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Integrated Disaster Risk Management of China

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Abstract: This paper firstly introduces the disaster (public security) status quo and situation of China briefly, and then gives a detailed explanation of the integrated disaster risk management system. China is one of the most natural disaster affected countries in the world. The disaster risk reduction work in China includes the pre-disaster decentralized management with separate fields and departments, the in-disaster integrated emergency management, and the post-disaster different-level cooperation between the central government and the local governments. So it can be regarded that the Chinese disaster risk management system depends mainly on the central management, with the mutual cooperation between the central government and the local governments. The integrated disaster risk management of China emphasizes the management mechanism of “combine the bars (the professional technology departments) and the blocks (the local governments), and mainly depend on the blocks”; the final goal of the integrated disaster reduction is to “realize the horizontal harmonization to the margin without dead angle and the vertical harmonization to the end without blank”; the Chinese disaster risk management strategy persists in the principle of “give priority to disaster prevention, and combine disaster prevention with disaster resistance and relief”. The natural disaster risk management is mainly taken charge by the civil affair departments of China and the insurance regulatory departments. As the key guaranteeing strategies for national sustainable development, the agriculture insurance and the large-scale catastrophe insurance are now under the stage of research and experiment. Some provinces of China have carried out the agriculture natural disaster insurance.

Key words: Natural disaster; disaster risk management; emergency and disaster reduction; China

China is one of the most natural disaster affected countries in the world. The Chinese government has been attaching much importance to disaster reduction work since 1949, and much structural and non-structural construction has been accomplished to improve the natural disaster resistant ability of China, mainly in the fields of flood and drought mitigation, earthquake mitigation, tide protection, etc, which protects the people's life and property and promote the socio-economic development.

However, China is at the transitional stage of economy and society. The economy

is developing at a high speed, while the society productivity development level is unbalanced. The foundation of the public security guaranteeing system is poor, and the heavy accidents and events occur constantly. It's estimated that every year, the economic loss caused by disasters (public security problems) amounts to hundreds of billion RMB, 3%-6% of China's total GDP. So the public security events have brought about great influence on the people's daily life and social sustainable development. Facing the serious public security events happening constantly these years, such as the heavy tropical storm, SARS, fowl influenza, Benzene pollution in Songhua River, etc, in order to minimize the socio-economic loss and bad influence of the public security events, the Chinese government has enhanced the disaster risk (public security) management from all government levels, both the central and the local governments. The Emergency Management Office of State Council at the national level establishment is established and the public emergency planning has been promulgated and implemented. Also according to some main public security factors, a series of laws, regulations and decisions have been carried out. At present, the Chinese integrated disaster risk management is still at the initial development stage, and has some problems needed to improving. So it's supposed to promote and consummate the disaster risk management on the base of the existing work, and establish a scientific and efficient integrated disaster risk management system. Meanwhile, it's significant to assimilate the worldwide advanced disaster risk management experience and technology, and strengthen the international cooperation in this field, with the purpose of making the whole world safer.

1 Issues of Disasters (Public Security) in China

According to the *Master State Plan for Rapid Response to Public Emergencies of China*, the public security events are divided into four kinds, namely natural disasters, industry accidents, public health emergencies and social security emergencies.

1.1 Natural Disasters

With the special geographic position of facing the Pacific in the east, China has the monsoon-controlled climate and the southeast coast areas are strongly influenced by typhoon; China lies in the world major seismic belt and has a frequent earthquake occurring; the terrain condition is complicated in China, and the area proportion of the hill region and the plateau region in the whole country reaches 69%, with severe soil and water loss, wind erosion and desertification. This geographic environment determines that natural disaster of China has the following characteristics: multiple natural hazards, high frequency of hazard occurring, significant regional differentiation and seasonal characteristic and severe disaster losses.

China is prone to nearly all natural hazards of varying magnitude except volcanoes. There are five main natural disasters threatening China: flood, drought, earthquake, typhoon and landslide/mudslide, and the losses caused by these five main natural disasters come up to 80%-90% of the annual disaster-loss total. The frequency of natural hazards is high, with large-scale drought of the average frequency over 7, floods 5.8, typhoon 7, Low Temperature and Freeze 2.5, each year since 1949. With the influence of monsoon climate, China has significant regional and seasonal characteristics. The droughts mainly distribute in the Northwest Loess Plateau and the North China Plateau in spring and autumn; the floods mainly distribute in the seven large river basins, especially in the middle and lower reaches of Yangtze River and Huaihe River in summer and autumn. The Losses caused by natural disasters is also very severe. In the general year, the natural disaster affected agricultural area is about one third of the nation total farmland area, of which one third is no-crop harvest area; the disaster affected population is around 200 million, and the urgently transferred person number is over 3 million; the Collapsed building number is around 3 million.

In 2006, the status of natural disasters in China is more serious than the preceding 6 years (Tab. 1). The death toll and direct economic loss were the highest in the recent 8 years since 1999, only urgently transferred people less than that of 2005, and the number of collapsed buildings was less than that of 2003 and 2005, though the proportion of the direct economic loss to the national GDP each year is declining with fluctuation since 1989 (Fig. 1). Generally speaking, the casualty of natural disasters in 2006 is mainly caused by typhoon, flood, landslide and Debris Flow in the East China, South China and southeast part of China.

Tab. 1 Disaster loss of China in 2001-2006

Year	Affected person (million persons)	Death toll (person)	urgently transferred people (million persons)	Direct economic loss (billion RMB)	Collapsed building (thousand houses)
2001	372.559	2538	2.111	194.22	922
2002	427.98	2384	4.718	163.72	1895
2003	497.459	2259	7.073	188.42	3430
2004	339.206	2250	5.633	160.23	1550
2005	406.537	2567	15.703	204.21	2264
2006		3186	13.845	252.81	1933

