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'G.A.T.E': Gap Analysis for TTX evaluation

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Abstract. A Table Top Exercise (TTX) gap analysis tool was developed with the aim to provide a complete, systematic and objective evaluation of TTXs organized in safety and security fields. A TTX consists in a discussion-based emergency management exercise, organized in a simulated emergency scenario, involving groups of players who are subjected to a set of solicitations ('injects'), in order to evaluate their emergency response abilities. This kind of exercise is devoted to identify strengths and shortfalls and to propose potential and promising changes in the approach to a particular situation. In order to manage the TTX derived data collection and analysis, a gap analysis tool would be very useful and functional at identifying the 'gap' between them and specific areas and actions for improvement, consisting the gap analysis in a comparison between actual performances and optimal/expected ones. In this context, a TTX gap analysis tool was designed, with the objective to provide an evaluation of Team players' competences and performances and TTX organization and structure. The influence of both the players' expertise and the reaction time (difference between expected time and time necessary to actually complete the injects) on the final evaluation of the inject responses was also taken into account.

Keywords: gap analysis; Table Top Exercise (TTX); CBRNe events.

INTRODUCTION

A 'gap analysis' consists in the comparison of the actual performance with the expected one and is devoted to the identification of the gaps between these two levels, in order to reveal areas that can be improved. A gap is defined as "the space between where we are and where we want to be" and, thus, the gap analysis is seen as a means of bridging that space. Gap analysis involves determining, documenting, and approving the variance between the optimal requirements and current capabilities and can be performed at the strategic or operational level of an organization. GAP can be used as a ranking of 'Good', 'Average' or 'Poor', taking into account that the gap could be positive (above the expected position) or negative (below the expected position). On the basis of these considerations, a gap analysis tool could represent a very useful and functional instrument in the context of emergency management exercises in the safety and security fields, allowing to provide an impartial evaluation of the organized trainings. Among the wide range of exercises, the Table Top Exercise (TTX) consists in a discussion-based one, composed of a tightened succession of numerous solicitations ('injects') addressed to the players by a Command and Operative Center (COC) [1, 2], aimed to test and evaluate plans, policies, and procedures (validation), to examine well-established procedures (testing), to highlight weaknesses and identify resource gaps (gap analysis), to improve individual and team performance, organizational communication and coordination, and to train personnel and clarify roles and responsibilities (training). In this context, a TTX gap analysis tool was developed including an evaluation of both Team players' competences and performances (taking into account their specific and personal competences and their level of knowledge for every area) and TTX organization and structure. The proposed tool (designed as 'G.A.T.E' (Gap Analysis for TTX evaluation)) was written in Visual Basic language, taking into account the influence of both the players' expertise and the reaction time (difference between expected time and time necessary to actually complete the injects) on the final evaluation of the inject responses [3].

G.A.T.E. STRUCTURE

The implemented tool is designed to perform a gap analysis by checking a complete set of report documents produced during TTX activities. It is made up of several excel sheets.

The sheets are thought to gather together homogeneous information about:

- TTX preparation and management (sheet “Check”).
- TTX organization and structure (sheet “TTXInfo”).
- Player’s knowledge and skills useful to accomplish the exercise (sheet “Players-Info”).
- Solicitations and answers given for single inject (multi-sheet “Inject X”).
- Final and cumulative evaluation of player’s replies to all proposed injects (sheet “Results”).

Each sheet contains predetermined cells to be filled in and a sequence of simple questions to be answered. Thus the staff involved in the gap analysis procedure may fill out every sheet very quickly and without a deep knowledge of emergency management.

The main evaluation criteria for the first release of the tool are two:

- response accuracy/quality;
- time of response.

In fact the tool allows the evaluator to set different “weights” for accuracy and response time, in order to stress the importance of speed response for a specific scenario. It is important to specify that the tool can be improved, introducing additional criteria, such as the preliminary expertise of the players, their preparation on specific activities, their professional background, the social/political/economical contest in which the exercise is designed.

Detailed description and guidelines for every sheet are reported below sheet by sheet.

Pre evaluation requirements

Before launching the evaluation process, it is necessary to verify the conformity to all the requirements for the evaluation process itself, such as the matching between the knowledge areas a player dealt with during the exercise and the macro-areas. The “Check” sheet is composed of several close-ended questions aimed to verify the compliance to requirements in the pre-exercise phase (training/briefing; plot/screenplay; accommodation/equipment), during exercise phase (exercise progress) and in the post-exercise phase (debriefing). In this sheet it is possible to select YES or NOT for every sentence, on the basis of the provided written documents.

Table Top Exercise Information

The second sheet “TTX Info” is a collection of very important information for the evaluation process.

