

**AN EMERGENCY RELIEF SHELTER RESPONSE FRAMEWORK
FOR FLASH FLOODS IN SAUDI ARABIA**

by
Abdulrahman Mohammedashraf A. Bashawri

Submitted in accordance with the requirements for the degree of
Doctor of Philosophy

The University of Leeds
School of Civil Engineering

May 2019

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

Abstract

Flash floods often have a devastating impact on the people left in their wake in Saudi Arabia (SA). They do not always affect people simply for a short period; rather, their general welfare and way of life can be disrupted after the event has occurred. Emergency relief shelters (ERS) are used to provide places of protection, privacy, security and well-being for people to live in when they have left their usual accommodation as a consequence of flash floods. ERS not only provide a quick and short-term response for the victims, but they also help them to recuperate from the injury and the trauma of a calamity, and give them a base from which they can begin the process of rehabilitation.

A review of the literature indicates that the performance and provision of ERS for victims of flash flooding in SA are not currently as effective as they should be. A general lack of sufficient consideration with regard to a range of matters such as delays and unappropriated ERS responses has been identified as a source of poor performance contributing to an unacceptable standard. In particular, the published guidance available in SA for the response to flash flood situations has been found to be too generic to be of much practical use.

This thesis develops an ERS response framework that helps to provide more focused guidance for flash flood situation in SA. Key features of the proposed framework are that it is an interactive tool that can be used on site and also that it can be developed and improved by being updated to capture good responses of ERS used in previous flash flood situations. The principal aim of the framework is to provide better guidance than that currently available to those who make decisions such as aid relief agency staff who are present at the flash flood site and whose role it is to provide help to those needing it with the minimum of delay. In doing so, it is hoped to maximise fitness for purpose, provide good value for money, improve life quality and save time.

Keywords: Emergency relief shelters (ERS); flash flooding in Saudi Arabia (SA); flood-affected victims; design factors; ERS response framework.

Acknowledgements

Completing the work for this thesis would not have been possible without the help of numerous individuals. I would first of all like to thank Professor Stephen Garrity and Mr Krisen Moodley for their supervision, constructive comments, positive reactions, incredible support and encouragement as I undertook the various stages of my research. My thanks also go out to the Postgraduate Research Tutors in the School of Civil Engineering: Dr Miller Camargo–Valero, Dr Akintunde Babatunde and Professor Simon Rees.

In addition, very special thanks are owed to all the academic and administrative staff at the University of Leeds and to my fellow students for their support, and to all other participants who helped to make this research possible.

I am also very grateful to the Government of Saudi Arabia, as represented by the King Abdullah Scholarship Programme and Umm Al-Qura University, The Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research, for offering a full grant. It would not have been possible to undertake my research without this essential support, which I acknowledge with sincere thanks.

To my mother (Sabiha Bashawri), wife (Dhuha Bajouda), daughter (Dhiyaa Bashawri) and son (Al-Hassan Bashawri), I communicate profound appreciation for their constant encouragement, administrative backup and moral support. I am also indebted to my sisters and brothers for their consideration and encouragement, right from the very beginning. The completion of this research is a small reward for their great expectations and efforts.

Finally, it is with profound sadness that I report that my father, Mohammedashraf, passed away in March 2017. He had hoped to see me achieve the degree of Doctor of Philosophy and I too had so much wanted both my parents to be able to witness my graduation. May his soul rest in peace.

Contents

Abstract.....	i
Acknowledgements.....	iii
Contents	iv
Figures.....	viii
Tables.....	xi
Abbreviations.....	xii
Chapter 1 Introduction	1
1.1 Overview	1
1.2 The research problem.....	2
1.3 Research aim	4
1.4 Research objectives	4
1.5 Research methodology	4
1.6 Research process diagram	6
1.7 Contribution to knowledge.....	8
1.8 Scope and limitations	8
1.9 Layout of the thesis	9
Chapter 2 Flash floods and emergency relief shelters	11
2.1 Introduction.....	11
2.2 Initial critical review of ERS guidance in SA for flash flooding.....	11
2.2.1 The Executive Plan for the Tasks of Hajj and Umrah and its Affiliated Parties Included in the General Plan of Emergency for the Hajj Pilgrimage (الخطة التنفيذية لمهام الحج) والعمرة (Ministry of Hajj and Umrah, 2017)	12
2.2.2 National Plan for Natural Disasters Risk Reduction (الخطة الوطنية لمواجهة مخاطر) الكوارث الطبيعية (General Directorate of Civil Defence, 2018)	13
2.2.3 Summary: Guidance review.....	16
2.3 Flash flooding in Saudi Arabia.....	17
2.3.1 Review	20
2.4 Emergency relief and its response phases	21
2.5 Emergency relief shelter types	23
2.5.1 Using a permanent building for a temporary period.....	25

2.5.2	Shelter kits with materials.....	29
2.5.3	Tents.....	32
2.6	ERS issues and their influence on SA flash flood situations	37
2.6.1	Environmental issues	37
2.6.2	Economic issues.....	39
2.6.3	Technical issues	40
2.6.4	Socio-cultural issues	43
2.7	Summary	46
Chapter 3 Existing ERS response methods.....		48
3.1	Introduction	48
3.2	Existing shelter response methods in emergencies	48
3.2.1	Method for distributing shelter kits (IFRC, 2010).....	50
3.2.2	Method for distributing plastic sheeting (IFRC and Oxfam, 2007).....	53
3.2.3	Method for choosing to distribute tents (United Nations, 2004)	59
3.2.4	Method for a transitional shelter (Shelter Centre, 2012)	63
3.2.5	Method for shelter in emergency (Humanitarian Aid and Civil Protection, 2016)	69
3.3	Summary	74
Chapter 4 Research methodology		76
4.1	Introduction	76
4.2	Epistemology versus ontology	76
4.3	Deduction versus induction.....	77
4.4	Explanatory versus exploratory.....	78
4.5	Quantitative versus qualitative	78
4.6	Research processes adopted	82
4.6.1	In-depth literature review.....	83
4.6.2	Expert interviews	85
4.7	Summary	91
Chapter 5 A conceptual ERS response framework for flash floods in SA		92
5.1	Introduction	92
5.2	ERS response framework for flash floods in SA	93
5.2.1	Stage 1. Define the ERS response need	98

5.2.2	Stage 2. Identify the basic ERS response requirements for a flash flood situation	125
5.2.3	Stage 3. Identify successful ERS responses and categorise for inclusion in a searchable database.....	125
5.2.4	Stage 4. Create a searchable database of ERS responses.....	125
5.2.5	Stage 5. Create a shortlist of possible ERS responses	129
5.2.6	Stage 6. Review the shortlisted ERS responses to select the final ERS response(s).....	129
5.2.7	Stage 7. Final recommendations for the ERS response(s) to flash flooding ...	129
5.3	Summary	135
Chapter 6 The verification of an emergency relief shelter (ERS) response framework for flash floods in SA		136
6.1	Introduction	136
6.2	Verification tool design.....	136
6.3	Respondents	138
6.4	Feedback from the verification exercise	141
6.4.1	General view of the response framework for ERS	141
6.4.2	The ERS response framework stage evaluation.....	146
6.4.3	Design factors identified from the ERS response framework evaluation.....	150
6.5	Results	154
Chapter 7 The validation of an emergency relief shelter (ERS) response framework for flash floods in SA		159
7.1	Introduction	159
7.2	Validation tool design	159
7.3	Validation steps.....	162
7.3.1	Validation Step – 1.....	162
7.3.2	Validation Step – 2.....	167
7.4	Results	172
Chapter 8 Conclusions		187
8.1	Introduction	187
8.2	Achievements of the research aim and objectives	187
8.2.1	Achievement of the research aim.....	187
8.2.2	Achievement of the research objectives	188

8.3	Contribution to knowledge.....	195
8.3.1	Theoretical level.....	195
8.3.2	Empirical level.....	195
8.4	Limitations of the research.....	196
8.5	Recommended future work.....	197
	References.....	199
	Appendix A: Semi-structured interview questions for a verification.....	208
	Appendix B: Structured interview questions for a validation.....	211

Figures

Figure 1-1: The research process diagram.....	7
Figure 2-1: Paper partition system used in a permanent building (Ban, 2014)	29
Figure 2-2: Typical items provided inside a shelter box (Shelter Box, 2018).....	32
Figure 2-3: Tents used for relief shelters (United Nations, 2004).	34
Figure 2-4: UNHCR tent (UNHCR, 2016).	35
Figure 3-1: Method for distributing shelter kits.....	50
Figure 3-2: Method used for distributing plastic sheeting.....	54
Figure 3-3: Options for shelter needing to be assessed before distributing tents (United Nations, 2004).....	59
Figure 3-4: The four main sections of a transitional shelter programme (Shelter Centre, 2012).	64
Figure 3-5: Indicative decision tree	71
Figure 5-1: The conceptual ERS response framework for flash floods in SA.....	97
Figure 5-2: Factors influencing possible responses to flash flooding.....	101
Figure 5-3: Flash flood information factor.	103
Figure 5-4: Flood-affected persons factor.....	105
Figure 5-5: Weather conditions factor.	107
Figure 5-6: Size factor.	109
Figure 5-7: Availability of safe buildings factor.....	111
Figure 5-8: Topographical features factor.	113
Figure 5-9: Materials factor.	116
Figure 5-10: Time factor.....	120
Figure 5-11: Financial and technical abilities factor.....	122
Figure 5-12: Risks and hazards factor.	124
Figure 5-13: Research boxes.....	127
Figure 5-14: Final recommendations.	130

Figure 6-1: The general understanding of the ERS response framework	142
Figure 6-2: Importance of the ERS response framework	143
Figure 6-3: Benefits of using the response framework.....	144
Figure 6-4: Drawbacks of using the ERS response framework.....	145
Figure 6-5: Does this list of stages cover the full spectrum of ERS response practices in Saudi Arabia?.....	147
Figure 6-6: Can the identified stages be applied in practice?	148
Figure 6-7: To what extent do the identified stages contribute to the ERS response in your area of expertise and how?.....	148
Figure 6-8: Rank the stages in terms of the priority for implementation.....	149
Figure 6-9: Does the list of design factors cover the full spectrum of ERS response practices in Saudi Arabia?.....	150
Figure 6-10: Can the identified design factors be applied in practice?.....	151
Figure 6-11: To what extent do the identified design factors contribute to the ERS response in your area of expertise and how?	152
Figure 6-12: Rank the design factors in terms of the priority for implementation	153
Figure 6-13: The ERS response framework for flash floods in SA (after considering verifications' feedback)	157
Figure 6-14: Availability of safe buildings factor.....	158
Figure 7-1: Stage evaluation	164
Figure 7-2: Design factors evaluation.....	165
Figure 7-3: Evaluation of approach attributes	166
Figure 7-4: Stage evaluation	169
Figure 7-5: Design factor evaluation	170
Figure 7-6: Evaluation of the approach attributes.....	171
Figure 7-7 The ERS response framework for flash floods in SA (the final framework).....	174
Figure 7-8: Flash flood information factor.	175
Figure 7-9: Flood-affected persons factor.....	176
Figure 7-10: Weather conditions factor.	177

Figure 7-11: Size factor.	178
Figure 7-12: Availability of safe buildings factor.....	179
Figure 7-13: Topographical features factor.	180
Figure 7-14: Materials factor.	181
Figure 7-15: Time factor.....	184
Figure 7-16: Financial and technical abilities factor.....	185
Figure 7-17: Risks and hazards factor	186

Tables

Table 2-1: Cases of flash flooding in SA (Al Saud, 2015; Abdalla, 2018)	18
Table 2-2: Advantages and disadvantages of different permanent buildings (Camp Coordination/Camp Management, 2010).....	26
Table 6-1: Details of experts interviewed to verify the ERS response framework.	139
Table 7-1: Details of the experts interviewed to verify the ERS response framework (step one).	163
Table 7-2: Details of the experts interviewed to verify the ERS response framework (step two).	167

Abbreviations

CC	Camp Coordination
CCCM	Camp Coordination/Camp Management
CM	Camp Management
DR	Disaster Relief
HM Government	Her Majesty's Government
ICRC	International Committee of the Red Cross
IFRCS	International Federation of the Red Cross and Red Crescent Societies
IRC	International Rescue Committee
IRP	International Recovery Platform
NFI	Non-food item
NGO	Non-governmental organization
NRC	Norwegian Refugee Council
OCHA	Office for the Coordination of Humanitarian Affairs
OSHA	Occupational Safety and Health Administration
T-shelters	Temporary and transitional shelters
UN	United Nations

UNDP	United Nations Development Programme
UN-HABITA	United Nations - HABITA
UNHCR	United Nations High Commissioner for Refugees
UNEPA	United Nations Environmental Protection Agency

Chapter 1 Introduction

1.1 Overview

In recent years, extreme flash floods have threatened cities more than ever before in Saudi Arabia (SA) due to contemporary society's high vulnerability (Mohamed, 2017; Chen et al., 2018). Hundreds of individuals annually have been displaced from their homes by flash floods. While the size and number of enormous flash floods and the number of individuals displaced vary from year to year, the country cannot turn away - it is simply not acceptable to do what we have done in the past. The need to provide suitable emergency relief shelter (ERS) responses is a challenge that must be met.

ERS following flash flooding are vital especially in the initial emergency stage, both economically and in terms of an effective response (Charlesworth, 2014; UNHCR, 2018). They should provide health and well-being, security against violence, privacy, dignity and places to live for people who have lost their accommodation and livelihoods (Davis and Lambert, 2002; Félix et al., 2015). Typical examples of ERS include the use of permanent existing buildings for a short period of time (such as hotels, furnished apartment or halls), and temporary facilities such as tents. Complementary support should come from all relevant responsible beneficiaries, e.g., different government ministries, local non-governmental organisations (NGOs), aid agencies, private contractors, private manufacturers, landowners and community leaders as well as the flood-affected people, where possible.

People are affected in many different ways by flash floods in SA, ranging from very serious life threatening injuries, those with less serious injuries requiring medical treatment, those who can self-treat with simple medication to those with no physical injuries. Many people often lose

their homes and urgently need a place to resume life as soon as is feasible (Shelter Centre, 2008).

In SA, the provision of shelters during relief emergencies is a necessary component of the response, but little attention has been paid to developing a process for providing an immediate response after flash floods strike in SA (Mohamed, 2017; Organisation for Economic Co-Operation and Development, 2018). SA is known for its dry climatic conditions, but has recently been subject to flash floods - heavy rain falling in large amounts continuously for several hours. Recently, the most severe flash floods have occurred in cities such as Jeddah, Asir, Makkah and Riyadh. They caused injury and death; damage to personal property including dwellings and cars (caused by rising water-levels); the breakdown of communities and damage to the environment (Youssef et al., 2016; Abdalla, 2018). SA has developed guidance for providing responses to flash flood events but it is very generic in nature (Ministry of Hajj and Umrah, 2017; General Directorate of Civil Defence, 2018). It does not provide focused guidance or advice on quick responses for the provision of ERS (Abosuliman et al., 2014; Youssef et al., 2016; Ali and Ameer, 2018).

1.2 The research problem

A review of the available ERS response guidance and documents related to ERS in SA (see section 2-2) indicates that they are very generic in nature and so do not actually provide useful response guidance for relief emergency shelters for those affected by flash floods in SA. This lack of useful guidance results in rushed, improvised decisions that can create chaos not only between organisations but between the site workers and survivors (Abosuliman et al., 2014; Youssef et al., 2016; Ali and Ameer, 2018).

This research therefore seeks to develop an ERS response framework for flash floods in SA that can be used by anyone responsible for decision-making, such as aid or relief workers, to

define the nature and extent of the victims' needs which can then be used to identify an appropriate ERS response. As explained later in the thesis (Chapter 5), this is obtained from a searchable database that is based on responses to flash flooding events in SA that have previously been used with some success. It is intended that the searchable database should be improved and extended as a result of experience, so that, when a successful ERS response has been used in flash flood events in the future (or in similar circumstances outside SA), the ERS response details can be added to the framework database. This will allow others to benefit from this good practice in the future by helping decision makers to make better, more informed decisions and provide a measure of confidence to implement the selected ERS response both quickly and effectively. The framework presents alternative concept-level responses that have been used, with success, in conditions that are matched with the situation on site. It is an interactive tool (which should be useful so that the end-user can define the nature and extent of the victims' needs before attempting to seek solutions) in which the aid worker provides information on a flash flood site that can be matched with successful ERS response used previously in order to increase the speed of the response decision.

It is also intended that the ERS response framework developed from this research will maximise fitness for purpose, provide good value for money, improve life quality and save time. The proposed framework is not intended to provide highly detailed designs of any particular ERS product but focuses more on design factors that reflect local needs, and environmental, economic, technical and sociocultural contexts in order to make the ERS response appropriate with an easier, quicker and better informed decision making process.

1.3 Research aim

This research aims to develop an ERS response framework for flash flood events in Saudi Arabia to support those who make decisions such as relief agency staff who are present at the flash flood site and whose role it is to provide help to those needing it. In doing so, it is hoped to maximise fitness for purpose, provide good value for money, improve life quality and save time.

1.4 Research objectives

The following specific objectives have been devised to investigate the stated research problem and to achieve the research aim:

Objective 1. To gain a detailed understanding of flash flooding in SA and its main challenges; the different phases of emergency relief responses; ERS concepts and types and also the environmental, economic, technical and socio-cultural challenges related to the provision of ERS;

Objective 2. To critically evaluate existing ERS response methods to establish if they are appropriate for ERS responses for flash flooding events in SA;

Objective 3. To develop, verify and validate an ERS response framework that will provide improved guidance for aid workers at the site of flash flood situations in Saudi Arabia enabling them to make better and quicker decision for sheltering flood-affected victims.

1.5 Research methodology

A ten-stage research process was devised by the author to address the stated research aim and objectives. This was formulated as described below and has been summarised in 1.6 and Figure 1-1. According to Cornwall et al.(1994), the approach to and choice of research methodologies

is a vital part of the research process, as they *'provide the user with a framework for selecting the means to find out about, analyse, order and exchange information about an issue. They define what can be known or exchanged, how that should be presented and by and for whom this is done'*. The rules and processes that have been followed in a research study are known as the research methodology (Fellows and Liu, 2015; Uma and Roger, 2016). The way in which the research is conducted is of utmost importance when conveying its authenticity (El-Diraby and O'conner, 2004; Tan, 2004). There is a strong association in every research study between the methods used to collect the data and the results obtained. The method used impacts on the conclusions (Rouse and Dick, 1994; Saunders et al., 2009).

A qualitative research design was used to conduct this research. Qualitative methodologies often come in the form of in-depth literature studies and interviews (Saunders et al., 2009; Robson, 2016). An in-depth literature study was undertaken to identify gaps in the up-to-date knowledge and to gain a detailed understanding of flash flooding issues in SA, emergency relief response phases, emergency relief shelters and the types and issues involved (to address research objective 1 as shown in Chapter 2).

In addition, we have critically evaluated the existing ERS response methods (to address research objective 2 as shown in Chapter 3) in order to identify if such methods are appropriate for the ERS response to a flash flood situation in SA. The outcomes from Chapter 2 and Chapter 3 were then used to develop the conceptual ERS response framework for a flash flood in SA.

The interview technique was used for the verification and validation of the ERS response framework. The main aim of the interview technique was to discuss the improvement and refinement of the ERS response framework by pursuing expert feedback from Saudi Arabia (that is, from those involved in a flash flood situation, sheltering flood-affected victims) about the developed ERS response framework, process, stages and design factors.

In a non-quantitative investigation, verification refers to the devices used during the research process to incrementally contribute to checking and guaranteeing reliability, therefore, the accuracy of a study (Fellows and Liu, 2015). Smith (1993) suggested that non-quantitative and hard frameworks can be verified by undertaking a qualitative approach through interviews, getting the participant's opinion and feedback. Therefore, a semi-structured interview form was undertaken by asking open questions in order to develop the conceptual ERS response framework for a flash flood in SA.

Proving the validity of a procedure-based ERS response framework is tough without there being a resource obligation to the organisation and time period requisite. It might take, at minimum, no less than a year to receive results referring to an ERS response applied to the framework. Thus, it is not achievable to use this technique for validation. Instead, framework validation can be conducted by a collection of specialists with a wide variety of expertise by interviewing them face to face. This increases the chance of an outcome, given that valuable insights into the topics being studied can be provided. Therefore, a structured interview was used by asking quantitative closed-ended questions using the Likert scale, in combination with qualitative comments through open-ended questions in order to develop the ERS response framework for a flash flood for SA.

1.6 Research process diagram

Figure 1-1 illustrates the overall research process adopted to develop an ERS response framework for flash floods in SA, while actions taken to achieve the objectives described in 1.4.

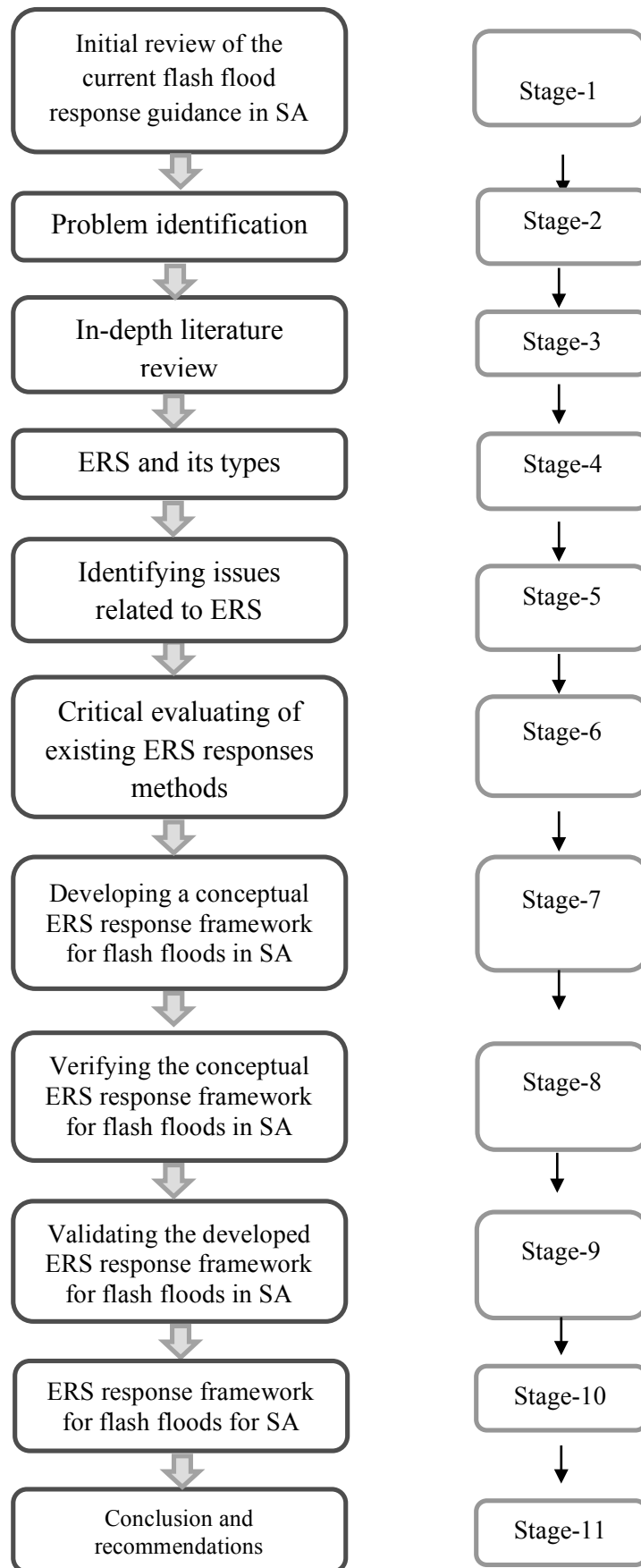


Figure 1-1: The research process diagram.

1.7 Contribution to knowledge

The preceding introduction and problem statement conveys the importance of creating an ERS response framework to use in the occurrence of a flash flood in SA for evacuees, especially in the early stages of the response. This study contributes significantly to the body of current knowledge. The ERS response framework will provide efficient, rapid, simple and practical guidelines to beneficiaries who are charged with decision-making such as aid relief workers, who can devise ERS responses that better fit the users' needs and wants. The study provides the impetus for further research, investigation and thinking in the context of ERS response and could form the basis of a response approach that could be extended to other forms of hazard and disaster, particularly where a rapid response is required.

1.8 Scope and limitations

The scope of this study encompasses the ERS response to flash flooding for SA. The ERS response framework provides recommendations that will guide decision-makers (such as aid relief workers) in devising useful ERS response solutions to suit the specific needs of the people affected by flash floods in SA. This, in turn, will provide ERS for displaced populations who have lost their usual accommodation because of flash floods and help them to resume their routine daily activities until they find a durable solution. Moreover, this research evaluates the specific environmental, economic, technical and socio-cultural factors. It does not specifically include ERS for other types of natural hazards (such as earthquakes, tsunamis, and so on), accidental or non-accidental technical disasters or for permanent shelters, but the ERS response framework may aid and inform the planning for longer-term solutions.

1.9 Layout of the thesis

The thesis consists of the following chapters:

Chapter 1 provides an overview of the research, the principal research problem addressed by the author, the research aim and objectives and the research methodology and process. This chapter also sets forth the study's contributions and limitations, and summarises the thesis structure.

Chapter 2 reviews the related literature. Initially, the existing published guidance in SA has been critically reviewed in detail with a specific focus on the ERS for flash floods, the background of flash floods in SA and the associated issues, emergency relief and its response phases and the provision of emergency relief shelters and the different types of emergency relief with examples used in flood events. Moreover, it identifies the range of issues that need to be considered in order to increase the performance of the ERS response in a flash flood situation in SA.

Chapter 3 critically evaluates the response shelter methods that are used in emergency situations including the method for distributing shelter kits ([IFRC, 2010](#)), the method for distributing plastic sheeting (IFRC and Oxfam, 2007), the methods for distributing tents (United Nations, 2004), a transitional shelter programme (Shelter Centre 2012) and the method for sheltering people in an emergency (Humanitarian Aid and Civil Protection, 2016).

Chapter 4 identifies the research approaches and techniques, and demonstrates the methods that have been conducted in this research in order to develop an ERS response framework for flash floods in SA.

Chapter 5 describes the development and main characteristics of the ERS conceptual response framework for flash floods in SA which have been developed from the literature review

(Chapter 2 and Chapter 3). The conceptual design framework is comprised of seven main stages: the ERS response need for a flash flood situation in SA (by considering the design factors including flash flood information, flood-affected persons, weather conditions, size, the availability of safe buildings, topographical features, materials, time, financial and technical abilities and risks and hazards), the basic ERS response requirements for a flash flood, the identification of successful ERS responses that have been used previously in flash flood situations in SA and the categorisation of the aforementioned for inclusion in a searchable database, the creation of a searchable database of ERS responses, the creation of a shortlist of possible ERS responses from the searchable database and finally, a review of the shortlisted ERS responses in order to select the final response(s) to a flash flood situation with a final recommendation.

Chapter 6 verified the conceptual ERS response framework for flash floods in SA through interviewing Saudi experts. Furthermore, it illustrates the conclusion derived from the data collection.

Chapter 7 validated the proposed ERS response framework for flash floods by pursuing Saudi expert feedback from two groups (first group recruited from public and private organisations and the second group recruited from an academic background) on its process, stages and design factors. In addition, the developed version of the ERS response framework for flash floods in SA has been shown.

Chapter 8 summarises the whole thesis with the achievements noted in terms of the aims and objectives, illuminating the contributions to knowledge, acknowledging the limitations, and also proposing a direction for future research.

Chapter 2 Flash floods and emergency relief shelters

2.1 Introduction

The current literature on the ERS response to a flash flood is limited in Saudi Arabia. However, the global literature on ERS is varied and wide-ranging. A brief review of the current literature reveals the subject to not only be varied but also to encompass a myriad of design philosophies and viewpoints. This chapter will seek to explore and identify the following: current guidance available for an ERS response to a flash flood in SA (see 2.2), the background of flash floods in SA and related issues (see 2.3), emergency relief and its phases that are used in a flash flood situation such as preparedness, and the emergency and early recovery phases (see 2.4), the emergency relief shelters that are provided in flash flooding events, the different types available (permanent buildings used for a short period of time, materials with shelter kits and tents) and examples (see 2.5) and the four principal issues that need to be considered in an ERS response, namely environmental, economical, technical, and socio-cultural in order to consider to what extent the factors will affect the ERS response and performance in a flash flood situation in SA (see 2.6).

2.2 Initial critical review of ERS guidance in SA for flash flooding

In the early stage of the research study, a critical review of the literature relating to the available guidance on the ERS response to a flash flood in SA was conducted. Unfortunately, the available guidance is generic in nature and might not be specific enough to use in a flash flood situation. For instance, there are two documents available - one of them is the Executive Plan for the Tasks of Hajj and Umrah and the Affiliated Parties included in the General Plan of Emergency for Hajj Pilgrimage (الخطة التنفيذية لمهام الحج والعمرة والجهات التابعة لها الواردة بالخطة العامة)

(Ministry of Hajj and Umrah, 2017). It is available as a hard copy in the ministry. The second one is the National Plan for Natural Disaster Risk Reduction (الخطة الوطنية لمواجهة مخاطر الكوارث الطبيعية) (General Directorate of Civil Defence, 2018). It is available online in the General Directorate of Civil Defence website; these documents will be explained in more detail in the following sub-section.

In addition, there are other documents available such as Flood Control Management for the City and Surroundings of Jeddah, Saudi Arabia (Al Saud, 2015), which is mostly focusing on hydrological behaviour, the geometric and morphometric analysis of the drainage systems, and controlling water and areas, which are out of the research scope. Other documents are not publicly available, as some responders noted in the interviews (addressed in Chapter 6).

2.2.1 The Executive Plan for the Tasks of Hajj and Umrah and its Affiliated Parties Included in the General Plan of Emergency for the Hajj Pilgrimage (الخطة التنفيذية لمهام الحج والعمرة والجهات التابعة لها الواردة بالخطة العامة للطوارئ بالحج ١٤٣٨ هـ) (Ministry of Hajj and Umrah, 2017)

The main reason behind the Executive Plan for the Tasks of Hajj and Umrah and its Affiliated Parties Included in the General Plan of Emergency for Hajj Pilgrimage document is to make a plan aimed at preparing and harnessing all financial and human resources, taking all appropriate measures to protect both pilgrims and citizens, keeping them safety from all the dangers related to accidents, hazards and disasters in all areas of the Hajj. This may require immediate relief, evacuation, sheltering and the protection of public and private property in hajj areas. In addition, it notes the importance of coordination between the concerned parties to carry out their work when facing the dangers, hazards and disasters present with all possible efficiency.

This document consists of information on the hazards that can potentially be encountered while on Hajj and plans to act against them. The hazards include natural hazards (flash floods, wind and hurricanes, earthquakes, rock falls, landslides and disease outbreaks including epidemics),

non-natural hazards, terrorist acts and hazards related to human crowds. As this research is focused on flash floods, therefore the response plans for flash floods will be looked at in more detail.

In terms of planning to face flash flooding hazards, this includes preparing the emergency exits to evacuate pilgrims during the implementation of the evacuations, paving them so then it is easier for the elderly, women and children; to switch off the electricity to the affected sites; undertaking field service groups coordinated with Civil Defence Officials to transport pilgrims to camps in safe locations close to their original camps; allocating of 200 buses to return the pilgrims to their places of residence after the removal of the danger, and the assigning of responsible organisations to preparing accommodation with the necessary supplies of furniture etc.

In terms of the evaluation of the sheltering plan in flash flood situations, it includes evacuating the victims to outside the tents and buildings to take them to a safe place, to provide translators to translate the emergency information if needed, to prepare all of the places that can be used to shelter victims, the use of human elements in the implementation of evacuation and shelter (scouts, pilgrim organisations, internal pilgrims etc.) as much as possible and estimating the number of the pilgrims who were almost evacuated, to identify their nationalities as much as possible.

2.2.2 National Plan for Natural Disasters Risk Reduction (الخطة الوطنية لمواجهة مخاطر الكوارث الطبيعية) (General Directorate of Civil Defence, 2018)

The main aim of this document is the same as the previous one (the Executive Plan for the Tasks of Hajj and Umrah and its Affiliated Parties Included in the General Plan of Emergency for Hajj Pilgrimage). However, this document provides some definitions for sheltering and the different types available. A shelter is a place to keep affected people in safe places, providing

all of the necessary requirements for the continuity of life until, if possible, they return to their original place of residence after the situation has returned to normal. The types of shelter encountered in an emergency include public buildings (such as camping camps, schools, gymnasiums and youth hostels), private buildings (such as hotels, furnished apartments) and/or free big areas (used when providing tents is necessary). However, it does not mention how to make a decision on the appropriate ERS type and what factors need to be considered while providing the shelter.

This document also contains a response plan for any natural hazards includes alerting and advising those affected by the evacuation of any dangerous risks to the safe gathering sites, rescuing all affected people and transferring the injured to treatment sites, treating fire incidents and combating them as quickly as possible to protect lives and property, guiding the affected people to the nearest exit and to the nearest safe area (with special consideration is given to the provision of special assistance to the elderly, sick, women and children), sorting out injuries and deaths, treating and transporting patients to fixed and mobile hospitals and providing appropriate treatment relief to the affected people by providing all necessary services for them including food, clothing, treatment. This is in addition to providing the means of living, housing, treatment and rest in the shelters, and to ensure that the work is done in the required manner until the case is completed and people can be returned to the original sites. The support from the different parties involved should be concerned with facing the hazards encountered in the context by providing all of the available mechanisms possible, referring to both human and technical abilities, in order to face the situation with all efficiency and competence, to assist in the rehabilitation of the hazard area and the removal of waste.

Nevertheless, the people responsible for facing the hazards have been identified in this document, including the Ministry of the Interior, the Ministry of Defence, the Ministry of Municipal and Rural Affairs, the Ministry of the National Guard, the Saudi Commission for

Tourism and Antiquities, the Saudi Red Crescent Authority, the Ministry of Education, the Ministry of Finance, the Petroleum and Mineral Wealth Ministry, the Ministry of Health, the Ministry of Water and Electricity, the Ministry of Commerce and Industry, the Ministry of Transportation, the Ministry of Social Affairs, the Ministry of Islamic Affairs, Endowments, Call and Guidance, the Ministry of Culture and Media, the Ministry of Communications and Information Technology, the Ministry of the Economy and Planning, the General Presidency of Meteorology and Environmental Protection and any other party whose position may require participation.

The General Directorate of Civil Defence is in charge of sheltering displaced people in hazard and disaster situations by selecting a building that can be used and running the emergency camps, managing them by coordinating other responsible parties. The Ministry of Finance also helps the General Directorate of Civil Defence in terms of providing money for food, and making sure that basic services such as water and electricity are available in the buildings used, as well as in emergency camps. In case tents are provided, the Ministry of Finance should provide a sufficient number of fire-resistant tents along with all other requirements, storing them in for emergencies. This includes securing the rest of the relief supplies and preparing to increase the quantity if needed. The Ministry of Finance should have contracts with sufficient manpower sources to carry out, load and construct the tents. Moreover, they need to be present in the affected area at the time of the announcement of the beginning of the implementation of this plan until the end of the task, and to prepare to increase the number of boots on the ground if the situation requires it.

2.2.3 Summary: Guidance review

After reviewing the documents, the first document is more focused on the hazard and disaster responses for Hajj. It provides a plan to face rainfall and flood hazards, and also a plan for evaluation and shelter. However, it does not mention any detailed information on the type of shelter response required, or any issues and criteria that need to be considered when providing an emergency relief shelter response.

The second document mentions shelter types (public or private buildings and also big areas when providing tents but without any more details on which, when and how to use them and what are the factors and criteria that need to be taken into account when making decisions in order to speed up the response and make it more appropriate); a general plan for facing natural hazards and disasters; the identified stakeholders and their role in hazard and disaster events (many organisations are involved in a response, as each of them provide specific information and help that relates to their own interests and specialists. After that, all of the information goes to the General Directorate of Civil Defence who is in charge of sheltering displaced people in flash flood situations) and future work that needs to be developed. One item that needs developing is the emergency shelter response plan to flash floods.

Generally, the guidance covering some of the information is of little help in an emergency situation in SA, where quick and focused guidance is needed as mentioned by the General Directorate of Civil Defence (2018). In addition, they did not mention any criteria or factors that need to be taken into account when providing an ERS response plan and also any stages that need to be considered when making the emergency shelter response process easy and quick to execute. The only sentence written in the documents was that sheltering victims was important, along with providing all of the necessary requirements (but it provided no more explanations on what the requirements are). Therefore, it is highly recommended to develop a framework that considers the important factors and stages that make the ERS response

successful, appropriate, easy and quick, and also to provide a chance for all responsible organisations in SA to be involved while providing an ERS response in a flash flood situation.

2.3 Flash flooding in Saudi Arabia

Climate change is perhaps the single most important factor that is influencing the severity and frequency of hydro-meteorological hazards such as flash flooding (Benthall, 1993; Centre for Research on the Epidemiology of Disasters and UN Office for Disaster Risk Reduction, 2015). Saudi Arabia is within an expanse of desert with very high temperatures and low rainfall. It is characterised by fluctuations and irregularity. In one year, the rain can fall in a large amount in the form of a fast-flowing torrential flood, and it may then be absent for several years. This may result in irregularity and variation in rain quantity from year to year, damaging lives and property (General Directorate of Civil Defence, 2018).

In recent years, flash flooding has threatened cities in SA more than ever due to contemporary society's high vulnerability (General Directorate of Civil Defence, 2018). A flash flood is a situation in which water temporarily covers the land where it normally does not. Flash floods usually happen in SA via continuous heavy rain (Alamri, 2010; Youssef et al., 2016) (this is specified as there are other types of flood such as coastal, urban and river which are not going to be considered in this research).

There are many cities in Saudi Arabia that accept flash flooding events annually such as Riyadh, Jeddah, Makkah, Yanbu, Jizan, Assir and Medina. It is still a major issue causing injury and death, damage to personal property including dwellings and cars (by increasing the level of water), the break-down of communities and damage to the environment (Al Saud, 2015; Abdalla, 2018) as shown in some examples displayed in Table 2-1 below.

Table 2-1: Cases of flash flooding in SA (Al Saud, 2015; Abdalla, 2018)

Floods	Descriptions
Yanbu flood in 1997	Heavy showers fell on Yanbu (located in western SA). The heavy showers continued for 24 hours, causing destruction to an area of over 130,000 km ² of land and killing 10 individuals.
Asir flood in 1997	Asir is an area in southwest SA. Heavy showers fell on the province, leading to floods that destroyed an area of just less 100,000 km ² , causing 16 fatalities.
Makkah flood in 2002	Makkah is an area in western SA. Heavy showers started and continued for 7 days. This led to flooding in many zones, claiming the lives of 19 people. Almost a hundred Makkah citizens were evacuated by the General Directorate of Civil Defence (GDCD) that week.
Makkah flood in 2003	Still not fully recovered from the previous year's rain, Makkah experienced yet one more heavy rainfall, defined as the worst rains in Makkah in 25 years. The level of water was stated to have reached 6 metres. 12 individuals were killed, but estimations of physical injury were not obtainable.
Jizan floods in 2004	Jizan is an area in southwest SA. Two floods hit the Jizan province, leading to what has been defined as Jizan's worst floods in 45 years. The floods killed 13 individuals, left over 400 individuals displaced and damaged many farms and roads.

Table 2-1: Cases of flash flooding in SA (continued) (Al Saud, 2015; Abdalla, 2018)

Medina flood in 2005	Medina is an area in western SA. Very heavy rains poured down on the Medina province. This caused a flood that killed 29 individuals, and caused the Yatamah dam to fail. 17 individuals were hurt, 50 were displaced and 43 had to be rescued.
Riyadh flood in 2005	Riyadh area in the centre of SA. Heavy showers fell on the Riyadh province. The subsequent flood claimed the lives of 7 individuals, 700 were left displaced and another 700 individuals had to be rescued via GDCD helicopters.
Jeddah flood in 2009	It was severely impacted by a heavy shower lasting for six hours, which affected more than 121 human lives. More than 10,000 were displaced, the damaged properties numbered 11,849, damaged cars totalled 10,913 and the financial damage was 3 billion riyals (1 Pound= 5.28 riyals).
Jeddah flood in 2011	At least 10 people died, with three missing. Aid relief teams evacuated 1,451 individuals and helicopters evacuated 498 citizens. ERS was needed as more than 1,500 families were completely displaced as a consequence of the flooding.
Jeddah flood in 2017	Hundreds of people were evacuated from flooded homes and stranded cars after a heavy shower hit. Civil Defence groups stated that they had evacuated 481 individuals, most of them from cars stuck in the flood water, and replied to an entire 1,989 calls for assistance.

In most flash flooding cases in SA, the General Directorate of Civil Defence is in charge of providing the ERS response (Al Saud, 2010; General Directorate of Civil Defence, 2018). The Ministry of Finance also supports the General Directorate of Civil Defence by providing funding for food and making sure that basic services such as water and electricity are available in cases where permanent buildings are used to provide shelter. Where it is necessary to use temporary shelters the Ministry of Finance provides a sufficient number of shelters, typically tents, along with all other support services (General Directorate of Civil Defence, 2018).

There are other governmental organisations which support the General Directorate of Civil Defence to provide ERS responses in the event of flash flooding. For example, the Ministry of Health provides ambulances to take injured people to hospitals. In addition, academics and other consultants with specialist knowledge of disaster management are employed to monitor the adequacy of the ERS responses and to provide independent reviews of the processes and success of the responses. As academics and other consultants play an important role in the assessment of ERS responses and processes, they were included in the validation process (see 7.3).

2.3.1 Review

After reviewing the examples, it can be noted that flash floods in SA, in many cases, result in injured people and loss of life, resources, houses and livelihoods. It seems that there is a delay in terms of providing an ERS response, as a lack of planning makes it difficult for the decision makers to save lives and mitigate the damage quickly. The resulting lack of planning makes it clear that there is a great need for an effective and immediate ERS response plan on part of the decision makers and relief agencies when trying to provide a proper ERS response for flash flood victims. During an emergency, quick and effective action is required. Planning the emergency relief shelter response in advance is an effective approach to mitigating the damage

caused by flash flooding (Zhao, L. et al., 2017; European Civil Protection and Humanitarian Aid Operations, 2018).

2.4 Emergency relief and its response phases

Efforts in reacting to or preventing hazards such as flash flooding have been referred to as emergency relief (Habitat for Humanity's, 2016). Emergency relief is defined as a government or humanitarian effort responding to the victims of a natural hazard, flooding specifically in this case. The purpose of these groups is to save lives, end the suffering caused by flash flooding, to limit further damage from the flash floods and to improve or restore that which is deemed essential for life (The Development of Concepts and Doctrine Centre, 2008 and Dolinskaya et al, 2012). Emergency relief responses need to control significant actions in the different phases (Brebbia, 2013). It is also generally agreed that emergency relief responses require proper planning, numerous resources and the assistance of organisations to coordinate all efforts, including public, private and voluntary resources, so then the response efforts are as effective as possible (IFRC, 2016). In the most basic sense, emergency relief is divided between Humanitarian Aid and Civil Protection (2016) and the General Directorate of Civil Defence (2018) in three stages, namely the preparedness phase, emergency phase and early recovery phases.

The phase of preparedness can be defined as the period before an emergency, which is not essentially imminent. It is altered from the phase of contingency, which is where the emergency is yet to happen but is likely to occur (Lloyd-Jones, 2006; Chou et al., 2013; Haigh et al., 2018).

According to the General Directorate of Civil Defence (2018), the most important elements of this stage include conducting studies that indicate the type, location and impact of potential flash floods and their effects, taking actions that are deemed to reduce the causes of flash flooding or to minimise risks such as the development of laws, regulations and safety

requirements in buildings and factories, public awareness of the necessary preventive measures to reduce the impact of flash flooding through the media, preparing appropriate contingency plans to face the flash flooding including the mechanism of human resources and the duties of all entities concerned with implementing the plan, paying attention to the training aspect of individuals and groups at all levels, and formulating and implementing the plans to test their effectiveness and efficiency. The underlying assumption is that, without this kind of assistance, the condition of the flood-affected victims will deteriorate to such an extent that their very lives will be in immediate jeopardy (Regnier, 2008; Gray and Bayley, 2015).

The emergency phase comprises all immediate life-saving actions in response to a flash flood. When displacement is prolonged, care should be implemented for the transit of the flood-affected victims from a border or front line to a harmless site (EPC and TCG International, 2004; Shaw, 2006).

The most important elements of this stage (General Directorate of Civil Defence, 2018) includes the immediate response and implementation of pre-set contingency plans such as rescue, ambulance, evacuation and shelters etc, implemented by all concerned parties, assessing the situation immediately after the flash flood in order to determine the scale of the flash flood and its effects, providing the affected area with urgent needs such as food, clothing, shelter, medicines and security etc. They will also follow up with the development of the assessment and preparation of reports and instant communications, and working to raise the efficiency of the response to the highest possible level.

Early recovery phase interventions consist of transitional activities and modalities, which bridge the gap between the emergency life-saving phase and recovery and reconstruction (Hidayat and Egbu, 2010). The elements of this phase, which are recommended by the General Directorate of Civil Defence (2018), include the implementation of the plan to restore the

situation (housing and rehabilitation) in the affected area. To clarify, in this plan, the objectives to be achieved at this stage and the implementation priorities include identifying a unified leadership to oversee situation reconstruction and to assess the progression of achievements, to create multiple task teams to implement the re-positioning plan and to oversee the lessons learned from the flash flood.

The author's research seeks to develop a tool that considers all of the stages. As in the preparedness phase, responsible people should be trained, know how to use the framework and be ready for a response when a flash flood happens. In the emergency phase, the framework should be implemented and the results should help the early recovery phase before the durable shelter response starts, as most of the problems occur in flash floods in SA in these stages (Alamri, 2010; Youssef et al., 2016; Ali and Ameer, 2018).

2.5 Emergency relief shelter types

ERS is an immediate need after a severe flash flood has occurred (Davis and Lambert, 2002; UNHCR, 2018), which results in a loss of homes, buildings, and ways of life. ERS here is not defined as a roof, but as a way of living with privacy and dignity. Thus, it is better defined as a protective element (United Nations, 2004; UNHCR, 2018). ERS temporary or otherwise, is a habitable dwelling that gives the inhabitant living space, security, and a healthy environment (IFRC and Oxfam GB, 2007).

Victims residing in an ERS must have suitable clothing, bedding, kitchen supplies such as stoves and fuel, access to a functioning water source and proper sanitation (Zhao, L. et al., 2017). Shelters are a productive component of the emergency relief response and are a necessity for the victims to work or rest, for childcare, for the care of the elderly, for storage and for healing and concentrating on the victims' livelihoods and progress (Hadafi and Fallahi, 2010). ERS aims to provide flood-affected individuals and households with assistance that is

conducive to protection from flash flooding. Technically, “ERS” starts when the victim is pulled from the destruction and wrapped in a blanket or jacket for protection. The ERS process does not end until the victim is in his or her permanent house (Habitat for Humanity’s, 2016).

These types of ERS are created for a temporary purpose, and this provision may involve refuge at a friend or relative’s house or any safe permanent buildings, the use of basic sheltering materials such as plastic sheeting or a public mass shelter that is used directly post-hazard (IFRC/RCS, 2013; NHHCR, 2014-2018) from just a few hours to, at most, a few days until they are moved to the rehabilitation stage or re-housed.