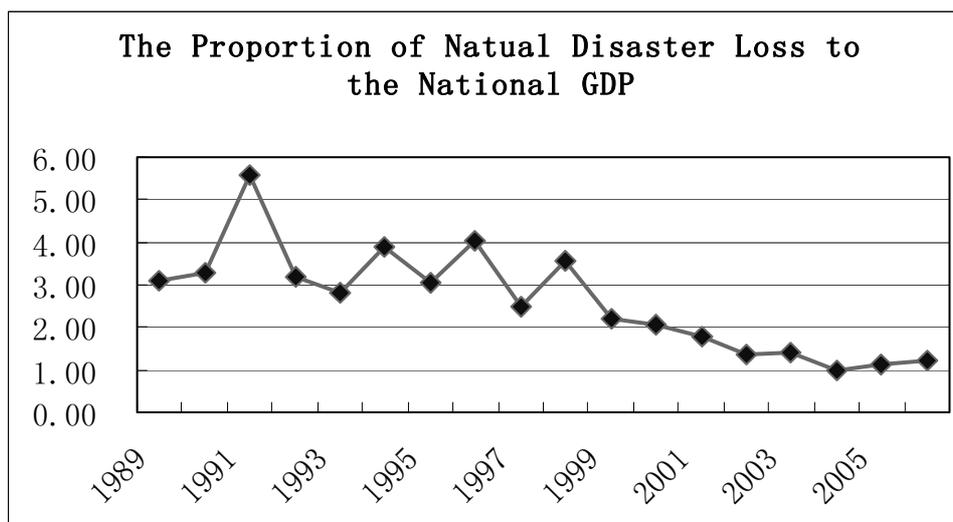


Fig. 1 The proportion of the direct economic loss to the national GDP each year from 1989 to 2006

1.2 Industrial Accidents

Around 717,900 industrial accidents occurred in 2005, killing 127,100 persons, down 10.7 and 7.1 percent from the year 2004, leading to 89 billion RMB direct economic loss. But big accidents with more than 10 persons killed happened 136 times, killed 3084 persons, up 3.8 and 18.3 percent than previous year. Huge accidents with more than 30 persons killed happened 17 times, killed 1197 persons, up 6.3 and 27.9 percent. In coal mine and transportation industries, big and huge accidents were still not well controlled.

Tab. 2 Times and death toll of four major kinds of industrial accidents in China in 2005

Type	Total times	Total death toll (person)	Times of Huge accidents	Death toll in huge accidents (person)	Times of big accidents	Death toll in big accidents (person)
Coal mine and other industrial enterprises' accident	13142	15868	13	1042	68	1942
Fire accident	235941	2500			5	118
Transportation accident	450254	98738			47	807
Public establishment and special equipment accident	571	649			2	

Tab. 3 Proportion of occurring times and death toll of different kinds of big accidents (%)

Type	Road transportation	Railway transportation	Waterway transportation	Fishing	Industrial enterprises	Agricultural equipment	Fire accident	Others
Times	77.7	5.8	0.4	0.5	12.5	1.1	2	
Death toll	35	-	4	6	49	-	4	2

1.3 Public Health Emergencies

The year 2005 witnessed 4122 public health emergencies (Tab.4), in which contagious disease, food poisoning, occupational disease, and bad vaccinate response happened 1631 times, affecting 82,230 persons, killed 702 persons, increased 31.0, 30.2 and 82.2 percent than previous year; animal epidemic 2491 times, direct subsidy 379.4 million RMB.

Tab. 4 Times of public health emergencies in China in 2005

Type	Huge	Bigger	Big	Ordinary	Total
Contagious disease	0	7	73	920	1000
Food poisoning	0	1	235	188	424
Occupational disease	0	5	42	19	66
Bad vaccinate response	0	1	2	5	8
Animal epidemic	1	2	4	2484	2491
Others	0	7	57	69	133
Total	1	23	413	3685	4122

1.4 Social Security Emergencies

There were 4.678 million criminal cases, financial accidents, and mass protests in 2005, killing 69,000 persons, causing 31.7 billion RMB of direct economic loss, down 2.3, 12.0, and 28.8 percent respectively compared to the previous year. Among them, the increasing trend of mass protests was under control, criminal cases were less, and financial accidents decreased much.

In a word, the situation of public security in China is generally good and welling. The numbers of industrial accidents and public security emergencies are decreasing, while natural disasters and public health emergencies are increasing, but the situation in some areas and fields are still not very optimistic. In 2005, there were 5.4 million unexpected public accidents in China, 210,000 less than the previous year; leading to the death of nearly 200,000 citizens, 10,000 less than the previous year; and causing 325.3 billion RMB of direct economic losses, much less than the previous year.

2 Integrated Disaster Risk Management of China

2.1 Management System

In order to enhance emergency management and implement the governments' function entirely, the Emergency Management Office of State Council at the national level establishment is established in the April of 2006. It works as an operation hinge, which takes charge of the daily work of the national emergency management, responds to the public security events, collects the real-time information and harmonizes the related departments. Since the establishment in 2006, the Emergency Management Office of State Council has carried out some effective work to enhance the disaster emergency management: helped actualize and implement the *Master State Plan for Rapid Response to Public Emergencies* of China; held the emergency management working meeting of State Council and the management working meeting of enterprise emergency work, to deploy and unify the emergency management, and emphasizes the governments of all levels to enhance emergency ability construction and get prepared for the prevention and dealing for the public security emergencies; started the Key Technologies R & D Program for the emergency platform construction to provide science and technology supporting for emergency management and increase the emergency treatment efficiency.

So far, the Chinese disaster risk (public security) management system has established, namely "one office and four committees": the establishment of the Emergency Management Office of State Council at the national level and the corresponding organizations with regard to the four public security incidents—the National Committee for Disaster Reduction to manage natural disasters, the National Committee for Work Safety to manage industry accidents, the National Committee for Patriotic Health to manage public health and the National Committee for integrated management to manage public security. The four committees are made up of a vice president or a committeeman of the State Council of China as committee director, a minister or vice minister from the main related ministries as administrative vice director or vice director, and the vice ministers from the corresponding ministries as committee members. At the local levels, there are corresponding disaster risk (public security) management organizations with accordance to the national level. The local emergency management centre and the committees for the four public security incidents management have been gradually established. The disaster risk management organization system of China can be concluded as the follows (Fig. 2).

