Research on Information Resource Sharing for Emergency Decision-making

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Abstract

Realizing the sharing of information resources is an important guarantee for the rapid response of emergency response. The article discusses the sharing of information resources and the dynamic information resources based on the significance of information resources sharing and the status quo of retrospective research. The two aspects of the information resources sharing content of emergency response decision-making are sorted out. Finally, the information resource sharing countermeasures for emergency response decision making are proposed based on the research status and the problems of experts interviewed by the practice department.

Keywords

Emergency decision-making; Information resources; Sharing.

1. Introduction

Emergencies involve various fields and departments of the society. Only at different levels and in different departments can the emergency decision-making activities be effectively carried out. Information resources are an important link for cooperation at all levels and departments. By sharing information resources and building a common information resource system, we can effectively promote synergy at all levels and departments to jointly respond to emergencies.

2. Overview of Information Resource Sharing for Emergency Decision-making

2.1. Basic Concepts

(1) Unexpected events. Incidents are natural disasters, accidents, public health events, and social security incidents that occur suddenly cause or may cause serious social hazards, and require emergency response measures to respond. Sudden events are characterized by suddenness, harm, derivation, complexity and high degree of uncertainty. According to the evolution process and life cycle of emergencies, emergencies can be classified as "before the incident, at the time of the incident, there are four stages in the incident and after the incident.

(2) Emergency decision-making. Emergency decision-making refers to a special and unconventional decision taken by decision-makers in the face of emergencies or emergencies, requiring decision makers to break the rules and go beyond certain links or procedures. The problems faced by emergency decision-making are characterized by suddenness, sharpness, disorder and chaos. The resources, information and manpower resources available to emergency decision-makers are very limited, and the consequences of emergency decision-making are unpredictable. According to the different stages of the emergency, the emergency decision can be divided into four stages: "pre-alarm monitoring and early warning, emergency response at the time of the incident, comprehensive response during the incident, and aftercare after the incident".

(3) Information. Information refers to refined, activated, and useful data and knowledge sets. Information has the characteristics of "knowledge, transitivity, utility, relativity, conversion and timeliness". According to the different stages of emergencies and emergency decision-making, the information of emergency decision-making can be divided into "pre-existing information". Information), incident information (real-time information), in-process information (derived information), and post-event information (experience information) are four types.

(4) Information resources. "Resources" is a general term for various elements such as manpower, material resources and financial resources. There is not much definition of what is an information resource. We divide the concept of information resources into generalized terms based on the understanding of resources and information. Understand and recognize from two angles. Broadly defined information resources generally refer to the collection of elements used to secure information activities, including information gathering, information personnel, information organizations and institutions, information technology equipment, and information rules and regulations. Narrowly defined information resources refer to the collection of information that is useful after processing, sorting, and ordering. This article mainly refers to the narrowly defined information resources. Therefore, the information resource of emergency response decision-making refers to the information generated around the emergency decision-making of the emergency, and is processed, processed and sequenced.

2.2. The Meaning of Information Resource Sharing

As a whole society's participation and concern, emergencies involve different levels and types of institutions and departments in the process of coping and disposition. Strengthening inter-departmental coordination and emergency response capacity building is an inevitable choice and trend. The co-construction and sharing of information resources for emergency response decision-making is an important measure and guarantee for strengthening the inter-departmental coordination and emergency response capability construction. Its significance mainly includes the following aspects.

(1) Reduce the redundant construction of inter-departmental information resources. In the emergency response and disposal process, various departments collect and form various useful information resources according to the needs of the department. Through the sharing of information resources, it is possible to effectively reduce the redundant construction of inter-departmental information resources, achieve "interoperability, complement each other", and form a streamlined and comprehensive information resource system.

