ASC Model: a process model for the evaluation of simulated field exercises in the emergency domain

Alayne da Costa Duarte
UFRJ, Brasil
alayneduarte@ufrj.br

Marcos Roberto da Silva Borges
UFRJ, Brasil
mborges@nce.ufrj.br

José Orlando Gomes
UFRJ, Brasil
joseorlando@nce.ufrj.br

Paulo Victor Rodrigues de Carvalho
IEN, Brasil
paulov@ien.gov.br

ABSTRACT

The undefined flow of execution of activities in an evaluation process hampers its implementation. A consistent evaluation process defines interrelated methodological steps that make it easier for the evaluator to lead the process. This article presents a process model for the evaluation of simulated field exercises in the emergency domain, including their sub processes and activities. The proposed model was derived from observations made during real situations of a simulated evacuation exercise of communities in high-risk areas in Rio de Janeiro (Brazil). The motivation came from the finding that the assessment of simulated field exercises is conducted by completing an activity report that does not follow a structural model, an evaluation program or a formal standard. The results of this research show the experts' satisfaction with the application of the model proposed for the development of an evaluation process. The same occurs when comparing to reports currently used by them for this purpose.

Keywords

Evaluation, emergency, process model

INTRODUCTION

The complexity of response phase in emergency management due the variability of the situations has been already recognized (W3C, 2009). Therefore, to bound complexity, organizations with responsibilities for emergency management develop many efforts in the response preparation for an adverse event. An adverse event is an unwanted phenomenon or event that triggers an emergency (Haddow, et al. 2011). Preparation for adverse event is a phase that runs in a cycle of activities that builds that capacity. The cycle occurs in four steps (FEMA, 2009): (i) planning, (ii) organize, train and equip, (iii) exercise, (iv) evaluate, and improve.

The simulated field exercises are used in response preparation for major industrial accidents (e.g. nuclear accidents) and more recently in natural hazards, rehearsing a population about what they should do in case of a real occurrence of an adverse event. The aim of such exercise is to simulate an environment as close as possible to the real scenario and also serves to evaluate abilities, skills and resources of anyone who has responsibility for emergency response.

The relevance of the evaluation of simulated field exercises is the opportunity that those responsible for response and recovery have to get indications to refine the skills of exercise preparation. Recognition that some actions were not well implemented or the identification of the absence of other actions allows improvements to the initial emergency plan (Haddow et al., 2011).

Currently, in the exercises we observe in Rio de Janeiro, the evaluation is an ad hoc process, mainly because the flow of execution of activities is not well defined. That occurs because there is no predefined pattern to guide the implementation of activities or their evaluation.

This paper proposes methodological steps logically interrelated to assist the development of the evaluation process of simulated field exercises ensuring its consistency and transparency. A description of the steps should allow anyone interested to understand the logic of the path taken by the assessor in the constitution process and provide ease of management for the makers of the evaluation.

The second section presents the model proposed by this paper, suggesting stages that constitute the evaluation of field simulation exercises based on their specific goals. The third section shows the results of a hypothetical experiment using the proposed model. In the fourth section, there are the final considerations containing the limitations of this work and expectations for the future.

ASC MODEL

The construction of the evaluation process starts even before the execution of the exercise. It needs to be set in the dynamics of the exercise's development stages. The ASC (Avaliação Simulado de Campo) Model presents sub processes and activities for the development of the evaluation of simulated field exercises as a process. Figure 1 shows the ASC model as a first level of abstraction, described in BPMN notation, describing the process of evaluating the simulated field exercises in its sub processes, the flow between them and the people involved in its construction.

The evaluator indicated as an actor in the development of the evaluation process, represents one or more components of the assessment team assigned to this function. The general coordinator is responsible for the entire organization, development and execution of the simulated field exercise. Observers are persons who use the assessment tool, assigning value to the actions described in the roadmap for the implementation of the simulated field exercise.

