Developing User-Informed Specifications for Refugee Shelters in Hot-Dry Climates: A study of the Al Za'atari Camp in Jordan

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DECLARATION

I hereby affirm that the PhD thesis entitled "Developing User-Informed Specifications for Refugee Shelters in Hot-Dry Climates: A study of the Al Za'atari Camp in Jordan" was carried out by me under the University of Salford regulations and guidance for the PhD degree and under the supervision of Dr. Claudia Trillo, School of the Built Environment, University of Salford, Salford, United Kingdom.

All data in the thesis are based on my reading and analysis of original text and are not published in other books, articles, or websites and I declare that the presented thesis has not been submitted before in any other university or academic institution as part of an academic award.

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Signed:
Rania Fayez Aburamadan
Date: December, 2016

LIST OF ABBREVIATIONS

BSI	British Standard Institution
CARE	Cooperative for Assistance and Relief Everywhere
CIAM	The Congrès Internationaux d'architecture Moderne
DS	Design Science
E.R.G	Growth Theory
ESA	European Space Agency
HFH	Habitat for Humanity
IDPs	Internally Displaced Persons
IESNA	Illuminating Engineering Society of North America
IFD	Industrial, Flexible and Demountable
IFRC	International Federation of Red Cross and Red Crescent Societies
IMO	International Organization for Migration
IS	Information Systems
IStructE	Institution of Structural Engineers
JWU	Jordanian Women's Union
MENA	Middle East and North Africa Region
NBC	National Building Specification
NGO	Non-government organizations
NRC	Norwegian Refugee Council
OSHA	Occupational Safety and Health Administration of the United. States Department of Labor
Oxfam	Oxford Committee for Famine Relief
PEC	Person-Environment Congruence

PV	Photovoltaic
QOL	Quality of Life
REN21	Renewable Energy Policy Network for the 21st Century
SCES	Sectional Compact Emergency Shelter
SRI	Solar Reflection Index
UN	United Nation
UNICEF	United Nations Children's Fund
UNHCR	United Nations High Commissioner for Refugees
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
UPP	Un ponte per

Abstract

The increase in refugee numbers is an important concern globally. Since the mid-twentieth century, many countries in different regions have been accommodating refugees by providing shelters. Recently, this response has been evident particularly in Lebanon, Turkey, Iraq, and Jordan, where these countries have faced political and economic obstacles whilst accommodating such large increases in refugees caused by the unstable political situation in the region.

Despite the abundance of examples of temporary shelters that various countries offer, previous studies have not shown adequate solutions for social and cultural diversity, as well as building and dismantling an appropriate shelter that is suitable for several environment conditions and particularly in hot-dry climates. There is an absence of studies that discuss refugees' settlements as a global interest. Furthermore, there are very few examples in the literature that discuss shelters suited to hot-dry conditions, whether provided by government or other international institutions.

Existing shelters that the United Nations High Commissioner for Refugees (UNHCR) and other institutions and donors provide do not satisfy refugees' needs; specifically, suitable design factors and urban organization aspects.

The main aim of this study is to develop the specifications for refugee shelters that meet user requirements in hot-dry climates. The design science method provides a theoretical framework to develop a specification that incorporates the design, structural aspects, layout, and to address the particular social and cultural challenges that are presented in refugee camps in hot-dry climates. The research develops specifications, in terms of shelter performance, and contemplates environment challenges and local context conditions besides adding value through a specifications list which incorporates differences of social and cultural aspects, which are not currently provided in humanitarian organizations' specifications and guidelines.

The result of the specification list gives an opportunity to illustrate infinite alternatives of shelter design which consider not only the users' needs, but also the local context

conditions of being located in the hot-dry climate of Jordan. These designs may also be applicable in other environments with similar climatic conditions. In so doing, the findings presented in the research help form a provisional view of peoples' needs that can be acted on by humanitarian organizations, which could lead to better standardized shelter solutions.

Keywords: Refugees' shelters, Shelters specifications, Hot-dry climate, Design science method.

Chapter One
Introduction: Contextual Background

1.1 Introduction

The purpose of this introduction chapter is to clarify the research background and the overview of the research regarding refugees' situation in camps, taking into consideration camps located in hot-dry climates, besides explaining the need and justification of the research. The chapter introduces the research aim, research objectives and underlying research questions. Also, it highlights the overall research organization and the thesis structure, together with the scope of the research.

1.2 Background of the Research Study

The world is currently facing significant difficulties in accommodating refugees, because of the unstable political situation that many countries are experiencing. As the United Nations High Commissioner for Refugees [UNHCR] reported in 2013a, many areas around the world are suffering from security situations and political unrest that has led to major challenges. Recently, Syria, Libya, Yemen and other countries have experienced conflict situations leading to large outflows of refugees. The UNHCR (2014-2015) describes the main stakeholders in conflict areas as being refugees, governments, non-government organizations (NGO), and neighboring areas and showed the total number of refugees in the Middle East and North Africa region (MENA) at 5,840,710 and 566,590 respectively in 60 refugee camps. They were categorized by the UNHCR as protected refugees, returned refugees, protected Internally Displaced Persons (IDPs), returned IDPs, Asylum-seekers, people under UNHCR's stateless mandate and 'various' others. By the end of 2012, Sub-Saharan Africa and Asia accounted for 63% and 29% of refugee camps, respectively. Maak (2015) indicated in Sub Saharan Africa 72 percent of the population live in slums and 59 percent in Southeast Asia, the demand from this increasing population is a critical concern around the world and the United Nation (UN) reports indicate that by 2050 the increasing refugee population will reach 1.5 billion people and additional needs of dwellings and services must be provided to meet the demand.

The aim to develop the specifications of a refugee shelter that reflects the needs of users in hot-dry climates is the central focus of this research. Specifically the research will assess refugees' physical and social needs and put forward specifications for shelters performance that are modified based on these needs, related to the particular circumstances of being located in the hot-dry climate of Jordan. Babister and Kelman (2002), Corsellis (2001) and Manfield, Ashmore, and Corsellis (2004) have considered temporary and permanent solutions for providing shelters, however, the basic design and function of refugee shelters has ostensibly remained unchanged for many decades. Furthermore, there is growing interest in the architectural and planning issues related to shelters and refugee camps (La Biennale, 2016). Temporary solutions for meeting unexpected or non-permanent needs are gaining importance within the contemporary disciplinary field of architecture and planning (The Harvard Graduate School of Design, 2012).

In short, this research will consider refugee camps generally, in hot-dry climate conditions that are located in different places around the world. In addition, each climate has different situations regarding shelter performance solutions and the researcher chose a hot-dry climate since most camps around the world are located in such climates. In this regard, The Al Za'atari camp in Jordan is located in such a hot-dry climate and is the second largest camp in the world as reported by the UNHCR (2013b). For this reason, this camp will be used as the location for primary data collection in this study.

1.3 Research Need

There is an increasing number of refugee globally and housing refugees is a crucial concern for humanitarian organizations and particularly housing refugees following consequences of disasters, whether man-made or natural disasters. Corsellis (2001, cited in Manfield, *et al.,* 2004) reported the impact of refugees' shelters on the quality of their living standards in camps, and reports of humanitarian organizations present minimum standards for basic needs including spaces inside and outside a shelter, the amount of water, food and other non-food items for each person. Nevertheless, these standards of providing shelter for refugees are lacking in many institutions' reports in terms of climate

conditions, context requirements, social and cultural aspects and urban organization of shelters in the community. These challenges require further study in order to ensure the system or process supports humanitarian organization solutions of providing an adequate shelter considering the differences of refugees' needs regarding their background, meanings and values, traditions, climate conditions and local context.

This study will consider providing specifications for shelters in a hot-dry climate to accommodate refugees that have fled their own country, due to conflict in the area. The research discusses the difficulties that refugees face in their camps, and especially those related to social and cultural aspects in the hot-dry climate conditions. Unfortunately, it is reported that a great number of countries are affected by disasters that are located within hot-dry climates (Herz, 2013).

A review of the literature shows a lack of attention to human needs regarding social and cultural differences, environment challenges and shelter performance. The research shows that there are inadequate solutions regarding providing what refugees need, where there is often a lack of alignment between refugees' needs in hot-dry climates and shelter performance. Zavei and Jusan (2010) mentioned the consequences of absence of the social factor from humanitarian organization reports as this can cause instability and impact on human psychological health that might lead to community violence. Also, findings of primary data in this study showed refugees' stories of frightening and terrifying times besides what they faced before and after settlement, and how this impacts on health and social stability.

