CSCanada
International Business and Management
Vol. 10, No. 1, 2015, pp. 50-54
DOI:10.3968/6483

ISSN 1923-841X [Print]
ISSN 1923-8428 [Online]
www.cscanada.net
www.cscanada.org

Applicationof Geological Disaster Risk Management Performance Evaluation System Based on the BSC

FU Yuanzhai[a],*; WANG Jingbo[a]

[a] Shandong University of Science and Technology, China.
* Corresponding author.

Supported by National Science and Technology Support Program, "a comprehensive study of seismic disturbance area major landslide disaster prevention technology and integration (2011BAK12B09)".

Received 21 December 2014; accepted 12 February 2015
Published online 28 February 2015

Abstract

China is one of the most serious geological disasters country in the world, strengthening the defense capability of geological disasters, reducing disaster losses, and protecting the public interest are the nature of geological disasters disaster relief management. In this paper, the Balanced Scorecard performance evaluation system is designed to improve the rescue process, gives the index weight by AHP, combined with the application of the index system specific cases, which optimize provide ways of rescue, which provide a reference for our work carried out geological disaster risk management.

Key words: Geological disasters; Relief management; BSC; Weight; Performance evaluation

Fu, Y. Z., & Wang, J. B. (2015). Applicationof Geological Disaster Risk Management Performance Evaluation System Based on the BSC. *International Business and Management, 10*(1), 50-54. Available from: http://www.cscanada.net/index.php/ibm/article/view/6483
DOI: http://dx.doi.org/10.3968/6483

INTRODUCTION

Due to the particularity of geographic location, and affected by geological conditions, topography and climate conditions, our country has become one country with the most serious geological disasters in the world. According to statistical data of recent years, the economic loss caused by geological hazards in China accounted for 20% to 25% of the total economic loss caused by natural disasters. Therefore, the enhancement of geological disaster risk management should minimize the economic loss and reduce damage to the environment. And this will be of great significance. In the process of a large number of geological disaster risks, our country gradually formed rescue system with the leadership of government departments, division of departments, the graded disaster management and localization management, although the disaster management ability has greatly be improved, there is a big gap compared with foreign advanced rescue system. So the adjustment and optimization of rescue management will be very beneficial for disaster relief and the progress of the society in the future.

1. THE GEOLOGICAL DISASTER RISK MANAGEMENT PERFORMANCE EVALUATION MECHANISM BASED ON BSC

Balanced Scorecard has leaded to wide consideration from both the academic researchers and the practitioners all over the world since the first generation. And it is reviewed as the greatest management tool in the past 75 years by Harvard Business Review. The biggest difference between BSC and other strategic management tool is the balance, and BSC appraises the performance from four dimensions of customers, internal process, learning and growth and finance. The four dimensions form cruciform structure and have the balance quality in terms of form and content. The real purpose of evaluating performance with BSC is converting the organization's strategic plan to specific indicators, and realizing the real-time control of strategy. Therefore, BSC is not only a performance management tool, but also strategic management tool, and enable the evaluated organizations improve their

own competitiveness under the strategic guidance. The geological disaster risk management performance evaluation emphasizes not just emergency management work, but more about summering up the problems from warning to rescue to the reconstruction of the whole process. Thus enhance the ability of geological disaster risk management work. In this paper, by using BSC, design a set of rescue strategy as the center, pay attention to index system of the balance between rescue dimensions, and evaluate the performance of geological disaster risk management with BSC and performance evaluation tool comprehensively in our country. Few scholars deeply research in the field. Having certain innovation is the advocate of a thinking and method of innovation.

The four dimensions overall index of geological disaster risk management performance evaluation is basically identical with BSC index system of enterprise performance evaluation, but there are different emphases on their major contents. The financial dimension is the core of enterprise performance evaluation, and the other three dimensions are factors to improve the financial dimension. The geological disaster risk management should regard the public interest as the core, and the other three dimensions are factors to meet the needs of the public interest. That is to say, meeting the needs of the public interest needs scientific and rational planning rescue process, improving the efficiency of the rescue process. Optimizing protection programs, allocating various security resources rationally; At the same time, also need to constantly optimize and study, improve the relief way and the level of the rescue. For the optimization of rescue process and protection programs, or for the study and improvement of geological disasters, there is only one final goal, that is as far as possible to reduce the negative effects on the public and society from the geological disaster management, and to reduce loss and improve the satisfaction of the public.