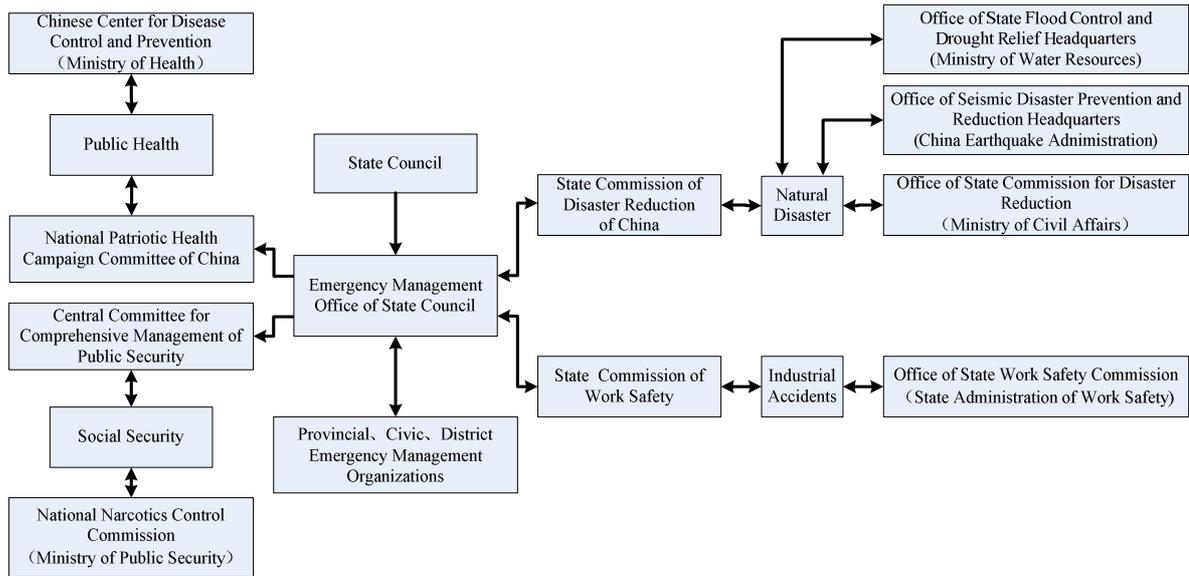


Fig. 2 Disaster risk management organization system of China

Besides, in order to enhance the disaster risk management work, in these related ministries and commissions, the corresponding management centers have been established, such as the Chinese Center for disease control and prevention (Ministry of Health), the National Disaster Reduction Center of China (Ministry of Civil Affairs), the Chinese Supervision Center for Work Safety (State Administration of Work Safety), etc.

In conclusion, China has started disaster risk (public security) management work on the basis of traditional disaster management and reduction, and has formed the primary disaster risk management framework of related professional fields. Besides, it is supposed to legislate emergency laws to enhance the legal system construction of disaster risk emergency management; The China Association for Disaster Prevention also established the first professional organization for risk research, which has been named as the Risk Analysis Specialty Committee; many Chinese universities and research institutes have been doing research on natural disasters, engineering hazards, economic risk, crisis management and disaster risk management, and so on. However, compared with the international situation, disaster risk management in China is facing an austere and significant challenge but also a very good opportunity.

2.2 Management Mechanism

On the basis of the existing disaster risk management resources, in the January of 2006, the state council of China promulgated the *Master State Plan for Rapid Response to Public Emergencies*, with the aim to improve the government's public security dealing and responding ability, minimize the loss of the public security events and promote the harmony and sustainable development of the whole society. The Master State Plan is the general program for the national emergency plan system and is the criterion file for the prevention and treatment of the public security events, which clarifies the classification and framework of the public security events,

prescribes the organization system, operation mechanism of the severe emergency dealing. The Master State Plan emphasizes to establish an emergency mechanism of classified management, different-level responsibility, bar and block combination but mainly depending on the blocks. Here, the bars mean the professional technology departments, while the blocks mean the local governments of all levels. So it can be regarded that the Chinese disaster risk management system depends mainly on the central management, with the mutual cooperation between the central government and the local governments. The related departments of the central government and the local governments take their corresponding pre-disaster, in-disaster and post-disaster responsibilities, and there's no single government department in charge of all the tasks (including disaster preparedness, emergency and disaster recovery and reconstruction) of a single public security factor.

The Chinese regional integrated disaster risk management mode persists in the principle of "give priority to disaster prevention, and combine disaster prevention with disaster resistance and relief". Namely, before disaster occurrence, it's important to establish and consummate the monitoring and warning system, carry out emergency planning, strengthen emergency material reserving ability, build ecologically healthy environment, accelerated regional economy and reduce disaster vulnerability; During disaster period, it's emphasized to improve emergency response ability, highlight the human-oriented actions, reduce the casualty and property loss and protect natural resource and environment maximally; After disaster, it's suggested to strengthen the government and society relief ability of all levels, especially the community self-rescue and self-relief ability, and based on the results of the rapid disaster loss assessment, it's urgent to recover lifeline and product line systems and accelerate reconstruction efficiency and effect.

By now, the natural disaster risk governance in China are taken charge by different ministries or bureaus in terms of different kinds of natural hazards, e.g. China Earthquake Administration takes charge of risk governance of earthquake disaster, China Meteorological Administration takes charge of risk governance of meteorological disasters, Ministry of Water Resources takes charge of risk governance of floods and droughts, Ministry of Land and Resources takes charge of risk governance of land slide and debris flow, State Ocean Administration takes charge of risk governance of ocean disaster, and so on. To enhance risk governance of some large-scale disaster, the State Council has set up several leading groups for natural disaster governance, such as State Flood Control and Drought Relief Headquarters and State Earthquake Relief Headquarters. Correspondingly, each regional and local government set up relevant departments. There are corresponding organizations in the local governments of all the levels in China. In a word, China adopts the natural disaster risk governance system of combined vertical inter-government and inter-regional management mode where vertical sector management is prior to integrated regional management.

2.2.1 Monitoring and Warning

During the disaster preparedness period, the mitigation and prevention work is taken charge by the professional technical departments, namely the bars.

In the recent years, the Chinese government has increased the investment on natural disaster monitoring and warning system construction, and has established the natural disaster monitoring, warning and forecasting system primarily, including the meteorological disasters monitoring and forecast, the earthquake monitoring and forecast, the hydrological monitoring forest fire prevention, the forest and crop pests monitoring and forecasting, the marine environment monitoring, the geological disasters monitoring and early warning. This natural disaster monitoring, warning and forecasting system can monitor the disaster dynamic development, and provide the information for the disaster emergency decision-making. Furthermore, China plans to launch two small optical satellites and one small SAR satellite in 2007, which is called the "2+1" Project, and also another 4 optical satellites and 4 SAR satellites before 2010 for the environmental and disaster monitoring and forecast. The ever improving monitoring and early warning systems virtually covering natural disasters of all kinds ensures timely response to disasters with effective rescue and relief efforts.

Meanwhile, since the SARS event broke out in 2003, the Chinese Center for Disaster Control and Development under the leadership of the Ministry of Health began to pay more attention to public health events, and established a series of files on public health risk management correspondingly, which made Chinese public health risk management became regular and developed to an international way. The national epidemic monitoring network of all levels and disease prevention and cure system has been well formed and improved.

