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Study on the Intelligence Service Model in "Scenario-Response" Emergency Decision Making: Taking China as an Example

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Abstract

Intelligence service model (ISM) plays a key role in emergency decision-makings (EDM). So, how will it be changed to better support those unconventional emergency decisions based on "scenario-response" paradigm? To solve it, the paper firstly analyzes the relationships between two main chains in EDM which are named "scenarios chain" and "decision-making chain", and adopts a "target-centric" intelligence process to establish a new ISM. Then, an example of "Songhua river water pollution incident" in China is taken to further explain the operation mechanism of this model. Finally, suggestions are promoted from three aspects - intelligence theory, intelligence culture and intelligence resources. The study is to provide a new perspective for the development of theory and practice in emergency intelligence services.

Keyword*: Unconventional emergency, Scenario-response, Emergency decision-making (EDM), Intelligence service model (ISM)*

1. Introduction

In recent years, various types of unconventional emergencies have occurred frequently, such as the 911 event, China's SARS crisis, India ocean tsunami, Japan's nuclear disaster and so on, which greatly endangered the regional and global security. Since rare and difficult to predict, these emergencies put forward higher demands to the intelligence services in EDM. However, due to many problems (*e.g.*, less time for the collection of intelligence, more difficult to verify the reliability of intelligence, more complicated to share and integrate information, *etc*.), it is very hard to achieve the desired quality for intelligence services. Even the USA who has a quite powerful intelligence system still failed in timely forecast and swift response of the 911 event and Katrina hurricane disaster [1]. After lots of discussion about intelligence failures in emergency decisions, the USA described the relationship between their intelligence system and emergency decision system as "two parallel running ships in the night", and considered their intelligence community to pay more attention to the nontraditional security threats (such as natural disaster, accident disaster, public health, social security and so on). Thus, a reform strategy of intelligence community integration was put forward, and a new ISM is being explored in the information era [2-4]. Meanwhile, the lessons also prompted them to focus on emergency decision problems. Based on the summary of many cases, the DHS issued a file named "national planning scenarios", in which the 15 national emergency planning scenarios were defined [5]. Since then, the ideas have been put forward that emergency decisions should be made based on scenarios, and a new paradigm of EDM has been developed. In the absorption of these new ideas, Chinese researchers promote a proposition that the paradigm of EDM should be changed from "predict-response" to

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"scenario-response", and have carried out some studies on the basic theories and technology applications [6-8]. However, with the increasing studies in this field, and the surging demands of intelligence services for EDM, what kind of model should intelligence services employed in the making of the "scenario-response" emergency decisions? This is a problem deserving of study, but there is little literature mentioned.

To bridge the gap, this article will focus on the ISM in the "scenario-response" emergency decision-making (SR-EDM), based on the summaries of emergency intelligence theory. From the analysis on the mechanism of EDM, two main chains ("scenarios chain" and "decision-making chain") are abstracted. Then through the study on the relationship between "intelligence service process" and "scenarios chain", a "target-centric" intelligence process is used to establish a logic framework of ISM. Furthermore, a case of "Songhua river water pollution incident" in China is taken to explain and verify this framework. Finally, suggestions are promoted to provide references for the development of intelligence services for EDM.

2. Literature Review

2.1. The Paradigm of SR-EDM

Because of the strong dependence of scenarios in unconventional emergencies, the traditional EDM of "forecast-response" paradigm should be replaced by the "scenario-response" paradigm, which would guide the policymakers to make real-time decisions according to the scenario evolvement of unconventional emergencies [9]. So intelligence services ought to be faster and more effective to support the generation of these real-time decisions which have more uncertainties and complexities. But the question is that how to change the traditional ISM to meet the demands of SR-EDM in the non-traditional security domain. Obviously, it needs more in-deep and systematic studies.