This sheet consists of six fields, described as follows:

- Brief plot of TTX: brief description of the exercise storyline that may help to understand the inject replies in the following inject evaluation sheets.
- Exercise objectives: illustration of the specific purposes of the developed TTX, allowing the evaluator to better understand the TTX role-players’ purpose and to calibrate evaluation parameters.
- Start and finishing time: specification of the start and finishing time, in order to verify the conformity to the sum of all inject reaction times and to identify possible waste of time.
- Injects details: indication of injects number, injects typology (e.g. situation report, operation/technology, crisis management, media) and available time (expressed in minutes). A click on a specific arrow (designed as “Generate Injects”) runs a Macro, aimed at generating as many “Inject evaluation” sheets as the number in the “inject number” cell (**FIGURE 1**).
- TTX workplan: description of the work plan, providing information about the progress of the exercise and allowing to identify criticalities or other issues that may have affected the result of the exercise.
- role players: description of the role players who are subdivided in two main categories, i.e. staff roles (e.g. Coordinator Incident commander (IC), Police (police commissioner, Public Health (118), Prefecture and other stakeholder, Trainers); players (number of team, number of players, TTX roles (e.g. team leader, deputy team leader, communication manager, note taker).

Input cells	
	number
	text
number of injects:	
time available [min]:	
knowledge areas	
operative/technological	
crisis management (CMS)	
media	
report	




FIGURE 1. Injects details and “Generate Injects” arrow (tool screen shoot)

Players Info

The '*Players Info*' sheet is focused on the description of the team players, specifying the team name, number of players and player profile.

The player profile fields to be filled in are the following:

- player name: in this field (discretionary) it is possible to note the player name. ;
- player role: in this field it is possible to select the player role among several optional ones, such as team leader, deputy team leader, communication manager, note taker.
- background and expertise: it is possible to select different entries, such as CBRNe technician/expert, National Health Service, law enforcement, Military, fire brigade, civil defence/protection, emergency communicator, emergency/rescue manager. For every entry it is possible to select the option YES or NOT. If YES is selected, a value of 1 is assigned, whereas if NOT a value of 0.
- level of knowledge: it allows to select among the following levels of knowledge, for every considered expertise area (e.g. CBRNe technician/expert, National Health Service, law enforcement, military, fire brigade, civil defence/protection, emergency communicator, emergency/rescue manager), with the related numerical values: not available (N.A., = 0), basic (= 0.5), good (= 0.75), expert (= 1). The knowledge level factor will be used as weight to evaluate Team average expertise in each area of evaluation.
- expertise factors for all TTX evaluation areas (i.e. operative/technical initiative, CMS relations, media/press relations, reports/logs).
- expertise suitability for the task: influence and suitability of Team specific expertise on the four evaluation tasks that are numerically evaluated between 1 and 3, based on expertise impact (low = 1, medium = 2, high = 3).

Moreover, player response to every task is evaluated considering the maximum value among the products between the degree of expertise suitability for the specific task and the player expertise (YES = 1, NOT = 0), obtaining pure expertise factors for every task. These factors can be multiplied for the numeric coefficient associated to the knowledge level, in order to generate the knowledge-weighted expertise factors.

Finally, pure and knowledge-weighted expertise factors for the whole Team can be calculated as a mean of the single player ones, in order to provide a comprehensive idea and view of the team competences. The obtained multivariate data can be displayed through a radar chart that consists in a two-dimensional plot of three or more quantitative variables represented on axes, called radii, starting from the same point (FIGURE 2). Generally, knowledge weighted expertise factors of a Team are lower than the pure ones. Moreover, in the reported example, the considered team can be considered well organized and furnished, presenting many, different and complementary competences.

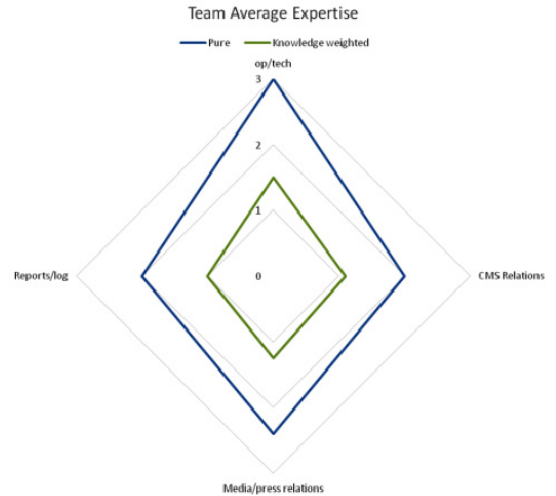


FIGURE 2. Radar chart of the Team's pure and knowledge weighted expertise factors.