Successful ERS provide the following: protection from the weather, individual safety and security, help and support for the affected families and the life of the community and improved resistance to infection and ill health. Furthermore, successful ERS will have minimal negative effects on the local economy and environment, and the available support and maintenance from local economic activities and household livelihoods will be maximised (Mathbor, 2007; Department for Communities and Local Government, 2017; IFRC, 2010).

In most flash flooding cases in SA, emergency relief shelters (ERS) are the most frequently considered when providing to victims immediately. However, the only types used in most cases are furnished flats, big halls or camps without any details on the reasons why they have been chosen and the criteria for choosing them (Al Saud, 2010; General Directorate of Civil Defence, 2018). Therefore, it is important to understand which type of ERS in a flash flood situation are the most appropriate for the group with flood-affected needs, as well as the environmental, economic, technical and socio-cultural contexts. There are several methods of sheltering displaced populations who are affected by flood hazards which could fit the different users’ needs, including providing a family with a place in which to base their livelihood

activities and to promote a sense of security. This includes using permanent buildings for a short period of time, providing materials with shelter kits and tents, as described below.

2.5.1 Using a permanent building for a temporary period

Using permanent buildings after a flash flood has occurred may be accomplished through a myriad of ways (Zhao, L. et al., 2017). Examples include finding temporary housing with friends or relatives, or using public or/and private buildings. Permanent buildings may also be used in order to utilise the basic construction skills of the victims who will try to repair the damage done to their homes (IRP and ISDR, 2011) or to allow them to have the time to provide more suitable temporary shelter (UNHCR, 2007). Moreover, it also reduces the environmental impact associated with a camp or temporary shelter construction. The earlier the response process begins, the lower the social and economic cost. Therefore, before new temporary structures are built, a need for them should be clearly established through a properly informed assessment (IFRC and Oxfam GB, 2007).

Buildings such as hospitals, stadiums, school gymnasias, child care centres, community centres, sports halls, town halls, religious buildings (such as mosques), military housing or barracks or hotels may be options for short-term use by flash flood victims (Camp Coordination/Camp Management, 2010). The advantages and drawbacks to each of these options has been illustrated in Table 2-2, in order to consider them when choosing.

Table 2-2: Advantages and disadvantages of different permanent buildings (Camp Coordination/Camp Management, 2010).

Type of building	Advantages	Disadvantages
Hospital	<ul style="list-style-type: none"> • Give quick and immediate response for solutions for injured victims • Workable infrastructure • Immediate access via roads, and is well known in the area • Good for service delivery • Located in a safe zone 	<ul style="list-style-type: none"> • Blocks the quantity and sometimes the quality of services during emergencies • May prove to be insalubrious in host community • Too easy to evict victims
Stadium	<ul style="list-style-type: none"> • Can host large amounts of people, and has proper sanitation • Is easily accessed • Already has the ability to accept large amounts of goods 	<ul style="list-style-type: none"> • Contains no roof and thus promotes exposure to the elements • May only provide victims with tents
Hotel	<ul style="list-style-type: none"> • Has a workable infrastructure in place already • Is already prepared for both short- and medium-term use • Has immediate privacy • Clear chain of command 	<ul style="list-style-type: none"> • Centralized so easily evicted • Often located in remote and inaccessible areas after a natural disaster and so has limited delivery capabilities
School or child care centre	<ul style="list-style-type: none"> • In plentiful supply • In immediate proximity to Collective Centre residents • Has basic infrastructure • Already has a management structure 	<ul style="list-style-type: none"> • Interrupts children’s education and routines • Coexistence leads to humanity and safety problems • School may be damaged from use • May promote tension between the host and displaced victims • Victims may easily be evicted

**Table 2-2: Advantages and disadvantages of different permanent buildings (continued)
(Camp Coordination/Camp Management, 2010).**

Type of building	Advantages	Disadvantages
Community centre, sports hall	<ul style="list-style-type: none"> • Numerous • Close to the neighbourhood of origin of Collective Centre residents • Can take more people • Established infrastructure • Clear management 	<ul style="list-style-type: none"> • Cannot provide anything long-term • Shelter will be very limited • No privacy
Town hall	<ul style="list-style-type: none"> • Good physical facilities and infrastructure • Clear management • State is involved • Easily accessed • Good for service delivery 	<ul style="list-style-type: none"> • Blocks quantity/quality of services • Causes discontent in host community • Unsafe in conflicts • Victims may easily be evicted
Religious building (mosques)	<ul style="list-style-type: none"> • Numerous • Close to the neighbourhood of origin of Collective Centre residents • Can take more people • Clear management structure • Often has ties to future Collective Centre residents • Can be centrally located • Easy access for service delivery 	<ul style="list-style-type: none"> • No good infrastructure (i.e. water/ sanitation) • Almost no options for shelter solutions • May become a target during conflict • Sometimes in remote locations with difficult access for services

**Table 2-2: Advantages and disadvantages of different permanent buildings (continued)
(Camp Coordination/Camp Management, 2010).**

Type of building	Advantages	Disadvantages
Factory	<ul style="list-style-type: none"> • Availability of larger spaces 	<ul style="list-style-type: none"> • Not prepared for human occupation • Lacks basic shelter as well as water and sanitation solutions • Does not meet environmental standards • May easily be a target • Location is not well known • Difficult access for service delivery
Military barracks	<ul style="list-style-type: none"> • Good physical facilities • Clear management structure • Easily accessible • Good for service deliveries 	<ul style="list-style-type: none"> • Blurs the distinction between military and civilian buildings • Military personnel’s lack of experience with displaced populations • Movement restrictions for displaced individuals • May become a target during conflict • Some humanitarian agencies may refuse services • High risk of forced eviction (unless the government approves usage)

Ban (2014) created a prototype of a Paper Partition System which has been used as a partition to divide families in a big open area in order to increase privacy and dignity, as shown in Figure 2-1. The connectors of the structure are elegantly well-organised, no longer even requiring nails. The walls of the units are designed to incorporate cotton fabric panels that can withstand systematic opening and closing. Moreover, they can be opened in any direction or

from any side. Panels can be omitted to create larger areas to accommodate larger or smaller families.



Figure 2-1: Paper partition system used in a permanent building (Ban, 2014)

2.5.2 Shelter kits with materials

Shelter kits with materials included are also sometimes distributed to relief sites. The shelter kit is a clearly defined collection of tools and fixings combined with two plastic tarpaulins. It is intended to support the people affected by flash flooding. It can be used to help create emergency shelters, as well as having other uses such as to repair damaged houses or to upgrade existing shelters. There are several reasons for distributing this type of response including it being a flexible solution, fast and simple to deploy, supporting local shelter solutions, shelter kits are cost effective and the primary responders in a flash flooding are those affected (IFRC, 2010).

These typically contain tools such as handsaws, nails, shovels for digging post holes, hoes to break up the surface soil, machetes for clearing the campsite from encroaching plant life, shears, tie wire, claw hammers and other packaging. The materials in these kits are versatile and can be used to construct temporary shelters or to repair a flood-damaged house. The tools included in the kits may further be used to dig drainage systems, to build latrines, to prepare the earth for the campsite or to support other community needs and activities (UNHCR, 2007). The earlier on that construction tools are provided to survivors, the sooner they are able to get their ERSs up, as opposed to waiting for others to aid in such provisions (International Recovery Platform et al., 2013).

The most common material used as a responsive form of shelter in a flash flood situation is plastic (polyethylene) sheeting (Humanitarian Aid and Civil Protection, 2016). It is low in cost and also light in weight, making it even more useful as a material substitute for shelters. This material is inert, does not decay, has the added benefit of being waterproof and is not susceptible to damage from salt, dung, excreta or urine (Davis and Lambert, 2002).

The plastic can be provided with a white pigment, creating a light and heat reflecting surface. This helps to control the temperature inside the structure when the ERS is used in hot climates. When the plastic is used in colder regions, it can be used in conjunction with other materials to provide thermal insulation (Howard and Spice, 1989). Such insulation materials may include the following: fibreglass, mineral wool, or even straw and hay in some regions depending on their accessibility (IFRC and Oxfam GB, 2007). Single sheets of plastic with a maximum length of 4m (reinforced) and 8m (non-reinforced) can be used, provided that they are kept out of direct sunlight as this limits their lifespan. Plastic sheets should also be stored in a dry place and protected from rodents that feed on plastic (IFRC and Oxfam GB, 2007).

Other materials such as canvas have been used, although it is prone to rotting. Because of this, government and disaster relief agencies will only use this material when there is no available alternative. One thing to consider when using canvas for emergency responses is the production time. Unlike plastic sheeting which is readily available, canvas needs to be manufactured. This can be an unacceptably long process, particularly in emergency response situations. Canvas material must be stored in a dry place that is well ventilated, clear of the ground and shielded from direct sunlight and rodents. It must be stored somewhere where it can be easily reached and counted for inventory reasons and piled at least ½ m away from the walls. It must also be regularly inspected and maintained.

This type of response has been used in many flash flood situations and can be used in SA, as it is provided in a box known as a shelter box (Shelter Box, 2018) (shown in Figure 2-2). The contents differ depending on the climate. It contains a selection of materials, including toolkits, ropes, fixings and heavy-duty tarpaulins, which can be used to make emergency shelters and repair damaged buildings. In addition, it also contains items such as solar lights, water storage and purification equipment, thermal blankets and cooking utensils to help start the process of returning back to normal life.



Figure 2-2: Typical items provided inside a shelter box (Shelter Box, 2018).

2.5.3 Tents

Tents have been used with some success for emergency relief sheltering purposes as they provide immediate shelter, may be used as an additional cover for a structure and are easily assembled. One of the drawbacks to a tent is that it is intended for short-term use only (Saunders, G., 2011). The tent materials must meet certain criteria when they are being used for relief, namely performance, durability, the ease of how the victim may clean the product, how well it may be stored as well as transporting it to and from the site, how quickly it may be assembled once on site and then deconstructed after use, how well it may be transported and how well it may be integrated with the structures already in place (Sever and Altun, 2009; The Institution of Structural Engineers, 2017). The main purpose of a tent is to provide protection from undesirable weather conditions (Department for Communities and Local Government,

2017), to segregate people so then disease is not widespread, to give a sense of privacy, and to prevent harm due to overcrowding (NHHCR, 2014-2018).

It must be noted, however, that a tent does not provide for all of a victim's shelter needs. They are in need of non-food items in order to survive, and must have access to certain facilities such as clean water, proper sanitation, places for children to play and engage and proper drainage (United Nations, 2004). The most common material used for tents as a response to flash flooding is plastic (polyethylene) sheeting (Humanitarian Aid and Civil Protection, 2016).

There are many types of tent that can be used in flash flood situations (United Nations, 2004; Humanitarian Aid and Civil Protection, 2016). Typically, these include ridges, centre poles (tall wall), centre poles (low wall), hoops, a frame and traditional nomadic tents. Each type has a description, covered area, advantages, disadvantages and weight with flysheet. These have been illustrated in Figure 2-3.

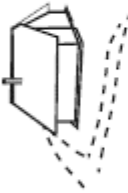




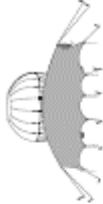
						
type of tent	ridge tent	centre pole tent (tall wall)	centre pole tent (low wall)	hoop tent	frame tent	nomadic tent (traditional)
description	traditional relief tent. Poles: 2-3 vertical, 1 ridge pole	centre pole tent with high walls. Walls held up by poles	tent with centre pole and low walls	tunnel-shaped tent	tent built on a rigid frame from flat poles	tents used by nomadic peoples (many designs exist)
covered area	12 m ² - 16 m ²	16 m ² - 24 m ²	12 m ² -16 m ²	12 m ² -18 m ²	16 m ²	10 m ² -30 m ²
advantages	tried and tested design	good headroom	relatively lightweight	good headroom, small footprint	good headroom throughout	well adapted to local climates materials and traditions
dis-advantages	limited head-room at sides	can suffer in strong winds. Heavy	limited headroom	requires many poles. Technology in development	requires many poles. Often expensive	large scale production in short period not possible
weight with flysheet	75-120 kg	120 kg	50-100 kg	40-80 kg	100-120 kg	200-300 kg

Figure 2-3: Tents used for relief shelters (United Nations, 2004).

The reason that tents are often used as an immediate go-to for temporary structures in the event of a flash flood is because of their versatility, their ability to shape to their environment, their many designs for different weather conditions and the fact that they are standardised (which makes distribution worldwide easy). They can easily be folded up and re-used in the context of other hazards and disasters for other purposes, and they may also be used in wide areas (Davis and Lambert, 2002). On the other hand, tents can be draughty, or unstable in high winds or heavy snow. Furthermore, the tent material (plastic or canvas) can have a limited life-span. As a result, if it is anticipated that tents will be used for a long duration, provisions for repair should also be made (Humanitarian Aid and Civil Protection, 2016).

There are many examples where a tent has been used in flash flood situations. One example of a successful tent that can be used in SA is a dome tent, as shown in Figure 2-4. It is self-standing and self-tensioning. It includes a shade fly that increases the thermal performance of tents in hot climates. The outside dimension of the tent is 4.3m wide x 4.3m long and it has a centre height of 1.8m (UNHCR, 2016).



Figure 2-4: UNHCR tent (UNHCR, 2016).

Generally, there are many options that can be used following a flash flood in SA including occupying empty buildings or erecting basic structures with shelter kits covered with plastic sheeting or lightweight ready-for-use emergency tents (IOM et al., 2015). Public buildings are often engaged with slight adaptations. Nevertheless, it must be assumed that displacement can frequently last for much longer than expected, and several buildings will be required once again for their main purpose (IOM et al., 2015).

Secondly, providing shelter kits with materials such as plastic sheeting has tended to become the most vital shelter element in a number of relief actions (IFRC and Oxfam GB, 2007). It is important to have a supply of material for use in a frame which is adequate enough to support plastic. The material of the frame must be renewable and have sustainable supply sources. Thirdly, lightweight ready-for-use emergency tents may be appropriate and useful, for instance, when locally available materials exist either seasonally or not at all (United Nations, 2004).

Thus, it is believed that tents are not an appropriate emergency shelter for any cold weather. However, if there is no other option, then they can save lives until further appropriate shelters have been identified. If necessary, additional plastic sheeting and blankets can be delivered in order to raise the retention of heat. Moreover, it is likely to heat the tent if an adequate temperature has been created in the tent stove. This type of stove requires fuel (i.e. kerosene or wood) around the clock to maintain a satisfactory temperature. Environmental aspects must be taken into account when wood is used. When using kerosene, the activities of procurement, distribution and storage might present hard challenges for their safe operation (UNHCR, 2007).

It is thought that neither pre-fabricated units nor shelter units that have been specially designed for emergency situations, not even winter shelter units, have been shown to be effective when it comes to accommodating flood-affected people in SA. There are many reasons for this that include the long time needed for shipping, the considerable expense, the long production time

and the problems of transport such as costs and the problem of cooling it in a high temperature (Davis and Lambert, 2002; UNHCR, 2007). Naturally, the provision of emergency shelters must have been implemented before moving to these systems (HM Government, 2014).

2.6 ERS issues and their influence on SA flash flood situations

ERS are temporary homes, rather than simply being artefacts and are therefore not necessarily objects (United Nations, 2004; Gray and Bayley, 2015). In order to have the best, as part of a wider and comprehensive solution, and most adequate ERS, people have come to realise that ERS is more than bricks and mortar, and that site management, environment, gender, participation, livelihood, and access to social and technical infrastructure are also important drivers of this comprehensive solution. Therefore, ERS must be approached from various and differing angles according to the circumstances, as exemplified through the four groups of principal issues (environmental, economical, technical, and socio-cultural), as exemplified below.

2.6.1 Environmental issues

ERS should consist of response with consideration for the geographic region, atmosphere, and the climate of the home environment (Kelly, 2005). Environmental changes must be considered, as elements such as intense sunlight/heat, snow, rain, wind, dust may have a negative effect on the ERS that could increase the likelihood of vector-borne diseases, poor air and water quality, the inefficient use of energy or water consumption, and an increased amount of waste that could result in the poor health of the flood-affected victims living in the shelters (United Nations, 2004; Johnson et al., 2006; Johnson, 2007; Arsalan and Cosgun, 2007; Arslan, 2007; The Sphere Project, 2011; Félix et al., 2013b).

The main climate types in SA are hot, dry and humid climates (in the west and east), and cold climates (in the north and south). In hot dry climates, the victims should be protected from the

sun and be in a cool area, while at altitude and in the desert atmosphere, the temperature goes down, so consequently, blankets and stoves may be required. ERS should also provide ventilation and protect against the wind and dust. In hot and humid climates, ERS ought to provide shade from the sun, be well-aired, have appropriate drainage and be rot-proof. In cold climates, the priorities for victims consist of proper clothing, blankets and mattresses (as the ground freezes) for survival as well considering the heating option (Kelly, 2005; Corsellis and Vitale, 2005). The primary purpose of an ERS, temporary or otherwise, is to keep the immediate environment around the person at a liveable temperature, to keep them dry, and to keep them covered and safe from exposure (UNHCR, 2007; Félix et al., 2015).

ERS materials should be easy to recycle, re-use, upgrade, resell and relocate (Shelter Centre, 2012; Kats and Alevantis, 2003). If an ERS is difficult to upgrade, re-use or repurpose, then it may become a pollutant after use. It may also run the risk of causing more resource use for its maintenance, and therefore negatively impact the environment (Félix et al., 2015).

When using ERSs, personal hygiene and health needs to be maintained (New Jersey Department of Children and Families, 2016; Seneviratne et al., 2010). This list includes proper water, sanitation, and a hygiene infrastructure that facilitates such necessities within the campus. These elements are complex depending on the nature of the emergency and require forethought and money, but they are completely necessary for the survivors' health (Camp Coordination/Camp Management, 2010).

ERS materials should not negatively impact the environment in any way, shape, or form. Thus, the materials should be ozone-friendly (not containing chemicals that negatively impact the ozone layer), meaning that it should be free of chlorine, plasticisers, catalysts and stabilisers. They should not cause dioxin formation (United Nations, 2004; Anhorn and Khazai, 2015). In fact, the materials should not cause any type of harmful emission, should be composed of

recyclable and sustainable material and should be easy to manufacture and construct for the purpose of re-use.

The identified environment issues (climate changes within the region through shifting seasons, the recycling, upgrading and disposing of materials, having clean water and air, and having as little impact on the surrounding environment as possible) will be covered when developing an ERS response framework for a flash flood situation in SA.

2.6.2 Economic issues

ERS is a commodity and therefore does not fit into the “gift” economy (Davidson et al., 2007; Gray and Bayley, 2015). It must be considered that economic principles will dictate the flow of money during these times (where and how much is spent) (Davidson et al., 2007; Camp Coordination/Camp Management, 2010; International Recovery Platform et al., 2013). The funds available for each flash flood event varies, and it is often a determinant of the ERS type and its cost. Therefore, it is no surprise that there are variations in the cost of the ERSs between responses (Gray and Bayley, 2015). Before new structures are made, a requirement for them must be obviously recognised through an informed evaluation. For instance, individuals might discover their own shelter with friends or relatives, conduct brief maintenance on their damaged homes or use public or private buildings. New shelters may not be needed, which saves a lot of money (IFRC and Oxfam GB, 2007; International Recovery Platform et al., 2013).

ERS should ensure that their required lifetime is appropriately focused on (Johnson, 2007). In any case, the public buildings are used for sheltering flood-affected victims need to be aware that the buildings will be required for their primary purpose at a future point in time (IOM et al., 2015). In addition, companies involved in emergency relief have their own infrastructure for material disbursement and procurement procedures (IFRC and Oxfam GB, 2007). During

an emergency, these companies often find it difficult to use their typical procurement procedures as time is of the essence.

Many bids which come from contractors are unsuccessful for meeting urgent needs and, depending on the harshness of a flash flood incident, a utility's preferred or pre-selected contractors may not be effective. Therefore, it becomes of paramount importance to have an established emergency plan of action for the procurement of kit and materials for ERS prior to the event of an emergency (United Nations Environmental Protection Agency, 2015). The contracts must provide generators, cables, electricity, pumps, water, mobile kitchen units, fuel, and so much more in the way of essentials. To summarise, the identified economic issues (cost and budget plans, lifetime, and livelihood and procurement styles) will be considered when developing the ERS response framework for flash flood situations in SA.

2.6.3 Technical issues

Technical issues are the most important issue to be considered in order to select the most appropriate type of ERS. Technical issues make the ERS easy to use, with fewer resources required, reducing delays and with the end result being more comfortable to live in (IFRC/RCS, 2013; IRP and ISDR, 2011; Humanitarian Aid and Civil Protection, 2016). Speediness in ERS use is of the utmost importance. Survivors depend on ERS immediately following a flash flood, as their survival depends on it. Providing ERS immediately also creates less expenditure, saves on resource use, and has less environmental impact (IFRC/RCS, 2013; Department for Communities and Local Government, 2017).

ERSs need to be provided quickly and not be dependent on skilled labour as the victims themselves will construct them (or the more simple versions). In terms of providing materials, shelter kits or ready-made tents, construction speed increases productivity, creates lower labour costs, makes for easier staging and allows for faster occupancy. A structure that is built rapidly

may also require quick repairs and reduce the amount of call-backs. ERSs need to be made from lightweight materials in order to allow the victims to construct and deconstruct them faster. This also requires them to have fewer movable pieces. Plastic tents fit this definition (Department for Communities and Local Government, 2017). Any complexity in the ERS design must then require skilled labourers, which will result in construction delays (IFRC/RCS, 2013).

Different hazards have different locations and details involved when it comes to the most suitable ERS. For example, for a flash flood, an ERS is chosen and built away from flood plains and sites with high water tables, while providing systems of suitable drainage. Selecting a safe area is the only method available to decrease the risks in this context (IFRC/RCS, 2013; Cordero-Scales et al., 2016). In addition, there are some criteria that need to be considered for site selection such as access, location, water sources and site hazards (Davis and Lambert, 2002; Anhorn and Khazai, 2015).

Although the land choice is often limited, the location of an ERS is often more important (IFRC/RCS, 2013), as poorly located ERSs can increase the risks faced by the occupants (such as weather concerns etc.). Well-located ERSs can reduce exposure to hazards (Davis and Lambert, 2002). Therefore, the location of the ERS is something that should be done carefully, and areas with uncertain life should be avoided. In those cases where there is insufficient public land, an agreement should be made with private owners to avoid confusion later on. In addition, travel time and cost should be considered carefully (Zhao, L. et al., 2017)

Using local resources is certainly a better choice than the importing of solutions. If obtainable, local materials are socially, and culturally more suitable, and also more cost-effective, since they avoid the high budgets that transport involves (Félix et al., 2015). The use of local

materials allows for the potential to include the local workforce in the established works, as local persons are used to handling them (UNHCR, 2018).

It needs to be considered that water will always be essential, and access to livelihoods, community infrastructure and other services such as electricity will be a requirement for most ERS projects in order to improve the rate of survival (Camp Coordination/Camp Management, 2010; Anhorn and Khazai, 2015). ERS projects ultimately will be unsuccessful if the people are unable to find the means to live where their camps are constructed (IFRC/RCS, 2013). Nevertheless, some survivors prefer to stay in ERS which are close to utilities and food, and also seek to make sure that their own properties are safe (International Recovery Platform et al., 2013).

The secured living space that an ERS must provide is a critical determinant of the cost and requirements that are part of the integrated logistics. At least 18m² of secured living space is frequently agreed upon as right in humanitarian responses for a family of five, with 3.5m² per person (The Sphere Project, 2011). However, giving 3.5m² to every individual does not imply that this measure of space must be given in all circumstances.

Nevertheless, the size of the ERS is also associated with different climates as follows: a minimum of 3.5m² for each individual in tropical and warm atmospheres, barring cooking facilities or a kitchen (it is expected that cooking will happen outside) and 4.5m² to 5.5m² for each individual in cold atmospheres or urban circumstances, including the kitchen and showering facilities. In cool atmospheres, it is likely that people with particular needs will stay inside their ERS during the day, and consequently, more space will be required (UNHCR, 2007).

ERSs should fit the needs and wants of each family regarding different layouts, space and outlines to allow for variants according to the size of the family (Félix et al., 2015). Flexible

solutions in terms of the variation of outlines and space provide flood-affected victims with the opportunity to use the unit as a multifunctional space as well as enable modifications and transformations. Moreover, it is easier for users to personalise the unit, which can aid them in adopting the space to their preferences (Félix et al., 2015).

Once the basic ERS or safe permanent buildings are provided, attention should be paid to how best to maintain and repair the short-term living ERSs. This support may be inclusive of toolkits, and extend to training sessions that instruct in the proper maintenance required (IFRC/RCS, 2013). In order to be frugal about their construction, it is important to perform regular maintenance (Camp Coordination/Camp Management, 2010).

The identified technical issues (how easily and quickly they can be used to shelter flood-affected victims, easy to reach, use local materials, provide access to certain services, are of a comfortable size, and are easy to be maintained and repaired) will be covered when developing the ERS response framework in a flash flood situation in SA.

2.6.4 Socio-cultural issues

Moving people to a different location generally results in social disruptions as communities lose access to their social infrastructure and their capacity to produce community resources (Weerasena et al., 2018). Socio-cultural issues consist of an ERS orientation for survivors (Shelter Centre, 2012). ERS responses must be easily adaptable to the specific Saudi Arabian community. Aid agencies must have respect for these differences, as well as maintaining and providing adequate living/ERS solutions (Félix et al., 2013a; Charlesworth, 2014). Thus, ERSs must reflect a knowledge and understanding of the Saudi Arabian cultural, Islamic laws, and gender values (women, girls, boys and men need systems, roles and responsibilities in relationship to the ERS). ERS must be modified to the local community in order to provide a sense of home, to not ostracise anyone, and to adhere to previous mores (Shelter Centre, 2012).

ERSs are not in place only for elemental protection, but also for individual security and social integrity (IFRC/RCS, 2013). Therefore, ERS must take into account privacy, dignity, and security, as well as encouraging design flexibility as partitions may be called for, depending on gender practices (Shelter Centre, 2012; Cordero-Scales et al., 2016). There may also be a need for lockable doors (as well as lockable windows), to ensure basic security.

According to Carlier et al. (1997) and Humanitarian Aid and Civil Protection (2016), people whose homes have been damaged regularly have genuine anxiety issues. Losing a house has a considerable psychological effect and can bring about physical anxiety manifestations, which leads to hyper-tension, and in severe cases, survivor suicide. Losing a home does not just cause serious trauma, but it also causes long-term harmful outcomes such as post-traumatic stress disorder, divorce, financial stresses, insurance woes etc. Moreover, the users' attitude and behaviour toward different types of ERS response has a vital influence on the stages of post-traumatic stress (The World Bank, 2016). As a result, it is critical to consider certain elements, for example, a larger size of window to decrease the stresses on the affected individuals when arranging ERS (Caia et al., 2010; Torus and Şener, 2015).

Proper communication in the early stage of an emergency is paramount to flood-affected victim survival. This may result in fewer negative impacts and help the victims to focus on future living conditions while working together (Hadafi and Fallahi, 2010). It also helps them to refresh their mind, communicate with one another and potentially have fun. Communication may be brought into emergency situations such as through TV, radio, internet, phone, grassroots campaigns such as leaflets and posters, information packets, organised committees, and training workshops (Shelter Centre, 2012; Organisation for Economic Co-Operation and Development, 2018).

Lines of wealth may divide ERS responses, and so equality is a major component of peaceable living after a flood (IFRC and OCHA, 2015). As an example, the poor people were in receipt of a poor-quality ERS response such as simple tents while rich people, who have a connection with committees, were given a high-quality ERS response such as furnished apartments. This is unfair (The Sphere Project, 2011; Cordero-Scales et al., 2016).

Flood-affected victims with medical needs or the elderly may not fare well with basic tents (HM Government, 2013; Nigg et al., 2006). Therefore, it may be more suitable for them to stay with friends or their families in a hotel, or even at a bed and breakfast (HM Government, 2014). In some circumstances, at-risk individuals will have been evacuated in professional transport and arrangements for ERS should be co-ordinated to allow for evacuation direct to the appropriate places. At-risk individuals can be helped by providing groups of trained builders and carpenters to aid with the building stage, or they can be given cash so then the households can rent labour (IFRC/RCS, 2013; The World Bank, 2016).

Thus, planning for the ERS response must take all of these sociocultural issues into account (consideration of Saudi Arabian cultural and Islamic laws, dignity and security, physical and psychological effects, communication, equality, and support for vulnerable people).

2.7 Summary

The number of flash floods suffered throughout Saudi Arabia is steadily increasing. They cause damage not only to communities but also to ways of life, the environment as well as to individuals (Youssef et al., 2016; Abdalla, 2018). In many emergency situations (General Directorate of Civil Defence, 2018), a response plan is often totally absent or, at best, insufficient, thereby leaving post-flood decisions as wayward improvisations that are rushed and that in turn lead to mismanagement and negligence (Abosuliman et al., 2014; Youssef et al., 2016; Ali and Ameer, 2018). Therefore, it is necessary to develop a framework that considers most important factors and stages that make the ERS response successful, appropriate, easily and quickly implemented and also gives a chance for all responsible organisations to be involved.

It is imperative that governmental and non-governmental organisations do all they can to foster a quick recovery in flood-affected areas. They must achieve this through technical, financial and organizational avenues and in as quick and efficient a manner as possible. ERS should provide health and well-being, security against violence, privacy, dignity and places to live for people who have lost their accommodation and livelihoods during a flash flood situation. Generally, there are many types of ERS that can be used following a flash flood in SA including occupy empty buildings, emergency shelter centres, or erect basic structures using plastic sheeting with shelter kits or lightweight ready-for-use emergency family tents.

It identifies and considers the range of environmental, economical, technical and sociocultural issues that must be taken into account when designing emergency relief shelter responses for flash floods in SA. Environmental issues have been considered such as climatic conditions, recycling, upgrading and disposing materials; hygienic water and air supply and minimising the impact on the surrounding environment, as have economic issues such as cost, and

budgeting, lifetime, livelihood, and procurement style. Technical issues have been included such as the speed with which flood-affected victims can be reached and sheltered, the use of local materials; access to certain services; and the provision of ERS of a comfortable size, and which are easily maintained and repaired. The socio-cultural issues discussed include considering Saudi Arabian culture and Islamic laws, human dignity and security, physical and psychological well-being, communications, equality, and support for vulnerable people. All those issues will be considered and addressed in chapter 5 when developing an appropriate emergency relief shelter response for flash floods in SA in order to make it more appropriate and successful for flood-affected victims.

Despite the lack of existing ERS response plans for flash floods in SA, the following chapter is going to critically review the existing international shelter responses that are used in emergency relief in order to understand how the methods work, what their processes are, the stages and factors involved and to what extent the results can provide successful ERS solutions in the Saudi Arabian context. After that, the results will be reflected in the conceptual ERS response framework (as addressed in Chapter 5).

Chapter 3 Existing ERS response methods

3.1 Introduction

ERS is one of the individual's most urgent needs, and it is fundamental for their well-being. After a flash flood, ERS is something that involves much more than just a roof to cover people. It is not only the structure itself that protects from the elements, but is the arrangement of exercises that households can carry out to adjust and develop a dwelling, including the whole range of continuing activities and livelihoods that individuals can pursue in and around their home. In other words, the process of providing ERS should be more than something just seen in terms of the technical level and specific designs.

Although ERSs have been generally utilised in SA after most flash floods, the ERS solutions on offer have been significantly criticised, mostly on the grounds of being insufficient, and furthermore, the immediate need for quick solutions has not led to very effective options (Youssef et al., 2016; Abdalla, 2018). In this chapter, some of the existing methods will be critically evaluated to determine whether the methods are helpful to those calling for their use, i.e. disaster relief agency staff who are present at the flash flood site and whose role it is to provide ERS help to those in need.

3.2 Existing shelter response methods in emergencies

The ERS response consists of the decisions undertaken and arrangements made to deal with the immediate after-effects of hazards and disasters. It includes the effort to deal not just with the immediate impact of the emergency itself (e.g. protecting people) but additionally, the more gradual impacts that are also suffered (e.g. disruption) (HM Government, 2013). Appropriate ERS response methods are required to meet the affected population's needs. Deciding how to

shelter victims is one of the most significant questions facing the decision-makers. Such a complicated decision with such significant possible consequences and ramifications must be arrived at with an urgency places an incredible degree of accountability upon the representatives involved, as well as upon the planners.

Unfortunately, the author could not find any ERS response that is used in a flash flood situation and more specifically in SA, thus, the author tried to gather other shelter methods used in emergency situations produced by international organisations. There are certain methods that have been developed to provide a shelter response in any type of natural hazards and emergency. This includes the method of distributing shelter kits (IFRC, 2010), the method for distributing plastic sheeting (IFRC and Oxfam, 2007), the methods for distributing tents (United Nations 2004), a transitional shelter programme (Shelter Centre 2012) and the method for providing shelter in emergencies (Humanitarian Aid and Civil Protection 2016). This was done by identifying the approach that the design response method used for constructing the sequence of the stages involved. The design factors that have been recommended for immediate response and the subsequent stages, and the limitations of the response method, have been shown below.

3.2.1 Method for distributing shelter kits (IFRC, 2010)

The shelter kit is a clearly defined collection of tools and fixings combined with two plastic tarpaulins. It is intended to support people affected by hazards. It can be used to help create emergency shelters, as well as having other uses such as repairing damaged houses or upgrading existing shelters. The distributing shelter kit method has four phases to be considered including preparedness/contingency, the disaster itself, implementing and the monitoring/evaluating phase as shown in Figure 3-1.

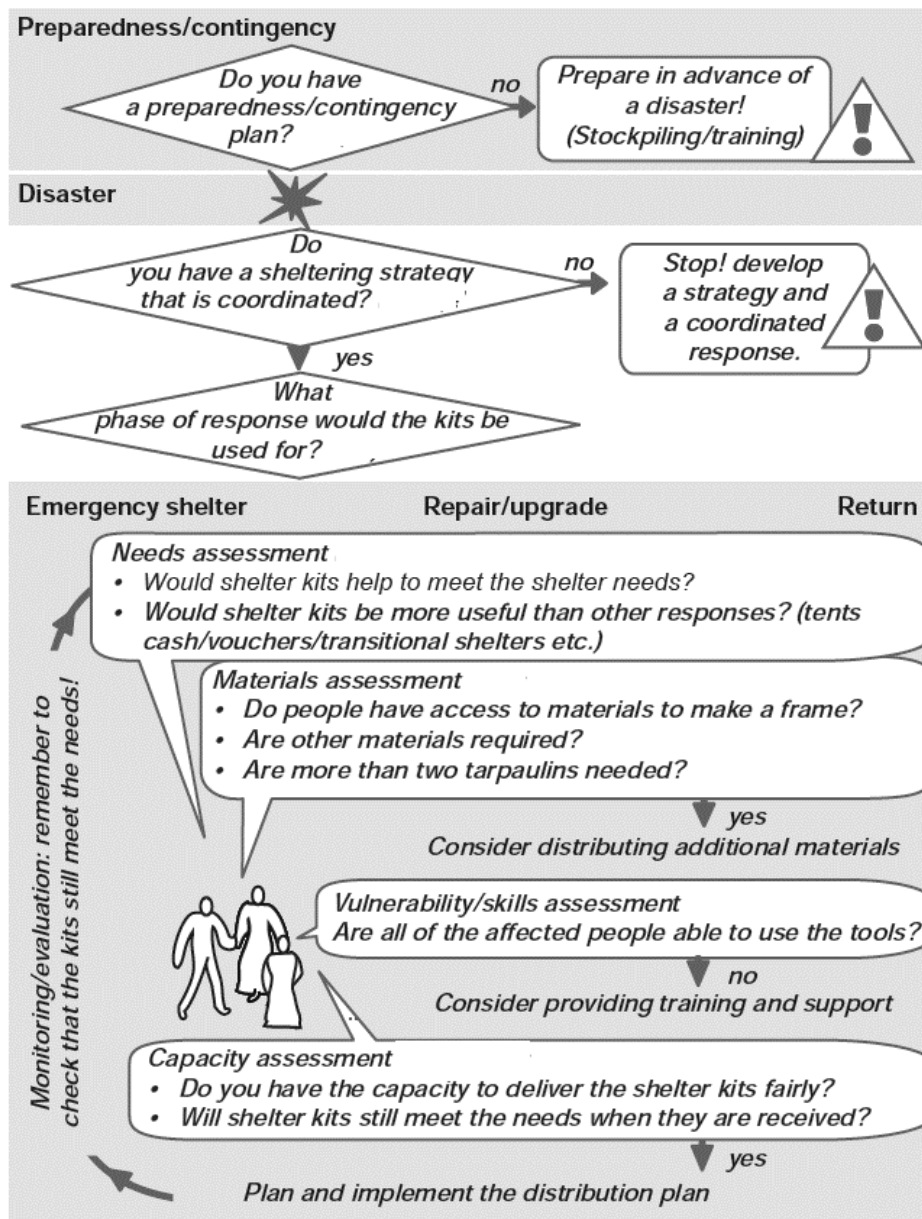


Figure 3-1: Method for distributing shelter kits

In the first phase, the preparedness/contingency plan should be prepared in advance before the hazard occurs. Contingency planning should be conducted in all at risk locations. Preparation may involve the pre-positioning of kits, training, and the analysis of the relevant markets. When the disaster happens, a sheltering strategy should be ready to coordinate with other organisations, as this is the second phase. Coordination is divided into two groups, including external and internal coordination. External coordination is where there should be coordination with other organisations to ensure that the level of support offered does not create an imbalance with the projects of other organisations. Internal coordination is where there is coordination internally with other sectors in the organisation: Sheltering is a process and may require intervention in the context of sanitation, livelihood, water, health and other sectors.

The following phase is implementation, where the response stage should be identified for using the shelter kits. There are three stages for response, namely emergency shelter, repair/upgrade and return. Before distributing the shelter kits, it needs to assess some of the issues including needs assessment, material assessment, vulnerability/skill assessment and capacity assessment. Under needs assessment, there are several questions that need to be addressed. Questions such as ‘would shelter kits help to meet the shelter needs?’ and ‘would shelter kits be more useful than other responses?’ need to be asked (other responses include tents, cash, vouchers, transitional shelters etc). As needs change with time, a kit that may have been useful in the first hours after a disaster may be less useful days later.

When assessing material availability, it should be taken into account the quantities and qualities of the materials accessible as well as the environmental impact of harvesting the materials themselves. One should be aware that the demand for materials and their availability changes seasonally, as well as with time. Material assessment involves three questions that need to be answered including: ‘Do people have access to materials to make a frame?’, ‘Are other

materials required?’ and ‘Are more than two tarpaulins needed?’ If the answers are yes, then they should consider distributing additional materials.

In the context of vulnerability/skills, the assessment needs to consider that it is not always the case that all people are able to build or repair their own houses. It should be asked who builds traditionally and to think of ways to supporting others in building safely. Vulnerable people can be supported by providing teams of trained carpenters and builders to help with construction, providing cash so then the households can hire labour, working with partner organisations who will provide labour, cash or training and to establish reconstruction committees to mobilise community support for the most vulnerable individuals. There should also be established, from the outset, the capacity of the organisation to deliver the shelter kits. The questions that need to be asked include ‘Do you have the capacity to deliver the shelter kits fairly?’ and ‘Will the shelter kits still meet the needs when they are received?’ Be aware that vulnerabilities and needs change with time following a disaster. The distribution of shelter kits must be accompanied by ongoing monitoring and evaluation, and adjusted accordingly. Shelter kits need to be useful, and an informed decision to distribute them must be taken as quickly as possible.

After reviewing the method, it was noticed that the approach uses a decision tree which follows set stages, and each stage has its own questions that need to be addressed. It is also observed that before distributing the shelter kits, there is a need for an assessment by considering some of the factors that are used to make a clear decision for distributing the shelter kits, including the needs assessment, material assessment, vulnerability/skill assessment and capacity assessment. After considering these assessments, the distribution starts with monitoring and evaluation. However, this method is still not a comprehensive response to a flash flood in SA. It only focuses on one type of ERS response. In addition, there is still the need to consider other

factors to assess the situation such as a tool assessment (as each hazard is different and has its own context) and climate assessment (as each weather condition has its own specifications in terms of materials). Overall, this information will be considered while developing an ERS response framework to use in the context of flash floods in SA (in Chapter 5).

3.2.2 Method for distributing plastic sheeting (IFRC and Oxfam, 2007)

Plastic sheeting (also known as plastic tarpaulin, tarp or polythene sheet) is a sheet of strong, flexible, water resistant and/or waterproof material. Although different qualities exist, those that are most suitable for humanitarian relief are made from polyethylene. A standard sheet has a black woven or braided core and is laminated on both sides. Plastic sheeting is primarily used in construction for family shelters, as well as sanitation or infrastructure projects, although it has many other uses. Before new structures using plastic sheeting are built, a need for them should be clearly established through a properly informed assessment. The method for distributing plastic sheeting has six sections, including needs, maintenance and site selection, any issues that need to be considered, for what purpose they are used, by who they will be distributed, the size of the plastic sheet and the fixing of the plastic sheet itself, as shown in Figure 3-2.

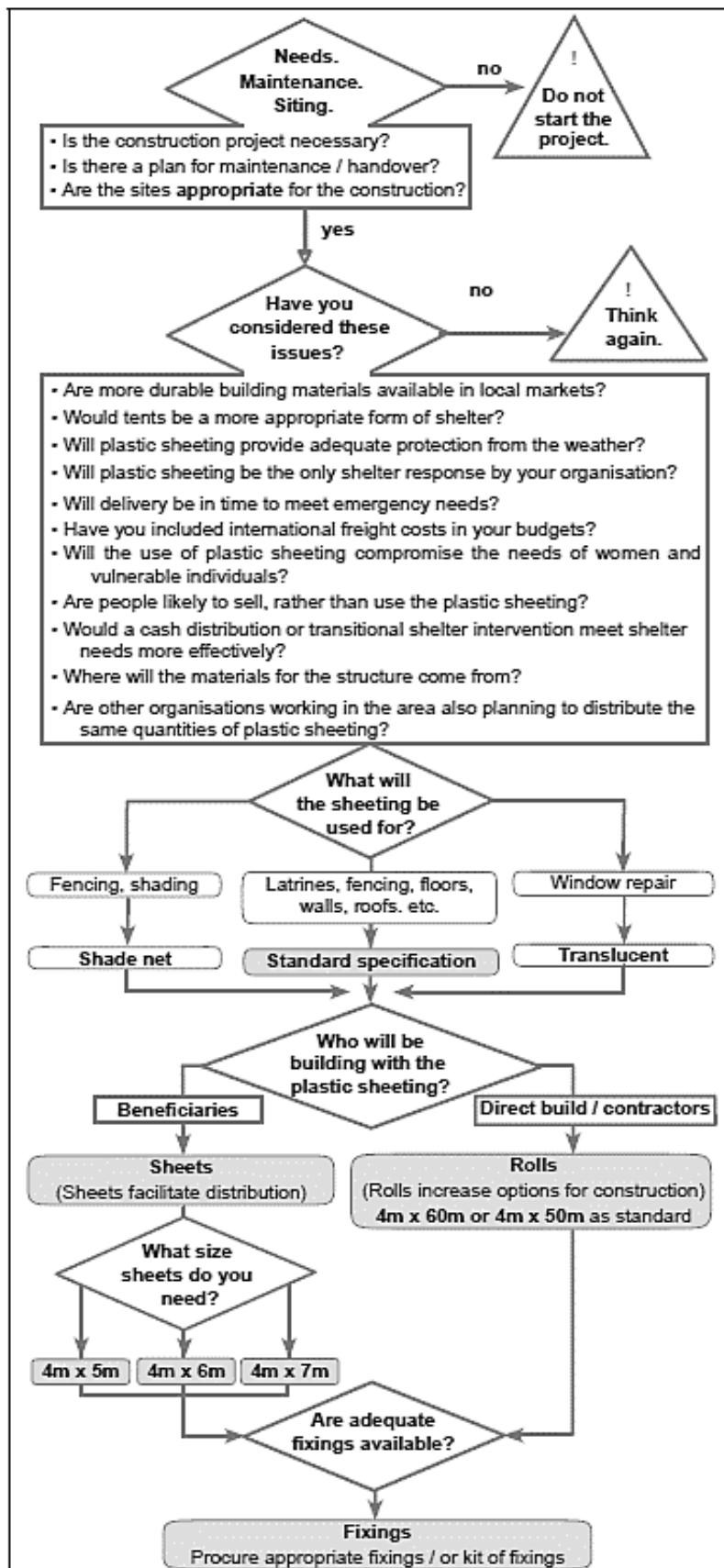


Figure 3-2: Method used for distributing plastic sheeting

The first thing that needs to be considered is the three factors of needs, maintenance and siting. In terms of need, before new structures using plastic sheeting are built, a need for them should be clearly established through a properly informed assessment. For example, people might find their own shelter with relatives or friends or make temporary repairs to their damaged homes, so new shelters might not be needed. As part of the assessment, focus group discussions or interviews should be used to identify the needs and capacities of the affected population.

In terms of maintenance, plastic sheeting is not intended for long term use, especially in harsh climates. When considering whether to use plastic sheeting or not, it should be ensured that the end users have the tools and information needed to make simple repairs. For public buildings, one should ensure that the maintenance plans are agreed upon for when the organisations have left. In terms of siting, people prefer to stay in or near their homes when and where possible. Displaced people (those who are forced to move) often remain at the new site long after the supporting organisations have left. Before specifying plastic sheeting as an emergency shelter material, it should be ensured that the site where people will rebuild is safe and that all affected people feel secure and protected.

The second section is for considering some of the potential issues before using plastic sheeting, namely materials, tents, climate, the phase of response / lifetime, lead time, cost, gender, adaptations, cash distribution, environment and coordination. The first issue is materials. In any construction, the design and materials used must be appropriate to the local skills, climate and culture. Plastic sheeting may not be the only material available for the given job. There may often be more appropriate materials available locally. The second issue is tents, which should be considered when the supporting materials (e.g. poles for structures) are scarce (especially in fragile environments), the existing structures cannot be used, rapid repairs, skills or the capacity to construct are limited, large structures (clinics or warehouses) are needed and

basic structures made from plastic sheeting cannot provide sufficient shelter from the native climate.

The third issue is climate which can be divided into two types; cold and hot. In cold climates, plastic sheeting is frequently used as an emergency measure to improve thermal comfort by creating warm rooms, or to help repair damaged buildings and tents. Cold climate shelter priorities includes clothing and bedding, waterproofing, bedding, wind proofing / thermal buffer, heating, and the insulation of the floors and walls. In hot climates, the key challenge in hot climates is to provide protection from the sun, heat and rainwater. Plastic sheeting can make spaces very hot. Buildings that use plastic sheeting should always be well-ventilated, such as via ventilated air gaps to reduce heat and to improve heat loss. Standard plastic sheeting is designed with a black core that helps to prevent structures from behaving like greenhouses.

The fourth issue is the phase of response / lifetime, and the anticipated lifetime of plastic sheeting is less than 2 years. It is often used to cover emergency shelter and sanitation needs until a more durable solution is found. The fifth issue is lead time, which can be as long as production might be on a small scale. The sixth issue is cost, as plastic sheeting has a limited lifetime and is less costly. However, tents can have longer lead times than plastic sheeting, are significantly more bulky, complex and are more costly to procure. The seventh issue is gender, which needs to be considered and the needs of women and vulnerable individuals can be compromised when using plastic sheeting.

