Emergency response in large public facilities: thoughts and reflections on the unique Dutch Campus University

The research studies aspects that influence the emergency response time within large public facilities in order to recommend improvements for responsible entities that warrant the safety within buildings of the University of Twente. Interviews were held with heads of these entities and the identified causes could lead to deteriorations of the systems structured with the help of an Ishikawa diagram. The goal, methods and results of the research are discussed and recommendations to improve performance are made to help the responsible entities. The practical recommendations are based on the philosophy of continuous improvement and on the new concept of antifragility.

Keywords: Emergency response time, safety culture and climate, continuous improvement, antifragility.

1. Introduction

As mentioned by (Nielsen, 2014) and confirmed by (DeJoy, 2005; Hale, Guldenmund, van Loenhout, & Oh, 2010) the lack of culture change intervention studies in the safety literature is actual and relevant.

The coordination of emergency response is demanding as it involves requirements typical of an emergency situation that include, for example, high uncertainty, necessity for rapid decision making, response under temporal and resource constraints (Chen et al., 2008). In this scenario, the right use of information, is essential both for initiating evacuation for directing people to appropriate exits (Fridolf et al., 2011) and for properly tackling the emergency. These considerations are exceptionally important in specific facilities and environments where different activities and personnel, technicians, students and visitors with different emergency training skills have to co-exist. As described by Borchiellini et al. (2015) this situation can make inadequate the usual approaches to the Occupational Safety and Health problems suitable to industrial activities or secondary educational institutions.

The University of Twente (UT) is the only Dutch purpose-built campus university. Housing, sports facilities, cultural and social activities are centralized and hosted within university buildings. In its laboratories, machineries and chemical, biological and toxic substances are used for research experiments. Consequently, the UT carries a larger than usual technical and social responsibility concerning the safety of visitors, students and employees. Especially, In Case of Emergency (ICE), such as fire (Bouwbesluit, 2012).

The research focus is on the “Horst” buildings at the faculty of Engineering Technology (ET). Emergency drills at the Horst complex in 2016 raised questions concerning the Overall Emergency Response Time (OERT). The OERT is defined as the time from the moment in which an accident or emergency occur until the moment the Emergency Response Team (ERT) has reached the location. The goal of this research regards the current system ICE for possibly offering recommendations to the UT Management to increase safety and reduce the OERT. The recommendations will not include improvements to infrastructures of buildings or equipment used by personnel.

They will be mainly focused on the safety culture/climate and layout of the organization.

Safety is part of an organization’s culture and climate. The attitudes and safety-related behavior of an organization’s members are believed to be affected by safety culture (Cooper, 2000). Safety climate is the expression of safety culture in operational activities, and can be determined through the perceptions and attitudes of employees (Flin et al., 2000). Fur-
thermore, a causal factor has been established between safety climate and safety leadership (Rafaeli et al., 2008).

1.1. Research Structure

The starting point of the research is a situation analysis divided in a brief literature study to acquire background information and on multiple interviews with the responsible entities at the UT to deeply understand the current processes ICE. Secondly, possible causes that could drift the emergency reaction away from planned procedures have been studied with the support of a survey and interviews. Finally, some interesting concepts have been introduced to formulate recommendations in order to improve the overall ICE performance.

2. Situation Analysis

The main entities that play a role during an emergency at the UT are the Emergency Response Team (ERT), the Security Service Desk (SSD), the Human Resource (HR) Management of the UT and visitors, students and personnel. Someone could object that with this approach everyone has to be involved to improve the safety level at the UT; this is true indeed. Improving safety levels is strictly related to involve all possible stakeholders in the process.

A simplified diagram of the current protocols ICE is offered in Figure 1. When an emergency occurs that triggers the automatic fire alarm (alarm buttons, smoke or heat detectors), a signal is sent directly to the SSD and to the ERT with the location and type of emergency. In all other cases, a visitor, a student or an employee has to contact the SSD through the alarm number. The SSD inquires the necessary information and notifies it to the ERT on their pagers within 2 minutes. In case of first aid, the ERT can directly go to the location of the emergency. In every other case, the ERT assembles at the ERT room to get fire protective and aiding equipment before moving out to the location of the emergency. If necessary, the local authorities (ambulance or fire brigades) are contacted for supporting the ERT.

