

Design and Validation of a Crisis Management Performance Assessment Questionnaire in Industries

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ABSTRACT

Background: The availability of an organization against the conditions of an emergency depends on several factors, including facilities and infrastructure, human resources, equipment, knowledge, education and availability of external resources.

Aim: To develop and validate the crisis management performance assessment questionnaire in the industries.

Method: This study was conducted in several phases including reviewing literature and standards, creating questionnaires and determining validity and reliability. To determine the face and content validity, a panel of experts consisting of 15 experts from the field of safety and crisis management was created and based on the stated comments, face validity; Content Validity Index (CVI) and content validity ratio (CVR) were calculated. To determine the reliability of the questionnaire, a questionnaire was completed in 20 provinces of Namin province and the Cronbach's alpha was calculated.

Results: The questionnaire contained 70 questions, 50 questions related to the phase of prevention and preparedness, 17 questions related to the action phase and 3 questions related to the retrieval phase. The lowest and highest content validity index was 0.79 and 1 respectively. Transparency, proportionality and simplicity of the questionnaire were calculated as 0.90, 0.93 and 0.91, respectively. The lowest and highest content ratio was 0.71 and 1.0, respectively. The content validity index and content validity ratio of the whole questionnaire were obtained 0.92 and 0.94, respectively. Cronbach's alpha coefficient was calculated to be 0.91.

Conclusion: The results showed that the questionnaire items in all dimensions of different domains have a high internal consistency. Considering the high validity and reliability of the questionnaire and designed to assess all areas of crisis management, using this questionnaire is useful in assessing the performance of crisis management in industries.

Keyword: Crisis Management, Validity and Reliability, Industries

INTRODUCTION

Disasters are not routine and ordinary occurrences. These events, either natural or artificial, disturb the lives and activities in each society, and destroy all individual and social resources¹. There are many definitions for disaster. According to the World Health Organization (WHO), disaster is the disorder in the function of society or community, leading to the extensive damages in terms of environment, economy, and human resources. It is beyond the ability of the damaged community to adapt to this condition, and requires international assistance^{2,3}. Reviewing the data related to the disaster in the past decade shows that 12000 individuals died during this time due to the natural disasters^{4,5}. The economic damage resulting from the natural disaster was estimated about 99 billion \$ in 2014. About 88% of all mortalities resulting from disaster are related to the natural disasters^{6,7}. Reviewing the history of disaster shows that Iran is the 10th country in the world and 4th country in Asia in terms of occurrence of natural disasters^{8,9}. The industrial developments in this country led to the appearance of another type of crisis called industrial crises during recent years (10). Each organization should continuously publish, document, implement and evaluate its preparedness and operational plans to deal with hazards¹¹. The identification of crisis potential in factories and organizations is the first step

toward controlling accidents resulting from these potentials; and the control planning is not possible unless the organization has enough cognition on the dangers¹². Various studies have been carried out on the identification of dangers and crisis management in organizations. Among these, a project was carried out by Dr. R. Preiss to develop, use, and extends the methodology related to the risk assessment and danger identification in 2009. The results of this project were the use of LOPA and HAZOP methods in assessing qualitative and quantitative risks, analyzing possible scenarios using the prepared checklist, and the use of the worst scenario against an external emergency condition (13). Karagiannis and colleagues showed that the presented model for designing the emergency conditions in the industries can be used as an appropriate questionnaire to evaluate the present designs and to develop emergency condition plans in industries (14). Elworth and colleagues designed a survey with seven sections to assess the status of emergency management and the readiness of local governments in Australia. One of these results indicates that the respondents do not have appropriate readiness in responding to the emergency statuses¹⁵. Gohar studied the preparedness of the Training Complex of Hamdan University of Medical Sciences in emergency condition using ISO2239 standard. This study emphasized designing and implementing an emergency condition management system, proportionate to university and training

environment based on the available similar standards¹⁶. The readiness of an organization in the emergency status is dependent on the various factors including facilities and infrastructures, human resources, equipment, knowledge, training and availability of external resources¹⁷. The clause 7-4-4 of OHSAS standard clearly explains that organization or industrial unit has to identify dangers, dangerous location, the connection way with related organizations, the way of achieving necessary information in emergency condition, providing personal protective equipment and so on¹⁸. In order to measure these important cases and performances of organizations in terms of various phases of crisis management, it is necessary to present a method for assessing this performance. Thus, the present study was carried to present a questionnaire for assessing the crisis management in industries.