2.2. Intelligence Service Model

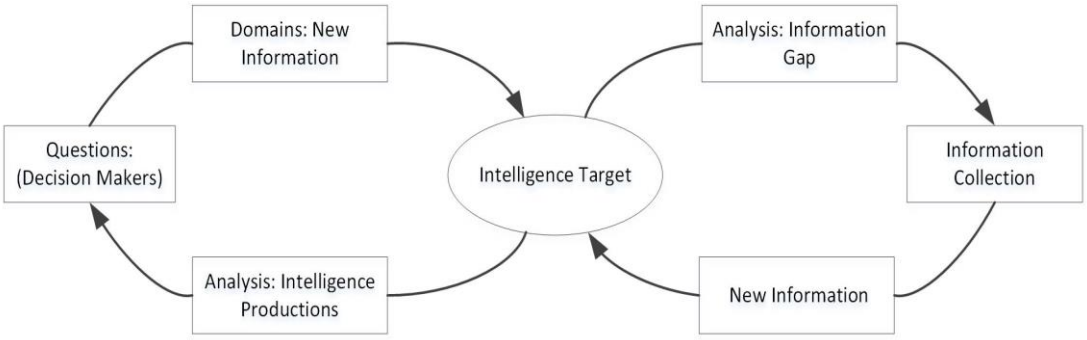

Figure 1. "Target-Centric" Intelligence Process

The traditional ISM is mainly in accord with the "intelligence cycle" theory [10]. During the period of traditional security, the intelligence services mainly focused on the support of political and military crisis decisions among countries. After the cold war, with the gradually increasing nontraditional security threats, the scope of intelligence services is extended into the field of public administration. Meanwhile, the western spooks with USA as representative, had also found many weaknesses of this traditional model whose intelligence system was organized like many chimneys. Under this background, Clark put forward a "target-centric" intelligence process to replace the traditional process (Figure 1) [11]. The process is as follows: When the decision makers meet some action problems, he/she can check the current

understanding of the intelligence targets, and then define the information demands. The targets will also be shared by intelligence analysis and collection staffs who transform the requirements into "information gaps" together. After information is updated, intelligence products will be finished by Intelligence analysts and sent to the decision makers. The comparison results of two ISMs were shown in Table 1.

Table 1. IT Operation and Maintenance Service Effects in Shanghai E-Gov

Comparison of subjects	*ISM based on intelligence cycle*	*ISM based on "target-centric" intelligence process*
Intelligence Process	A series of relatively independent, orderly, linear steps(requirements, planning and direction, collection, processing and exploitation, analysis and production, dissemination)	A dynamic network in which all the stakeholders work together across the borders of their departments.
Intelligence Bodies	Professional intelligence officers(excluding intelligence users)	All the stakeholders (including intelligence users)
Characteristics of Intelligence System	Closed	Opened
Means of Intelligence Collection	Mainly with secret means	Combined with secret and opened means
Methods of Intelligence Analysis	Mystery solved model	All source intelligence fusion model to complete the whole picture of a complex event as soon as possible
Characteristics of Intelligence Communication	Usually secret, and unwilling to share information; limited channels to get expert support	Information sharing are encouraged, while information security is still concerned; wisdom and resources from multi-field are integrated; Problems are solved in a multi-stakeholder, collaborative environment
Responsibility Issues	Departments mutual shirk responsibility	Collective responsibility
Information Load	Analysts' brains have to receive too much information	Advanced information technologies are used to process big data, and information load is shared through team work.
User Participation and Acceptance	Decision makers do not take part in the intelligence cycle, and cannot give feedback timely; They often hold doubts to adopt the advice of intelligence reports.	Decision makers take part in the intelligence process, and can give their feedback in real-time; They understand the value of intelligence products, and adopt them actively.

Based on the above comparison, the traditional ISM cannot well suit the demands of real-time decision-making in unconventional emergencies. The reasons are as follows: a) Decision makers are outside the intelligence cycle, which do not fit the actual situation of EDM. b) The isolated intelligence functions reduce the speed and quality of intelligence processing, and it is hard to chase the responsibilities. c) The linear process does not meet the cognitive process of human brain which is leap, nonlinear, especially in case of emergency. While, in the ISM based on "target-centric" intelligence process, all the stakeholders (even an ordinary people who can provide information on time), including decision makers themselves who may not be intelligence professionals, would play a part in the process. Under the guidance of same targets, they share and integrate intelligence and information timely through a network cooperation based on information technology (IT), which may form a great power to improve the efficiency of EDM. Therefore, the ISM based on "target-centric" intelligence process is more suitable to the SR-EDM.