2.2.2 Emergency Response

During the disaster period, the emergency management offices and the disaster reduction committees of all levels are in charge of the emergency response, together with the Civil Affairs departments, the Public Security departments, the arms, etc. Namely the bars and the blocks are combined together closely and rapidly to deal with the emergencies as soon as there are emergency event. At present, a disaster emergency response system is up and running to guarantee that rescue taskforces, relief supplies, funds and information are on the ground and in place to address the immediate and real needs of the affected.

According to disaster emergency management, the Chinese government has strengthened the emergency plan system construction. In *the Master State Plan for Rapid Response to Public Emergencies*, the public security events are divided into four kinds (natural disasters, industry accidents, public health and social security) according to their occurring process, characteristics and mechanism, and four grades (huge, bigger, big and ordinary grade) according to their severity degree, degree to be

controlled and affected range. And it's prescribed that the huge and bigger grade emergencies must be reported to the State Council in 4 hours after the occurrence, and the local governments or related departments have to start the related emergency plan timely and effectively in the responsibility and power range to control the further development. Besides, there have been several special plans and department plans for Rapid Response to Public Emergencies; and the plans for Rapid Response to Public Emergencies of national and local governments have also been compiled and accomplished, which makes the disaster risk management and disaster reduction more regular and systematic. Up to March 15th 2006, China has constituted 24,293 emergency response plans for unexpected public accidents, in which 1 national, 25 special, and 80 sectional, 971 from the sectors in the State Council (not including 80 sectional ones), 158 from central enterprises, 23058 regional ones. By now, the national emergency plan system has formed initiatively, and the emergency management system is under rapid construction.

As for the natural disaster emergency, as prescribing in the "State Emergency Response Planning for Natural Disasters", according to the disaster loss degree, the Ministry of Civil Affairs of China adopts a four-grade response system (Fig. 3). In other words, different emergencies influence degree is treated by the governments of different levels. The more severe the situation is, the higher level of the government will response and do decision-making

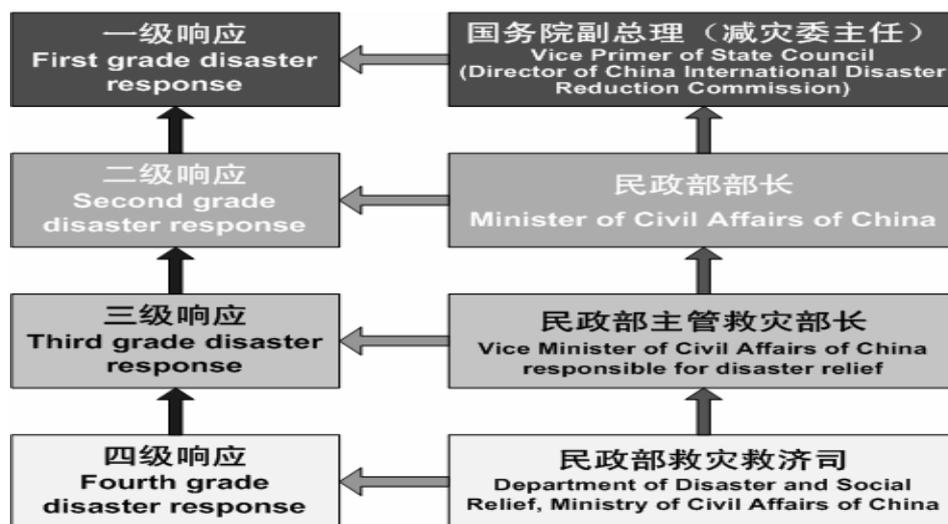


Fig. 3 Emergency response degrading for natural disasters in China

The further emergency management work emphasis will focus on the emergency management platform, including the integrated natural disaster information platform, the emergency network communication platform, the emergency decision-making supporting platform and emergency commanding platform. It's important to share information and cooperate comprehensively to react and respond timely and effectively. Meanwhile it's also essential to enhance the related research like the disaster loss assessment, disaster process simulation, and the ability construction including disaster rescue equipments, emergency commanding, etc.

2.2.3 Relief、 Recovery and Reconstruction

During the post-disaster period, the disaster relief and recovery work is charged by the local disaster reduction committees, which works as a coordinator for the main departments to organize the people in disaster area to recover to the normal life state, which includes the Civil Affairs departments, the Health departments, the Development and Deform Commission, the Finance departments, the Communications departments, the Construction departments, the Railway departments, etc. Namely, the blocks are the main responsibility body. Among these different departments, the Civil Affairs department takes the main responsibility for the disaster victims' life relief, and the insurance companies carry out the compensation for the disaster victims to help them to recover as soon as possible.

With regard to the disaster relief work, the Ministry of civil affairs of China has set up the central system of material reserve for disaster relief since 1998. At present, the central stations of material reserve has been build in ten cities, which include Shenyang city, Ha'erbin city, Tianjin city , Zhengzhou city, Hefei city, Wuhan city, Changsha city, Nanning city, Chengdu city and Xi'an city. Some regions of high disaster frequencies, high vulnerability has also built the local storages of material reserve for disaster relief. Thus, the network of material reserve network for disaster relief which relies on the disaster relief storages has been established. At present, the central reserve bases store 135000 tents, and the local reserve bases store 236000 tents. If the severe disaster happens, the first tents for disaster relief would be sent out to the people in the 24 hours.

At the same time, the Chinese government encourages the public social donation activities from the whole society and the NGOs to be an important force in the post-disaster period, including the endowment activity for the severe disaster, the mutual support activity between the eastern area and ten provinces in the west, and the disaster relief activity of the social organization. There are nearly 30 thousand urban donation receiving stations in China, carrying out regular social donation activities perennially, especially in the period when some natural disasters occurs. This social mobilization mechanism provides a solid material supporting for disaster management, and help the people in the less-developed area to recover rapidly after disasters.

2.3 Management Legalization

China has instituted, promulgated and enforced 30-odd laws and regulations as it moves forward to phase in a legal framework for disaster reduction. But the laws and regulations are all about single aspects of the disaster risk management, such as “Law of the People’s Republic of China on Protecting Against and Mitigating Earthquake Disasters”, “Flood Control Law of the People's Republic of China”, “Law of the People's Republic of China on Safety in Mines” and so on, the systematic and comprehensive series of laws and regulations about disaster reduction have not been

constituted, especially in disaster relief, disaster insurance, post-disaster subsidy for reconstruction, tax declining for the victims, and so on. Moreover, existing laws and regulations are generally aimed at single disaster types. So it's urgent to legislate a law in the integrated disaster risk management to carry out integrated disaster prevention and reduction, and there isn't explicit legal status for any integrated and coordinated sectors.