METHOD

The present research is a descriptive-analytical study in terms of purpose, application, and methodology; this study was conducted to prepare a questionnaire for assessing the crisis management in industries. This study was carried out in several phases including assessing literatures and standards, creating question bank, determining reliability and validity. Standards, articles and references related to the crisis management were evaluated in the first phase. Based on the assessed literatures, the question bank was prepared, and the primary questionnaire was developed based on the criteria and the sub-criteria of crisis management. This questionnaire was designed in three areas including preparedness and protection, confrontation, and recovery; and is measured using several questions. The protection and preparedness refers to the necessary measures, which are carried out by managers and other stakeholders before crises. Risk assessment, identification of dangers, removing hazard centers, designing crisis management chart, agreement with assistant organizations, and preparation of training literatures based on the dangers are some examples of the protection and preparedness in this area. The confrontation is the measures carried out in the emergency status, and can have various types dependent on the kind of crisis. However, the aim of these measures is mainly the same including keeping people alive, reducing financial damage, preventing from extension of crisis. The confrontation can involve relief and rescue, providing health, cure, security, and transportation, restraining the consequences of crisis, notification, and alertness. Finally, the recovery is important in two aspects in industrial and production units. Firstly, the continuous production and its normalization is dependent on the recovery of region and damaged facilities. Moreover, showing damages facilities to the personnel create depressive atmosphere among the staff. The face validity and content validity are used in designing checklist to apparently conform it and to determine the content scope of checklist, respectively. The face validity looks at a tool in terms of apparent validity, its logic, proportionate and attractiveness, the logical sequence of questions, and its comprehensiveness and concise. The convenience sampling method was used to perform this stage. Fifteen persons from masters and experts in the safety and crisis

management were chosen and invited to cooperate in this case. They received the primary designed checklist and were asked to evaluate sentences and options in terms of apparent form, selecting understandable words and sentences; and write their view to improve the sentences. The questions were modified and edited based on their view, and finally a new edited checklist was prepared. The content validity ratio (CVR) and content validity index (CVI) were used to evaluate the content validity. The experts were asked to classify each question based on the three-section Likert scale including "the question is necessary", "the question is useful but is not necessary", "the question is not necessary". After filling the questionnaire using the responses of experts, the data obtained from the experts were analyzed, and the content validity was computed based on the following formula:

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

N=total number of experts who rank the question
 n_e = number of experts who rank the question as necessary

Table 1 shows the minimum accepted amount of CVR regarding the number of individuals participating in the psychometric of questionnaire recommended by Lawshe. Given that 15 individuals participated in the determination of validity, thus the accepted number of CVR is 0.49¹⁹.

Table 1- The criteria for accepting accepted CVR

Minimum accepted CVR	The number of experts determining the content validity
0.99	5
0.99	6
0.99	7
0.78	8
0.75	9
0.62	10
0.59	11
0.56	12
0.54	13
0.51	14
0.49	15

The Waltz and Bussell's method was used to evaluate CVI. The experts used four-section Likert scale to determine relevance, clarity and simplicity of each question. Finally, the total positive score with the rank of 3 and 4 (maximum score) for each question was divided into the total number of experts to achieve the score of CVI.

CVI= total number of experts giving the score of 3 and 4 to the question / total number of all experts.

Based on the standards, 0.5 and 0.79 were considered the approval amount of CVR and CVI, respectively. After summing the results and computing CVI and CVR, some questions achieved the score less than the accepted criteria, and thus these questions were removed. The reliability means that the tool under the same condition to what extent gives the same results. Cronbach's alpha coefficient was used to measure the reliability. The value of this index is often between zero and one. The reliability coefficients zero and one indicate no reliability and complete reliability, respectively. According to the previous studies, Cronbach's alpha coefficient more than 0.9 is excellent, more than 0.8 is good and more than 0.7 is

acceptable (19). Regarding the aim of this research, which was designing the questionnaire to evaluate the crisis management in industries located in Namin city, the questionnaire was filled in these industries to determine reliability. This index was computed using SPSS-16 software.

