

International harmonisation for dealing with human factor aspects during incidents and calamities in the maritime context

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Abstract

One of the domains that will grow in importance in crisis management is the cognitive factors that play a role in handling a crisis situation. Every maritime crisis, whether it is a fire aboard a passenger vessel or a tanker accident with resulting oil leakage, has an “element of novelty”, i.e. one cannot rely on procedures alone. A certain amount of improvisation must be incorporated. Thus, one must take a knowledge-based approach, which is the type of human operation that is most vulnerable to many types of cognitive failure. Organisations as well as individual people have a tendency to interpret situations in terms of their preconceived sets of ideas or schemas. Complex remote, information systems intended to promote safety might even enhance these failures. Cognitive psychology considers this selective perception as a double-edged sword. Without it, all information processing would have to be conscious and take too much time, whereas proceeding in accordance with an available schema that does not fit the situation at hand leads to wrong decisions. The challenge is to maintain adequate situational awareness during crisis situations, despite all the cognitive disturbance factors. Using a focused research effort, we can get more insight into the crucial competencies that determine successful crisis management. This will result in, among other benefits, crisis management training programmes that give more insight into individual development needs and enable international harmonising through competency-based benchmarking.

Introduction

In crisis management and crisis management training the focus is mainly on solving the crisis situation as a team. Thus, the success of crisis management teams is mainly defined in terms of global results, such as “the passengers were evacuated and everybody survived”. Mostly it remains unclear, however, what was the contribution of each individual crisis management team member and in what direction each individual team member could develop in order to have more added value. To have

more insight into the crucial human factors of crisis management, we advocate a competency-based approach towards human resource related topics in crisis management. This will lead to more transparency with respect to the performance of crisis management teams, allowing more effective international harmonisation in terms of empirically validated human success factors.

Crisis management and cognitive “failure”

Each crisis situation contains an element of novelty. Therefore, crisis management cannot only rely on skill-based behaviour (i.e. sensory-motor performance, automated without conscious control) or rule-based behaviour (i.e. behaviour that is guided by a stored sequence of subroutines or procedures), but also depends on knowledge-based behaviour [1]. Knowledge-based behaviour is typical for coping with unfamiliar situations. It implies that goals are formulated, plans are developed and tested against the goal. Each type of human task behaviour has a specific type of errors associated with it. With respect to the knowledge-based behaviour which is always to some extent needed in crisis situations, one can expect the following types of errors:

- prejudice by selective attention;
- prejudice by looking for confirmation;
- prejudice in probability assessment;
- prejudice by overconfidence;
- inadequate heuristics (obsolete heuristics, too obvious heuristics, and heuristics that are derived from inadequate comparisons).

We will give some examples of these knowledge-based errors.

In case of an emergency in for instance a port area like Rotterdam, the emergency response will be a concerted action of a number of public services like the Port Authority, its executive the Vessel Traffic Service, the Fire Brigade, the Police, and environmental and health services. Given the fact that each of these services has its specific task and expertise it will be clear that there is a risk that each response organisation involved will have its own specific perception of the situation. Organisations as well as individual people have a tendency to interpret situations in terms of their preconceived sets of ideas or schemas.

We give an example from the domain of person perception: when somebody sees a person who is dressed like a business man he or she may assume that the person also possess other characteristics that businessmen may have, i.e. earning a lot, working hard, having a mobile phone and a fast car.

Cognitive psychology considers this selective perception as a double-edged sword. Without it, all information processing would have to be conscious and take too much time, whereas proceeding in accordance with an available schema which does not fit with the situation at hand leads to wrong decisions. Thus, a person with a fire fighting background could approach a certain calamity situation from the fire fighting point of view, which might not be the most appropriate framework.

We give some examples of this phenomenon from the domain of emergency response:

For the 3rd of 4th time consecutively the automatic fire alarm in a shopping mall sounded. There was nothing to be seen, so four firemen perform a reconnaissance without breathing protection, also entering the florist's shop. Regrettably, it turned out that the florist used an extremely hazardous pesticide to disinfect his shop, closed to door behind him and went home. As a consequence four firemen were exposed to this substance.

The following example illustrates that all people, both response workers and civilians are often driven by habits, not only cognitively as with schemas, but also in their manifest behaviour during emergencies.