3 Understanding of Integrated Disaster Risk Management Mode

3.1 Integrated disaster risk administration mode

Considering the complexity of disaster system and its chains, and the advantages of different modes of regional disaster risk governance from several countries, here we put forward a mode of Integrated Disaster Risk Administration Mode (IDRAM). The relationship among vertical, horizontal, and institutional harmonization in the IDRAM for integrated regional disaster reduction is expressed in Fig. 4 and Fig. 5. This three-dimensional mode put horizontal harmonization, vertical harmonization, and institutional harmonization together. Vertical harmonization (Lo) means harmonization among central, and all levels of regional governments, where local governments are more important in the field of disaster reduction management; Horizontal harmonization (La) means harmonization among different government departments and other disaster reduction organizations; Institutional harmonization (P) means harmonization among all kinds of policies related to disaster reduction. And the optimization of system structure in searching for bettering system functioning means to find best usage of disaster reduction resources (Io) from vertical and horizontal harmonization by coordination of policies (P) related to disaster reduction.

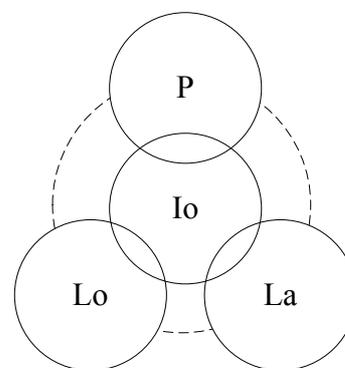


Fig. 4 Sketch map of integrated disaster risk administration mode

This management mode of IDRAM is precious for constructing harmonious society and well-off society to enhance natural disaster risk governance in China, and it is meaningful to build a safe world. Meanwhile, it would promote science and technology of public security and personnel training of risk management.

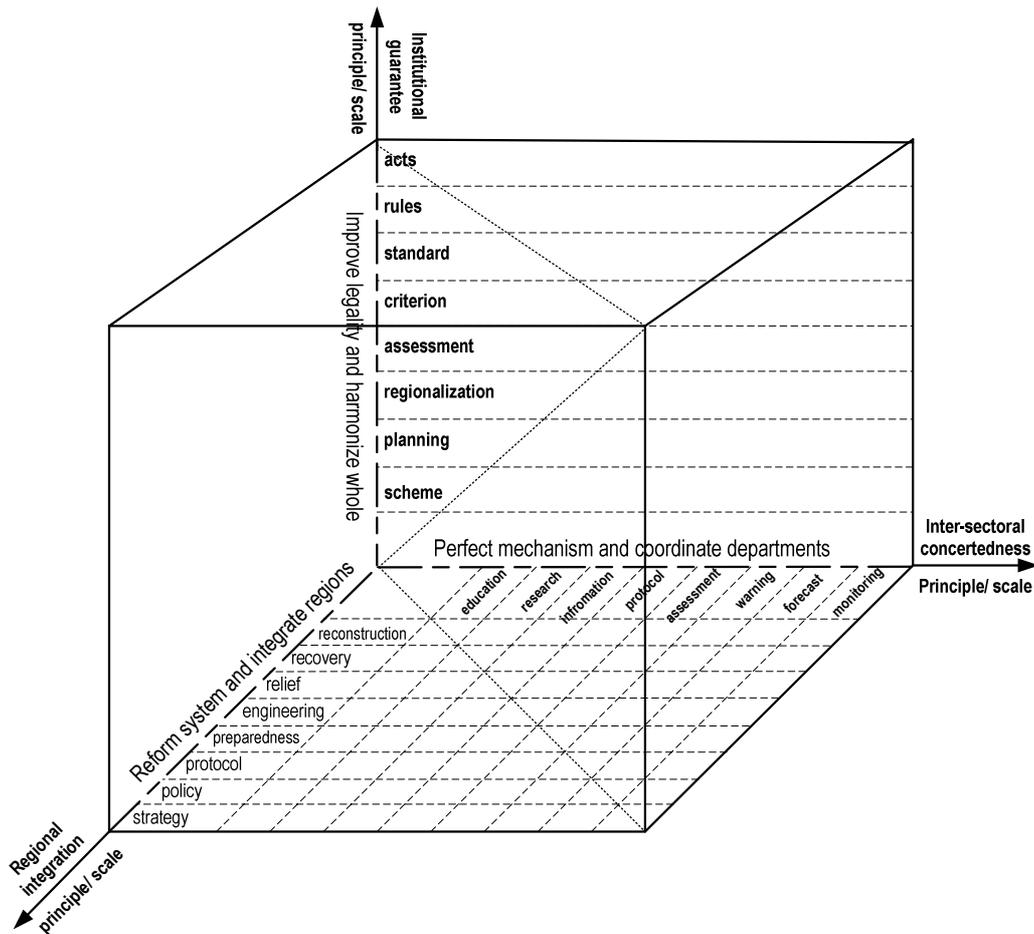


Fig. 5 Integrated disaster risk administration mode

As the diversity of public security elements, integrated disaster risk administration management should first achieve the vertical harmonization, namely harmonious between central, and all levels of regional governments, where local governments are more important in the field of disaster reduction management. All levels of principals should work together, and the administrative regions of different levels should be well harmonized. Therefore, the maximum efficiency and effect of disaster reduction resources use can be achieved, which can be called “vertical to the end with no blank”. Meanwhile, the horizontal harmonization among different government departments and other disaster reduction organizations is also very important. In other words, it’s significant to fully promote the active role of government at all levels and related institutions of disaster risk management, and improve the intercommunication and cooperation, which can be called “horizontal to the margin and no dead angle”. The Chinese governments have established some coordinating departments in same level of government departments, such as the National Disaster Reduction Committee, Anti-flood and anti-drought Guide group of the State Council. At last, in order to realize vertical and horizontal harmonization, co-construction and share disaster risk management information, improve efficiency of resources use and information communication, institutional harmonization is an

indispensable precondition. Legislation of related laws on disaster risk management, which coordinate organizational and individual behaviors in vertical and horizontal harmonization, could fully exploit governmental and social resources for disaster reduction. This means achieve integrated administrative management of public security through the harmonization of related policies, for example, the coordination between regional development planning and disaster reduction planning, between urban planning and its hydrological network protection, between land development planning and ecological construction, between flood-drought disaster and soil water conservation.