The eighth issue is adaptation, in terms that people are more likely to sell rather than use the plastic sheeting, which needs to be thought through. The ninth issue is cash distribution, as many materials distributed in emergencies can be re-traded and sold in the local markets. Plastic sheeting is more likely to be sold if there is a lack of coordination among the distribution agencies, or if the distribution continues after the initial emergency phase. If agency-distributed

plastic sheeting is appearing in large quantities in the local markets, then it can be used to assess whether the programme objectives might be more effectively realised through other means. This might include the distribution of local building materials, cash, or engaging in more direct livelihood support activities.

The tenth issue is environmental, which impacts on the bulk use of local materials, which should carefully be considered. Additionally, the large scale purchase of materials impacts on the local and even national markets. In some cases, a combination of different construction materials could prove to be the most appropriate. The final issue is coordination in case, if there are other organisations working in the area that are also planning to distribute the same quantities of plastic sheeting.

After considering all of the aforementioned issues, the following section is about selecting the use of plastic sheeting for purposes such as fencing, shading, latrines, floors, walls, roofing and window repair. After selecting the reason for using the plastic sheeting, it needs to be considered who will build with the plastic sheeting, whether it be beneficiaries or direct build / contractors, as well as if are they going to use it as sheets or rolls (4m*60m or 4m*50m), as a forth section. The next section is for choosing the plastic sheet size. It is recommended to provide a minimum of 3.5m² covered space per person. By these indicators, one 5m x 4m sheet will provide a sloping roof with no floor or walls for three people only. 6m x 4m will provide a roof with no floor or walls for only four people. 7m x 4m will provide a roof with no floor or walls for only five people. The final section is for adequate fixing availability. Once good quality plastic sheeting has been procured, the main principles to observe when fixing plastic sheeting are to spread the load, to prevent the sheeting from flapping, to avoid contact with the points of friction and to avoid hot spots.

After reviewing the method, it was identified that some factors need to be considered before new structures using plastic sheeting are built, namely needs, maintenance and siting. After that, other factors should be considered before using plastic sheeting including materials, tents, and the climate, the phase of response / lifetime, lead time, cost, gender, adaptations, cash distribution, the environment and coordination. After considering those factors then need to thing for the use of plastic sheeting, providers, size of plastic sheeting and fixings to use. In addition, the approach for making a decision was a decision tree to move from stage to stage. However, this method is not a comprehensive response to a flash flood in SA. It only focuses on one type of ERS response. Overall, the information will be taken on and the limitations considered while developing the ERS response framework to flash floods in SA (in Chapter 5).

3.2.3 Method for choosing to distribute tents (United Nations, 2004)

Making the decision to choose tents for a victim needs to take several questions into account to be answered by yes or no in the form of a decision tree tool used in this method, as shown in Figure 3-3.

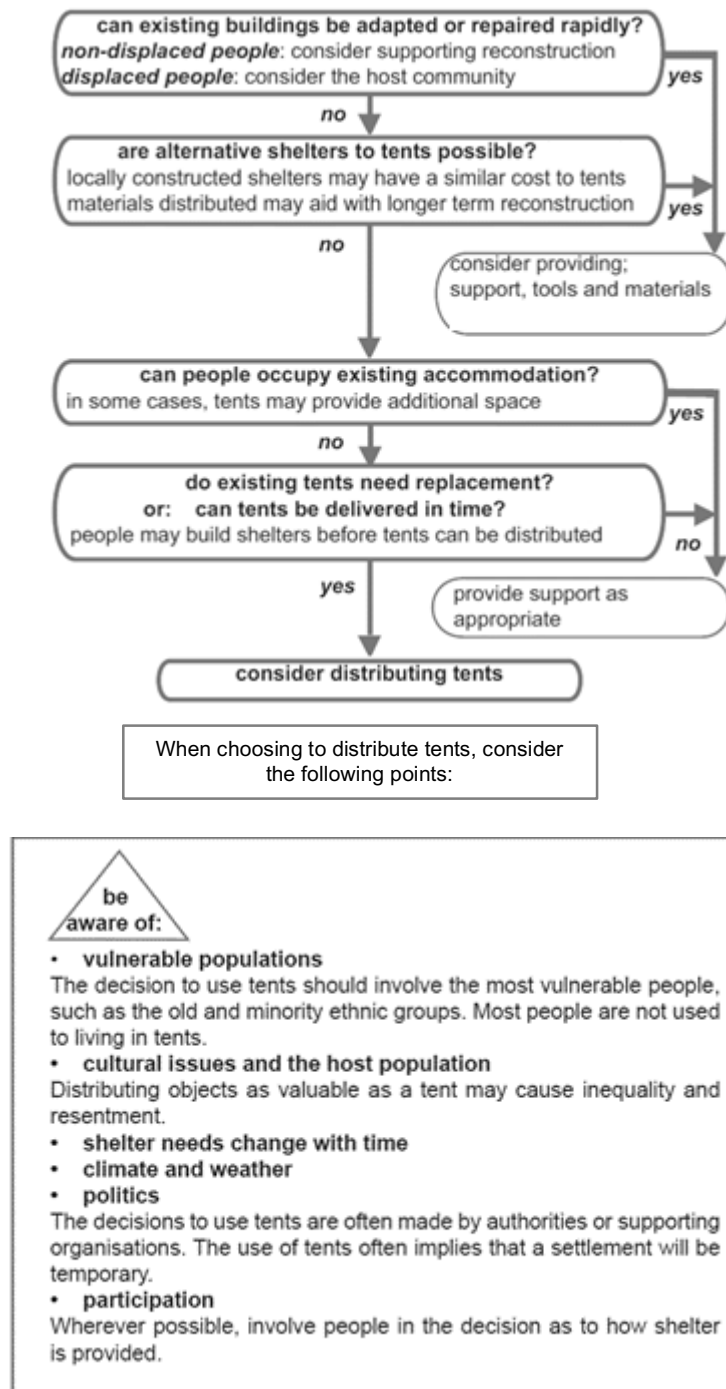


Figure 3-3: Options for shelter needing to be assessed before distributing tents (United Nations, 2004).

The first two questions are: “can existing buildings be adapted or repaired rapidly?” and “are alternative shelters to tents possible?” If the answers are yes, then there is a need to consider providing support, tools and materials. It is believed by the author that tents are not the only structure that can be used in an emergency. It depends on rapid maintenance that can be made to affected buildings, on local circumstances, or on the availability of locally existing materials which can be used to create temporary shelters. They could be available not only more cheaply than tents but also more rapidly.

If, however, the answer is no then we need to go to the next question, which is “can people occupy existing accommodation?” If yes, then suitable support needs to be given, and if not, then the following question should be considered, namely “do existing tents need replacement? Or can tents be delivered in time?” If yes, then the distribution of tents needs to be taken into account, or otherwise suitable support needs to be given. When tents have been chosen for distribution, there are some issues that need to be considered, namely vulnerable populations, cultural issues and the host population, given that shelter needs change with time, climate and weather, politics and participation.

First of all, as regards vulnerable populations, when the decision has been made to provide tents, it must engage the needs of vulnerable people, i.e. elderly people and smaller ethnic groups. Another matter that calls for careful consideration is that it is the first time for most people to live in tents. Secondly, cultural issues and the nature of the host population need to be taken into account when distributing tents, since that process could cause anger and accusations of inequitable treatment to arise. Third, shelter needs change with time, meaning that individuals might improve materials delivered through emergency assistance into more permanent structures. In other words, it starts from an immediate structure that contains plastic

sheeting, poles and rope and progresses to a more durable structure with adobe walls and roof, and using plastic sheeting in the roof.

Fourth, there is the climate and weather issue. This guidance mentions only three main types of climate, including hot dry climates, hot humid climates and cold climates. In hot dry climates, tents ought to give shade from the sun, and be aired so as to cool; while at altitude and in desert atmospheres the temperature goes down, so that consequently blankets and stoves may be required. Flysheets need to be considered to keep the users cool. The way of using the flysheet should ensure that it is separated from the inside tent as this creates a gap of air, which provides ventilation. It must be possible to close tents against wind and dust. Moreover, the door of a tent is supposed to be opened. So the tent should have ties in order to raise edges and hold doors open. In hot and humid climates, tents ought to give shade from the sun, be well-aired, have appropriate drainage and also be rot-proofed.

In cold climates, the heat is quickly lost from a tent, making it hard to keep it warm. The cold temperature increases in the night time before sunrise. A simple winterized tent should therefore have a hole for a stove-pipe, a cotton lining and flysheet, and its occupants should be sure to have access to adequate blankets, clothes and stoves (along with fuel and chimneys). There is also a need to provide beds or mattresses to keep occupants off the floor. Furthermore, local climatic variations including shading from the sun under cliffs or in deep valleys and where wind is funnelled through gaps in mountains need to be taken into account. Obstructing draughts (decreasing infiltration heat losses) is likewise fundamental to making tents warm. Doors should be orientated away from the prevailing wind. They can be isolated by structure walls or by excavating tents into the ground, and blocking gaps. However, action must also be taken to make sure that persons do not get poisoned or suffocated by stoves. In cold climates, food portions might need to be larger because individuals burn more calories. Malnourished persons might die through energy loss from extreme shaking.

Fifth, if we turn to consider politics, in most cases supporting organisations and authorities often decide to use tents, and this frequently suggests that a settlement will be short-term. Finally, as regards participation, efforts should be made to involve people as much as possible in the decision process as to how the shelters will be distributed.

After reviewing this method, it is noticed that there are some good points that should be noted concerning the ERS response to flash floods in SA, including considering other shelter options such as permanent buildings before making a decision for distributing tents. Careful consideration of this stage can reduce the environmental impact that is associated with the camp or temporary shelter construction, and decrease both social and economic costs. In addition, the discussion of this method has also covered some issues (namely vulnerable populations, cultural issues, the nature of the host population, shelter needs that change with time, climate and weather, politics and public participation) in order to consider how to improve the shelter response. Moreover, it is used a decision tree for move from stage to stage. However, this method still has not been seen as a comprehensive picture of the ERS response to flash floods in SA as other vitally important issues have been missing. For example, size details, materials, future risks and hazards, and topographic features. Only the good stuff will be taken into consideration and the limitations will not be considered while developing the ERS response framework for use in relation to flash floods in SA (in Chapter 5).

3.2.4 Method for a transitional shelter (Shelter Centre, 2012)

The questions and thoughts put forward in this method are considered to support technical specialists and programme managers in asking the related questions when making a decision about whether a programme of transitional shelter might be a suitable shelter response or not. This method is to be undertaken with the full contribution of the victims to allow them to select the best approach to their individual recovery from an emergency to a durable solution. The method is divided into four main sections including appropriateness (A), internal capacities (B), shelter properties (C) and assistance methods (D), as illustrated in detail in Figure 3-4.

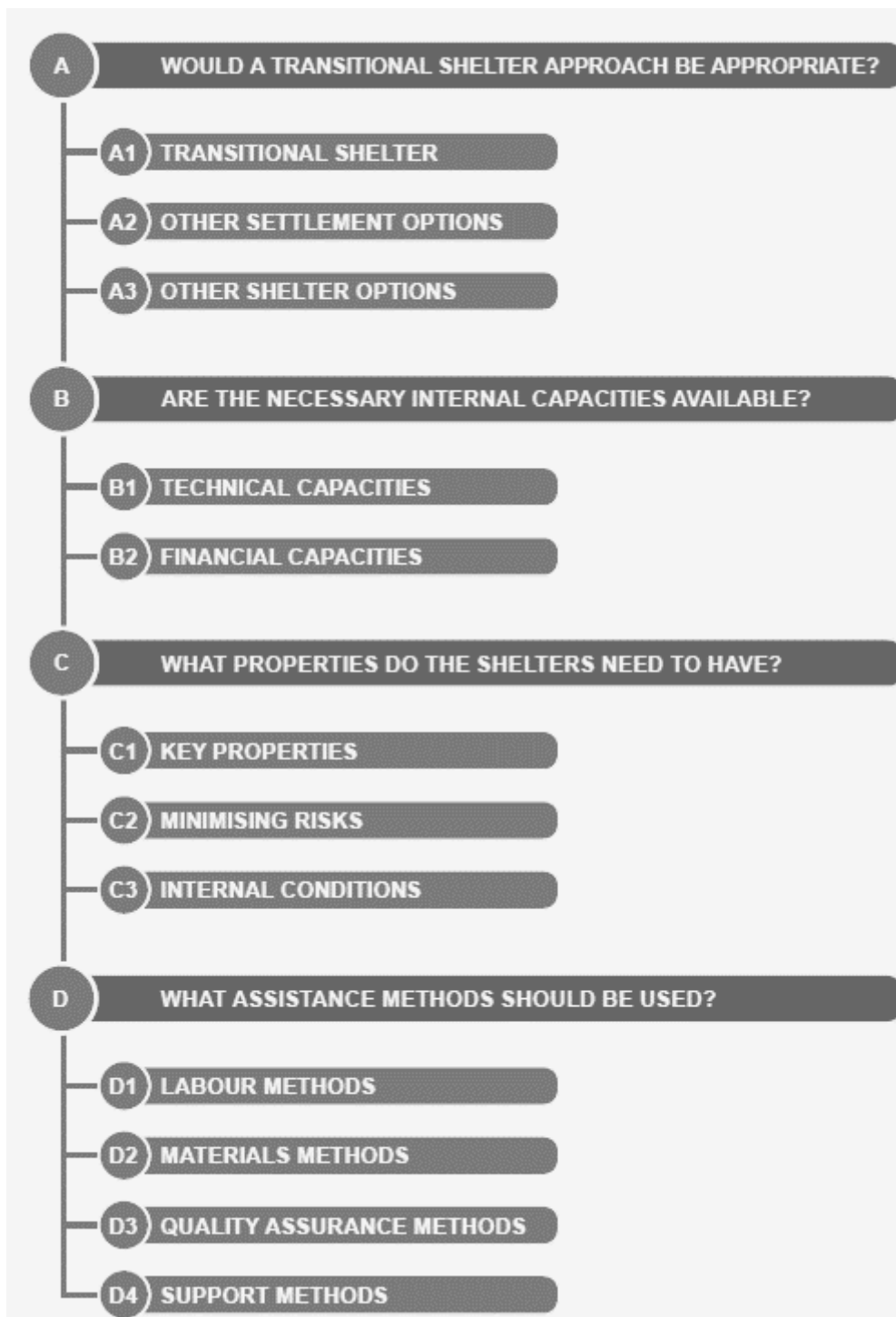


Figure 3-4: The four main sections of a transitional shelter programme (Shelter Centre, 2012).

The first step in section A is to consider whether the transitional shelter is appropriate or not by examining some issues including assessment, community, strategy, vulnerability, standards, maximising choice, buying time, incremental process, site planning and reconstruction. The first of those issues is assessment, meaning that transitional shelter will not be the only suitable shelter response for all circumstances or for all victims in any condition. There is a huge number of alternative methods available for providing temporary shelter in the aftermath of hazard circumstances, and wide-ranging assessments must be carried out to recognise the possible opportunities, threats, strengths and weaknesses of all shelter responses prior to choosing the most suitable one.

Secondly, as to community, the supreme effort in a shelter response is habitually that made by the affected populations. Furthermore, they are the ones who generally know of the most sustainable, suitable, and quick ways to recovery. The bigger the participation of the community in operation, the more cost-effective and well-organized the shelter response will be. Third, strategy involves defining that the programme should be used to give support to suitable groups within the victims for a time. This must be considered as part of a comprehensive inter-sector shelter strategy that recognises early recovery, camp coordination and camp management, health, WASH issues and protection, as well as cross cutting issues, to assist the entire people, both non-displaced and displaced, until appropriate shelter responses are identified.

Fourth, the vulnerability issue means believing that the approach must decrease the vulnerability of the victims and contribute to risk reduction of hazard by using location preparation, location selection, shelter design and building as a stage for greatest practice and techniques of communicating hazard resilience, and by constructing capacity within the hazard-affected people. The fifth issue is one regarding the standards that should be agreed

upon, with participation from the affected population, which are appropriate for each beneficiary group. Standards should consider the implications of local hazards, climate, available labour and skills, available materials, traditional building practices, cultural requirements and social and household activities.

Sixth, maximising choice, means that the mixture of shelter and settlement choices made by each household on their recovery rate, and the route to a solution of durable shelter, will differ as a result of their varying resources and needs. The shelters' design and construction themselves must exploit the choice of shelter and settlement options for each household by letting users upgrade, recycle, resell, re-use, or relocate their shelters as requested, and through given assistance methods. Seventh, there is the issue of buying time. In a major hazard the sustainable reconstruction can take several years to build; more than the normal lifespan of tents, as the author argues. Aspects of responses such as securing land tenure, community participation, and the standards agreement take time to start and finish; but on the other hand, if rushed they create poor sustainability, inequality, and greater vulnerability. Transitional shelter is the only method to assist with providing needed shelter while sustainable reconstruction is chosen.

Eighth, regarding the incremental process, it is thought that the sheltering process should improve gradually from the distribution of relief items until the point when durable shelter solutions have been achieved, at the same time offering chances for incremental progress, reselling, re-using, or recycling by recipients at their own pace. Transitional shelter is not to be seen as an additional phase of a response, but it starts as the early shelter response and takes place in parallel to rebuilding.

Ninth, as to site planning, the beneficiaries of transitional shelter programmes need to be located on a site that is legal, secured, and suitable. This might be successfully achieved through location planning which combines the integration of hazard risk reduction, service integration and zoning. Site planning must recognise the full community and its wants, and is significant for both non-displaced and displaced people in rural and urban settings. Finally, there is the question of reconstruction. Programmes of transitional shelter must be applied in the same period of time as programmes of permanent reconstruction. The shelter itself must be designed to accompany and subsidise a programme of rebuilding through the procedure of being re-used, upgraded, resold, or recycled.

Each issue needs to be assessed properly, and its related questions answered in order to make a decision on whether the transitional shelter is appropriate or not. If most of those questions have been answered in the negative, then transitional shelter might not be an appropriate response option. Other settlement and shelter options then need to be considered.

Settlement options for displaced populations include host families, urban self-settlement, rural self-settlement, collective centres, self-settled camps and planned camps. Other shelter options include semi-permanent shelter responses, sites and services responses and core responses. However, settlement and shelter options are not explained in this guidance with enough detail.

If the answer to most of these questions is yes, then transitional shelter might be a suitable response. Move on to section B to determine whether the essential internal capacities are available. The capacity is divided into two main groups, namely technical capacities which include human resources, logistics capacities and partner organisations, and financial capacities which include funding and accounting/budgeting.

The next section is C, which aims to support technical specialists and programme managers in creating stipulations for shelters in close collaboration with the victims. This stage must be

reconsidered many times throughout a programme of transitional shelter to bring up-to-date specifications as shelters are progressed over the course of the transitional shelter programme.

Section C has three factors that need to be considered, namely first of all the key properties of lifespan, five design characteristics (upgrading, re-using, relocating, reselling and/or recycling), cost, standards, cultural appropriateness and equity of response, then minimising risks (hazard resistance, climate and weather, and safety and security) and internal conditions (temperature, ventilation, internal space, privacy and vector control).

After all the properties have been measured, the following section is D which aims to support programme managers in choosing suitable labour methods (including self-help, community, direct and contract), materials methods (including local, prefabricated parts, imported and construction items), quality assurance methods (including technical experts and capacity building) and finally support methods (including cash, vouchers, loans, market support, local information centres, advocacy, return and transit items, infrastructure and environmental management) for transitional shelter programmes together with the victims. When arranging an overall hazard response, all choices under this section can be measured in parallel. After going through all those sections, the transitional shelter programme will then be ready for implementation.

After reviewing this method, it is recognised that it seeks to engage the victims with the full contribution offered in order to allow them to select the best approach to their individual recovery from the emergency stage until a permanent solution is achieved. For flash flooding in SA, most flood-affected people are created because the level of the water is increased in their houses. They need a quick and short-term shelter response and this programme is hard as it is.

However, it will be a good idea to consider the stage (A) and its related factors, which will help to choose the type of shelter response that is required. The factors are assessment, community, strategy, vulnerability, standards, maximising choices, buying time, incremental process, site planning and reconstruction. It also mentions other factors that could be taken into account in respect of the immediate response such as shelter location, capacities, design characteristics, risks, climate and weather, materials and labour methods. Moreover, this method also used a decision tree approach to increase the speed of the decision. However, this method is not a comprehensive response to a flash flooding in SA. It only focuses on a transitional shelter for a short-term to a long-term response. Overall, the good stuff will be taken into account and the limitations considered while developing an ERS response framework to a flash flood in SA (in Chapter 5).

3.2.5 Method for shelter in emergency (Humanitarian Aid and Civil Protection, 2016)

This guidance is for funding responses in terms of humanitarian shelter and settlement (S&S). There are five response options to select, and one of them at least should be considered before making a funding decision. Option one: this considers the short term responses to an acute crisis in support of a population that has been recently displaced and/or on the move (this will be discussed later in more detail). Option two: this considers the fully-fledged S&S response to ongoing humanitarian crises, either as a stand-alone intervention or as a component of a multi-sector intervention, for example, linking relief with reconstruction and development. Option three: this considers the disaster preparedness or disaster risk reduction actions. Option four: this considers the necessary but limited S&S intervention which is required to facilitate a primary (and possibly more critical) humanitarian action such as protection. Option five: this considers an institutional S&S capacity-building intervention, directly benefiting the

commissioned humanitarian-implementing partners. These options have been explained in more detail in the document (in pages 42 to 45).

Before selecting the response option, the S&S needs are agreed by assuming that a) an assessment has confirmed the humanitarian S&S needs which are consistent with the objective of the applicable funding decision; b) addressing these needs is achievable through standard humanitarian and/or civil protection means; c) the implementing partner(s) are equipped and competent enough to address these needs; and d) the proposal respects basic humanitarian principles. After that, the main question that needs to be addressed is: ‘Does the proposal seek to directly address the S&S needs of the population at risk?’ If the answer is yes, then this answer has four options to potentially follow. If no, then this answer has only one option to follow (as illustrated in Figure 3-5).

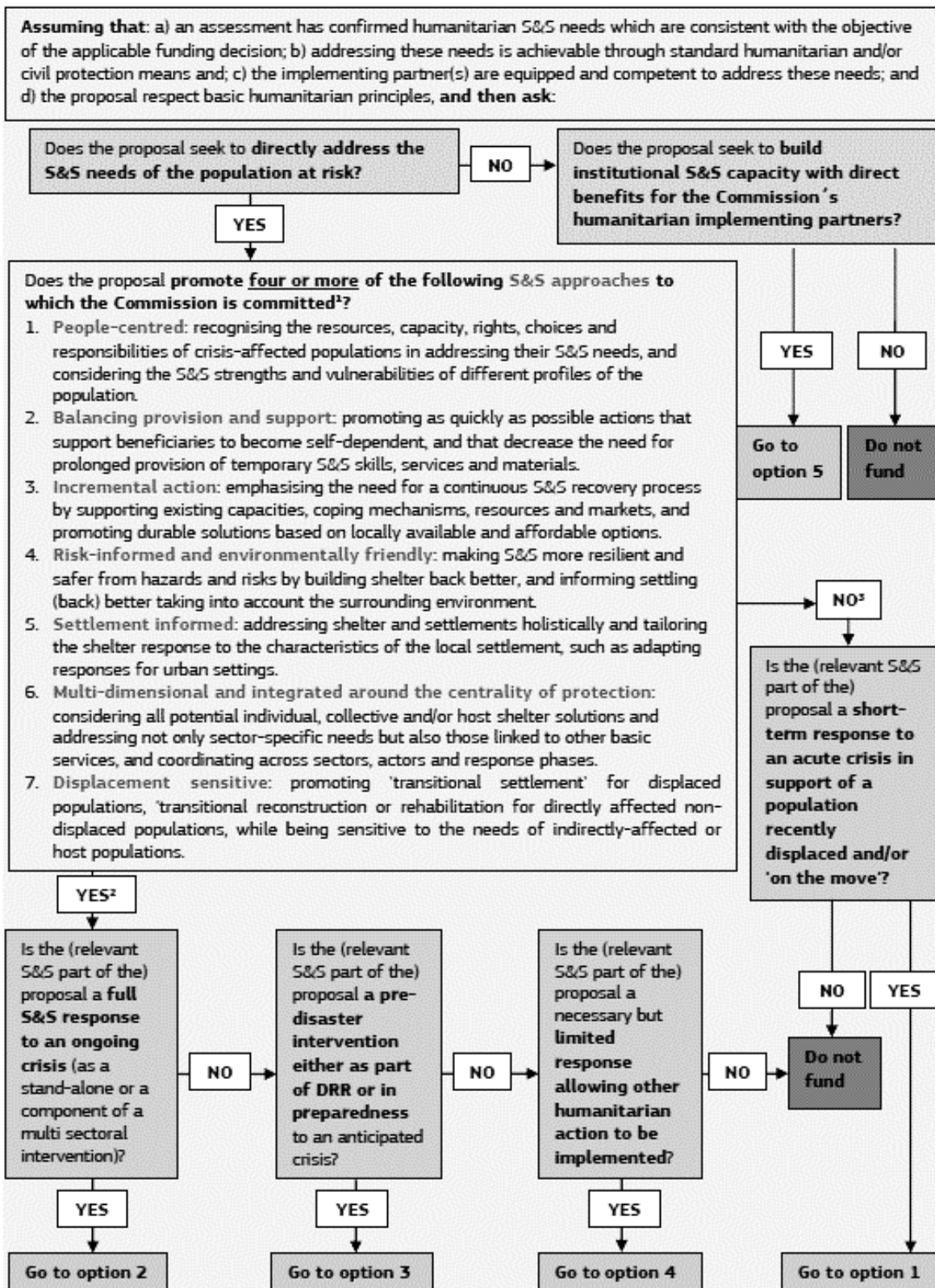


Figure 3-5: Indicative decision tree

Before moving on to the first four options, there are some approaches to which the commission is committed such as being people-centred, balancing provision and support, incremental action, being risk-informed and being environmentally friendly, multi-dimensional and integrated around the centrality of protection and displacement sensitivity.

If these approaches have not been considered, then the following question becomes ‘is the (relevant S&S part of the) proposal a short-term response to an acute crisis in support of a population recently displaced and/or 'on the move'?’ If yes, then option one is the best choice. If no, then there is no need for funding. On the other hand, if these approaches have been considered then the following question is asked: ‘Is the (relevant S&S part of the) proposal a full S&S response to an ongoing crisis (as a stand-alone or a component of a multi-sector intervention)?’ If yes, then option two is the best choice or if no, then the following question is asked: ‘Is the (relevant S&S part of the) proposal a pre-disaster intervention either as part of disaster risk reduction or in preparedness of an anticipated crisis?’ If yes, then option three is the best choice. If no, then the following question is asked: ‘Is the (relevant S&S part of the) proposal a necessary but limited response, allowing other humanitarian actions to be implemented?’ If yes, then option four is the best choice.

The first option is for a short-term response (as the core of this research). It needs to match the four main issues to get funding, including the objective and substantiated evidence of a sudden loss of access to basic shelter, grossly-inadequate S&S conditions or related goods and services, a high risk of succumbing to or seriously suffering from illnesses, injuries and/or abuses, ensuring the timely access to safe shelter goods and services and securing settlement and an acceptable short-term exit strategy that can be satisfactorily achieved. This takes into account the potential, plans and comparative advantages of the other relevant S&S stakeholders.

After reviewing the method, it is observed that these options are not exhaustive and may vary according to the context. Whilst some may not be achievable early on in the response, the implementing partner is expected to continuously assess which ones can be realistically adopted as early as possible and take swift corrective action where appropriate. These responses are more suitable to be considered when funding is a big issue, but in SA, the funding is not that big of a deal when it comes to making the ERS response appropriate. However, there are some factors that need to be taken into account in order to develop an ERS response framework for flash floods in SA, like a decision tree approach to the links between the stages. In addition, there are some factors which can be considered to access the ERS response, including the people's needs, conditions, equality, risk information, if it is environmentally friendly, basic services, protection, communication, coordination and displacement sensitivity.

3.3 Summary

After reviewing and critically evaluating ERS response methods, it has been shown that none of the current methods (as they are) are sufficiently helpful to those who make decisions, such as aid relief staff who are present at flash flood sites and whose role it is to provide ERS response simply and quickly to those needing it in SA. This is partly because each flash flood has its own particular context which emerges only when the flash flood has occurred. However, there are some elements of best practice which may be learnt from those methods and included within the development of the ERS response framework for a flash flooding event in a Saudi Arabian context.

It has been noticed that the approach which is common to most methods involves the use of a decision tree, which flows through a series of yes/no questions or sets of criteria. In addition, the tree usually follows a sequence of stages (Cross and Roy, 1989). Each stage can be iterative, and frequently work on one stage causes the decision makers to go back and improve the work of previous earlier stages. There are many advantages in following the stages formally, one of them being that it decreases the risk of having to create expensive modifications late in the process. Each stage creates a certain output that can be revised before implementation. Within each stage, altered groups can work in parallel. Since it is common to all shelter response methods, the author believes that the decision tree approach is going to be suitable for developing ERS design framework for flash floods in SA, where an immediate and quick decisions are required.

Needs may change between different hazards and countries, and this consideration may impact on the question of which ERS responses offer the most effective forms of assistance; yet the basic needs for emergency shelters are similar in most such emergencies. There are some considerations identified by previous methods which would be indispensable and applicable to

responses to flash flood situations in SA. These: needs, materials, vulnerability/skills, capacity, maintenance, location, type of shelter, climate, lifetime, time, cost, gender, adaptation, cash distribution, coordination, use, providers, size, fixing tools to repair and build, cultural issues, community, maximising choice, incremental process, design characteristics, risks, labour, equality, environmentally friendly, basic services, protection, communication and displacement sensitive. Moreover, in terms of stages for shelter response methods, it is been noticed that the first stage for all shelter response methods considers factors to be assessed before providing the ERS response. They also incorporate subsequent stages such as evaluation and monitoring. All those identified factors and stages (from this chapter (2) and the previous chapter (3)) will be considered when developing the ERS response framework for a flash flood in SA (as addressed in chapter 5).

The following chapter identifies the research approaches and methods that will be conducted in this research in order to develop, verify and validate the ERS response framework for flash floods in SA in order for them to be more successful.

Chapter 4 Research methodology

4.1 Introduction

The laws and processes that are followed in an investigation of something is referred to as the research methodology (Fellows and Liu, 2015). The way that the research is conducted is of utmost importance in deciding the authenticity of the research (El-Diraby and O'conner, 2004). There are different approaches available including epistemology versus ontology, deduction versus induction, explanatory versus exploratory, and the quantitative and qualitative approaches. In addition, there are different techniques that can be used for data collection, verification and validation for developing ERS response framework.

4.2 Epistemology versus ontology

Easterby-Smith et al (2002) claim that it is significant for investigators to create their respective epistemological and ontological positions, as this will lastly lead them to the study design. Epistemology refers to studying knowledge and gaining its validity, nature, value, techniques and scope. Ontology refers to the study of existence (Girod-Seville and Perret, 2001; Bryman and Bell, 2015).

The study of the ERS response to a flash flood event in SA establishes a substantial challenge for the investigator, as the nature of the topic shows that the associated data is frequently hard to count and intangible. In ERS response study, the epistemology is between the two excesses, which are the positivist and interpretivist styles. Positivism suggests that the social world can be observed using objective realism, which is assumed through the finding of facts and measurement, which lead to the rules of causality (Easterby-Smith, 2002; Fellows and Liu, 2015). An interpretivist style reflects the approaches of natural science, which is unsuitable as

human beings are intricate. For this reason, as claimed by Fellows and Liu (2015), dissimilar individuals will understand a condition in altered paths as happens in ERS responses. For this research, it was selected in order to apply the interpretive style due to the subjective nature of the research exploring ERS responses to flash floods in SA.

Regarding ontology, the world is supposed to be perceived and understood through two competing standpoints of ontology, which are the realist and nominalist approaches (Gualliers, 1992; Easterby-Smith, 2002). Burrell and Morgan (1979) put forward the realist approach, which states that the social world is distinct from the individual and consists of concrete, real structures. Even though there may be no terms or concepts to express them, they have been present before there was any awareness of their existence. The nominalist, on the other hand, believes that the world is a social construction and that titles and ideas are essential for its representation, so then the world can be described and made sense of. Hence, according to the researcher, the nominalist ontology is the most appropriate for this research study.

4.3 Deduction versus induction

The analytical process through which a conclusion is reached after presenting the premises is what is meant by deduction. That is, inferences are made through reasoning to move from the general phenomenon to those that are more specific. If the initial proposition is accurate, then the conclusion that is logically derived from this premise must also be correct as represented through this process (Karin, 2001). The way that the nature of the relationship between theory and research is usually considered as being represented is through deductive theory (Bryman and Bell, 2015).

On the other hand, induction refers to reaching the truth of a general proposition by taking into account the specific cases that promote it (Glaser and Strauss, 2017). It can be explained as the process of identifying and verifying general propositions, which means that we assume that

what is true in a certain case or cases is going to be true in all cases that are similar in relation to a particular aspect (Karin, 2001). Therefore, the only method that can be undertaken in order to understand the current practices is to begin inductively generating the ERS response framework for flash flood situations.

4.4 Explanatory versus exploratory

Exploratory research encourages thoughtfulness, and is appropriate for new arenas of research where there are rare definitive hypotheses, and where slight study has been completed. Slight is recognised in the nature of the topic, such as the ERS response plan in SA for flash flood situations (Patton, 1990). Explanatory studies, on the other hand, seek to improve declarations which create roughly comprehensible information about why stuff is the way it is (Blaxter et al., 2010). The emphasis is typically positioned on testing theories, and a scientific, positivist stance is frequently adopted (Silverman, 2001; Yin, 2002). This research is an attempt to discover the vital factors and stages that guarantee the success of the ERS response framework. Thus, it can be argued that this study is exploratory in nature as it attempts to understand and discover the up-to-date practices of the ERS response in SA to flash floods.

4.5 Quantitative versus qualitative

The quantitative approach allows for the collection of data about things that are easy to measure. This is termed 'realistic'. It refers to numbers, researcher distance, theory testing, static, generalisation, structured and reliable data, as well as behaviour, macros and artificial settings. Quantitative research can be carried out on various topics that are fundamentally qualitative (Moore, 2000). This approach carries forward from past studies that have established standards, laws and theories, which enables the researcher to determine the data needed for the specific research. Factual data can be collected through a quantitative research method and the relationship between the facts can be examined. This is so then one can

understand how the facts and relationships are in line with the theories presented by the past research findings (Fellows and Liu, 2015; Bryman and Bell, 2015).

The qualitative approach is used for things that are not simple enough to comprehend through calculations, which are those that are studied through qualitative research, which is referred to as “idealistic”. Questions about people in special circumstances are solved in a systematic and empirical way through the qualitative approach. It is a way of explaining and trying to comprehend the observations about the activities that people indulge in or what they can convey about their experiences, for any individual, group or theme of communication (Locke, 2013). Understanding people’s views and interactions with ‘the world’ is also its objective (Fellows and Liu, 2015).

Theory generation is also an integral part of qualitative research (Fellows and Liu, 2015; Bryman and Bell, 2015). Research that follows the qualitative approach has three main objectives: to understand, to create or to identify. Qualitative studies are mostly descriptive and exploratory, the aim of which is to ascertain the deeper explanations and insights into challenging circumstances that have not been identified in the literature. The qualitative approach to research is differentiated as follows (Locke, 2013): in qualitative research, the data is usually collected through interviews, different kinds of observation and document collection. The data is usually represented through words, for instance, field notes, transcriptions of interviews and so on. However, sometimes it is also represented through numbers, frequencies and graphic illustrations. The respondents in a qualitative research sample are selected cautiously, so then the effectiveness of the data used for fulfilling the objectives of the research is maximised. Occasionally however, random processes are used to form the sample (Robson, 2016).

Qualitative studies are best applied for solving a range of problems in that they can help to increase knowledge and understanding which can be used to explain behaviour, actions and motivations of humans. Since it was essential to work with people and to recognise their behaviour within context variables that are difficult to recognise, quantify or define, a qualitative study was judged to be the most suitable for this research. In a qualitative procedure, a variation of specialised research methods are used, such as action research, ethnographic, laboratory, case studies, grounded theories and survey (Fellows and Liu, 2015, Saunders et al., 2016 and Remenyi et al., 1998) in order to deliver an in-depth understanding of the consumers and their subconscious motivations.

Action research as identified by Fellows and Liu (2015) involves the active participants by the investigator in the procedure under investigation, to determine, promote and evaluate issues and possible solutions. The limit of this method is the investigator studies and observes the issue in one particular organisation on a daily basis and the generalised data are limited within an insufficient sample of the population, whereas the ERS response is complicated and large with many organisations. Consequently, it can be understood that action research is not appropriate for the research described in this thesis.

According to Remenyi et al. (1998), though ethnographic research has some relevance in management and business study it is not used widely. This approach needs long field studies and requires detailed as well as observational evidence which is likely to be inconsistent if studying the management of ERS responses. Flash flooding situations are unpredictable and hard to gather direct observational evidence from the field in SA. Hence, this approach will not be used in this research. Experimental research as described by Fellows and Liu (2015) and Saunders et al. (2016) is more appropriate for a precise study, typically linked to laboratory

work, rather than study of the management of real-life ERS response involving complex relationships between stakeholders. Thus, it is also not adopted for use in this research.

Despite the detailed data provided (Naoum, 1998 and Ling and Bui 2010), case studies will limit this study because of its nature in time consuming and the researcher would have to limit the research within an inadequate amount of cases and consequently cannot capture more valuable information. In addition, there are difficulties in investigative and testing the proposed ERS response when it does not signify a sample in a very huge population like flash flooding cases in SA. Thus, case studies approach have been rejected as being inappropriate for this study.

Grounded theory is an approach which enables a theory to be developed from information through inductive and deductive thinking (Strauss and Corbin, 1998). Therefore, in this research, the grounded theory method has been seen as inappropriate because the proposed response solution has been developed from existing literature and from existing response methods. The survey technique provides a quantitative or numeric description of attitudes, trends or opinions of a population by researching a sample of that population (Creswell, 2009). This type of research includes using questionnaires or interviews for collecting data. Surveys are primarily concerned with identifying specific characteristics of a particular population of subjects (Gill and Johnson, 2010).

Naoum (1998) claims surveys are implemented to collect data from a reasonably large number of respondents within a restricted period setting. According to Naoum (1998), there are two kinds of surveys: the analytical survey and the descriptive survey. The analytical survey attempts to set up relationships and associations between the dependent and independent variables of the subject matter. In contrast, the descriptive survey attempts to answer the questions ‘who’, ‘how many’, ‘what is happening’, ‘when’ and ‘where’? It counts the number

of respondents with convinced opinions about or attitudes towards a particular subject which will be studied to compare or illustrate future trends. For this research, it was decided to use a descriptive survey because of the subjective nature of the study.

Moreover, Remenyi et al. (1998) proposed using surveys in two forms: large-scale surveys and in-depth surveys. They explained that large-scale surveys frequently use questionnaires to gather evidence. In contrast, in-depth surveys generally try to follow-up detailed in-depth evidence from a reasonable number of informants over a sequence of interviews, as applied in this research.

After reviewing of all the possible applicable research methods, it was judged that the survey was the most helpful for achieving the research's aim and objectives. Therefore, this study used a survey technique by adopting interviews as the most appropriate tool for investigating the ERS response for flash floods in SA. It was able to give a comprehensive view of the topic and generate rich data and useful information.

4.6 Research processes adopted

The technique relays itself to the method that is conducted for collecting, assessing and interpreting the data (Dainty, 2008). Fellows and Liu (2008) believe that the most appropriate method to implement relays is as the link to the collected data and the outcomes analysed in relation to the study question investigated. The techniques used in this study were an in-depth literature review (in order to develop a conceptual ERS response framework for flash floods in SA) and interviews (in order to verify and validate the developed ERS response framework for flash floods in SA), as explained below.

4.6.1 In-depth literature review

The in-depth literature review aims to discover the information currently available regarding the theme of the research. The information possessed by the research conducted regarding the research problem is assembled in the literature review. This allows the researcher to identify the gaps, background and thoughts associated with the focus, and to come up with a fitting solution. For this, it is important that the researchers have the complete and latest available knowledge that is in the literature, thorough background information of the subjects under review, technical know-how and a substantial amount of time and resources (Saunders, M. et al., 2009; Robson, 2016).

During the initial phase of the research, it is important to look for literature related to the current study. According to Fellows and Liu (2015), ‘the literature must be considered in the context of the theory’. The study and critical interpretation of the data requires a review of the literature (Royer and Zarlowski, 2001). In order to comprehend the outcome of the subsequent research and to realise the background in which the subject is present, it is highly imperative to have a historical overview of the topics under study.

An in-depth literature review is important as it fulfils the following objectives (Luciano, 2011): distinguishes the things that have already been accomplished from what needs to be studied further, identifies the significant variables with respect to the subject matter, gains a fresh outlook, ascertains the link between concepts and how they are implemented, gets to know the context in which the problem exists, finds out how important the issue is, enhances the vocabulary of the problem, gains a complete understanding of the associated theory and methodology, practically applies the theories and concepts, determines the key research techniques that have been implemented and considers the historical context of the research to illustrate its significance with respect to the advances.

Some search criteria must be considered when carrying out an in-depth literature review. First, is quality: the researchers should select only publications and reports from reputable organisations and institutions, peer-reviewed papers or journals, magazines or blogs that have been reviewed for documentation and established library catalogues. Second, is relevance: this criterion is concerned with organisational and institutional reports and publications from bodies such as key knowledge institutions, key donor institutions and institutions or agencies that have reported as investigating and/or studying ERS responses. Finally, are the areas of focused interest: flash floods in SA, emergency relief responses, issues, and ERS types and response methods.

There is a need to develop a tool to use in an ERS response that can be used in a flash flood situation for sheltering the victims in SA in order to mitigate the problems and to provide a safe place to protect the flash flood-affected victims as soon as possible. It is thought that a framework is a good method to use to help stakeholders to attain success in their ERS response. It is a bridge that addresses the theories to resolve specific problems. The pros of a framework are clear and thus it has been chosen and will be improved on in this study.

It is pre-requisite to review the related material and then to find the common topics that have arisen from the literature on the ERS response and any related issues. Therefore, the in-depth literature review technique critically reviews the related literature. Initially, the existing published guidance in SA has been critically reviewed in detail with a specific focus on the ERS response for floods, the background of flash flooding in SA and its issues, emergency relief and its response phases and the provision of emergency relief shelters with examples for use in flood events. Moreover, it identifies the range of issues that need to be considered in order to increase the performance of ERS response in a flash flood situation in SA (addressed in Chapter 2).

In addition, it allows us to critically evaluate the shelter response methods (internationally) that are used in emergency situations, including the method for distributing shelter kits (IFRC, 2010), the method for distributing plastic sheeting (IFRC and Oxfam, 2007), the method for distributing tents (United Nations, 2004), a transitional shelter programme (Shelter Centre, 2012) and the method for implementing shelter in an emergency (Humanitarian Aid and Civil Protection, 2016). It is done by identifying the approach that response method used for making the sequences of the stages, the design factors that have been recommended for the immediate responses and stages, and the limitations of the response method (addressed in Chapter 3).

The outcomes from the chapters (2 and 3) will go through stages of data analysis as proposed by Tesch (2013) and Bryman and Bell (2015). These include the underlying meaning, gathering of a list of all factors that are derived from the study, the grouping of these factors, coding the factors, the intricacy of the factors with the goal of rotating them into certain headings and defining inter-relationships and lastly, making a lasting choice on the coding of the headings. After that, the conceptual ERS response framework for a flash flood situation in SA will be built and structured (explained in more detail in Chapter 5). The following technique used was expert interviews to verify and validate the ERS response framework.

4.6.2 Expert interviews

The interview method was selected as it is a vital data collecting technique (Denzin and Lincoln, 2011). This method enables the investigator's ability to gain in-depth and rich real life knowledge from the interviewees. In the qualitative approach, the respondents are chosen on the basis of the following four factors: the research setting, the interviewee, the actions of the interviewee and the process through which the actions of the actors progress within the setting (Miles and Huberman, 1994). The purpose of conducting the interviews is to choose

participants from SA in a way that best meets the research objectives and helps the researcher to verify and validate the ERS response framework for use in flash flood situations in SA. It can be used to cover a great number of members working on the ground and thus characterises an appropriate sample of the population.

The quantitative approach usually selects participants randomly (sampling). However, this research will not follow this method as it needs people who have a lot of experience in ERS response during flash floods in SA, so then they can provide comprehensive information (Saunders, M. et al., 2009). Interviews allow for the collection of factual data through direct or indirect conversations, so then the views and emotions of people about a particular problem can be acquired (Collis and Hussey, 2013). The available stages in the procedure are often used to indicate back to the goal of the study, and to emphasise attention on where to look for the evidence and information that will achieve the study goal and objectives (Soy, 1997). It is assumed that, in this research, the suitable people will be the ones who are active players in the ERS response during flash floods in SA.

In this research, the sample was stated as being expert organisations and people who have been delivering an ERS response during flash floods in SA. Commonly, the ones who were stated in the earlier section fit this definition. The determined organisations as the sources of data collection (SA) are, in fact, the most well-known out of those involved in the ERS response during flash floods in SA, particularly regarding their reputation and frequent participation in flood situations.

The organisations were purposively determined in this research study because, firstly, the organisations have been already working with the others in past flash flood situations throughout the country. Secondly, there is the possibility to produce relevance and rich information for the study. Thus, the results are interconnected and interrelated. When involving

organisations in this research, they can possibly provide clear answers for the themes that are being studied. Finally, concerning the quality of the ERS responses that have been done, these involve an inclusive view about the themes that are being studied and therefore they may be able to provide impartial and unbiased comments. In addition to this, the author has connections and contacts with the organisations and corporations involved in the emergency response to flash floods, particularly with senior managers in the top management boards.

Interviews come in three forms: unstructured, semi-structured and structured. Some studies may require just one type of interview while others might require a mixture more than one type (Naoum, 2012). For this study, the semi-structured form was chosen for verification and the structured form was chosen for validation.

Firstly, semi-structured interviews are more official than unstructured interviews in which there is a quantity of exact issues around which to build the interview (Naoum, 2012). The author selected this type of interview due to the open and closed-ended questions involved, which were not requested as part of a specific instruction and no list was used. Moreover, this type of interview begins by asking indirect questions to create a link with the interviewees to obtain a vision of the topic and ideas, and then to discover the particular issues that the interviewer has noticed. Bryman and Bell (2003) noted that semi-structured interview procedures are flexible. This research is going to use a semi-structured form of interview, which is going to be the most important means of verifying the conceptual ERS response framework for flash floods in SA (Robson, 2016). This method is used quite extensively as it has the ability to provide useful information, which is why it is considered to be a powerful research instrument (Punch, 2013). These interviews intend to determine the opinions and experiences of the respondents and how they understand their lives (Fraenkel, 2006; Locke, 2013). In addition, an important concern for the researchers is to gain an understanding of the way that things occur (Fraenkel, 2006).

Fellows and Liu (2015) advised that the questions must be easy and clear for the respondents, and that they must not cover the requirements for needless data. According to Naoum (2012) and Fellows and Liu (2015), the questions to be requested must look for knowledge, facts, and be truthful questions that are intended to succeed objective information while opinion questions are intended to gain subjective information (Pole et al., 2002).