2.3. Theory and Practice of Intelligence Services for EDM

Compared with Europe, USA and other developed countries in practice of emergency intelligence services, the EDM of China emphasize the concept of "information services" more than "intelligence services", except in the military and police intelligence field. Thus, the concept of "intelligence" is not fully reflected in the building of her emergency system: a) the mechanism construction of intelligence services for EDM is unsound. The other countries have already made lots of effect in this field, especially the information sharing and intelligence integration environment, and released many detailed guidance documents [12-14]. However, China hasn't done so deeply. Although some policies related to information reporting and sharing have been released, there are still plenty of works to do in the mechanism construction of intelligence analysis, distribution and security and so on. b) Management system of emergency intelligence service capacity (EISC) has not been established in emergency management. Emergency preparedness and exercises in the other countries even western are "capacity building" oriented. A "gap analysis" method is used to identify the gap between the existing and expected EISC, the results of which can give a scientific guidance to improve EISC. But China has not yet applied any systemic evaluation and management methods to the enhancement of EISC. c) Staffs in emergency departments are lack of professional intelligence training and guidance. In western countries, emergency staffs must get some intelligence ability trainings, and both the "intelligence studies" and "information science" theories (the two "IS" theories) are integrated to guide these training programs. Moreover, many best cases of emergency intelligence practice have been written and distributed to them to encourage the exchange of experiences [15]. However, in China, due to the conceptual confusion of "intelligence" and "information", training and guidance for staff are mainly about information skills, and lack of intelligence skills [16].

In theory, there is little related literature in China, since the researches were carried out later than developed countries. And the existing literature mainly focuses on IT or case studies. For example, Bo discusses the experience and deficiency of intelligence services for emergency public events in Hainan province [17]; Song and Gao analyze the cases of intelligence services for disaster emergency provided by the library and information organizations in USA and Mexico [18]; Lin and Yao sum up several key problems in China's emergency intelligence services, based on a survey of some emergency management departments in Sichuan province [16]. Besides the case studies above, there are some studies on IT. For example, Fan and Li design a collaborative emergency response information system, based on the static game model and top design theory [19]; Zhu, Feng and Wang build an emergency information system model, and design the basic function of it [20]. However, promoted by the international concept of "intelligence-led policing", the intelligence theory of police field pays more attentions to related issues [21, 22].

In fact, it can be find that the current emergency intelligence services theories are more suitable for "forecast-response" decisions. Thus, what's the model of intelligence services in the "scenario-response" decisions? How does it work? How to improve the existing intelligence system? It is necessary to do some further studies.

3. Model Construction

To solve the above problems, a logic framework is proposed in this section, which can explain the basic elements and operation principle of ISM in SR-EDM.

3.1. Logical Framework of ISM in SR-EDM

The logical framework of ISM in SR-EDM is shown in Figure 2. The evolution process of an unconventional emergency includes three stages: latent period, explosive period and recovery period. As a kind of real-time decisions, "scenario-response" decisions are made in explosive period. And the framework of ISM in SR-EDM contains two main chains which named "scenarios chain" and "decision-making chain". Intelligence process is included in the "decision-making chain", composed of intelligence "demand chain" and "task chain".