3.2 Integrated disaster risk governance mode

Regional integrated disaster process determines the mode of regional disaster risk governance. Therefore, it's necessary to confirm the main factors relating to integrated disaster risk governance, according to the time, space, attribute organization, management and other aspects. From the spacial perspective, it's supposed to compartmentalize the high, middle and low risk area in the entire disaster region; from the temporal perspective, it's supposed to compartmentalize the stage before, during and after disaster; from the attribute perspective, it's supposed to confirm the relationship between the disaster region, disaster victims and disaster effect; from the institutional perspective, it's supposed to confirm the functions of the governments, enterprises and communities; from the management perspective, it's supposed to clarify the duty of the centre, departmental and local governments. The integrated disaster risk governance mode is to integrate these factors related to the disaster risk governance, form the strongest integration force, and improve the efficiency and effects of the disaster reduction resources consequently.

3.2.1 Factors related to integrated disaster risk governance

(1) Disaster risk zoning

According the historical disaster data, by estimating the exceeding probability, it's easy to confirm the various disaster risk levels, namely the realization of disaster risk zoning. In China, flood risk is usually zoned by 1/100a, 1/50a and 1/20a, etc. The division of the high risk, middle risk and low risk areas is not only needed to consider the disaster intensity in the region, but also needed to consider the disaster diversity and frequency. Therefore, the high risk area is where various disasters of great intensity frequently occur and the disaster status is also of the most severity. By compartmentalize the risk region, it provides clue and suggestion for regional development planning, especially for directly supporting the regional land use planning and ensuring that the regional development can avoid the high risk region.

(2) Stages of disaster reduction process

Disaster process commonly contains the three stages before disaster, during disaster and after disaster. The task of pre-disaster reduction mainly includes disaster supervision, warning and some other preparedness and plans for disaster. The task of in-disaster reduction mainly focuses on emergency transfer, allocation and other emergency task. And the task of post-disaster reduction mainly includes disaster recovery and reconstruction.

(3) The definition of disaster region, victims and effect

Each disaster brings direct and indirect influence and losses. As the direct disaster influence, the disaster region commonly refers to the hazard influencing region. While as the indirect influence of the disaster, the disaster region is likely to expand obviously with the evolvement and development of the disaster chains and disaster process. Taking a watershed for example, the rainstorm in the upper region necessarily affect the lower region, hence the disaster region expands from the upper region to the entire watershed. Besides, the landslides and the mud and stone flows caused by flood, destroy the traffic main lines. In this way, the region influenced by the halt of the traffic expands, and accordingly the disaster region expands along the traffic main lines. In July of 2006, the flood in Hunan province broke off the Jingguang railway and Jingzhu freeway, which are the arteries of the south-north traffic of China. As a result, the traffic along these main lines cannot perform normally, and the disaster regional expand from Hunan to Guangdong, Hubei and some other regions. Disaster victim commonly merely include the death, the wound and the people affected by the disaster, namely three types in all. In the situation of disaster, lots of basic facilities in the disaster region are affected, so precise calculation of different disaster victims has great importance in taking transfer and allocation measures. It also brings influence to making reconstruction plans in the disaster region. Besides the disaster victims, the disaster effect includes the property loss of the victims directly caused by disaster, the resources and environment damage, as well as the indirectly economic loss and social influence (especially the impacts on the normal economic and social process). The precise calculation of disaster effect is still a quite difficult technical work.

(4) The confirmation of the disaster reduction organizations

Once a disaster happens, the disaster relevant organizations often include the governments and its related departments, the enterprises and its affiliated sections, as well as the disaster region communities (mainly includes community projects, public guarantee, and households, etc). After disaster, the government as disaster victim not only has to face and respond to the disaster, and also should mobilize various resources to take part in the disaster reduction of the entire disaster region; the enterprises which is also the victim of the disaster, should face and respond to the disaster, and also play an important role in the material and equipment guaranteeing for disaster as constitute of the production line or life line in the disaster region; the

communities, the most basic units of disaster reduction, it's essential not only to organize self-aid and mutual-aid when the disaster happens, but also plays a determinative role in disaster reduction education and safety culture construction.

(5) The confirmation of disaster management levels

Different countries and regions have different governmental management modes. Take China as an example, it is usually divided into the center, departmental and local three systems. "Center" stands for the center of the Communist Party of China, the State Council, the Central Military Commission, the National People's Congress and the Chinese People's Political Consultative Conference; "departmental" stands for functional departments and affairs-handling departments which are affiliated to the center of the Communist Party of China, the State Council and the Central Military Commission; "local" can generally be divided into four levels: provincial level (municipality and autonomous regions), prefecture level (city at prefecture level and region at prefecture level), county level (city at county level, region at county level and street office at county level), town level (town at the town level and street commission at the township level). In the progress of implementing integrated disaster risk management, it's significant to clarify the division of duty and responsibility of the centre, departmental and the local governments in the implementation of the public security goal—"vertical to the end with no blank, and horizontal to the margin with no dead angle".

3.2.2 Integrated disaster risk governance mode

According to the integrated disaster process and the aforementioned main factors of integrated disaster risk governance, Fig. 6 demonstrates the integrated disaster risk governance mode. From the disaster management perspective, this mode clarifies the responsibility among the central, departmental and local governments and promotes an integrated disaster administration management system, namely cooperating the governments of all levels to realize the "vertical to the end and horizontal to the margin" integration; from the disaster process perspective, it clarifies the overall planning before, during and after disaster to realize the integration of disaster preparedness, emergency, recovery and reconstruction; from perspective of the relevant disaster departments, it emphasizes the harmonization of the governments, enterprises and communities to realize the integration of disaster capacity construction, insurance and relief. The three types of integration mentioned above is the core content of this integrated disaster risk governance.

In other words, this mode emphasizes that, under the guidance of scientific disaster reduction, and in terms of the dynamic and non-dynamic actions in disaster forming process, it's essential to construct the system, mechanism and legislation for integrated risk governance. The objective is to unite the governments, enterprises and communities as an organic entity during the whole disaster reduction process (including the pre-disaster preparedness, in-disaster emergency and post-disaster recovery and reconstruction) and realize the disaster risk management goal.