Most of the questions were phrased and designed before conducted the fieldwork. Nevertheless, the responders were free to be flexible when it came to the issues being debated. The semi-structured interview questionnaire used qualitative comments through open questions and some of them had multiple options in order to make them easy to answer (as shown in Appendix A). The main reason for choosing the semi-structured interview form was to discuss the improvement and refinement of the conceptual ERS response framework. Each interview was ended with a short summary by the author.

It is essential to verify their real influence on the ERS response. The greatest ones will emerge and thus be given in the framework. The participants will have to carefully focus, analyse and underline them with reliable answers in order to guarantee that the ERS response will be able to cover the influences and succeed in the end (Fellows and Liu, 2015; Sekaran and Bougie, 2016).

The first section involved personal questions such as name, email, qualifications and related experience. The following section involved generic questions with some options as follows: ‘What is your understanding of the response framework for ERS?’, ‘Based on your knowledge, how important is the ERS response framework for decision making?’, ‘What are the benefits of using the ERS response framework?’ and ‘What are the drawbacks of using the ERS response framework?’

The third section asked about the stages of the ERS response framework for floods in SA as follows: ‘Does this list of stages cover the full spectrum of ERS response practices in Saudi Arabia?’, ‘Can you add to or remove from the diagram?’, ‘Why have you added/removed this specific stage?’, ‘Can the identified stage be applied in practice?’, ‘To what extent do the identified stages contribute to the ERS response in your area of expertise and how?’, ‘Which sector/discipline-specific aspects are not covered by the stages?’ and ‘Rank these stages in terms of priority for implementation’.

The final section asked about the design factors as follows: ‘Does the list of design factors cover the full spectrum of ERS response practices in Saudi Arabia?’, ‘Can you add to or remove any from the list?’, ‘Why have you added/removed this specific design factor?’, ‘Can the identified design factor be applied in practice?’, ‘To what extent do the identified design factors contribute to the ERS response in your area of expertise and how?’, ‘Which sector/discipline-specific aspects are not covered by the design factors?’ and ‘Rank these design factors in terms of priority for implementation’.

On the other hand, the validity of a procedure-based ERS response framework can be tough without any resource obligation to the organisation and burden and time period requisites. It might take at minimum of no less than a year to receive results for the ERS response applied in the framework. Thus, it is not achievable every time to use this technique for validation. Instead, the framework validation can be accepted by the collection of specialists with a wide variety of expertise by interviewing them face to face. This increases the chance of outcome giving valuable insights into the topics being studied. Therefore, the structured interview method has been chosen.

Structured interviews, as stated by Naoum (2012), classify that the questions offered are identical for all responders. Bryman and Bell (2003) claim that in this kind of study, the

structured interview type is commonly employed. This method is comprised of a standardised format linking straight questioning - which may begin with roughly open questions, changing to a closed question format – and the responses. It lets the responders have complete control of the questionnaire throughout the procedure of the interview.

Throughout the face to face interviews, the author was able to inspire the interviewees to elaborate, clarify or amend what they mention. However, essentially, the author tried his best to be a listener rather than a speaker throughout the interviews. Naoum (2012) defines that the main pros of structured interviews includes the fact that the reply percentage is comparatively high (around 60-70%), particularly if the responders are contacted directly, the replies can be more accurate and precise and the replies can be discovered as well as why the certain replies are said. Remenyi et al (1998) claim that the usage of the interview method delivers the chance to explore difficult issues in a comfortable atmosphere, and it lets the researcher to provide a clarification of the purpose of the study better than a covering letter on a questionnaire, thus gaining better value data. Structured interviews can be conducted for the validation of developed design frameworks after considering the feedback from the verification. This was done in two steps. The first step involved is interviewing some experts from the previous group in order to make sure that the changes are what they meant. The second step involved interviewing the academic people.

The structured interview questionnaire used quantitative closed-ended questions using the Likert scale in order to be less laborious and to guarantee that all components measure the objects equally (Oppenheim, 2000). This was in combination with qualitative comments through open-ended questions. The questionnaire had several sections (as shown in Appendix B).

The first section was about personal questions such as name, email, qualifications, and experience. The following section evaluated the ERS response framework stages for flash floods in SA. The third section evaluated the design factors. The final section evaluated six attributes including efficacy, practicality, helping the decision makers, saving lives, saving money and saving time.

4.7 Summary

In this chapter, the basic principles, concepts and methodologies related to the study philosophy have been considered. The first part reviewed the common research methodologies, whereas the second part focused on the study procedures adopted to achieve the aims and objectives of the study. The study has adopted a qualitative research approach which fitted the main purpose of the research due to its inclination in order to let the researcher understand the meaning of reality and how this reality is constructed. The main aim of the research is to develop an ERS response framework for flash floods in SA. The development of the approach adopted the following methods: an in-depth literature review and expert interviews (semi-structured for verification and structured for validation). In the following chapter, a conceptual ERS response framework for flash floods in SA will be developed by considering the outcome from the literature review chapters (2 and 3) in order to support those who make decisions and whose role it is to provide help those who need it.

Chapter 5 A conceptual ERS response framework for flash floods in SA

5.1 Introduction

Emergency relief shelters (ERS) are likely to be one of the most significant elements of common living situations and are frequently one of the more critical instances of non-recurring spending. ERS delivery will be required, after which there might be a request to support flood-affected people who have been recommended to shelter in a certain location or after an evacuation. However, most of the time, flash flood situations are characterised in SA by a huge amount of damage to lives, buildings, a community, and an environment where important decisions must be made very quickly due to the urgency involved.

An ERS response framework to flash floods in SA is required, as it helps aid relief workers to define the nature of the need, and may be used as the basis for searching the database for possible ERS solutions simply and quickly. In addition, such a framework needs to consider the most important design factors in the short-term and may aid longer-term response programmes so as to provide aid relief staff with useful relief shelter recommendations to pass on to flood-affected populations in SA. It also provides immediate and appropriate actions to contain and moderate the effects of the emergency, to protect life and to create the right circumstances for a return to routine. In this chapter, the conceptual design framework will be developed after considering the previous chapter (2 and 3) outcomes.

5.2 ERS response framework for flash floods in SA

WordNet (2003) describes that a framework is a theoretical account or model of a phenomenon. It might likewise relay to ‘a structure for supporting or enclosing something else, especially a skeletal support used as the basis for something being constructed; a fundamental structure, as for a written work; and a set of assumptions, concepts, values, and practices that constitutes a way of viewing reality’. It must set out groups of factors that must be measured related to a specific phenomenon, as well as the recommended order or sequence in which to reflect them (Dictionary.com, 2018).

Thus, an ERS response framework for the purpose of this study will be defined as a tool for supporting aid relief workers in flash flood sites in SA in order to define the nature of the need by considering the involved factors in order to mitigate the impact of an incident on the public and the environment. To make an ERS response appropriate, it should reflect the needs, as well as the environmental, economic, technical and sociocultural contexts of the flood-affected community (IFRC/RCS, 2013; UNHCR, 2018). It may also be used as the basis for searching the database for possible ERS solutions simply and quickly. During an emergency, quick and effective action is required. If appropriate action is not taken, or if the response is delayed, lives, resources, houses and livelihoods will be needlessly lost (Abosuliman et al., 2014; Youssef et al., 2016; Ali and Ameer, 2018).

An ERS response framework is not defined in this research as a model for drawing details to build up a shelter as a product. However, it is more focused on considering the environmental, economical, technical, and sociocultural factors that are involved in designing an ERS response in order to make it more successful. As every context is different, the ERS response must be adapted to SA.

It is difficult to find a response method that could help decision-makers to make well-informed decisions about the most adequate ERS response to flash floods in Saudi Arabia (Abosuliman et al., 2014; Youssef et al., 2016; Ali and Ameer, 2018). Such a complex decision with such important potential consequences needs to be made with a degree of urgency, which places tremendous responsibility on the designers, planners and officials involved (NHHCR, 2014-2018).

After reviewing and analysing the current existing guidance and documents related to ERS in Chapters 2 and 3, it has been noticed that the approach that has been most frequently used is a decision tree, which flows through a series of yes/no questions or sets of criteria. For instance, it has been used for distributing shelter kits (IFRC, 2010), distributing plastic sheeting (IFRC and Oxfam, 2007), distributing tents (United Nations 2004), a transitional shelter programme (Shelter Centre, 2012) and as a method for shelter in an emergency (Humanitarian Aid and Civil Protection, 2016).

The approaches used for ERS responses are very practical (Cross and Roy, 1989; Massey, 2016), and they usually follow a logical sequence of stages. Each stage tends to be iterative in nature with the decision makers having to revisit a previous stage to make adjustments in order to decrease the risk of having to make expensive modifications later on in the process or, perhaps worse still, the ERS response has serious performance deficiencies. Each stage creates a certain output that can be revised before implementation. Therefore, this style will be employed and adapted in the response framework for ERS in order to help the more responsible people to make a decision quickly and appropriate.

It is hard to find a specific ERS response method from the previous shelter response methods that can be used as the ERS response for flash floods in SA. There are, however, some stages involved in the different methods that could be used in-part, such as considering the factors

that help to provide an appropriate ERS response and evaluating the stages to reach the final decision for an ERS response. Thus, the author will develop the first stage of the ERS response framework by considering the factors with questions to be addressed by responsible people in order to identify the appropriate response of ERS for flash floods (this will be explained in more detail in sub-section 5.2.1) (IFRC, 2010; IFRC and Oxfam GB, 2007; United Nations, 2004; Shelter Centre, 2012; Humanitarian Aid and Civil Protection, 2016).

The ERS response in SA involves many organisations. Therefore, there needs to be a stage for gathering information from all responsible organisations in one template as this will be the second stage of the ERS response framework in order to increase the coordination level between all organisations (United Nations, 2004; IFRC and Oxfam GB, 2007; IFRC, 2010; Shelter Centre, 2012; Humanitarian Aid and Civil Protection, 2016). For the following stage, the author is considering developing a database in order to gather the ERS successful responses that have been used previously in flash flood situations in SA. During an emergency, quick and effective action is required. If the appropriate actions are not taken quickly, or if the response is delayed, lives, resources, houses and livelihoods will be needlessly lost (Abosuliman et al., 2014; Youssef et al., 2016; Ali and Ameer, 2018). In addition, the use of a successful database allows for many future successful ERS responses to be included, which proves the quality of the database and so improves the response framework. Furthermore, good practice can, in this way, be recorded and used again instead of being forgotten.

The next stage will appear to show the initial results that match the needs of the current situation for ERS. However, the initial results might indicate that there is more than one solution for the ERS response. Therefore, there needs to be a stage that has research to choose from them. The most appropriate ERS responses will quickly and easily match the flood-affected victim's

needs (Trans-European and Education Networking, 2006; Battelle, 2005). The final stage will review the selected ERS response(s) with the final recommendations (Lawson, 2006).

The stages that have been developed and categorised into seven stages are: *Define the ERS response need* (IFRC, 2010; IFRC and Oxfam GB, 2007; United Nations, 2004; Shelter Centre, 2012; Humanitarian Aid and Civil Protection, 2016); *identify the basic response requirements for flash floods* (General Directorate of Civil Defence, 2018); *identify successful ERS responses and categorise them for inclusion in a searchable database* (Abosuliman et al., 2014; Youssef et al., 2016; Ali and Ameer, 2018); *create a searchable database of ERS responses* (Trans-European and Education Networking, 2006; Battelle, 2005); *create a shortlist of possible ERS responses* (Lawson, 2006); *review the shortlisted ERS responses in order to select the final ERS response(s)* (Félix et al., 2013a; United Nations et al., 2009) Milton and Rodgers, 2013) and *make a final recommendation* (Cross and Roy, 1989). The seven stages have been illustrated in Figure 5-1 and explained in more detail below.

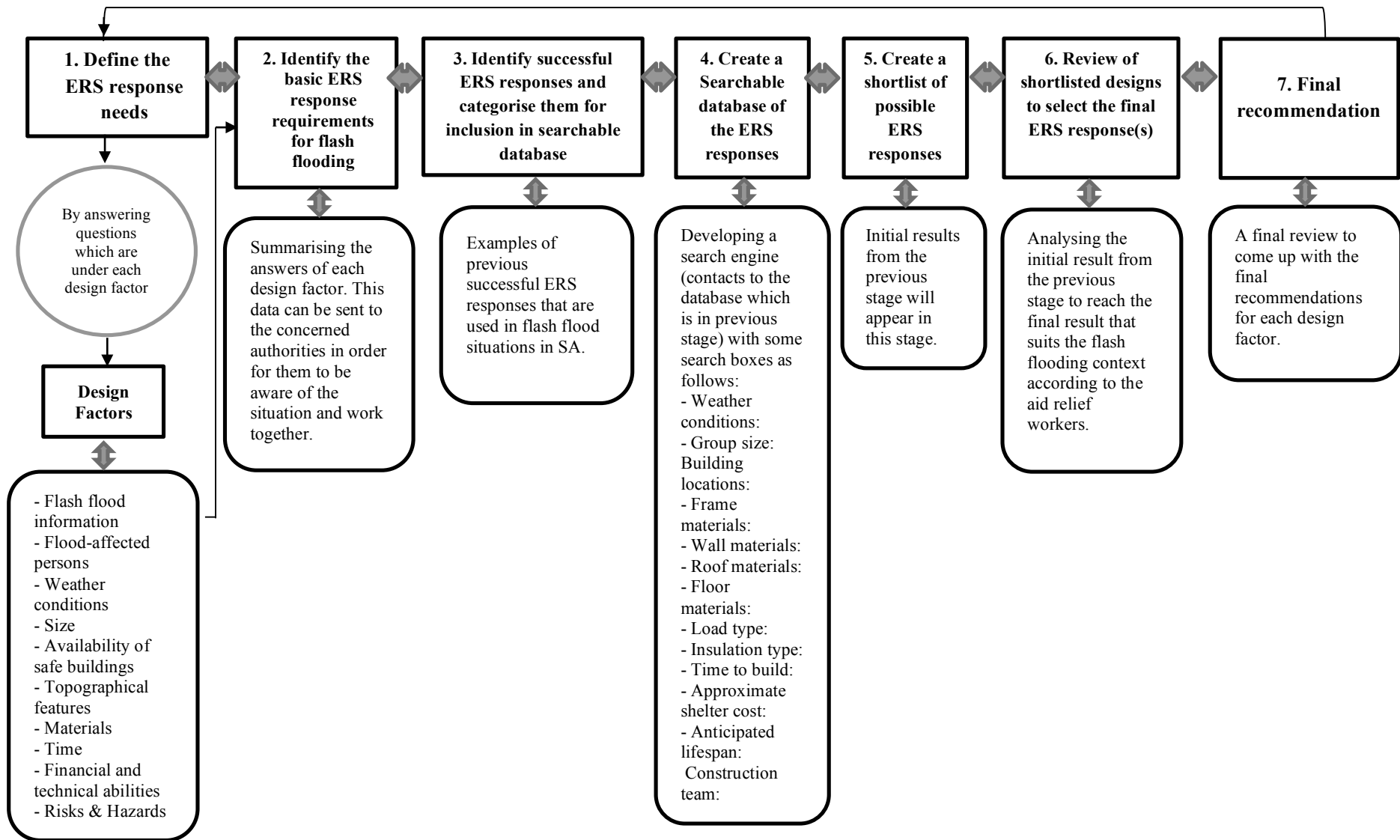


Figure 5-1: The conceptual ERS response framework for flash floods in SA

5.2.1 Stage 1. Define the ERS response need

To make an ERS response appropriate, it should reflect the factors that are related to the flood-affected population's needs, and the environmental, economic, technical and sociocultural contexts (IFRC/RCS, 2013). As every context is different, the ERS response must be adapted to SA. After reviewing the literature related to ERS (addressed in Chapter 2) and critically evaluating the existing shelter response methods (addressed in Chapter 3), there are some factors that can be chosen in order to make the ERS response more appropriate and successful. The chosen factors have been identified through several stages according to Tesch (2013) and Bryman and Bell (2015). These stages include the underlying meaning, a gathering of a list of all factors that are derived from the study, the grouping of these factors, coding the factors, detailing the factors with the goal of rotating them into certain headings and defining their interrelationships and lastly, making a final choice on the coding of the headings.

Those headings are:

- *Considering flash flood information* (Johnson, 2007; IFRC/RCS, 2013; IFRC and OCHA, 2015; Alamri, 2010; Youssef et al., 2016; Abdalla, 2018);
- *Flood-affected persons' conditions* (United Nations, 2004; Johnson, 2007; Shelter Centre, 2012; IFRC/RCS, 2013; Humanitarian Aid and Civil Protection, 2016; IFRC, 2010; IFRC and Oxfam GB, 2007; UNHCR, 2007; IOM et al., 2015; UNHCR, 2018; United Nations et al., 2009; Félix et al., 2013a; Rajib, 2016; Camp Coordination/Camp Management, 2010; World Vision, 2016);
- *Weather conditions* (United Nations, 2004; Johnson, 2007; Shelter Centre, 2012; IFRC/RCS, 2013; Humanitarian Aid and Civil Protection, 2016; IFRC and Oxfam GB, 2007; Corsellis and Vitale, 2005; Félix et al., 2015);

- *Size* (Gray and Bayley, 2015; The Sphere Project, 2011; Shelter Centre and Norwegian Refugee Council, 2010; IFRC/RCS, 2013; IFRC and Oxfam GB, 2007; UNHCR, 2018);
- *Availability of safe buildings* (United Nations, 2004; Shelter Centre, 2012; IFRC/RCS, 2013; IFRC and Oxfam GB, 2007; International Recovery Platform et al., 2013; Davidson et al., 2007; Camp Coordination/Camp Management, 2010; Zhao, L. et al., 2017);
- *Topographical features* (Johnson, 2007; Shelter Centre, 2012; IFRC/RCS, 2013; IFRC and Oxfam GB, 2007; May, 2013; NHHCR, 2014-2018; European Civil Protection and Humanitarian Aid Operations, 2018);
- *Materials* (United Nations, 2004; Johnson, 2007; Shelter Centre, 2012; IFRC/RCS, 2013; Humanitarian Aid and Civil Protection, 2016; IFRC, 2010; IFRC and Oxfam GB, 2007; Kats and Alevantis, 2003; Davis and Lambert, 2002; Sever and Altun, 2009; IRP and ISDR, 2011; Arslan and Cosgun, 2008; Karunasena and Amaratunga, 2015; Saunders, G., 2011; IOM et al., 2015; The World Bank, 2016);
- *Time* (United Nations, 2004; Shelter Centre, 2012; IFRC/RCS, 2013; Humanitarian Aid and Civil Protection, 2016; IFRC and Oxfam GB, 2007; United Nations et al., 2009; Félix et al., 2015; Department for Communities and Local Government, 2017);
- *Financial and technical abilities* (United Nations, 2004; Shelter Centre, 2012; IFRC/RCS, 2013; Humanitarian Aid and Civil Protection, 2016; IFRC, 2010; IFRC and Oxfam GB, 2007; Hendriks et al., 2016; UNHCR, 2018); and
- *Risks and hazards* (Shelter Centre, 2012; IFRC/RCS, 2013; Humanitarian Aid and Civil Protection, 2016; Smilowitz et al., 2006; Oxfam, 2012; Davis and Lambert, 2002; Hayat et al., 2018) (will be explained in more details later on).

In addition, under each factor, there are several questions as seen in Figure 5-2. Some of the questions are closed in nature, inviting a short focused answer, which means selecting one or more options. These closed questions are easy to answer. Some of them, however, are open questions which need more information (as shown in Figure 5-3 through to Figure 5-11, inclusively). It is expected that this stage of the process will be handled by the aid relief workers who are responsible for decision making in a flash flood situation. As in SA, the decisions involved in the ERS response involve many organisations and each organisation will answer its related questions. After that, these factors will be ranked in order of their preferential scores, according to the preferences of the specialists and the flash flood situation (Sever and Altun, 2009). In addition, the answers provided will create basic ERS response requirements going forward into the next stage which will assist the aid relief workers in arriving at the most appropriate response for ERS. The ten factors have now been discussed in more detail below.

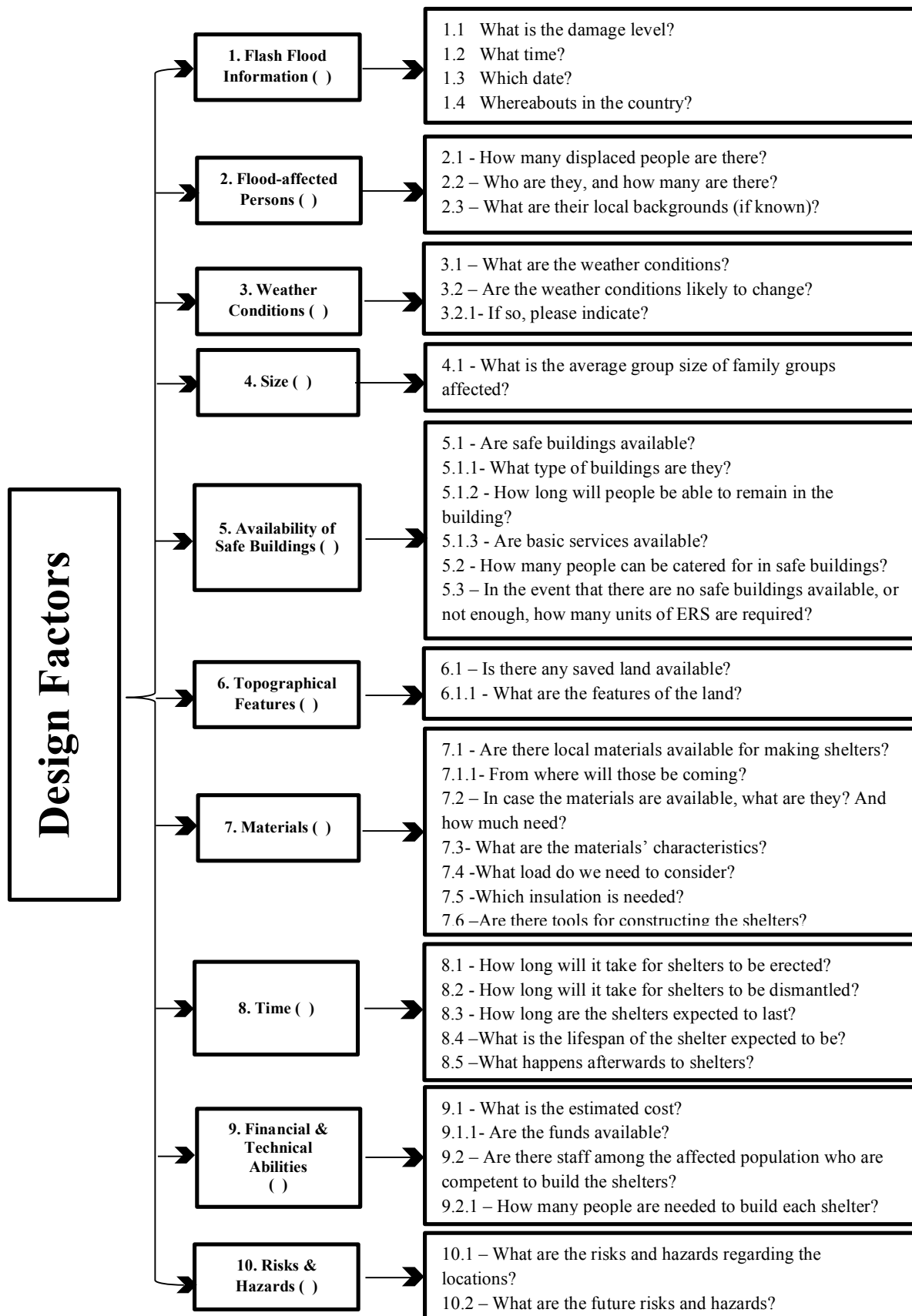


Figure 5-2: Factors influencing possible responses to flash flooding

5.2.1.1 Flash flood information

There are many different types of flood including coastal, urban, river, pond and flash floods. The most severe type of flood in SA is a flash flood, which happens according to continuous heavy rain (Alamri, 2010; Youssef et al., 2016). It causes injury and death, damage to personal property including dwellings and cars (by increasing the level of water), the breakdown of communities and damage to the environment (Youssef et al., 2016; Abdalla, 2018). Therefore, it is important to know the level of the damage caused by the flash flood and also to account for the period of the flash flood and its location (IFRC/RCS, 2013; IFRC and OCHA, 2015), as shown in Figure 5-3.

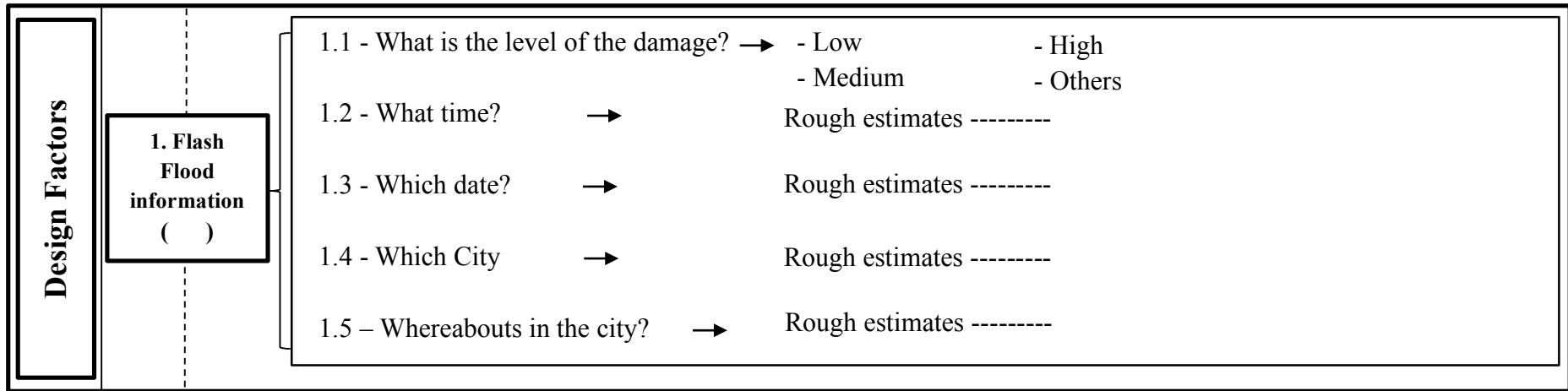


Figure 5-3: Flash flood information factor.

5.2.1.2 Flood-affected persons

To build ERS for a flood-affected community is a complex task. It involves a range of social, cultural and economic considerations. A carefully responded, fit-for-purpose ERS can have a great effect. It allows people to lead their lives in a safe, supportive and culturally appropriate setting (UNHCR, 2007; IOM et al., 2015; UNHCR, 2018). Thus, the users should engage in the proposed ERS solutions and their point of view should be considered (United Nations, 2004; IFRC and Oxfam GB, 2007; Humanitarian Aid and Civil Protection, 2016). The ERS solutions does not need to be a remarkable architecture (Félix et al., 2013a; United Nations et al., 2009). There are many more important factors that also need to be considered such as age, sex, vulnerability (with particular needs, for instance, by the persons affected by chronic disease, persons with disabilities or older persons) (Rajib, 2016; NHHCR, 2014-2018), ethnicity, customs, traditions, and/or political features of the host community and the displaced populations, as illustrated in Figure 5-4 with the relevant questions (Camp Coordination/Camp Management, 2010; The World Bank, 2016).

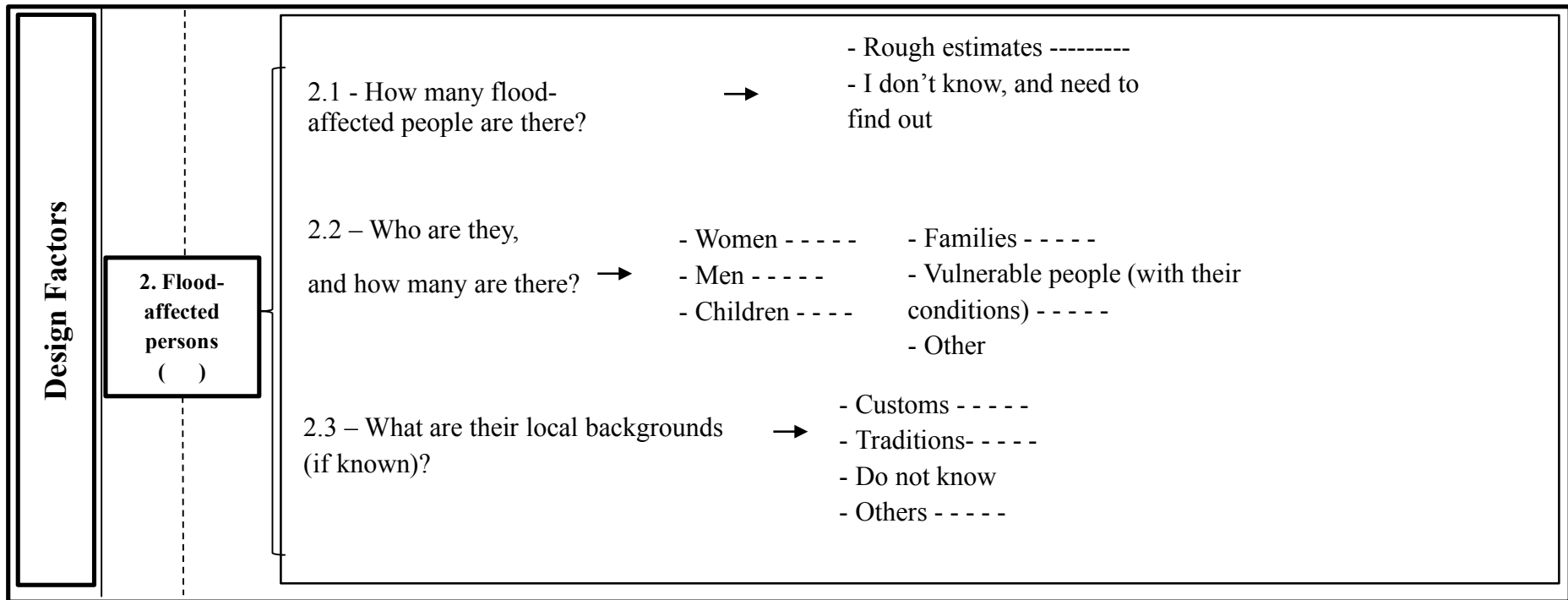


Figure 5-4: Flood-affected persons factor.

5.2.1.3 Weather conditions

The weather differs considerably between potential flash flooding sites and throughout the different seasons experienced in SA. This needs to be considered before selecting the type of ERS response (Félix et al., 2015; Humanitarian Aid and Civil Protection, 2016). People in different regions who experience different climates might discover different that types of ERS are more comfortable and appropriate for their respective conditions (IFRC and Oxfam GB, 2007). Weather conditions that prevail may be, for example, sunny, cloudy, dry, wet, windy or snowy or a mixture of some or all of these.

The most common climate conditions in SA are, in the North and South, hot-humid and hot-dry in the West and East. Each of them requires precise and particular ERS preparations. First of all, flood-affected populations in cold conditions must be kept well off the ground with mattresses (United Nations, 2004; Corsellis and Vitale, 2005). They must also have stoves and fuel accessible and must be provided with appropriate blankets and clothing (IFRC, 2010). Air gaps should be reduced so as to make the space warm and free of drafts. The second type is hot-humid weather. In this case, ventilation and shade from the sun is suggested. Finally, for hot-dry weather conditions, the aid workers should consider likely drops of temperature, mostly at night time, in open spaces like deserts and in spaces at a great altitude. Ventilation and shade from the sun is also important (United Nations, 2004). Therefore, it is very important to know the current climate conditions in a flash flood situation (as shown in the Figure 5-5; the variety of options when it comes to the weather conditions), the requirements that they impose in terms of response and any likely climate changes that may occur during the ERS response period.

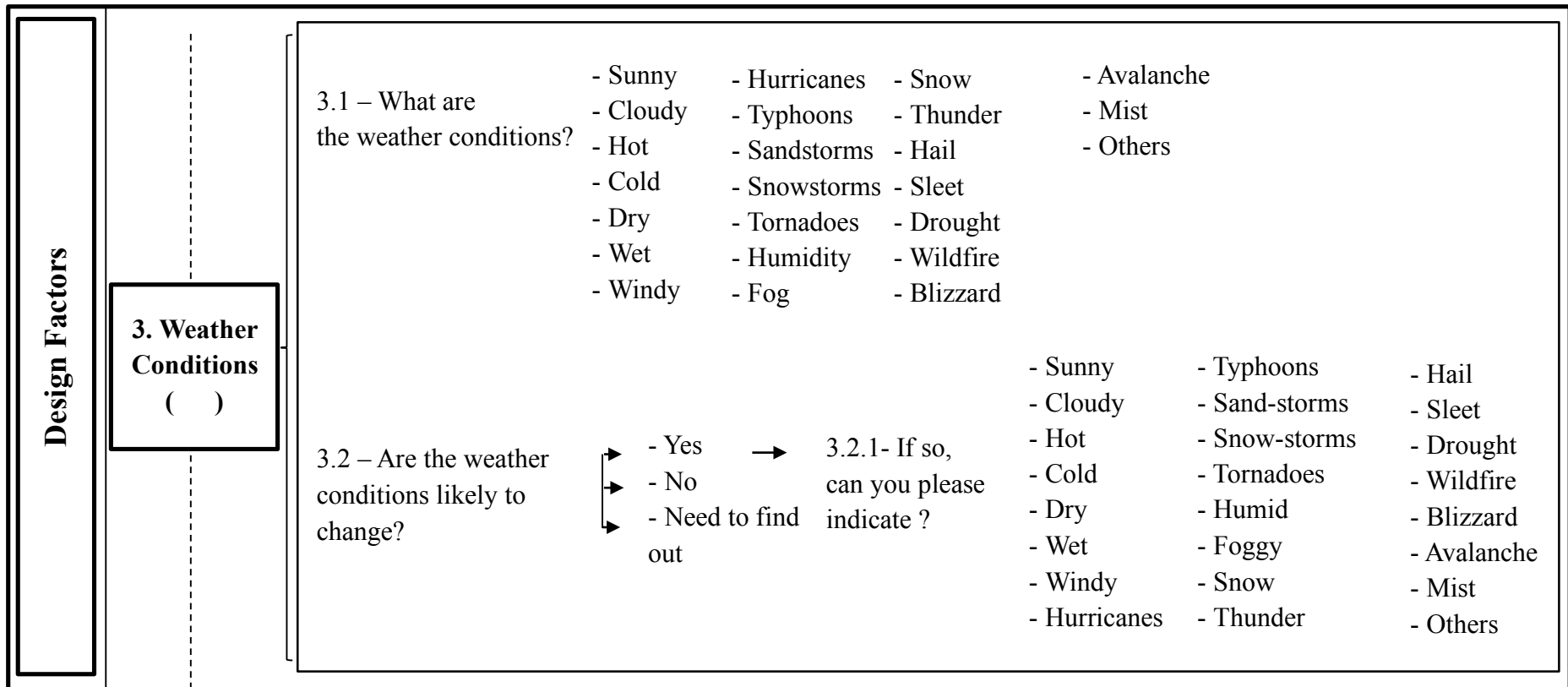


Figure 5-5: Weather conditions factor.

5.2.1.4 Size

It is important to know the approximate number of flood-affected people and their living patterns to help to provide sufficient amounts of material, while meeting at least the minimum standards for floor area (UNHCR, 2007; UNHCR, 2018). A minimum of 4.5m² to 5.5m² covered living space per individual is required in cold temperatures, counting bathing facilities and kitchen, as more time will be spent inside the ERS for cooking and eating. There should be 2m high ceilings so as to reduce the heated space (IFRC and Oxfam GB, 2007; IFRC/RCS, 2013).

A minimum area of 3.5m² covered living space is needed per person in warm weather, without kitchen or cooking facilities. This is assuming that cooking activities will take place outdoors. There should be a minimum height of 2m at the highest point (Gray and Bayley, 2015; The Sphere Project, 2011; Shelter Centre and Norwegian Refugee Council, 2010). Therefore, it is important to clarify the average size of the affected households (see Figure 5-6). In cold weather, the area provided per family should be 27m² for a family of six, 22.5m² for a family of five or 18m² for a family of four. In hot-humid and hot weather, the size per family is as much as 21m² for a family of six, 17.5m² for a family of five or 14m² for a family of four. The ERS response ought to, if possible, allow for change by its users to suit their specific needs.

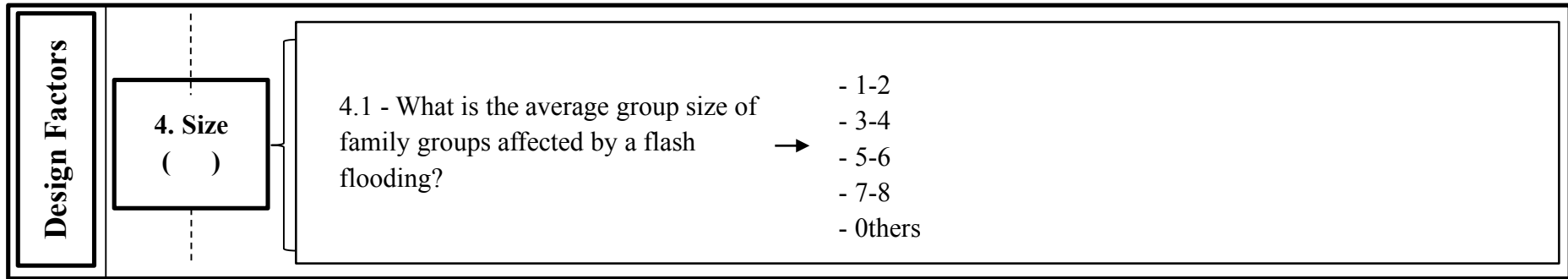


Figure 5-6: Size factor.

5.2.1.5 Availability of safe permanent buildings

Most of the time, the emergency shelter phase does not need to construct or supply any kind of new emergency shelters because it only refers to the aftermath of the flash flood (United Nations, 2004; International Recovery Platform et al., 2013; Zhao, L. et al., 2017). Therefore, existing big spaces such as stadiums, sports halls, religious buildings (such as mosques) or hotels may be options for shelter for short-term use by flood-affected victims (see Figure 5-7) (IRP and ISDR, 2011; Shelter Centre, 2012). In this case, public expenditure will be minimised and can instead be allocated to the development of permanent houses, rather than spent on new emergency shelters (Davidson et al., 2007; Camp Coordination/Camp Management, 2010; International Recovery Platform et al., 2013).

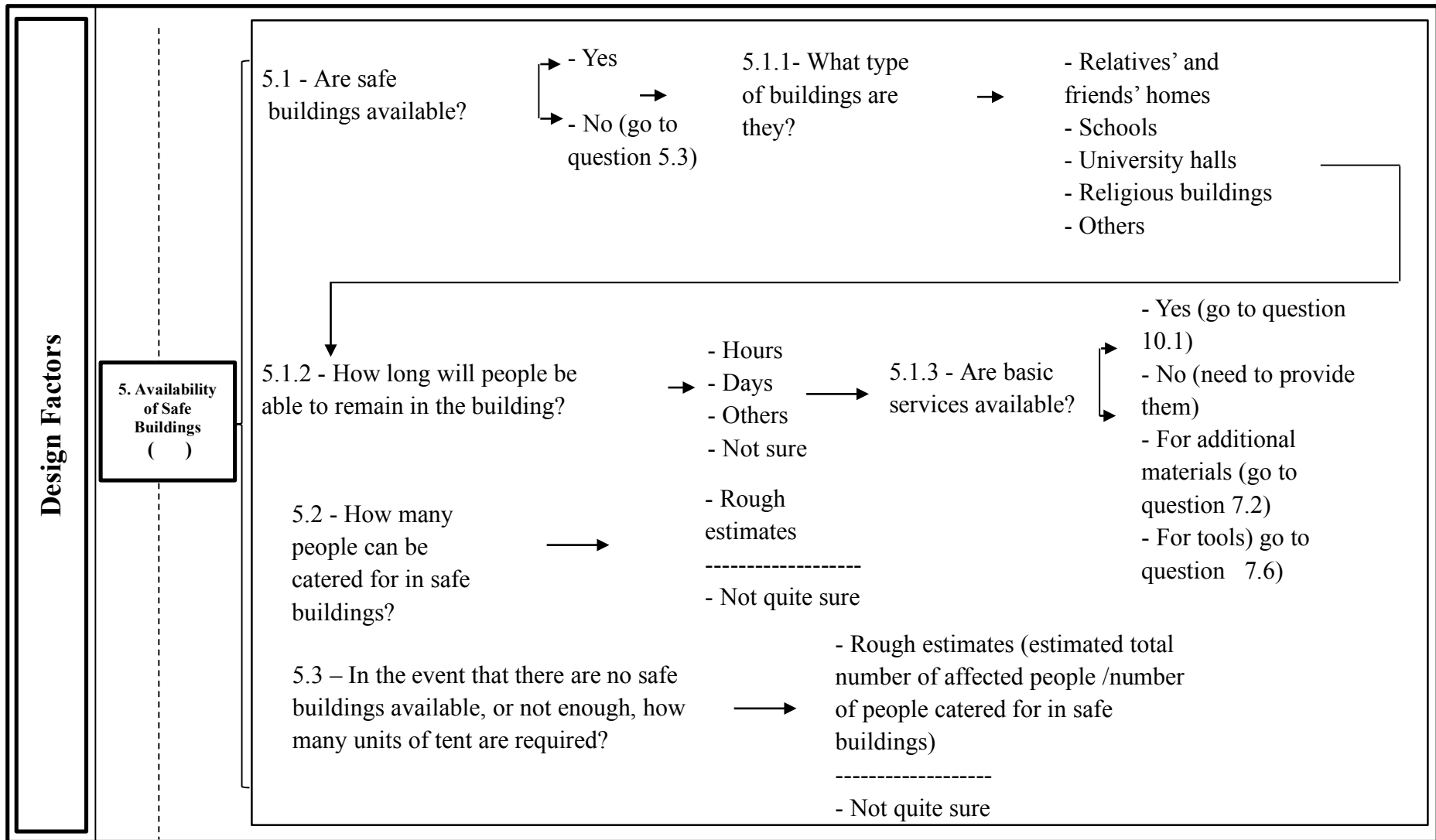


Figure 5-7: Availability of safe buildings factor.

5.2.1.6 Topographic features

Although the selection of land is often tightly constrained to building new emergency shelters where no safe buildings are available, the site of an emergency shelter is frequently more significant than its design (Johnson, 2007; Zhao, X. et al., 2017). Badly sited emergency shelters can increase the risks faced by users, while well-sited emergency shelters can decrease exposure to threats (IFRC and Oxfam GB, 2007). The preparation of the pre-selected areas used for siting emergency shelters is an important aspect of the action plan for responding to a flash flood in an area highly exposed to such contingencies. Furthermore, it is important to consider the accessibility and availability of basic services (Camp Coordination/Camp Management, 2010). Most flood-affected individuals prefer to stay in or close to their homes whenever possible (Shelter Centre, 2012; IFRC/RCS, 2013).

Before specifying the emergency shelter, care must be taken to ensure that the location where people will reconstruct is harmless and that all flood-affected populations feel protected and secure (IFRC and Oxfam GB, 2007; European Civil Protection and Humanitarian Aid Operations, 2018). The main criteria for location determination for emergency shelter includes the availability of water, ease of access (by port, road, or airport), a good drainage system (least 2% slope), sufficient circumstances for sanitation and a strategic site to assist in the purposes of the operation (UNHCR, 2007; May, 2013). If accessible, stones should be located at the emergency shelter base to allow for the development of drainage (IFRC, 2010). Therefore, the location of ERS should be decided upon carefully and areas about which there are any uncertainty should be avoided (see Figure 5-8). In cases where there is insufficient public land, an agreement should be made with private owners to avoid any confusion later on (UNHCR, 2014-2018).

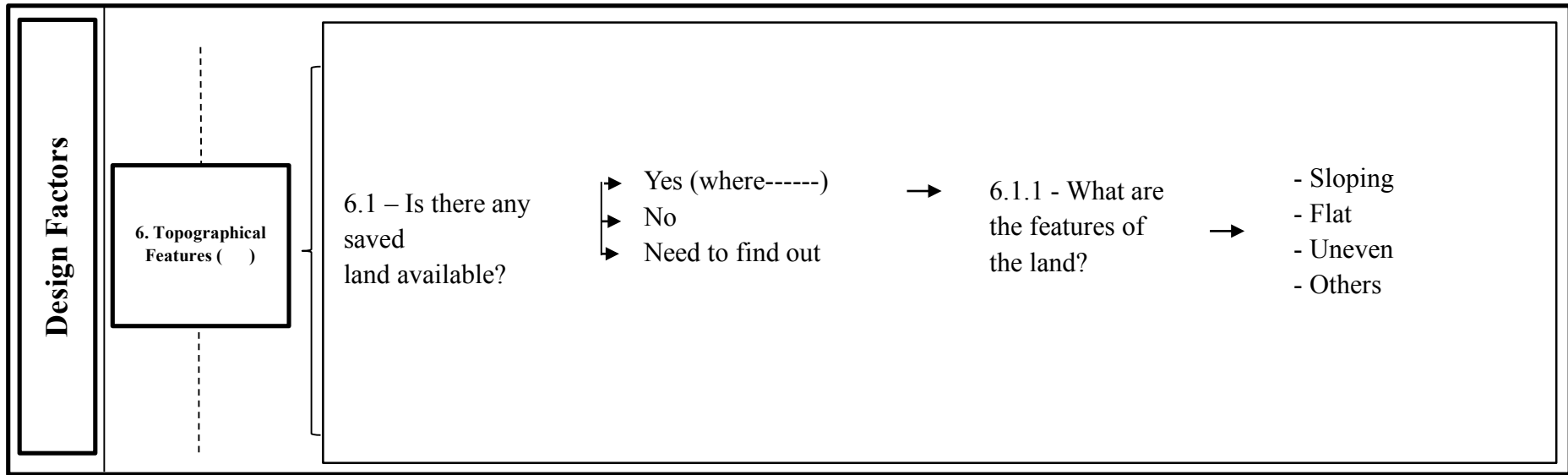


Figure 5-8: Topographical features factor.

5.2.1.7 Materials

Concerns regarding emergency shelter materials ought to include their cost, quality, suitability, the local availability of materials, local knowledge and experience in using the materials, their influence on local marketplaces and the environmental influence of the materials (IRP and ISDR, 2011; Shelter Centre, 2012). The quantity of whole components needs to be reduced (Sever and Altun, 2009). The emergency shelter structure should be capable of withstanding the weight of the coverings and other outside stresses such as the force of the flash flood (IFRC, 2010; IFRC/RCS, 2013).

There are a significant number of different materials that can achieve the aforementioned requirements. For frames, steel, or timber can be used. For walls, plastic sheets, plywood sheathing, or timber can be used. For roofing, plastic sheets, metal, timber may be used. For flooring, plywood may be used (Davis and Lambert, 2002; IFRC and Oxfam GB, 2007; Humanitarian Aid and Civil Protection, 2016).

The emergency shelter materials must be easy to upgrade, recycle, re-sell, reuse and relocate after use (Shelter Centre, 2012; Kats and Alevantis, 2003). Arslan and Cosgun (2008) define an ERS as “recycled” when it can either, in part or as a whole, be rebuilt from disassembled materials. In order to make an emergency shelter more environmentally-friendly, it is very important to know how durable the emergency shelter is and how beneficial it can be regarding offering alternative future use. Emergency shelters might have a lower impact on the environment if they are designed and planned with a dual function in mind (Karunasena and Amaratunga, 2015). Otherwise, emergency shelters that are difficult to reuse and upgrade are likely to take up more resources, create more waste and consequently have a bad effect on the environment.

