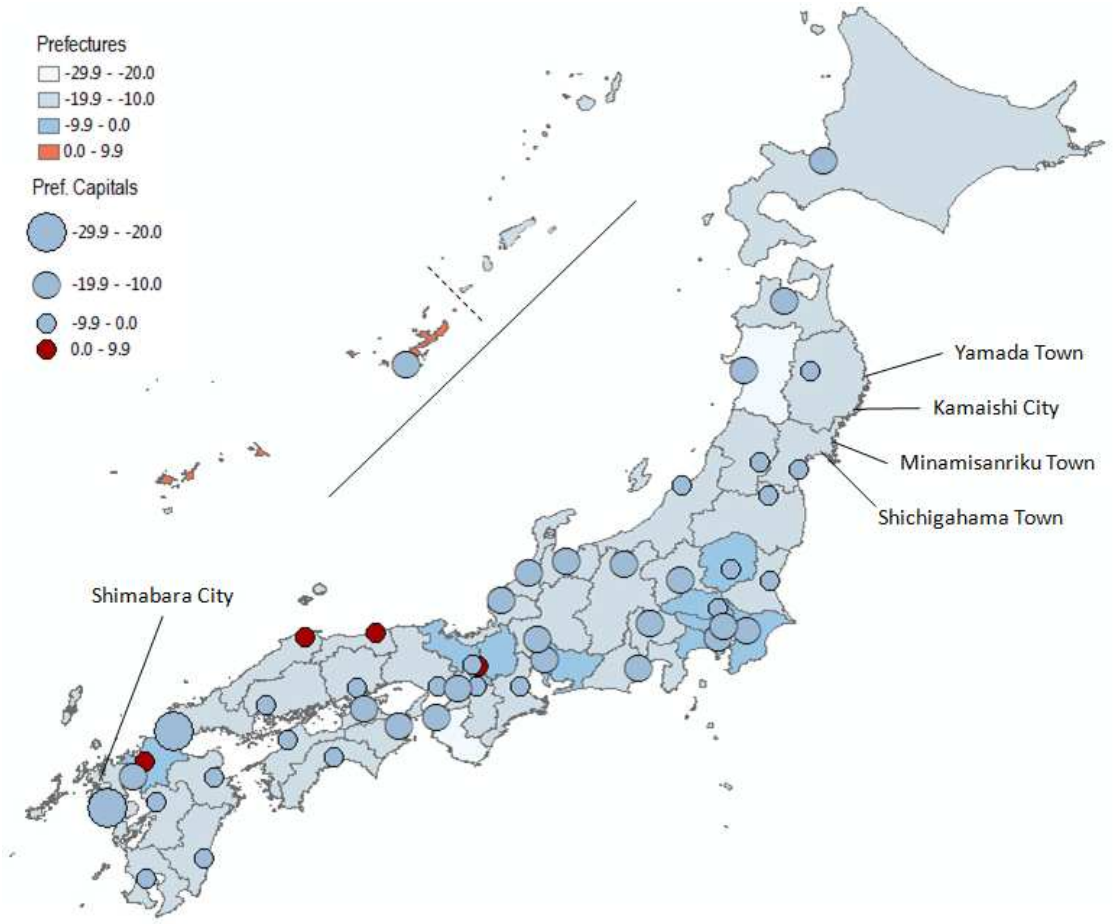
Map 2: Population change in Japan by prefecture and prefectural capital, 1990-2010.



Source: Statistics Bureau (2011a).

Second, until recently depopulation was confined to peripheral regions, as Japan's megacities and regional centres benefited from rural-urban migration (Author, 2011; Map 1). It could be argued that rural shrinkage is but an unfortunate consequence of national economic expansion, in which all Japanese eventually benefit. However, it might be said that urban areas have grown at the expense of demographic shrinkage and socio-economic decline in rural locales, as human capital transferred into the country's megacities to power the factories that drove the 'economic miracle' (Author, 2011). Under national depopulation that scenario of rural shrinkage powering urban and national growth becomes unsustainable, as depopulation broadens to include urban centres (Map 3). Hence, rural communities now face the debilitating prospect of competing against the country's cities, as well as each other, in a zero-sum game whereby one settlement's gain becomes another's loss.

Map 3: Projected population of Japan by prefecture and prefectural capital, 2010-30.



Source: NIPSSR (2003).

Third, in Tōhoku itself, between 2000 and 2010 the combined populations of Iwate, Miyagi and Fukushima Prefectures shrank by 3.5 percent, from 5.908 to 5.708 million people (Statistics Bureau, 2011a). Prior to the earthquake, the Japanese government had forecast that by 2030 the three would shrink a further 791,000 to 4.917 million (13.9%); making a total decline of 16.8 percent (NIPSSR, 2003). It is almost certain that the 11 March disaster will have made the anticipated depopulation more severe, with a total fall of 20 percent (1.181 million) by 2030 being plausible.