RESULTS

The questionnaire had 70 questions, in which 50 questions were related to the preparedness and protection phase, 17 questions were about the confrontation and 3 questions about the recovery. The questionnaires were given to the target group and were asked to express their views on the degree of difficulty. The questions with a score less than 1.5 were removed or modified. Six questions were modified in these questionnaires. Generally, the CVI in this questionnaire was computed according to the method mentioned above. The minimum accepted amount of CVI is 0.79. Thus, three questions with the CVI 0.56, 0.69 and 0.75 were removed from the questionnaire. The minimum and maximum amount of the validity was 0.79 and 1,

respectively. Relevance, clarity and simplicity of questionnaire were computed as 0.9, 0.93, 0.91, respectively (Table 2). Minimum and maximum amount of CVI were in the protection scope (0.92) and the confrontation scope (0.88), respectively (Table 2).

The value of CVR, the mean number of the views, and the results of the acceptance or rejection of the questions were computed according to the method (mentioned above). Minimum and maximum values of CVR were 0.71 and 1, respectively (Table 2).

Maximum value of CVR was related to the preparedness scope (0.96) and minimum value was related to the confrontation scope (0.86).

In the present study, the total values of CVI and CVR in the questionnaire were 0.92 and 0.94, respectively (Table 3). Results showed that the questionnaire has an appropriate validity. Moreover, Cronbach's alpha coefficient for the questionnaire was 0.92, indicating that this index was good in the present study.

Table 2: evaluating the validity of questionnaire related to the crisis management in industry

Questions	The mean of questions	
	CVR	CVI
Has the organization been established based on the layout studies, town zoning and assessment of the outcome? Has it received the necessary permissions?	1	0.81
Have the layout of machineries, their distance from other rooms and office buildings, and their installations been determined based on the regulations and supervision of the Technical and Health Protection Committee?	0.73	0.93
Are the periodic visits of equipment, machineries and warning systems, and protective reparations carried out to ensure their appropriate functions?	0.73	0.82
Has the organization used the passive defense to protect the unit from a military attack and a crisis management?	1	0.84
Has the organization been insured against natural and artificial incidents?	1	0.91
Does the organization have a comprehensive crisis management plan?	1	0.93
Has the crisis management plan been reviewed and signed by the chief executive officer over the year?		
Have the organizational chart of the crisis management, the levels of command and obedience, substitutes, and duties of individuals been formulated? Have the necessary measures been carried out if changes occur in the chart?	1	0.82
Have the members of the organization's crisis committee been appointed? Are the committee meetings held on a regular basis?	1	0.93
Are the level of crisis (inside the organization, city and province) and the role of the organization in the crisis management plan for the region (city and province) characterized?	1	0.79
Is there an agreement with assistant organizations such as meteorology, firefighting, health, the Red Crescent, private sector and related companies? Has the emergency communication process been defined?	1	0.93
Has at least one meeting been held with an assistant and supportive organization in the last year?	1	0.98
Has any measure been carried out in risk assessment, danger identification and their removal?	1	0.91
Is there any measure to estimate the dimensions of the crisis through methods such as crisis simulation using crisis management software (FAST, WISER, etc.)?	1	0.84
Was the risk mapping in the factory prepared based on the risk assessment? Does staff know it?	1	0.96
Are the instructions available for the protection of the organization's resources (people and equipment) in emergency conditions against the remaining risks?	1	0.89
Are employees familiar with the organization's hazard list?	1	0.93
Is there any process and procedure for reporting incidents and hazardous situations to the crisis management team by the staff?	0.73	0.95
Are there meetings between executives and staff on crisis management plans and crisis dangers?	1	1
Were the tasks of the crisis management team, staff and other people, including trainees, contractors in a specified emergency condition written and determined for individuals?	1	0.93
Was the training of employees, contractors and students (new and old) in dealing with the risks and their roles in the theoretical, practical and implementing maneuver documented?	1	0.98
Is there any schedule for maneuvering at defined levels (inside the organization, city and province)?	1	0.93
Were the training materials prepared based on all the risks that can be created in the company and provided to the staff? Is there any measure to assay personnel information?	1	0.93

