The Chinese Disaster Management Mechanism

*Sheo Nandan Pandey**

Geographic position, climatic features, and geological structures cause natural disasters in almost cyclical order in China. Man-made disasters such as the SARS epidemic add a new dimension to the over all woe of a nation which is home to 18.5 per cent of the world population. The paper explores the extent of the face lift achieved by the People's Republic of China (PRC) from once being known as the "Land of Famines" and the "Land of Death", and, in particular, the positive contribution of the People's Liberation Army (PLA) in the whole gamut of disasters. The findings highlight the otherwise avoidable chinks in the Chinese model.

Introduction

China has been ravaged all through its history by an array of natural disasters *(tiān zāi)* with enormous human and material costs. These are perennial and stem largely from China's characteristically diverse geographic position, land forms, climatic features and geological structure.[1] It bears testimony to Heinz Pagels' postulate of the near "nonlinearity of human existence" in China, which is the home to 18.5 per cent of the 7 billion strong world population today.[2] Man-made disasters (*rén huò*) in different forms and shapes constitute altogether a new frontier of concern.

For most part, as Cambel's "Chaos Theory" (1993) suggests, natural disasters are but inevitable. This is for the simple reason that the endogenic (tectonic) and exogenic (meteoric) processes, responsible for maintaining the balance in the landscape, can seldom be predicted with precision, much less manipulated at will. All knowledge of seismology, volcanology, river hydrology, and geomorphology can not promise more than a good guess of future events.[3] Depending on resilience levels, made possible through an array of interventions, the populace of the vulnerable areas can thus hope for reduced trauma. They cannot altogether escape their plight. Man-made disasters carry a different connotation because it lies within human competence to prevent them. Chance occurrence is a different matter.

* **Dr Sheo Nandan Pandey** has richly contributed to area studies, in particular *Hanxue* (Sinology), Defence and Security Studies, Education, and Meta-evaluation. Before superannuating as Officer on Special Duty (OSD) with the National Technical Research Organisation (NTRO), he served in Ministry of Home Affairs, Ministry of Human Resources Development, and the Ministry of Defence. He is fluent in modern standard Chinese (*Pǔtōnghuà*).

China has had more than its fair share of natural as well as man-made disasters for long. More than 70 per cent of its big cities, with 50 per cent of its population accounting for 75 per cent of it gross domestic product (GDP) are located in disaster-intensive areas.[4] Of the world's 10 deadliest disasters in history, China has suffered as many as six, including the top three: the 1931 Yellow River flood, the 1887 Yellow River flood, and the 1556 Shaanxi earthquake[5] with a total estimated death toll of 6.8 million people. In the 1990s and the first decade of the new millennium, on an average, natural disasters in China annually affected 300 million people, destroyed more than 300 million buildings, and forced the evacuation of more than 9 million people.[6] The Wenchuan earthquake in 2008 with a magnitude of 7.9 Mw (moment magnitude scale) and 8.0 Ms (surface wave magnitude) also claimed 87,149 lives while adversely impacting the lives of another 46 million people.

It was therefore necessary for China to experiment and evolve a wide range of disaster management models, which included the age old government-led approach, to greater civil society involvement, and decentralised community participation. This development is based on the Chinese cliché *mōzhe shítou guòhé* (crossing the river stone by stone).

This paper looks at China's disaster management mechanism and explores, inter alia, the flip side of the contribution of the Chinese armed forces, in particular the PLA (*Rénmín Jiěfàngjūn).*[7] As disasters of the same magnitude as that faced by China have an international dimension, the paper also looks at the supplementing and/ or complementing the catalytic role of the international community.

A mix of postulates and prescriptions, contained in the contingency, system, and chaos theories and the 4R approach of reduction, readiness, response, and recovery offer a much needed framework for adjudging the adequacy of the responses.[8] The paper also focuses on Policy and Legal Covers, Early Warning and Research Framework, Resource Mobilisation and Plan Implementation, and the Role and Contribution of the PLA, to gauge the state of preparedness to meet the contingencies.

Policy and Legal Covers

China's Natural Disaster Economic Loss Index (NDELI) stands at 25 above Italy (18) and Japan (23), and below the US (29), Spain (37), and France (48). According to Anna Moss of Maplecroft, the risk intelligence and rating company, it is symptomatic of "high risks".[9] In terms of gross domestic product (GDP), China's per annum economic loss from disasters runs to 3-5 per cent.[10] This is a staggering 25 per cent in terms of the gross national product (GNP).[11] The

economic loss caused by just the Wenchuan earthquake was $85 billion[12]; while the human and social costs are incalculable. Disasters are thus a bane of China's socio-economic life. The phenomenon has had a definite impact on the political life of China as well.

In such a scenario, China has adopted a national policy for strengthening and promoting natural disaster information gathering, prevention, mitigation, and management capabilities. The impetus for this came in the wake of the UN General Assembly observing the 1990s as the International Decade for Natural Disaster Reduction (IDNDR). The 1993 International Conference on Disaster Management, held in Beijing, also provided the much desired context for the declaration of the policy.