2. THE INDEX DESIGN OF GEOLOGICAL DISASTER RISK MANAGEMENT PERFORMANCE EVALUATION BASED ON BSC

The index system of geological disaster risk management performance evaluation based on BSC is as shown in Table 1, and it is refined on the basis of the first level index. After establishing the index system, score all the index through site inspection, social investigation, expert evaluation, data processing. Get the final performance score combined with the preset weights. The effective operations of BSC needs a extensive discussion of performance evaluation plan. And establish effective feedback mechanism to improve the index system and ensure the dynamics of performance evaluation.

Table 1
The Index Design of Geological Disaster Risk Management Performance Evaluation Based on BSC

Dimension A	First level B	Second level C
A_1 Public interest dimension	B_{11} The public's right to know	C_{111}: Release the use of relief materials
		C_{112}: Timeliness of disaster information release
		C_{113}: Communication of disaster information
	B_{12} Living security of the public	C_{121}: The issue of basic living Things in disaster area
		C_{122}: Building of emergency shelter
		C_{123}: Vulnerable groups protection mechanism in disaster area
	B_{13} Post-disaster reconstruction	C_{131}: Compensation mechanism
		C_{132}: Formulation and implement of the planning
		C_{133}: Psychological rescue of victims.
		C_{134}: Disbursement and use
		C_{135}: Development post-disaster
A_2 Rescue process dimension	B_{21} Emergency warning	C_{211}: Pursing and renovating the potential risk
		C_{212}: Basic facilities for emergency
		C_{213}: Warning system construction
		C_{214}: Completeness of emergency plan
	B_{22} Emergency response	C_{221}: Self-rescue ability of victims
		C_{222}: Ability of rescue mutually in community
		C_{223}: Corresponding speed of government bailout
		C_{224}: Ability of corporation approach
		C_{225}: Resource integration capability
	B_{23} Recovery	C_{231}: Disease control and prevention in disaster area
		C_{232}: Maintaining social order in disaster area

To be continued

Continued

Dimension A	First level B	Second level C
A_3 Protection program dimension	B_{31} Human resource level	C_{311}: The size of rescue team
		C_{312}: Arrive timely
		C_{313}: The quality of rescuers
		C_{314}: The scope of volunteer actual participation
		C_{315}: Quality of commanders
		C_{316}: knowledge level of experts
	B_{32} Financial guarantee level	C_{321}: The size of special fund from government
		C_{322}: The size of geological insurance
		C_{323}: Utilization of capital market
		C_{324}: The size private donations
	B_{33} Physical resource guarantee level	C_{331}: Contingency reserve supplies
		C_{332}: The size of relief material
		C_{333}: Timeliness of relief material
		C_{334}: Equipment level
	B_{34} Environmental protection level	C_{341}: Completeness of policy, laws and regulations
		C_{342}: Accuracy of disaster scale assessment
		C_{343}: Completeness of disaster relief agencies
		C_{344}: Completeness of warning agencies
		C_{345}: Establishment and participation of professional social organization
	B_{35} Facility security level	C_{351}: Emergency road transport security
		C_{352}: Lighting system security
		C_{353}: Communication system security
		C_{354}: The establishment of medical institutions
	B_{36} Information security level	C_{361}: Advanced release time of disaster
		C_{362}: Times of warning
		C_{363}: Predicted transmit rate of disaster
A_4 Learning and Improving dimension	B_{41} Learning ability	C_{411}: The extension of disaster relief knowledge
		C_{412}: Cultivate consciousness of disaster relief
		C_{413}: Times of emergency exercise
		C_{414}: Education and training level of rescuers
	B_{42} Improved ability	C_{421}: research productivity of rescuing technology
		C_{422}: Frequency of rescue equipment improvement
		C_{423}: Frequency of rescue skills improvement
		C_{424}: Smooth level of accountability channel

3. THE DETERMINATION OF THE ASSESSMENT INDEX WEIGHTS

For hierarchical relationship within geological disaster risk management performance evaluation index system based on BSC, combined with the principle of weight determining and analytic hierarchy process, calculate every weight of aspects of BSC in geological disaster rescue.