(2) Relieve the phenomenon of "information asymmetry" in emergency decision-making. In the process of emergency decision-making, "information asymmetry" is mainly manifested in the following aspects: First, before the incident, due to the lack of timely information acquisition, it is impossible to prevent and control in advance; the access to information is impaired and cannot meet the information needs of the rapid growth of emergency decision-making. Third, in the event of incidents, various derivative information and false information are associated, which makes the information in a rich situation. It is necessary to obtain useful information from it to provide reference for emergency decision-making. . Through the integration of information resources, the basic information available at each level and in each department and the information collected in real time are integrated together for unified processing, analysis and transmission, and "consisting from point to line, from line to face" to construct common information. The resource system can effectively alleviate the situation of "information asymmetry" in emergency decision-making.

(3) Improve the quality of emergency decision-making information resource services. Emergency response decision-making requires "high-speed, high-quality and high-efficiency use" information, through the integration of information resources, to avoid the use of their

respective information processes (collecting, processing, analyzing, transmitting and using information separately), to achieve centralized information processing, transmission and sharing, can shorten the information time lag, ensure the unification, standardization and standardization of information resources, and improve the quality of emergency decision-making information services.

3. Literature Review

Through the relevant database search and review, it is known that the information resources sharing of emergency response decision-making is the research topic or object, but the research literature related to the topic is relatively rich.

In the United States, etc., there are many related research results for reference. For example, Mears G etc. (2002) studied the construction of emergency management information resource database , and proposed a database technical framework for establishing cross-departmental information resource sharing[1].Schooley BL etc. (2007) studied the sharing and integration of information resources among emergency medical organizations, pointing out that through the sharing and integration of information resources, better decision-making can be made under time and information is limited[2]. Trecarichi G etc. (2010) studied the open knowledge system (Open Knowledge) to realize the information resource collection mode in emergency response. The knowledge open system can realize the interoperability of information resources in different fields in emergency situations[3].Ipe M etc. (2010) used the public health sector as a case to explore issues of mutual trust, coordination, and information sharing between the public sector and information intermediaries[4].Bharosa N etc. (2010) analyzed the challenges and obstacles of information resource sharing and coordination among disaster relief agencies through field exercises[5].Aedo I etc. (2010) proposed an end-user-oriented strategy to promote multi-organizations to adopt emergency management information systems, pointing out that coordination and cooperation in existing practices still have problems of "bad information sharing, unsmooth communication and lack of coordination". The study proposes the proposal to jointly build an emergency management information system through "participant group of participatory design, absorption of cognition and practice"[6].Carminati B etc. (2013) studied the framework of fast and controlled information sharing systems in emergency situations, and proposed an access control model for rapid access and sharing of information resources, which helps to quickly meet emergency management in natural disasters or emergencies. Information sharing requirements[7].

In China, there are also many related research results for reference. For example, Wei FQ etc. (2002) used the information sharing platform of the DongChuan Debris Flow Observation and Research Station of the Chinese Academy of Sciences (http://nsl.imde.ac.cn/). For example, the method and experience of the information sharing platform development and construction to realize the information sharing of debris flow disasters are summarized[8].Fan XY etc. (2006) proposed countermeasures for the development of public health science data sharing policies, establishing sharing mechanisms and policy support mechanisms, etc.[9].Huang HS etc. (2008) studied the issues related to the standardization of seismic field data sharing and the drafting of standards[10].Zhang YZ etc. (2008) studied the issue of knowledge sharing system in the public policy of national defense earthquake relief from the aspects of "meeting system, resource sharing system, information disclosure system, and popularization and dissemination system of earthquake disaster management knowledge"[11].Zhang ZM etc. (2010) analyzed the generation and flow characteristics of emergency information flow in emergencies, and combined the elements of emergency information flow (including emergency response tasks, emergency response departments, data sets and emergency assistance models) to study emergencies. The definition of the information model for emergency response and its