In order to provide a legal basis for the emergency management system and cater to long- and short-term policy goals, the Standing Committee of the National People's Congress (NPC), the State Council, and the Ministry of Civil Affairs have since promulgated and implemented more than 30 laws and regulations relating to one or the other set of disasters. The flood and drought cycle have had once earned China the sobriquet of the "Land of Famine". Legendary founders of the Chinese Xia (2070-1600 BC) and Shang (1675-1046 BC) dynasties, Yu the Great (*Dà Yǔ*) and Chen Tang, earned legitimacy for their reigns by fighting floods and handling droughts which their predecessors had failed to do. In modern times, the notable laws and regulations passed to deal with the menace include: the Law of the People's Republic of China on Water and Soil Conservation (June 29, 1991) and the Law of the People's Republic of China on Flood Prevention (August 29, 1997). There are also scores of regulations which, inter alia, include: Flood Control Regulations of the PRC (adopted in 1991 and amended in 2005); Hydrology Regulations of the People's Republic of China (March 28, 2007; and the Drought Control Regulations of the People's Republic of China (February 26, 2009).

As borne out by the different provisions of these laws and regulations, the PRC has gone for comprehensive and long-term plans to thwart the untoward in the form of floods and drought disasters. While the measures stand stout against famines, the catastrophes of flood and drought keep haunting China year after year. In 2011, 13 provinces and autonomous regions in central and southern parts of the country suffered from floods while the others, especially the north-west experienced the worst of drought effects.

Tropical cyclones (typhoons and tropical storms), heat waves, cold surges, snow storms, and dust storms are equally dreadful.[13] All the 11 provincial level units of coastal China from north to south including Liaoning, Beijing, Hebei, Tianjin, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, and Hainan bear their

brunt year after year. Typhoons (*tai feng*) such as *Chanchu* (May 2006), *Bilis* (July–August 2006), *Saomai* (August 2006), *Nesat* (September–October 2006), and *Muifa* (August 2011), quite often stalk the region from early summer to early autumn and cause extensive damage. The severity of the situation prompted China to promulgate the Meteorology Law of the People's Republic of China (October 31, 1999) and pass a host of regulations including Decree No. 348 passed by the State Council on March 19, 2002 to give legal cover to deal with the situation in more than one way. As emergency response to a catastrophe of such huge magnitude is well nigh difficult, if not impossible, without the involvement of the Chinese armed forces, the Chinese State Council and Central Military Commission (CMC) had to pass regulations in June 2005 on the participation of the PLA and the People's Armed Police Force (PAPF). When a savage spell of freezing weather, sleet and snow storms hit southern China in early 2008, the PLA and PAPF deployed "240,000 troops, 1.036 million militiamen and reservists, and flew 226 sorties/ time to undertake the urgent, difficult and dangerous tasks of clearing major lines of communication, rescuing victims and restoring power supply."[14]

China's disaster management mechanism traditionally faces no a less challenge in limiting the damages of wild fires and industrial fires. These have multi-faceted ramifications, including the loss of the sparse coniferous and broad leafed forest cover of just 13.9 per cent. The mean forest area per person is less than 0.11 ha and the stock volume is about 8.4 m. In this scenario, the mean burnt area per annum amounting to around 8.2x105 ha cannot be overlooked.[15] Heilongjiang, Inner Mongolia, Yunnan, Guangxi, Guizhou, and Sichuan provinces suffer such damage most frequently. Industrial fires and mine accidents make for devilish headlines year after year. Chinese legal cover for fire disaster now includes: the Laws of the People's Republic of China on Fire fighting (April 29, 1998); Grassland Fire Control Regulations of the People's Republic of China (March 1, 2003); and, the Fire Protection Law of the People's Republic of China (May 1, 2009).

Seismological disasters in China have been monstrous all through its history. Low and medium intensity tremors remain frequent, while high intensity earthquakes of 2008 Wenchuan type are not rare. In the 20th century and the first decade of the present century, there have been as many as 12 earthquakes with a magnitude of 7 and more on the Richter scale that have claimed 662,436 lives. There were other 15 quakes of less than 7 intensity on the Richter scale. The Tangshan earthquake of 1976 with an intensity of 7.5 on the Richter scale remains so far the deadliest with 242,419 deaths. Death tolls in earthquakes of identical intensity vary widely, depending on various factors including the density of population and the prevention potential of the city. The Wenchuan earthquake of 2008 tops the list in the present century in terms of the death toll.

The Yingjiang earthquake of March 2011 was of 5.4 intensity on Richter scale and caused 25 deaths in the sparsely populated area of Yunnan province.

