Archives Preservation in China: Current Challenges and Countermeasures

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1. Introduction

As rapid development of of archives undertakings as a whole in recent years, archives preservation in China has also come a long way in either concepts, tactics or technologies. However, challenges always coexist with opportunities. In recent years in particular, China's archives protection has also encountered some new challenges in the course of reform and development. These challenges include how to further enhance their disaster prevention and resistance capacities and deal with the attack of frequent natural disasters; how to further emphasize the concept of building low-carbon and green repositories so as to address the worsening environment and the requirement of low-carbon life; and how to further increase the digital memory and storage capacities so as to meet the practical demands of the popularization of electronic government and the mass production of electronic records. These are among the major challenges we have to deal with in a serious manner.

2. Three Major Challenges to Archives Preservation

2.1 Challenge 1: Threat of Natural Disasters to Archives Safety

Natural disasters and other emergencies have become more frequent and have posed new requirements for archives to cope with emergencies and boost disaster prevention and reduction capacities.

While natural forces have brought benefits to humanity, they have never stopped causing impacts and damage to human civilization and the people's lives and properties. When a natural disaster occurs, it causes huge damage and enormous loss to human lives and properties. We have lots of indelible memories. While the memories of the Wenchuan Earthquake and the Fukushima Tsunami remained fresh, the eruption of Eyjafjallajokull Volcano in Iceland, the attack of Hurricane Irene in the United States and the wreak havoc of Typhoon Nanmadol in the Philippines came one after another.

China is a country fraught with natural disasters. In recent years, natural disasters have become more frequent. In the past two to three years in particular, catastrophes

hit the country repeatedly. In 2008, we witnessed the Wenchuan Earthquake in Sichuan. In 2010, we witnessed the Yushu Earthquake in Qinghai, the Zhouqu Mudflow in Gansu, the rainstorm in Hainan and the flood in southern provinces. In 2011, we witnessed the Yingjiang Earthquake in Yunnan. In addition to these natural calamities, emergencies caused by human factors have occurred from time to time. The accidents in Wen'an in Yunnan and in Longnan in Gansu were all unforgettable traumas.

Whenever a major disaster occurs, the archives authorities unavoidably suffered direct or indirect losses. In the Wenchuan Earthquake, local archives structures and those in neighboring regions were seriously damaged and the destruction of archives was astonishing. Statistics indicate that in the six most-affected regions of Aba, Mianyang, Deyang, Chengdu, Guangyuan and Ya'an, 610,000 of the 4.25 million archive folders in the national general archives were in seriously-damaged buildings. Throughout the province, a total of 43,915 square meters of archives buildings were damaged, though in different degrees. The archives of Beichuan County was totally destroyed in the earthquake, and the archives were buried in debris and soaked in rains. The catastrophic aftermath done to these archives has caused serious threats to and extreme difficulties in the safe preservation and effective utilization of archival heritages.

In the face of frequent natural disasters, the CPC Central Committee has put forward a demand of "improving the system on disaster prevention and reduction and boosting the capacity for resisting natural disasters" (chapter 26). Therefore, an important task for archives authorities at various levels is to expedite the boosting of their capacities to cope with emergencies and natural disasters.

2.2 Challenger 2: Threat of Worsening Environment to Sustainable Development of Archives Protection

Global warming, environmental deterioration and energy shortage have posed an unprecedented demand for the development of low-carbon life. At the Copenhagen Conference, low-carbon economy received high attention of all countries. Energy conservation and CO_2 emission reduction are a global task that concerns the survival of humanity. Therefore, the sustainable development of archives protection also faces a major challenge.

Energy depletion and rising consumer demand constitute another grave test to human development. On the one hand, an enormous amount of energy is consumed

globally each day. On the other, these resources are not renewable and no substitutes have been found to replace fossil energies to meet the global demand. According to the 2010 Case Reference of the World Energy Outlook, the global energy consumption driven by the economic growth in developing countries will rise 49% during the 2007~2035 period at the current rate of energy consumption growth. The Poten & Partners, an American energy institution, said in its latest report that China's crude oil demand has doubled in the past five years and China has become the second largest energy consumer in the world.