Rural regions are also at the centre of another slowly developing crisis in Japan; the parlous state of the nation's finances. As early as the 1960s rural decline as a consequence of depopulation had become recognized officially, and the government began to sink money into regeneration initiatives such as the *jiba sangyō shinkō jigyō*

(Regional Industry Promotion Projects), and the *isson ippin* (One Village One Product) movement of the 1970s (Knight, 1994). While such measures have been part of policy approaches to rural decline since that time, in their aggregate they have not only provided almost no beneficial outcomes, they may have made the situation worse.

Even as government debt spirals beyond 200 percent of GDP (Nakamoto, 2011) the central government continues to pour money into rural infrastructure, ostensibly to provide employment and boost local economies, but also to oil a co-dependent system of patronage and payback (Author, 2011; Feldhoff, 2005; McCormack, 2001 and 2002). In the course of building nearly 100 regional airports, 14,000km of expressways, and more than 2,600 dams this 'construction state' has accumulated huge debts, often with little thought as to whether facilities were needed, while the real concerns of rural people went unheard. Within this emerging system, municipalities felt encouraged and then coerced into taking on more debt than they could sensibly handle in order to maintain their status as shrinking communities and continue receiving subsidies (Author, 2011; Feldhoff, 2002; Katayama, 2008; McCormack, 2002; Mizohata, 2010; MLIT, 2011; Yoshimura *et al*, 2005). The spectacular collapse of Yūbari City in Hokkaido is but one, rather extreme, example of a nationwide crisis in which thousands of communities have either vanished entirely, been merged with stronger neighbours to avoid collapse, or even been sold by their residents for a better life elsewhere (Author, 2011; BBC, 2004; Seaton, 2010).

Into these unfolding crises have come the Great East Japan Earthquake, tsunami and nuclear meltdown, to deal the Tōhoku region the greatest blow to its vitality in historical memory. Having destroyed significant portions of three prefectures, the disaster raises many difficult questions about the structure of governance and policy-making in Japan, the direction of Japan's postwar development, and the degree to which reconstruction plans are affordable and realistic. The rest of the article will explore these issues by examining the magnitude of the disaster and an analysis of major issues that it exposes. The concluding discussion will tie together the themes covered and address the three principles of a safe, sustainable, and compassionate society that Prime Minister Naoto Kan has put forward as his vision for the post-quake reconstruction.

The Magnitude of the Disaster

On 13 March PM Kan described the challenges presented by the Great East Japan Earthquake as the toughest crisis that the Japanese people have faced since the Second World War (BBC, 2011b). Nevertheless, Japan has overcome huge disasters in the past. The Great Kanto Earthquake of 1923 killed 142,800 people, with most of the region's infrastructure being destroyed either in the earthquake itself or the ensuing fires (USGS, 2011b). Millions of Japanese lost their lives in the Second World War, and the American strategic bombing campaign not only razed Tokyo and Yokohama once more, but also flattened more than 60 cities, killing over 500,000 people (Caidin, 1960). Then, of course, there were the atomic bombs dropped on Hiroshima and Nagasaki in August 1945.

Japan's cities were rebuilt quickly, and by the early-1950s the country had recovered its growth trajectory such that by the 1980s it was being praised as having the most vibrant economy in the world (Vogel, 1979). Later, in 1995 the Great Hanshin Earthquake killed 5,502 and injured 36,896 (USGS, 2011b), devastating Kobe and requiring probably the most expensive reconstruction operation in world history, costing approximately USD64 billion in damage to capital stock; though the regional economy had almost completely recovered within 15 months of the disaster (Horwich, 2000).

Without wishing to portray the Japanese people as the victims on all these occasions, each time they have responded positively and vigorously to their adversities. The Japanese are a resourceful and knowledgeable people, and possess deep wells of self-discipline and determination, and these attributes will stand them in good stead. Japan and Tōhoku will survive. The question then becomes, how and in what form, given that both were shrinking prior to March 2011?

On 11 April the government announced the formation of an earthquake Reconstruction Design Council, which had its inaugural meeting on 14 April (Prime Minister's Office, 2011a). Headed by Professor Makoto Iokibe, President of the National Defense Academy, the Council has been assigned the ambitious task of designing a 'grand vision' for the reconstruction of Tōhoku which is not 'stuck with[in] a traditional

framework', and which would be 'highly regarded in history' (Prime Minister's Office, 2011b). Professor Iokibe was involved in city planning for Kobe after the Great Hanshin Earthquake, and the Council and sub-committee is composed of experts from relevant fields, including architect Tadao Ando, who also worked on the Hanshin reconstruction plans, and Professor Takashi Mikuriya of Tokyo University, who has researched the Great Kanto and Great Hanshin Earthquakes (Prime Minister's Office, 2011b, p. 2).

In its rapid response to the initial humanitarian crisis in Tōhoku, the government appears to have learned from the Kanto and Hanshin earthquakes where, in the latter case, even yakuza crime syndicate members were reported to have rendered assistance more rapidly than the JSDF, and the government refused desperately needed offers of overseas assistance (Fukushima, 1995). Moreover, the poor initial response was later compounded by a top-down approach to reconstruction that favoured infrastructure recovery over human welfare, and which did not leverage the event into an opportunity to tread a new path in Japan's development (McCormack, 1996; Miyamoto, 1996). Early indications suggest that the Design Council has transferred lessons from Tokyo and Kobe for the post-disaster reconstruction planning phase too, when on 14 April Iokibe announced after the council's first meeting that it had developed the following five point basic approach (Prime Minister's Office, 2011a: 2).