First invite 20 persons forming the expert group to focus on discussing, and those persons come from scientific research institutions, relief agencies, the people in disaster areas and society, the media, the enterprise. After repeated discussions and adjustment, construct judgment matrix of all levels; Again use the analytic hierarchy process to get the weight of the index system; At last, according to each index score from the experts, score the final performance by weighted average. The calculation process is briefly as follows:

3.1 Weight Definition of Dimensional Level

According to judgment matrix of dimensional level, determine index weight.

Table 2
Judgment Matrix and Index Weigh

	A_1	A_2	A_3	A_4
A_1	1	2	3	4
A_2	1/2	1	2	3
A_3	1/3	1/2	1	2
A_4	1/4	1/3	1/2	1
Weight	0.47	0.28	0.16	0.10

$\lambda_{max}=4.03$, CR=0.011＜0.1, through the consistency examination.

3.2 The Calculation of First Level Index Weights

Table 3
First Level Index Weights

Index	Weights		
B_{11} B_{12} B_{13}	0.09	0.64	0.27
B_{21} B_{22} B_{23}	0.24	0.68	0.08
B_{31} B_{32} B_{33}	0.39	0.10	0.24
B_{34} B_{35} B_{36}	0.04	0.15	0.07
B_{41} B_{42}	0.67	0.33	

The calculation of index weights are all through the consistency examination.

3.3 The Calculation of Second Level Index Weights

Table 4
Second Level Index Weights

Public interest dimension	Index weights	Rescue process dimension	Index weights
C_{111} C_{112} C_{113}	0.07, 0.28, 0.65	$C_{211}C_{212}C_{213}C_{214}$	0.06, 0.16, 0.29, 0.48
$C_{121}C_{122}C_{123}$	0.61, 0.27, 0.12	$C_{221}C_{222}C_{223}C_{224}C_{225}$	0.43, 0.27, 0.15, 0.05, 0.09
$C_{131}C_{132}C_{133}C_{134}C_{135}$	0.27, 0.38, 0.06, 0.18, 0.11	$C_{231}C_{232}$	0.5, 0.5
Protection program dimension		Learning and Improving dimension	
$C_{311}C_{312}C_{313}C_{314}C_{315}C_{316}$	0.21, 0.42, 0.11, 0.04, 0.15, 0.06	$C_{411}C_{412}C_{413}C_{414}$	0.25，0.51，0.16，0.09
$C_{321}C_{322}C_{323}C_{324}$	0.47, 0.16, 0.10, 0.28	$C_{421}C_{422}C_{423}C_{424}$	0.47，0.29，0.17，0.07
$C_{331}C_{332}C_{333}C_{334}$	0.29, 0.16, 0.46, 0.09		
$C_{341}C_{342}C_{343}C_{344}C_{345}$	0.42, 0.06, 0.26, 0.16, 0.10		
$C_{351}C_{352}C_{353}C_{354}$	0.47, 0.10, 0.28, 0.16		
$C_{361}C_{362}C_{363}$	0.63, 0.14, 0.24		

The calculation of index weights are all through the consistency examination

3.4 Total Sequencing Weight of Index Hierarchy

Through above analysis, single and total sequencing weight are as shown in Table 5.

Table 5
The Corresponding Table of the Composite Score

A	Score	B	Score	C	Score
				C_{111}	7.4
		B_{11}	7.27	C_{112}	8.1
				C_{113}	6.9
				C_{121}	9.2
		B_{12}	8.13	C_{122}	6.6
A_1	7.21			C_{123}	6.1
				C_{131}	5.1
				C_{132}	4.2
		B_{13}	5.01	C_{133}	5.3
				C_{134}	6.8
				C_{135}	4.5
				C_{211}	9.2
		B_{21}	8.82	C_{212}	9.0
				C_{213}	9.3
				C_{214}	8.6
				C_{221}	9.7
A_2	8.95			C_{222}	9.3
		B_{22}	9.25	C_{223}	9.2
				C_{224}	9.6
				C_{225}	7.9
		B_{23}	6.80	C_{231}	7.1
				C_{232}	6.5