China is also noted for serious pollutant emission. The report of the first national survey on polluting sources reveals that in 2007, China's total waste water discharge from the sources reached 209.28 billion tons and its total waste gas emission reached 63,720.37 billion cubic meters. They have produced serious negative impacts on people's production and life (they are also harmful to the permanent preservation of archives).

In the face of the growing energy crisis and worsening air pollution, low-carbon economy, energy conservation and emission reduction have become a global consensus. This is vitally important to human survival and reproduction. All countries, regions, races and industries should fulfill their responsibilities.

China's 12th Five-Year Plan for economic and social development says that the civilized, economical, green and low-carbon consumption concepts should be advocated so as to form green lifestyle and consumption model in conformity with China's national conditions. The document also calls for active response to global climate change and strengthened energy conservation and management. In order to encourage public institutions to conserve energy, increase their energy use efficiency and play exemplary roles in energy conservation, China promulgated the Regulations on the Energy Conservation of Public Institutions in 2008, on top of enacting the Energy Conservation Law. The Regulations specifies the plan, management and measures for energy conservation and contains explicit supervisory and support mechanisms. They are the basic rules that must be observed by archives and other public institutions in energy conservation and emission reduction. In this respect, archives should and can make their own contributions. In the ongoing wave of archives construction, great attention must be paid to constructing green archives and ensuring the sustainable development of archives protection.

2.3 Challenge 3: Threat of Information Explosion to Digital Memory Protection

With the rapid development of modern civilization, informatization, networking and digitalization have gradually become a basic mode of production and life for modern human society. Large amounts of exchanges are realized in the electronic form and through various networks. The mass production of electronic documents has become an important tool for human society to record, transmit and store information and one of the main forms of social documents. This has added new object and new content to archival work and posed a new problem to the safety of the non-traditional media archival information.

Currently, electronic documents are still a form of information that cannot be directly read and must be retrieved through special equipment and software. They have innate fatal weakness and insurmountable vulnerability. While they can be easily transmitted, they are also highly prone to change, vanishing and stealing. Prince Hamlet once said, “To be or not to be, that is a question.” And this is also a question to archival workers. To ensure that electronic documents are complete, genuine and valid and can be retrieved and utilized in dozens or hundreds of years is a major issue that should receive special attention and a fundamental issue that should be specifically solved. The repeated data loss and unreadability as what happened to the Appollo Missions, the Beijing Asian Games and the Early Population Census are all tragedies reminding us that the Sword of Damocles of information blankness always hangs above us.

3. Countermeasures

3.1 Boost Disaster Prevention and Reduction Capacities

3.1.1 Improve Emergency Mechanisms

Improving emergency-dealing systems, establishing crisis prevention and management mechanisms and strengthening emergency management are indispensable measures to boost capacities to deal with natural disasters.

In recent years, crisis management and disaster prevention and preparation are no longer an academic topic. Instead, they have become a practical issue and concrete practice that have received high attention from the archives authorities and related international organizations. Since its establishment, the International Committee of the Blue Shield has devoted to promoting the disaster prevention and reduction in the field of cultural heritage and the protection of cultural heritages in emergencies. In 1997, the

International Council on Archives published the Directory of Disaster Prevention and Reduction in Archives. In 2006, the International federation of Library Associations and Institutions published the Handbook for Disaster Preparation and Planning. These were all concrete expressions of high attention paid to this issue.

In order to minimize the damage of natural disasters and human accidents to archives, the State Archives Administration of China launched a special research project on the disaster prevention of archives in 1997. This project played positive roles in formulating policies on disaster prevention. One of the inspirations from this research project is that while the occurrence of natural disasters and their damage are beyond human control, such damage can be avoided or reduced if archival workers make earnest preventions.