The discussion Chapter (5) shows that humanitarian organizations support one solution for all situations of disasters, and that leads to standardized users' needs and as a result standardized shelters are offered by organizations. The consequences of standardization influence daily activities of users. Lack of awareness of differences between users leads to produce one solution as a product, yet users need more than a place to cover them from environmental conditions or intruding strangers. The settlement stakeholders should consider what users exactly need relating to several factors, for example, age, gender, social and cultural aspects, values and traditions, educational background and economical background; it is not just about providing a minimum standard for all cases in the same

way. The social and cultural needs are the most important factor that influences the way users live and act within the community, yet humanitarian organizations do not consider this in their reports as being an essential factor. At the very early part of the twenty first century, urban theories showed understanding of the impact of standardization that extracts from functional approaches as solutions. More recently, Schalk (2007) showed the importance of social aspects to success in any place, they support architectural theory of the city as a complex set of social and cultural aspects in society - it is not just a machine age.

According to the findings and discussion, there is huge importance and need to present established specifications to provide a shelter for refugees in different situations and considering several factors. In this regard, time needed to build a shelter is not considered because it is a variable factor in terms of available materials in the local context. The design science method provides the tools for the foundation required to establish a process of producing a framework which is shown in the specifications list, it supports inserting different requirements of stakeholders and their prioritizations. Furthermore, engagement of social and cultural aspects within the basic requirements of settlement of refugees taking into consideration environmental challenges and context diversities has not previously been studied.

1.4 Research Aim

The main focus of the research is to provide adequate accommodation for people who are forced to leave their original home and cross the border to neighboring countries. However, previous studies showed shelter solutions as individual products without consideration of the process strategy. Additionally, for decades refugees have suffered from inadequate shelters and services in camps where the solutions proved insufficient towards the challenges of environmental aspects and local context differences. The aim of the research, therefore, is:

“To develop the specifications of a refugee shelter that reflect the needs of users in hot-dry climates”

1.5 Research Objectives

The following objectives for the research are:

1. To investigate refugees' requirements in a camp located in a hot-dry climates i.e. the Al Za'atari camp in Jordan.

2. To examine the environmental and social difficulties that have an influence on the provision of shelters in hot-dry climates, with the Al Za'atari camp in Jordan being used as the case study.

3. To develop specifications in order to support appropriate design of a shelter that meets the needs of refugees in hot-dry climates.

4. To demonstrate the formulated specifications of feasibility to meet refugees' needs in hot-dry climates.

5. To evaluate the ability of specifications to solve the explicated problem (meet refugees needs).

1.6 Research Questions

The goal of the research is the provision of specifications that assist humanitarian organizations and other local institutions to develop an adequate shelter for refugees in hot-dry climates, and this will be achieved through the following questions:

1. What are the problems that refugees define as their needs?

2. What are the challenges that are encountered when establishing shelters in hot-dry climates?

3. How can the specifications be articulated to achieve a shelter that meets the needs of refugees?

4. What are the required specifications that can be used to address the design of refugees' shelters in hot-dry climates?

5. How well will the specifications be utilized for supporting the design of a shelter that meet the needs of refugees in hot-dry climates?

1.7 Research Organization and Structure

This thesis offers a detailed theoretical background through reviewing literature and providing a research justification, method measurement, data collection and survey analysis results. The findings are formulated to provide the research conclusion and recommendations.

This research consists of seven chapters as follows:

Chapter one is an introduction to the general outline of this report and explains the scope, aim and objectives that the research study addresses.

Chapter two shows the background of camps and presents the Jordanian camp, the Al Za'atari, which has a vital role in the settlement of refugees in its region. It presents the background about previous shelter practices and investigates shelters through types of shelter performance that are used to accommodate refugees around the world, from humanitarian organizations. It reviews human need theories and refugees' needs in terms of accommodating refugees and introduces the difficulties that people face when they settle in hot-dry climates.

Chapter three reviews the philosophy that the research will adopt through the methodology, research approach, research method and tools for collecting data, justifying the use of design science and explaining the ability of design science phases compared to other traditional methods of research strategy.

Chapter four shows the research stages of survey analysis that were tested and conducted under design science phases, it presents the findings of each phase, the research criteria that were formulated by reviewing the literature and previous practices, it also shows the process of developing a specifications list and finally includes the evaluation phase of the specifications list, with a number of illustrations of potential design shelters provided and discussed regarding the feasibility of solving practical problems.

Chapter five is an overview of the findings of the research and looks in depth between theoretical and practical aspects of the research where the discussion highlighted gaps in terms of linking between the literature review and the primary data.

Chapter six gives the synthesis of the research findings by presenting a number of lessons learned besides highlighting the research contribution; also achievements and limitations are reflected in the chapter, followed by the recommendations for future research.

1.8 Scope of the Research

This research focuses on providing adequate shelters for refugees in camps and specifically in hot-dry climates, it investigates the circumstances of disasters on living conditions for refugees, and indicates differences between man-made disasters and natural disasters. The research supports social and cultural aspects towards the design of shelters while the research leaves the urban organization of camps for future research.

The research develops a framework for the process of designing shelters for refugees, the unique knowledge aims to create specifications for several alternatives of design shelter and it does not attempt to create a prototype. The specifications are provided by the research works as a guide for those users to house refugees who are the first beneficiaries when institutions offer a better place to live.

1.9 Chapter Summary

The introduction chapter has given an overview of refugees' situations around the world, it shows the challenges that refugees face and also what regions have faced due to the increasing number of refugees. The research background clarified the need for a tool to establish adequate places to live for meeting refugees' needs and improving refugees' quality of life in camps.

The chapter covered the need for the research through presenting this by reviewing literature and supported by findings of the primary data. Also, it identifies such needs in terms of the standardized approach that humanitarian organizations take for housing refugees around the world. The aim and research objectives are provided with an

explanation of each objective followed by the research questions. The penultimate section describes the research structure and organization including the overall view of each chapter to enable the research aim and objectives to be met. Finally, the last section explains the scope of the research and the potential implementation by stakeholders.

The next chapter will review the literature regarding the background of camps and refugees' situations, the example of the Al Za'atari camp in Jordan and review the previous studies regarding shelter practices and refugees' needs when they settle in a new community, in order to obtain a comprehensive understanding of the reality behind the difficulties of housing refugees in a hot-dry climate.

Chapter Two
Review of the Literature
Problem Definition

2.1 Introduction

In the previous chapter, an overview of the research background of refugees' situations was given, the need and importance of the research was also provided as the grounds of the research aim and objectives. The research questions were outlined to support and justify the research contents.

This chapter reviews the literature, which gives a space to discuss the related area of explicating the research questions. The purpose of this chapter is to understand refugees' needs in relation to human needs in general. The beginning of the chapter shows the background of camps as a place to protect people, and introduces camps in the Middle East and North Africa region to clarify camp circumstances and their situation regarding solutions that are currently offered by humanitarian organizations. In this regard, the chapter reviews refugee camps as a temporary solution or as an informal city in terms of reviewing literature of users' needs and humanitarian organizations' points of view, and circumstances of the Al Za'atari camp in Jordan, thus located in a hot-dry climate. Also, it gives an introduction of accommodating refugees and provides practices of developing shelters for affected people around the world in different terms such as design implementation. This chapter discusses the meaning of needs, reviewing the theories of needs and highlights the characteristics of adequate shelters in theory and with relation to functional efficiency and shelter performance, taking into consideration the climate conditions of being hot and dry where the Al Za'atari camp is located.

2.2 Background of Refugee Camps

Camps are secure places for survivors that governments and organizations provide and which are away from danger. The institutional frameworks of humanitarian agencies require intergovernmental organizations, donors and NGO to provide aid, assistance and protection for refugees' rights in camps.

The Sphere project (2011) discusses how camps must provide for the needs of survivors after disasters, whether natural or man-made. This includes food and non-foods items such as mattresses, blankets and shelter, especially during the early stages of their arrival. Its guidelines are contained within the UNHCR's Handbook for Emergencies (Herz, 2013).

Camps were first established in the early seventeenth century in response to crises involving war, flooding, earthquakes and hurricanes. People left their homes to find places of safety, whether this was inside the country or across a border (UNHCR, 2014a).