An emergency shelter's ability to resist a flash flood hazard is based on its design. There are several loads which need to be considered, such as wind load, snow load, gravity load or dead load, live load, and flood load. Furthermore, it is generally agreed that ERS must be designed with materials for thermal, fire and noise insulation as well as protection from the weather (Saunders, G., 2011; IOM et al., 2015).

Providing relief items to survivors in the early stages helps them to start the shelter process themselves, instead of waiting for the delivery of ready solutions such as tents. Items and tools also help them to be able to recover their broken homes from their surroundings, including whatever useful items they are able to access. Relief items are, for example, tarpaulins, ropes, handsaws, nails, shovels, hoes, machetes, shears, tie wires, claw hammers and packaging (IFRC, 2010). Relief items may be provided in cash as well (The World Bank, 2016). All of these have been considered in Figure 5-9.

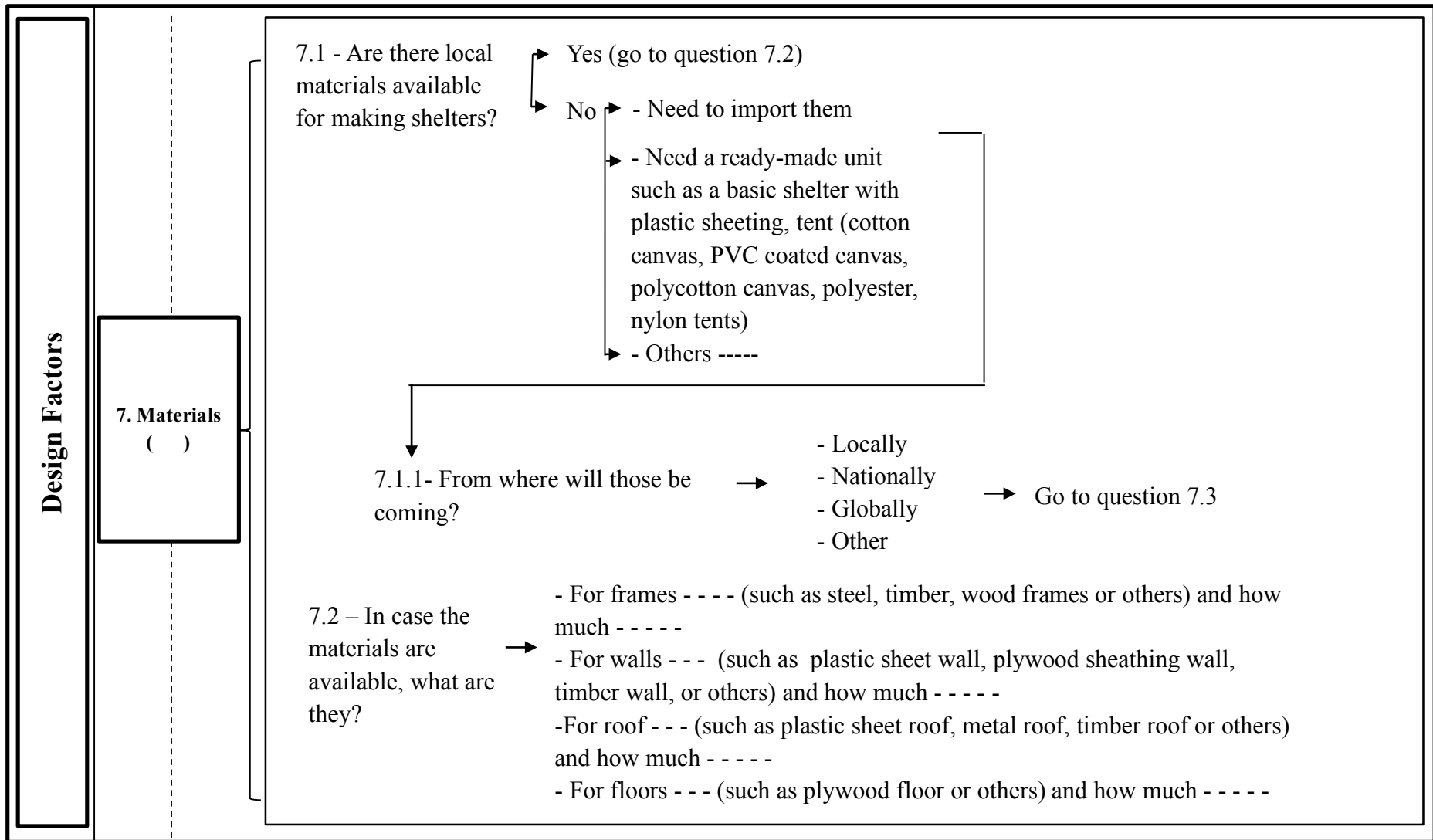


Figure 5-9: Materials factor.

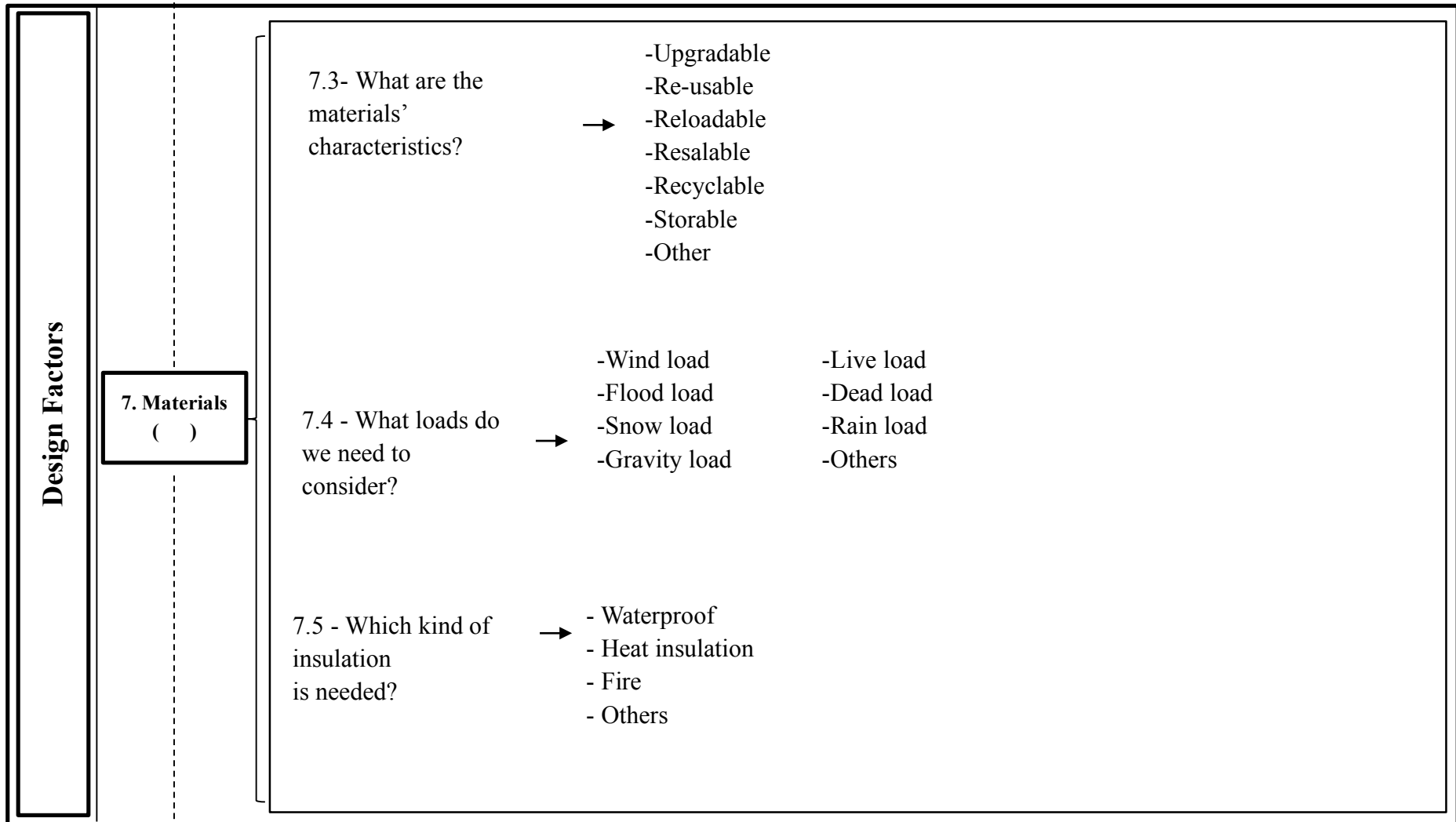


Figure 5-9: Materials factor (continued).

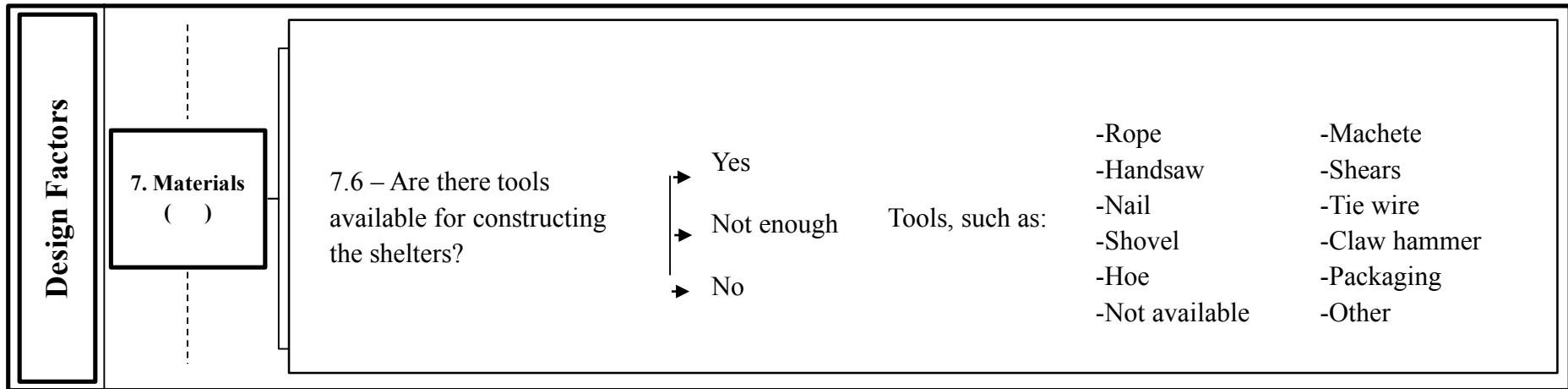


Figure 5-9: Materials factor (continued).

5.2.1.8 Time

In sheltering flood-affected victims during an emergency, the timeline is of the utmost importance (United Nations et al., 2009; United Nations, 2004). When it comes to using permanent buildings, many buildings will be required for their primary purpose. In the case of building new emergency shelters, the faster a structure can be provided or built, the more that flood-affected victims will be sheltered (IFRC/RCS, 2013; Félix et al., 2015). Emergency shelters need to be made of construction materials that can be installed quickly with less dependence on highly skilled labour. Furthermore, a quickly built structure benefits from rapid repairs and reduced call-backs (Johnson, 2007; Shelter Centre, 2012). For ERS to be easy to erect and dismantle and to fulfil a number of purposes and functions, it needs to be lightweight and consist of a small number of components.

Certain forms of emergency shelter, such as structures with plastic sheets, are easily constructed for a short life span and then dismantled (Department for Communities and Local Government, 2017). If the emergency shelter design is complicated, then it will need more resources and training to construct it, leading to possible delays and a lack of provision of emergency shelters for people who are in a very vulnerable situation. Thus, it is important to guarantee that emergency shelters will be created and dismantled on time when developing or evaluating designs. In addition, what will happen to the emergency shelters when they are no longer needed (whether they will be re-used, stored or sold) should also be considered (IFRC and Oxfam GB, 2007; Humanitarian Aid and Civil Protection, 2016) (see Figure 5-10).

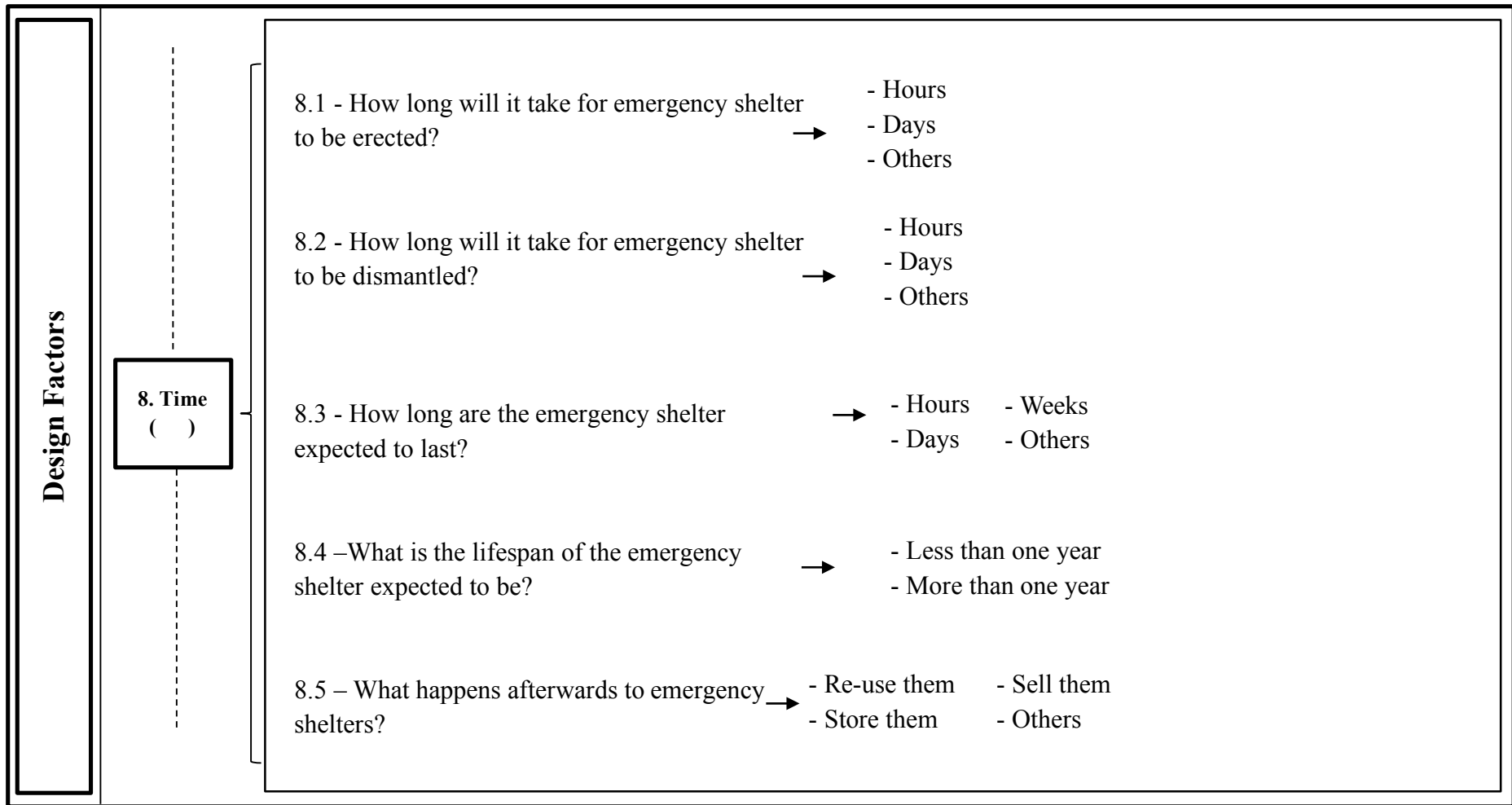


Figure 5-10: Time factor.

5.2.1.9 Financial and Technical abilities

There are important differences in the cost of ERS between the response solutions (Humanitarian Aid and Civil Protection, 2016; Hendriks et al., 2016). Before new structures are built, a need for them should be clearly established through a properly informed assessment. For example, people might find their own shelter with relatives or friends, make temporary repairs to their damaged homes or use public or private buildings, so new shelters might not be needed which save a lot of money (IFRC and Oxfam GB, 2007; International Recovery Platform et al., 2013).

Once the price per ERS has been assessed, the price of each unit should be compared with the disposable income of both the displaced and host people (United Nations et al., 2009; IFRC/RCS, 2013). Information on all matters such as the estimated cost, from where it can be procured, who will be running the responses - whether public organisations, private organizations (such as humanitarian agencies) or/and NGOs (such as aid agencies), and the availability of local competent people among survivors to build ERS (for example carpenters, electricians, plumbers, and so on) needs to be ascertained (IFRC, 2010; Shelter Centre, 2012) (see Figure 5-11). Training should be provided in cases where skills are needed (UNHCR, 2018).

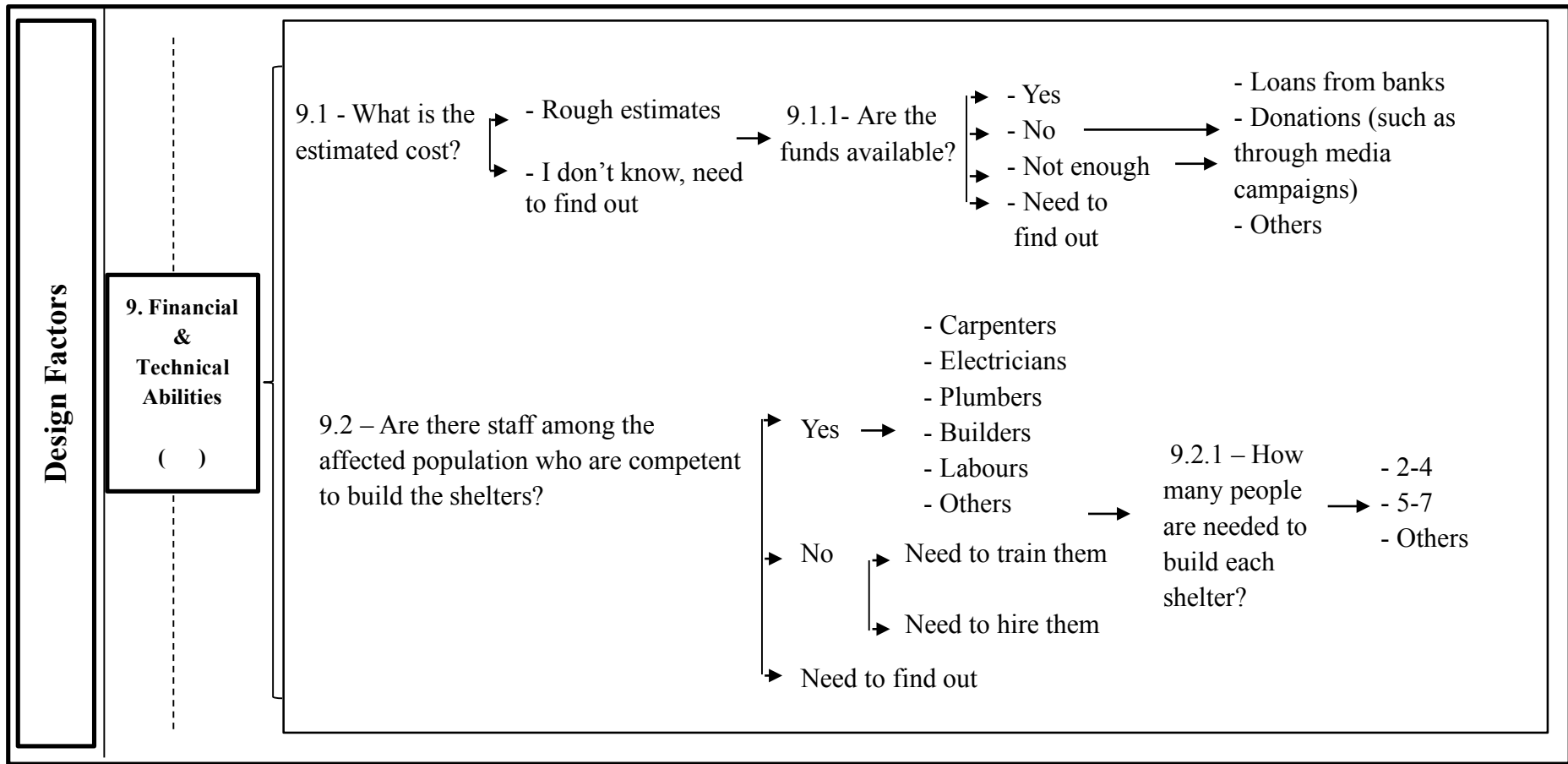


Figure 5-11: Financial and technical abilities factor.

5.2.1.10 Risks and hazards

A structure used to provide ERS must be designed to protect its users from the risks and hazards arising from flash flood events (IFRC and Oxfam GB, 2007; Humanitarian Aid and Civil Protection, 2016). Effective mitigation and preparedness can greatly reduce the threat posed by flash floods (IFRC/RCS, 2013; Hayat et al., 2018) (see Figure 5-12). As each type of hazard has its own specific features, ERS for flash floods should be raised above ground level (Camp Coordination/Camp Management, 2010; Smilowitz et al., 2006; Oxfam, 2012).

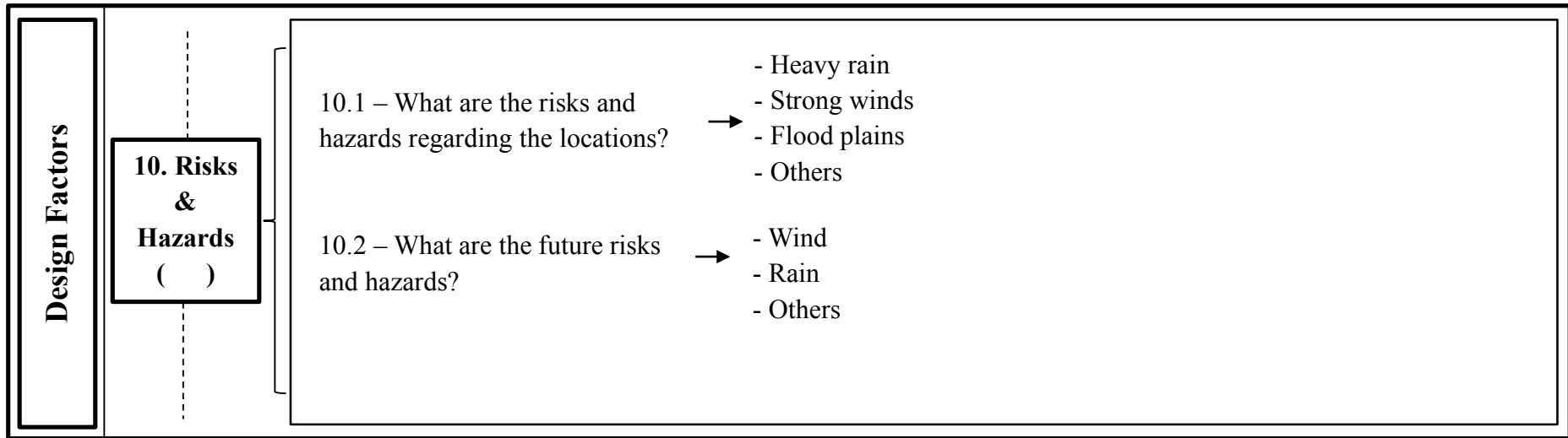


Figure 5-12: Risks and hazards factor.

5.2.2 Stage 2. Identify the basic ERS response requirements for a flash flood situation

The main ERS response requirements for a flash flood will be identified once the questions covering all of the design factors have been answered by the responsible organisations. After the response requirements have been identified for ERS, they can be used for researching similar ERS responses from the previous flash flood scenarios (as shown in the next stage in details) and used as a data as a record, for sharing with other organisations and/or future studies.

5.2.3 Stage 3. Identify successful ERS responses and categorise for inclusion in a searchable database

In this stage of the framework, the previously successful ERS responses that have been used in previous flash flood situations in SA have been identified and categorised in terms of the potential answers to the questions posed in stages 1 and 2. It is proposed that all of the potential ERS solutions can be stored in a searchable database. To cater for the very wide range of flash flood situations that can exist in practice in SA, a broad menu of different types of ERS response is required. Such a database can be extended, added to and updated by including further successful ERS responses in SA to flash flood solutions in the future. The literature describing each of these ERS responses contains information such as the weather conditions, group size, building and/or emergency shelter centre locations, materials, load type, insulation type, the time needed to build, approximate shelter cost, anticipated lifespan, construction team, the ERS description and drawings.

5.2.4 Stage 4. Create a searchable database of ERS responses

This stage of the framework makes use of a search engine in which the framework user can use the answers to the questions posed earlier, in the form of keywords, flags or tags as appropriate (Trans-European and Education Networking, 2006; Battelle, 2005). The search engine contains several search boxes (including weather conditions, group size, building and/or emergency shelter centre location, materials, load type, insulation type, time to build, approximate shelter cost, anticipated lifespan and construction team). Some of these have options in order to make

it easier for the relief agencies to choose an appropriate answer. These have been illustrated in Figure 5-13.

Search boxes	<ul style="list-style-type: none"> - Weather conditions: - Cold - Hot - Sunny - Cloudy - Dry - Wet - Windy - Snow - Hot-humid - Others
	<ul style="list-style-type: none"> - Group size: - 1-2 - 3-4 - 5-6 - 7-8 - Others
	<ul style="list-style-type: none"> - Materials: - For frames (bamboo, timber, wood frames, others) - For walls (plastic sheet wall, plywood sheathing wall, timber wall, others), - For roof (plastic sheet roof, metal roof, timber roof, others) - For floors (plywood floor, others) - Others
	<ul style="list-style-type: none"> - Building and/or emergency shelter centre's location:
	<ul style="list-style-type: none"> - Load type: - Wind load - Flood load - Snow load - Gravity load - Others

Figure 5-13: Research boxes.

Search boxes	<ul style="list-style-type: none"> - Insulation type: - Waterproof - Fire - Heat insulation - Others
	<ul style="list-style-type: none"> - Time to build: - Hours - Days - Others
	<ul style="list-style-type: none"> - Approximate shelter cost: - Approximately - - -
	<ul style="list-style-type: none"> - Anticipated lifespan: - Less than one year - More than one year - Others
	<ul style="list-style-type: none"> - Construction team: - 2-4 - 5-7 - Others

Figure 5-13: Research boxes (continued).

5.2.5 Stage 5. Create a shortlist of possible ERS responses

After entering the information in the previous phase (the ‘Create a searchable database of ERS response’ phase) in each or some of the research boxes (including weather conditions, group size, building and/or emergency shelter centre locations, materials, load type, insulation type, time to build, approximate shelter cost, anticipated lifespan and construction team), the initial results will show up in this stage.

5.2.6 Stage 6. Review the shortlisted ERS responses to select the final ERS response(s)

In this stage, the initial results in the previous phase (the ‘Create a shortlist of possible ERS response(s)’ phase) will be analysed to reach the final result that matches the flash flooding context as seen by the aid relief workers and engaged users.

5.2.7 Stage 7. Final recommendations for the ERS response(s) to flash flooding

Further adjustments may be required (Cross and Roy, 1989) to increase the level of quality and at the same time, to reduce costs and the risk of delay or failure. The considerations made lead, potentially, to adjustments as illustrated in Figure 5-14.

Final recommendations	<p>1. Flash flood information ()</p> <p>1.1 - level of damage: -----</p> <p>1.2 - Time: -----</p> <p>1.3 - Date: -----</p> <p>1.4 - Country: -----</p> <p>1.5 - Region: -----</p>
	<p>2. Flood-affected persons ()</p> <p>2.1 - Number of displaced persons: -----</p> <p>2.2 - They are:</p> <ul style="list-style-type: none"> - Women: ----- - Men: ----- - Children: ----- - Family: ----- - Vulnerable people: ----- <p>2.3 - Local background:</p> <ul style="list-style-type: none"> - Customs ----- - Traditions ----- - Others -----

Figure 5-14: Final recommendations.

Final recommendations	<p>3. Weather conditions ()</p> <p>3.1 - Type of climate:</p> <p>-----</p> <ul style="list-style-type: none"> - Considerations in cold weather such as: <ul style="list-style-type: none"> - Keeping the ERS warm inside. - Protection from the ground (e.g. mattresses). - Reducing air gaps. - Reducing infiltration heat losses. - ----- - Considerations in hot-humid weather such as: <ul style="list-style-type: none"> - Ventilation. - High ceiling - Keeping the ERS cold inside. - Material should be rot-proofed. - Considerations in cold weather: <ul style="list-style-type: none"> - ----- - Considerations in hot weather such as: <ul style="list-style-type: none"> - Ventilation - Shade from the sun. - Flysheet and bed net - Keeping the ERS cold inside. - ----- - Size per person in different weathers such as: <ul style="list-style-type: none"> - In cold weather 4.5m². - In hot and hot-humid weathers 3.5 m². - Others----- <p>3.2.1 - Next weather condition:</p> <p>-----</p>
------------------------------	--

Figure 5-14: Final recommendations (continued).

Final recommendations	<p>4. Size ()</p> <p>4.1 - Average size of family groups affected by a flash flooding:</p> <p>-----</p>
	<p>5. Availability of Safe Buildings ()</p> <p>5.1.1 - Building types:</p> <p>-----</p> <p>5.1.2 - Time of using building:</p> <p>-----</p> <p>5.1.3 - Availability of service:</p> <p>-----</p> <p>5.2 - Number of people catered for in safe buildings:</p> <p>-----</p> <p>5.3 - Number of emergency shelter units which are required:</p> <p>-----</p>
	<p>6. Topographical Features ()</p> <p>6.1 - Location:</p> <p>-----</p> <p>- It is recommended to be close to such things as:</p> <ul style="list-style-type: none"> - Their own homes - Services - ----- <p>6.1.1 - Land features:</p> <p>-----</p>

Figure 5-14: Final recommendations (continued).

Final recommendations	<p>7. Materials ()</p> <p>7.1 - Material availability: -----</p> <p>7.1.1 - Coming from: -----</p> <p>7.2 - Materials for Frames: -----</p> <p>Walls: -----</p> <p>Roof: -----</p> <p>Floor: -----</p> <p>7.3 - Material characteristics: -----</p> <p>7.4 - Type of load: -----</p> <p>7.5 - Type of insulation: -----</p> <p>7.6 - Construction tools: -----</p>
	<p>8. Time ()</p> <p>8.1 - Time for erecting the emergency shelter units: -----</p> <p>8.2 - Time for dismantling the emergency shelter units: -----</p> <p>8.3 - Time for using the emergency shelter units: -----</p> <p>8.4 - Lifespan of the emergency shelter units: -----</p> <p>8.5 - Using the emergency shelter units afterwards: -----</p>

Figure 5-14: Final recommendations (continued).

Final recommendations	<p>9. Financial and technical abilities ()</p> <p>9.1 - Estimated cost: -----</p> <p>9.1.1 - Funded by: -----</p> <p>9.2 - Condition of local people's skills: -----</p> <p>9.2.1 - Number of construction team: -----</p>
	<p>10. Risks & Hazards ()</p> <p>10.1 - Location risks and hazards: -----</p> <p>10.2 - Future risks and hazards -----</p>

Figure 5-14: Final recommendations (continued).

5.3 Summary

The ERS response framework was developed to support the staff of relief during a flash flood situation in SA in defining the nature of the ERS response need, and to be used as the means for searching the database for possible flash flood solutions so as to enable the staff to come to the right decision, and then to carry out the chosen ERS response plan of action simply and quickly with regard to the specific situation at hand. There are seven stages in this method, including: define the ERS response needed, identify the basic ERS response requirements to the flash flood, identify successful ERS responses and categorise them for inclusion in a searchable database, create a searchable database of ERS responses, create a shortlist of possible ERS responses, review the shortlisted ERS responses in order to select the final ERS response(s) and make a final recommendation for the ERS response(s) to the flash flood situation.

The framework has to consider the most important design factors that reflect the local needs and wants in Saudi Arabia. Help in the short term may assist with a longer-term response programme to provide decision-makers with useful relief recommendations to choose suitable ERS for flood-affected people (including flash flood information, flood-affected persons, weather conditions, size, the availability of safe buildings, topographical features, materials, time, financial and technical abilities and risks and hazards).

In the next chapter, this conceptual ERS response framework will be verified by experts who have experience and who have been involved in many flash flood situations in Saudi Arabia. Their feedback will be addressed in order to refine and develop it further.

Chapter 6 The verification of an emergency relief shelter (ERS) response framework for flash floods in SA

6.1 Introduction

Verification here is described as the process of checking, confirming, making sure and being certain. In qualitative research, verification refers to the mechanisms used during the process of research to incrementally contribute to checking and ensuring reliability and, thus, the rigor of the study (Fellows and Liu, 2015). Smith (1993) suggested that non-quantitative and hard frameworks can be verified by undertaking a qualitative approach through interviews, as a way of getting opinions and feedback on the framework used in the verification procedure. Therefore, since the ERS response framework improved in this study is qualitative, the verification process was carried out by gaining expert judgements revealed through semi-structured interviews.

6.2 Verification tool design

The verification tool considered to use to search for changes, modifications and evaluation in the ERS response framework in relation to flash floods in SA was created through the knowledge of experts (in SA) who have a high level of knowledge and experience about responding to flash flood events. The verification sheet demanded qualitative comments through open questions. Some of the questions had provided options to make them easier to answer (Oppenheim, 2000). The validation sheet has been shown in Appendix A.

The validation sheet is intended to examine whether the ERS response framework can satisfy the goal or not, with the goal being to help aid relief workers who are involved in flash flood ERS response situations in SA to define the nature of the problem as the basis of searching the database for possible solutions. This is in order to come to the right decision, and to carry out

an ERS plan of action simply and quickly so as to cover and mitigate the effects of the emergency, to protect life and to create the right circumstances for a return to routine.

This was conducted through a verification sheet which mirrors the expected features of the ERS response framework, to ascertain the insights of experts in the field. These features contain numerous components linked with the ERS response framework regarding any modifications and/or changes advised in the various stages, and the design factors themselves.

The size of the sample, as in any qualitative approach, is justly small if the focus is on achieving a good understanding of the features under investigation and on the range of responses. Consequently, a suitability sample was engaged within the qualitative investigation (Uma and Roger, 2016). The validation was conducted through semi-structured interviews. To gain an in-depth response on the ERS response framework, the experts were asked whether any modifications and/or changes were recommended in order to improve the framework.

The stages of the ERS response framework were to define the ERS response needs, to identify the basic ERS response requirements concerning flash flood, to identify successful ERS responses and to categorise them for inclusion in a searchable database, to create a searchable database of ERS responses, to create a shortlist of possible ERS responses, to review the shortlisted ERS responses in order to select the final ERS response(s) and to make a final recommendation for the ERS response(s) in the flash flooding situation. The design factors were flash flood information, flood-affected persons, weather conditions, size, the availability of safe buildings, topographical features, materials, time, financial and technical abilities, and associated risks and hazards.

6.3 Respondents

A verification sheet covering the questions for verification was given to eighteen specialists who have important knowledge in the field of flash floods. The specialists' details have been shown in Table 6-1. They occupy senior positions in their respective associations and are highly qualified. They have also done a good deal of research, and have been practitioners who have engaged with a number of flash flood situations. The verification forms were given to the specialists by hand.

Table 6-1: Details of experts interviewed to verify the ERS response framework.

No	Organisation	Tasks	Experience	Years Experience
1	Centre for Crisis and Disaster Management	Ex-director of Centre for Crisis and Disaster Management	Evacuation and sheltering	3
2	General Authority for Meteorology and Environment Protection – Disaster Management	Director of Disaster Management	Natural disasters (hazards)	5
3	General Authority for Meteorology and Environment Protection – Disaster Management	Head of Coordination and Follow-up	Natural disasters (hazards)	5
4	General Authority for Meteorology and Environment Protection – Disaster Management	Deputy Director of Disaster Management	Natural disasters (hazards)	10
5	General Directorate of Civil Defence	Director of Risk Analyses Division	Floods in western region	15
6	International Islamic Relief Organisation	Coordinator of Emergency Processes	Natural disasters (hazards) and disputes	10
7	International Islamic Relief Organisation	Director of Strategic Development Department	Strategic development for the organisation	30
8	UNHCR	Protection	Humanitarian works	20
9	Saudi Red Crescent Authority	Assistant for Emergency Affairs	Health and sheltering	33

Table 6-1: Details of the experts interviewed to verify the ERS response framework (continued).

No	Organisation	Tasks	Experience	Years Experience
10	Arab Red Crescent and Red Cross Organisation	General Secretary	Relief Internationally	30
11	Arab Red Crescent and Red Cross Organisation	General Director of International Relations and Humanitarian Media	Humanitarian Relief	35
12	Arab Red Crescent and Red Cross Organisation	Researcher of International Humanitarian Law	Humanitarian Relief	-
13	Ministry of Hajj and Umrah	Counsellor	Emergency	40
14	Jeddah Municipality	General Director of Emergency and Disasters	Floods – Jeddah	10
15	911 Centre	Director of Confrontation Disasters and Crisis Division	Floods	14
16	Emirate of Makkah region - Crisis and Disaster Management Centre	Head of Operation in Crisis and Disaster Management Centre	Floods - Jeddah	15
17	Emirate of Makkah region - Crisis and Disaster Management Centre	Deputy Manager of the Centre	Floods - Jeddah	20
18	Emirate of Makkah region - Crisis and Disaster Management Centre	Delegate of Border Guards in the Centre	Floods - Jeddah	15

6.4 Feedback from the verification exercise

The feedback of the verification sheet has been divided into three main sections. First of all, there is a general view of the response framework of ERS. The next two feedback stages were about the identified stages and design factors of the ERS response framework in terms of if there are any changes, additions, removals or priorities in terms of responding to flash floods in SA. The method of descriptive statistical analysis was engaged in by using the Excel, as explained below.

6.4.1 General view of the response framework for ERS

In this section, the general view of using response framework was on its importance, benefits and any difficulties. The questions were designed as multiple choice. The responder could choose more than one and they could also add more options drawn from their experience which were not covered in the questions.

The first chart (as illustrated in Figure 6-1) is about the meaning and understanding of the response framework for ERS by the responders. It has four options, including resolving the problem, proving the information, directing and advising. Most of them selected the ‘resolving a problem’ option. The following group said that they were between proving the information and directing. The advising option was also selected by some of the responders. From this result, it shows that the ERS response framework could help to reduce the issues (such as injuring people and losing lives, resources, houses and livelihoods) once it has been provided.

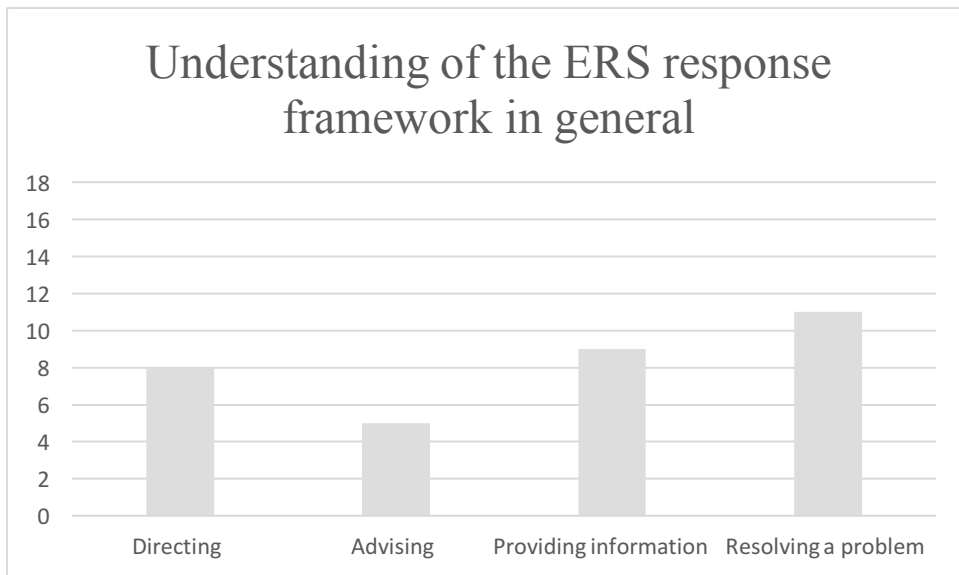


Figure 6-1: The general understanding of the ERS response framework

In terms of the importance of the ERS response framework, there are four options including unimportant, slightly important, important and very important. The majority of the responders chose the option of very important as shown in Figure 6-2. This means that the ERS response plan is very important to help responsible people to make an adequate decision when seeking to shelter flood-affected victims in safe, secure places.

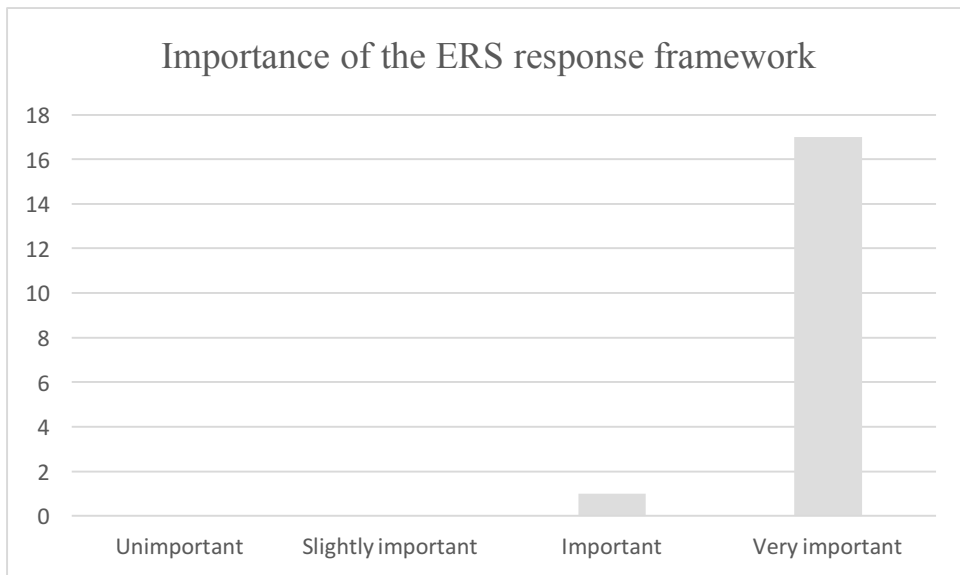


Figure 6-2: Importance of the ERS response framework

This chart (Figure 6-3) is about showing the benefits of using the response framework for ERS according to the responder's opinion. It has four main options, including helping the decision makers to provide a quick and adequate response (chosen by majority), saving lives and times (almost the second in terms of priorities) and the last option chosen was saving money because they believe that the government is rich and that the money is available. This result says that the ERS response should be provided easily and quickly as well as saving lives, money and time.

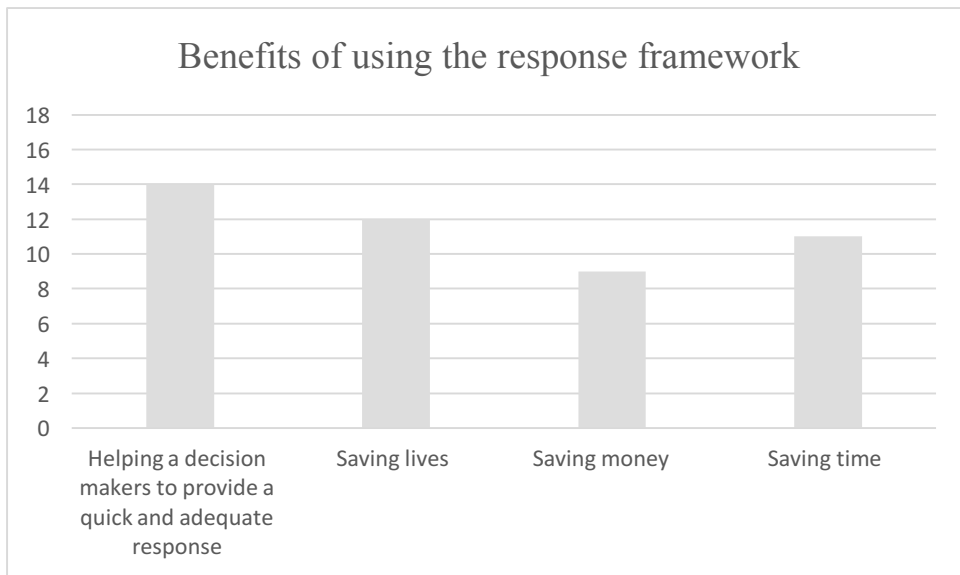


Figure 6-3: Benefits of using the response framework

The drawbacks of using the response framework for ERS in the responder’s opinion was that some of existing ERS response plans were hard to use as a first option as shown in Figure 6-4. The second option was too generic in nature, which sometimes cannot provide specific information. Some of them believed that it is time consuming. In addition, some of them had no comment because they thought that any plan can help, even if not with a lot information. Even a little information can help to save people and property.

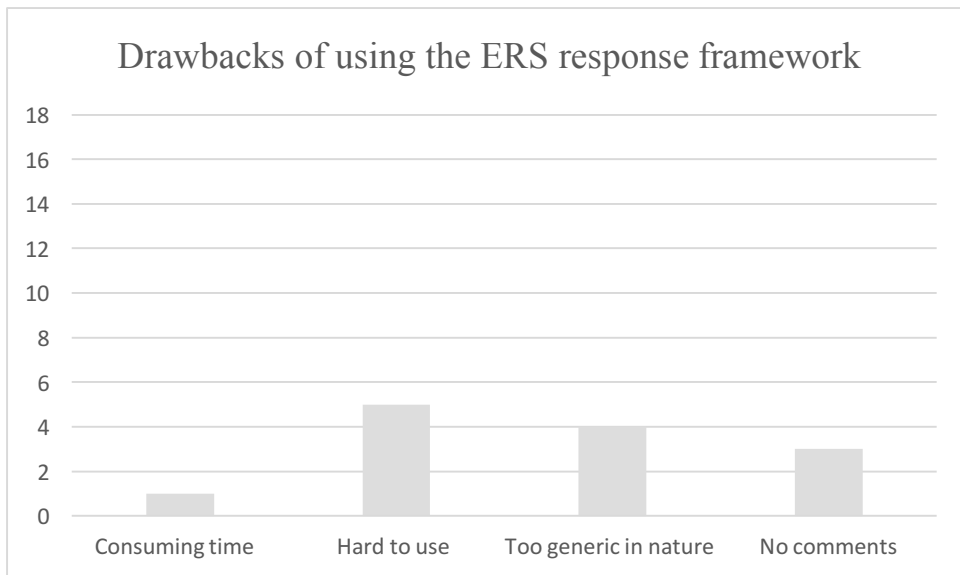


Figure 6-4: Drawbacks of using the ERS response framework

Nevertheless, some of responders gave other comments regarding the ERS response like a lack of understanding and the perception of some organisations as to how to use the plan (2), a lack of understanding of the plan by society and a lack of awareness of the plan in some organisations (3), a lack of the understanding, responsibility and perception of the community and organisations concerning the instructions (4), the difficulty when concerning the suitability of all environments and locations (7), that the plan itself has no problems in general if it is easy to use but the problem is with the workers on the site, as they do not know how to use the plan (10). There are many plans options available provided by different organisations but it is hard to use them on site (11).