1. The Council should not be partisan.
2. Discussions should have 'local ownership'.
3. Discussions should result in 'creative' outcomes.
4. Plans should have nationwide support.
5. The plan should give 'hope for the future'.

In addition, the government has established an office for managing the economic impacts of the nuclear crisis, which will work with TEPCO to compensate those affected. TEPCO has offered JPY1 million as a preliminary payment to each household directly affected (TEPCO, 2011b), and outlined a plan for those who have suffered losses due to negative rumours, such as tourism businesses in Fukushima Prefecture and farmers and fishermen in Fukushima, Ibaraki, Gunma, and Tochigi, and some areas of

Chiba (Daily Yomiuri, 2011). A nationwide Disaster Reconstruction Tax and reforms to the existing tax system are being discussed, and Kan is basing his thinking on the assumption that this is a national-scale disaster in which all Japanese citizens have a role.

Although the wider economic impacts are substantial, they are not catastrophic: Tōhoku accounts for just 6.4 percent of Japan's GDP (Dickie, 2011). Thus, while Honda reported on 28 April that quarterly results for June 2011 would show a 50 percent production decline (NHK, 2011d), on 1 June Toyota announced that its worldwide year on year sales for 2011 would match 2010, indicating a sharp rebound (Dawson, 2011). However, the number of domestic and foreign tourists has dropped, by 50.3 percent in March and 62.5 percent in April 2011 (JNTO, 2011), and farming and fishing communities in Tōhoku have suffered income losses due to radiation and loss of public trust in food safety. Livestock within the evacuation zone has also been abandoned, leading to starvation and, after 24 April, culling (Jiji Press, 2011); while animals that remain alive have lost their economic value.

In April 2011 the Bank of Japan downgraded its quarterly assessments for seven of Japan's nine regions, citing supply-chain and production difficulties, as well as cautious sentiment (BOJ, 2011). Early estimates put the recovery cost at USD200 billion (Economist, 2011), but this will rise, as the nuclear cleanup and decommissioning were not included in these calculations. Power shortages will also slow recovery. The disaster, and the mounting inherited problems of the postwar system that it unveils, has even prompted Takashi Mikuriya to urge for its recognition as a watershed event; the end of the 'postwar' and beginning of the 'post-disaster' era (Dickie, 2011). But, when we consider that the economic cost will be in the region of 3-5 percent of GDP, as against 86 and 29 percent for previous watershed events such as the Second World War and Great Kanto Earthquake respectively, is it more realistic to conclude that this disaster was actually too small for the emergence of the conditions necessary for the era-changing experience that Mikuriya calls for (Dickie, 2011)? Instead, might this crisis come to be seen as a major staging post along the long route of regional decline that began with the establishment of the 1955 system?

(Re)Constructing Tōhoku: An Initial Assessment

To begin with, it is likely that municipal boundaries in Tōhoku will have to be redrawn, and that some destroyed communities in low-lying areas will be amalgamated into 'compact' towns and relocated to higher ground (NHK, 2011a). Public infrastructure may be scaled down to account for community shrinkage prior to and after the earthquake (NHK, 2011a). Reconstruction will also need to acknowledge the high proportion of older residents with special needs (NHK, 2011a). Beyond this it is still unclear how the built environment will be redesigned, what considerations the design will be based upon, and what levels of investment are needed to protect from future disasters.

As an example of what is under consideration, on 14 April 2011 NHK (2011b) presented a report from Minamisanriku Town in Miyagi Prefecture, which was almost totally destroyed, with whole areas being swept away (photos 1 and 2). Miyagi prefectural government has produced two scenarios for the town's reconstruction and invited comments from residents and municipal officials. The plans describe the viability of the region's fisheries, and base economic recovery around marine products. The prefecture plans to rebuild the port, turn the low-lying coastal area into a green belt and park, and place residential and commercial zones on higher ground (NHK, 2011b). More parkland may be created on specially raised areas, and these will act as evacuation points. However, in its totality such a scenario may promise more in its conception than deliver in its execution, thereby raising public expectations to unrealistic levels; the town's population shrank 6.5 percent in just the five years between 2005 and 2010, from 18,641 to 17,431 persons (Statistics Bureau, 2011a), and as of 11 April 2011, 9,500 persons had been evacuated to emergency shelters, 398 were confirmed as having died, and 800 were missing (Asahi Shinbunsha, 2011a). In addition, the photographs show that the coastal area has subsided below sea level and may need to be reclaimed, and there is not enough contiguous flat land in the surrounding hills to rebuild the settlement in the way that planners envisage.

Photos 1 and 2 show aerial shots of Minamisanriku Town, Miyagi Prefecture before (2001) and after (27 March 2011) the tsunami.

Source: Sankei Shinbunsha (2011), p. 31; Also Available from: SankeiPhoto Website: http://photo.sankei.jp.msn.com/kodawari/data/Earthquake/201103/31/kuusatsu1/. Reproduced by kind permission of Sankei Books.