During a hotel fire, two casualties were found in a corridor, 3 metres beyond the emergency exit, giving direct access to the street which they passed. It appeared from the analysis that the people involved always used the corridor to leave the building.

Cognitive failure can also result from role behaviour. Vessel Traffic Service operators, or air traffic controllers are used to looking at vessels or aircraft as dots on a radar screen with which they communicate about positions, destinations, courses and times. From this perspective they might forget to pass on information about the contents of these dots, for instance hazardous cargoes, to other relevant parties, for instance fireman who have to extinguish the fire when the plane crashed. For the work of emergency response teams, we are faced with a psychological dilemma. On the one hand, given that time in an emergency situation is scarce, certain response actions need to be taken in an automated way, since there is no time for extensive contemplation, whereas on the other hand each situation must also be taken at face value using common sense. This stresses the need for adequate team communication and poses a great challenge for the training of response teams (or bridge teams). Simulator training can be an important tool to train both bridge teams and emergency response teams in effecting and maintaining a common and adequate perception of the situation at hand.

Situational awareness

Crisis management is a complex perceptual and cognitive task. Inside the cognitive system of the crisis manager all the incoming information, for instance the exact characteristics of the crisis, the location of the various crisis response units and relevant details about the surroundings have to be translated into a mental image, that is, a mental picture of the situation and how it should be tackled. Based on this internal model, the crisis manager decides if and what action should be taken. This mental representation can be well described with the concept of situational awareness. According to Endsley's [2] definition, situational awareness can be seen to consist of three levels:

- perception of elements in the current situation;
- comprehension of current situation;
- projection of future status.

It will be clear that situational awareness is one of the most crucial competencies in crisis management. In order to cope effectively with crisis situations one must be able

to predict what the situation will be in the near future in order to take effective measures. Making correct predictions on the future status requires a correct comprehension of the actual situation, which in turn implies a correct perception and interpretation of the current elements or components of that situation. Situational awareness is a crucial factor in crisis management, but a lot of work still has to be done to identify the crisis management competencies that determine situational awareness. Also, given its cognitive nature, maintaining a correct situation awareness is extremely vulnerable to the above described knowledge-based type of errors.

The management of crisis management competencies

As was indicated above more insight into the competencies that determine effective crisis management is necessary. It is useful to clarify the notion of competencies here. Competencies can be described as combinations of knowledge-based, skill-based and attitudinal aspects as they can be observed in human performance during task situations [3]. It will be clear that some competencies, like “delegating” or “progress control” will be more directly observable than competencies such as “interpersonal sensitivity”. Realistic crisis management competency profiles contain first of all descriptions of the relevant tasks and responsibilities and the required results belonging to a certain crisis management function. Beside the description of tasks and responsibilities, also the necessary knowledge, capacities, skills, attitudes and personality characteristics that are needed to be able to complete crisis management tasks successfully are specified. Once the crucial management competencies are determined, an integrated approach can be taken towards:

- the selection;
- the training; and
- the performance appraisal of crisis management personnel.

The fact that many crisis management teams consist of representatives from different organisations for instance, Vessel Traffic Service, Coast Guard and ship owners increases the need for a competency management system for crisis management teams. Thus, a platform can be created enabling the build-up and maintenance of explicit and objective knowledge possessed implicitly by individual team members. Moreover, it enables learning lessons from experiences not only on the level of general approaches, tactics or outcomes, but also on the level of individual performance of crisis management personnel.

Measurement of crisis management competencies.

To be able to conduct effective competency management for crisis management personnel a metric for crisis management competencies is required. Assessment Centre Methodology (ACM) testing can play an important role here. ACM testing [4] has already a long history as a method of human performance evaluation. The roots of structural ACM-testing can be found in World War II. The American Secret Service used task simulations to find suitable secret agents. This method was also used by the German Military to find leadership capabilities and by the British forces in their selection methods. After the war the American Telephone and Telegraph company (AT&T) was the first civilian organisation to use this newly developed methodology.

Since then, ACM testing has made a revolutionary progress. An important development was the Equal Employment Opportunity Committee. This special committee had to ensure that discrimination on the basis of race, gender or skin colour would not effect the selection process. The assessment centre methodology is a sound selection method in that sense.