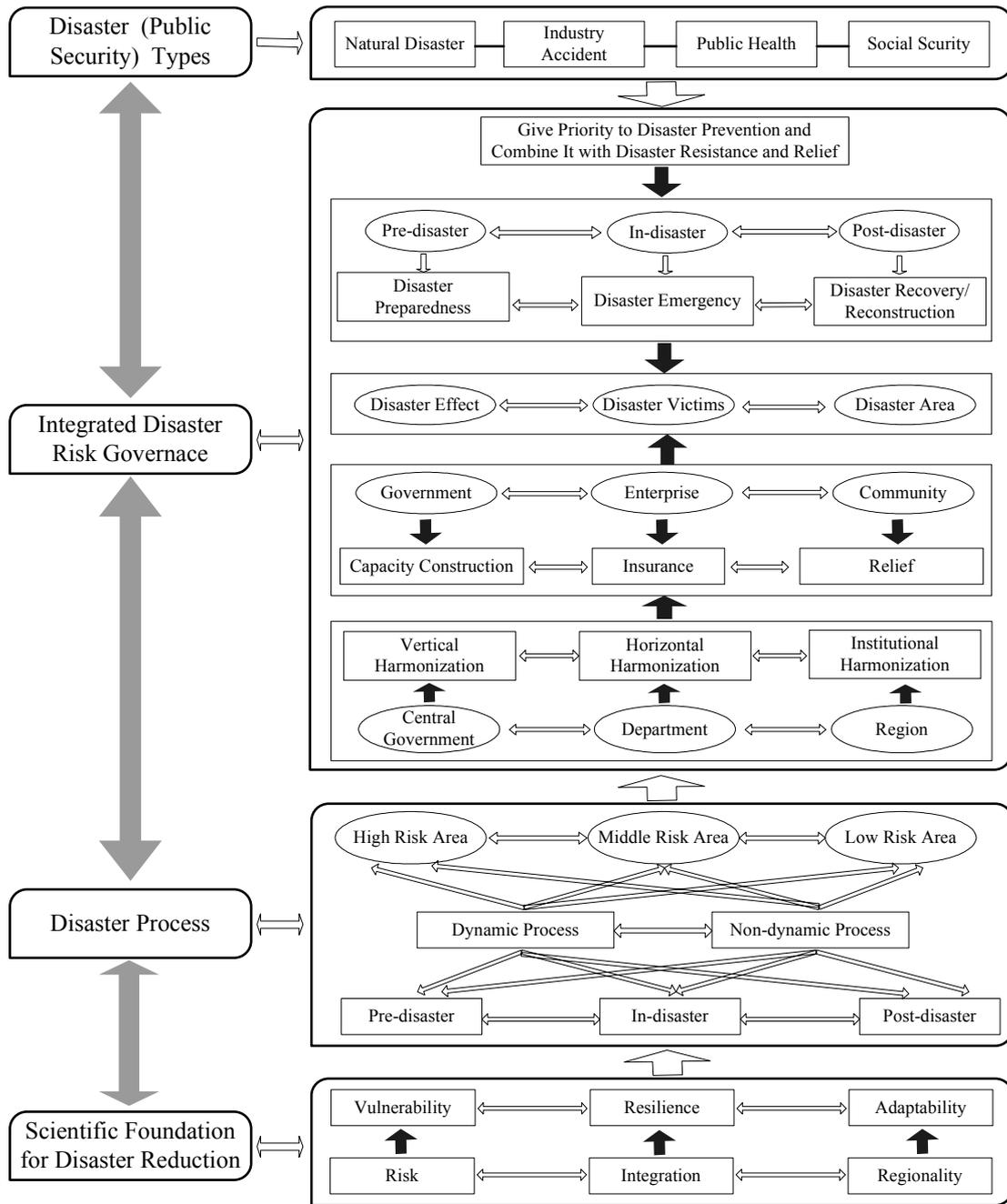


Fig. 6 Integrated Disaster Risk Governance Mode

4 Integrated Disaster Risk Management Strategies of China

4.1 To establish the “National Disaster Reduction Planning”

Disaster reduction has been high on the agenda for the central government, which views it as vital to sustainable economic and social development, coordinated development and harmony between economy, natural resources and ecology. The

central government has created the State Disaster Reduction Commission (SDRC) to harness the synergy of relevant efforts and initiatives. 30-plus relevant laws and regulations have been promulgated and put into force, integrating disaster reduction into national legal framework. In 1998, *the Disaster Reduction Planning of the People's Republic of China (1998-2010)* was designed to identify guidelines, targets, commitments and measures for disaster reduction efforts. With the guidance of the Disaster Reduction Planning, all the local governments, the departments, and the industries have enhanced the disaster reduction work effectively, and the integrated disaster reduction ability is improved.

In the 11-fifth development of China, according to the new period development needs and based on the *Disaster Reduction Planning of the People's Republic of China (1998-2010)*, it's necessary to establish more detailed *National Integrated Disaster Reduction Planning in the 11-fifth Period*, to define the main tasks of the national integrated disaster reduction and the key disaster reduction programs to be implemented in this period. As the guidance for the disaster reduction work, this new-period disaster reduction planning is now under the stage of experts' auditing and last-edition revision, which means that it's going to be promulgated and implemented all over the country immediately.

4.2 To accelerate the construction of disaster reduction ability

The Chinese government has paid much attention to the disaster reduction ability construction. This can be proved from the disaster risk management research programs. The National Natural Science Foundation and of China has sponsored and carried out a large number of risk management research projects, such as "regional disciplines of Chinese natural disaster" and so on. The Ministry of Science and Technology also supports risk management research in the fields of major natural disaster, engineering accidents, public health, and public security, through the Key Technologies R&D Program every five-year period. Since the SARS event broke out in 2003, Chinese government greatly increases the investment and input in the public security field, and a series of risk management research and technology development became to carry out and develop quickly. However, the disaster reduction ability is still needed to be accelerated, by learning from the developed and other developing countries and through all the possible ways to utilize the disaster reduction resources efficiently and effectively.

4.3 To improve the emergency response program

The *Master State Program for Emergency Response* is the general program for the national emergency response program and is the criterion file for the prevention and treatment of the public security events, which clarifies the classification and framework of the public security events, prescribes the organization system, operation

mechanism of the severe emergency dealing. Although the *Master State Program* is of great importance and guidance, it only pays much attention to the in-disaster integrated response, but overlooks the integrated optimization among the in-disaster emergency management, the pre-disaster mitigation, and the post-disaster recovery and reconstruction. So it's necessary to improve the rapid emergency response plans, harmonize all the aspects of integrated disaster reduction, and ensure the emergency response program is political, scientific and feasible.