Many case studies of camps located in different geographical areas and climate conditions have been undertaken. Some lie in desert conditions, forested areas or dry savanna zones. Most studies uncover problems with living conditions due to infections, disease, epidemics or environmental difficulties. Beyond that, little change has taken place regarding camp systems and regulations. People often feel more insecure and unstable regarding community of the camp over a period of time (Corsellis, & Vitale, 2005).

Most case studies of camps have shown how they were established as an emergency response and over time became permanent, as shown in Figure (2.1). NGO provide assistance for people which is adequate for a couple of months, after which the situation in the camps becomes an inappropriate place in which to live and it becomes necessary to offer more than an immediate solution of a shelter and to re-establish people within a new community (Schilderman, 2004). Case studies show how people have been forced to live in undesirable conditions. In a few cases, however, people have become successfully involved in establishing a more comfortable environment more suitable to their ideological, social and cultural values.

Figure 2.1: Permanent situation in the Al Za'atari camp (Source: www.google.jo)

2.3 Camps in the Middle East and North Africa Region (MENA)

The UNHCR (2013b) shows that there are more than 45 million persons of concern around the world who need assistance and protection. The estimate shows that more than 55 percent of refugees worldwide come from Africa and Asia, mainly the central Middle East and North Africa, a trend that began with Palestinian refugees in the last century.

The Middle East and North Africa are one of five major regions in the world that include a high ratio of refugees. In addition, countries of each region have similar weather conditions and material resources. The UNCHR (2014a) showed total refugees between Middle East and North Africa was 5 and 12.1 million respectively. Thus, the MENA region had the ten largest operations located in Chad, the Democratic Republic of Congo, Ethiopia, Iraq, Jordan, Kenya, Lebanon, South Sudan, Syria and Turkey. According to UNHCR (2014a) the MENA region contains the most refugee camps. By the end of 2012, sub-Saharan Africa and Asia accounted for 63 % and 29 % of refugee camps around the world respectively. Regarding Jordanian camps, as the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) reported in 2000, Palestinian refugees originally came to Jordan in large numbers during the 1948 war when an estimated 100, 000 refugees crossed the Jordan river to take shelter in temporary camps. Jordan has around 19 camps, 13 camps are registered under the UNHCR and the others are illegal camps (Jabr, 1989), additionally, camps are distributed mainly in the

capital of Jordan, Amman, however the Jordanian authority is suffering from demands of camps in terms of political and economic aspects.

For example, the Kakuma camp, in northwestern Kenya, as shown in Figure (2.2) houses more than 45,000 refugees, most of them from south Sudan and Somalia fleeing from war. It became a large camp and refugees improved their shelters to meet their permanent requirements by constructing houses (UNHCR, 2007).

Figure 2.2: Constructed houses at the Kakuma refugee camp (Source: www.reuters.com)

Another example is the Dadaab camp, which includes five camps, developed in 2011. Most refugees were fleeing the civil war and famine in Somalia, a UNHCR report in 2012 showed that around 350,000 refugees were crowded into unplanned camps in hot-dry climates. The majority settled in nomadic tents and later people covered their shelters with plastic sheets, fabrics or iron sheets and a wooden frame, as shown in Figure (2.3). When refugees recognized that their stay was going to be longer than expected, they constructed their own structures and built shelters with wooden frames, plastic sheeting and corrugated iron roofs.

Figure 2.3: The Dadaab camp (Source: www.hiiraan.com)

Most countries of this region are undeveloped and suffer from limited resources and the UNHCR works to deal with the challenges presented and the lack of durable solutions and financial support. The Middle East and North Africa have a crucial number of UN budgets based on the conflicts in the region.

In this regard, the International Organization for Migration (IOM) manual report in 2012 highlights that around 2 million Syrian people were forced from their homes by 2012 and who sought safety in neighboring countries such as Lebanon, Turkey, Jordan, Iraq and Egypt. By 2013, the distribution of Syrian refugees was as follows: Lebanon, Jordan, Turkey, Iraq and Egypt with 812,268, 548,780, 506,551, 197,844, and 126,081 respectively (Scavino, 2013).

Jordan is the second most affected country of this crisis, as the majority of Syrian refugees come from areas close to the Jordanian border which allows free access to Syrian refugees as shown in Figure (2.4) to settled in five transitional camps, then move to the Al Za'atari camp. The common geographical boundaries between Jordan and Syria mean that many are families that are connected by marriage. Extended families are mixed from two or three different nationalities in the Middle East region. Furthermore, pan-

Arabism affects language, culture, heritage, religious beliefs, ideologies and history (Mason, 2011).

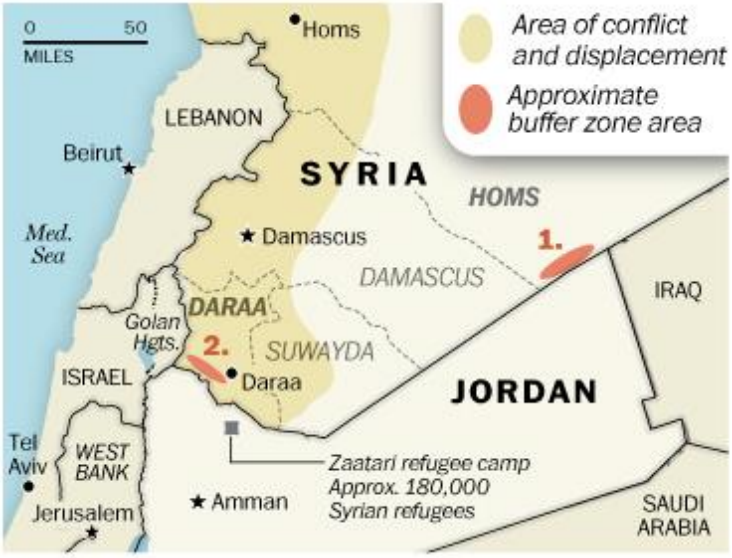


Figure 2.4: Syria border with Jordan (Source: www.whyisrael.org)

2.4 Camps as Temporary Camps and Informal Cities

The meaning of camps initially referred to ancient Rome as a place of military compound, however, refugee camps are a different story, often growing to extend beyond strategies and planning to meet different societal demand and desires (Grbac, 2013). The basic level of refugee camps is as a temporary situation for those forced to leave their home, yet camps are embodied with possibilities and difficulties for victims, also, refugee camps are a significant operation of human needs in one large geographical area and sometimes isolated areas within a local community like the Al Za'atari camp as the case of this research. However, refugee camps are complex areas that academics and practitioners are struggling to define, between camps as a city, in terms of socio-spatial potential or as a place full of the remit of humanitarian protection and aid (Sanyal, 2014).

2.4.1 Temporary Camps

When refugees leave their original home they are becoming uprooted and stateless regarding place and feeling 'right-less' regarding human rights, although humanitarian organizations and refugees have worked together by developing political conditions for

refugees (White, 2002). Zetter (2012) indicates the point represents that humanitarian organizations and the host community have an interest to present aid and assistance to refugees in isolated areas near to the border to be temporary residents and then they may go back to their home when the danger has passed. Herz (2013) argues that refugee camps have three main characteristics. 1) As a space for humanitarian agencies to save lives; 2) As a living space where all aspects of refugees' lives are controlled by institutions and governments and 3) Spaces of desolation and poverty. However, the most traditional description of refugee camps is as a humanitarian facility that is constructed to protect refugees. By choosing an appropriate camp location where tents, non-food items and health care facilities can be provided it considers camps as a central mechanism with the exceptions being environmental factors, the social and cultural aspects of the refugees and the planning requirements of the host community.

In the same regard, Herz (2013) mentions how humanitarian agencies plan a camp within a certain special organization but the area per person inside and outside a shelter is one limitation of satisfaction and refugees simulate it as a prison as discussed in section (4.6), as a result, refugees deal with this inappropriate situation through different ways, such as adding spontaneous elements and transforming the camp organization to an informal layout and adjusting the form as a permanent situation.

Humanitarian organizations are mainly concerned with offering assistance for refugees, for instance, the UNHCR handbook does not take into consideration the right of permanent situation which leads to citizenship. The UNHCR handbook uses language and labels such as *person of concern or displaced population*. In addition, other bureaucratic documents and papers that apply to refugees exist such as food cards, identity cards, holiday leave to support a temporary situation. There are many limitations that lead to temporary situations in terms of economic and political control. Palttala, Boano, Lund and Vos, (2012) mention that lack of communication between public authorities and between organizations themselves that have different ways to handle a disaster situation is a barrier to share benefits of practices for providing solutions in the form of more applicable shelters.