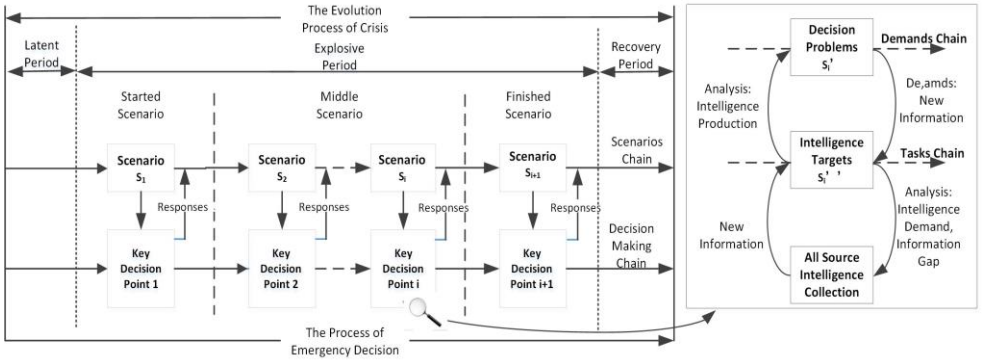

Figure 2. Logic Framework of ISM in SR-EDM

3.2. Basic Elements in the Framework

1) Scenarios chain

Scenarios chain is the realistic scenario evolution of unconventional emergency, consisting of a series of information nodes which can describe key scenarios of the event (Figure 2). If scenario Si is defined as a set of all sub-scenarios at Ti moment, then the started scenario node is S_1, the middle nodes are $S_2,\ldots,S_i$, the finished node is S_{i+1}. Scenarios chain is a trigger condition of decision-making. Intelligence services should build the data structure models of key information in these scenario nodes (*e.g.*, knowledge element method or ontology technology can be adopted to build these models). And the models will be stored in the information system, based on which all sources intelligence can be fused to analyze problems such as the real-time status, evolution trend and influence factors of an emergency. So the main picture of its "scenarios chain" which may give policymakers points for reference can be gained as soon as possible.

2) Decision-making chain

Decision-making chain is a critical decision process in the face of crisis scenarios, consisting of a series of key decision nodes (Figure 2). When scenario Si activates the task of key decision point i, decision makers will make plans and carry out some responses with the support of intelligence services. The results will directly affect the subsequent scenario evolution.

3) Demand chain and task chain

Intelligence services at each key decision point are based on a "target-centric" intelligence process, and also contain two main chains (Figure 2): a) Demand chain. It's a set of decision problems at all key decision points, represented by $\{S_1', \ldots S_i', S_{i+1}'\}$; b) Task chain. It's a set of intelligence target models by which all intelligence activities will be guided, represented by $\{S_1'', \ldots S_i'', S_{i+1}''\}$.

3.3. The Operation Principle

In this framework, when the scenarios nodes activate the key decision points, the intelligence demands are generated and intelligence services are started. Any changes of demands at each key decision point will need new information, and these information gaps will be exactly defined and gathered as soon as possible. Updated information will be put into the intelligence target models for analysis to support the decision-making. This is an iterative process with the evolution of event scenarios. During the whole explosive period, intelligence services system runs effectively according to the above principle.

4. Case Study

In the fight against the unconventional emergency, if ISM cannot well support the RS-EDM, it would cause the crisis out of control and the situation deteriorated. "Songhua river water pollution incident" which occurred in 2005 in China is a typical case [23]. As known, the initial situation of this accident was "a chemical plant instantly exploded". So the main functions of ISM in this RS-EDM should be as follows: a) Defining possible paths of scenario evolution in advance; b) Capturing the key points of decision-making accurately in the scenario evolution; c) Providing effective intelligence productions rapidly; d) Making sure that the government keeps communication with the public media and other stakeholders during the whole event.

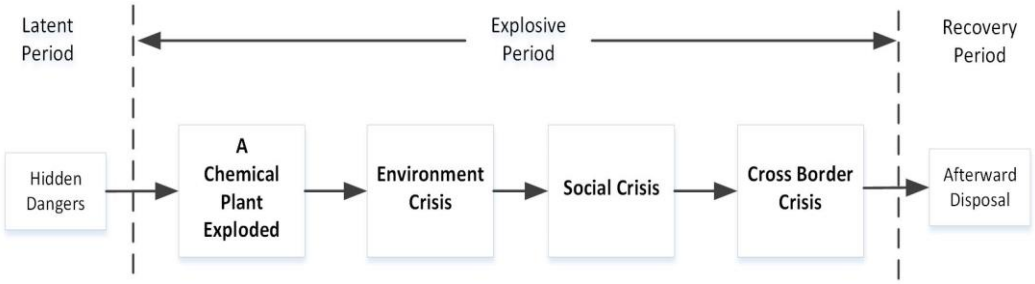

Figure 3. Scenario Evolution of "Songhua River Water Pollution Incident"

According to the scenario evolution stages in explosive period (Figure 3), "Scenarios chain" and "Decision-making chain" can be divided into four key points:

Scenario S_1 (the beginning of the crisis): At 13:30 on November 13, 2005, a chemical plant exploded and caused a large fire, in Jilin province in China. This situation activated the tasks of the first key decision point. However, local government departments did not obtain intelligence services effectively at that time - neither did they monitor and estimate the danger sufficiently, nor did they listen to the experts carefully. Lack of understanding of the situation, their decisions mainly relied on past experiences rather than professional knowledge, which resulted in a wrong judgment of the crisis' nature and level. They just treated it as a common fire, and didn't realize the possibility of secondary disasters (water pollution). Thus, the best time was delayed to report and require support from related departments. Besides, without intelligence support in chemical explosion, the firefighters put out the fire with plenty of water. This mistake aggravated the water pollution. It was these tactical, strategic intelligence failures causing the event to develop into second stages.

Scenario S_2: On November 14, all contaminated water drained into Songhua River, and pollution spread rapidly. This situation activated the tasks of the second key decision point. Unfortunately, due to the imperfect mechanisms of intelligence monitoring and warning, the supervision departments (*e.g.,* water conservancy, environmental protection sections, *etc*.) didn't notice the abnormal data of water quality timely, and also did not verify the data records about pollution concealed by the chemical plant, which made water pollution out of control.

Scenario S_3: November 15 to 27, after cutting off the water supply, rumors spread around. Then, many people rushed to purchase drinking water and foods, and even fled to other cities. This situation activated the tasks of the third key decision point. However, the poor intelligence services did not remind the decision makers to realize the necessity of information disclosure and public opinion management, which led to a mistake again and caused a social crisis.

Scenario S_4: Chinese top decision makers didn't recognize to report the Russian government until November 22, after the polluted water had already flowed into the river in Russia. This error brought much criticism from Russia and other countries, and initiated a cross-border crisis. So the tasks of the fourth key decision point were activated at the moment. However, the collection of emergency intelligence mainly depended on the reports of each unit from the bottom to the up. This channel was single, and had too many links as well as information islands, which made information sharing blocked and decision opportunities lost.

The above analysis indicates that Chinese present ISM is no longer fit for SR-EDM. Nevertheless, the ISM being proposed in this paper may have an advantage in improving the quantity, quality and speed of intelligence services. In terms of quantity, intelligence is collected from all sources (MASINT, IMINT, SIGINT, HUMINT, *etc*.). For example, in this case, there were many sources(*e.g.,* the abnormal data of water quality from water testing equipment along the river, the reports from the persons on the spot, the warnings and suggestions from experts, *etc*.) to gather intelligence when the incident broke out. The fusion of all-source intelligence would effectively support decision-making. In terms of quality, results of intelligence fusion will help decision-makers to predict the key decision-making points or problems in scenario evolution quickly and correctly. Mistakes will be reduced and planning time will be more. In the case above, if decision-makers got the warning that the explosion was most likely to cause water pollution and then properly evaluated the nature and level of the accident, they would report the truth to higher authorities as soon as possible, and the result would be different. Moreover, a high quality intelligence service also requires the intelligence officers not only report information, but also pay attention to the deep analytics of information. In this case, if analysts were sensitive to capture the signals from abnormal data of water quality and carried out an investigation, the danger would be discovered timely. In speed, a "target-centric" process in ISM can make the intelligence collected and integrated quickly, with the aid of IT. However, to realize this model, the intelligence system also needs to develop the mechanisms of information disclosure, public opinion management and information sharing and intelligence fusion.

5. Discussions

Since SR-EDM are real-time, the ISM being built here is mainly fit for the decision-making during explosive period. However, to enhance EISC more work needs to be done in the latent and recovery periods. And this is a long-term, foundational and systematic construction of intelligence system. In this regard, efforts should be made in the following three aspects:

5.1. Intelligence Theory Construction

At present, there are still few emergency intelligence studies in China. And the findings mainly scatter in the fields of emergency management, information sciences and intelligence studies. Thus, how will the theoretical and practical experiences from the two "IS" theories be applied to "emergency management"? This issue needs more study. Firstly, the intelligence discipline itself should solve the problems about how to integrate the two "IS" theories and use them to guide the practices of intelligence services in a non-traditional security period. Secondly, in colleges and universities, the training objectives of intelligence discipline need to be adjusted. The graduates may not only be good at information technology for the social development, but also have some general intelligence skills for the national security service. To realize this goal, suitable theories, methods and courses may be introduced from military/police intelligence field at home, and intelligence studies as well as educations in western countries. Finally, there are some differences between emergency and general intelligence theories. So it is necessary to discuss what kind of intelligence theories to be adopted and how to use them to solve the problems in emergency decision-making.