To be continued

Continued

A	Score	B	Score	C	Score
				C_{311}	9.4
				C_{312}	9.7
		B_{31}	9.15	C_{313}	7.5
				C_{314}	9.4
				C_{315}	9.1
				C_{316}	8.9
				C_{321}	9.6
		B_{32}	8.20	C_{322}	4.1
				C_{323}	3.2
				C_{324}	9.7
				C_{331}	6.4
		B_{33}	7.61	C_{332}	9.3
A_3	7.51			C_{333}	8.2
				C_{334}	5.5
				C_{341}	8.0
				C_{342}	6.7
		B_{34}	7.81	C_{343}	8.3
				C_{344}	8.6
				C_{345}	5.1
				C_{351}	3.3
		B_{35}	4.44	C_{352}	5.6
				C_{353}	4.6
				C_{354}	6.5
				C_{361}	4.3
		B_{36}	4.59	C_{362}	4.7
				C_{363}	5.1
				C_{411}	7.0
		B_{41}	5.29	C_{412}	5.1
				C_{413}	3.4
				C_{414}	4.4
A_4	5.75			C_{421}	7.0
		B_{42}	6.67	C_{422}	6.8
				C_{423}	6.9
				C_{424}	3.4

3.5 Comprehensive Scores

For performance of each geological disaster, experts could score every second class index, and the grading system is: Excellent (8.5-10), good (7-8.5), normal (5.5-7), bad (3-5.5), awful (<3). Score the total evaluation system according to every index weight and index score.

4. CASE ANALYSIS

May 12, 2008, a magnitude 8.0 earthquake hit the Whenchuan Area of Sichuan Province. More than 10 Provinces such as Sichuan, Gansu, Shanxi, Chongqing were affected. In regard to the worst-hit area Mianyang Government's management performance in this earthquake, we can use the Performance Reference Model we build earlier to do a simple case analysis to prove that this model is more operable. As for the Mianyang Government's performance in earthquake relief, experts score and evaluate the second class index, then average them, as is shown in Table 5.

With simple weighted average method, we know that the Mianyang Government's performance score of crisis management in Wenchuan Earthquake is 7.21. It means that Mianyang Government's whole management level is good according to the rating. It put human at the center, had a swift response and good measures, and accumulated precious experiences. It made a remarkable achievement and was praised by many people. We can get the first class indexes as follows:

(1) Public interest dimension scored 7.21, it was good. This showed that government follows the principle of people first. It published the condition and information timely, and with full participation and multilateral coordination. The quality of relief was greatly improved. Public are confident with government. But government lack of prediction of this disaster, it influenced public's satisfaction.

(2) Rescue process dimension scored 8.95 (emergency warning scored 8.82, emergency response scored 9.25, recovery scored 6.80). It showed that the relief put adequate resources and used them in a effective way. Emergency warning and emergency response plans were good, but the emergency recovery were not so good.

(3) Protection programs dimension scored 7.51(Human security level was 9.15, financial guarantee level was 8.20, physical resource guarantee level was 7.61, environmental protection level was 7.81, facility security level was 4.44, information security level was 4.59). It was excellent. But facility security and information security are in the Low level, which need to be improved.

(4) Learning and improving dimension scored 5.75 (learning was 5.29, improving was 6.67). It showed that the Mianyang Government's learning and improving ability of crisis management was normal. In order to create power for improving disaster managing ability, it needed to be improved with external wisdom.

CONCLUSION

In conclusion, according to the public interest dimension, rescue process dimension, protection programs dimension, learning and improving dimension, as well as first level index and second level index, we can reveal the factors of geological disaster risk management performance change. By using BSC and strategic goals and requirements aiming at geological disaster risk, we creatively built a geological disaster risk managing performance evaluation index system with 4 dimensions, which including 14 first level indexes and 56 second level indexes. Combined with the expert scoring and the principle of analytic hierarchy process, calculate the weight of each index hierarchy of the evaluation index system in BSC. Through the performance evaluation tool improve and optimize the rescue process, and provide ways and methods for adjusting and optimizing rescue, and provide a reference for geological disaster risk management work in China.

REFERENCES

Bi, D. (2010). *The research of major natural disasters performance evaluation of county government* (Master dissertation). Changsha: Xiangtan University, China.

Liu, Q. (2010). *The research of natural disasters crisis management performance evaluation of our government* (Doctoral dissertation). Hefei: University of Science and Technology of China.

Lv, Z. (2009). Based on the BSC method to construct the government emergency management performance evaluation index system. *Journal of statistics and consulting*, *4*, 40-42.

Wang, Y. (2012). Discussion of geological disaster prevention performance evaluation system. *Journal of Catastrophology*, *10*, 47-50.

Zhang, S. & Wang, J. (2007). A brief analysis on the balance of the balanced scorecard is. *Value engineering*, *2*, 130-132.