The Law of the People's Republic of China on Earthquake Prevention and Disaster Reduction (December 29, 1997) provides the much needed legal cover for all interventions. The regulations include: Regulations on the Prevention and Control of Geological Disasters (2003); Regulations on the Handling of Destructive Earthquake Emergencies (2005); and, Regulations on post-Wenchuan Earthquake Restoration and Reconstruction (2008).

Along with the disasters, the PRC has faced the challenge of outbreak of infectious diseases from time immemorial.[16] Over and above the five top killers such as Rabies, TB, Hepatitis B, and Hemorrhagic Fever, it has been facing unprecedented challenges from a new set of infectious disease like Severe Acute Respiratory Syndrome (SARS) and Avian Influenza. Measured on the Wilson-Collmann Scale (WCS), China has faced a large number of events that fall in the range of Category 4, 5, and 6.[17] The legal cover for the same in China now comes from the People's Republic of China on Prevention and Treatment of Infectious Diseases (August 2004), and Regulations on Handling Major Animal Epidemic Emergencies (November 16, 2005).

Environment pollution has, of late, taken a serious turn, and threatens to disrupt China's much yearned for social cohesion and economic growth with a difference. In its recent report, China's State Oceanic Administration (SOA) has acknowledged that 14 of the 18 ecological marine zones China, accounting for over 18,000 square miles of coastal oceanic territory presently stand heavily polluted. It also found that 86 per cent of its estuaries, bays, wetlands, coral reefs and seaweed beds were below health norms.[18] According to a World Health Organisation estimate, over 70 per cent of China's lakes and rivers are heavily polluted. Around 100,000 Chinese die every year from water pollution related illness, and 75 per cent of life claiming diseases in China are linked to poor quality of water.[19] All this is the outcome of the ever increasing solid and liquid waste disposal into the water system. Air pollution surpasses most of the countries in the world. As this situation continues to pervail to the detriment of Chinese life, the PRC has enacted an array of Laws and Regulations to combat its impact. These include: the Marine Environment Protection Law of the People's Republic of China (March 1, 1983); Law of the People's Republic of China on the Prevention and Control of Environmental Pollution from Solid Waste (October 30, 1995); Law of the People's Republic of China on the Prevention and Control of Pollution from Environmental Noise (March 1, 1997); and the Law of the People's Republic of China on the Prevention and Control of Water Pollution (February 28, 2008).

Early Warning and Research Framework

Early warning systems (EWS) and their accuracy theoretically hold the key to varying levels of success in disaster mitigation endeavours. The traditional framework of early warning systems world over normally consists of three phases: monitoring of precursors, forecasting of a probable event, and the notification of a warning or an alert should an event of catastrophic proportions take place. An improved four-step framework is now being promoted by national emergency agencies and risk management institutions around the world. The additional fourth phase is the onset of emergency response activities once the warning has been issued. The purpose of this fourth element is to recognise the fact that there needs to be a response to the warning, where the initial responsibility lies with emergency response agencies.

Pushed to the wall, China is of late setting up three dimensional EWS: Land Based Monitoring System, Ocean and Ocean-bed Based Observation System, and the Space Based Observation System. While yet in the initial stages of development and operation, the Chinese EWS holds promise.

In generic terms, floods and droughts stem from the same root of meteorological disturbances. For real-time EWS, it is imperative to put in place an efficient operational system of information gathering, processing, and dissemination. China has developed a five-leg EWS, consisting of (a) Sky Eyes System *(tiān yǎn qì xiàng zōng hé yè wù xì tǒng)*; (b) Hydrological Information Consulting System for Flood Control *(*fáng hóng huì shāng xì tǒng*)*; (c) Hydrological Information Inquiry System (shuǐ qíng chá xún xì tǒng); (d) National Flood Forecasting System (*zhōng guó hóng shuǐ yù bào xì tǒng*); and (e) Information Service System (xìn xī fā bù xì tǒng).[20] In the bargain, the PRC has a veritable hydrological monitoring network, composed of 3,171 hydrological stations, 1,244 gauging stations, 14,602 precipitation stations, 61 hydrological experiment stations, and 12,683 groundwater observation wells.[21]

A seismological disaster surpasses a meteorological disaster in terms of the catastrophic loss of life and property. The latter, however, remains dominant in terms of frequencies of occurrence and levels of virulence. Earthquake alert systems furnish only a few seconds of warning. Earthquakes begin with tremors called P-waves that have short wavelengths and generally do little damage. They may not even be felt by humans. Seconds later, longer-wavelength tremors known as S-waves occur and inflict damage as they shake buildings and land masses. The gestation in terms of exact number of seconds depends on the distance from the quake's epicentre. Early-warning systems normally consist of seismographs that detect the P-waves and send out electronic alerts. Networks of such sensors improve the accuracy of the systems. One problem with early-warning systems

is that they require many sensors distributed over a wide geographic area; the greater the number of sensors, the more precise the calculation of the quake's epicentre and magnitude, and the earlier the warning. To fill in gaps left by conventional seismic instruments, some researchers have proposed exploiting sensors inside laptop computers to allow them to serve as distributed P-wave sensors.