An ACM- test is based on five principles:

- 1) The ACM-test must be based on relevant job behaviour referring to critical success or failure factors in the job, so called job samples. These job samples are incorporated in tailor made exercises that are designed to invoke relevant job behaviour from candidates.
- 2) The resulting behaviour is analysed using objective and well-defined criteria, on which each candidate is judged.
- 3) Apart from the job samples, it is preferred to also use other assessment methods like behavioural interviews, and psychometric testing.
- 4) The assessments are based on the judgements of several assessors who have to be trained in assessing candidates.
- 5) Finally, it is important that the judgement of behaviour should be strictly separated from the observation and registration of that behaviour.

The Assessment Centre Methodology constitutes a method of personnel assessment by which an objectified judgement can be made of the (potential) job performance of candidates. Many of the more traditional selection methods assess the abilities or capabilities of candidates on the basis of behaviour and performance in earlier functions. This might be a sound strategy when the new occupation does not differ much from the previous one. In general, however, the prediction of future performance on the basis of the performance in previous different occupation is a risky business. By contrast, the ACM method offers an objective way to measure in a goal directed way the human competencies that are relevant for specific personnel decisions, e.g. selection decisions, promotion decisions, individual (management) development decisions etc.

The construction of an ACM test consists of the following steps, which are shown in Figure 1. Each step requires decisions that are influenced by prior decisions.

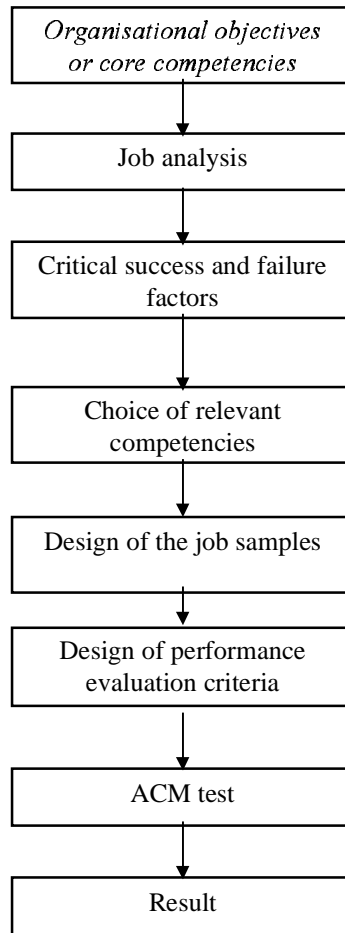


Figure 1: steps in constructing an ACM test

ACM testing is the link between personnel selection, training and performance appraisal. Apart from ACM testing, which mostly requires independent, trained assessors and takes place in a laboratory kind of setting using for instance role playing, 360 degrees feedback can also play a role in the assessment of crisis management competencies. The method of 360 degrees feedback means feedback coming from various parties around the feedback receiver using competency-related questionnaires that are completed based on real life interaction with the feedback receiver (see Figure 2).

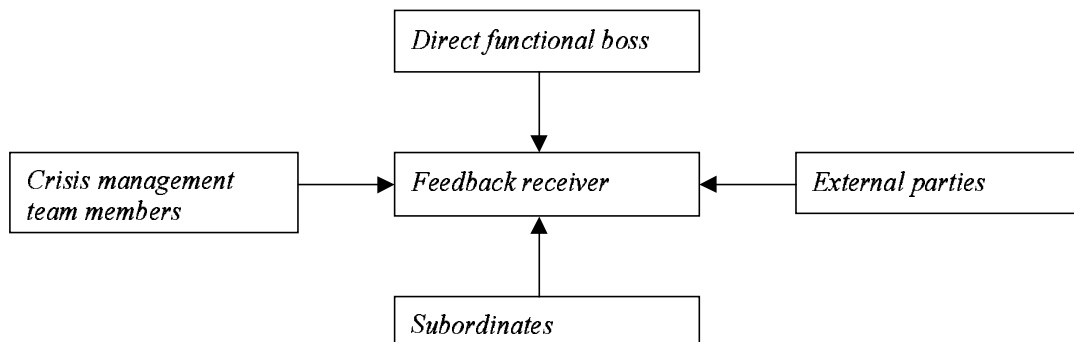


Figure 2: 360 degrees feedback

Research on crisis management competencies

Often the choice of the competencies to be used for certain types of jobs are based on critical event interviews with job holders or their managers. Thus, the resulting competency profiles risk being susceptible to many types of bias like social desirability, subconscious equation of one's own competencies (or the competencies of one's own organisation) with the required competencies, trendy perceptions of jobs or (internal) political compromise. Furthermore, it is mostly unclear whether the chosen competencies

- are measurable and;
- effectively contribute to successful performance in the job.