In 2009, the State Archives Administration formulated the Regulations on the Management of Emergencies in Archival Work. The document requests that contingency plans should be formulated for the rescue and protection of archives in all possible unexpected disasters so that these emergencies can be handled according to these plans. In 2010, the agency compiled the Guidelines for Disaster Prevention of Archives and publicized the document in various places. It became a document to guide the archives authorities in disaster prevention and preparation, emergency handling, and rehabilitation and reconstruction

The contingency plans should include the establishment of emergency command, the specification of the duties of relevant departments and personnel, the rescue, transfer and rehabilitation of archives in various circumstances, the evaluation of the losses arising from disasters, the contact with the departments in charge of disaster relief, and the prevention of secondary disasters. Meanwhile, drills should be conducted to enhance the execution ability. Conducting drills according to the contingency plans is an important way to enhance the actual emergency-reaction ability.

In drawing emergency plans, fire and water prevention is of paramount importance. As the short-cut arising from cable ageing the improper use of electric equipment are the main causes of the fire disasters occurring in archives, and tighter safety management can prevent the occurrence of fire disasters in archives. Drawing emergency plans for all possible disasters can minimize the losses of archives after the occurrence of disasters.

3.1.2 Conduct Risk Assessment

In dealing with crises and easing risks, the first priority is to have a full awareness of the existence of crises and risks. The Hain rules fully explain the reason why prevention is so important: there are 29 signs of accident, 300 symptoms of accident and 1,000 hidden dangers of accident behind every major accident. People tend to ignore the hidden dangers and symptoms of accident and even fail to pay adequate attention after discovering them. This is an important cause of unexpected safety accidents. Therefore, one of the most fundamental measures to ensure the safety of archives and archival information is to make a systematic, standard and scientific assessment of possible safety risks and to identify the possible loopholes or hidden dangers on all links, and nib them all in the bud.

At the end of 2010, the State Archives Administration of China decided to consider the establishment of an archives safety risk assessment mechanism, the archives safety risk assessment indicators and their implementing plans. The risk assessment would be used to guide all units to take targeted safety precautions to prevent the occurrence of safety accidents and would provide a scientific basis for the handling of safety accidents.

3.1.3 Increase Resource Reserves for Archives Protection

In preventing and reducing disasters, it is imperative to increase resource reserves. Of all resource reserves, the protection techniques for rescuing and rehabilitating damaged archives should be regarded as one of the most important strategic reserves. In the efforts to rescue and rehabilitate archives after the 2008 Wenchuan Earthquake, the lack of practical techniques and specialized rehabilitation personnel for the mass treatment of affected archives highlighted the importance and urgency of increasing technique and personnel reserves. Such a serious damage to archives may occur once in a century. But when it does happen, it is imperative to have emergency plans, smoothly implement them, choose the methods and processes to rescue the seriously damaged archives, and choose the right rehabilitation techniques and equipment so that the damaged archives can be rescued in a timely and scientific manner. In this process, both personnel and technique reserves must be sufficient. For this reason, it is imperative to constantly train personnel and organize research and development so as to ensure the sustainable development of archive undertakings.

3.2 Boost Capacity for Sustainable Development

3.2.1 Build Energy-Saving Green Archives

According to China's national standards, green buildings refer to the buildings that can save resources (energy, land, water and material) as much as possible during their service life, protect the environment, reduce pollution, provide hygienic, suitable and efficient space to use, and coexist in harmony with nature. Green buildings are also called sustainable buildings, ecological buildings, nature-returning buildings, or energy-saving and environment-friendly buildings.