calculation [12].Xu X etc (2011)In the perspective of information supply chain, the information sharing of sudden public crisis is studied. In the case of sudden public crisis, there are "incomplete information collection and processing mechanisms, lack of standardization of information publishing content, low information sharing and single channel". And other issues, put forward the "improvement of information supply chain system based on information demand model, improve the information response mechanism of sudden public crisis management" and other aspects of the countermeasures[13].Fan B (2011) for the department of emergency management information system interoperability difficult current situation , explores the inter-agency information systems integration method[14].Li Y etc. (2012) pointed out that knowledge sharing related to emergencies in virtual communities is an important source of emergency decision-making information, and the application of virtual community knowledge sharing in emergency decision-making is studied[15].Bing B etc(2013) studied the "Information Sharing motivation unconventional emergencies online social network users"[16].Fan D (2013) studied the related issues of spatial data sharing for major natural disaster monitoring and evaluation, and proposed the technical framework for natural disaster monitoring and evaluation from the four levels of "support, monitoring, analysis and service", aiming at "lack of co-ordination Coordination, sharing lack of mechanism guarantee, lack of technical system support, lack of mutual synergy support and lack of unified standards and norms. The five aspects of space data sharing are raised, and the "shared coordination and infrastructure for strengthening the spatial data of major natural disasters" is proposed. Three ways to solve the problem of building and sharing a soft environment[17].Shi YX etc.(2014) studied the social crisis information sharing model led by Weibo Network, and analyzed the roles and differences of different subjects in social crisis information sharing[18].

From the above analysis, the research results of information resource sharing for emergency decision-making are rich. The main features include: First, the research objects cover emergencies in different fields such as natural disasters, public health, accident disasters and social security, among which natural disasters and Public health events are two types of emergencies with high attention, and the research results of defining research objects as emergency response decisions are still few. Second, the United States and other studies focus on empirical case analysis, focusing on technical or theoretical issues in a certain aspect of information resource sharing, which is worthy of research and continuous deepening; China's research is based on basic theoretical research, and there are more information resources sharing. The problems and countermeasures suggest relevant research results, and the issues of resource content and its circulation in information resource sharing need to be further studied.

4. Information Sharing Content of Emergency Decision-making

Some researchers pointed out that the data and information resources needed for disaster preparedness and emergency decision-making not only exist in the database built by local governments, but also exist in other governments, enterprises, social media and other institutions[19].From the content of information resources sharing in emergency decision-making, there are two main aspects: one is the basic information resources of various departments and fields, and the other is the dynamic information resources generated during the evolution of emergencies. For convenience of description, we collectively refer to the basic information, real-time information, derivative information and empirical information resources generated during the emergency process as dynamic information resources. Basic information resources are the basic guarantee for emergency decision-making, and dynamic information resources are an important basis for emergency decision-making and revision.

4.1.   Basic Information Resource Sharing for Emergency Decision-making

The basic information resources refer to the relevant information about population, geography, economy and various facilities needed for emergency decision-making. These basic information resources are usually controlled and managed by different functional departments and institutions. Through the sharing of basic information resources mastered by various departments, it can quickly realize the summary analysis of basic information resources and extract useful basic information, monitoring and early warning of emergencies, rapid response to incidents, rapid response to incidents, and timely summary process afterwards. Play an important auxiliary role. What are the basic information resources that need to be shared for emergencies can be determined by reference to existing domestic standards, norms and research. We have sorted out relevant domestic standards, norms and research, and extracted representative documents or opinions, as shown in Table1.

Table 1. Basic information type of emergency (Take China for example)