Were the safe spaces (safe gathering places) identified? Were the plans related to the safe evacuation and safe areas prepared? Is the staff aware of these plans?	1	0.91
Is there any plan for alerting non-resident employees at the time of emergency?	1	0.98
Do the all staff (native and non-native) have periodic discharge training until knowing the evacuation routes well?	1	0.98
Have the alert conditions and signs, under which the discharge should be carried out, and their managers for the issuance of this discharge and their successors been determined?	1	0.96
Is there any plan to identify missing people?	1	0.93
Have the units and equipment of the company been identified and the instructions and responsible persons for transferring equipment to safe havens and places been designated?	1	0.98
Are there any training to employees on how to go after the alert, where to go, how to seek refuge and when to leave the shelter?	1	0.98
Is there an emergency power to ensure that there is enough light on the stairs during the main power failure?	1	0.91
Are there any guidelines for health facilities and medical care in each shelter?	1	0.94
Is there the list of resources and capacities inside the organization and foreign organizations (manpower, vehicles, fire brigade, water supplies, electricity, medical facilities, etc.)?	1	0.91
Are there the resources and equipment needed, including machinery, food, water, lighting, fuel, radio communications with additional batteries (fixed and unloaded), and measurement equipment needed for response operations, forecasting and recovery?	1	0.98
Have the storage equipment been stored in a safe location with no hazard such as earthquakes, fires, and so on?	1	0.98
Have the process of protecting data and information, records and information technology in an emergency condition been defined?	0.87	0.93
Is the updated list of names and contact information of personnel, donor organizations (EMS, firefighting, fire alarms ...) available?	0.87	1
Is there a comprehensive plan of site map, buildings, fire extinguisher locations, automatic fire extinguishing system, water taps and power supplies, ducts and shuttle lines, inputs, natural gas pipelines, seals building, street name, number of personnel in each hall? Has a version of these informations been sent to the offices of the fire department of the Governor's Crisis Management?	1	0.98
Have fire preventive systems been previously tested? Are they ready to work?	0.73	0.96
Are there the maps related to all interruptions and connections of devices, including switches, power lines, etc.? Have the responsible for the backup device set to disconnect and shut down the devices been determined?	1	0.96
Has the organization implemented the necessary measures related to the establishments and land plots to meet the standards required to prevent short-circuiting and thunder-storm and its consequences?	1	0.89
Are there firefighting personnel trained in the organization to shut down equipment and resources?	1	0.91
Is there any plan for physical protection of the organization and staff and the control of invading people into the organization?	1	0.91
Is there a process to ensure that the crisis management team is present at the site on time?	1	0.98
Is there any plan for easy and safe transportation of rescuers and quick access to hospitals?	1	0.98
Do organizations have any plan to introduce a person as a permanent guardian of the building to the city's management and respondent organizations for coordination during the crisis?	0.87	0.93
Does the incident management room have sufficient space, safety, and necessary facilities, including desk, office, digital clock, computer, internet, fax, whiteboard, google map, factory map, area map, projector video msds, USP?	1	0.96
Is there any plan or method to validate news, rumor control, and correct news reporting?	0.87	0.87
Has the monitoring checklist been developed for the performance of emergency team and maneuver to improve the response to the crisis through its results?	1	0.959
Are there the budget and the necessary funds to be spent on emergency conditions, repairs and damages and losses?	0.87	0.93
Is there the appropriate notification of damages, casualties and ... to the Operations Command / EOC after the emergency?	1	0.91
Have the staff, who should continue the confrontation operation after having informed about the start of operations issued by the commander, been ready in a timely manner?	0.73	0.8
After collecting information, does the commander of the crisis issue orders for declaring the level of crisis (organization, city, province) in accordance with the goals and objectives of the relief campaign?	1	0.89
Is the correct and timely information as the internal and external to the organization (to the employees / people / authorities) carried out according to the level of the crisis?	1	0.87
Is collecting information about the dimensions of the crisis (territory, developmental process and possible consequences) and identifying the hazards, sections and vulnerable groups given the commander to take a decision?	1	0.89
Have the hot, cool, and warm areas been created according to existing protocols?	0.71	0.82
Are specific security measures (traffic control, security for human and critical resources, prevention of sabotage, asset conservation, discharging, and helping to move to shelter) carried out according to the plan?	0.73	0.87
Do the members of the crisis team act according to the training and their duty in the confrontation time?	0.73	0.87