Another NHK report (2011c) focused on Shichigahama Town in Miyagi, which is the smallest municipality by land area in Tōhoku, and whose population fell by 3.1 percent (from 21,068 to 20,419) between 2005 and 2010 (Statistics Bureau, 2011a). The Mayor says that many residents would prefer to rebuild on higher ground, but regulations prevent this because most of the higher land (60 percent of the town's land area) lies within an urbanization restricted zone created to preserve its natural beauty and ecology. This area is noted for its tourism potential, which the local authorities want to develop, but which might be compromised by the location of residential communities. There exists a tension, therefore, between the need to redesign the built environment on higher ground, and the wish to retain the area's natural heritage and develop its tourism potential (NHK, 2011c). The question that emerges is: to what extent do reconstruction authorities prioritize the long-term survivability of human settlements that were already shrinking prior to the disaster over the sustainability of the region's environment, on which the residents also depend for their survival and prosperity?

The same report moves on to Yamada Town, Iwate Prefecture, where almost the entire town was submerged and has effectively ceased to exist (NHK, 2011c). The fishing industry has gone and the town lacks the finances even for a modest start in rebuilding. The town's tax revenues total approximately JPY1.2 billion in a normal year, but in 2011 condolence money for deaths due to the disaster will cost JPY1 billion. The mayor says that bold measures are needed if Yamada is to survive, but that the regulatory and tax structures do not allow for the special measures needed by these communities (NHK, 2011c).

The historic settlement of Kamaishi City is located along the scenic Sanriku coast, which is characterized by a series of rias which offer natural harbors and shelter (at least from storms) for coastal communities, and which provide ideal geographical and ecological conditions for marine products industries (photos 3 and 4). The city had recently completed construction of a USD1.5bn defense breakwater, reputedly the deepest in the world, as part of the its revitalization and disaster prevention plans; its population has also been declining; by a staggering 7.9 percent between 2005 and 2010 (Statistics Bureau, 2011a). The main populated area of the city, along with the famous

Kamaishi steel works, is located at the head of a ria and it is likely that, as the tsunami advanced it was ‘funneled’, raising its height, and breaching the breakwater destroying the port area (Onishi, 2011). Because the port buildings had also been compacted by the narrow topography and were densely nestled on the valley floor, the water level was probably forced still higher as it advanced inland and through the narrow streets. Reports suggest that the tsunami measured 9 meters in the port area (Asahi Shinbunsha, 2011a); though, a massive tsunami of up to 20m or more appears to have inundated smaller communities along the coast, such as Unosumai (photos 3 and 4)(Nakamura, 2011). Fujii and Satake’s (2011) simulated tsunami calculations show the maximum height along the coast of Kamaishi passing 25 meters and going off the scale on two occasions.

In April it was estimated that 1,308 people were either dead or missing in Kamaishi, rendering a staggering 11 percent aggregate decline in the population since 2005 (Asahi Shimbusha, 2011a). Moreover, many citizens currently housed cheek by jowl for months in emergency shelters are doubtless currently pondering their futures, while others have already moved away for good. Low-lying parts of the city, including areas which had been inundated in previous tsunami, have been swept away. Farmland has been rendered unusable by seawater, subsidence, and the deposition of ocean sludge. The city’s fishing fleet, on which much ‘hope’ for community revitalization had been placed (Genda and Nakamura, 2009; Nakamura, 2008) is destroyed. Ships have been dumped inland, with one 6,000 ton freighter, the MV Asia Symphony, left straddling the port wall (Gilligan, 2011).

Photos 3 and 4 show aerial shots of the Unosumai district of Kamaishi City, Iwate Prefecture before (2007) and after (29 March 2011) the tsunami.

Source: Sankei Shinbunsha (2011), p. 31; Also. Available from: SankeiPhoto Website: http://photo.sankei.jp.msn.com/kodawari/data/Earthquake/201103/31/kuusatsu1/. Reproduced by kind permission of Sankei Books.

Despite the damage and debris, and the procedural and regulatory obstacles, recovery has begun. Nippon Steel restarted its Kamaishi works on 12 April using previously accumulated inventory; but it is uncertain how long the plant will remain open (Kyodo News, 2011b). Many of the employees are either dead or missing. 42,000 people in Iwate alone have lost their jobs and are receiving benefits which can be claimed for a maximum of 360 days (NHK, 2011e). Though Kamaishi was known for difficult employment conditions due to the run-down of the steel works (Nakamura, 2008), the pre-11 March 731 businesses employing approximately 9,000 people in the city have been reduced to 413 businesses employing 4,000. Most of these are small enterprises and have no income to pay wages or service debt, yet employees need wages to pay mortgages and for purchasing goods and services from local stores. A vicious cycle of economic collapse awaits unless cash begins to flow through Kamaishi's ruined economy.

Competition for land for reconstruction is already evident in Kamaishi. Ruined businesses need raised flat land serviced by utilities to rebuild factories and warehouses, and they need to do this within 360 days to retain employees, upon whose knowledge businesses depend. However, the city government's priority is to use flat land in higher areas for 3,000 units of emergency housing (NHK, 2011e). Although neither Kamaishi nor Tōhoku have disappeared, much work remains in resolving the contradictions involved in community reconstruction in this already depopulating and economically depressed region.