source	Basic information resources (data, database)
"Twelfth Five-Year Plan for the Construction of Governmental Informatization Projects" (2012)	5 categories: population information resource library; legal entities and information resources; spatial geographic information resources; macro-economic information resources; cultural information resource library.
National Emergency Platform System Provincial Emergency Platform Database Table Structure Specification(Trial) (2008)	22 categories: information minorities; economic statistics; state-level poverty-stricken counties; key protection objectives; major hazard; emergency response agencies; emergency rescue force; emergency expert information; emergency relief supplies; emergency medical resources; emergency communication resources; emergency transportation Resources; emergency shelters; major pollution sources; monitoring and monitoring sites; maps of nature reserves and tourist attractions; distribution maps of major accidents and hazards; emergency plans; typical cases; disaster statistics; knowledge;
Notice of the General Office of the State Administration of Work Safety on Strengthening the Construction of Emergency Production Resources Database for Safety Production (2011)	6 categories: Emergency Management Agency database; ENTERPRISES database; emergency plan database; emergency team database; emergency supplies and equipment database; emergency expert database.
"Local Standards for Basic Information of Guangdong Emergency Platform System Database Specification" (2012)	13 categories: basic information database (key protection goals, major hazard, shelter locations, health units, communications security agencies, transportation companies, technical support organizations, demographic, economic statistics, natural disaster statistics, accidents, disasters statistics , public health incident statistics, social security incident statistics, administrative divisions; geographic information database (basic geographic information data, thematic map data, comprehensive geographical names data); plan database; work network database (emergency management agency; emergency personnel; institutions Contact with personnel); rescue team database, emergency materials database (emergency materials storage, emergency supplies, emergency equipment, emergency materials production enterprises); expert database (expert group, experts, expert groups and experts), regulations library (regulations, Policy documents); case base; knowledge base (emergency common sense, standards and technical specifications); event information database (event receiving, forecasting results, early warning release); model library and document library.

It can be seen from Table 1 that there are many kinds of basic information resources related to emergencies, and there are many fields involved, which need to be accumulated and collected for a long time to be established. These basic information resources play an important auxiliary role in emergency response decision-making. Without long-term accumulation and sharing, it will take a lot of time to collect such basic information resources when the emergency breaks out, and then delay the decision-making. Opportunity. Only under the guidance of the sharing concept, unified and standardized construction can realize the sharing and interoperability between different departments and institutions in the event of an emergency improve the coordination and emergency response capability of various departments and handle the sudden the efficiency of the event.

4.2.   Dynamic Information Resource Sharing for Emergency Decision Making

The event information resource is accompanied by the occurrence, evolution and disappearance of emergencies, and is an important method to grasp the state and evolution trend of emergencies. In the process of an emergency, each department collects, analyzes, and processes related information resources according to the functions and needs of the department. The sharing of dynamic information resources emphasizes "speed, quality and utility". The content of dynamic information resources sharing includes information about events before, during, and after the incident, as shown in Table 2.

Table 2. Event information resource type example

Types of	Content example
Basic information	Relevant information such as disaster monitoring, risk investigation, and risk assessment. Taking earthquake disasters as an example, various basic information such as geological topographical distribution data, demographic data, urban layout maps, medical institution information, meteorological information, hydrological data, and earthquake prediction information are important pre-basic information for dealing with earthquake disasters. The source of resources, once the earthquake disaster breaks out, these seemingly "normal" basic resources can be immediately transformed into important basic information to provide basic guarantees for emergency decision-making.
Real-time information	Relevant information on the time, location, damage, status and evolution trend of the disaster. Taking earthquake disasters as an example, real-time information such as "earthquake burst intensity information, casualty information, house damage data, geological topographic damage information, hydrological damage information, lifeline damage information and aftershock information" are important for earthquake disasters. The source of real-time information, in the event of an emergency, the faster the acquisition of such real-time information is more conducive to the emergency response and scientific decision-making of the emergency department and decision makers.
Derived information	Information related to disaster events that are transformed, correlated, and derived from emergencies. Taking earthquake disasters as an example, information about "recovery information for victims, material distribution information, lifeline repair information, housing reconstruction information, and financial donation information", and information generated by "secondary disasters and related events" after the earthquake are all An important source of derived information in the development and evolution of emergencies.
Empirical information	Relevant information on disaster summary, assessment and experience. Taking earthquake disasters as an example, "disaster assessment reports, post-disaster reconstruction experiences and post-disaster research reports" are important sources of empirical information. Emergency information workers need to consolidate and translate these summarizing experiences and research reports into empirical information in a timely manner. ,in case for need.