Humanitarian organizations organize and see refugee camps as temporary sites even after a long time, and that is presented in the handbook of the UNHCR, which leads to isolated users by sectors, blocks and community, it is a matter of separation of refugees from function and productivity and calculates refugees by family unit not by individual. Kennedy, Ashmore, Babister, and Kelman (2008, cited in Grbac, 2013) said that the handbook of the UNHCR does not relate camps to the surroundings in the local community and stands as a temporary and isolated site. In summary, camps have not changed significantly and still have in common the same modular grid, regulated by rules and standards that are formulated by humanitarian institutions for basic services, planning, shelter implementation and general standards. Humanitarian organizations insist on minimizing individual areas for living and daily activities. Also humanitarian organizations and local governments may conceal the temporary situation and their concentration on maximum speed and lower costs appears to be a problematic situation when permanent measures are the only solution for refugees after two years of residency inside the camp (Hadafi & Fallahi, 2010). Picker and Pasquetti (2015) indicate the question is that camps are becoming a city in the sense of a social and political space, yet there are shortages of services and this temporary situation of accommodating people does not account for the longer term socio economic situation. The urban requirements frame a camp as a city or as an incomplete urban formation.

2.4.2 Growth into an Informal City

Camps grow over time where tents and temporary shelters are replaced by permanent structures and it is normal for refugees to re-arrange their living space and environmental improvements such as tree planting (REACH informing more effective humanitarian action, 2014). Many factors play a role in determining the characteristics of a camp. Refugees' experiences transform a space into an adequate space for different activities e.g. women gathering, cooking and washing and in which traditions and values can exist. Knox and Mayer (2013) explain that place is formulated by people who suit their needs and express their values, so they can impose themselves on the environment in which they live and work and gradually modify and transform the special organization of the camp as shown in Figure (2.5).

Figures 2.5: The Champs-Elysees in the Al Za'atari camp (Source: www. refugeeresettlementwatch.wordpress.com)

Camps have changed to a more informal and fluid layout than a grid layout where the limitations of the camp become less obvious. The urban fabric of shelters is more organic and meets peoples' desire to stay near relatives and friends. They start adding spaces and rooms to the shelter structure and take into consideration the organization of the shelter for extending their family as shown in Figure (2.6). Jabr (1989) discussed how camps are too small and as the family expands by birth or marriage the camps become overcrowded. All social activities including births, deaths and marriages take place in these restricted spaces.

Figure (2.6): Children play nearby their modified shelter (Source: www.huffingtonpost.ca)

Refugees adapt the camps to represent spaces to trigger their memories for return, so new spaces do not follow modular patterns that were established by humanitarian organizations and from this point camps started to grow as an informal city. Grbac (2013) indicates when refugees influx in large numbers and cross borders to an area they need all the services of a normal town, such as a sewage system, water and other services, so over time this geographical area becomes like a small town or incomplete city. Refugees follow stages in the process of transforming the camp to an informal city. Malkki (1995, cited in Grbac, 2013) said that at the first stage, refugees agree with humanitarian organizations assistance, then some refugees start to reorganize their places to be close to relatives and family community, besides new relationships start also to shape, thus in this point reposition their unit places and this regrouping leads to an informal layout of the camp. Social and cultural aspects direct the camp through urban perspectives which is supported by individual motivation and needs.

Whilst humanitarian organizations establish a camp as a fixed solution with a long list of regulations and checklists, the reality of spontaneous action of users is the only way to figure the camp layout, many examples of camps around the world have become informal cities and rebel against restrictions, such as the Dadaab camp as discussed in section (5.3.1) where tents and shelters became full of traditional Somali huts, also the International Federation of Red Cross and Red Crescent Societies [IFRC] (2013) showed T shelters were offered to the Al Za'atari camp as shown in Figure (2.7) as permanent solutions, however planning organizing and standardization solutions as discussed in section (5.2.1) of such shelters did not deal with climate difficulties and upheld barriers in the political situation and lead refugees to refuse such solutions by adding their modifications on such shelters. It does not matter if camps are located in rural or urban areas, physical constructions highlight and reflect social aspects and refuse to adhere to political regulation. Refugees construct their vision of a camp as a city when humanitarian organizations set documents of historical practices of planning a camp when refugees operationalize their needs.

Figure 2.7: T Shelter in the Al Za'atari camp-Jordan (Source: www.google.jo)

Michel Agier (2008, cited in Synal, 2014) stated that humanitarian organizations are struggling between a camp being a city or a temporary site, because the complexity of a camp layout has political and economic demands on the aid strategy besides demands on the local community. So refugees are no longer able to continue as temporary numbers and must find a durable solution (Corsellis *et al.,* 2005). Understanding refugees' conditions must be considered from an informal urban lens and take this as a supportive guide to standards and principles in humanitarian organizations' handbooks.

The issue of whether or not a camp should be considered a temporary solution to accommodate displaced people in the host country, giving hospitality to real and proper "political subjects", has enormous implications on the approach followed by the international organizations, while coping with the challenges of providing refugees with a place to live. It exceeds the purpose of this study to tackle the issue of providing refugees with a suitable architectural solution from this perspective, while specific attention will be given to the most relevant individual element of the camp, i.e. the shelter. However, it is hereby clarified that improving the approach to the shelter provision is only part of the solution to the problem of a lack of consistency between refugees' needs and international organizations' responses, since the wider context of the shelter itself deserves a proper discussion. Within the scope of this study, the shelter will be accurately investigated in order to extrapolate an appropriate response to the users' needs.

In summary, the literature review looks at the formality and informality of camps, temporary and permanent situations, also scholarly literature that recognizes

understanding of the space of a camp as an exceptional site located between two directions of political control and a social context. Humanitarian organizations, other responsible institutions and the local community often fail to consider the dynamic of reorganizing the camp by users in long term camps, while they should recognize a camp as a normal site or informal city and thinking about policies could be a key feature of a preplanning strategy of accommodating refugees in an informal city.

2.5 Overview of the the Al Za'atari Camp

The Al Za'atari is located 10 km east of Mafreq, it opened in early 2012 as shown in Figure (2.8); it connects to a secondary road to the highway near to the military border, surrounded by rural and agricultural areas. The topography is slightly flat and sandy and prone to wind and dust storms.

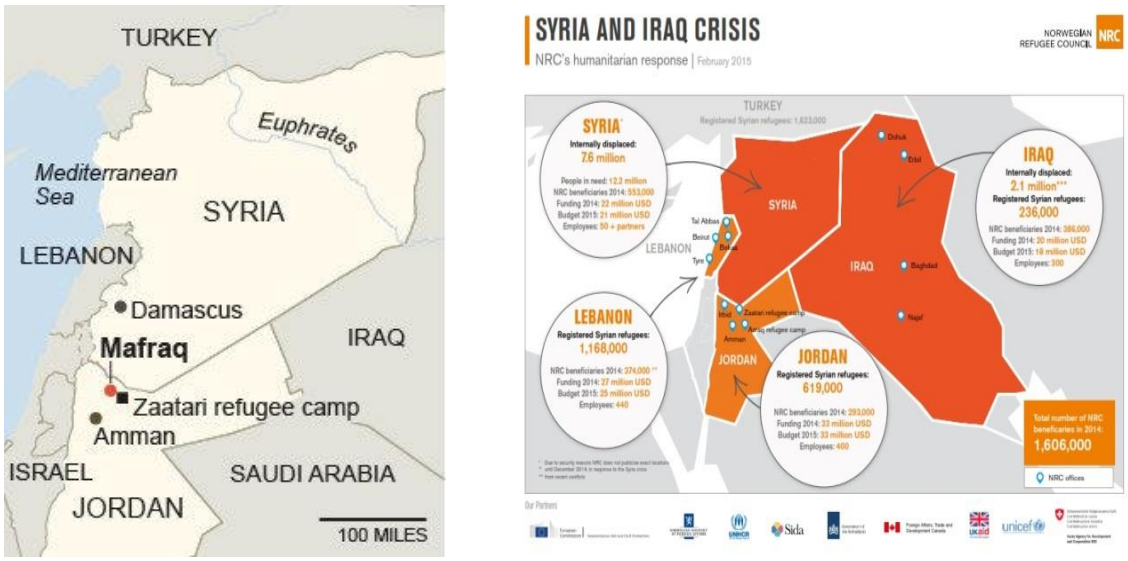


Figure 2.8: The Al Za'atari camp location (Source:www.google.jo)

The Al Za'atari camp has grown out of a desert area and which is the second largest camp in the world after the Dadaab camp in Kenya which houses 329,811 refugees; the Al Za'atari has grown to become the fourth largest city in Jordan (Ledwith, 2014).