It can be noticed from the comments that concerning the current situation in SA, there is a lack of perception when it comes to using an ERS response plan and its importance. There are some organisations that have their own plans for flash flood responses (some of them were not given to me because the plans are not publicly available), little information available on the ERS response and that it is hard to use in a flash flood situation. In many past situations, the displaced people did not know where to go and where to stay safely immediately after the flash

flood. The aid relief workers and decision makers also did not know how to respond easily and quickly in order to protect the flood-affected people's lives and to allow them to achieve their wants and needs in terms of ERS. Thus, the results say that there is a strong need to develop a response framework that can support aid relief workers at a flash flooding site to allow them to provide an appropriate and quick ERS response, which is one of the aims of this research.

6.4.2 The ERS response framework stage evaluation

This section is about evaluating the developed stages of the ERS response framework that will be used in a flash flood situation in SA. The majority of the responders believed that the stages (including stage 1 defining the ERS response need; stage 2 identifying the basic ERS response requirements to a flash flood; stage 3 identifying successful ERS responses and categorising them for inclusion in a searchable database; stage 4 creating a searchable database of ERS responses; stage 5 creating a shortlist of possible ERS responses; stage 6 reviewing the shortlisted ERS responses in order to select the final ERS response(s); and stage 7 making a final recommendation as to the ERS response(s) to the flash flood) cover the full spectrum of ERS response practices in Saudi Arabia (see Figure 6-5). However, some of them are not quite sure if the stages cover the full spectrum of ERS response practices in Saudi Arabia because they need to be applied to a flash flood situation first.

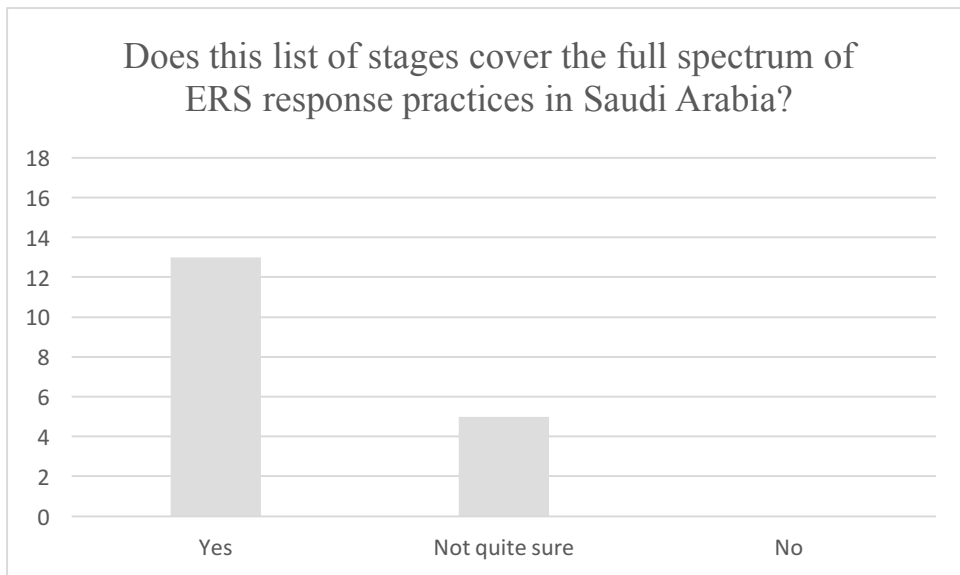


Figure 6-5: Does this list of stages cover the full spectrum of ERS response practices in Saudi Arabia?

In terms of adding or removing from the stages, a big number of the responders did not add or remove any; they agreed on them. However, one of them suggested adding working staff responsibility roles in order to increase the work speed (2). The flow chart (Figure 6-6) determines if the identified stages can be applied practically in Saudi Arabia or not. Most of them selected the yes option and on the other hand, a few of them were still not quite sure. They recommended using them in a flash flood situation first.

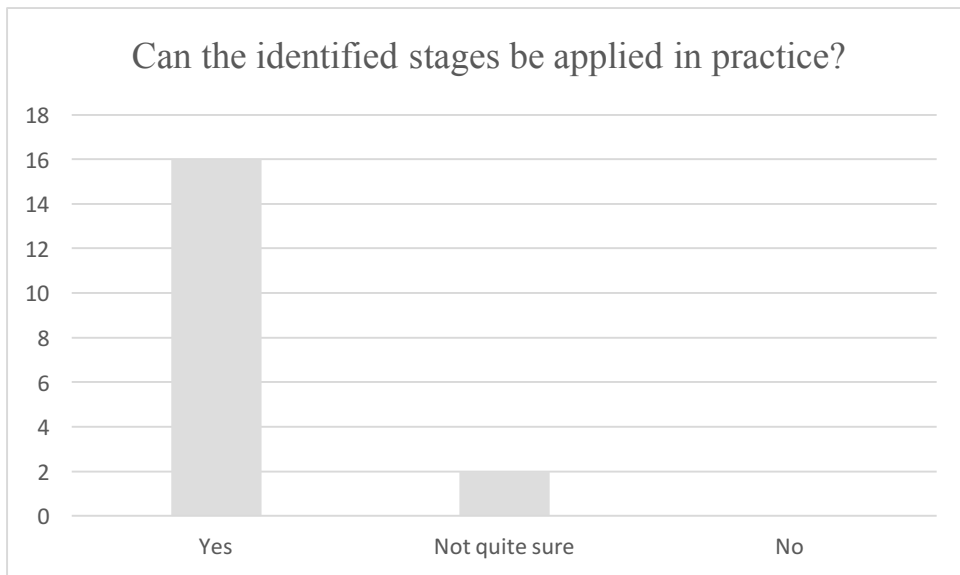


Figure 6-6: Can the identified stages be applied in practice?

According to many of the responder's experience, the identified stages contributed to a large extent in their working area as illustrated in Figure 6-7. However, some of the responders chose 'moderate to small extent' because the stages need testing in a real situation first.

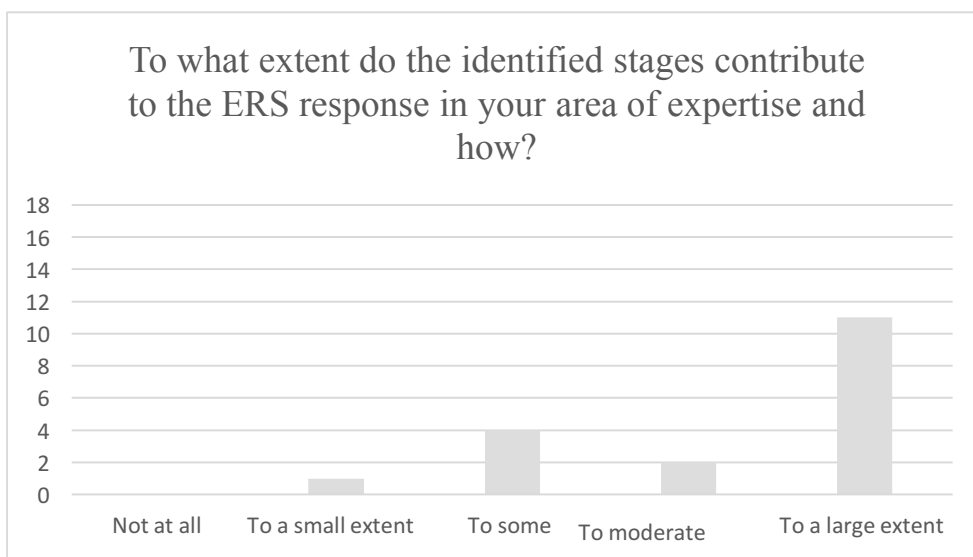


Figure 6-7: To what extent do the identified stages contribute to the ERS response in your area of expertise and how?

It was also asked if any sector/discipline-specific aspects were not covered by the identified stages. The majority of them did not mention anything. However, a few of them added an administrative aspect (1), training system (8), awareness and perception (13) and awareness of the importance of the framework provided (15). Most of the comments can be considered in the preparedness phase before the implementing the ERS response plan.

In addition to this, they were also asked regarding the identified stages, such as if they need to be re-ordered in terms of priority for implementation. On the one hand, it is thought that the current order of the stages is fine. On the other hand, it is believed that the order of the identified stages might change depending on the situation and context as each flash flood context has its own needs. Thus, the proprieties will be clear when the event occurs (as shown in Figure 6-8).

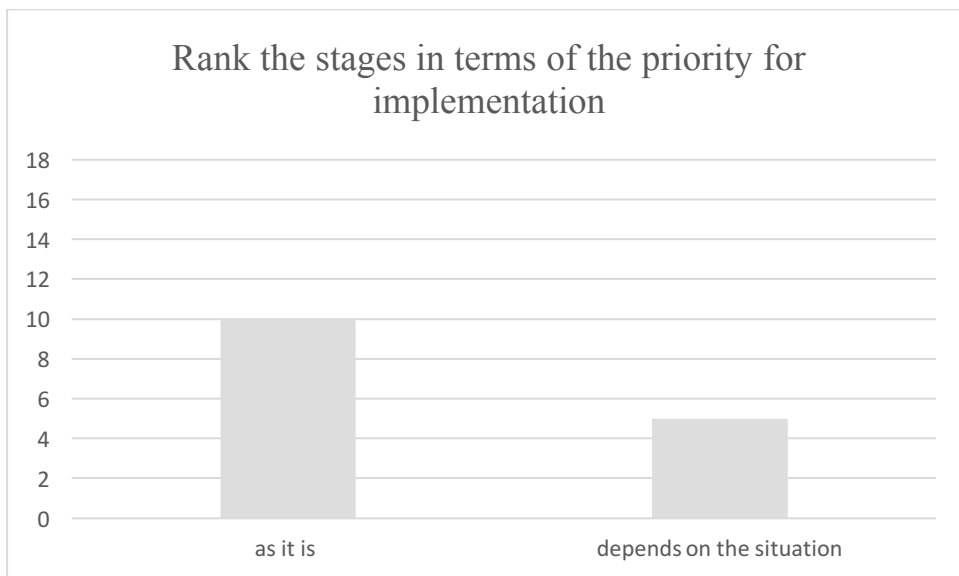


Figure 6-8: Rank the stages in terms of the priority for implementation

To summarise the above section, the majority of responders believed that the identified stages in the ERS response framework will help to aid relief workers at a flash flood site in providing places of protection, privacy, security and well-being for flood-affected victims.

6.4.3 Design factors identified from the ERS response framework evaluation

This section is about evaluating the identified design factors for the ERS response framework. The majority of the responders believed that the design factors (flash flood information, flood-affected persons, weather conditions, size, availability of safe buildings, topographical features, materials, time, financial and technical abilities and risks and hazards) cover the full spectrum of ERS response practices in Saudi Arabia (see Figure 6-9). However, some of them were not quite sure if the design factors cover the full spectrum of ERS response practices in Saudi Arabia or that more design factors need to be considered. This will be clear when considering them in a real flash flood situation.

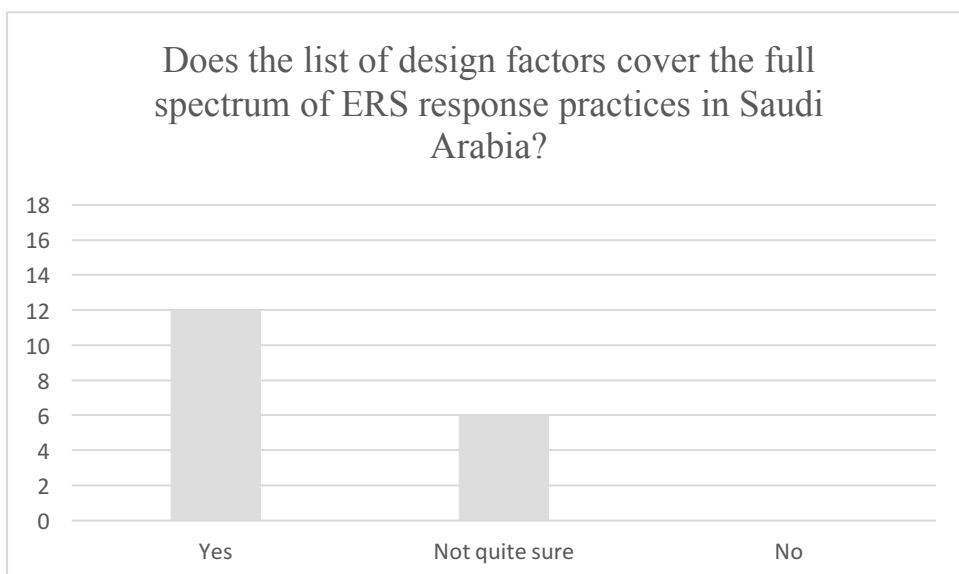


Figure 6-9: Does the list of design factors cover the full spectrum of ERS response practices in Saudi Arabia?

In terms of adding or removing from the list of identified design factors, a big number of responders did not add or remove any. However, the minority of them suggested adding

working staff responsibility in order to increase the working speed (2), early working system (8) and offering cash allowances to allow displaced people to choose their own place of shelter such as hotels, flats, and so on in order to lessen the government’s responsibilities (14). These comments will be taken into consideration when developing the ERS response framework in a second vision.

The flow chart (Figure 6-10) asks if the identified design factors can be applied in Saudi Arabia or not. Most of them selected the yes option. A few of them were still not quite sure; they recommended using them in a flash flood situation first.

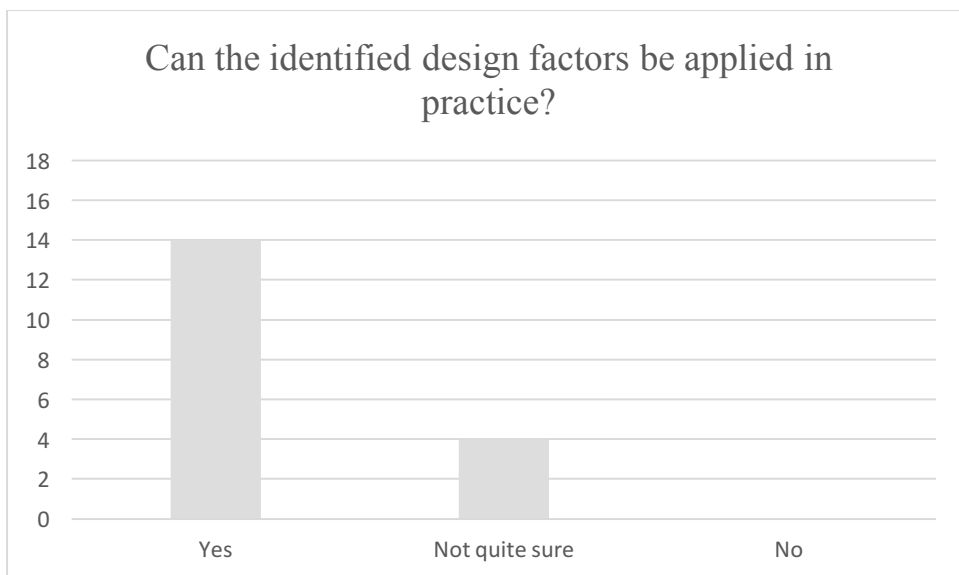


Figure 6-10: Can the identified design factors be applied in practice?

According to the responder’s experience, the identified design factors contributed to a large extent in their working area as illustrated in Figure 6-11. The reasons behind this, as mentioned by the responders, included that the factors will increase the responsibility and relationship between the organisations to encourage them to work together. They contributed to specific things in detail that might be forgotten by some workers on the site due to their keenness to

provide a quick response in a disaster situation. However, some of the responders chose ‘moderate to small extent’ because it is hard to notice in advance when a flash flood is going to occur, what will happen after and what requirements will be the priority.

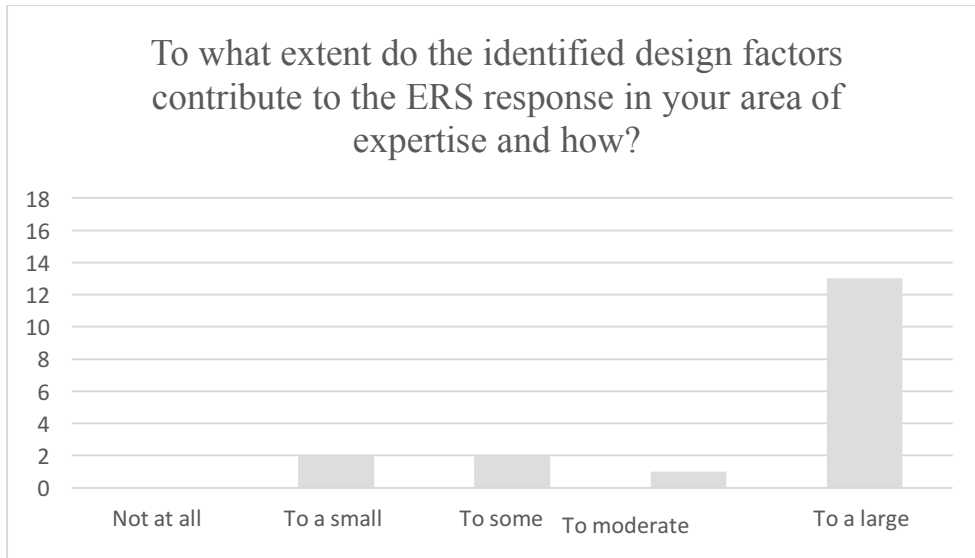


Figure 6-11: To what extent do the identified design factors contribute to the ERS response in your area of expertise and how?

It was also asked if any sector/discipline specific aspects are not covered by the design factors. The majority of them did not mention anything. However, a few of them added that manpower needs to be considered (7); community awareness (5); coordination, working mechanism between organisations (10); coordination, developing risky areas and an awareness of how displaced people deal in flash flood events (11); considering social aspects (13) and an awareness of the importance of the guidance provided (15). Most of the comments had been considered and more attention will be paid to them in the developed ERS response framework.

In addition to that, it was also asked, regarding the identified design factors, if they need to be re-ordered in terms of their priority for implementation. On the one hand, it is thought that the current order of the identified design factors is fine. On the other hand, it is believed that the

order of the identified design factors might change depending on the situation (as shown in Figure 6-12). Nevertheless, one of them changed the order of the identified design factors such as flash flood information, flood-affected persons, financial and technical abilities, and the availability of safe buildings, topographical features, materials, time, and risks and hazards, weather conditions and size.

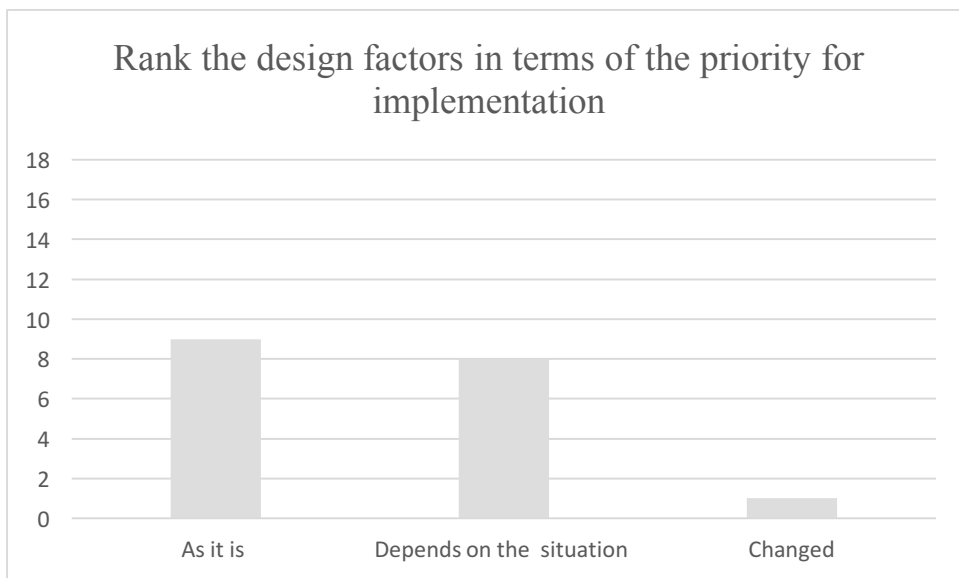


Figure 6-12: Rank the design factors in terms of the priority for implementation

To summarise this section, the feedback that was indicated by the majority of the responders was that the identified design factors reflected the local needs, and the environmental, economic, technical and sociocultural contexts. However, it needs to include a shelter allowance as one of the responses in ERS, when and where safe permanent buildings are available such as furnished flats and hotels. It is believed by the responder that this option provides more flexibility to flood-affected people to choose where to live or they could use it to fix the slight damages to their own property. Other comments such as manpower need to be considered (it had been considered under the financial and technical abilities factor); community awareness, considering the social aspects and coordination (it had been considered

under flood-affected persons). Comments also included an early working system, a working mechanism between organisations and developing risky areas. The comments are outside of the research scope but some of them had been considered briefly in the ERS response framework.

6.5 Results

The current situation in SA is that there is a lack of understanding when it comes to using an ERS response framework in a flash flood context and its importance. Some organisations have their own plans for responding to floods (some of the plans are not made available to the public) but with only a tiny amount of information available on the ERS response, which is hard to apply in a flash flood situation.

In many past flash flood situations, the flood-affected victims did not know where to go or where to stay safely immediately after the flash flood occurred. It will also the aid relief workers and decision makers who do not know how to respond in easy and quick way to protect flood-affected people's lives and to achieve their wants and needs. Thus, the results say that there is a strong need to develop a framework to use to support aid relief workers at a flash flooding site to allow them to provide an appropriate and quick ERS response. This is an aim of this research.

After verifying the stages of the ERS response framework, the responders were willing to state that the stages should increase the coordination, responsibility, perception, and awareness of using the framework in a flood situation while encouraging consultations with all of the organisations who are responsible in the decision making context. The framework should also consider the local needs, environmental, economical, technical, and socio-cultural contexts. The framework also needs to consider consultations with flood-affected people to allow them to be a part of the response.

Most of the comments were considered and emphasised in the ERS response framework from the first stage when identifying the basic ERS response requirements and needs (when each organisation provides its own information - such as the 911 organisation providing the first factor of information (flash flood information factor) like the level of damage, flood period and location) through to the last stage (when they provide the final recommendations which will be executed by a committee which includes the representative persons from each organisation involved in the ERS response and managed by the Ministry of Civil Defence). By considering these points, the level of coordination between the responsible organisations, responsibility itself and the working speed will be increased.

It was also said, by the responders, that most of the flood-affected people in past scenarios did not stay in open areas such as halls for a long period because they said that the open places decreased their level of privacy and security. They wanted separate spaces for each family such as furnished apartments or suites (where safe permanent buildings are available). It was believed by the flood-affected people that the government is rich enough to be able to provide the apartments and suites requested. At moment, according to some responders, the government has been trying to develop a policy which would oblige those who own furnished suites, furnished apartments and hotels, to leave 15% of their buildings empty to be used in emergency situations as an option for sheltering flood-affected people.

In addition, it was also said by some of the responders that there is a new approach to ERS being developed which would involve a shelter allowance that being to flood-affected people for them to use for sheltering themselves. This option will provide flexibility in terms of choosing a dwelling, requiring there to be less responsibility and effort on the part of the government when it comes to choosing and providing shelters and making provision for maintenance money when using public buildings. However, there is a risk when providing this

kind of option, that the price of renting the flats might go up. Thus this needs to be considered and controlled by the government.

This option will be added to the developed framework for ERS under the availability of safe buildings factor as one of the options after identifying safe places. However, in case there are no safe permanent buildings available, then tents will be the only option available to provide shelter for flood-affected people. Furthermore, the framework for the ERS response should be explained through workshops and training for all organisations and workers in advance (before applying the ERS response in a flash flood situation), including how to use it and what each organisation tasks and involvement is (as future work). After considering the feedback of the responders, the developed ERS response framework for a flash flood situation in SA has been shown below in Figure 6-13 and a sheltering allowances option has been added under the availability of safe building factor as illustrated in Figure 6-14.

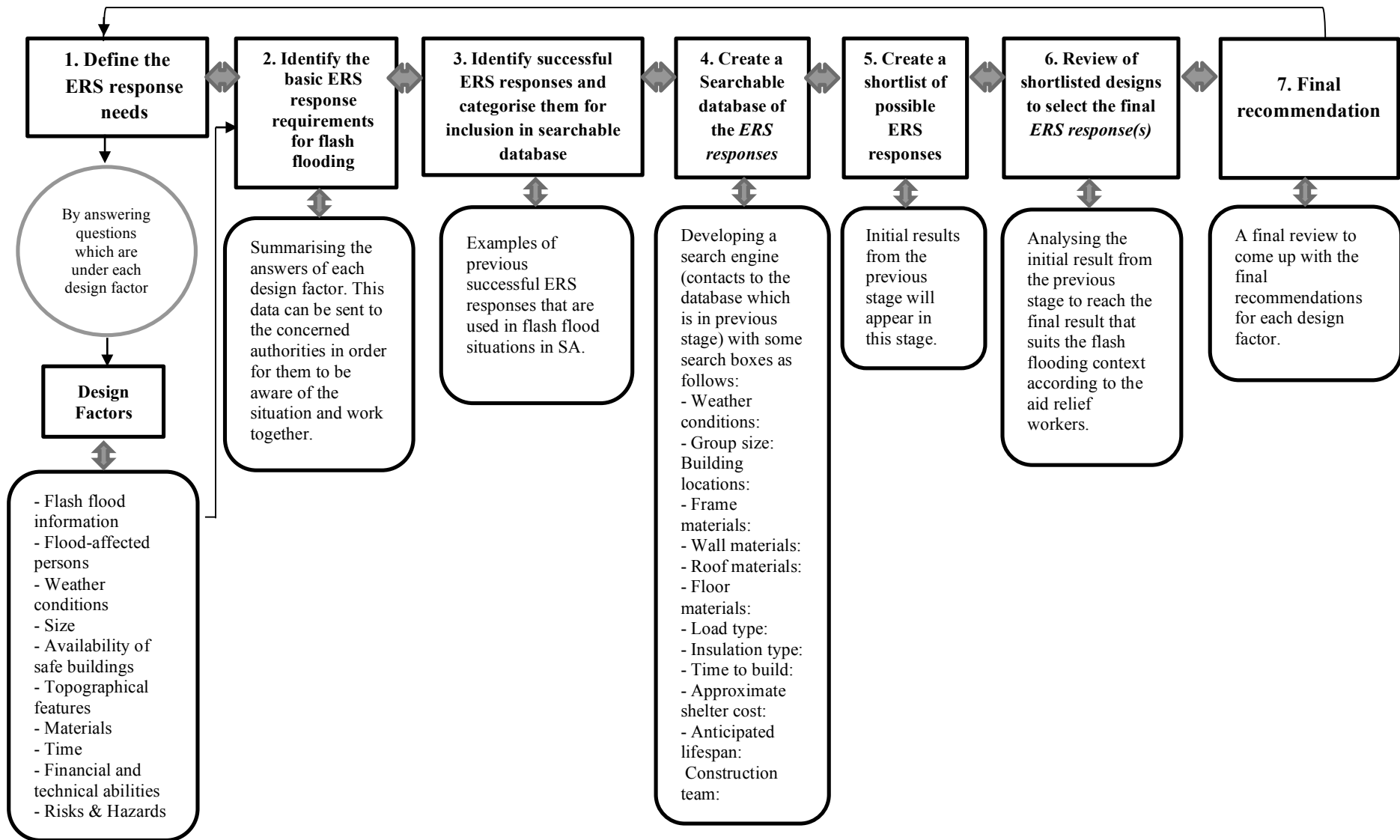


Figure 6-13: The ERS response framework for flash floods in SA (after considering verifications' feedback)

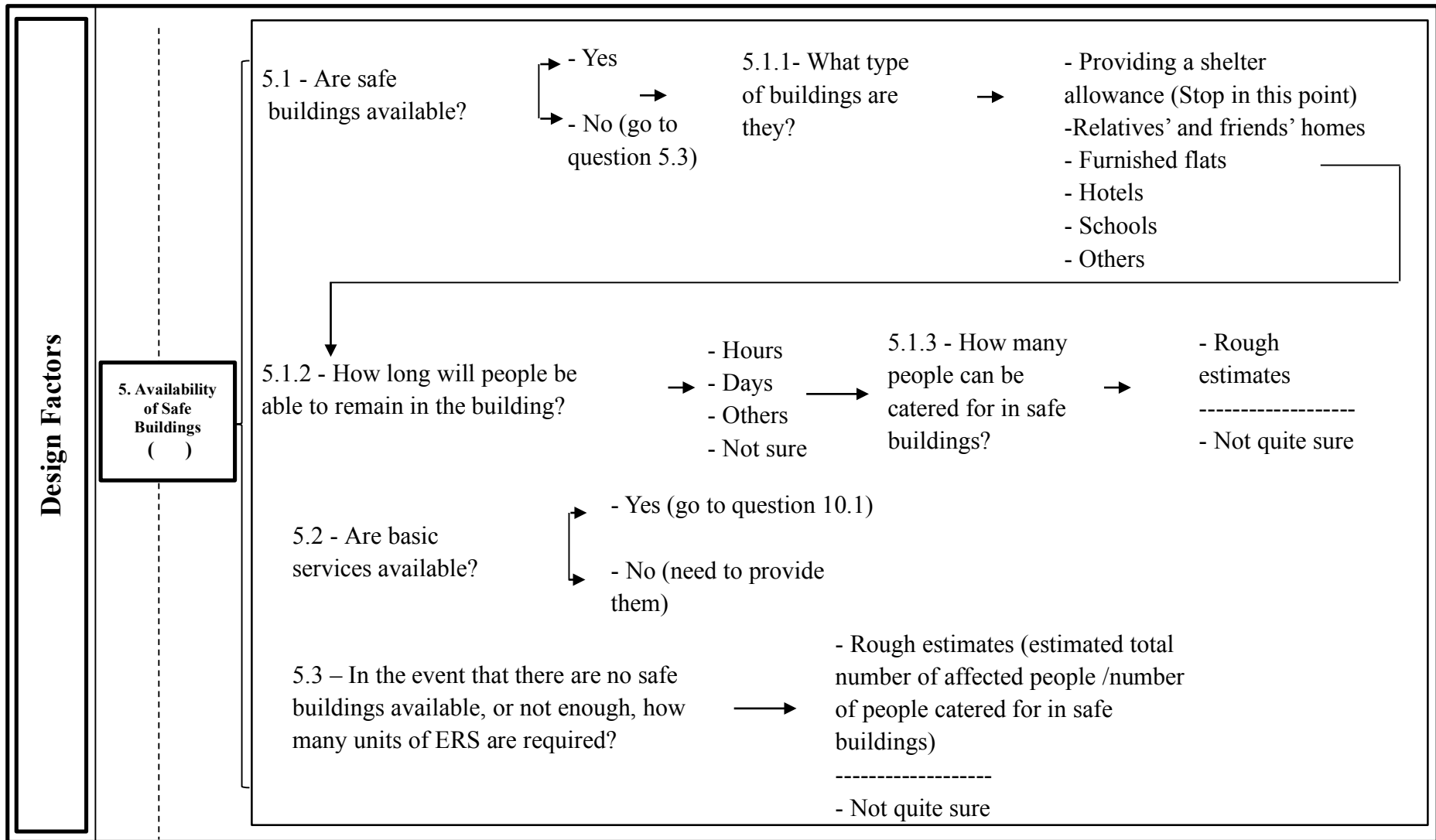


Figure 6-14: Availability of safe buildings factor.

Chapter 7 The validation of an emergency relief shelter (ERS) response framework for flash floods in SA

7.1 Introduction

The ERS response framework for use in a flash flood situation, which has been developed throughout the in-depth literature review and the verification stage, has been subjected to a validation procedure in this chapter. The validity of a procedure-based ERS response framework may be executed without the resource obligation to the organisation burden and time period requisite. It might take, at minimum, no less than a year to receive results for the ERS response to which the framework is applied. Thus, it is not always achievable to use this technique for validation. Instead, the framework validation was accepted by a collection of specialists with a wide variety of expertise by interviewing them face to face. This increases the chances of an outcome that provides valuable insights into the topics being studied.

7.2 Validation tool design

The structured interview method was considered in order to evaluate and determine whether the ERS response framework works in reality by interviewing experts who have a high level of knowledge and experience on the ground and often participate in responding to flash flood events in SA. It is similar to the Delphi technique used to estimate the likelihood and outcome of future events by driving an agreement from a group of experts who make predictions about future development (Clayton, 1997 and Rowe, 2007). Although when using the Delphi technique it is recommended that questionnaires should be used, given the complexity of the framework it was considered that the use of questionnaires would not provide sufficiently robust and reliable data and so structured interviews were used instead.

Bryman and Bell (2003) claim that in this kind of study, the structured interview type is commonly employed. This method consists of using a standardised series of questions on which to base and develop the interview. This allows the respondents to have greater control of the answers they provide in response to the questions posed throughout the interview. Through face-to-face interviews, the author was able to encourage the interviewees to elaborate, clarify or amend their statements.

Naoum (1998) explains that the main advantages of structured interviews includes the fact that the reply percentage is comparatively high (around 60-70%), particularly if the respondents are contacted directly. Indeed, the replies can be more accurate and precise and the reasons for them ascertained. Remenyi et al (1998) claim that the use of the structured interview method delivers the chance to explore difficult issues in a comfortable atmosphere and it lets the researcher clarify the purpose of the study better than a covering letter on a questionnaire, thus helping to gain more valuable data. On the other hand, this method is logistically difficult with limited numbers of respondents.

The validation sheet (Appendix B) is intended to examine whether the ERS response framework can fulfil its primary goals (or not). The main goal is to help aid relief workers to define the nature of the problem which will then be used as the basis to search the database for all appropriate ERS response solutions. This should help the relief workers to come to a good decision, and to carry out an ERS plan of action simply and quickly so as to cover and mitigate the effects of the emergency, to protect life and to create the right circumstances to allow for a return to routine.

The size of the sample, as in any qualitative approach, is justly a reasonable number if the focus is on achieving a good understanding of the features under investigation and of the range of responses. Consequently, a suitability sample was engaged within the qualitative investigation

(Uma and Roger, 2016) through two stages. Firstly senior government officials who are experts with a high level of knowledge and experience on the ground, key decision makers and managers, who often participate in responding to flash flood events in SA. Secondly, academics and other consultants responsible for emergency response policy and practice, involved in many research and development studies related to develop ERS responses, review the ERS response process for flash floods in SA and participate in other disasters and hazards events globally.

The validation used the Likert scale. To gain an in-depth response of the likely success of the ERS response framework, the experts were asked whether any modifications and/or changes were recommended in order to improve it (Oppenheim, 2000). The extent to which the established ERS response framework's stages and design factors were valued according to their significance was assessed on a 5-point Likert scale ranging from 'very high=5' to 'very low=1'.

The stages of the ERS response framework were: to define the ERS response needs; to identify the basic ERS response requirements concerning flash flooding; to identify successful ERS responses and to categorise them for inclusion in a searchable database; to create a searchable database of ERS responses; to create a shortlist of possible ERS responses; to review the shortlisted ERS responses in order to select the final ERS response(s) and to make a final recommendation for the ERS response(s) in flash flooding situations. The design factors were: flash flood information; flood-affected persons; weather conditions; size; the availability of safe buildings; topographical features; available materials; time available for implementation; financial and technical abilities and risks and hazards.

Aspects of the ERS response framework such as its efficacy, its practicality, its helpfulness to decision makers, its potential to save lives, money and time were prioritised on a 5- point Likert scale namely; 'extremely = 5', 'very = 4', 'moderately = 3', 'slightly = 2' and 'not = 1'.

All interviewees were questioned using the same questions about the ERS response framework, which was printed and provided to them before starting the interview. The author presented the request in such a way that the questions were straightforward and clear. Throughout the face-to-face interviews, the author was able to encourage the respondents to elaborate, clarify, or amend what they mentioned. However, most significantly, the author did his best to be a listener rather than a speaker throughout the interviews.

7.3 Validation steps

The validation was done in two different stages; the first one with some people from the same verification group and the second one was with academic staff from different universities in SA, as explained in more detail below.

7.3.1 Validation Step – 1

In this stage, the ERS response framework was re-assessed by some people (7 persons) from the previous (verification) group (as illustrated in Table 7-1) in order to make sure that the adjustments were correct and what they had described.

Table 7-1: Details of the experts interviewed to verify the ERS response framework (step one).

No	Organisation	Task	Experience	Years Experience
1	Emirate of Makkah region - Crisis and Disaster Management Centre	The Head of the Centre	Floods – Jeddah and other cities	30
2	Emirate of Makkah region - Crisis and Disaster Management Centre	Head of Operation in Crisis and Disaster Management Centre	Floods - Jeddah	15
3	Emirate of Makkah region - Crisis and Disaster Management Centre	Deputy manager of the Centre	Floods - Jeddah	20
4	Saudi Red Crescent Authority	Training Management	Jeddah floods and incidents	15
5	Emirate of Makkah region - Crisis and Disaster Management Centre	Delegation of Border Guards in the Centre	Floods - Jeddah	15
6	Ministry of Finance	Delegate	Jeddah floods and incidents	21
7	General Authority for Meteorology and Environment Protection – Disaster Management	Director of Disaster Management	Natural disasters (hazards)	5

7.3.1.2 The ERS response framework processes evaluation

To objectively test the components of the improved ERS response framework, a method of descriptive statistical analysis was engaged using Excel. The specialists were asked to rate the significance of each stage and each of the design factors, and also to add any absent stages or design factors that they considered to be essential and rate them. In addition, they were also asked for any common feedback that they considered would add value to the ERS response framework.

All of the specialists decided that the ERS response framework stages ((including stage 1; S1) defining the ERS response need; stage 2 (S2) identifies the basic ERS response requirements for a flash flood; stage 3 (S3) identifies the successful ERS responses and categorises them for inclusion in a searchable database; stage 4 (S4) creates a searchable database of ERS responses; stage 5 (S5) creates a shortlist of possible ERS responses; stage 6 (S6) reviews the shortlisted ERS responses in order to select the final ERS response(s) and stage 7 (S7) makes a final recommendation as to the ERS response(s) to flash flooding) high in significance, as shown in Figure 7-1.

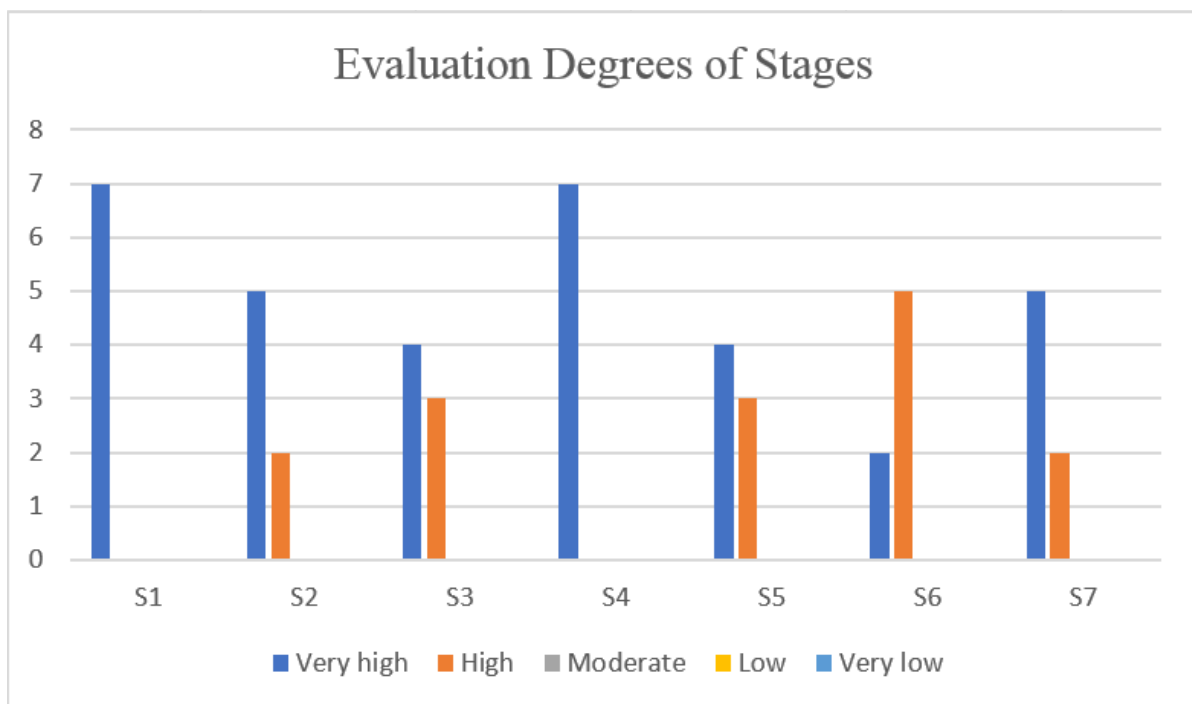


Figure 7-1: Stage evaluation

In addition, Figure 7-2 illustrates how all of the marks of significance of the design factors (flash flood information (FFI), Flood-affected persons (F-FP), weather conditions (WC), size (S), availability of safe buildings (ASB), topographical features (TF), materials (M), time (T), financial and technical abilities (FTA) and risks and hazards (RH)) were rated high and very

high. However, one of them thought that the risks and hazards factor was moderate (he thought that this factor could be addressed before applying the ERS response plan).

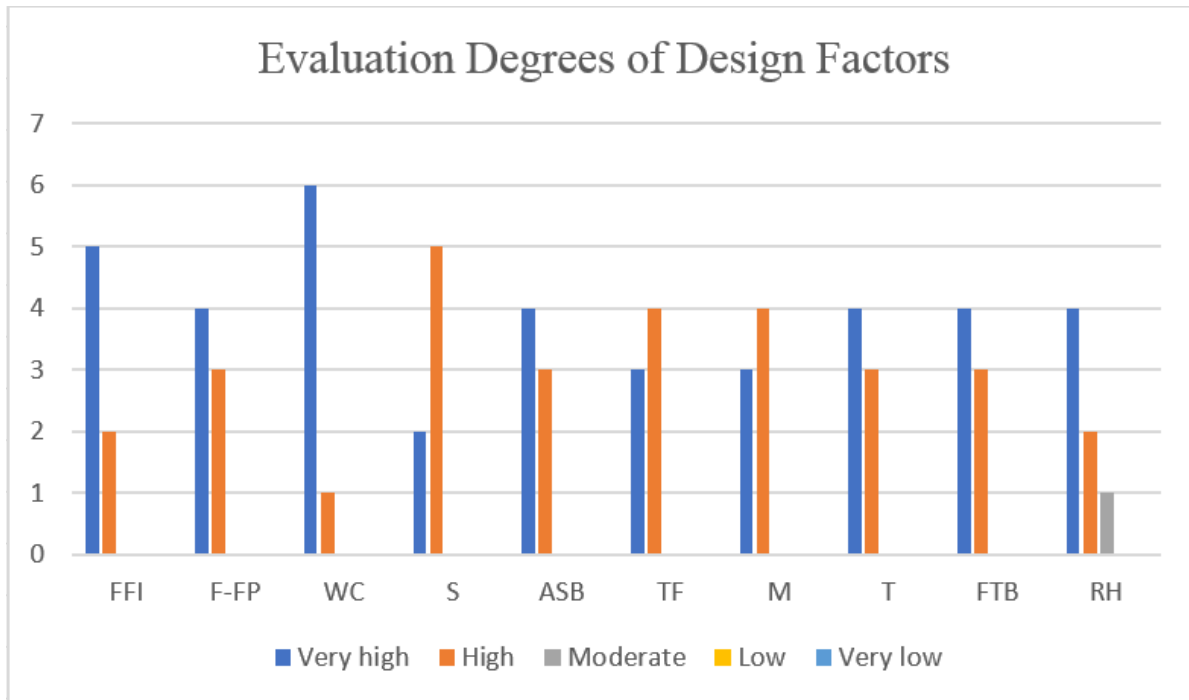


Figure 7-2: Design factors evaluation

7.3.1.3 Evaluation of the different attributes

Efficacy reflects to what extent the ERS response framework will succeed in producing the planned outcome, which is to help aid the relief teams in defining the nature of the problem. It is used as the basis to search the database for possible ERS response solutions, to come to the right decision, and to carry out an ERS response plan of action simply and quickly in order to cover and mitigate the effects of the emergency, to protect life and to create the right circumstances for a return to routine. Practicality refers to the level to which the ERS response framework will be inclined to action, rather than speculation or theory, in creating the planned goal as stated above. This will help the decision makers to evaluate to what degree the ERS

response framework will assist in the achievement of the long-term aims related to decision-makers' anticipation. In addition to that, saving lives, money and time was also evaluated.

So as to objectively assess the six attributes of the ERS response framework which have been mentioned above, the method of descriptive statistical analysis was engaged by using Excel. The average evaluation of most of the attributes of the ERS response framework when it came to ascertaining if it achieved its anticipated objectives was great, as can be seen from Figure 7-3.

This evaluation signified that the ERS response framework is a very efficacious and practical, and helps decision makers to save lives, money and time. The results indicate that all attributes are very important and have an almost equal value. However, a few experts suggested that the ERS response framework needs testing at a relief site, and also that some workshops need to be held to teach relief workers how to use it. Moreover, it needs more co-operation and participation by the other relief organisations in order to enter the required data.

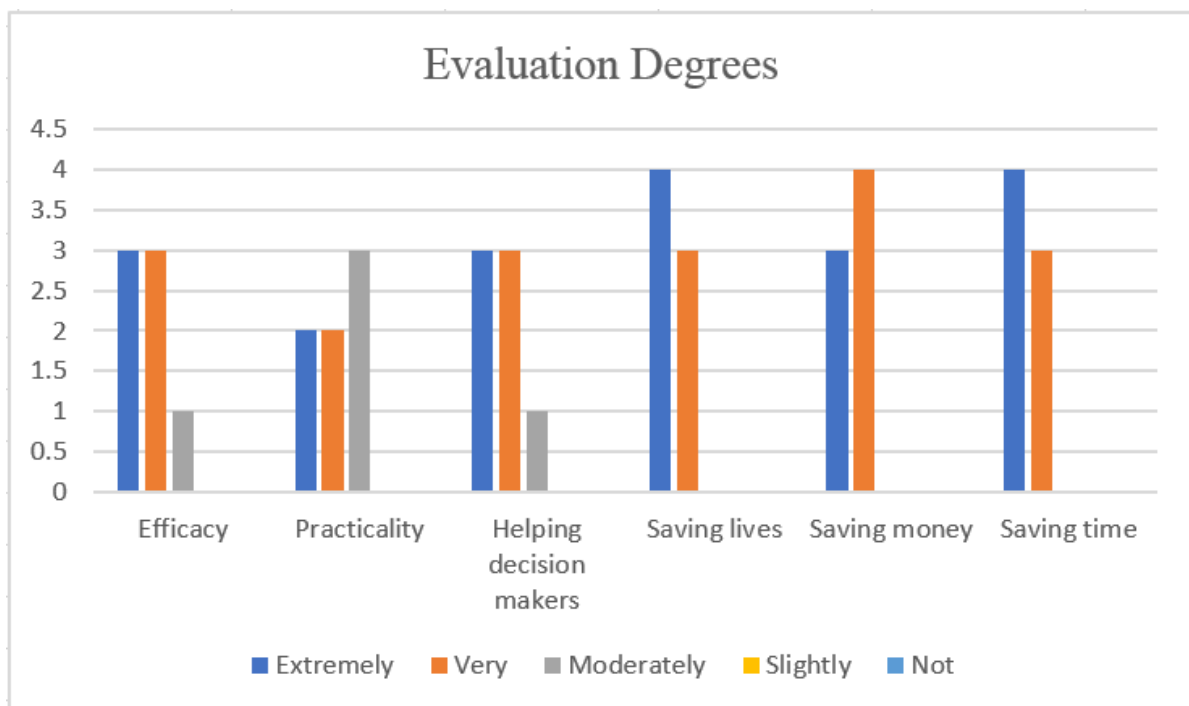


Figure 7-3: Evaluation of approach attributes

7.3.2 Validation Step – 2

In this stage, the ERS response framework was checked with academic individuals (7 persons) from four universities in Saudi Arabia in different cities (as shown in Table 7-2), in order to make sure that the information can be applied in flash flood events in Saudi Arabia. These people are usually worked and involved in reviewing the emergency plans that are created by governments and non-governmental organisations in order to comment as consultants.