In this situation, the importance of safety related behavior and safety leadership has to be further stressed by the role-rule model. Each role in an organization is associated with a set of social behavioral rules. These rules can be considered as guiding principles related to the role that a person has adopted, and they will influence the actions taken in an emergency situation (Tong et al., 1985; Lovreglio et al., 2014). Top management, middle management and supervisors should behave according to their level of responsibility to achieve a proper level of safety. Especially ICE.

2.1. Emergency Response Team

Time-wise, the ERT carries the responsibility for the largest portion during an emergency. Their responsibilities include: giving first aid, retrieving harmed people in harmful situations and evacuating attendants of the building (Rijksoverheid, 2017). The capabilities of an adequate ERT are dependent on the following aspects: building size and complexity, activities, number of persons, number of independent persons and the response time of municipal emergency services. The ERT of the Horst complex is the largest and best equipped from all UT buildings since it houses most students and personnel (University of Twente, 2015). Furthermore, experiments are conducted in the Horst complex using hazardous substances and most of the production processes take place in this location. The ERT has an emergency room that is used every time the team pulls out. It is equipped with all necessary equipment to offer aid or rescue people in harmful situations. Finally, fire protective and breathing equipment is available. The ERT consists essentially of volunteers and the emergency drills are performed on a monthly-base.

2.2. Security Service Desk

Time-wise, the SSD carries the responsibility between receiving the call from visitor / student / personnel and sending the signal to the pagers of the ERT. If the fire alarm is triggered, this is done automatically. During any emergency, the SSD stays in contact...
with the ERT to prevent communication errors. During emergency drills, the time between receiving and sending is timed with a stopwatch and is set to be within 2 min. This time limit is the same as for the municipal emergency line. During the 2 minutes, information concerning the situation is deducted from the incoming caller via a standard set of questions.

3. Deterioration of ICE performance

In order to understand to what extent, the ICE actions could drift from expected performance a 5-question survey for visitors, students and personnel and a set of interview with the ERT manager, with the SSD manager and with the HR management were carried out.

“Human beings have invented the concept risk to help them understand and cope with the dangers and uncertainties of life” (Slovic, 1992). The feeling of safety is usually based on experiences from the past and, often, not on rational experiences or assessment of the surroundings (Rundmo, 1992). The evaluation of this awareness, together with the understanding of possible pitfalls in the ICE protocols, is especially important since visitors, students and personnel are unknowingly an inherent part of the emergency plans.

3.1. 5-question survey

As said, a 5-question survey was setup to gather information regarding the perception and basic knowledge of risk of visitors, students and personnel at the UT. 15 set of answers have been collected.

The results indicate that around 80% instinctively knows what to do ICE describing the main actions that form the safety protocols. Among the respondents, around 20% has experienced an accident themselves. 80% was unable to give the telephone number of the SSD and approximately 50% was not able to state the location of an emergency exit in UT buildings they have entered. It is debatable whether the perception of risk from the respondents is corresponding to the actual risk. Finally, less than 10% participated to a fire drill.

3.2. Interview with ERT, SSD and HR management

The performed interviews highlighted some interesting points.

First of all, as common in several domains, the performed drills are not always representative of real life situations regarding time pressure and conditions (no real of fake smoke). Usually, the drills are performed to practice the protocols such that ICE the ERT is able to act quickly and instinctively. The best response time with full equipment in a real-life situation should be around 3 minutes. Secondly, since being member of the ERT is based on voluntary decisions, often it is quite challenging for the ERT leader to find willing volunteers that want invest time and efforts on this activity.

Finally, it is difficult in some cases, due to a complex management structure, the identification of the chain of responsibility, generally considered as a not negligible parameter for having a robust safety approach.

3.3. Causes that could deteriorate the OERT

Despite the great efforts that the UT is investing in managing the ICE situations (i.e. the introduction of an app system to increase the clarity of communication between SSD and ERT) also recognized by the municipality and by the local fire brigades, some aspects that could lead to insufficient OERT can be still recognized. They have been identified using a well-known tool for process improvement, the Ishikawa diagram (Fig. 2), developed by Kaoru Ishikawa (1985). It has been used in similar researches to determine the safety culture of an organization (Boraiko, 2008). The diagram used in this research summarizes possible causes for all entities that have an effect on the seemingly insufficient OERT (more than 5 minutes).

As possible to note, four main categories could affect the performance of the OERT during emergency situation: manpower, safety culture, standards and regulations and procedure and protocols.

4. Discussion

First of all, it has to be said that a possible reduction of the OERT is only relevant when an emergency concerns a life-threatening situation, which can be relieved by the current system.

Moreover, the limitations of this study have to be underlined: the subjectivity of the interview and the number of respondents to the survey not statistically robust could only provide indications and further researches should be car-

Aprile 2018
ry on to prove its validity from a scientific perspective.

However, the methods used in this research have academically proven to be useful in similar cases. The literature review, interviews, survey underline the possible OERT deterioration causes using an Ishikawa diagram have served their purpose since useful recommendations can be made.

According to the preliminary research, the current system is working properly if considered the relative number of accidents at the UT and the system is completely compliant with European standards and regulations.

However, some suggestions regarding a safety culture/leadership perspective, can be offered. The current protocols for the ERT drills is based on the idea of “transfer of skills”, practicing the necessary skills and steps without pressure, to be able to perform them instinctively in real situations. This transfer of skills from practice to real-life situations is questioned by Kevin Ford et al. (2000) and T.P. Baldwin et al. (1988), since real situations usually differ and bring the ERT to face different challenges. Time pressure complicates this even further. Finally, the outsourcing of personnel from the SSD may offer advantages, but it could also result in “socially thin employment relationships” and low identification with the employing organization (Koene et al., 2006). A too high turn-over of staffing could bring to a lack of clarity and exceeding time limits during drills.

In order to reduce these issues, a Continuous Improvement (CI) approach has to be reinforced. CI philosophies find their origins, and are still widely used, in manufacturing industries. Since their first use, CI has evolved into a much broader term, growing into a management tool for incremental improvement involving all the stakeholders applicable on a multitude of industries and organizations (Imai, 1986). Some of the well-known CI tools are: the Deming circle, lean manufacturing,
six-sigma and balanced scorecard. From these philosophies, the following concluding aspects can be used for the possible reduction of the OERT:

- Mapping processes, make tangible/quantifiable (plan);
- Setting concrete targets (do);
- Measuring performance/deviation (check);
- Acting on responsibility not on tasks (act);
- Repeating PDCA circle;

Finally, an interesting model to follow to make stronger the ICE protocols is the Antifragility concept (Taleb, 2012). Antifragile systems grow and benefit from shocks, volatility, randomness, uncertainty and disorder. Taleb states: “Antifragility is beyond resilience or robustness. The resilient resists shocks and stays the same; the antifragile gets better.” As proved by Martinetti et al. (2018), the application of this concept to technical domains is already started. However, this philosophy can be used in several sectors, only when a system has shown a certain level of maturity and resilience, the antifragility concept can offer the best results bringing the system to a higher level of safety. Introducing errors and mistakes in the drills could help the ERT to become stronger, being able to face unexpected situations during the real emergencies.

5. Conclusion & further research

In this research, the current system and ICE protocols at the Horst building of the UT have been studied to evaluate if possible improvements on the OERT were feasible.

Standards and regulations that rules the implemented protocols have been researched; it can be concluded that the overall system is fully compliant with the governing acts concerning emergency situations and the number of accidents at the UT is far below the European average. However, according to the survey conducted among visitors, students and personnel on risk perception and safety culture/climate less than half of the respondents has been actively prepared for a harmful situation, and around 80% of the respondents instinctively knows what to do ICE. From the interviews, it was concluded that improvement possibilities are present concerning safety culture/climate as well as for the protocols. The causes for insufficient OERT have been structured using an Ishikawa diagram. The transfer of skills for emergency drills without time pressure, as well as the effectiveness by outsourced personnel is questioned. Recommendations have been made to improve the safety maturity level. Thus, for further researches, it is suggested to firstly evaluate and determine the current safety maturity level at the UT and afterwards, introducing new approaches for continually improving the OERT.

References


Borchiellini, R., Maida, L., Patrucco, M., Pirra, E., 2015. Occupational S&H in the case of large public facilities: A specially designed and well tested approach, in Chemical Engineering Transactions, ISSN 2283-9216, 43, pp. 2155-2160. DOI: 10.3303/CET1543360


Loveglio, R., Fonzone, A., dell’Olio, L., Borri, D., Ibeas, A., 2014. The role of herding behavior in exit choice during evacuation, Procedia-Social and
University of Twente, 2015. Facts and figures.

Acknowledgements

The insight into the currently ICE protocols at the UT would have not been possible without the cooperation of the heads of ERT, SSD and HR Management. The authors want to thank all of them for taking the time to explain in details the system, providing valuable information and showing their patience with some difficult/edgy questions.