Initially the camp had a planned capacity of 20,000 refugees but reached 45,000 by the end of 2012. In early 2013, the figure was 65,000 and continued to rise to 76,000 refugees in February 2013. Later, in 2013, a large number of Syrian refugees crossed the

Jordanian border because of instability in southern Syria and the number of Syrian refugees peaked at 156,000 with 3,000 to 4,000 refugees arriving each night. The Al Za'atari camp, therefore, has been in high demand to provide protection and services for unexpected numbers of refugees (UNHCR, 2013a). Most refugees have settled in the Al Za'atari from Dara and have worked in agriculture although some are skilled workers such as builders and carpenters.

By 2015, the estimated number of refugees was 83,000, distributed amongst 13 sectors, each sector containing blocks, communities and shelters as shown in Figure (2.9). A report by the UNHCR in April 2016 stated that the Al Za'atari housed 79,551 Syrian refugees. Young people comprised 57% with 19.9% under 5 years old with one in five households headed by women. The ratio of men to women was 50% for each part (UNHCR, 2016).

Figure 2.9: The Al Za'atari camp between 2012 and 2016 (Source:www.google.jo)

As shown in Figure (2.10) by 2013, and due to the increasing capacity of the Al Za'atari, a second camp (Al Azreq) was built 20 km from Zarqa city and opened to transfer Syrian refugees to it. The United Arab Emirates was the donor who established the camp, although different types of units were built to a higher standard than the Al Za'atari camp. Refugees did not prefer Al Azreq due to its location and distance from public transportation. Refugees would prefer to stay in poorer conditions with services and shelters rather than leave their families and relatives in the Al Za'atari camp.

Figure 2.10: Al Azreq camp in Jordan (Source: www.nrc.no)

Ledwith (2014) indicates that the Al Za'atari camp costs 500,000 USD per day. The Al Za'atari has a high poverty rate with two thirds of refugees below the national poverty line as determined by the UNHCR (2016). The following Table (2.1) shows the Al Za'atari by numbers and livelihoods.

Overview of the Al Za'atari	**Estimated number**
Number of Syrian refugees	120,000 Syrian
Area of the Al Za'atari	530 Hectares
Number of caravans	17,000
Number of tents	8,000
Percentage of refugees from Dara	90%
Shops	2,500
Large store	680
Other shops	680 shops that engage children
Employment	65%
Number of water tanks per day	360
Number of NGO offered jobs	1,500
Number of mosques	120 Mosques
Number of hospitals	3 l
Number of babies born per month	200 children
Number of schools	3
Illegal electricity wires	300 kilometers
Cost of electricity per day	16,130 USD

Table 2.1: The Al Za'atari by numbers and livelihoods (Source: Ledwith, 2014, p.20)

In the Al Za'atari, around 3,000 informal shops are operated by refuges and 3,000 laborers have opportunities to work for community-based NGO. As far as services, three boreholes provide 3.3 million liters of water per day distributed by 82 trucks delivering water to public and private water tanks. But an unfair distribution of water happens in the camp, UNHCR (2016) identified up to 14 million USD for constant energy for refugees of up to 11 hours per day. In reality, refugees experience electricity cuts of a month due to the illegal use of energy and lack of supervision.

2.5.1 The layout of the Al Za'atari camp and current shelter design

The Al Za'atari camp is located on a ring road, it measures from east to west 3.5 kilometers. The west was located first and is called the old side. In the beginning, the camp was not organized and refugees were settled wherever they wanted to be, close to relatives and water sources. On the old side of the camp, caravans replaced tents but it was a challenge to accommodate caravans into a small area and retain access for emergency vehicles and other services (Ledwith, 2014).

Refugees originally settled in tents after which they were arranged in new caravans in the same informal layout and organized in U shapes to be close to relatives and friends in courtyards and gathering spaces (The National, 2016). This way of spontaneous urban organization had an influence on the quality of services provided to refugees. On the other hand, the grid layout established new sectors and caravans were placed in rows that took into consideration the provision of adequate access to services.

Regarding housing refugees, the UNHCR 2012 report specified white canvas tents with blue UNHCR stamps with the following dimensions: 660×400 cm; the maximum height is around 140 to 220 cm as shown in Figure (2.11). One space is provided for four to six people and refugees are responsible for assembling their tents. The tent's lifespan depends on its use, climate conditions and how it has been stored. A previous study has shown that they do not last more than 12 to 18 months although some Syrian refugees stayed in such tents for more than 24 months with an inappropriate quality of life, and cramped living space affected intimacy in the family - especially partners and children

without access to private kitchens and toilets. Eight percent of refugees installed their private toilets and kitchens with their own money and due to difficulties in using public services. UN (2014) gave generous donations in cooperation with the UNHCR, they have provided 25,000 prefabricated shelters with dimensions of 5.3 meters width and 2.4 height although some donors have provided larger prefabricated shelters.

Figure 2.11: UNHCR family tent (Source: www.google.jo)

By the end of 2013, most tents had been upgraded to prefabricated shelters as shown in Figure (2.12).

Figure 2.12: Prefabricated shelters in the Al Za'atari camp (Source: www.google.jo)

Section (4.6.2.2) discussed local manufacturing companies such as Al Maani and Al Awadi that implemented prefabricated caravans in different sizes based on donors' requirements of the minimum standards of the UNHCR: a steel frame with a 40mm polyurethane sandwich panel and covered on both sides by a galvanized steel sheet (Scavino, 2013) as shown in Figure (2.13). The UNHCR's report of 2013b discusses how the prefabricated production of shelters is limited to a few large factories that specialize in steel construction in Jordan. The same report also shows that the local market in Jordan cannot provide the necessary number of shelters due to a shortage of basic components, the high cost of prefabricated shelters and the variation of shelter prices based on quality and the level of manufacturing.

The shelter structure, supported by the cost of the UNHCR tents, is USD 500 with a prefabricated unit costing between USD 3,500 to 5,000 with an expected lifespan of 24 months.

Figure 2.13: Examples of prefabricated caravans in the Al Za'atari (Source: www.google.jo)

In addition, in the early stages of the existing camps in Jordan, there was a limitation to using permanent elements in construction, such as cement, concrete, stone, steel and any other permanent construction materials. The UNHCR report in 2015 presented a T shelter, or transitional shelter design with fixed foundations as shown in Figure (2.7), as another example for a new sector in the Al Za'atari and Al Azreq camps.

2.5.2 Assumptions and Challenges

The UNHCR report (2014b) discusses a number of challenges to connecting units' performance and design requirements to the community context as shown in Figure (2.14). Although prefabricated units provide more durable and comfortable living conditions, these units are manufactured from light materials. Technical challenges, the lack of an electricity supply and the small size of the units are some of the difficulties when compared with other units manufactured by different suppliers. Using formaldehyde materials in manufacturing units causes many allergic problems and unpleasant smells inside. Polyurethane foam is used to insulate internal walls which can cause a reaction if it is touched directly. It is also flammable and elements of units are easy to break and missing after transit. Using a gasoline heater inside the shelter and installing electricity pipework above the door increases the possibility of gas and fire accidents. Also, poor conditions of services, water leaks in the street and the shelter's structure have a negative impact on the quality of living standards (Ledwith, 2014). A 2014 report by Jordan's water ministry identified the challenge presented by pollution due to the absence of sewage system planning (Norwegian Refugee Council [NRC], 2014).