5. Information Resource Sharing Countermeasures for Emergency Decision-making

Through the review of the research status quo, combined with the results of the expert group interviews with the emergency management department experts, it can be concluded that there are five problems in the current emergency department information resource sharing: First, the information system of each professional department is divided, sharing difficulties, resulting in redundant construction of resources. There is still a lack of effective integration methods; second, the information system construction standards, data formats, software versions and open interfaces of various departments are inconsistent, which makes it difficult to integrate basic information and real-time information between departments; Different sources and unbalanced interests lead to difficulties in the cooperation of information systems in various departments. Fourth, information resources are not well understood, software and hardware construction is emphasized, and data construction is underestimated. Fifth, information resources lack specific laws and regulations and top-level design. In this regard, we can start with the following measures to promote the sharing of information resources for emergency decision-making among departments.

5.1. Establish a Long-term Mechanism for Information Resources for Emergency Decision-making

The construction of information resources for emergency decision-making is a long-term large-scale project. It is necessary to establish a series of long-term mechanisms as a guarantee. Specifically, it includes the following aspects.

(1) Develop long-term plans. It should be led by the national emergency management department to organize emergency management and relevant departments to carry out unified planning of information resources construction for emergency response decision-making. The planning contents include information resource target planning, demand planning, and regulatory standard planning for emergency response decision making. System and platform planning, as well as different levels and departmental mission planning. By formulating long-term and unified information resource planning for emergency response decision-making, it can effectively solve the problems of decentralized construction, redundant construction and non-standardization construction of the current emergency department, and clarify the duties and tasks of various departments and the outbreak of emergencies Information role.

(2) Establish a legal system. Judging from the current laws and regulations, "information" can only be obtained in specific sections such as "The People's Republic of China Emergency Response Law", "National Overall Emergency Plan" and other types of laws and regulations or "monitoring, prevention and early warning" of planning. It is emphasized that there is still a lack of a complete and systematic system of information resources related to emergency response decisions. The publication of relevant laws and regulations on information resources for emergency response decisions in the form of government orders is the legal basis for realizing the sharing of information resources between departments. In addition, we should also pay attention to the construction of some supporting systems, such as organizational coordination mechanism, exchange and sharing system, funding guarantee mechanism, interest balance system, confidentiality system and incentive system.

(3) Improve standards and norms. For the formulation of information resource standard specifications, reference may be made to the current National Emergency Platform System Information Resource Classification and Coding Code and the National Emergency Platform System Provincial Emergency Platform Database Table Structure Specification (Trial) and other related standards and norms. Standards and standards related to information resources for emergency response decisions, selection criteria and construction specifications for

information resources themselves, information hardware and software related to information resources.

5.2. Integrate the Information Flow of Emergency Decision-making between Departments

The integration of information flow is one of the important measures to promote the sharing of emergency decision-making information resources. Specifically, it integrates the information workflow of emergency response decision-making departments to achieve unified planning and centralized collection of information resources. Centralized analysis and processing unified delivery and sharing. Inter-departmental information flow integration, as shown in Fig 1.
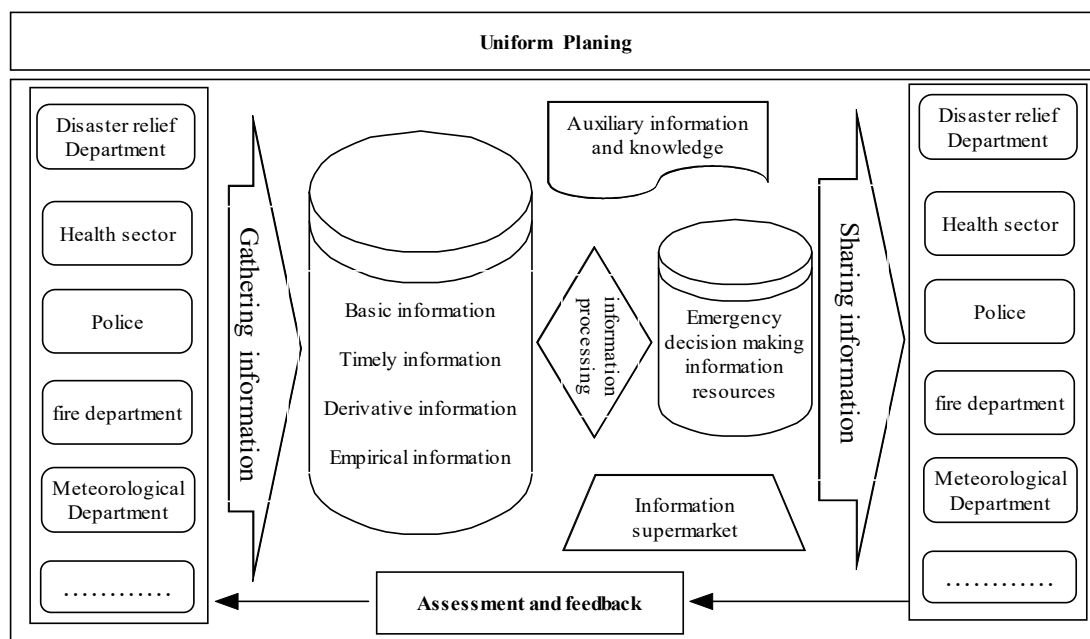