5.2. Intelligence Culture Construction

Construction of intelligence culture environment is a critical path to improve EISC. There are some thoughts (*e.g.*, "reporting only good news" and "keeping the skeleton in the cupboard") that may hurt intelligence cooperation rooted in Chinese traditional intelligence culture. Therefore, firstly, the intelligence awareness of the leaders in emergency departments should be strengthened; Secondly, through the top-level design of emergency intelligence system, the mechanism of emergency intelligence mobilization, coordination and accountability (*e.g.*, the intelligence operation mechanism in emergency plans, information sharing mechanism, information disclosure and confidentiality mechanism, *etc*.) can be improved. Thirdly, due to the rapid returns on investment, government administrators who want to show their political achievements easily may focus on the development of hard capabilities over soft capabilities. These short-term ideas will lead to the consequences of a large number of advanced technology resources being idle and wasted. Therefore, an assessment and management system of EISC should be established, during periods of emergency preparation (based on the process of emergency drills) and recovery (based on real-time experiences). Taking the scientific assessment results as a guide, the government is able to carry out a more reasonable allocation of emergency intelligence resources, and keep a healthy and sustainable development of EISC.

5.3. Intelligence Resources Construction

In the information age, emergency intelligence service is a "human-technology" integrated process. From technical point of view, China ought to strengthen the construction of technology resources in emergency intelligence system. On the one hand, the investment in new intelligence technologies and equipment needs to be increased. On the other hand, the existing resources of technologies and equipment (*e.g.*, resources located in military/police forces, government departments, key infrastructures, professional and technical institutions, commercial organizations, *etc*.) should be fully utilized. Not only hardware, but also the software construction should be accelerated. So it is necessary to develop the digitization of emergency resources. Basic database resources need to be established (*e.g.*, the databases of emergency plans, cases, strategies, knowledge, *etc*.). Information standards may be

built and new findings of information sciences (*e.g.*, social media technology, big data mining technology, internet public opinion analysis technology, intelligent technology, *etc*.) may be applied to emergency intelligence services. From the perspective of human resource management, there are also lots of improvements to be made. For example, intelligence skills education may be added in emergency trainings and drills, and intelligence guidebooks ought to be written for special domains (such as infectious diseases, hazardous chemicals and so on). The assessment indexes of intelligence capacity may be adopted in human resource management of emergency staffs. Thus their recruitment, training, performance and promotion will be based on these assessment results. In addition, China should take the advantages of the large population. For example, in undeveloped areas, government should pay more attention to the building of traditional human resource intelligence networks; And in developed areas, government can use e-government technologies to create an online emergency intelligence network, which may encourage citizens to become human sensors by using various convenient intelligent terminal equipment. And the online scenarios simulation exercises can realize a long-distance education of emergency intelligence skills to citizens. With the help of these new information technologies, government can gain more social forces (*e.g.*, workers in key infrastructures, community workers, volunteers, *etc*.) as fast as possible, and not only rely on the existing information assistants hired from grass-roots level. The participation of whole nation will greatly improve the ISM of SR-EDM.

6. Conclusions

In conclusion, the theory and practice of emergency intelligence services are not too mature in China. Especially, when the paradigm of EDM is transformed, the ISM should be adjusted accordingly. But how will it be realized? This article conducts some studies to solve this issue. Firstly, a logic framework of ISM for SR-EDM is proposed to meet the real-time intelligence demands in unconventional emergencies; Secondly, a case of "Songhua River water pollution incident" in China is taken to explain and test the compatibility of the framework; Finally, the paper further discusses the construction of intelligence system during the latent and recovery periods, and gives some suggestions on the construction of intelligence theory, culture, and sources. This research might be useful to provide reference for the development of theory and practice in emergency intelligence service.

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