Figure 2.14: Challenges of units' performance and services (Source: www.google.jo)

Enabling the provision of electricity is the one of the biggest challenges faced by refugees. An electricity supply is missing in most prefabricated shelters. This leads refugees to create their own way of installing electricity at their shelters despite it being provided in the Al Za'atari camp. Since 2014, the high monthly cost of electricity has been reason to stop generating energy to the camp as few households can afford to buy diesel or operate electricity. The UN provides electricity for street lighting to support security and safety, whereas, due to the high cost of the service, electricity is distributed unevenly on camp sectors, which leads to violence between refugees (Ledwith, 2014). This explains the inadequate living conditions which make refugees leave camps. In addition, the sexual and gender abuse, crime and violence between refugees - whether due to the ideological differences or financial problems, is still in evidence inside the camp, since crime has spread in the Al Za'atari the Jordanian government clamped legal permission to exit the Al Za'atari and enter into the urban community which limits the ratio of violence inside and outside the camp but this procedure was not acceptable and caused refugees' dissatisfaction.

Syrian refugees stimulate the local economy in the camps, but there are many obstacles to a normal life, including shortage of resources, poor education, disease, increasing youth unemployment, demand for water, and unreliable energy. The UNHCR encourages local government and organizations to establish development strategies to include health and education systems, and skills and training programs that benefit the Jordanian economy. In short, these challenges are faced by refuges every day and lead Syrian families to choose between staying or returning home. Although they do not obtain assistance form NGO if they decide to live in the urban area, their need for employment, education and the inadequate living conditions are the main reasons that they decide to return, despite the ongoing insecurity in Syria (UNHCR, 2016).

2.6 Previous Studies of Shelters

Humanitarian organizations and other involved institutions are concerned with delivering shelters for large numbers of people. Crawford, Manfield and McRobie (2005) point out that the main concern is to provide shelters for large numbers of refugees within a limited time even though recent examples show that shelters are slow to develop and often inadequate for occupation.

Davis (1978, cited in Hadafi *et al.*, 2010) said that refugees need to be accommodated immediately in an emergency or temporary shelter as a quick response to their situation at relatively short notice. Emergency shelters are often provided in the form of tents which can last for up to two years, if facing changing weather conditions (Jabr, 1989). After this time, refugees should be moved to semi-permanent or permanent prefab shelters. A variety of strategies have been employed in pre-disaster and post-disaster programmes, including industry, based on standardisation, repetition and a single technology, while the informal sector leads to variety, multiplicity and a combination of structural technologies (Lizarralde & Root, 2007).

When refugees arrive in the camp, they need shelters as the immediate environment of family life and daily activities. It provides protection and security, personal safety, and access to services such as clean water and sanitation (Hadafi *et al.*, 2010). Shelter is referred to in many different ways but all have the same meaning; emergency shelter, temporary shelter, temporary housing or dwellings, recovery and reconstruction housing.

All these refer to protecting people who have faced unpredictable situations. Temporary shelters provide places for a limited stay for refugees until they move to permanent accommodation. Problems arise when people stay beyond the life of the temporary shelter which cannot function under the climate difficulties and structural limitations. A United Nation [UN] (2006) report points out that as well as providing immediate shelter, a shelter must consider the importance of adaptation within a host community.

Verderber (2001) discusses four levels of providing shelters, each of which has programming implications for design. The first level is the provision of shelters in up to seven days; the second level is provision between 30 to 60 days and the third level is a transitional shelter that may be established on a destroyed site or near to the host community and which exists up to one year. The fourth level is a permanent shelter which is not acceptable to the local community in most cases.

The recent approach to providing shelters was as a transitional shelter, as developed by the Shelter Center. The approach to the transitional shelter as described by Corsellis is to improve a temporary shelter from a plastic sheet to sustainable local materials until the reconstruction of destroyed houses is complete. Life of between two to five years means it is more durable than tents which last no more than 12 months (Corsellis *et al.*, 2005).

With regards to the transitional shelter, Corsellis and Johan, who created an IKEA T-shelter, mentioned in an interview with UNHCR innovation (2015) that there was a difference between the prototype and the product. There were 45 developed shelters in the UNHCR alone and the challenge was to develop the prototype through establishing a process, involving a non-stop design process. However, the examples established to accommodate affected people were presented as a prototype for certain circumstances rather than global concerns.

2.6.1 Illustrations of Implemented Shelters

Many cases have studied the essential features and characteristics of shelters necessary for the comfort of refugees. The research covers some of these studies from different places around the world. Additionally, these studies examine the operation of shelters in

different climate conditions. There are many studies that have looked at temporary shelters where some of the shelters are provided through program management and others by design technology. In contrast, this study explores the feasibility of providing shelters in certain climate conditions with defined specifications to accommodate refugees as discussed in section (4.7.1).

Researchers including (Quarantelli, 1995; Johnson, Lizarralde, & Davidson, 2006; Arslan & Cosgun, 2008; Hadafi *et al*., 2010; Rawls & Turnquist, 2012) have discussed the challenges of refugee settlements. They explain that these challenges include the need for rapid establishment, low costs per unit, and being mindful of protecting the environment, and the following section discusses a number of practices in different locations.

In Turkey, the government has an up- bottom' strategy and program planning. Turkey's efforts did not meet the needs of refugees with regular prefabricated concrete slab units. In spite of the planning program for such units, the shortage was to cover social safety and stability by supporting gathering spaces for refugees in a camp. After building these units, the lead community encouraged users to personalize their units with a planted garden and by adding other elements inside and outside the shelters as shown in Figure (2.15).

Figure 2.15: Temporary Housing project (Source: Johnson, 2007)

Regarding (Bolin, 1990; Bolin & Stanford, 1991; Dandoulaki, 1992; Davis, 1978; Gilbert, 2001; Quarantelli, 1982; UNDRO, 1982, cited in Johnson, 2007) that units have standard organization, and ignore users' needs due to their rapid construction. This gap

between providing units and establishing refugees' needs has been evident after the modifications made by refugees has brought back memories of their original home.

Another example in South Africa offered shelter in cooperation with the formal and informal sectors. The differences between these sectors are considered when the informal construction sector meets the competitive advantages and affordability of the formal sector. In Cape Town, a project offered shelters made from recycled materials and created by domestic skills as shown in Figure (2.16). The project aimed to combine standardization and local skills of variety and multiplicity by creating a cluster organization of units (Lizarralde *et al.*, 2007).

Figure 2.16: Informal shelter in Cape Town (Source: www.google.jo)

In Japan, a Sectional Compact Emergency Shelter (SCES) was proposed, based on design technology and developed an emergency shelter for victims' usage. It is portable and can be built in a short period of time (Tanaka *et al.*, 2013). The shelter can be easily stored where there is electrical power and waste-heated water is powered by a container car with rechargeable batteries. In Iran, shelters made from sandbags filled with nearby material were provided with labour supplied by the local community (Hany Abulnour, 2014). A

drawback to this method is that it limits the shape of shelters and can be difficult to dismantle, as shown in Figure (2.17).

Figure 2.17: Sandbag shelter in Iran (Source: www.earthbagbuilding.com)

The following example illustrates a new technique of manufacturing - the mobile factory. The Q-Brixx block is produced by using and sorting debris through a process of separating, crushing, filtering, preparation, mixing, mould assembly and casting, as shown in Figure (2.18). Q-Bixx, is collected like Lego bricks without mortar or cement. Brick is prepared from rubble, as in Haiti where earthquake victims used bricks to rebuild houses. The construction was made very simple by preparing ground work and then standing bamboo poles in corners and openings. Bricks were then stacked by hand and roofs fixed to bricks by steel anchors and poles.

Figure 2.18: Q-Bixx shelter (Source: www.engineering.com www.engineering.com & themobilefactory.org)

Another material utilized in disaster situations is compacting concrete as a honeycomb concrete panel, which is light and as a result easy to build in a short time (Bradford & Sen, 2005). In terms of durability, as discussed in section (4.8), honeycomb is provided which is based on an origami design that is used in military shelters, as shown in Figure (2.19). The concept of this design are core sandwich panels with an outer and inner face which look heavy but in reality are light because of the hole inside which provides a high level of thermal insulation.

Figure 2.19: Example of honeycomb shelter (Source: throughthesandglass.typepad.com)

Military shelters are more technically advanced in the materials used and the structure. A number of soft wall accordion shelters such as tent accordions have been developed, as shown in Figure (2.20). This type of shelter is a tent made from lightweight materials that can be folded and extended.