In building green archives, the first point is to enhance the properties of archive storehouse protection structures. Therefore, environment-friendly and sustainable materials should be used to reduce energy consumption required for indoor heating and temperature and humidity adjustment. The second point is to use energy-saving products and equipment and use more renewable resources. In particular, natural light and energy-saving lighting and equipment should be used as much as possible. Besides, geothermal energy should be used to adjust temperature and humidity, and rainwater should be harvested for recycled use.

Relevant data indicate that worldwide, buildings consume nearly half of all energies. In China, buildings account for nearly 30% of all energy consumption. In recent years, landmark buildings have become higher and higher and many buildings used glass curtain walls which have a high heat conductivity coefficient. This further increased energy consumption. The air-conditioners, elevators, water supply system, sewage system and fire control system have been overburdened.

In the initial stage of archives planning and designing, energy conservation and ecological consideration should be one of the important principles. In the course of designing, ecology and environment-friendliness should be the standard for environmental designing, and green architecture should be the standard for architectural designing, and the healthy, comfortable and energy-saving air-conditioning technology should be the standard for selecting the energy sources for the heating and air-conditioning systems.

Based on the existing technologies and new building materials, the construction of modern archives has a great potential in conserving energy and protecting the environment. An archives building with excellent thermal insulation property can visibly reduce energy consumption. In this respect, both the structural forms of the buildings and the use of new technologies and new materials play important roles.

The protection structures of the walls of archives storehouses should be scientifically designed. Multi-layer compounds should be used to build the single walls for archives storehouses so as to acquire a good thermal environment required for the preservation of archives. In recent years, China's archives authorities have made active explorations. For example, Guangdong Archives carried out joint researches on protection structures and energy conservation with universities in 1998 before the building was constructed. While selecting the building materials with better temperature and humidity insulation properties, they built a model of the storehouse to test the heat transmission coefficient. This provided valuable first-hand data for the construction of the new archives and was rewarded by the relevant government departments. After the storehouse was completed and put into use, the temperature in the storehouse remained in the +2℃ range when the air-conditioning system had stopped for 62 hours. This ensured the energy-saving operation of the air-conditioning equipment of the storehouse.

The use of thermal insulation compound walls (protective layer + humidity-proof layer + thermal insulation layer + respiratory layer) for archive storehouses ensure the high-level protection function of the protection structures of the walls of the archives storehouses. This compound structure excels the structure of single material in water and humidity prevention and thermal insulation and preservation.

The 18-storey archives center of the Suzhou Industrial Park formally inaugurated in May this year has a total floor space of 22,400 square meters. Its main green features include the respiratory curtain walls, the green self-recycling roof-top micro environment, the solar power generation, the natural lighting, the geothermal pump air-conditioning system, the rainwater recycling system, the sunshade system and the automatic terminal control room.

3.2.2 Use Renewable and Energy-Saving Products and Equipment

First, the energy conservation of air-conditioning equipment is vitally important to archives. The Energy Conservation Office of the Shanghai Construction Commission and Tongji University conducted a joint investigation in 2003 into the energy conservation of some public buildings. They discovered that the lighting system, the air-conditioning system and other power systems respectively accounted for 15%, 50% and 35% of all energy consumption by buildings. Therefore, the archives used energy-saving products as much as possible and carried out transformation of the

energy-consuming facilities and equipment. This is another important way to conserve energy and protect the environment.

The Minhang District Archives in Shanghai uses geothermal energy for heating in winter and cooling in summer. It uses the geothermal heat pump systems to control the temperature and humidity in the storehouse of the archives. For example, they include the cooling heat recycling technology and the turbine humidity removing technology. The application of these renewable energies and technologies in the construction of archives can greatly widen the prospect of energy conservation.

The rational use of local renewable natural resources for the long-term operation and maintenance of archives can reduce energy consumption and pollution. It is a meaningful effort. They include the use of solar energy, geothermal energy and rainwater.