Fig 1. Inter-departmental information process integration

(1) Integration points. Build a unified virtual "controlled access" information resource platform[20], integrate the original independent information processes of each department, and build a unified information resource library, processing and analysis network platform to achieve unified delivery And sharing. The unified information resource library includes "basic information resources, pre-existing basic information, real-time information of incidents, derivative information in the event, and post-employment experience information". The unified information platform personnel are composed of relevant information workers of various departments.

(2) The meaning of integration. Through the integration of inter-departmental information processes, one can streamline the information workflow, avoid redundant information resource collection, processing and analysis, save resources for each department, and at the same time, each department acts as the end user of the integration subject and information resources. Invisibly increased the ability of participatory coordination and cooperation between departments[21]; Second, through a unified processing and analysis platform, gathering wisdom of the public, improving the speed, quality and effectiveness of information processing and analysis, in time emergency, information Better decision making in limited situations[22].

5.3. Strengthen the Software and Hardware of Information Resources

(1)Consolidate the construction of hardware facilities. Hardware is the basis for emergency decision information resource sharing. A good hardware environment can improve the processing speed and efficiency of information resources. From the perspective of inter-departmental information resource sharing, the level of hardware construction between departments cannot be too different. The departments with backward hardware should be updated in a timely manner. The departments with missing hardware construction should be supplemented in time to lay the foundation for information sharing of emergency decision-making information.

(2) Strengthen software and system construction. The information resources of "high speed, high quality and high efficiency" not only rely on advanced hardware equipment, but also rely on software and systems to collect, process, analyze and transmit information resources. Appropriate information resources-related application software and systems should be selected in accordance with uniform and standardized standards to ensure a high degree of consistency between software versions, data interfaces and system standards among departments to promote the sharing and sharing of information resources between different organizations.

(3) Promote the construction of shared information. The sharing of information resources for emergency decision-making and the good sharing of information environment are important guarantees for the rapid, stable and safe information of emergency decision-making information resources. The Internet and the national e-government network should be fully utilized to strengthen the information resource sharing information construction of emergency response decision-making, and gradually realize the construction of interconnection, resource sharing, business coordination and security and confidentiality.

6. Conclusion

The information system in emergency decision-making plays an important role in decision-making support and auxiliary role. Information resources are the core of the entire information service work, and the blood of the entire information system is effectively operated. Information resource sharing is to improve the information of all levels and departments. The effective integration of resources and the important guarantee for the construction and operation of the rapid response information system for emergency response decision-making. In the content sharing of information resources, the basic information resources and dynamic information resources related to emergencies are shared and shared, and the combination of peace and war in information resources construction is emphasized. In the information resource sharing strategy, the long-term mechanism is used as a guide and information. The process is integrated as a link and based on hardware and software construction. Through the research and practice of information resource sharing for emergency decision-making, the "information resource sharing big supermarket" will be constructed, and the "goods" required by the emergency management departments and information resource demand departments will be stored in the information resource supermarket to realize the emergency decision-making information resources. "The urgency of the people, think of what people think", improve the ability and level of emergency decision-making.

Acknowledgements

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