While there is reckonable development in EWS theory and technology, China failed squarely in its bid at least in the case of the May 12, 2008 Wenchuan quake which had Mw 7.9 main shocks. It did not work satisfactorily in predicting secondary disasters either to mitigate, much less neutralise, the direct and indirect economic loss and adverse social impacts. Chen Jianmin, Director, China Earthquake Administration (CEA) has been candid in accepting China's comparative inferiority in EWS.[22]

China's EWS for seismic disasters draws strength from a network of Disaster Remote-sensing Monitoring System (DRMS) that use small satellites named Constellation A and Constellation B, and Earthquake Monitoring and Forecasting System (EMFS) that gathers and analyses data from 937 fixed seismic stations and over 1,000 mobile seismic stations. China has also set up 1,300 earthquake precursor observation stations along with a network of 4,000 mobile observation stations. A cell phone message service to provide timely earthquake reporting is simultaneously in place. The Chinese EWS initially blinked during the Wenchuan crisis for an array of reasons including the over centralisation effect of the endeavours.

A recent study by China's Institute for Geo-Environmental Monitoring has identified over 200,000 geological disaster prone areas in China.[23] As many as 19,552 spots spread over Yunnan, Guizhou, Gansu, Shaanxi, Hunan, and Hubei provinces and Chongqing Municipality tend to put a spanner in China's EWS exercise year after year. Landslides triggered by torrential rains in Zhouqu County, the Gannan Tibetan Autonomous Prefecture, and Gansu Province on August 8, 2010 are a case in point about the nature of catastrophe. It put the lives of nearly 7 million people at stake while over 1,000 people died. China has since put in place a Geological Disaster Monitoring System (GDMS) and Land Subsidence Monitoring Network (LSMN), which covers around 120,000 spots. Much of the efforts are concentrated in the vicinity of Three Gorges Reservoir area. It largely works on 3S technologies.[24]

Notwithstanding, these China has been working on identical EWS responses for environmental pollutants, wild animal epidemics, plant disease, and pest disasters, forest and grass fire, and marine disaster forecasting systems. Several pioneering works in the field included the launch of HJ-1 Environmental Satellites

A and B to carry out real time ecological monitoring. Observation stations remain the mainstay for all sets of information gathering and disseminations.

Resource Mobilisation and Plan Implementation

Given an array of factors including China's political and administrative system, the Chinese model of disaster management is essentially "governmental". The State Council provides the leadership and the departments responsible for disaster reduction and relief —such as the National Disaster Reduction Committee, State Earthquake Control and Rescue Headquarters, and National Disaster Control and Relief Coordination Office—work within the State Council and carry out ground level tasks. Local governments do have corresponding coordination offices at their ends. The PLA, the PAPF, militia reservists, and policemen act as task forces. Furthermore, social groups, NGOs, and volunteers join in the effort of disaster reduction and relief work.

As the structure of government agencies in the PRC is vertical from central and provincial to local governments, the resource mobilisation for disaster management largely takes place from and at the bidding of the State Council, and the government agencies down the line follow the command in compliance. This is notwithstanding the contributions of NGOs and multinational aid and assistance taking a different, non-linear route.

The 2008 Wenchuan quake happens to be the latest case in point. The direct economic loss from the earthquake was 980 billion Yuan ($152.29 billion).[25] The reconstruction efforts were hard to fulfil from the resources of Sichuan Province, and the State Council pledged 1 trillion Yuan ($146.5 billion) from the coffers of the central government over next three years.[26] In addition, the State Council called upon 19 prosperous provinces and municipalities to contribute at least 1 per cent of their annual fiscal revenue towards reconstruction projects. It was a "Paired Assistance Programme", whereby designated provinces and municipalities were each required to adopt at least one severely affected county/city.

The Shandong, Guangdong, Zhejiang, Jiangsu, Hebei, Liaoning, Henan, Fujian, Shanxi, Hunan, Jilin, Anhui, Jiangxi and Hubei provinces adopted Beichuan, Wenchuan, Qingchuan, Mianzhu, Pingwu, An, Jiangyou, Pengzhou, Mao, Li, Heishui, Songpan, Xiaojin, Hanyuan and Jiangge counties, respectively. The Beijing, Shanghai and Chongqing municipalities adopted Shifang, Dujiangyan and Chongzhou cities while Tianjin committed itself for rebuilding the ravaged areas in Shaanxi province as a whole. Shenzhen, the sub-provincial city of

Guangdong Province adopted the seriously affected counties and cities of Gansu Province.[27]