Figure 2.20: Military folded shelter (Source: www. inhabitat.com)

Closed prefabricated shelters are more durable, such as shipping containers, as shown in Figure (2.21), which uses the steel frame of a container to establish the shelter. Many studies have shown the impact of shipping containers that have been surplus at third world ports and which were out of service. This approach has involved decision-making by governments with responsible agencies who have worked in parallel to find quick solutions with consideration using free toxic painting materials (Corsellis *et al*., 2005).

Figure 2.21: Shipping containers for accommodating affected people (Source: www.gatewaycontainersales.com.au)

In the Philippines, there has been experience of building 'core shelters' as shown in Figure (2.22) following the aftermath of typhoons (Diacon, 1992). The Core Shelter

technical design refers to connecting roofs with walls to resist strong winds by supporting roof trusses. Schilderman (2004) shows how, after the Indian Ocean tsunami, India, Thailand, and Indonesia and the Habitat for Humanity (HFH) repaired homes in 2009-2010 by providing a core house that used recycled materials and offered the potential for future extension. After completion, the project made modifications that illustrated the inadequacy of the innovative core house where HFH support the project as a process to recover holistic activities. Many other practices and case studies in Asia and Latin America show the reconstruction of houses or development of new sites.

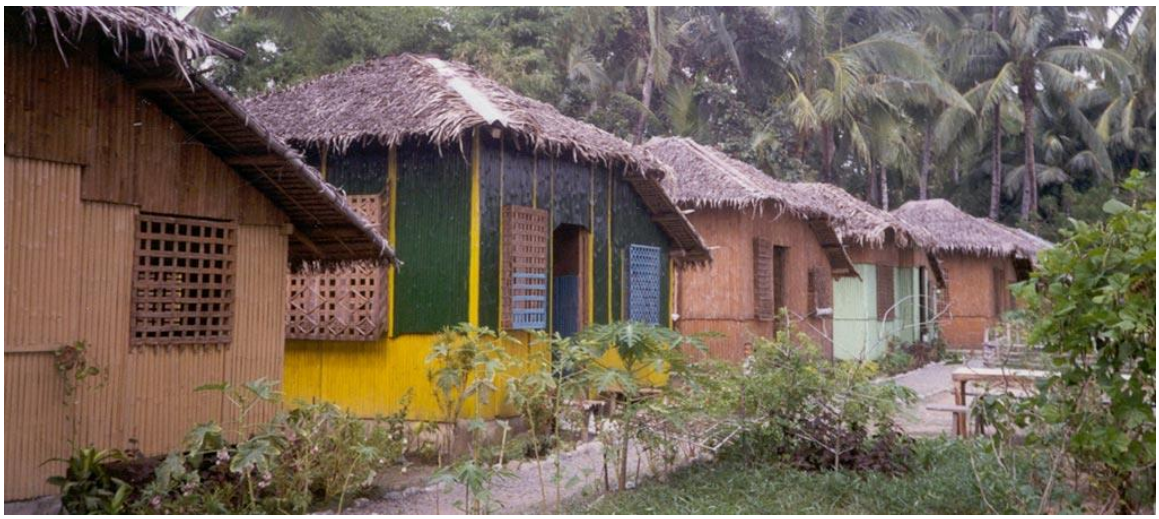


Figure 2.22: Core shelter in the Philippines (Source: www.bshf.org)

Thus, several examples have been developed for accommodating affected people each year, which are discussed, however, most of these examples provide solutions for certain circumstances considering cost and time factors.

2.7 Shelters Provided by Humanitarian Agencies

The UNHCR provides standard tents for most destroyed areas as quick assistance for people affected by disasters, before proper shelters are arranged. The standard tents are provided by agencies with a ridge, center pole tall wall, center pole low wall, tunnel, frame, and warehouse, however the one that is used by the UNHCR has drawbacks in terms of canvas rot, being inflexible, having limited heat, and being a heavy weight (Corsellis, *et al.*, 2005). These types of tent have different characteristics and their

dimensions are based on the number of occupants, materials and shape (see Appendix A). In addition, the standards of tent used by the UNHCR and Red Cross have changed from the limited range in the 20th century. This has influenced the quality of life in camps and the changes in living standards to the present day (Manfield *et al.*, 2004).

Comparing the UNHCR tent with a traditional tent is difficult as the users are culturally and environmentally better adapted to the traditional tent since it uses natural materials, thus traditional designs influence efficiency. Because of this, many types of traditional tent are presented in different regions and climates such as the Koryak and Chukchi tents in northern Asia, the Scott tent, Yurts as shown in Figure (2.23 A & B) and others, but most of them share the same conclusion of adapting to climates (Manfield, 2000).

Figure 2.23.A: Scott tent (Source: www.google.jo)

Figure 2.23.B: Yurt tent (Source: www.theplanner.co.uk)

In the same regard, many agencies use traditional tent elements and functions to formulate a new tent. An IFRC report in 2013 shows the Tuareg tent is an art of their culture by comparing thermal performance inside and outside and the IFRC developed a new tent based on the Tuareg tent which provides stability, rigidity, durability of materials, thermal efficacy by cladding materials and wind resistance. The Tuareg tent is a unique example of a tent in hot-dry climate conditions in terms of using local materials and distributing spaces with consideration to sun direction, as shown in Figure (2.24).

Figure 2.24: Tuareg tent (Source: www.devex.com)

Another example adapted from a nomadic tent is the DesertSeal, which was developed by the ESA (European Space Agency). This tent concept stands on cool air that enters the tent by a fan which is located on the top of the tent which is powered by batteries that are charged through flexible solar cells located outside the tent for safety, as shown in Figure (2.25).

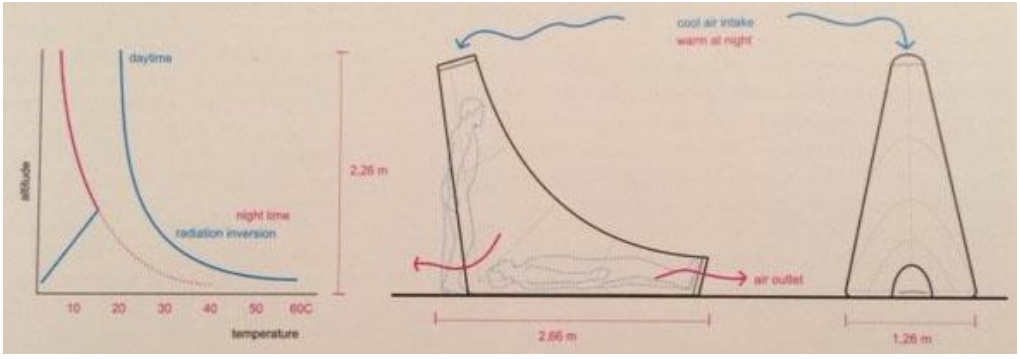


Figure 2.25: Specific temperature curve in Desert Seal (Source: Suh & Seonwook., 2011)

Another example of an extreme weather emergency shelters can be found in Kyrgyzstan, as shown in Figure (2.26). This is a transitional shelter which is being developed by the UNHCR and uses fixed materials such as concrete, steel and bricks. Although concrete and blocks are materials that do not allow the shelter to be dismantled it is an example of a permanent solution but which is not an option in this study (UNHCR, 2012).

Figure 2.26: Kyrgyzstan shelter by UNHCR (Source: www.unhcr.org)

In association with the Swedish furniture company, IKEA, the UN has provided different types of shelter around the world. IKEA's shelter is supplied to refugees in locations such as Lebanon, Iraq, and Ethiopia. The IKEA foundation has reported that refugees can use the shelters for six months before the effects of sun, wind, humidity and rain are felt. Refugees stay, on average, for 12 months and for this reason IKEA's shelter has been designed with durable features by types of material. Figure (2.27) shows that the prototype is made from lightweight insulated materials combined with laminated solar panels which reflect the sun's radiation during the day and retain heat in at night. The shelter takes four hours to build and is twice as large as a regular shelter (Dezeen Magazine, 2015).

Figure 2.27: IKEA shelter for refugees (Source: www.dezeen.com)

Other examples of shelters that are formulated by humanitarian organizations for displaced people and refugees are shown in Appendix C. These have been evaluated by the American Red Cross, the International Organization of Migration, and the Oxford Committee for Famine Relief (Oxfam), the UNHCR, the United Nations Children's Fund (UNICEF), NRC and others. This work is derived from the United Nations Human Settlements Programme, and IFRC (2010) with other international institutions, which is an institutional collaboration between UN-HABITAT and IFRC in different regions that have had disasters and which have lead people to move to other locations in search of safety, security and stability. In short, each type of shelter solution must consider the minimum standard of protection and floor space per person, however local materials and skills are not considered in the humanitarian agencies principles. Table (2.2) shows the different types of shelters and their advantages and disadvantages.