4.4 To strengthen the discipline and human resource construction of disaster reduction

The Chinese organizations dealing with disaster risk management research mainly include the university research institutes, centres and laboratories, the academe research organizations and the government departments or research organizations. The research staff is made up of teachers and R&D members with a total amount of about 10 thousand. However, compared with the international situation, the Chinese disaster risk management still needs to enhance the discipline and human resource construction of disaster reduction. It's imperative to establish and develop the disaster reduction science and technology in China. The disaster reduction science and technology mainly contain the following parts: disaster science, to reveal the disaster system structure and functioning, and the disaster-forming dynamic and non-dynamic mechanism; emergency technology, to develop the technologies of disaster preparedness, emergency, recovery and reconstruction; risk management, which includes risk identification, perception, assessment, modelling and simulation, communication and adaptation, the risk governance institution, mechanism and laws, the risk transfer strategies and approaches, etc.

4.5 To improve the action of disaster rescue and disaster relief

A disaster rescue and relief mechanism has been put in place to regulate the placement of the victimized, rescue and relief, recovery and reconstruction efforts. The mechanism features rational input, comprehensive coverage and regulated allocation and helps straighten out the management of emergency response, recovery and reconstruction and the follow-up relief efforts to help the affected community to tide over tough unproductive times. A system is in place to put the livelihood arrangement of the affected on record, ensure that the relief efforts to help rebuild houses are available to each village and household. The subsistence for the affected has been well secured as the introduction of Relief Card Program has made relief supplies accessible and available to the entire disaster-stricken community.

Despite all these efforts, the emergency rescue ability of China is limited. Inadequate professional skill training and emergency rescue staff, and decentralized rescue force are the main reasons for the weak professional rescue ability. Because of

the outdated equipment and information construction, the emergency response speed is slow, and hard to implement efficient measures in time. Take work safety as an example, currently, there are only 150 thousand rescue staff but are divided into more than ten departments. So it's urgent to promote the disaster rescue ability, increase the practical emergency efficiency and effectiveness and guarantee the people's life and property security. Meanwhile, though the material reserving network for disaster relief is established, the disaster relief degree is still limited for the developing country of such a great population, which is not adequate for the victims to continue their normal life. So it's needed to continue to strengthen the disaster relief work, increase the disaster relief degree and effectiveness.

4.6 To emphasize the financial mechanism of large-scale disaster risk-transfer

The Chinese government is more and more taking insurance as an important commercial way for disaster risk transfer. In 2006, the total insurance premium of China is about 564.14 billion RMB Yuan, increasing 14.4% compared with the same period last year. Property insurance accounts for 150.94 billion, increasing 22.6%; life insurance accounts for 359.26 billion, increasing 10.7%; health insurance accounts for 53.94 billion, increasing 19%. The insurance depth is 2.8%, and the insurance density is 431.3 RMB Yuan. But there is still a huge gap between insurance in China and the World. China's GDP ranks 4th in the world, while the premium ranks 11th. The global average of premium proportion to GDP is 8%, while in China the number is 2.8%. The global average premium per person is 512 USD, while in China the number is 55.3 USD. The ratio of the insurance capital to the whole finance industrial capital in China is 1:33, while that of the developed countries is 1:5.

In China, the natural disaster insurance is just in the initiating stage. So far the natural disaster insurance just played as an affiliation to property insurance for the enterprises and rural families. The catastrophic and agricultural insurance is still under developing. Some provinces are making experiments on agricultural natural disaster insurance, including professional agricultural insurance company, agricultural insurance company of foreign capital, the combination co-insurance between the commercial insurance companies and the local governments, etc, but the testing range is very limited.

In 2006, the State Council of China proclaimed "Some Opinions of the State Council on the Reform and Development of the Insurance Industry", which emphasizes that insurance departments must sum all the experience up in the insurance testing area, probing agricultural insurance developing mode suitable for China, and extend the coverage of agricultural insurance. Construct an agricultural insurance system with multi-form and multi-support. The document also said that the old agricultural disaster mitigation mode should change to a new mechanism of agricultural insurance combined with financial support from government. Meanwhile, complete a multi-level agricultural catastrophic risk transition mechanism, exploring

an agricultural reinsurance system with governmental financial support. Only in this way can agricultural insurance be an important part in stabilizing the basic living standard of farmers, improving the disaster resilience and serve well for rural society.

Beside the agriculture insurance as the key devoting direction of the Chinese insurance industry, the catastrophe insurance is also under the research stage. With regard to the catastrophes, according to statistical data, catastrophes happened in China in 20 century account for 30% of global total catastrophes happened during the period. The losses from natural disasters in China are on the rise, average annual losses from natural disaster these years are 1.4 times of counterpart in the 1980's. Especially, damages caused by catastrophes increased faster. From 1950, there were 26 catastrophes happened in China, among which severe drought account for 10, flood account for 5, earthquake 7 and storms 4. Beside the great losses caused by catastrophes, great influence pressed on public's mind, for instance the Tangshan Earthquake in 1976 and floods in 1998. Based on researches it's pointed out that China will experience a severe natural disaster period in the early half century, and this mean that China's and global sustainable development of economy will face to a big challenge. It's a good chance for global insurance industry and other financial industry to set up catastrophe insurance in China.

At present, China's insurance industry experiences its primary development, mature and self-contained catastrophe insurance system has not established yet. And insurance companies in China are often on a small scale, lack in necessary national financial policies support. These situations limited domestic insurance industry's ability of catastrophe insurance, hindering the development of catastrophe insurance in China. Insurance companies' management and service can't meet the need of catastrophe insurance management. As technology demand and cost in catastrophe domain is high, insurance companies have difficulty to get an exact estimate about loss from catastrophes such as earthquakes, storms floods, causing these insurance agents unable to develop abundant types of catastrophe insurance product. Instead, conservative attitude are often adopted in catastrophe insurance field.

Thus, it's urgent to establish of catastrophe insurance system with Chinese characteristics. According to distribution, occurrence situation, market requirement on insurance, actual and macro-economic development of regions in China, taking advantages of foreign successful model experience, with state financial support, in a move to encourage domestic insurers to play a greater role in providing insurance for potential disasters, a catastrophe insurance system with Chinese characteristics is going to be established.

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