The Library and Archives Canada, located near the Tropic of Cancer, uses a double arc dome roof to collect solar energy. The National Archives of Singapore collects rainwater for flower watering and sanitation. Landscaping done around the storehouses can help create a pleasant micro environment. Planting some special flowers and grasses on the platforms of archives buildings can effectively reduce the temperature of storehouses. The Rotterdam Archives in the Netherlands also uses similar methods and produces fairly good results.

Apparently, the energy conservation and emission reduction of archives must begin with small things. This also proves a popular Chinese saying that long travels are completed in steps and rivers and seas are formed with streams. So energy conservation and emission reduction must begin now with small things. In short, the concept of green archive buildings must be updated from time to time and must conform to different environmental conditions and actual architectural conditions. Guided by the scientific outlook on development, green concepts should be incorporated into the construction and management of archives.

3.3 Boost Digital Memory Storage Capacity

3.3.1 Important Archives Must Have Backup Copies in Different Places

The system to have backup copies of important archives is an important measure to enhance the capacity to resist various emergencies. Miguel de Cervantes Saavedra said in Don Quixote, “Don’t place all eggs in one basket.” China has observed a system since ancient times to keep several backup copies in different places. Today

when frequent social emergencies and natural disasters threaten the safety of archives, we must further enhance our awareness on risk prevention and place greater emphasis on having backup copies of important archives in different places. This can boost our capacity to deal with disasters.

The system that different archives have mutual backup copies of important archives can greatly reduce the cost of constructing the archives backup bases and expedite the implementation of the backup system. Having inter-media backup copies of digital archive information resources can further improve the safety mechanism of digital archive information in the environment of network and new technologies. This can avoid nontraditional threats that transcend time and space, mitigate the system risks arising from hacker attack, digital carrier fragility and information platform upgrading, and effectively increase the safety and reliability of digital archive information.

3.3.2 Emphasize Timely Transfer of Electronic Archives (Inter-Media Backup Copies)

In recent years, the State Archives Administration of China requested that all important electronic documents that must be permanently preserved must be transformed into paper or microfilm documents for preservation. As a result, inter-media backup copy of important electronic documents has formally become a basic system for archives management in China. This system has been established in light of new circumstances and new challenges and should be observed for a long time.

In order to ensure the quality of inter-media backup copies, the output requirement and technical standards have also been established and improved. In 2009, the State Archives Administration of China promulgated the Technical Standards for the Transfer of Digital Archive Information to Microfilms (DA/T 44-2009), which contains the technical standards for inter-media backup copy.

In selecting inter-media backup copy plans, full consideration should be given to the advantages of the backup methods, the properties of the storage media, the achieving paths and other factors. At the same time, consideration should be given to how to ensure and improve the accuracy, achievability and optimal expected efficiency of inter-media backup copies. The President of the National Archives of Singapore said that microfilming will come to an end in the 21st century as a technology, but microfilm will live forever as an archival medium. His personal view is that as long as

Kodak lives, we must continue to microfilm. This is because the greatest advantage of microfilms is that they can be read by humans and are not so much dependent on equipment and systems.

The Oriental Electric Corporation suffered devastating damage in the 2008 Wenchuan Earthquake. But the company could resume production soon after the earthquake largely because it had observed a microfilm backup system. This is a typical case that has been cited by many people in the industry. The profound inspirations from this case will perhaps live on for generations.

In short, we must stick to the inter-media backup system before the key issues concerning the permanent preservation of current electronic documents are solved. This can ensure the safety of electronic documents and digital archives and preserve our common lasting memories.

4. Conclusions

Of course, the challenges to archives protection are not limited to coping with frequent natural disasters, adapting to low-carbon life featuring environmental protection and energy conservation, and ensuring the lasting safety of digital memories. In light of the requirements of the times and the basic national conditions, we must have a fuller estimation of the impacts arising from various challenges, a fuller consideration of the countermeasures and a fuller implementation of various response plans. In this way, we the archival workers can seek advantages, avoid disadvantages, and pursue safe, coordinated and sustainable development.

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