One idea for how reconstruction might proceed has emerged from Shimabara City in Nagasaki Prefecture, which was deluged by water and volcanic debris during the eruptions of Mt. Unzen in the 1990s. There, affected housing was raised by 9 meters by laying compacted debris and soil. However, the report noted that these measures cost more than JPY9 billion, and the area concerned is far smaller than that affected in Tōhoku (NHK, 2011b), being only one part of a single settlement. It is doubtful, therefore, that land-raising and community reconstruction of this type will be employed across Tōhoku. More likely is that a range of options will be implemented according to risk assessment and cost considerations. For example, many taller concrete structures

such as public buildings, offices and apartment blocks managed to survive even the fiercest assault by the tsunami (see photos). Replacing densely packed low-level housing in port areas with widely spaced apartment blocks surrounded by gardens, leaving the bottom two floors for car parking, may be more cost-effective than, and just as safe as, moving the community onto artificially raised land. Liquefaction.

While the idea of relocating residents into compact communities on raised land appears ideal many problems and contradictions lie along the route to achieving this. Given the existing topography, it is difficult to see where these new communities can be located, if we consider the number of people and the associated public infrastructure and industrial and commercial zones (see photos). Japan's rural and coastal landscape, or the *satoyama* and *satoumi*, has been carved as much by humans as by nature, with broad flat silted valleys at or near sea level made suitable for wet rice cultivation surrounded by steep forested mountainsides. Settlements have developed on the low-lying areas because farmers live on and alongside their land, and fishermen near their boats, and the mountainsides are susceptible to landslips during the torrential rains that accompany the autumn typhoons.

There is also a danger that the overall welfare and preferences of local people will not be heeded. While the idealized image of the pre-modern *ie* and *mura*, or household and village, may be disappearing from the Japanese rural landscape in the 21st century, planners must include citizens' wants and needs if the new communities are going to 'work' for local people. In particular, the emotional and psychological welfare of citizens in the post-disaster era needs to be considered, and especially that of older people. Research from Kobe will be useful for the Design Council; though the council will doubtless understand that Kobe is a densely populated cosmopolitan trading port. Tōhoku it is not.

Raising Uncomfortable Questions About Governance in Postwar Japan

The earthquake and its aftermath are a grim reminder of some deep-seated and uncomfortable questions that Japan's shrinking regions, and indeed the state and nation as a whole, have inherited from the 1955 settlement and which urgently demand

answers. Of the 13,135 bodies identified and assigned a cause of death by 11 April, 65.2 percent were aged 60 or over and 92.5 percent were by drowning (Japan Times, 2011b). Mainly for reasons of mobility, many older people had been unable to reach safety in time, and it is reasonable to assume from this that a high proportion of disabled people also unnecessarily fell victim.

The high rate of older victims points to the presence of wide differentials within Japanese society, highlighting misgivings about whether the state and society offer adequate care and protection of the country's most vulnerable citizens and whether a society of gaps – *kakusa shakai* – is emerging in the 21st century (see, Yamada, 2006). In addition, many older people are suffering 'relocation damage' from living in emergency shelters and being evacuated away from their homes, families and neighbourhoods. One group of 39 older people who were moved from a care facility in Minamisoma City, Fukushima Prefecture in the wake of the nuclear crisis endured constant anxiety, depression, and hyper-tension as they were moved first to a temporary evacuation facility in a nearby elementary school gymnasium that had no electricity, then by bus to a care facility in Yamagata Prefecture in the middle of the night, and finally to another facility in Minamiuonuma City in Niigata Prefecture when it became clear that the care facility in Yamagata, which was charging JPY300,000 per night to accommodate the group, would wait no longer for confirmation of who out of Minamisoma City or Fukushima Prefectural governments would pay for their care (NHK, 2011f). Group members also rarely receive visits from family members who endure difficult circumstances of their own; some relatives are unable to visit because they had abandoned their cars when they were evacuated from the radiation zone and are not yet permitted to retrieve them. Moreover, lack of personal care, exercise and entertainment in temporary accommodations add to the depression and confusion among the group (NHK, 2011f).

The nuclear meltdown also exposes the fragility and contradictions in Japan's energy policy and the misplaced optimism of postwar assumptions that economic expansion and advanced technology would provide solutions to the problems associated with Japan's accelerated economic development model. Fukushima Daiichi is not the only

nuclear facility in Japan that is vulnerable. The massive Kashiwazaki-Kariwa complex in Niigata Prefecture, also owned by TEPCO, sustained damage when a magnitude 6.6 earthquake occurred close to the plant in July 2007 (USGS, 2011b). Worrying too is that the Hamaoka complex in Shizuoka Prefecture, owned by Chūbu Electric Power, sits near the Nankai Trough subduction zone, where a magnitude 8+ earthquake is predicted soon (Map 1) (Matsumura, 2010; McCormack, 2011).