Table 7-2: Details of the experts interviewed to verify the ERS response framework (step two).

No	Organisation	Tasks	Experience	Years Experience
1	Research and Consulting Studies Institute – Umm Al-Qura University	Institute’s deputy	Emergency’s plans, courses and consultations	4
2	Research and Consulting Studies Institute – Umm Al-Qura University	Engineer	Emergency’s plans, courses and consultations	2
3	Risk management unity – Taibah University	Head of risk management unity	Consultations and laboratory	12
4	Emergency and Disaster Centre – King Abdulaziz University	Deputy director of the centre	Consultations	16
5	Emergency and Disaster Centre – King Abdulaziz University	Assistant Vice President Projects	Plans and floods events	18
6	Emergency and Disaster Centre – King Abdulaziz University	Delegate	Plans and floods events	8
7	Taif University	Director of Disaster and Crisis Management (Previously)	Plans for Hazards and disasters	3

7.3.2.1 The ERS response framework processes evaluation

To objectively test the components of the improved ERS response framework, a method of descriptive statistical analysis was engaged using Excel. The specialists were asked to rate the significance of each stage and each of the design factors, and also to add any absent stages or design factors that they considered to be essential and to rate them. In addition, they were also asked for any common feedback that they considered would add value to the ERS response framework.

All of the specialists decided that the design framework stages (including stage 1 (S1) define the ERS response need; stage 2 (S2) identifies the basic ERS response requirements for a flash flood response; stage 3 (S3) identifies the successful ERS responses and categorises them for inclusion in a searchable database; stage 4 (S4) creates a searchable database of ERS responses; stage 5 (S5) creates a shortlist of possible ERS responses; stage 6 (S6) reviews the shortlisted ERS responses in order to select the final ERS response(s); and stage 7 (S7) makes a final recommendation for the ERS response(s) to the flash flood) were high and very high in significance, as shown in Figure 7-4.

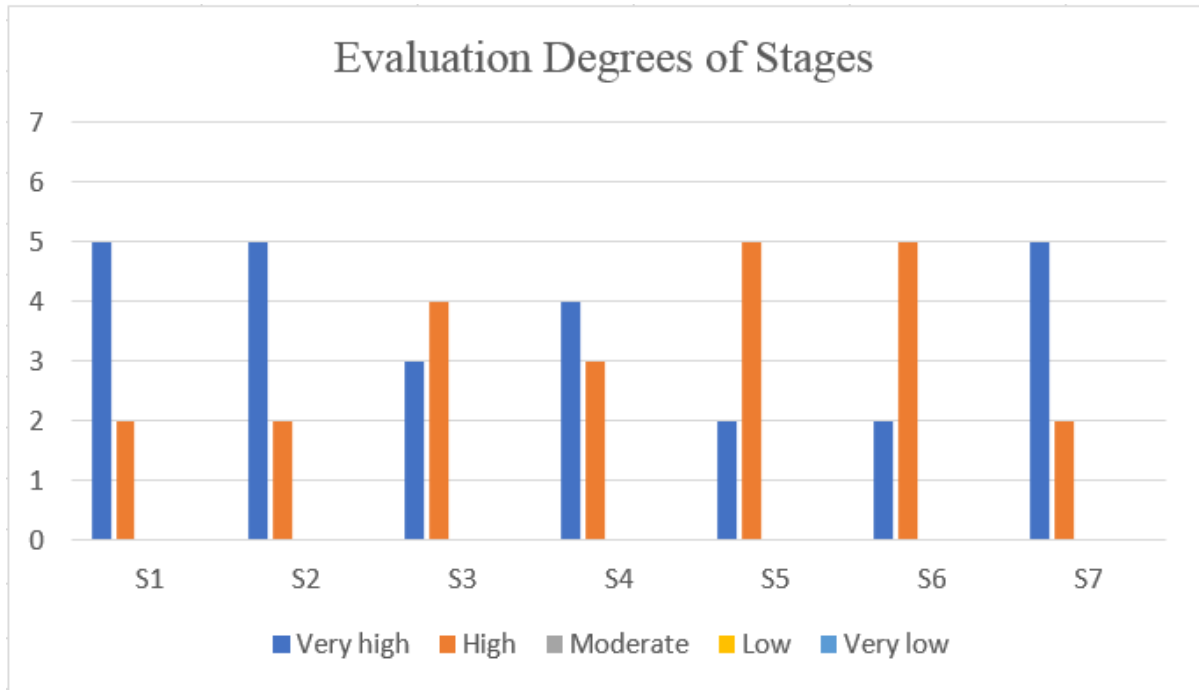


Figure 7-4: Stage evaluation

In addition, Figure 7-5 illustrates how all of the marks of the significance of the design factors (flash flood information (FFI), flood-affected persons (F-FP), weather conditions (WC), size (S), availability of safe buildings (ASB), topographical features (TF), materials (M), time (T), financial and technical abilities (FTA) and risks and hazards (RH)) were most rated high and very high. However, the material factor was moderate because some of the responders believed that the materials should be considered in advance before the event occurs and that they need to be available in stores.

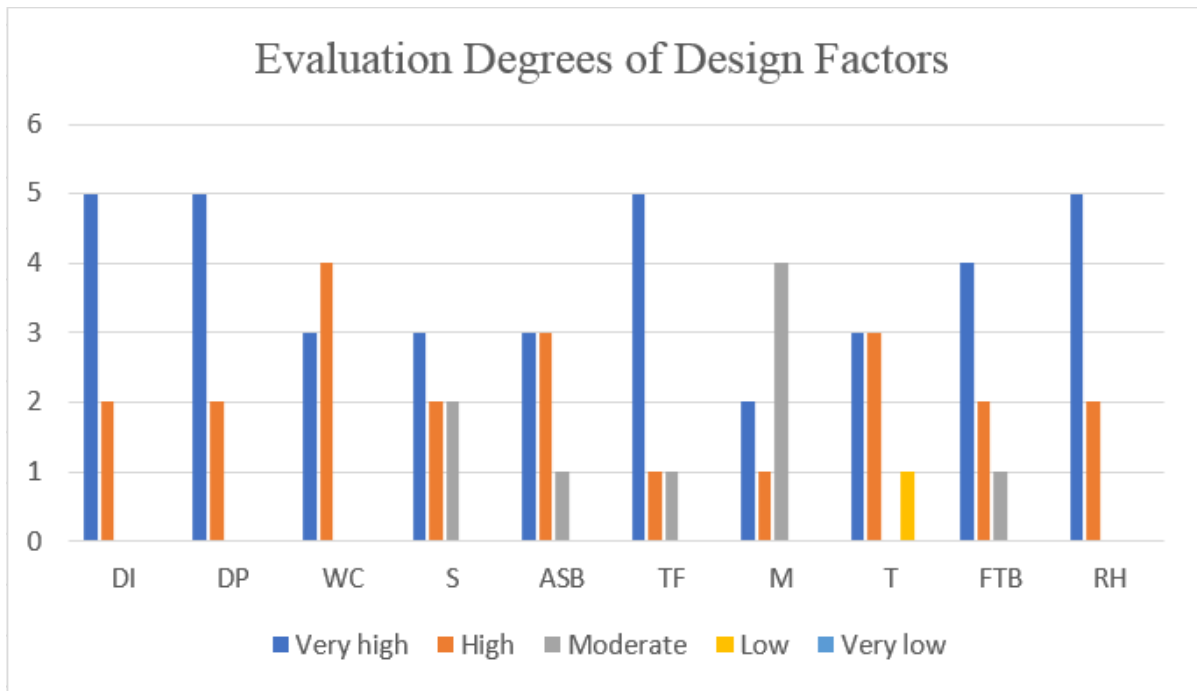


Figure 7-5: Design factor evaluation

7.3.2.2 Evaluation of the different attributes

Efficacy reflects to what extent the ERS response framework will succeed in producing the planned outcome, which is to help aid relief teams in defining the nature of the problem used as the basis to search the database for possible ERS response solutions, to come to the right decision, and to carry out an ERS response plan of action simply and quickly in order to cover and mitigate the effects of the emergency, to protect life and to create the right circumstances for a return to routine. Practicality refers to the level to which the ERS response framework will incline to action, rather than speculation or theory, in creating the planned goal as stated above. Helping the decision makers to evaluate to what degree the ERS response framework will assist in the achievement of long-term aims relates to the decision-makers' anticipation. In addition to that, saving lives, money and time was also evaluated.

So as to objectively assess the six attributes of the ERS response framework which have been mentioned above, the method of descriptive statistical analysis was engaged by using Excel. The average evaluation of most of the attributes of the ERS response framework when it came to if it achieved its anticipated objectives was great, as can be seen from Figure 7-6.

This evaluation signified that the ERS response framework is a very efficacious and practical, and that it helps the decision makers to save lives, money and times. The results indicate that all attributes are very important and have almost an equal value. However, a few experts suggested that the ERS response framework needs testing at a relief site in order to come up with information that can be used to improve and update the design framework. In addition to this, a committee needs to be set up involving all organisations involved in emergency events such as planners, designers, consultants and workers in order for them to work together and achieve the task.

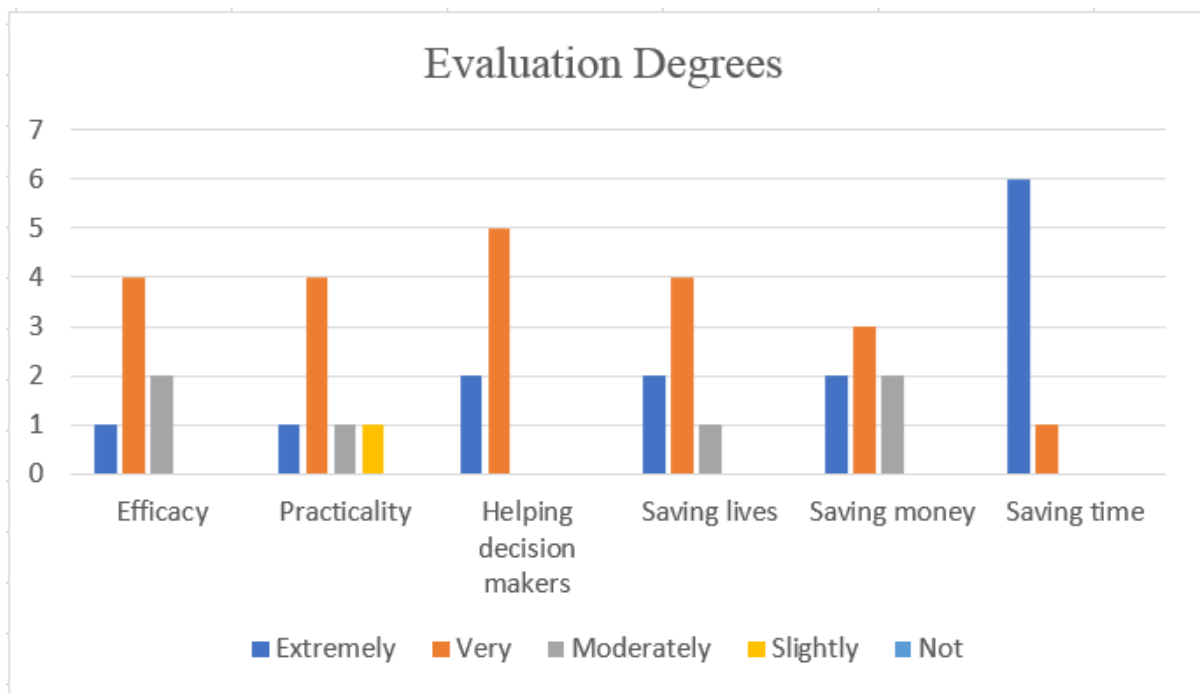


Figure 7-6: Evaluation of the approach attributes

7.4 Results

The feedback has been presented in this chapter from two groups who have substantial knowledge and experience of responding to flash flood events in SA. Firstly, senior government officials and secondly, academics and consultants responsible for emergency response policy and practice. These are the main parties involved in addressing flash flood situations in SA. The feedback was gained through structured interviews using a validation sheet including questions evaluated on a Likert scale and with open-ended questions included, all issued by the author in person. The responses were mostly positive in both groups.

Fourteen specialists from the two groups who were contacted favoured the idea of adopting the ERS response framework for use in a flash flood event in SA and mentioned its possible benefits. Generally, the evaluation has shown that the developed ERS response framework has a clear and detailed foundation anticipating the various stages and design factors, and that it is comprehensive. However, they made some suggestions for future work; they stated that the ERS response framework requires more rigorous testing at relief sites when a flash flood happens to ensure its practicality, and also that some workshops need to be held to teach relief workers who work at flood sites how to use it because it is a new approach for some of them.

The final development of the ERS response framework has been divided into seven stages, which are: define the ERS response need (by considering several design factors including flash flood information; define the flood-affected persons; identify the weather conditions; determine the size of the group, the availability of safe buildings available as temporary shelters; topographical features; available materials, time for implementations, financial and technical abilities and risks and hazards); to identify the basic ERS response requirements relating to a flash flood; to identify successful ERS responses and to categorise them for inclusion in a searchable database; to create a searchable database of ERS responses; to create

a shortlist of possible ERS responses; to review the shortlisted ERS responses in order to select the final ERS response(s) and to make a final recommendation on the ERS selected response(s).

This has been shown in Figure 7-7 through to Figure 7-17 below.

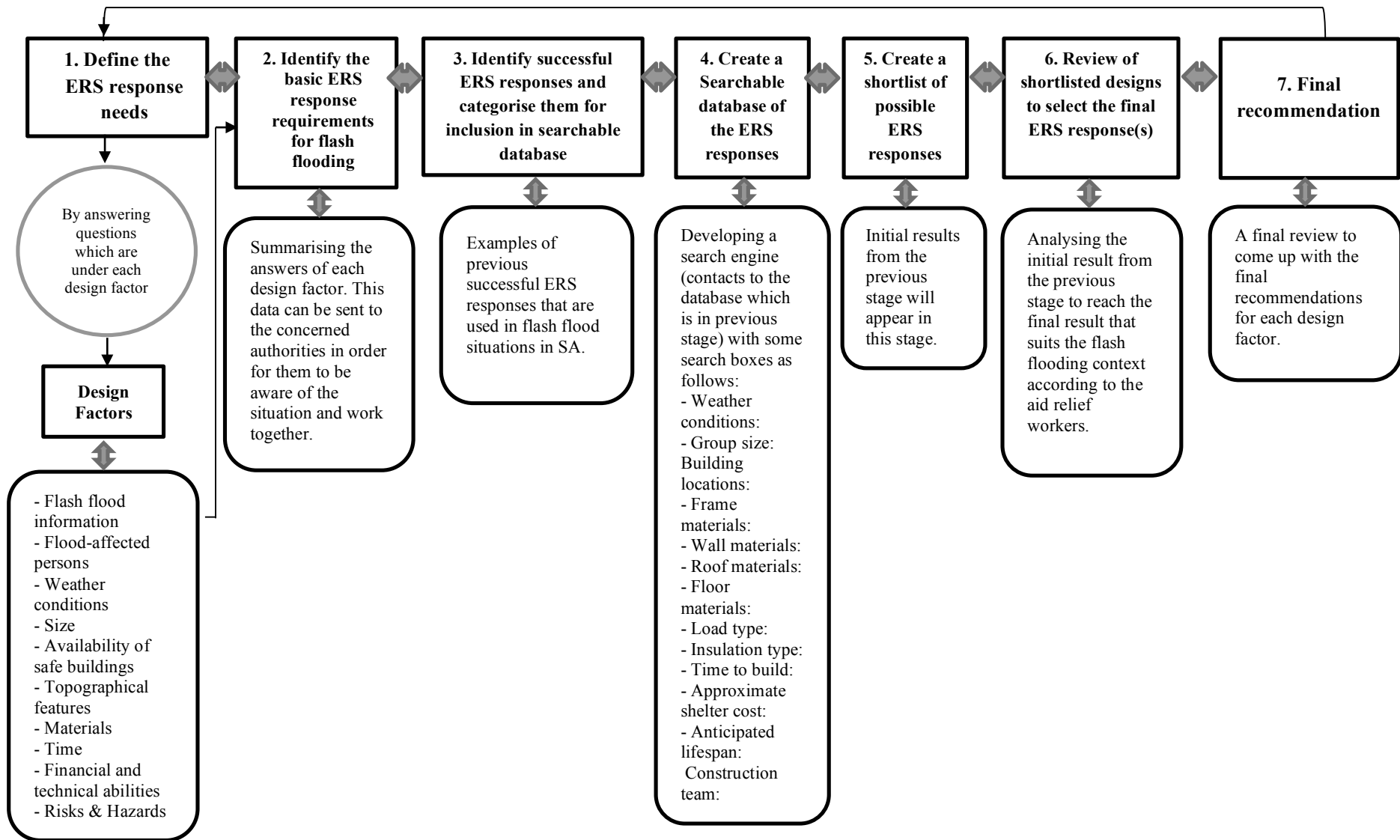


Figure 7-7 The ERS response framework for flash floods in SA (the final framework)

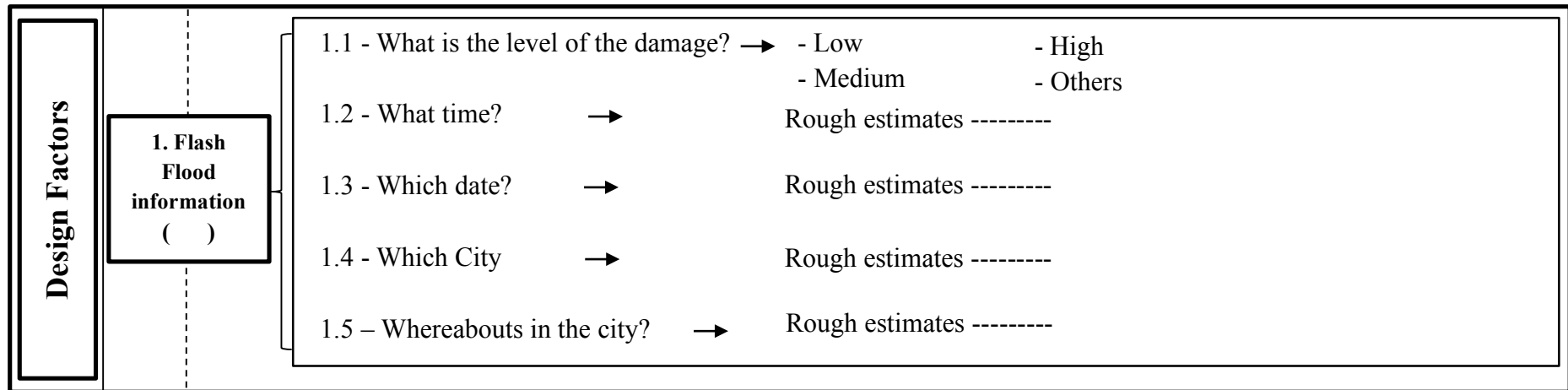


Figure 7-8: Flash flood information factor.

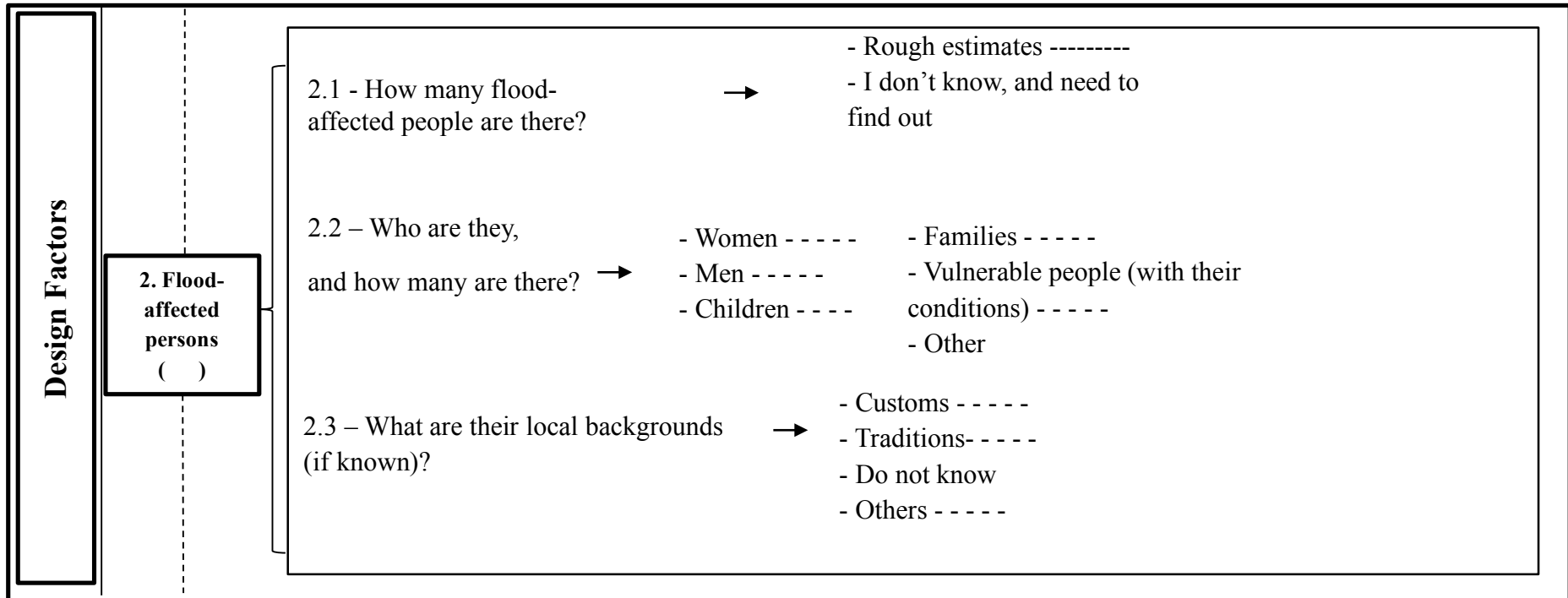


Figure 7-9: Flood-affected persons factor.

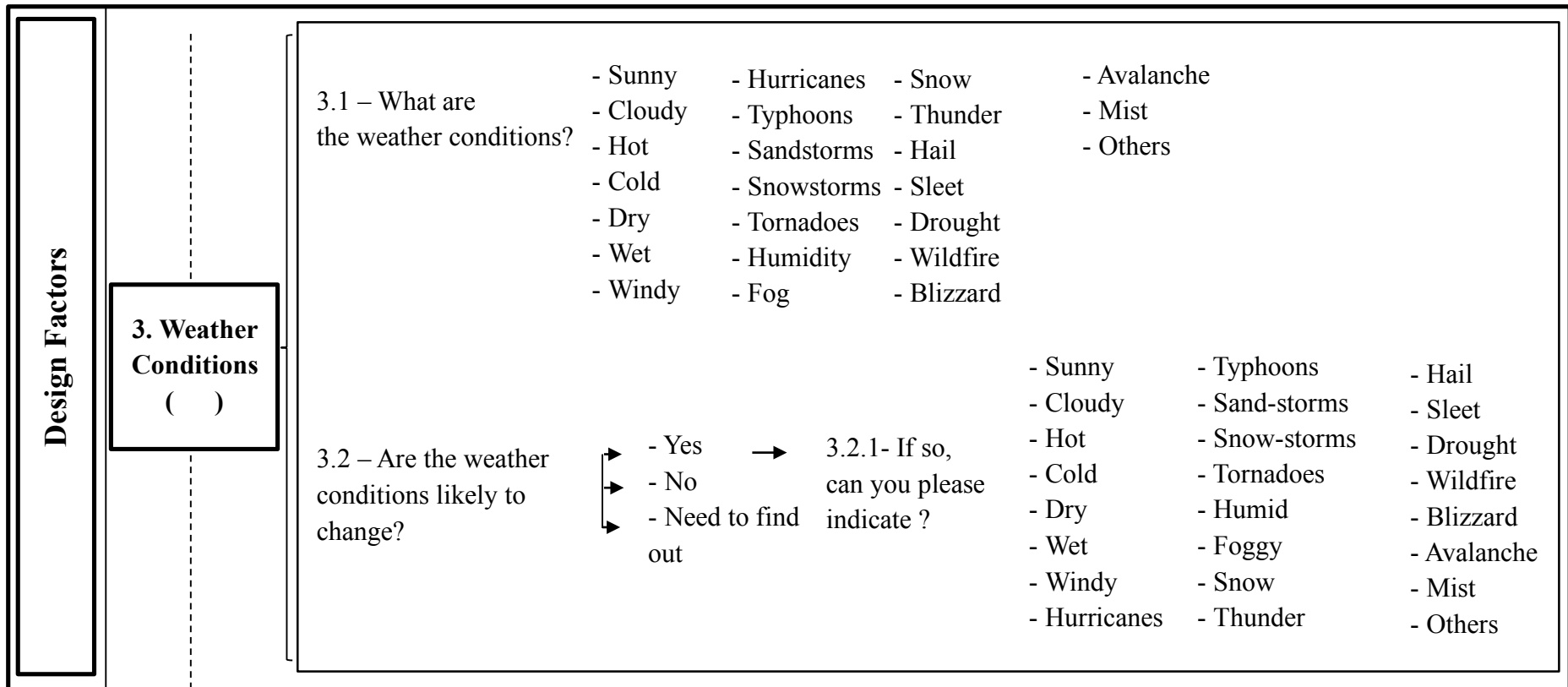


Figure 7-10: Weather conditions factor.

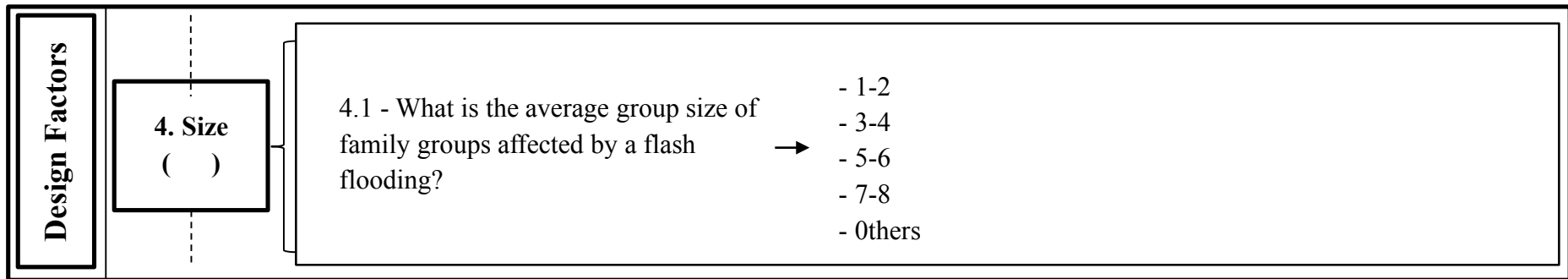


Figure 7-11: Size factor.

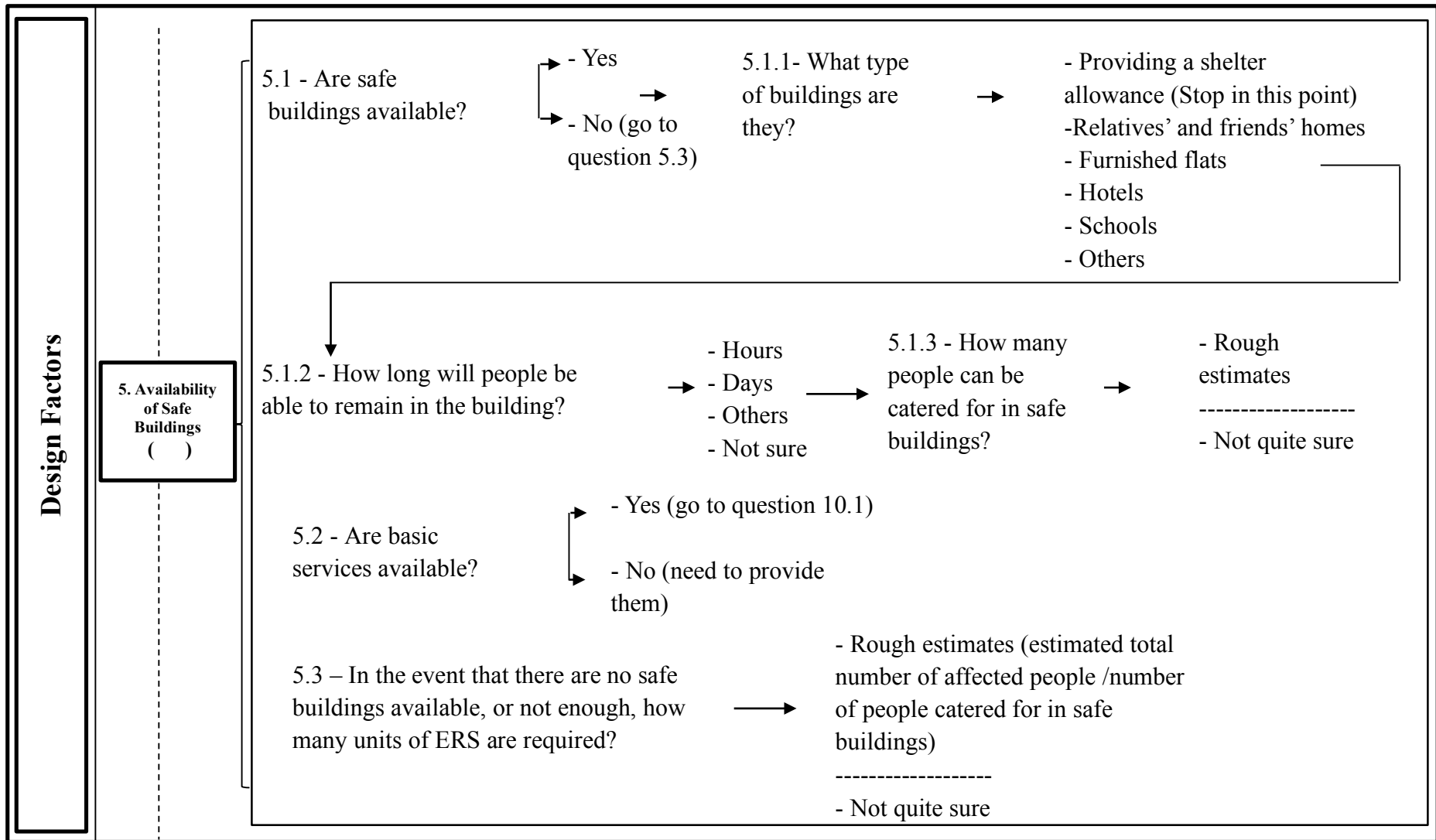


Figure 7-12: Availability of safe buildings factor.

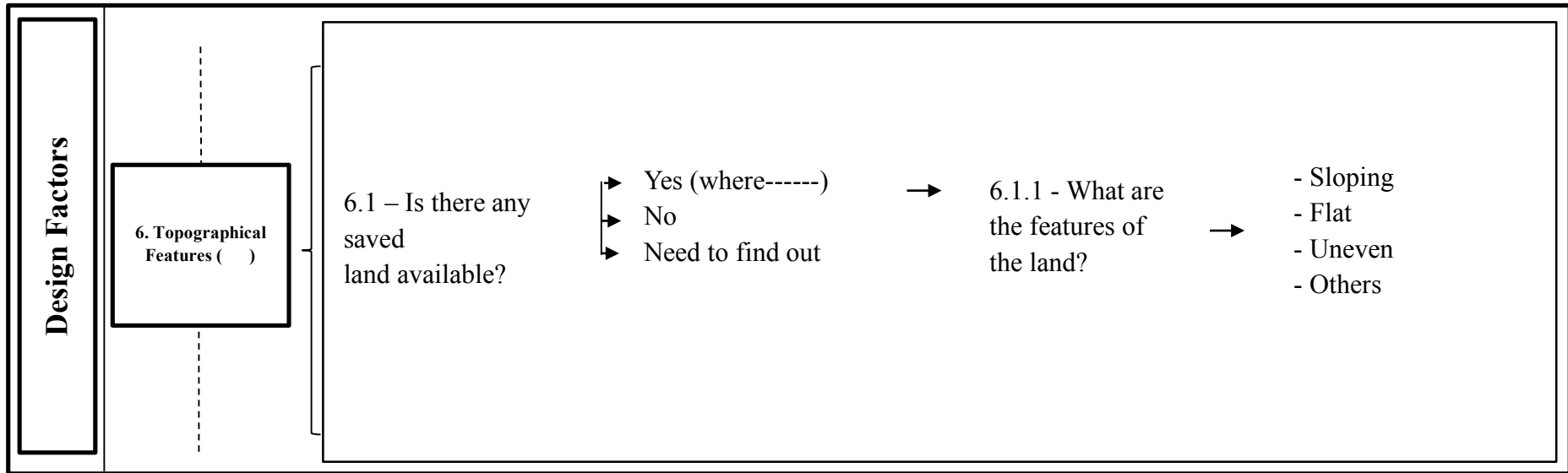


Figure 7-13: Topographical features factor.

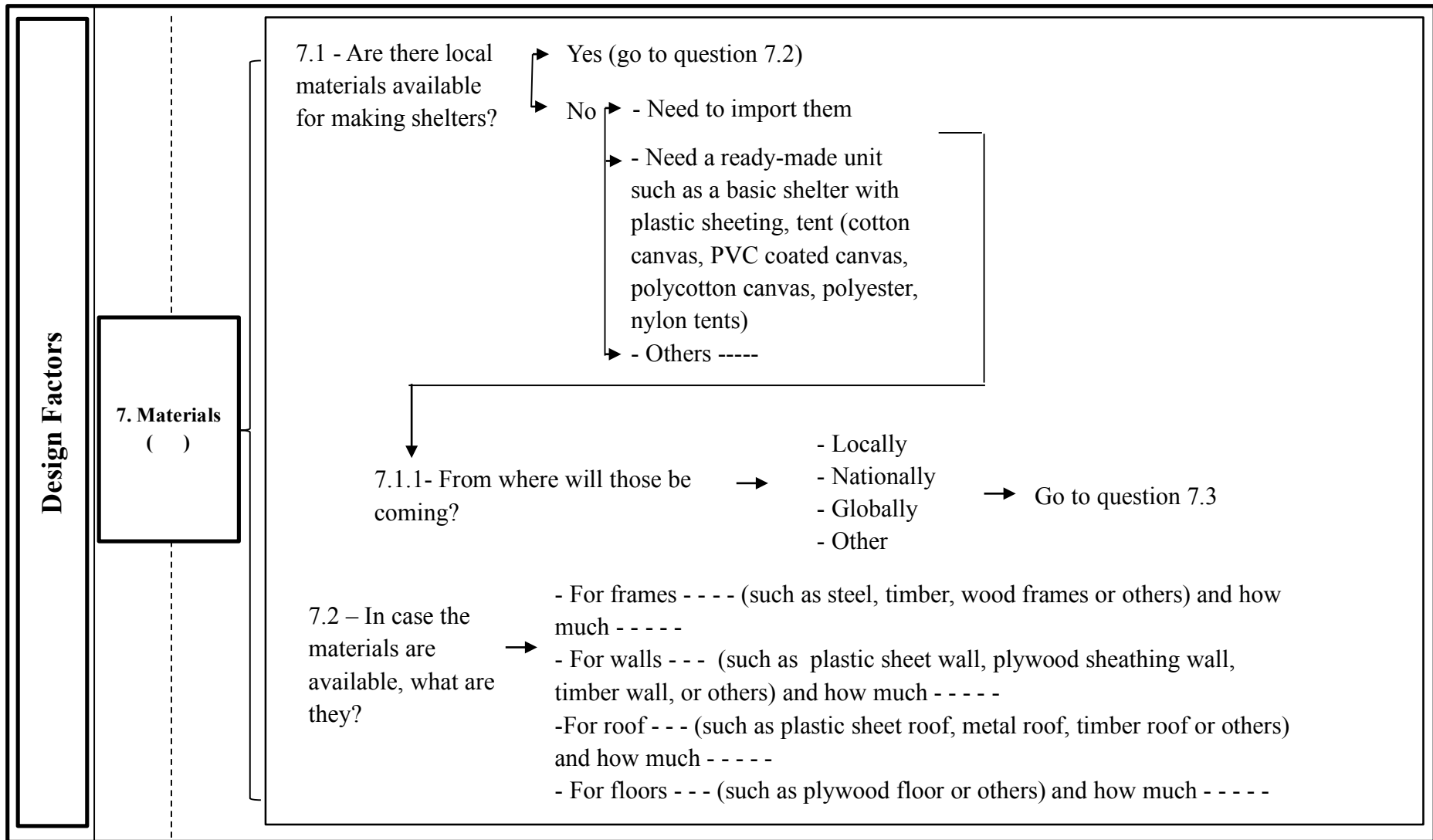


Figure 7-14: Materials factor.

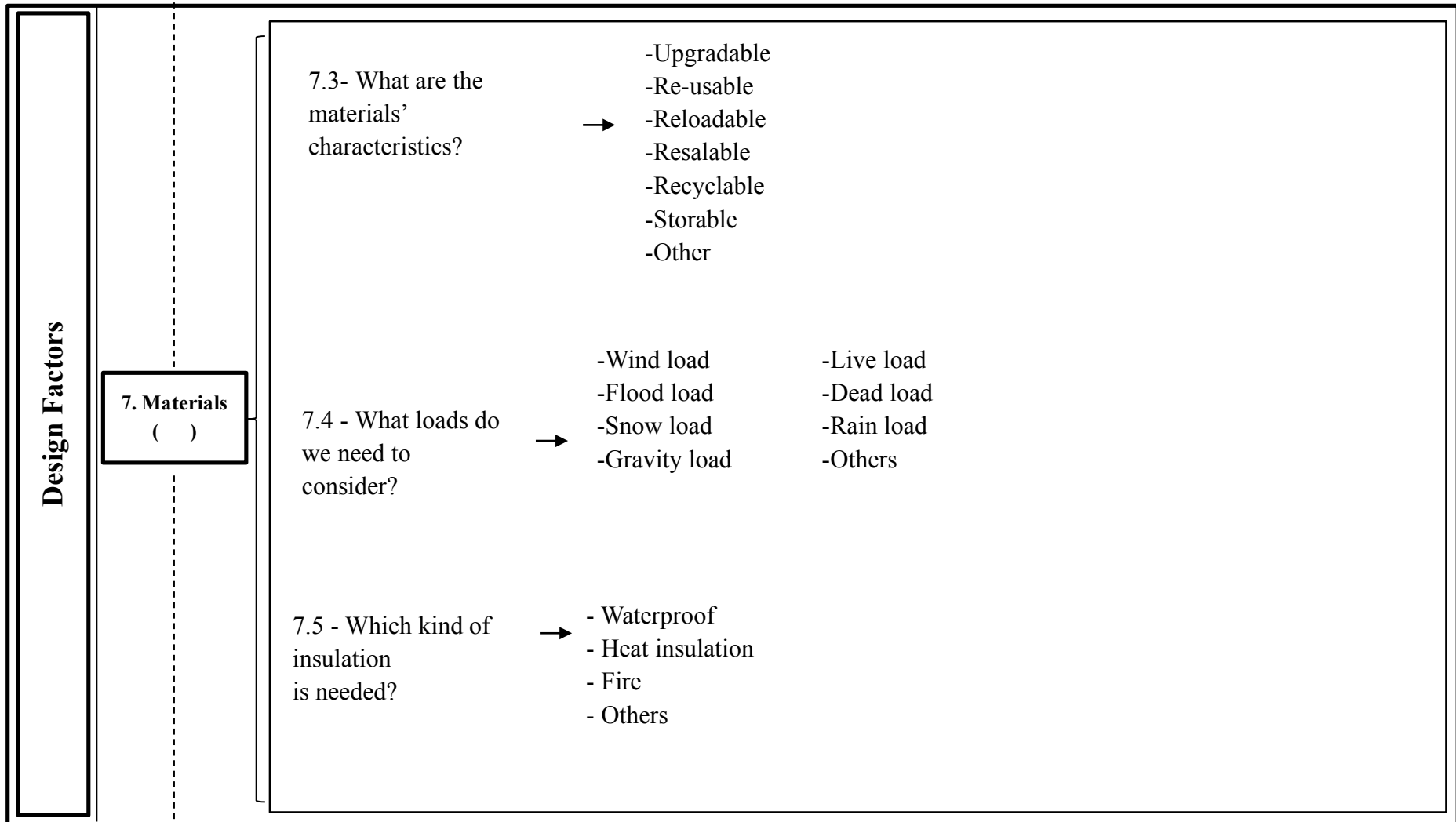


Figure 6-9: Materials factor (continued).

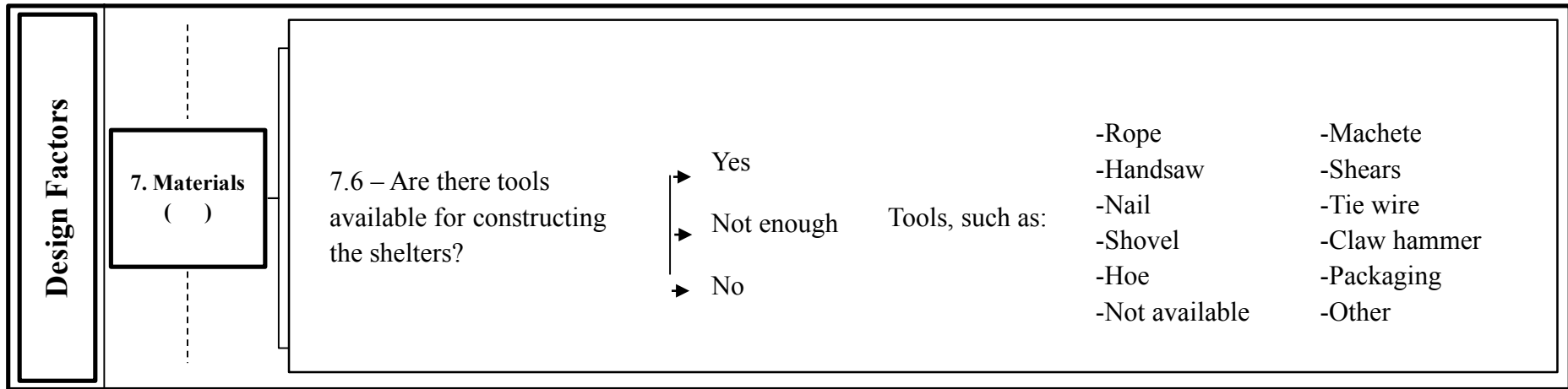


Figure 6-9: Materials factor (continued).

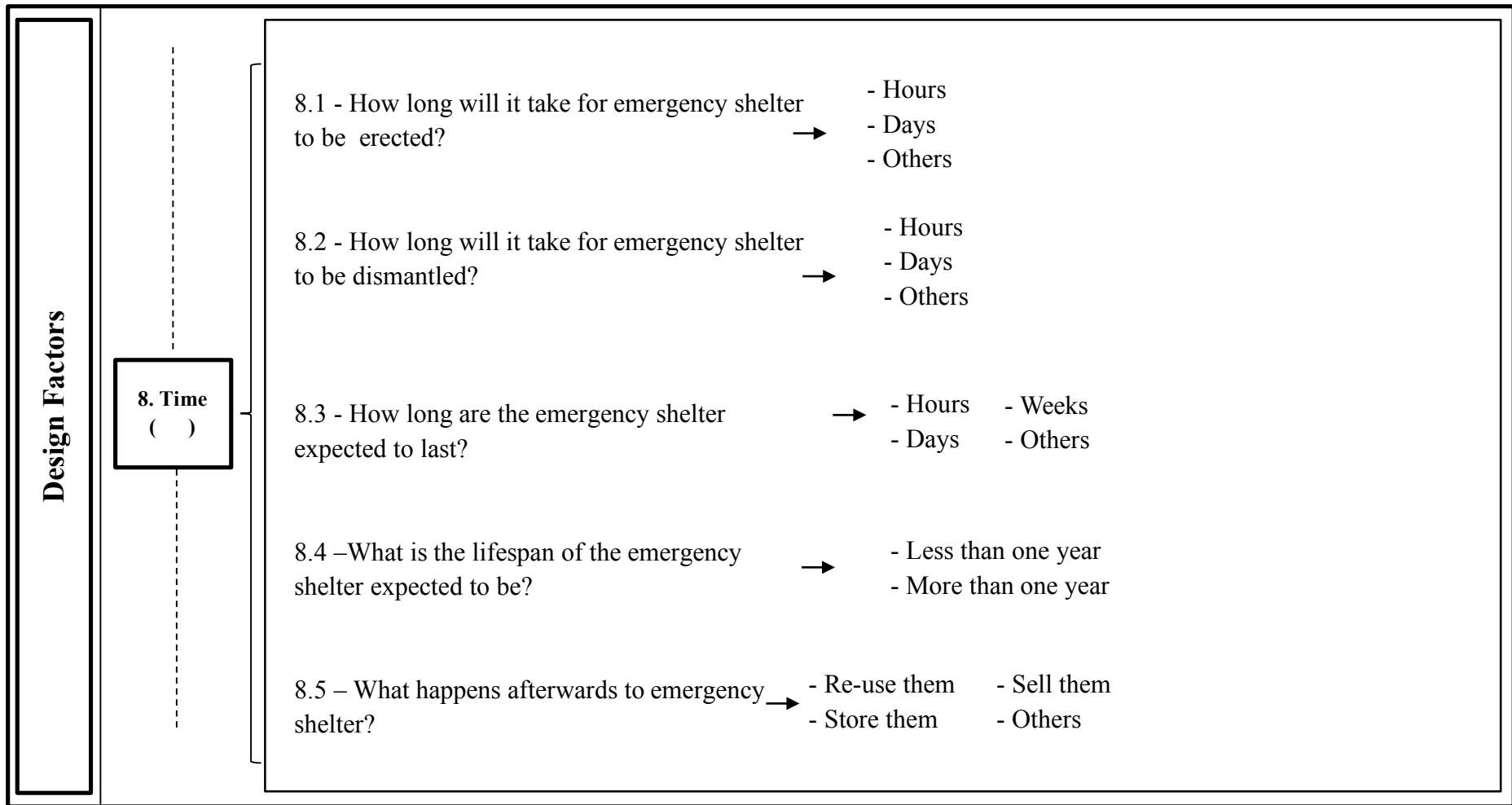


Figure 7-15: Time factor.