The post-earthquake construction works in all such counties and cities broadly involved planning, architectural design, expert counselling, engineering construction and supervision; construction and restoration of urban and rural residential houses; construction and restoration of public facilities, including schools, hospitals, television broadcasting stations, cultural and sports facilities, and social welfare facilities; construction and restoration of infrastructure, including urban and rural roads, water supply and drainage, gas supply, and disposal of sewage and garbage; construction and restoration of agricultural and rural infrastructure; providing mechanical equipment, instruments and tools, construction materials, and services such as selecting teachers and medical personnel, talent training, non-local nursery and school enrolment, labour export and import, agricultural technology, encouraging companies to invest in building local plants, setting up trade and circulation service facilities, and participating in commercial infrastructure construction projects; and, other associated miscellaneous job works.[28]

Reconstruction work in the Wenchuan earthquake hit region has been complex in nature and character. It is difficult to work out time-cost relationships. Some academics including Sun Caiyu and Xu Jiuping have tried their hand using Bromilow's time-cost (BTC) model and the Elman network (EN) model.[29] It is yet hard to gauge with precision whether the government-centric Chinese model worked efficiently. Until the terminal period of three years from the date of commencement, each of the 19 participating provinces and municipalities had completed over 90 per cent of their projects in hand. Around 885.15 Yuan ($136 billion) of the overall budget of 1 trillion Yuan ($146.5 billion) was by then spent on those projects.

The performance of each of the 19 participants varies, both in terms of resource mobilisation and the quality of work. Complexities of the ground-level problems also made a difference. Taking the statement of the Executive Vice Governor of Sichuan Wei Hong at its face value, the reconstruction efforts have yielded appreciable results. In Sichuan alone, nearly 3,000 schools, 1,000 hospitals, and more than 5 million homes have been built or renovated. The achievements in other areas, including Gansu and Shaanxi provinces, are not negligible either.

In a break from the past, the PRC has since recognised the role of NGOs—both native and foreign. The responses of the international community were both prompt and efficient. Four days after the incident, on May 16, 2008, the PRC received $457 million in donations from 19 countries and four international organisations. The general public also donated approximately 10.7 billion Yuan

($ 1.66 billion). Multinational corporations (MNCs) operating in China also announced large donations. In a way, these donations dwarfed the contribution of the Chinese government which by then had committed only $772 million.[30] In the eyes of perceptive analysts, the NGO participation in post-disaster recovery remained weak. However, it must be noted that the NGOs played a key role in looking after special needs of vulnerable people, namely the children and youth.

This pattern is repeated in other set of disaster management exercises in China. In 2008, there were as many as 354 natural disasters of different denominations in the world, which claimed altogether 236,000 lives and grievously affected 211,628,186 people in comparison with the average of 397 natural disasters, with 66,812 deaths and a total of 231,588,104 people affected from 2000 to 2007. Wenchuan earthquake together with Cyclone Nargis that hit Myanmar accounted for the most of the tolls.[31]

Role and Contribution of Armed Forces

The PLA, PAPF, the militia and the police force constitute veritable "taskforce" in China's disaster management model. Academics both in and outside debate the propriety of this on several counts including the trade-off in terms of its being a detraction from their core war fighting and policing missions and their impact on China's force projection capabilities, and hence the worries.

No sooner did the catastrophic tremors strike Wenchuan on May 12, 2008, the PLA and PAPF units, located in all the 21 affected provinces, autonomous regions and municipalities, deployed 568,000 regular armed forces personnel/time. Apart from these, the PLA reserve and paramilitary units contributed 1.79 million armed forces personnel/time to the rescue and relief operations.[32] As many as 180 PLA officers of the rank of Major General/Lt General personally supervised the activities.[33] The PLA Ground Force altogether deployed 34,000 military vehicles and the PLA Air Force pressed 100 aircraft into service.[34]

The Chinese armed forces employed some unheard of measures during the operations. They used kitchen trucks and armoured cars for de-icing the two km long Tongren airport runway in Guizhou province, which had remained closed for 23 days with 13 cm thick ice on the ground.[35] It used machine guns to shatter ice from the overhead power cables. Among other tasks, the Chinese armed forces cleared 17,000 km of highways and evacuated 4.38 million people. They reached the homes of the people in far flung areas to distribute 419,000 quilts, 219,000 cotton padded coats and thousands of tonnes of relief materials.[36] PLA medical units treated over 1.9 million injured men, women, and children and offered psychological therapy to 895 people.[37]

Chinese print and electronic media profusely praised the various acts of the armed forces during the Wenchuan earthquake. As on date, over 20 million PLA Ground Force/PAPF personnel have been deployed for rescue and relief works for different natural and man-made disasters. This is apart from the involvement of militia (*minbing*) and police (*gonganju*) personnel. The PLA Air Force has undertaken over 100,000 air flights and rescued around 12 million people.

According to *China's Military Encyclopaedia*, the PLA put a total of 1,369,000 regulars 91,500 vehicles at the disposal of disaster management outfits for rescue and relief works. Apart from the PAPF and militia reservists whose number ran to around 15.64 million armed forces personnel.