Since deep geological storage has not achieved public acceptance, the government also has yet to devise a long-term solution to the question of nuclear waste (and since 11 March 2011, melted fuel and irradiated debris, soil and water). By 2008 Japan had accumulated 666m^3 of high level waste and 229,000m^3 of low and intermediate level (IAEA, 2011), while the country possesses 11,806m^3 of remaining disposal capacity. Some of this waste will be hazardous far into the future (Pu239, the principal plutonium isotope in nuclear fuels, has a half life of 24,000 years; though Pu242, present in spent fuel at around 3-7% of Pu at discharge, has a half life of 374,000 years (WNA, 2009)). Hence the practice of accumulating spent fuel in pools next to nuclear reactors, which then presents a hazard when power plants suffer seismic damage. How did Japan's energy policy come to be so dominated by nuclear power?

At the centre of Japan's 'iron triangle' lies the nuclear industry, which is overseen by METI and a raft of other interwoven agencies including NISA, the agency responsible for ensuring nuclear safety. Instead of being independent of the government and TEPCO, NISA is under the direct supervision of METI, whose job is to promote the development of nuclear energy as well as the expansion of the electric power industry (Meyer, 2011; NHK, 2011g). More than any other, the nuclear industry – and TEPCO in particular – symbolizes the co-dependent network of relations between the government, bureaucracy and corporate elites; relations which are maintained and strengthened by the practice of *amakudari* (descent from heaven), whereby elite bureaucrats retire to lucrative advisory roles in corporations such as TEPCO, and are therefore unable to exercise effective control while employed in regulatory roles (Colignon and Usui, 2003; Duffield and Woodall, 2011; Fukue, 2011; Okuda, 2011). Indeed, within Japan's so-called 'nuclear village' this network includes the scientific establishment,

mainstream media, think tanks and advisory bodies, and even labour unions (Dusinberre, 2011; Meyer, 2011).

Under this administrative system, nuclear energy has also been used as a proxy for funneling state subsidies into the regions, to generate employment and shore up an eroding rural political base, and for subsidizing the regional power companies; a policy which has long-term consequences for the vulnerability of politically weak areas to natural disasters. For example, in building the fuel reprocessing facility at Rokkasho in Aomori Prefecture, which was also developed in part to delay deciding the fate of the accumulating mountain of nuclear waste (McCormack, 2011), the government 'showered' the locale with 'economic assistance' measures, which included JPY38 billion given for 'residual health risks' and JPY18 billion to 'upgrade farming and improve village life' (Dauvergne, 1993, p. 587). Indeed, Rokkasho's development has reportedly cost the Japanese taxpayer around JPY19 trillion (McCormack, 2011).

Emblematic of the status of the nuclear industry within the iron triangle has been the government responses to violations of safety procedures by TEPCO and reports of bureaucratic collusion between the authorities (METI and NISA) and TEPCO in keeping this information veiled from public view (Okuda, 2011; Onuki, 2011). Revelations that TEPCO had concealed evidence of cracked reactors and incorrect procedures at Fukushima Daiichi and Kashiwazaki-Kariwa led to the company eventually admitting more than 200 other incidents of false technical reporting over more than two decades, and which also exposed systemic lax oversight by the authorities in checking and investigating TEPCO's data submissions (Cooke, 2009; Meyer, 2011; Okuda, 2009). Indeed, reports that TEPCO continues not to heed safety concerns at the stricken Fukushima Daiichi plant mount as workers complain about inadequate safety equipment and that TEPCO is hiding behind contracts with sub-contractors, who employ so-called 'nuclear gypsies' from vulnerable groups and discriminated communities as temporary workers, to shield itself from public scrutiny (Horie, 2011; Jobin, 2011).

Since the 1970s, when the nuclear share of Japan's electricity was 3 percent, the

government has nurtured nuclear energy under the assumption that the country lacks significant energy resources of its own and is therefore vulnerable to political volatility overseas (Kelly, 2005; Samuels, 1986). Under the government's now discredited 2010 Basic Energy Plan there were plans for 14 new reactors, which would have raised the nuclear share from 29 percent in 2011 to 50 percent by 2030; or from 10 to 24 percent of Japan's primary energy mix (Duffield and Woodall, 2011, p. 3743; McCormack, 2011).

In a country which possesses abundant geothermal energy, an average of 1,800-2,100 hours of sunshine per year at a latitude equal to Spain, and which possesses some of the most plentiful wind, tidal, and wave energy resources in Asia, it is incorrect to state that Japan lacks domestic energy sources. More accurately, Japan lacks fossil fuels, and the state has invested huge sums in developing nuclear power as a substitute while, according to PM Kan (2011a), the electric power companies have treated renewables as a 'nuisance'; in a country with the highest density of magnitude 8+ earthquakes in the world since 1900 (USGS, 2011b). In the process, the relationship between the government and the electric power industry has deepened, to the point of fostering what amounts to a catastrophic disregard for public safety, and which has crystallized in the accident at Fukushima Daiichi. Will the events of March 2011 come to be seen as the watershed moment that some have advocated, symbolizing a change of course towards a transparent and accountable government and nuclear industry, a conversion to clean renewable energies, and the restoration of hope in Japan's shrinking regions?