As a result, ACM tests might be performed based on subjectively obtained competency profiles and not on the competencies (attitudes, skills and knowledge components) that verifiably contribute to success criteria such as:

- effectiveness of crisis management communication
- quality of situational awareness and
- added value to crisis management team situational awareness

By the same token, crisis management training programs or scenarios are often aimed at the performance of the complete crisis management team. Therefore they cannot necessarily be expected to focus consistently on the competencies that provide the best return training revenue (i.e. competency improvement) for a given crisis management team member.

Therefore, we advocate a continuous research effort aiming to identify and fine-tune the competencies that really contribute to successful crisis management. For this research effort data should be gathered as follows:

- by combining crisis management training with ACM testing and 360 degrees feedback methods;

- by unobtrusive performance-related data collection during simulator based training,
- by using available personnel data from the relevant human resource departments and
- by re-analysing crisis investigation reports using a competency-based framework.

Using exploratory data analysis, or data mining techniques on the collected data more light can be shed on the competencies that really determine successful crisis management.

Intercultural differences

As many maritime crises take place in international waters, there is a high probability that crisis management will involve teams of mixed nationality, or teams of different nationality. Although the basic crisis management competencies will most likely be independent of culture, they are likely to interact with intercultural differences. Here we refer to the intercultural differences on the attitudinal level, as these were described by Hofstede [5], i.e.

- *Power distance*: the extent to which less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally
- *Individualism*: the extent to which everyone is expected to look after himself or herself and his immediate family
- *Masculinity*: the extent to which gender roles are distinct within a culture
- *Uncertainty avoidance*: the extent to which societies are relaxed about ambiguity and uncertainty

Table 1 gives the differences on these dimensions for a number of seafaring nations.

Country	Power distance high = 100	Individualism high = 100	Masculinity high = 100	Uncertainty avoidance high = 112	Long-term focus high = 118
Britain	35	89	66	35	25
Netherlands	38	80	14	53	44
Denmark	18	74	16	23	
France	68	71	43	86	
Germany	35	67	66	65	31
Greece	60	35	57	112	
Hong Kong	68	25	57	29	96
India	77	48	56	40	61
Indonesia	78	14	46	48	48
Japan	54	46	95	92	92

Table 1: intercultural differences for a number of seafaring nations

It will be clear that coping with these attitudinal differences will increase in importance as a critical success factor in crisis management. ACM testing can play a crucial role in the selection, training and performance evaluation of personnel taking into account these intercultural dimensions.

Benchmarking

Benchmarking can be defined as the continuous search for and application of significant better practices that lead to superior organisational performance [6]. In the context of crisis management, it has three key elements:

- the identification and selection of outstanding crisis management performance in key areas;
- an assessment of the processes that have generated the outstanding crisis management performance; and
- the task of applying such processes to own crisis management organisation.

Benchmarking should be more than simple emulation or matching, because crisis management organisations have different resources, technological expertise and organisational and national cultures. Using a competency-based and research-based approach to crisis management, crisis management practices can be copied from other (i.e. foreign) crisis management organisations in such a way that the likelihood of enhancing relevant crisis management competencies in the own organisation is maximised.

Conclusion

By using a competency-based and a research-based approach to crisis management we can get more grip on the human factors that really determine successful crisis management. As a result, learning from own experiences and the experiences of other organisations through research and benchmarking will be facilitated, leading to more

valid selection and training practices. Thus, crisis management organisations can develop into learning organisations [7] that are constantly working on evidence-based performance improvement in terms of crucial competencies. As a result best practices that add maximum value on the competency level can be deployed on a wider scale. Also taking intercultural differences into account, this will lead to a more internationally harmonised and more effective crisis management.

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