Conventional wisdom would not find any fault with China deploying its armed forces for the disaster management functions. This is happening around the world and qualifies as support welfare function. Surprisingly, Chinese military writings support the measures as a substitute to battle exposure.[38] In this context, the Wenchuan earthquake of May 2008 provided an enviable opportunity for the Chinese armed forces to test their combat capabilities in terms of logistics management and deployments. As stated in the Chinese media, the PLA formed a lead team headed by the PLA Chief of General Staff within 24 hours of the event on May 13, 2008 and 48 hours thereafter, a total of 130,000 personnel were on way to different locations. Chinese and foreign analysts have largely appreciated the feat on several counts including the scale, distance, collaborative actions, and the follow-up services.

The PLA enjoys legal protection under various statutory provisions. These include: Regulations of People's Liberation Army Political Work (1995); Regulations of People's Liberation Army Command (1997); PLA Casualties Insurance Provisions (1998); and Regulation of Military Participation in Disaster Relief (2005). In June 2005, China's Central Military Commission took a major decision to build up a professional force for emergency disaster rescues. The PLA now has 19 professional emergency rescue forces. These specialised troops have not only improved the efficiency of disaster management and thus reduced the number of casualties, but also cut off the troop losses in disaster rescues.

Future Outlook

The Chinese state has, of late, pulled out all stops to mitigate the impact of the catastrophes to a bare minimum. It is no longer the "Land of Famines" and the "Land of Deaths". In fact, as Lillian M. Li says, the interventionist policies of the PRC have outdone the Qing emperors of 18th century in mitigating the hardship.[39]

China has gone on to build a relief materials reserve network based on special storehouses, which has seen year-on-year improvements. The country has now 10 such storehouses for daily necessities at the central level, and new storage centres for relief and flood and forest fire control supplies are being continuously built and improved. Coupled with the reserve relief supply centres being set up in some provinces, cities and counties, a preliminary disaster control and relief materials reserve system has taken shape. To guarantee the timely purchase of relief supplies, a list of relief supply manufacturers has been made, and emergency purchase agreements signed with them for the supply of relief materials in case of emergency.

Capability building efforts to counter the impact of the catastrophe, inter alia, include improving the early warning and emergency response, enhancing the science-techno support system, personnel training, and enhancing the levels of awareness and participation among the broad section of people.

The flood and drought cycle is almost demonic in its regularity. The proactive financial policy has already yielded some results. As the Chinese White Paper on Disaster Relief (May 11, 2009) bears out, the construction and renovation of dykes in the middle and lower reaches of the Yangtze River (*Changjiang*) have since been completed; the construction of standardized dykes in the lower reaches of the Yellow River (*Huanghe*) are close to completion; 19 major flood control projects for the Huaihe River have also largely completed; and, water conservation projects at the Three Gorges on Yangtze River, Xiaolangdi on the Yellow River, and Linhuaigang on the Huaihe River have been able to avert crises to a large extent. However efforts are being made to prevent seepage from major reservoirs.

Seismological disasters are formidable. While precision in prediction remains a far cry in terms of the available scientific and technological developments in China as elsewhere, the PRC has taken some tangible measures to improve the early response for rescue and relief operations. In this context, the PRC has published the zoning map of China with seismological parameters and improved its earthquake-proof construction evaluation system.

While largely impressive the Chinese system of disaster management has some weaknesses. It is largely bereft of community partnership, cooperation, and coordination.[40] As it is governmental in form and spirit, it is found wanting in the foolproof implementation of the envisaged tasks. "Grassroots Strategy" was appropriate until the vertical structure of political management was in place. With all its systems support, the Chinese armed forces reached the area in Wenchuan County quite late and in small numbers and undertake the tasks. It called for the institutionalisation of training at the community level.

The effectiveness, efficiency, and accountability of the post-disaster recovery process are doubtful. For example, a report by the National Audit Office (Liu, 2010) indicated that a total amount of 5.82 billion Yuan for post-Wenchuan earthquake recovery was siphoned off in 2009.[41] This is perhaps the tip of the iceberg. System transparency still eludes China. It is a pointer for all—including India—for a better tomorrow.

Notes:

1. Stoltman, Joseph P., John Lidstone, and Lisa M. Dechano (eds), *Advances in Natural and Technological Hazards Research: International Perspectives on Natural Disasters,* Springer 2004.

2. Pagels, H, *The Dreams of Reason*, Simon and Schuster, New York, 1988, p. 56.

3. Based on the movement of Earth's tectonic plates and the location of fault zones, seismologists are now better equipped than every before to guess where major earthquake would occur. Looking at the history of earthquakes in a particular region, they can pinpoint a general timeframe as well. However, accurateness remains a 50–50 chance as the strain released along one part of a fault system has potential to increase the strain in another part. Volcanology is far from being fully developed science. It has not been possible to predict the timing of eruptions for a variety of reasons. Movement of magma has been hitherto the main indication of possible eruptions. However, since magma cools below the surface of the earth, it does not always produce volcanic eruption.