Discussion: Towards the (Re)Construction of a Safe, Sustainable, and Compassionate Society in Japan's Shrinking Regions

On 11 April, one month after the earthquake, PM Kan issued an address that was carried in the *New York Times*, among other publications worldwide (Kan, 2011b; 2011c). He thanked those who have helped Japan face this historic crisis and he expressed deep regret for the nuclear accident. In assuring that Japan will contribute to preventing such accidents in the future, Kan presented:

… a two-pronged challenge: responding to rising global energy demand and striving to

reduce greenhouse gas emissions to combat global warming. Going forward, I would like to present a clear vision to the world — that includes the aggressive promotion of clean energy — that may contribute to solving global energy issues. (Kan, 2011c)

Addressing regional reconstruction, Kan wrote that 'this difficult period' will provide a 'precious window of opportunity to secure the "Rebirth of Japan"', and that he wished to 'realize a forward-looking reconstruction that gives people bright hopes for the future' (Kan, 2011c). He established three principles for the reconstruction.

1. To create a regional society that is highly resistant to natural disasters.
2. To establish a social system that allows people to live in harmony with the global environment.
3. To build a compassionate society that cares about people, in particular, the vulnerable.

Significantly, Kan does not mention the economy, instead prioritizing societal recovery and environmental sustainability. Moreover, he sees potential in leveraging the reconstruction of Tōhoku into an opportunity for treading a new path for rural Japan. Kan's vision is ambitious and, coming at a low point in Japan's history, it is inspiring. But is it realistic?

Addressing Kan's three principles in turn, it is probable that some successes will be achieved, but that entrenched systems and structures will prevent a full realization. First, in terms of disaster preparedness and community safety, central and municipal governments have learnt from the past and this process is ongoing. Existing defensive infrastructure is being improved, such as at Hamaoka, and new defenses being built. Mistakes in tsunami evacuation are being examined and procedures being enhanced. New technologies are being developed and employed. Beyond this, community reconstruction will also make some settlements safer by building compact communities on higher land, and by developing safer buildings and neighbourhoods in low-lying areas. The top-down delivery of 'hard' reconstruction will be efficient and effective; Japan's 'construction state' is geared for precisely this task.

However, only so much can be done within the financial, technological and topographic limits of early 21st century Japan, and expectations have been raised, perhaps unrealistically. There will be competition for financial, material, technical, labour and land resources within Tōhoku as the reconstruction gets under way, and between Tōhoku and other shrinking regions in Japan, which will drive up costs and constrain the speed and scope of the recovery. It is also certain that disasters will occur again, though perhaps with fewer losses. Worrying, therefore, is the fact that Japan appears to be entering an era of greater seismic intensity (Ishibashi, 2011; USGS, 2011b), which will require proportionately greater investment in defences.

As we have seen, ahead lie many hurdles and contradictions, some human-made, that must be negotiated for successful 'hard' reconstruction to take hold. Pragmatic compromises between divergent interests, established procedures and regulations, and deeply held principles will be required. It is likely that, under these circumstances, some citizens and communities will be disappointed, and that environmental needs will be subordinated to re-establishing housing, infrastructure, and community functions. Moreover, with the country struggling under massive debts and the national population ageing and shrinking, it is unrealistic to hope that reconstruction in Tōhoku can be transposed into a generalized revitalization of rural Japan. More realistic, in fact, is the potential for further decline.

The second principle is more difficult to assess, partly because it is unclear what constitutes living in 'harmony with the global environment.' Looking only at electricity generation and consumption, Japan is already comparatively energy efficient, but the loss of nuclear capacity will require, in the medium-term, increased dependence on fossil fuels. Hence, the government has asked for a 15 percent reduction in personal consumption. Given the measures already implemented – from wearing looser clothing through using fewer escalators, lifts, and lights – and the high degree of public cooperation, this may be achieved. Over the longer term, it is also possible that Japanese will be moved to reconsider and change their lifestyles.

Encouraging is the news that the government will review energy policy and intends to

develop renewables to 20 percent of electricity generation by the 2020s (Ito, 2011). But, to what degree will fossil fuel consumption be reduced? The government will not abandon nuclear energy, but the loss of a planned 7.456GW at Fukushima Daiichi, less nuclear capacity elsewhere, and the difficulty of persuading municipalities to accept new stations and/or reactors, will all restrict Japan's ability to replace fossil fuels. Moreover, a shift towards renewables will not come about suddenly, and will cost money that Japan needs for recovery and reconstruction.