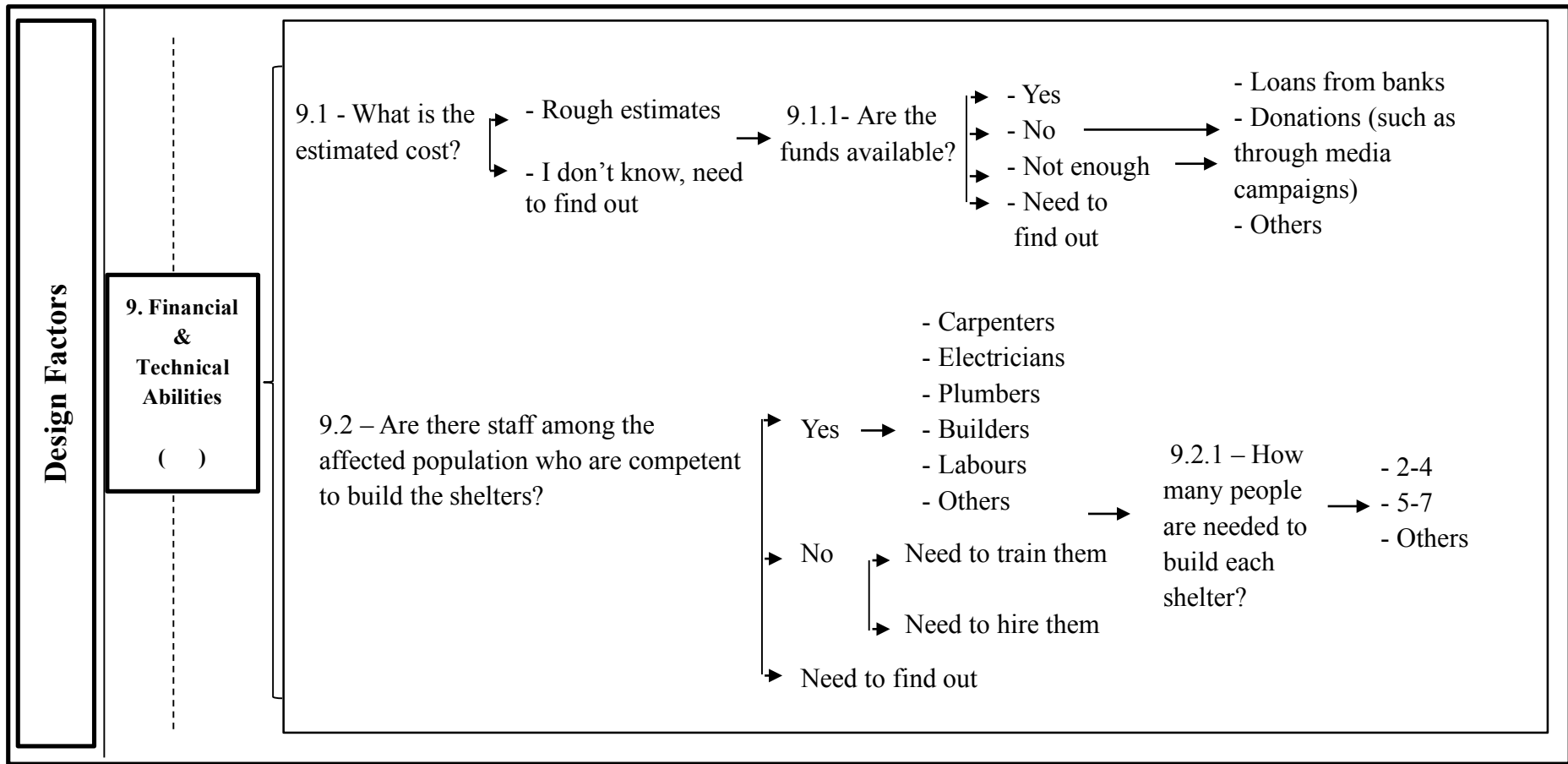


Figure 7-16: Financial and technical abilities factor.

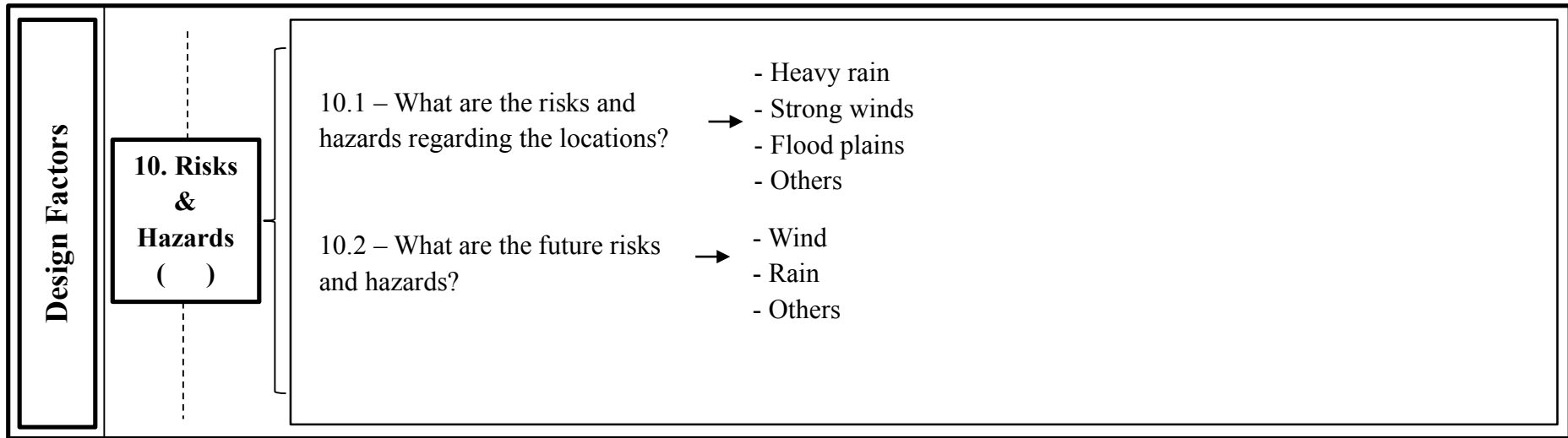


Figure 7-17: Risks and hazards factor

Chapter 8 Conclusions

8.1 Introduction

This chapter provides conclusion related to the extent to which the research's aim and objectives have been achieved, details the main contributions that have been made to current knowledge and outlines the limits of the research. Recommendations for future work are also debated.

8.2 Achievements of the research aim and objectives

8.2.1 Achievement of the research aim

The motivation of this research is the need to improve and achieve ERS response for a flash flood in SA whilst mitigating the severe problems (injuries to people and loss of lives, resources, houses and livelihoods) which might, otherwise, occur. As clarified in the introduction to Chapter 1, the main aim of this study is to develop an ERS response framework for Saudi Arabia to support those who make decisions such as relief agency staff who are present at the flash flood sites and whose role it is to provide help to those needing it (as discussed and presented in Chapter 5 and Chapter 7). In doing so, it is hoped to maximise fitness for purpose, provide good value for money, improve life quality and save time.

The ERS response framework was developed to support relief agency staff during a flash flood situation in SA in defining the nature of the ERS response needs that can then be used to identify appropriate ERS response solutions. This will help staff to identify a better solution than would otherwise be possible and will help them to implement an ERS response plan of action simply and quickly with regard to the specific situation at hand. In addition, the use of a database of best practice allows for future successful ERS responses to flash flood events to

be added, thereby improving the quality of the database and the ERS response framework. Good practice can, in this way, be recorded and repeated instead of being forgotten.

8.2.2 Achievement of the research objectives

Objective 1. *To gain a detailed understanding of flash flooding in SA and its main challenges; the different phases of emergency relief responses; ERS concepts and types and also the environmental, economic, technical and socio-cultural challenges related to the provision of ERS;*

This objective has been achieved through the review of relevant literature in Chapter 2. An in-depth review of the literature has provided a comprehensive picture of flash flooding in SA together with an improved understanding of ERS concepts and typical alternative forms of shelter currently used in practice.

A review of previous flash flooding events in SA indicated that many resulted in injuries to people and loss of life, resources, houses and livelihoods. It seems that there is normally a delay in deciding how best to respond to a flood event, as a lack of planning makes it difficult for those responsible to help save lives and mitigate the damage quickly. This lack of preparation makes it clear that there is a great need for an effective and immediate ERS response plan led by the relief organisations. During an emergency, quick and effective action is required. Planning the emergency relief shelter response in advance is an effective approach to mitigating the damage caused by flash flooding.

Following the review of the relief response phases, the author's research seeks to develop a tool that considers each stage. In the preparedness phase, the people given the responsibility to respond should be trained so that they know how to use the proposed framework and be ready to respond quickly when a flash flood happens. In the emergency phase, the framework should be implemented and the results should help the early recovery phase before the durable shelter

response starts. It is in these earlier stages that most of Saudi Arabia's flash flood problems occur.

There are many options that can be used following a flash flood in SA including occupying empty buildings or erecting basic structures with shelter kits covered with plastic sheeting or lightweight ready-for-use emergency tents. Public buildings are often requisitioned with slight adaptations. Nevertheless, it must be assumed that displacement can frequently last for much longer than expected, and that such public buildings will be required to revert to their original purpose after a relatively short period of time.

Secondly, providing shelter kits with materials such as plastic sheeting has tended to become the most vital shelter element in a number of relief actions. It is important to have a supply of materials for use in a frame which is adequate enough to support plastic and be capable of resisting winds, sandstorms and other similar effects. The frame materials should be renewable and have sustainable supply sources. Thirdly, lightweight ready-for-use emergency tents may be appropriate and useful, when locally available materials don't exist in sufficient quantities to meet the ERS demands.

SA can experience very low temperatures at night. Although tents or similar temporary structures do not provide effective shelter in cold weather conditions, they could be used as a very short-term solution until alternative more appropriate shelters have been sourced and provided. If necessary, additional plastic sheeting and blankets can be delivered in order to improve heat retention together with tent stoves. This type of stove requires fuel (e.g. kerosene or wood) around the clock to maintain a satisfactory temperature. Environmental aspects must be taken into account when wood is used. When using kerosene, procurement, distribution and storage might present difficult challenges.

Neither pre-fabricated units, shelter units that have been specially designed for emergency situations, or even winter shelter units, have been shown to be effective when it comes to accommodating flood-affected people in SA. There are many reasons for this including the long time needed for shipping, the considerable expense of the shelters, the long lead-in and production times, the transport costs and the problem of cooling them in the high temperature environment that exists in SA.

The review identifies and considers the range of environmental, economical, technical and socio-cultural factors that must be taken into account when designing emergency relief shelter responses for flash floods in SA. Environmental factors including climatic conditions, recycling, upgrading and disposing materials, hygienic water and air supply and environmental impact have been considered, as have economic issues such as initial cost, budgetary constraints, lifetime costs, livelihood and procurement style. Technical issues have been included such as the speed with which the flood-affected victims can be reached and sheltered as well as the use of local materials, access to support services and the provision of ERS of a comfortable size that can be easily maintained and repaired. The socio-cultural issues discussed include considering Saudi Arabian culture and Islamic laws, human dignity and security, physical and psychological well-being, communications, equality, and support for vulnerable people.

Objective 2. *To critically evaluate existing ERS response methods to establish whether they are appropriate for ERS responses for a flash flood situation in SA;*

This objective has been achieved through the critical evaluation of existing ERS response (internationally) in Chapter 3. After reviewing and critically evaluating ERS response methods, it has been shown that none of the current methods (as they are) is sufficiently helpful to those who make decisions, such as aid relief staff who are present at flash flood

sites and whose role it is to provide ERS response simply and quickly to those needing it in SA. This is partly because each flash flood has its own particular context which emerges only when the flash flood has occurred. However, there are some elements of best practice which may be learned from those methods in the development of the ERS response framework for a flash flood in a Saudi Arabian context.

It was identified that the approach which is common to most methods involves the use of a decision tree, which flows through a series of yes/no questions or sets of criteria. In addition, the tree usually follows a sequence of stages. Each stage can be iterative, and frequently work on one stage causes the decision makers to go back and improve the work of earlier stages. There are many advantages in following the stages formally, one of them being that it decreases the risk of having to create expensive modifications late in the process. Each stage creates a certain output that can be revised before implementation. Within each stage, altered groups can work in parallel.

Needs may change between different hazards and countries, and this consideration may impact on the question of which ERS responses offer the most effective forms of assistance; yet the basic needs for emergency shelters are similar in most such emergencies. There are some considerations identified previously which would be indispensable and applicable to responses to flash flood situations in SA. There are: needs, materials, vulnerability/skills, capacity, maintenance, location, type of shelter, climate, lifetime, time, cost, gender, adaptation, cash distribution, coordination, use, providers, size, fixing tools required to repair and build, cultural issues, community, maximising choice, the need for incremental processes, design characteristics, risks, labour, equality, environmental impact, the provision of basic services, protection, communication and displacement sensitivity.

Objective 3. *To develop, verify and validate an ERS response framework that will provide improved guidance for aid workers at the site of flash flood situations in Saudi Arabia enabling them to make better and quicker decisions for sheltering flood-affected victims.*

This objective has been achieved by adopting the outcomes from chapter 2 (objective 1) and chapter 3 (objective 2), and discussed in Chapter 5 in order to develop a conceptual ERS response framework. The results collected from the fieldwork which have been analysed in Chapters 6 (verification) and 7 (validation).

After the conceptual ERS response framework has been developed, it has been verified through the semi-structured interview method involving eighteen specialists who have important knowledge in the field of flash floods. Results from the verification stage have shown that the current situation in SA is that there is a lack of understanding when it comes to using an ERS response framework in a flash flood context and its importance.

The responders were willing to state that the stages should increase the coordination, responsibility, perception, and awareness of using the framework in a flood situation while encouraging consultations with all of the organisations who are responsible in the decision making context. The framework should also consider the local needs, environmental, economical, technical, and socio-cultural contexts. The framework also needs to consider consultations with flood-affected people to allow them to be a part of the response.

It was also said, by the responders, that most of the flood-affected people in past scenarios did not stay in open areas such as halls for a long period because they said that the open places decreased their level of privacy and security. They wanted separate spaces for each family such as furnished apartments or suites (where safe permanent buildings are available). It was believed by the flood-affected people that the government is rich enough to be able to provide the apartments and suites requested. At moment, according to some responders, the government

has been trying to develop a policy which would oblige those who own furnished suites, furnished apartments and hotels, to leave 15% of their buildings empty to be used in emergency situations as an option for sheltering flood-affected people.

In addition, it was also said by some of the responders that there is a new approach to ERS being developed which would involve a shelter allowance being given to flood-affected people for them to use for sheltering themselves. This option will provide flexibility in terms of choosing a dwelling, requiring there to be less responsibility and effort on the part of the government when it comes to choosing and providing shelters and making provision for maintenance money when using public buildings.

However, there is a risk when providing this kind of option, that the price of renting the flats might go up. Thus, this needs to be considered and controlled by the government. This option has been added to the developed framework for ERS under the availability of safe buildings factor as one of the options after identifying safe places. After considering the feedback of the responders from the verification stage, the developed ERS response framework was expanded.

The next step was validation the developed ERS response framework following the verification stage. The feedback was gained through structured interviews using a validation sheet including questions evaluated on a Likert scale and with open-ended questions included, all issued by the author in person. The total responses were mostly positive in the two groups including senior government officials and academics and consultants responsible for emergency response policy and practice. Generally, the evaluation has shown that the developed ERS response framework has a clear and detailed foundation involving all the various stages and design factors, and that it is comprehensive.

Most of the comments from verification and validation were considered and incorporated in the ERS response framework. As the final ERS response framework has improved it comprises

seven main stages: First, define the ERS response need stage, by answering questions which are under each of the design factors (flash flood information, flood-affected victims, weather conditions, size, availability of safe buildings, topographical features, materials, time, financial and technical abilities, and risks and hazards).

The second stage is identification of the basic ERS response requirements, after answering the questions (in the previous stage) which are under the design factors by different organisations.

The third stage is to identify successful ERS responses and categorise them for inclusion in a searchable database (this phase can be extended and added to with more successful ERS response solutions that used in future flash flood situations).

Fourth: create a searchable database of ERS responses by developing a search engine (that connects to the database mentioned in the previous stage) with some search boxes. Fifth: create a shortlist of possible ERS responses (initial results from the previous stage will be shown in this stage). The sixth stage involves reviewing the shortlisted ERS responses to select the final ERS response(s) by analysing the initial result from the previous stage to reach an appropriate final result. The last stage is to make final recommendations to come up with the final results for each design factor in order to maximise fitness for purpose, provide good value for money, improve life quality and save time.

8.3 Contribution to knowledge

The original contribution of this research can be seen at different levels, as follows:

8.3.1 Theoretical level

The preceding introduction and problem statement convey the importance of creating an ERS response framework for flash flood evacuees in SA, especially in the early stages of the response. The developed ERS response framework will provide efficient, rapid, simple and practical guidelines to beneficiaries in Saudi Arabia who are charged with decision-making (such as aid or relief workers) enabling them to devise ERS responses that better fit users' needs and wants in a flash flood event. Such a framework does not currently exist in SA. As experience is gained in its use and the searchable database is extended and enhanced, the proposed framework should help to maximise fitness for purpose, provide good value for money, improve life quality and save time.

ERS provides places of protection, privacy, security and well-being for people to live in when they have left their usual accommodation as a consequence of flash floods. ERS not only provide quick and short-term responses for the victims, but they also help them to recuperate from the injury and the trauma of a calamity, and give them a base from which they can begin the process of rehabilitation. The study provides the impetus for further research, investigation and thinking about ERS responses for floods and could form the basis of an approach that could be extended to apply to other forms of hazards and disasters, in other countries, particularly where a rapid response is required.

8.3.2 Empirical level

The proposed ERS response framework for flash floods provides a tool which will help all organisations responsible for ERS responses to bring major changes to current practice in SA and also help and encourage those organisations to work together in a more effective way in

order to decrease the delay in the response. It will oblige each participating organisation to share information from the outset to the last stage (when they provide the final recommendations) which will be executed by a committee which includes representatives from each organisation involved in the ERS response and managed by the Ministry of Civil Defence.

8.4 Limitations of the research

In any study, there are bound to be limits that have to be recognised. As far as the author is aware, the research described in this thesis is the first that seeks to improve Saudi Arabia's response to flash flooding events. Inevitably, there were some limits which had to be accepted during the research, which may offer scope for further study. There are many publications relating to ERS responses internationally, but only a few about ERS responses to flash floods in SA. As a consequence, data collected from the literature review was limited. However, this limitation did not have any severe influence on the study, since the structured interviews redressed what was missing in the literature. Conducting interviews with a number of specialists has provided an opportunity to explore the research problem in detail as well as providing the essential opportunities for verification and validation of the proposed ERS response framework.

To maintain its currency, the database needs to be expanded, and updated by including successful ERS responses to SA flash flood solutions. It should contain information such as the weather conditions, group size, building and/or emergency shelter centre locations, materials, load type, insulation type, the time needed to build, approximate shelter cost, anticipated lifespan, construction team expertise and availability, the ERS description and drawings.

The framework has not been trialled in a real flash flood situation by agency because of time limitation. Another limitation relates to the extent to which the results of this research might be useful in other developing countries or elsewhere where flash floods occur. This ERS response framework, relates only to flash flood situations. This might raise requests about whether the ERS response framework can also be efficiently and effectively applied to other types of hazards and disasters.

8.5 Recommended future work

According to the study and conclusions addressed, research and future work are suggested as shown below:

- Testing the ERS response framework in real-life flash flood situations.
- The ERS response framework for a flash flood for SA needs to be agreed approved and ratified by all responsible organisations before it can be implemented on the ground.
- The ERS response framework for a flash flood for SA needs workshops to teach relief workers how to use it. In addition, it needs more co-operation and participation from other relief organisations to help enter the required data.
- The ERS response framework for a flash flood for SA needs regular updating. This ERS response framework and its related database allows for many future successful ERS responses to be included, improving both the quality of the database and the ERS response framework.

- Due to the changing climate, it is anticipated that flash floods will continue to occur and that the interest in ERS response will increase. Thus, it is prudent to expand research on the topic in order to create powerful and effective solutions.
- It is recommended that ERS response actions be put into place before a flash flood actually happens. Having a pre-planned ERS response enables organisations to deal with the difficulty when it occurs, and decisions will then be made without the stresses involved in a post-flash flood scenario.

References

- Abdalla, R. 2018. Urbanization and Crisis Management Using Geomatics Technologies.
- Abosuliman, S.S., Kumar, A. and Alam, F. 2014. Flood disaster planning and management in Jeddah, Saudi Arabia-a survey. In: International Conference on Industrial Engineering and Operations Management.
- Al Saud, M. 2010. Assessment of flood hazard of Jeddah area 2009, Saudi Arabia. *Journal of Water Resource and Protection*. 2(9), pp.839-847.
- Al Saud, M. 2015. *Flood Control Management for the City and Surroundings of Jeddah, Saudi Arabia*. Springer.
- Alamri, Y.A. 2010. Emergency management in Saudi Arabia: Past, present and future. *Un. Of Christchurch report, New Zealand*. p21.
- Ali, A.B. and Ameer, F. 2018. An Assessment of Jeddah's Hydraulic Protection and Management Systems of Flood. *Open Access Library Journal*. 5(02), p1.
- Anhorn, J. and Khazai, B. 2015. Open space suitability analysis for emergency shelter after an earthquake. *Natural Hazards and Earth System Sciences*. 15(4), pp.789-803.
- Arsalan, H. and Cosgun, N. 2007. The evaluation of temporary earthquake houses dismantling process in the context of building waste management. In: *International earthquake symposium Kocaeli, 22-36/10/2007, Turkey*.
- Arslan, H. 2007. Re-design, re-use and recycle of temporary houses. *Building and environment*. 42(1), pp.400-406.
- Arslan, H. and Cosgun, N. 2008. Reuse and recycle potentials of the temporary houses after occupancy: Example of Duzce, Turkey. *Building and Environment*. 43(5), pp.702-709.
- Ban, S. 2014. *Humanitarian Architecture*. Aspen: Aspen Art Museum
- Battelle, J. 2005. *The search: how Google and its rivals rewrote the rules of business and transformed our culture*. USA: Penguin Group.
- Benthall, J. 1993. *Disaster, relief and the media*, I.B. London, New York: Tauris and Co Ltd.
- Blaxter, L., Hughes, C. and Tight, M. 2010. *How to research*. New York: Open University Press.
- Brebbia, C. 2013. *Disaster management and human health risk III: reducing risk, improving outcomes*. UK: WIT Press.
- Bryman, A. and Bell, E. 2015. *Business research methods*. USA: Oxford University Press.

- Burrell, G. and Morgan, G. 1979. *Elements of Sociology in Corporate Life*. London
 Heinemann Books
- Caia, G., Ventimiglia, F. and Maass, A. 2010. Container vs. dacha: The psychological effects
 of temporary housing characteristics on earthquake survivors. *Journal of
 environmental psychology*. 30(1), pp.60-66.
- Camp Coordination/Camp Management. 2010. *Collective centre guidelines*. United Nations
 High Commissioner for Refugees and International Organization for Migration.
- Carlier, I.V. and Gersons, B.P. 1997. Stress reactions in disaster victims following the
 Bijlmermeer plane crash. *Journal of Traumatic Stress*. 10(2), pp.329-335.
- Centre for Research on the Epidemiology of Disasters and UN Office for Disaster Risk
 Reduction. 2015. *Human cost of natural disasters*. Belgium
- Charlesworth, E. 2014. *Humanitarian Architecture: 15 Stories of Architects Working After
 Disaster*. UK: Routledge.
- Chen, Z.-M., Yeh, Y.-L. and Chen, T.-C. 2018. Assessment of a Regional Flood Disaster
 Indicator via an Entropy Weighting Method. *Natural Hazards Review*. 19(2),
 p05018002.
- Chou, J.-S., Ou, Y.-C., Cheng, M.-Y., Cheng, M.-Y. and Lee, C.-M. 2013. Emergency shelter
 capacity estimation by earthquake damage analysis. *Natural Hazards*. 65(3), pp.2031-
 2061.
- Collis, J. and Hussey, R. 2013. *Business Research : A Practical Guide for Undergraduate and
 Postgraduate Students*. 4th edition ed. London: Macmillan Press.
- Cordero-Scales, C., Kellum, J., Rule, A. and Harris, L. 2016. *Gender & Shelter: GOOD
 PROGRAMMING GUIDELINES*. United Kingdom: CARE International UK.
- Corsellis, T. and Vitale, A. 2005. *Transitional settlement displaced populations*. Oxfam GB.
- Cross, N. and Roy, R. 1989. *Engineering design methods*. New York: Wiley
- Davidson, C.H., Johnson, C., Lizarralde, G., Dikmen, N. and Sliwinski, A. 2007. Truths and
 myths about community participation in post-disaster housing projects. *Habitat
 International*. 31(1), pp.100-115.
- Davis, J. and Lambert, R. 2002. *Engineering in emergencies, a practical guide for relief
 workers*. Second ed. London, United Kingdom: ITDG Publishing.
- Denzin, N.K. and Lincoln, Y.S. 2011. *The SAGE handbook of qualitative research*. Sage.

- Department for Communities and Local Government. 2017. Temporary demountable structures: guidance on procurement, design and use. London: The Institution of Structural Engineers.
- Easterby-Smith, M. 2002. Management Research: An introduction. London: Sage Publications.
- El-Diraby, T.E. and O'conner, T. 2004. Lessons learned in designing research methodology in field-based construction research. *Journal of Professional Issues in Engineering Education and Practice*. 130(2), pp.109-114.
- EPC and TCG International. 2004. Participatory planning guide for post-disaster reconstruction. India and Washington.
- European Civil Protection and Humanitarian Aid Operations. 2018. Disaster Risk Reduction. Modex/Mareike Harms.
- Félix, D., Branco, J.M. and Feio, A. 2013a. Guidelines to improve sustainability and cultural integration of temporary housing units. In: 6th International i-Rec Conference, 26/5/2013, Switzerland. i-Rec conference, pp.1-12.
- Félix, D., Branco, J.M. and Feio, A. 2013b. Temporary housing after disasters: A state of the art survey. *Habitat International*. 40, pp.136-141.
- Félix, D., Monteiro, D., Branco, J.M., Bologna, R. and Feio, A. 2015. The role of temporary accommodation buildings for post-disaster housing reconstruction. *Journal of Housing and the Built Environment*. 30(4), pp.683-699.
- Fellows, R. and Liu, A. 2015. Research methods for construction. Oxford: John Wiley & Sons.
- Fraenkel, J.R., and Wallen, N. E. 2006. How to design and evaluate research in education. New York: McGraw-Hill.
- General Directorate of Civil Defence. 2018. National Plan for natural disasters risk reduction Ministry of Interior - Saudi Arabia.
- Girod-Seville, M. and Perret, V. 2001. Epistemological foundations. In: R. Thietart and et al., eds, *Doing Management Research: A Comprehensive Guide* 1 edn. London: SAGE Publications.
- Glaser, B.G. and Strauss, A.L. 2017. *Discovery of Ground Theory: Strategies for Qualitative Research*. New York: Routledge.
- Gray, B. and Bayley, S. 2015. Case study: shelter innovation ecosystem. UK: Department for International Development, UK aid Network.

- Gualliers, R.D. 1992. Choosing Information Systems Research Approaches. Oxford: Blackwell Scientific Publication.
- Habitat for Humanity's. 2016. Disaster Risk Reduction and Response. habitat.org.
- Hadafi, F. and Fallahi, A. 2010. Temporary housing respond to disasters in developing countries-case study: iran-ardabil and lorestan province earthquakes. World Academy of Science, Engineering and Technology. 66, pp.1536-1542.
- Haigh, R., Amartunga, D. and Hemachandra, K. 2018. A capacity analysis framework for multi-hazard early warning in coastal communities. Procedia engineering. 212, pp.1139-1146.
- Hayat, E., Thakore, R., Liyanage, C.L., Haigh, R. and Amaratunga, D. 2018. Research Approach towards Formulating Research and Innovation Capacity Development Framework for Disaster Resilience in Higher Education Institutions. International Journal on Advanced Science, Engineering and Information Technology. 8(1), pp.264-271.
- Hendriks, E., Basso, M., Sposini, D., van Ewijk, L. and Jurkowska, H. 2016. Self-built housing as an alternative for post-disaster recovery. Eindhoven University of Technology, Eindhoven.
- Hidayat, B. and Egbu, C. 2010. A literature review of the role of project management in post-disaster reconstruction. In: C. (Ed) Procs 26th Annual ARCOM Conference, Leeds, UK. Association of Researchers in Construction Management, pp.1269-1278.
- HM Government. 2013. Emergency response and recovery. London: Crown copyright.
- HM Government. 2014. Evacuation and shelter guidance. London: Crown copyright.
- Howard, J. and Spice, R. 1989. Plastic Sheeting UK: Oxfam.
- Humanitarian Aid and Civil Protection. 2016. DG ECHO Thematic Policy Document: Shelter and Settlements. EU.
- IFRC. 2010. IFRC shelter kit guidelines. Switzerland: International Federation of Red Cross and Red Crescent Societies.
- IFRC. 2016. What we do in shelter [Online]. [Accessed 2/7/2016]. Available from: <http://www.ifrc.org/en/what-we-do/disaster-management/responding/services-for-the-disaster-affected/shelter-and-settlement/what-we-do-in-shelter/>
- IFRC and OCHA. 2015. Shelter after Disaster. Geneva, Switzerland: International Federation of Red Cross and Red Crescent Societies and Coordination of Humanitarian Affairs.

- IFRC and Oxfam GB. 2007. Plastic sheeting, a guidance to specification and use of plastic sheeting in humanitarian relief. International Federation of Red Cross and Red Crescent Societies and Oxfam-GB.
- IFRC/RCS. 2013. Post-disaster shelter: Ten designs. Geneva: International Federation of Red Cross and Red Crescent Societies.
- International Recovery Platform, Shiozaki, Y., Yasuo, T., Akihiko, H., Sofia, B., Kobe University and World Bank. 2013. Recovery planning: Transitional shelter. [Online]. Global Facility for Disaster Reduction and Recovery and World Bank. [Accessed 5/2013]. Available from: <http://wbi.worldbank.org/wbi/content/knowledge-notes-cluster-4-recovery-planning>
- IOM, NRC and UNHCR. 2015. CAMP Management Toolkit. International Organization for Migration, Norwegian Refugee Council and UN Refugee Agency.
- IRP and ISDR. 2011. Guidance Note on Recovery Shelter. Japan: International Recovery Platform Secretariat.
- Johnson, C. 2007. Strategic planning for post-disaster temporary housing. *Disasters*. 31(4), pp.435-458.
- Johnson, C., lizarralde, G. and Gonzalo, C. 2006. A systems view of temporary housing projects in postdisaster reconstruction. *Construction Management and Economics*. 24.
- Karin, S. 2001. Temporary Buildings: The Trade Fair Stand as a Conceptual Challenge
- Karunasena, G. and Amaratunga, D. 2015. Capacity Gaps in Post Disaster Waste Management: Case Study in Sri Lanka. *Recovery from the Indian Ocean Tsunami*. Springer, pp.403-415.
- Kats, G. and Alevantis, L. 2003. The cost and financial benefits of green buildings- A report to California's sustainable building task force. Australia: Sustainable Building Task Force.
- Kelly, C. 2005. Checklist-based guide to Identifying critical environmental considerations in emergency shelter site selection, construction, management and decommissioning. Geneva: UNEP/OCHA Environment Unit.
- Lawson, B. 2006. *How designers think: The design process demystified*. UK: Routledge.
- Lloyd-Jones, T. 2006. *Mind the Gap! Post-disaster reconstruction and the transition from humanitarian relief*. UK: RICS.
- Locke, F.L., Spirduso, W. W. and Silverman, S.J., 2013. *Proposals that work: A guide for planning dissertations and grant proposals*. London: Sage Publications, Inc.

- Luciano, T. 2011. *Doing a literature review: releasing the social science research imagination*. UK: Theodora (Thea) Bredic.
- Massey, N. 2016. *The Contract Design Process*.
- Mathbor, G.M. 2007. Enhancement of community preparedness for natural disasters the role of social work in building social capital for sustainable disaster relief and management. *International Social Work*. 50(3), pp.357-369.
- May, S. 2013. *Low cost, low tech disaster proof shelter*. Cambodia: People in Need.
- Miles, M.B. and Huberman. 1994. *Qualitative data analysis*. Thousand Oaks, California: Sage Publications, Inc.
- Ministry of Hajj and Umrah. 2017. *The executive plan for the tasks of Hajj and Umrah and its affiliated parties included in the general plan of emergency for Hajj pilgrimage*
- Mohamed, M.I.A. 2017. Khartoum and Hybrid Disasters. *Disaster Management and Human Health Risk V: Reducing Risk, Improving Outcomes*. 173, p195.
- Moore, N. 2000. *How to do research: The complete guide to designing and managing research project*. London: Library Association publishing.
- New Jersey Department of Children and Families. 2016. *Sheltering Guidelines for Children and Families*. Trenton.
- NHHCRC. 2014-2018. *Global strategy for settlement and shelter*. Switzerland: United Nations High Commissioner for Refugees.
- Nigg, J.M., Barnshaw, J. and Torres, M.R. 2006. Hurricane Katrina and the flooding of New Orleans: Emergent issues in sheltering and temporary housing. *Annals of the American Academy of Political and Social Science*. 604, pp.113-128.
- Oppenheim, A.N. 2000. *Questionnaire design, interviewing and attitude measurement*. London and New York: Bloomsbury Publishing.
- Organisation for Economic Co-Operation and Development. 2018. *Towards an All-Hazards Approach to Emergency Preparedness and Response Prevention Mitigation Safety Preparedness Guidance Response Emergency Recovery: Lessons Learnt from Non-Nuclear Events*. France: OECD.
- Oxfam. 2012. *Emergency shelter principles and practice*. OXFAM Technical Brief
- Patton, M.Q. 1990. *Qualitative evaluation and research methods*. SAGE Publications, inc.
- Punch, K. 2013. *Introduction to Social Research: Quantitative and Qualitative Approaches*. London: SAGE Publications Ltd.
- Rajib, S. 2016. *Recovery from the Indian Ocean Tsunami*. Springer.

- Regnier, P.e.a. 2008. From emergency relief to livelihood recovery Lessons learned from post-tsunami experiences in Indonesia and India. *Disaster Prevention and Management*. 17(3), pp.410-429.
- Robson, C. 2016. *Real World Research*. Oxford: John Wiley & Sons.
- Rouse, A. and Dick, M. 1994. The use of NUDIST, a computerized analytical tool, to support qualitative information systems research. *Information Technology and People*. 7(3), pp.50–62.
- Royer, I. and Zarlowski, P. 2001. Research Design. In Thietart et al. *Doing Management Research: A Comprehensive Guide*. London: Sage Publications.
- Saunders, G. 2011. Family tent, 16m2. IFRC Shelter Research Unit.
- Saunders, M., Philip, L. and Adrian, T. 2009. *Research methods for business students*. London: Pitman Publishing.
- Sekaran, U. and Bougie, R. 2016. *Research methods for business: a skill-building approach*. New York: John Wiley & Sons.
- Seneviratne, T., Amaratunga, D., Haigh, R. and Pathirage, C. 2010. Knowledge management for disaster resilience: Identification of key success factors.
- Sever, S.M. and Altun, M.C. 2009. Design of a post disaster temporary shelter unit. *ITU Journal of Faculty of Architecture*. 6, pp.58-74.
- Shaw, R. 2006. Indian ocean tsunami and aftermath. *Disaster Prevention and Management*. 15(1), pp.5-20.
- Shelter Box. 2018. Shelter Box Delivery [Online]. [Accessed 18/9/2014]. Available from: <https://www.shelterbox.org/shelter/impact?gclid=CPXJzZuE1NQCFaad7Qodg>
- Shelter Centre. 2008. Transitional shelter (PowerPoint). [Online]. [Accessed 2/2013]. Available from: <http://sheltercentre.org/meeting/shelter-meeting-09a>
- Shelter Centre. 2012. *Transitional Shelter Guidelines*. Switzerland: Shelter Centre.
- Shelter Centre and Norwegian Refugee Council. 2010. *Urban shelter guidelines, assistance in urban areas to populations affected by humanitarian crises* Shelter Centre and NRC.
- Smilowitz, R., Blewett, W., Williams, P. and Chipley, M. 2006. *Design guidance for shelters and safe rooms*. US: Federal Emergency Management Agency.
- Smith, J.H. 1993. Modeling muddles: Validation beyond the numbers. *European Journal of Operational Research*. 66(2), pp.235-249.
- Tan, W. 2004. *Practical Research Methods*. Singapore: Prentice Hall.
- Tesch, R. 2013. *Qualitative research: Analysis types and software*. Routledge.

- The Institution of Structural Engineers. 2017. Temporary demountable structures: Guidance on procurement, design and use. UK: IStructE Ltd.
- The Sphere Project. 2011. Minimum standards in shelter, settlement and non-food items. Switzerland: The Sphere Project.
- The World Bank. 2016. Building Resilient Communities: Risk Management and Response to Natural Disasters through Social Funds and Community-Driven Development Operations. Washington.
- Torus, B. and Şener, S.M. 2015. Post-disaster shelter design and CPoDS. A|Z ITU Journal of the Faculty of Architecture. 12(1), pp.269-282.
- Trans-European, R. and Education Networking, A. 2006. Internet users' research guide. Harlow: Pearson Prentice Hall.
- Uma, S. and Roger, B. 2016. Research methods for business: A skill building approach. New York: John Wiley & Sons.
- UNHCR. 2007. Handbook for Emergencies. Geneva, Switzerland: United Nations High Commissioner for Refugees.
- UNHCR. 2016. Shelter design catalogue. Switzerland: UNHCR.
- UNHCR. 2018. Shelter solutions.
- United Nations. 2004. Tents: A guide to the use and logistics of family tents in humanitarian relief. Geneva: United Nations.
- United Nations, OCHA, IFRC and International, C. 2009. Timber as a construction material in humanitarian operations. United Nations, OCHA, IFRC and CARE International.
- United Nations Environmental Protection Agency. 2015. Develop Emergency Procurement Policy and Procedures. [Online]. [Accessed 4/4/2015]. Available from: <http://water.epa.gov/infrastructure/watersecurity/funding/fedfunds/emergency.cfm>
- Weerasena, N., Amaratunga, D., Hettige, S., Haigh, R. and Sridarran, P. 2018. Provision of Social Infrastructure for Resettled Victims of the 2004 Tsunami: Evidence from the grass roots. *Procedia engineering*. 212, pp.379-386.
- World Vision. 2016. Worst natural disasters of 2015. [Online]. [Accessed 26/7/2016]. Available from: <http://www.worldvision.org/news-stories-videos/natural-disasters-2015>
- Youssef, A.M., Sefry, S.A., Pradhan, B. and Alfadail, E.A. 2016. Analysis on causes of flash flood in Jeddah city (Kingdom of Saudi Arabia) of 2009 and 2011 using multi-sensor remote sensing data and GIS. *Geomatics, Natural Hazards and Risk*. 7(3), pp.1018-1042.

- Zhao, L., Li, H., Sun, Y., Huang, R., Hu, Q., Wang, J. and Gao, F. 2017. Planning Emergency Shelters for Urban Disaster Resilience: An Integrated Location-Allocation Modeling Approach. *Sustainability*. 9(11), p2098.
- Zhao, X., Coates, G. and Xu, W. 2017. Solving the earthquake disaster shelter location-allocation problem using optimization heuristics. IMT Mines Albi-Carmaux (École Mines-Télécom).

Appendix A: Semi-structured interview questions for a verification

Research title: **EMERGENCY RELIEF SHELTER (ERS) RESPONSE FRAMEWORK FOR A FLASH FLOOD IN SAUDI ARABIA (SA).**

Flash flood are increasing in SA, causing such considerable damage to people, economic, environment and personal and public properties. They do not always affect people simply for a short period; rather, those people's general welfare and way of life can be disrupted for many months after the event has occurred. Emergency relief shelters (ERS) are used to provide places of protection, privacy, security and well-being for people to live in when they have left or lost their usual accommodation as a consequence of a flash flood. Typical examples of ERS include using permanent buildings for a short period of time (buildings such as furnished flats, stadiums, halls, and so on), as well as tents. The below questions are trying to develop a response framework for ERS to support decision makers to come up with an adequate and quick shelter response immediately after the flood occurs in SA.

A. Personal information

Name		الاسم	Organisation		الجهة
Tel No		رقم الجوال	Email		الإيميل
Academic qualified		المؤهل الأكاديمي	Professional qualified		المؤهل الدقيق
Major Specialty:		التخصص العام	Minor Specialty		التخصص الدقيق
Experience and years		الخبرة وسنواتها	Tasks		المهمة
Projects		المشاريع	Others		أخرى

B. Generic questions

B.1.	<p>What is your understanding of a response framework for ERS? ما هو فهمك للهيكل التصميمي لأموى الإغاثة الطارئة؟</p> <p>1. Directing توجيه 2. Advising تقديم مشورة 3. Providing information تقديم معلومات 4. Resolving a problem حل مشكلة</p> <p>Other أخرى</p>
B.2.	<p>Based on your knowledge, how important is the ERS response framework for decision making? بناء على خبرتك، ماهي أهمية الهيكل التصميمي لأموى الإغاثة الطارئة؟</p> <p>1. Unimportant غير مهم 2. Slightly important أقل أهمية 3. Important مهم 4. Very important مهم جدا</p> <p>Other</p>

B.3.	<p>What are the benefits of using the ERS response framework? ما هي فوائد استخدام الهيكل التصميمي؟</p> <p>1. Helping a decision makers to provide a quick and adequate response 2. Saving lives حفظ الأرواح 3. Saving money توفير الأموال 4. Saving time توفير الوقت Other أخرى.....</p>
B.4.	<p>What are the drawbacks of using the ERS response framework? ما هي عيوب استخدام الهيكل التصميمي؟</p> <p>1. Consuming time مضیحة للوقت 2. Hard to use it in a real time صعوبة الاستخدام 3. Too generic in nature معلومات عامه Other أخرى.....</p>

C. An ERS response framework for ERS for a flash flood situation in SA الهيكل التصميمي لمأوى الإغاثة الطارئة أثناء الفيضانات بالسعودية

C.1. An ERS response framework stages خطوات الهيكل التصميمي

C.1.1.	<p>Does this list of stages cover the full spectrum of ERS response practices in Saudi Arabia for a flash flood? هل هذه الخطوات تغطي كامل السلسلة العملية بالسعودية؟</p> <p>1. Yes. نعم 2. Not quite sure. لست متأكد 3. No. لا</p>
C.1.2.	<p>Can you add to or remove from the diagram? هل توجد إضافة أو حذف لهذه القائمة؟</p> <p>.....</p> <p>.....</p>
C.1.3.	<p>Why have you added/removed this specific stage? لماذا؟</p> <p>.....</p> <p>.....</p>
C.1.4.	<p>Can the identified stage be applied in practice? هل يمكن تطبيق الخطوات المحددة عمليا؟</p> <p>1. Yes. نعم 2. Not quite sure. لست متأكد 3. No. لا</p> <p>.....</p>
C.1.5.	<p>To what extent do the identified stages contribute to ERS response in your area of expertise and how? إلى أي مدى تسهم هذه الخطوات المحددة لتقديم مأوى الإغاثة الطارئة في مجال خبرتك</p> <p>1. Not at all لا على الإطلاق 2. To a small extent إلى حد بسيط 3. To some extent إلى حد ما 4. To moderate extent إلى حد معتدل 5. To a large extent إلى حد كبير How? كيف؟.....</p>

C.1.6.	Which sector/discipline specific aspects are not covered by the stages? ماهي الجوانب أو المجالات التي لم يتم تغطيتها بعد؟
C.1.7.	Rank these stages in terms of priority for implementation. رتب هذه الخطوات من حيث الأولوية للتنفيذ؟

C.2. Design factors العوامل التصميمية

C.2.1	Does this list of design factors cover the full spectrum of ERS response practices in Saudi Arabia for a flash flood? هل هذه القائمة تغطي كامل السلسلة العملية بالسعودية 1. Yes. نعم 2. Not quite sure. لست متأكد 3. No. لا
C.2.2	Can you add to or remove from the list? هل توجد إضافة أو حذف لهذه القائمة؟
C.2.3	Why have you added/removed this specific design factor? لماذا؟
C.2.4	Can the identified design factor be applied in practice? هل يمكن تطبيق العوامل التصميمية المحددة عمليا؟ 1. Yes. نعم 2. Not quite sure. لست متأكد 3. No. لا
C.2.5	To what extent do the identified design factors contribute to ERS response in your area of expertise and how? إلى أي مدى تسهم هذه العوامل التصميمية المحددة لتقديم مأوى الإغاثة الطارئة في مجال خبرتك 1. Not at all لا على الإطلاق 2. To a small extent إلى حد بسيط 3. To some extent إلى حد ما 4. To moderate extent إلى حد معتدل 5. To a large extent إلى حد كبير How? كيف?
C.2.6	Which sector/discipline specific aspects are not covered by the design factors? ماهي الجوانب أو المجالات التي لم يتم تغطيتها بعد؟
C.2.7	Rank these design factors in terms of priority for implementation. رتب هذه العوامل التصميمية من حيث الأولوية للتنفيذ؟

Appendix B: Structured interview questions for a validation

1. Personal information

Name		Organisation	
Tel No		Email	
Academic qualified			
Experience and years		Tasks	
Projects		Others	

2. Please rate the importance of each stage of the proposed response framework of ERS that support staff of relief agencies in SA during flash flood situation. Please add any missing stage or information you see important and rate their importance. Please remove any unnecessary or redundant stages or information.

Stages of proposed framework	Degree of importance				
	Very high	High	Moderate	Low	Very low
Stage one: define the ERS response need -----					
Stage two: identification of basic ERS response requirements -----					
Stage three: identify successful ERS responses and categorise for inclusion in searchable database -----					
Stage four: create a searchable database of ERS responses -----					
Stage five: create shortlist of possible ERS responses -----					
Stage six: review of shortlisted ERS responses to select final ERS response(s) -----					
Stage seven: final recommendation -----					

3. Please rate the importance of design factors for ERS response that maximise fitness for purpose, provide good value for money and save time. Please add any missing design factor you see necessary and rate their importance.

Design factors	Degree of importance				
	Very high	High	Moderate	Low	Very low
Flash flood information					
Flood-affected persons					
Weather conditions					
Size					
Availability of save building					
Topographical features					
Materials					
Time					
Financial and technical abilities					
Risks and hazards					

4. Please rate the degree of the following aspects of the ERS response framework for a flash flood in SA and provide your comments you might have.

A. Efficacy

Will the response framework of ERS produce the intended result?

- Not Efficacious
- Slightly Efficacious
- Moderately Efficacious
- Very Efficacious
- Extremely Efficacious

Your comments if any:

B. Practicality

Will the response framework of ERS incline to action rather than theory or speculation?

- Not practical
- Slightly practical
- Moderately practical
- Very practical
- Extremely Practical

Your comments if any:

C. Helping decision makers

Will the response framework of ERS help the attainment of long term goals related to decision makers' expectations?

?

- Not
- Slightly
- Moderately
- Very
- Extremely

Your comments if any: -----

D. Saving lives

Will the response framework of ERS saves lives

- Not
- Slightly
- Moderately
- Very
- Extremely

Your comments if any: -----

E. Saving money

Will the response framework of ERS saves money?

- Not
- Slightly
- Moderately
- Very
- Extremely

Your comments if any: -----

F. Saving time

Will the response framework of ERS saves time?

- Not
- Slightly
- Moderately
- Very
- Extremely

Your comments if any: -----

General Comments:

