Reflection

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1. Reflection

With a passion for advanced communication technologies, safety management and real estate management, the author of this masters' thesis participated in new experiences during this study. In particular, conducting research activities that are outside of his routine while there is generally a lot of learning going on. In this respect, the purpose of this section is to reflect on the relationship between the master track and graduation topic, the connection between research and design, research instruments that have been used during the study, ethical issues, utilization potential, scientific and societal relevance.

1.1 Relationship between graduation topic and master track

This empirical research is carried out for the completion of the master track Management in the Built Environment (MBE) at Delft University of Technology (TU Delft) in The Netherlands. Up till now, the author gained interesting and new knowledge through this master track including how to manage the construction process and urban development, designing an accommodation strategy to ANZ in the Real Estate Management course, and how to involve all relevant stakeholders in the project 'De Rotterdam' to name a few.

However, the author observed that less attention has been given to the facility management in building fire emergency operations with the focus on smart tools during the master track MBE. In this respect, this subject matter provides the author with a great opportunity to combine knowledge from both the Faculty of Architecture and the Built Environment and Faculty of Technology, Policy and Management at TU Delft. In particular, this graduation project uses the knowledge about Facility Management and Corporate Real Estate Management gained from the master track MBE and, at the same time, it enables the author to focus on the use of smart tools in building fire emergency operations. In this sense, knowledge about safety management from an external faculty of TU Delft, Faculty of Technology, Policy, and Management, is used to support this research. Continuing on this line, it is worthwhile to note that using the studies of Den Heijer (2011), Den Heijer et al. (2016), Valks et al. (2016), and Valks et al. (2018) is very valuable which provide a fundamental basis for this masters' thesis. By doing so, the author believes that this study provides novel knowledge in a specific research domain which can be beneficial for both Faculty of Architecture and the Built Environment and Faculty of Technology, Policy and Management.

1.2 Relationship between research and design

The research design during P2 to P4 is based on empirical research with the focus on multi-criteria analysis and semi-structured interviews. Up till now, the author believes that this is the right approach for this study because the answers to the main research question and sub-research questions are eventually determined sufficiently while keeping the time constraints of the graduation project in mind. However, it must be noted that a case study in favor of this empirical research was taken into consideration during P2. The idea behind it was to gain in-depth knowledge about the role of the facility managers during fire emergency situations and what information items should be needed during a building fire emergency operation. Eventually, after careful consideration, a case study is not included in this research because it does not provide the necessary and extensive data that is needed to answer the sub-research question and, even more important, the main research question.

1.3 Lessons learned from conducting research

The author has gained interesting information during the semi-structured interviews. All interviewees were very enthusiastic about this research and, therefore, willing to provide comprehensive answers to all questions. Moreover, it must be noted that a semi-structured interview is an appropriate method for data collection because it enables the author to gather extensive and valuable knowledge. However, the author experienced a lack of time during all interviews. This led to the fact that the author was not able to (1) ask follow-up questions in favor of data collection and (2) to gain a more in-depth understanding of the subject matter. In this context, the author suggests that multiple-choice questions would be a suitable instrument for future research. In particular, the author believes that this research instrument will enable the interviewer to collect accurate and valuable data within time. For example, the author eventually added a multiple-choice question such as 'Please select the 5 most important preferences to utilize a smart emergency applicant during a fire emergency? Subsequently, the participants were asked to select only the choices offered as a list. This has benefited this research because it enables the author to collect specific data and within time.

Further, the intention to use the ALARP method in this research is useful to demonstrate whether a fire cause belongs to the acceptable, ALARP (tolerable) or unacceptable region. By doing so, particular attention can be devoted to the cause that is unacceptable or tolerable. It was supposed that this result helps the author (1) to determine whether the objective data of CBS (2013) correspond to the subjective data of this research. (2) Evaluate whether emergency apps are presenting the information about the cause of the fire to the facility manager and, therefore, improve their situational awareness during a fire incident. However, the author of this masters' thesis has eventually learned that the results of the ALARP method contribute indirectly to the main research question of this study. In addition, using the current ALARP method in this study is not accurate enough. Ultimately, the author would suggest using the 'ALARP risk matrix method' with the corresponding likelihood and impact as depicted in figure 1. By doing so, the author believes that it enables a researcher to compare the subjective data with the objective data of CBS (2013) and examine the degree of risk acceptance in an accurate manner.

Likelihood	Severity			
	catastrophic	critical	marginal	negligible
frequent	A	A	A	A
probable	A	A	A	B
occasional	A	A	B	C
remote	A	B	C	C
improbable	B	C	C	D
incredible	C	C	D	D

Figure 1 the 'ALARP risk matrix method' for future research. Table retrieved from Cook (2008)

Besides, the research in smart tools helps the author to increase the understanding of the usefulness and functionality of the current smart emergency apps. In this regard, the studies of Valks et al. (2016), and Valks et al. (2018) are very helpful to this research. More accurately, these studies provide a direction to the author on how to analyze the current smart tools and, therefore, increasing the understanding of the usefulness and functionality of smart tools. In the future, it is recommended to use the format of Valks et al. (2018) as a fundamental basis for the smart tools' analysis.

1.4 Societal and scientific relevance of the work

With reference to the societal relevance and transferability of the results, the author believes that the findings of this research are valuable for researchers, facility managers, emergency managers, and app developers. In particular, it can be a resource for the researchers for reviewing their smart emergency applications in terms of information provision. Moreover, this study can be a stimulant for the researchers to create novel smart emergency apps through operational research. Additionally, the findings of the research provide constructive feedback to the facility managers. They may use this research to find out which smart emergency applications are advantageous to them according to their required information during an emergency situation. Regarding scientific relevance, most studies focus on the benefits and technical elements of smart tools during emergency situations. However, a need was identified for a detailed study from a distinctive perspective. Hence, the contribution of this research is to add to the current body of knowledge: generating new insight and findings based on the prior available knowledge by doing empirical research with the focus on multi-criteria analysis for supporting the selection of smart emergency application in the facility management.

1.5 Ethical issues

While important and relevant data was gathered for this research, the author also experienced an ethical issue in data collection. In particular, during this research, confidential information about the cost of an emergency app and a script for emergency activities is not included in this study. Permission to publish this confidential information is not granted by the participants. Further, as stated by Kumar (2011), it is unethical to gather information without the consent of the participants. Therefore, this study seeks consent by providing a consent form to the participants of the interview. In this regard, this study uses the consent form that is retrieved from TU Delft. The aim of this informed consent is to make participants aware of the purpose of the research, whether personal information (e.g. real name and job title) of the participant can be used for quotes and for which purpose. In the latter case, it must be noted that all participants give permission to use their real name for quotes.

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