4. 我国有70%以上的大城市、半数以上的人口、75%以上的工农业生产值，分布在气象、海洋、洪水、地震等灾害严重的沿海及东部地区，中国的危机管理机制，2005 年09月23 日(China's Disaster Management System, September 23, 2005, available at http://www.gov.cn/yjgl/2005-09/23/content_69182.html, accessed on December 30, 2011.

5. Jessica Rowe, "Nature's Deadliest Disasters", *Associated Content*, November 2, 2007, available at http://www.associatedcontent.com/article/431483/natures_deadliest_disasters.html?cat=58 accessed on December 30, 2011; also available at http://www.unescap.org/idd/events/cdr-2009/CDR_2E.pdf.

6. *China's Action on Disaster Prevention and Reduction*, Chinese Government White Paper, May 11, 2005, available at www.scio.gov.cn, accessed on Accessed on December 30, 2011.

7. People's Liberation Army (PLA) has five main service branches: the PLA Ground Force, PLA Navy (PLAN), PLA Air Force (PLA AF), Second Artillery Corps, and the PLA Reserve Force. It does not include the People's Armed Police Force (PAPF), which functions under the dual leadership of the Chinese Central Military Commission (CMC) and the Ministry of Public Security (MPS).

8. Fiedler's "Contingency Theory" and the "Situational Theory" of Hersey and Blanchard take a rather broad view of the capability of the leader, including the contingent and restrictive factors and variables within the specified situation. The effectiveness of the leadership is perceived to be central to the success in the endeavours. "System Theory", expounded by Chester Barnard and Ludwig von Bertalanffy speak of inter-relationship and interdependence of part and the whole in the ultimate go for the success of interventions. "Chaos Theory" of James Gleick, L. Douglas Kiel, and Frederick David Abraham talks of crisis communication prerequisites.

9. The National Disaster Economic Loss Index (NDELI) measures the risk of economic losses from damage costs and death caused by natural disasters to reflect both the direct and indirect economic impacts on the lives of the populace. In terms of intensities, Haiti, Mozambique, Honduras, Vanuatu, Zimbabwe, El Salvador, and Nicaragua fall among

seven "extreme risk" countries while China figures among the "high risk" countries. India, UK, Germany, and Canada stand among "medium risk" countries in the world. See http://maplecroft.com/about/news/economic_losses.html, accessed on December 31, 2011.

10. See http://www.undp.org/cpr/dosred/documents/publications/corporatereport/asia/china.pdf, accessed on December 31, 2011.

11. At http://sedac.ciesin.org/china/policy/acca21/218-8a.html, accessed on December 31, 2011.

12. http:www.undo.org/cpr/documents/disaster/asia_pacific/china_Early%20Recovery%20and%20Risk%20

    Management.pdf, accessed on December 31, 2011.

13. Zhang, Q., D. Ye, and H. Lieu, *Atlas of Weather Disasters in China*, Meteorological Press of China, 2007, pp. 110.

14. At http://www.china.com.cn/guoqing/2011-10/16/content_23635372_12.htm, accessed on December 31, 2011.

15. Maohua Zhong, Weicheng Fan, Tiemin Liu, and Peida Li, "Statistical Analysis on Current Status of China Forest Fire Safety", *Fire Safety Journal*, Vol. 38, No. 3, April 2003, pp. 257–269 available at http://www.sciencedirect.com/science/article/pii/S0379711202000796, accessed on December 31, 2011.

16. "Outbreak", "epidemic", and "pandemic" are three terms in use to describe health emergencies, with variations in propensities. There is definitional problem with the term "infectious disease" as well. Beyond the controversies, this paper uses these terminologies as being crisis of sort that invites non-routine attention of the system within and without a nation state to meet the requirement of time.

17. Categories of outbreak of infectious diseases are referred in terms their impacts in sociological terms and much required responses on the part of decision makers. It speaks out as to when it turns a disaster. In the Wilson-Collmann Scale (WCS), Category 4, 5, and 6 relate to a state of social disruption, community disintegration, and apocalyptic scenario coming to fore with the outbreak of the event in the lives of the people.

18. Available at http://www.upi.com/Top_News/World-News/2011/06/20/%20Marine-pollution-problrm-for-china/UPI-42411308614779/, accessed on December 31, 2011.

19. For details see http://www.pacificenvironment.org/section.php?id=207, accessed on December 31, 2011.

20. Liu, Zhiyu, "Practice and Recent Development of Flood Management in China", Workshop on Developing Capacity for Resilience to Water Related Disasters in Pakistan through Space Applications and Flood Risk Management, Pakistan, March 1–4, 2011, available at http://www.unescap.org/idd/events/2011-Pakistan-Flood-Islamabad/21-Liy-Zhiyu-Flood-Management-in-China.pdf, accessed on January 02, 2012; Cai Jianuan, "Hydrological Monitoring and Information Services in China", Bureau of Hydrology, Ministry of Water Resources, The People's Republic of China, available at http://www.hydroinfo.gov.cn, accessed on January 02, 2012.

