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Steel enterprises' system building of emergency management capability assessment

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ABSTRACT

The rapid development and technical improvement of China's steel enterprises put a higher demand in production safety, it's important to build steel enterprises' emergency management capability assessment system, which can improve the level of organization and coordination of emergency management and production, reduce security risks, and effectively prevent emergencies from happening. This paper is based on the research of emergency management at home and abroad. Combined with relevant experts' suggestions, the paper builds steel enterprises' emergency management capability system, and uses AHP to determine the weight of each index. According to the actual case of a steel company, gray analysis is used to evaluate its emergency management capabilities and give some suggestions, which provides a reference for enhancing its emergency management capabilities.

Keywords: Emergency Management, Capability Assessment, Gray Analysis, Analytic Hierarchy Process

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INTRODUCTION

Sudden catastrophic event is occurring more frequently in modern society, it has caused great inconvenience to the people's life and work. On February20, 2012, in An gang Heavy Machinery Co., Ltd, The steel foundry spray burst, caused 13 deaths and 17 injuries, on April 11, 2012, Hebei Jinxi iron explodes, several workers injured.

Asearlyasin 1985, McLoughlin indicated theimportanceofintegrationinemergencymanagement[1].Knottintroduced a bulk food transportation problem, developed a linear programming model in which two objectives were considered, namely, minimize transportation cost and maximize the amount of food delivered [2].

China pays concern and attention on emergency management capacity after SARS in 2003. To date, scholars from different disciplines have studied the emergency management capabilities, such as Fenghua Zhang, Zhongyuan Kang, Han Zhang Zhao's research on urban earthquake prevention capacity evaluation system [3]. The Yunfeng Deng, Shuang zhong Zheng; An Chen, Tieming Liu, Huicui Ni built a city emergency capability assessment index system including 18 categories, 76 properties, 405 feature [4-5]. Zhangwei Yang, Lili Xie, Meijun Meng constructed the city disaster Response Capacity Evaluation model from the point of view of system theory, combining with the characteristics of urban disaster management, using AHP and expert investigation method [6]. Lei Ji, Hong Chi used complex system theory, process management theory, fuzzy analytic hierarchy process theory to build the urban public emergencies Emergency Management ability evaluation system and system-wide evaluation system model.

This paper study the emergency management issues for steel enterprises from a systems perspective, evaluated public emergencies management capabilities for steel enterprises using the focused analysis method. The effective

combination of the two can embody the theory on practical guidance as well as the operability.

2 Emergency management capability assessment and model

Steps of emergency management capability assessment are as follows:

1. Expert scoring method to score each factor

2. AHP to determine weight

(1) Build hierarchy model.

(2) Establish judgment matrix as shown in Table1.

Table1.Weights of judgment matrix

Scale	Explanation
1	Compared to two factors, equally important
3	Compared to two factors, one is important
5	Compared to two factors, one is more important
7	Compared to two factors, one is much more important
9	Compared to two factors, one is extremely more important
2,4,6,8	Between the two adjacent scale

(3)Calculate the index weights and do the consistencies test

Eigenvector method is commonly used to calculate the judgment matrix vector to determine the index weights in the analytic hierarchy process. First, calculate the judgment matrix product of the elements of each row and open the nth root. Then, standardizing. Finally, calculate the maximum eigenvalue.

The ideal judgment matrix should satisfy the consistency conditions; therefore judgment matrix must do the consistency test. Index (CI) is commonly used to measure the judgment matrix consistency: During consistency test, correction value RI should be introduced, as shown in Table 2.

Table 2.Consistency index value of different dimension random

Dimension	1	2	3	4	5	6	7
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32

,if, the judgment matrix satisfies the consistency requirements, otherwise, we need to re-construct the judgment matrix.

3. The application of multi-level gray evaluation method to evaluate emergency management capabilities. Steps of the gray evaluation methods：

(1)Formulate grading standards of evaluation index

The pros and cons of each layer indicators can be grading into 4 grades: excellent for 4 points, good for 3 points, not bad for 2 points, bad for 1 point. If index level between two adjacent, then score 3.5 points, 2.5 points, 1.5 points.

(2)AHP to determine the evaluation index weights

(3) Organize e experts rating

(4) Seeking the evaluation sample matrix

(5) Determine the evaluation gray class

Determine the evaluation gray class means determining the evaluation gray class level, gray number and whitening weight function. As Table3 shows:

Table 3. The gray class functions and schematic diagram

class	'excellent'(e=1)	'good'(e=2)
Gray number	Gray number	Gray number
whitening weight function		
class	'not bad'(e=3)	'bad'(e=4)
Gray number	Gray number	Gray number
whitening weight function		

(6) Calculating the gray evaluation coefficient

(7) Calculating the gray evaluation weight vector and weight matrix.

The evaluation of the weight vector ： , then gray evaluation weight matrix： , comprehensively evaluate ,the evaluation results are ： .

(8) Comprehensively evaluate U, the evaluation results of, then B, the evaluation results of indicators of U,.

(9) Calculate the value of comprehensive evaluation and sort

The first gray class 'excellent' points 4,the second gray class 'good' points 3,the third gray class 'not bad' points 2,the forth gray class 'bad' points 1,so gray class rank value C, then , is vector transpose of the gray class level value.

3Construction and Empirical Analysis of steel enterprises emergency response capacity system

3.1The constitution of evaluating system

The selection of indicators should reflect the core of the emergency management capacity, and the ultimate goal of emergency management is to reduce losses, casualties, and the loss of property.

Table 4.The evaluating system of emergency management capability of steel enterprise

Target layer	Criteria layer	Index layer
Emergencies management capabilities of steel enterprises	Rescue capacity(U_1)	Training before Disposal(T_{11})
		Drills before disposal(T_{12})
		Rescue knowledge and skills(T_{13})
	Ability of rescue persons and property(U_2)	Self-help and mutual aid(T_{21})
		Casualties(T_{22})
		Rescue goods(T_{23})
		Economic damage(T_{24})
	Disaster control capability(U_3)	Disaster Control Measures(T_{31})
		Effective power (T_{32})
		The disaster spreading(T_{33})
	Ability of disaster recovery and summarize(U_4)	Redevelopment project(T_{41})
		Specify preferential policies(T_{42})
		Restoration of public facilities(T_{43})
		Psychological counseling(T_{44})
		Implementation of recovery and reconstruction(T_{45})
		Conclusion(T_{46})

3.2Empirical research--take Y Steel Company as example

1.Calculate the weight by AHP

Based on the index system has been established, the weight of index can be calculated by AHP.

Table 5 Judgment matrix of the first level indicators

	U_1	U_2	U_3	U_4	weight
U_1	1	1/2	1/3	3	0.161
U_2	3	1	2	4	0.436
U_3	2	1/2	1	3	0.323
U_4	1/3	1/4	1/3	1	0.080

Table 6Evaluation index weight of emergency management capacity of the steel enterprises

Target layer	Criteria layer	Weight	Index layer	weight
Emergencies management capabilities of steel enterprises	Rescue capacity(U_1)	0.161	Training before Disposal(T_{11})	0.203
			Drills before disposal(T_{12})	0.649
			Rescue knowledge and skills(T_{13})	0.148
	Ability of rescue persons and property(U_2)	0.436	Self-help and mutual aid(T_{21})	0.124
			Casualties(T_{22})	0.538
			Rescue goods(T_{23})	0.066
			Economic damage(T_{24})	0.271
	Disaster control capability(U_3)	0.323	Disaster Control Measures(T_{31})	0.637
			Effective power (T_{32})	0.258
			The disaster spreading(T_{33})	0.105
	Ability of disaster recovery and summarize(U_4)	0.080	redevelopment project(T_{41})	0.404
			specify preferential policies(T_{42})	0.098
			Restoration of public facilities(T_{43})	0.041
			psychological counseling(T_{44})	0.053
			Implementation of recovery and reconstruction(T_{45})	0.228
			conclusion(T_{46})	0.177

2. Multi-level gray evaluation method

Five experts are invited to rate the various indicators of steel enterprises.

Table 7.The scoring table of experts

No.	index	Expert one	Expert two	Expert third	Expert four	Expert five
1	Training before Disposal(T_{11})	2	3.5	3	4	2
2	Drills before disposal(T_{12})	1.5	2	4	3	2
3	Rescue knowledge and skills(T_{13})	3.5	2	2.5	2.5	3.5
4	Self-help and mutual aid(T_{21})	3.5	3.5	3.5	2	3.5
5	Casualties(T_{22})	3	4	4	3.5	3
6	Rescue goods(T_{23})	3.5	3	3	2	2.5
7	Economic damage(T_{24})	3	3	4	3	2.5
8	Disaster Control Measures(T_{31})	2	4	3	3.5	2.5
9	Effective power 入(T_{32})	4	3	4	3.5	3
10	The disaster spreading(T_{33})	4	3	3.5	3	3
11	redevelopment project(T_{41})	2	2	3.5	3.5	3
12	specify preferential policies(T_{42})	2.5	2	2	3	2
13	Restoration of public facilities(T_{43})	2	2.5	2	2.5	3
14	Psychological counseling(T_{44})	3.5	2	3.5	3.5	2.5
15	Implementation of recovery and reconstruction(T_{45})	3.5	3.5	3	4	3
16	Conclusion(T_{46})	2.5	2.5	3.5	2.5	2.5

According to the data, the gray evaluation matrix can be calculated ：, and. The results can be calculated as follows:

Use as index of first layer, as results, according to：, According to .

Table8.Results of emergency management capabilities Y steel enterprise

Target layer	Weight	Criteria layer	Results	Index layer	Results
Emergencies management capabilities of steel enterprises	3.16	Rescue capacity(U_1)	2.96	Training before Disposal(T_{11})	3.09
				Drills before disposal(T_{12})	2.89
				Rescue knowledge and skills(T_{13})	3.10
		Ability of rescue persons and property(U_2)	3.24	Self-help and mutual aid(T_{21})	3.18
				Casualties(T_{22})	3.34
				Rescue goods(T_{23})	3.04
				Economic damage(T_{24})	3.14
		Disaster control capability(U_3)	3.19	Disaster Control Measures(T_{31})	3.13
				Effective power (T_{32})	3.33
				The disaster spreading(T_{33})	3.25
		Ability of disaster recovery and summarize(U_4)	3.08	Redevelopment project(T_{41})	3.04
				Specify preferential policies(T_{42})	2.91
				Restoration of public facilities(T_{43})	2.92
				Psychological counseling(T_{44})	3.12
				Implementation of recovery and reconstruction(T_{45})	3.29
				Conclusion(T_{46})	3.01

3.3The analysis and recommendations of the evaluation results

First, focus on the evaluation value of the target layer. The final score of the evaluation of the company's emergency management capability is 3.16; it is at a high level. Next, look at the evaluation value of criteria level which shows that：Rescue capacity scores 2.96, Ability of rescue persons and property scores 3.24, Disaster control capability scores 3.19,Ability of disaster recovery and summarize scores 3.08. Rescue capacity has a low score; it needs more attention, Disaster control capability scores just more than 3.0, it needs improvement. Finally, focus on evaluation values of indicators layers which should be compared in the same criteria.

In the rescue capacity, Drills before disposal, Ability of disaster recovery, Restoration of public facilities score less than 3.0, other two indicators score higher than 3.0. Therefore, the number of exercises should be increased in the usual exercise, take up their social responsibility initiatively to public recover destroyed facilities. The indicators of Capacity of rescue personnel and property and disaster control capability score more than 3.0, which shows the enterprise is able to fully mobilize social forces so that everyone involved in the emergency rescue of the accident, which should be remained.

Based on the above analysis, this article put forward the following recommendations to enhance emergency management capabilities: enterprise should carry out some training activities; after the disaster, enterprise should strengthen the moral and material compensation for employees; enterprises should summarize the reasons for disasters in order to avoid a similar situation from happening again; last, when accident happens, enterprises should promptly contact with the government, and cooperate with the government to control the damage of the accident.

CONCLUSION

Build the enterprise emergency management capability evaluating system by analyzing the status quo of China's steel enterprises emergency management and the problems; determine the weights of the various indicators of the emergency response capacity of the steel enterprises by AHP; quantize indicators of the emergency response

capacity of the steel enterprises by gray evaluation method.

Because of my actual level and the objective situation of limitations, this paper has some problems, and the evaluation model should be further optimized to make the results of the evaluation more accurate.

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REFERENCES

[1] Me Loughlin D. A framework for integrated emergency management[J]. Public Administration Review, **1985**, 45: 165-172
[2] Knott R. The logistics of bulk relief suppliers[J]. Disaster, 1987;11:113-115Zhangwei Yang, Lili Xie, Meijun Meng. *Business culture*, **2007**(6):189-190.
[3] Fenghua Zhang, Zhongyuan Kang, HanZhang Zhao. *Journal of Natural Disasters*,**1999**,8(2):61-66.
[4] Yunfeng Deng, Shuangzhong Zheng. *China Work Safety Bureau academic*,**2006**,2(2):9-13.
[5] An Chen, Tieming Liu, Huicui Ni. Modern emergency management theory and methods [M].Science Press,**2009**.
[6] Zhangwei Yang, Lili Xie, Meijun Meng. Disaster Mitigation and community building: The cornerstone of the city's emergency management [J].Business culture,**2007**(6):189-190.