Third, achieving a compassionate society via the 'soft' reconstruction of Tōhoku's broken communities will be challenging; the proportion of older people in Japan is set to rise beyond 30 percent in the coming decade, and to more than 50 percent in many rural areas. There is therefore space for civil society groups to fill the widening gap between state objectives and the willingness of taxpayers to fund them. In addition, there are growing demands for greater public consultation in municipal governance and planning. But progress in achieving community involvement has been slow and top-down local governance mechanisms still predominate (Sorensen and Funk, 2007). Although the spontaneous appearance of volunteer groups after the Hanshin earthquake was remarkable and their role has been prominent in Tōhoku, the evidence suggests that the authorities are happy for volunteers and civil society groups to assist during disasters, but less so in normal times. However, the physiological and psychological effects of this disaster on victims will be deep and long-lasting, and experience from Kobe shows that post-traumatic stresses may increase in intensity and scope if not adequately tackled (Iwai, 1999). The combined needs of the affected communities in Tōhoku are very great, and cannot be quickly resolved. Civil society groups should be encouraged to remain involved over the long term, first, in order for the short-term 'soft' reconstruction in Tōhoku to achieve success and, second, for the participation of civil groups in social maintenance and improvement to become normalized across the country over the longer term.

To that end, it is worth noting that since the early Meiji period (1868-1912), Japan's development has been achieved via a top-down programme of purposive accelerated socio-cultural modernization and economic expansion (Tominaga, 1990). This required

the development of a set of institutions that could execute the government's strategic vision through a coordinated mobilization of the nation's resources and people. Since that time Japan has not wavered from this path. In the postwar era the 'iron triangle' of political, bureaucratic and corporate elites became institutionalized such that its structure and behaviour is now deeply embedded within the nation's culture. Japan does not right now have a culture or set of institutional arrangements to be able to realise a bottom up reconstruction process. Such a reversal in the principles and structure of national and local governance requires deep cultural shifts as well as an organic, and at times chaotic and confrontational, process of institutional evolution. Civil society does not just happen, it must be achieved; and it also cannot and will not be mandated into existence via a sort of self-contradictory orgasm of political self-destruction on the part of the government and bureaucracy. Although Japan has been progressing towards a more open and accountable system, and the disaster in Tōhoku will doubtless hasten this, it will require vigilance, struggle and time – perhaps the passing of a generation – to play out.

Conclusion: Watershed or Marker? Acknowledging the 11 March 2011 Disaster as a 'Moment' in Japan's History

On 7 June 2011 the Japanese government submitted a report to the IAEA on the nuclear meltdown, acknowledging that 'consistent preparation for severe accidents was insufficient' and listing 28 lessons learned from the accident; including lax requirements on TEPCO to ensure safety at its reactors (Prime Minister's Office, 2011c, p. 41). Separately, on 24 May the government had established a third-party panel to investigate the events at Fukushima. Headed by Professor Emeritus Yotaro Hatamura of Tokyo University, an expert on accidents and organizational failures, the 12 member panel will submit its final report in the summer of 2012 (NHK, 2011g). Among four areas of enquiry, one will examine social and systematic factors, including the involvement of political circles, administrative organizations and private enterprises over a span of thirty to forty years. Another will investigate safety procedures and regulatory systems, including the role of NISA. PM Kan wishes the committee to place everything and everyone, including himself, under close scrutiny; while Hatamura has stressed that the panel will not be influenced by special interests (NHK, 2011g). However, the

government has not given the panel legal powers to require testimony or force the submission of documents and, in order to promote transparency no one's testimony will be subject to legal prosecution (Japan Times, 2011c).

The 11 March triple disaster was a 'moment' in Japan's history. Whether it will come to be regarded as a watershed event will depend on four outcomes. First, the extent to which 'hard' and 'soft' reconstruction solutions in Tōhoku will be made possible, and then transferred to other shrinking regions, is dependent on the recommendations of the Reconstruction Design Council. Second, the development of a transparent and accountable nuclear industry as a step towards the deconstruction of the iron-triangle will depend on the recommendations of the nuclear accident investigation panel. Third, the implementation of these two committees' recommendations will depend upon which party is in government and who is Prime Minister. Naoto Kan is likely to resign before autumn 2011, and the LDP may force a general election that returns them to power. With its roots in the formation of the 1955 system, the LDP's enthusiasm for a break-up of the iron-triangle is open to suspicion. Fourth, the development of a civil society which can hold the government to account on its promises depends on the willingness of ordinary citizens to enforce their beliefs and values on the political, bureaucratic and corporate elites, not on the top-down imposition of government decree, however benign; such a process would be self-contradictory. This can come, among other methods, through the deployment of effective citizen challenge via the legal system. If TEPCO, NISA, METI and other bodies are shielded such that those affected by the disaster cannot somehow assert their moral right to be recognized legally as victims, then the Japanese people may lose the opportunity to transform the earthquake, tsunami and nuclear meltdown into a watershed event. Instead, 11 March 2011 may come to be regarded as but one more (major) marker along the road towards the collapse of Japan's rural society.

In concluding this article I wish to express my deepest sympathies and condolences to the victims of the Great East Japan Earthquake, and to add my contribution towards the restoration of a vibrant society in Tōhoku, the revitalization of Japan's shrinking regions, and a fundamental re-ordering of Japanese political life.

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[1] Electricity distribution in Japan is divided into two regions, which are separated along a line that cuts roughly midway across the island of Honshu. North-east of this frequency divide electricity is distributed at 50Hz, whereas south-west of the divide it is 60Hz. Hokkaido is within the 50Hz region, but the cable linking Hokkaido with Honshu under the Tsugaru Straits has limited capacity of approximately 600MW.