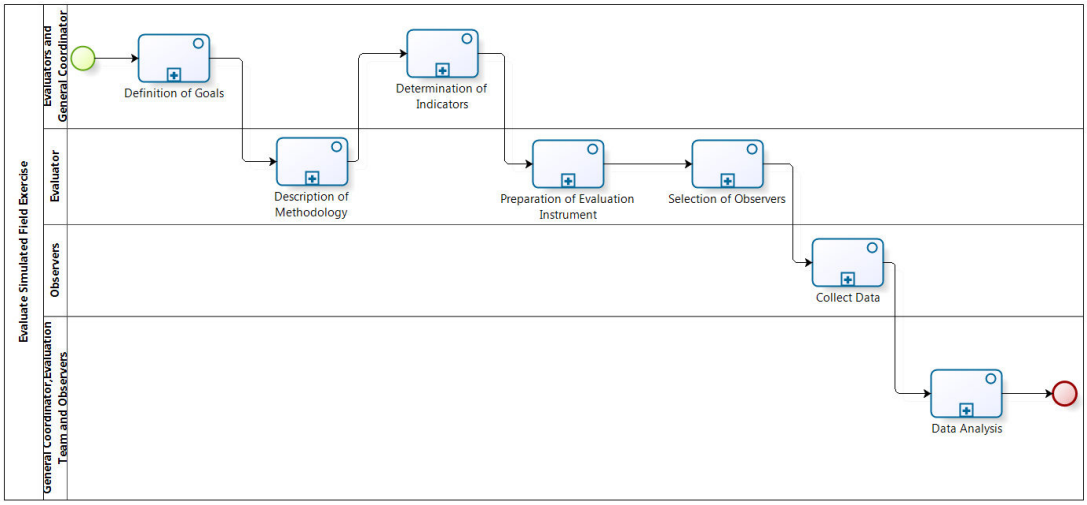

Figure 1. BPMN notation of the first level representation for the process of evaluation of a simulated field exercise.

Considering the aspects of the evaluation process, it is necessary to present specific objectives considering the focus of observation for which you want to evaluate. In this regard, it is desirable that sub processes exist that enable one to: (i) identify the assessment objectives , (ii) establish the methodology used to conduct the evaluation, (iii) define general and operational indicators specific to the conditions being evaluated, (iv) prepare the instrument to be used for data capture; (v) identify and select professionals who will observe the execution of the exercise, (vi) collect measurement data, and (vii) analyze the collected data and identify correlations to complete the assessment for presentation to the organizations.

In the second level, the model breaks down the sub processes into their activities, flow between them and their generated or required artifacts. The second level of the process model is described below.

Definition of Goals

It is important to state clearly the objectives of the evaluation, because not doing so may lead to a misperception about what should be evaluated. What is relevant here is the definition of the goals of the simulated exercise, which will drive the other activities of the process, creating conditions for the flow continuity.

The evaluator and the general coordinator of the simulated field exercise determine the focus and goal of this, from existing general and specific objectives in the strategic plan for emergency, establishing the link between them. At the end, a list is generated containing the objectives of the simulated exercise.

Description of Methodology

The description of the methodology defines and details how the next steps in the evaluation process will be executed. With the goals of the simulation well defined, it is time to choose the most appropriate methods for each of the sub processes or activities that follow.

The details indicate how the assessment process should be conducted or performed. For example, the description of the criteria for selection of candidates for observation, the method of survey indicators and criteria for selection of observers comprising the data capture sub process, among others. The output of this sub process is a list with details of the defined methodology.

Determination of Indicators

Please Indicators are items that want to know and compare in the evaluation. They are identified labeled according to the approach and objectives of the evaluation. Generally, indicators have guiding parameters for comparison with the results obtained. The importance of this sub process is to identify what one wants to know relative to the objectives of the simulation. Once indicators are identified, it is possible to define the variables that comprise each one.

The evaluator searches for generic or operational indicators aligned with the objective for which the exercise is proposed. Generic indicators are general assessment items applicable to the whole domain, while operating indicators are specific to certain situations within the referred domain, and depending on the situation, some indicators may be relevant and others not. The general coordinator of the simulated field exercise is responsible for determining the assessment parameters of the defined indicators and thresholds that point to good performance. Thus, a list of generic and operational indicators, along with their assessment parameters, is obtained at the end of this sub process.

Preparation of the Evaluation Instrument

The evaluation instrument should be particularly well defined with criteria established for this purpose. The evaluation result is nothing more than the weighting of the data collected through the evaluation instrument based on the criteria previously determined (PACHECO, 2002).

The evaluator poses the questions that make up the evaluation instrument. The questions should include the objectives of the simulation associated with indicators that one wants to consider. For this, it's necessary to consider the simulation objectives list, the methodology details list, and the generic and operational indicators list. In addition, the evaluator specifies the type of questions to be used, which can be open (discursive), closed (objective) or mixed (discursive and objective). In the case of mixed or closed questions, there is a need to specify a range of responses, such as yes or no, or a Likert scale, among others.

Another point to be considered is how to apply the instrument. The evaluator must have the support of a computational tool that supports editing of instrument questions and choosing the most appropriate form to present them. It may be that in a given situation printed forms are a good way to apply the instrument, but in other cases, such as outdoors in unstable weather, this is not a good measure. The output of this sub process is the assessment instrument.

Selection of Observers

Observers are the responders of the evaluation instrument. The importance of this sub process is to select suitable and qualified people to collect data about the simulated field exercise during runtime. When choosing observers, the evaluator should consider the skills of the candidate linking them to the objectives of the exercise and the selection criteria defined in the Methodology Details List. This sub process includes interviews with candidates or volunteers for the observer roles, as well as the identification of individual skills that are then compared to the desired skills, based on Simulation Goals List. With this, the Observers List is generated.

Collect Data

This is a sub process performed by the observers. The variables that comprise the indicators are represented in questions to be answered in an evaluation instrument, regardless of the form of its presentation. The issues are judged by observers as they accompany the implementation of the script execution of the simulated exercise. Values are recorded alongside their respective issues, as well as the observers' individual perceptions about the

exercise. At the end of this sub process, the assessment tool will have been filled out.

Data Analysis

Data analysis is started after the execution of the simulated field exercise. At this point the evaluator reads the data contained in the instantiated evaluation instrument and, then, processes the collected data. The evaluation team then carries out the next step, comparing the obtained results with the expected results, based on the values previously set as satisfactory values by the coordinator general in the Determination of Indicators sub process.

The evaluation team and observers gather to share considerations about the results and personal perceptions. The results and the considerations deemed relevant should then be disseminated through a formal final report to the organizations involved in the simulated field exercise. This report will will indicate how the results could be used by the organizations. This document is the output of this sub process and generating it is the responsibility of the exercise's General Coordinator and of the assessment team's Coordinator.

EVALUATION OF THE ASC MODEL AND RESULTS

The ASC model evaluation was performed using hypothetical execution of its sub processes, activities and instantiation of artifacts. For this, six people with extensive knowledge in the emergency domain and with experience in developing or participating in simulated field exercises were asked to participate in the evaluation of the simulation. Among them, two are master students at the Federal University of Rio de Janeiro. Two experts are Civil Defense agents in the municipality of Rio de Janeiro / RJ / Brazil, one of whom is also the coordinator of the Emergency Training Center. One specialist is a Civil Defense agent in the municipality of Duque de Caxias / RJ / Brazil and also the coordinator of the Awareness and Preparedness for Emergencies at Local Level (APELL) program in that same municipality. And one expert is the former chairman of an Internal Accident Prevention Commission at a government institution. Three of the simulation evaluators had previously participated in between three and six field simulation exercises and the others had more than seven participations.

The investigation occurred on aspects related to the development and execution of activities undertaken by participants in evaluating the ASC Model, including templates of artifacts. The units for analysis of the experiment were: the completeness of the model in its specification of activities, flexibility, agility in the development of the evaluation process for simulated field exercise and the generality of application by the participant in performing the tasks according their specific experience with emergency simulation.

The experiment was conducted in three parts: expository presentation of the model to the participants, implementation of activities with hypothetical instantiation of the artifacts and completing structured interviews using questionnaires to evaluate the proposed model. The questionnaire adopted closed questions offering Likert scale response options. The scale sought to measure the degree of agreement of the participant, the intensity factor of ease, the intensity factor of satisfaction, and the degree of comparison. The scale values ranged from (1) low to (5) high.

To examine whether the proposed model provide the evaluator with more agile means conduct this process, were used ease of use and ease of understanding as variables. About the ease that the method provides for the development of the evaluation process, 2 (two) experts and 1 (one) student among the participants reported agreeing (degree 4 in the scale) and another 2 (two) experts and 1 (one) student reported strongly agreeing (degree 5 in the scale). Due to the use of standard notation to simplify the description of the model and its elements, and the use of the same vocabulary as is used in the interaction domain, the results are: 3 (three) experts among the participants reported agreeing and the other 2 (two) experts and 1 (one) student informed strongly agreeing.

To evaluate it on its generality values were assigned to the variables that measure the application of the ASC Model in different simulation situations and to those that measure the understanding of the model proposed by all involved. To answer if the proposed model met the requirements of the simulation environment to which it was applied , the participants were asked to consider their experiences with simulations, the peculiar characteristics of simulations that worked and the organization to which they belong. According to the analysis of the results, 1 (one) student among the participants agrees with the possibility of applying the model to the simulations of the specific organizations or institutions to which they belong (degree 4 in the scale). The remaining 5 (five) participants responded with absolute agreement (degree 5 in the scale). Moreover, the generality can be measured from the level of understanding that the model provides for all involved in the evaluation. The results show that 4 (four) of the participants, 2 (two) students and 2 (two) experts, agree that the model provides understanding and 2 (two) experts strongly agree.

The flexibility aspect considered the values assigned to the variables of generality and to the variable about capacity of adaptability. This last refers to the adaptation of the ASC Model in different simulation situations in the same domain. 2 (two) experts among the participants agree that the Model is adaptable to the specific characteristics of the organizations or institutions to which they belong. The remaining 4 (four) participants responded with absolute agreement.

Regarding the completeness of the model as to the sufficiency of proposed activities, the evaluation included the following variables: sufficient and necessary activities and integration between activities. Of the participants, 2 (two) experts agreed (degree 4 in the scale) that the model suggests activities that are necessary and sufficient to process. The other 4 (four) of respondents strongly agreed (degree 5 in the scale) with this statement, too. The same result was obtained to questions about the integration of the various proposed activities.

The questionnaire also considered the comparison between the ASC Model and the models normally used by experts for evaluating the simulated field exercises. The results of the experiment reflect the participants' satisfaction relative the ASC Model. The results are positive when the proposed model is compared to the models that are currently used by them. A participant (1) evaluated the ASC Model as worse than the ad hoc process commonly used by him when compared to ease of use and as regards the simplicity to implement the evaluation process. He justified his evaluation reporting that their own forms and reports have less content, making it simpler and easier to fill out even though that does not guarantee transparency, consistency and reliability of the final results.

FINAL CONSIDERATIONS

Process modeling allows detailed visualization of processes, sub processes, activities and tasks of an organization independent of the domain in which it is presented. This article presents the application of the process model to develop the evaluation of simulated field exercises in the emergency domain, which will allow its future improvement once a process model not only supports the development of the same, but its execution repeatedly allows enhancement of its realization through experience.

The evaluation made by experts who participated in this experiment with the model proposed in this study suggests that a structured model containing steps defined sequentially and logically interconnected facilitates the management of the evaluation process of simulated field exercises, ensuring its consistency, transparency and reliability of the results.

The instantiation of the proposed model, its processes, templates and activities was carried out in a controlled hypothetically environment, with experts in the emergency domain. As future work, it is necessary to monitor the implementation of the ASC Model in real environments of simulated field exercises, assessments about its use among specialists and comparisons of results obtained in both environments.

ACKNOWLEDGMENTS

Our thanks to experts from Civil Defense agencies and students of the Federal University of Rio de Janeiro who were willing to help us experimenting and evaluating the model proposed here. The authors Marcos R. S. Borges, Jose Orlando Gomes, and Paulo V. R. de Carvalho gratefully acknowledge the support of the Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro – FAPERJ and Conselho Nacional de Pesquisas – CNPq.

REFERENCES

1. FEMA. FEMA Transition Binder. 2009. For the 2009 Presidential Administration Transition "Prepared. Responsive. Committed.". USA: Federal Emergency Management Agency.
2. Haddow, G. D., Bullock, J. A. and Coppola, D. P. (2011). Introduction to Emergency Management. 4ªed. Oxford: Butterworth-Heinemann.
3. W3C Incubator Group Report. 2009. Emergency Information Interoperability Frameworks. (Set. 2011). DOI= http://www.w3.org/2005/Incubator/eiif/XGR-Framework-20090806/.