Are emergency actions (firefighting, discharging, and disaster relief) and emergency assistance provided to victims?	0.73	0.85
Regarding the safety and security of personnel and delivery of the necessary equipment, including personal protective equipment, antidote, and so on, which activities are carried out?	0.87	0.937
Is the advice given by chemical and hazardous experts to those exposed to the material?	0.87	0.937
Does the decontamination of the reaction team members and injuries occur in an emergency condition?	0.87	0.87
Are emergency shelters protected from risks such as fire, flood, leakage, and so on?	1	0.93
Are there appropriate answers to the questions and the status of the families whose spouses are in the company and who are injured or killed?	0.87	0.93
Is the budget, planned for the preparedness phase, spent in the confrontation and recovery phase?	1	0.85
Is there the documentation of all steps taken in the time of confrontation and recovery?	1	0.85
Are there the measures of support and resistance, including the establishment of transportation routes, the normalization of transportation to the region with crisis, the provision of amenities (water, food), the treatment of victims, the provision of mental health services and religious services?	1	0.9
Is the scene of the incident cleaned up and made after the confrontation stage?	1	0.9
Have the safety principles and technical and design principles been observed to bring the situation back to pre-crisis status?	0.85	0.88
Is there the hold of meetings for the crisis analysis in order to more learn and avoid the occurrence of similar events?	0.87	0.91

Table 3: the mean of CVR in the questionnaire related to the crisis management in industry

Scope	No of questions	The mean of total CVI in each scope	The mean of total CVR in each scope
Protection and preparedness	50	0.92	0.96
Confrontation	17	0.88	0.89
Recovery	3	0.89	0.90

Table 4: CVR and CVI in the questionnaire related to the crisis management in industry

Number of all questions	70
CVI values in the questionnaire	0.92
CVR values in the questionnaire	0.94
Cronbach's alpha coefficient	0.91

DISCUSSION

Industrial development as the driving force for the development of the country and industrialized towns are one of the most basic developmental infrastructures in the country, and these facilities highly require planning (Ahmad Reza Fattahi). The crisis management is an applied scientific, looking for a tool to prevent a crisis or prepare for immediate relief and recovery^{19,20}. This study was carried out to design and validate the questionnaire related to crisis management in the industry. As mentioned above, this questionnaire was designed for the first time to evaluate the performance of managers in emergence status and crisis. The result showed that Cronbach's alpha coefficient was 0.91, and the validity of the questionnaire was approved because this value was more than 0.7. Performance evaluation model of contractors working in Pars Special Economic Energy Zone, based on the guideline published by CCPS (center for chemical process safety) and checklists of processing industries in the oil industry are some similar tools that can be mentioned here (20). This tool is special for processing industries, and more focuses on the dangers of the processing industries. However, the tool designed in this study focused on the performance of crisis management in all industries. Among the positive points of the designed questionnaire is that it

covers all three scopes in the crisis management including preparedness and protection, confrontation and recovery. Regarding that the obtained CVR and CVI for each scope is very higher than the acceptable value, it can be concluded that this questionnaire has an appropriate efficiency to evaluate different scopes of crisis management in the industry. Given the terrible consequences of incidences (natural, industrial and so on), providing a design to control these consequences guarantees the survival of the organization. Thus, it is vital to identify the critical points of the organization, natural disasters in the geographical location of the organization. Then, it is necessary to identify potential talent in the organization and external relief teams to respond to these crises to plan and develop an emergency response plan. The relevant training and documentation in this area are very useful for strengthening the design. Finally. The use of the checklist will be very helpful to the assessment team¹². The results of the study carried out by the International Tactical Operations Committee of the United States showed that organization requires collecting data and assessing the level of readiness in respondents using a standardized questionnaire in order to control a catastrophic event such as a terrorist attack or natural disaster²¹. Thus, it is necessary to design a standard native questionnaire to evaluate the performance of crisis management¹⁴. Another study, which was carried out on determining the validity and reliability of the crisis management in hospitals showed that the questionnaire related to the crisis management based on the sevenfold principles of resistance engineering in hospitals is efficient and appropriate, and can be used to recognize the weakness and positive points of the crisis management in the hospitals (22). Vaziri and colleagues performed a study on designing a questionnaire to assess the preparedness of Centers of Operations in the Medical Sciences Universities of Iran. The results showed that the questionnaire was useful to measure the performance of control centers for crisis operations²³.

CONCLUSION

Based on the results obtained from this study and the previous studies, it can be concluded that the use of the

questionnaire is useful in the assessment of crisis management. It is necessary to have a powerful tool for measuring the performance of crisis management in the industry. Regarding the obtained high value of CVR and CVI in this study, the use of this questionnaire in assessing the performance of industry is useful, and its implementation is recommended in the related organizations.

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