21. Ibid.

22. Speaking at the 14th world Conference on Earthquake Engineering (WCEE) on Oct 13, 2008, Chen Jianmin said, "We are still in trial and error stage." Quite a few Chinese scientists hold that China is several decades away in terms of accurately predicting eathquakes.

23. At http://www.china.org.cn/china/2010-08/20/content_20757828.htm, accessed on on January 4, 2012.

24. Zhou Pinggen and Yao Leihua, "Landslide Hazard early warning System in China and Future Trend", IAEG 2006 Paper No. 2006, available at http://iaeg2006.geolsoc.org.uk/cd/PAPER/IAEG_805.PDF.

25. At http://www.bjreview.com.cn/print/txt/2011-8/05/content_381939.htm, accessed on January 4, 2011.

26. At http://forum.globaltimes.cn/forum/showthread.php?t=16791, accessed on January 5, 2012.

27. http://www.china.org.cn/china/earthquake_reconstruction/2010-01/25/content_19312096.htm, accessed on January 4, 2011.

28. Ibid.

29. Sun Caiyu and Xu , "Estimation of Time for Wenchuan Earthquake Reconstruction in China", *Journal of Construction Engineering and Management*, Vol. 137, No. 3, Technical Papers, Cost and schedule, available at http://ascelibrary.org/coo/resource/1/jcemd4/v137/i3/p179_s1?isAuthorised=no.

30. At http://www.adb.org/documents/TARs/PRC/42150-PRC-TAR.pdf and http://wn.com/Rescue_Relief_Efforts_China_WenChuan_EarthQuake, accessed on February 5, 2012.

31. At http://reliefweb.int/sites/reliefweb/.int/files/reliefweb_pdf/node/-24403.pdf accessed on February 6, 2012.

32. At http://news.xinhuanet.com/english/2008-02/05/content_7575061.htm, accessed on December 30, 2011.

33. PLA Generals, who figured quite prominently, included the Chief of the General Logistics Department Gen. Liao Xilong, Commander of PLA AF Gen. Xu Qiliang and Political Commissar Deng Changyou, Commander of PAPF Gen. Wu Shangzhan and Political Commissar Sui Mingtai, Commander of Chengdu Military Area Command Gen. Li Shiming, Commander of Guangzhou Military Area Command Gen. Zhang Qinsheng, and others.

34. PLA aircraft used during the snow disaster to carry and airdrop relief materials and rescue trapped people included Yu-7 and Y-8 transport, Mi-17, S-70C, z-8 and Z-9 helicopters.

35. CCTV-4, Chinese, 0730 hrs (IST), February 6, 2008, quoted statement of Zhu Xiulin, GM, Tongren Airport.

36. Sheo Nandan Pandey, "Chinese Emergency Response Mechanism to Meteorological and Seismological Disasters: Still Many Holes", South Asia Analysis Group Paper No. 3069, February 26, 2009, available at http://www.southasiaanalysis.org/%5Cpaper/31%5Cpaper3069.htmal, accessed on February 6, 2012.

37. Beijing Review, July 31, 2008, available at http://www.bjreview.com.cn/special/2008-07/26/content_144768_3.htm, accessed on January 6, 2012.

38. The Chinese PLA had its last test of battle in border conflicts with Vietnam in early 1979, when it mobilized a large number of regulars in the Lao Mountain and Faka Mountain near to its border region. It has since enjoyed peace with its neighbours, barring occasional low-intensity border skirmishes.

39. Li, Lillian M., *Fighting Famine in North China: State, Market and Environmental Declines, 1690s-1990s*, Stanford University Press Palo Alto 2007.

40. Tan, N.T. , "Disaster Management: Strengths and Community Perspectives", *Journal of Global Social Work Practice*, Vol. 2, No. 1, 2009, available at http://www.globalsocialwork.org/vol2no1_Tan.html, accessed on January 6, 2012; Perrow, C., *The Next Catastrophe: Reducing Our Vulnerabilities to Natural, Industrial and Terrorist Disasters*, Princeton University Press, Princeton, 2007; and, Drabek, T.E., "Community Processes: Coordination", in H. Rodríguez, E.L. Quarantelli, and R.R. Dynes (eds), *Handbook of Disaster Research* Springer, New York, 2006, pp. 217–233.

41. Liu, J.Y. *Guanyu 2009 Nian Zhongyang Yusuan Zhixing he Qita Caizheng Shouzhi de Shenji Gongzuo Baogao* [Audit Report of Central Government's Budget Execution and Other Financial Cash Flow Balance in 2009], 2010, available at http://www.audit.gov.cn/n1992130/n1992364/n2526505/n2526524/2526735.html, accessed on December 30, 2011.