Injects sheet

The sheet “Injects” is the core of the tool and can be generated by a “macro”, pressing on the keyboard the “shift+ctrl+I” combination. As already underlined, the desired number of injects can be automatically generated by inserting this number in the related 'injects number' field of the 'TTXInfo' sheet and clicking on the arrow “Generate Injects”.

In this sheet it is possible to insert information related to each inject played in the screenplay and give a grade to the response of the team in each evaluated area.

In the upper part of the form there is a box to fill in with the inject description and the expected reaction time, pre estimated by the screen player. Below this field, there is a form where the evaluation areas that may be interested by this inject are indicated: Operative/Technical initiative, Field/technical operations, Resources allocation/logistics, Sampling/investigation/forensics, Support operations, Crisis Management System (CMS) relations, Media/Press relations, Reports/logs.

By flagging “YES” to one of this areas, the corresponding field in the evaluation form will get red, in order to remember to the evaluation operator that is necessary to assign a grade to the selected area.

To perform a gap analysis of the inject answer, each inject sheet contains also the following boxes:

- “Expected response”: to be filled with the given by the screen player.
- “Given response”: to be filled with the given response by the team (it is very important to provide the more detailed information for a better evaluation).
- “GAP”: the area addressed to describe with a short sentence the GAP detected and the possible improvement areas/other suggestions. Depending on the grades in the evaluation form, the corresponding box in “Areas to be improved” may turn violet, indicating a gap in this evaluated area.

It is very important to notice that gap individuation phase of the evaluation is, necessarily, very affected by the subjectivity of the evaluators and all the comments in this field are to be intended as a suggestion.

In the right area of the sheet there is the evaluation form. First, the evaluator should insert the actual reaction time (in minutes), considered as the time employed by the team to give response to the inject.

For each evaluated area it is possible to assign a grade and a numerical evaluation, on the basis of the following assignments: not given = -1; not adequate = -0.5, not available/not necessary = "-", partially adequate = 0.33, adequate = 0.66, good = 1, more than adequate = 1.5.

Results sheet

The “Results” sheet assembles all the final data from inject sheets, reporting both pure and time weighted average values of the numerical evaluations assigned to each single question for every evaluated area.

The implemented algorithm allows to take into account the reaction time necessary to reply to each inject (Δt). Therefore, for every inject response a time weighted value can be determined, assigning specific weight to the time

factor and to the other grades (e.g. 20 % and 80 %, respectively). This sheet also presents a grid with average grades of the response injects related to the same area (i.e. 1. Response to the inject; 2. CBRNe agent detection/identification; 3. Sampling; 4. Hot area identification/zoning; 5. Investigation/forensics; 6. Technical resources allocation; 7. Medical resources allocation; 8. Viability management; 9. Personnel decontamination; 10. Area Recovery; 11. CMS Relation; 12. Communication; 13. Reporting), both pure and time weighted.

Finally, all grades are summarized for each knowledge area (i.e. Operative-technical/CMS/Media/Report) as average values, both pure and time weighted (average grade).

A pure “ratio” (average grade in an area/team expertise in the same area) and a “knowledge weighted ratio” (k.w., average grade in an area/knowledge weighted team expertise in the same area) are also determined, in order to evaluate the influence of the team expertise on the responses to the proposed injects. These ratios are calculated considering both normalized pure and knowledge weighted team expertise factors and are designed as team knowledge weighted normalized expertise factor and pure normalized expertise factor, respectively. Analogously, the time weighted average grade and ratios, both pure and knowledge weighted, are also calculated.

Final evaluation is based on the calculated ratios (r) between the average grade and the team normalized expertise factor, both pure and knowledge weighted.

CONCLUSIONS

In the present paper a gap analysis tool for performance benchmarking in Table Top Exercise emergency response management was implemented with the objective to furnish an impartial evaluation of the TTX structure and the players' performances, on the basis of their personal competences and level of knowledge for every area. The developed tool is user-friendly, flexible, customizable and modular. It is devoted to perform a gap analysis by checking the complete set of report documents, produced during TTX activities. Response accuracy and time of response are considered as main evaluation criteria. The implemented tool allows to evaluate both the single Team players and the whole Team and both the response to single injects and the comprehensive response to injects belonging to the same area of interest as average values. It enables to identify the 'gap' between the given response to a specific inject and the expected response and to assign evaluations which can be translated in numerical assessment. Finally, it is also taken into account the influence of the players' background and skills and of the difference between the expected time and the actual time necessary to complete the injects on the quality of inject response. It is important to highlight that G.A.T.E. is a powerful tool that can be used not only for TTX related to CBRNe events but it can be also employed to evaluate the preparation of advisors and first responders during their exercises (table top, drills, full scale) in other emergency situations like natural or man made disasters.

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