Shelter solution	Pros	Cons	Image
Family tent	Traditional tent made from lightweight materials	It is unsuitable for long-term occupancy or in harsh climate conditions	
Plastic sheeting	It has a wide range of uses and good UV resistance, flexible and lightweight	A wooden frame is needed that is harmful to the environment. It is unstable in heavy winds	
Prefab unit or container	An almost permanent solution, durable and re-usable materials	Logistical problems of cost and transport, inflexibility and disregard for social aspects	

Table 2.2: Different types of shelter are required by humanitarian agencies

Table (2.2) shows advantages and disadvantages of each type of shelter provided by humanitarian organizations. However, the key issue of shelter development of humanitarian organizations meets logistical criteria for shelters as a product not as a process.

Humanitarian organizations follow policies and obligations of government which lead to standardized solutions and temporary shelters, as discussed in section (5.2) and as result humanitarian organizations do not consider factors of shelter performance, materials used, shelter functionality, durability, climatic conditions, building and dismantling and spatial organization as one process, in their provision of shelters, as shown in Table (2.3), such factors influence the efficacy of shelters in relation to climate difficulties, social and cultural features and livelihood. These are important factors in establishing adequate shelters and to consider the inadequacy and shortcomings of humanitarian organizations' existing practice, it is apparent that there is a shortage of guidelines, requirements and a framework for building applicable shelters through the integration of design and planning programs.

Furthermore, each of these temporary housing solutions do not have clear methods that guide the suppliers to offer shelters that would meet refugees' preferences. In other words, most implementation does not establish clear criteria for shelter performance or the needs of refugees. This includes an analysis of climate difficulties and the social challenges if they are fleeing from disasters. As far as time and cost management is concerned, multi-transitional levels of sheltering begin with tents, temporary shelters, core houses, repairing houses, and ends with permanent and unclear constrictive methods of providing shelters as a factor for non-inclusive solutions. Most shelter construction is provided quickly as an emergency response to a disaster and there are no comprehensive methods that lead to the design and planning of shelters as defined by the user.

Shelter Requirements		Adequacy	Shortcoming	How this study addresses the shortcomings
Shelter Requirements of humanitarian organizations	**Shelter Performance**	Shelters provided are suitable for a temporary situation.	Types of shelters offered from NGO have limited functionality.	
	Materials used	It is light materials.	There is limited usage of local materials due to prefab units.	This study investigates the ability of using appropriate materials based on climate conditions (hot-dry climate).
	Shelter functional	Spaces inside shelters are appropriate for an emergency period.	Lack of integration between inside and outside shelter needs to be considered depending on duration of stay.	Takes into consideration space availability per person.
	Durability	Durability depends on length of stay.	Limited durability if the duration exceeds one year.	Establishes durability by using appropriate materials and skills for climate conditions (considering hot-dry climate temperature variations).
	Climatic condition resistance	It is not considered.	Prefab shelters cannot withstand climate difficulties even for a short duration.	Considers materials and construction skills applicable for hot-dry climates.
	Build and dismantle	Reduces time and cost if applicable.	Few studies mentioned this action.	Guidelines that enable building and dismantling with less time and cost (reduced labor, energy efficacy, and re-use of shelters).
	Special organization in camps	The spatial organization of camps offers greater density by organizing and reducing energy consumption.	This orientation would not create spaces that remind refugees of home.	This study would organize these shelters within a camp by spatial urban organization that supports refugees' needs, services and conserving energy consumption.

Table 2.3: Applying adequacy and shortcomings in shelter requirements

Table (2.3) shows the inadequacy and shortcomings of shelter features previously provided. The examples presented shelters as an object without connection to the local context besides the absence of a clear strategy and guidelines in terms of design guide, climate requirements and duration of settlement.

The following section covers the different theories of human needs by considering the necessity of refugees' shelters as a basic need and how providing better shelters is the opening to satisfying needs.

2.8 The Meaning of Need

Peoples' needs are at the core of their satisfaction and to generate this satisfaction, many researchers have discussed human needs from philosophical, psychological and physiological points of view to establish the theory of modern evolutionary needs. Among others (Maslow, 1943; Aldrefer, 1969; Deci & Ryan, 2000) have studied this area and Maslow's theory is one such modern evolutionary theory that discusses human needs. As a basic explanation, people need to feel satisfaction in their lives and to reach this point they have to satisfy their basic needs which include food and non-food items on the physiological side including safety, security and social bonding on the psychological side in order for them to feel happy.

Satisfying needs is the first step in improving quality of life but the question still arises as to what, exactly, people need and desire.

Generally, individual performance, social context, economic aspects and historical background are factors that formulate personal characteristics (Gomes, 2011). Researchers have discussed needs from the point of hierarchy to include different levels of motivation that stem from basic physiological needs such as food, clothing and sleep. An individual's needs then move to the need for safety, love and a sense of belonging and respect. More advanced needs include the need for knowledge and understanding. At its highest level is the need for self-actualization which is to realize the personal meaning of life and the need for transcendence - to become integrated in the world.

This comprehensive meaning of needs that does not exist in humans at birth is concerned with the process of social satisfaction that humans need. There is no specific solution for

acquiring specific needs and it is dependent on the individual and their circumstances. Also, Kenrick, Griskevicius, Neuberg and Schaller (2010) discuss how the perspective of needs differs and is influenced by variables such as age, sex, culture, experience, environment, and others. Individual learning experiences and local ecological factors play a vital role in directing needs and motivations.

Refugees' needs are not, for example, just about obtaining a private bath or kitchen. They go beyond physical objects. The debate here is about satisfaction and well-being, and over time it develops towards more advanced needs. Individual happiness in society is based on quality of life (QOL) although Gomes (2011) has another view that it is a base of changing needs which are subjective. Political and personal needs overlaps and others, such as financial and leisure needs, may occur at multiple levels from the individual to society, national or global, and change over time as they are influenced by social patterns and standards.

2.8.1 Theories of Human Needs

Throughout history, many theorists and researchers have shown an interest in human needs as a vital factor in generating satisfaction. Although many researchers insist there is an order to obtaining needs one by one, others dispute that from the point of overlapping human needs to achieve satisfaction. These theories divide into two approaches; one approach discusses *overlapping* needs and the other discusses *independent* needs. The discussion here seeks to clarify how these two approaches meet human motivations for achieving adequate living conditions for refugees.

Conversely, the Growth Theory (E.R.G.) by Alderfer (1969) discusses needs in three directions; existence (physiological and safety needs), relatedness (social and internal esteem needs) and growth (external esteem and self-actualization needs). Neither one of these determines achievement of the others. Alderfer claims that 'lower' satisfaction is not a prerequisite for 'higher'. The difference between Maslow and E.R.G is that Maslow does not mention the relationship between the overlapping needs and leaves a gap in the theory that E.R.G fills by measuring satisfaction and desire and the connections between each need and others.

In Alderfer's theory, peoples' desire is represented by more than one need at different levels at the same time, which means it is possible to experience incomplete lower needs before moving to a higher level on a pyramid of needs which may vary across individuals and cultures. Researchers including (Alderfer, 1969; Huizinga, 1970) showed an overlap in the deviation of needs and others showed self-actualization as an independent need.

In addition, social and behavioral scientists have discussed overlapping needs in terms of achieving identity, security and dignity. Accordingly researchers (Christie, 1997; Deci & Ryan, 2000; Kelman, 1990) propose different directions of understanding in establishing needs, however the overlap between needs levels is central to human well-being (Staub, 2003). As Sheldon, Elliot, Kim and Kasser (2001) agree, basic need is at the top of the hierarchy although they argued that it is influenced by other social and environmental factors such as autonomy, self-esteem, relatedness and competence, which as social aspects help to obtain autonomy needs.

To summarize, some theories support the overlapping of needs and some support independent needs. In relation to refugees, their needs overlap as their sense of well-being is a result of first finding motivation.

2.8.2 The Hierarchy of Needs-Maslow

In 1943, Abraham Maslow established and published his theory of the quality of life; 'Towards a Psychology of Being' as shown in Figure (2.28).

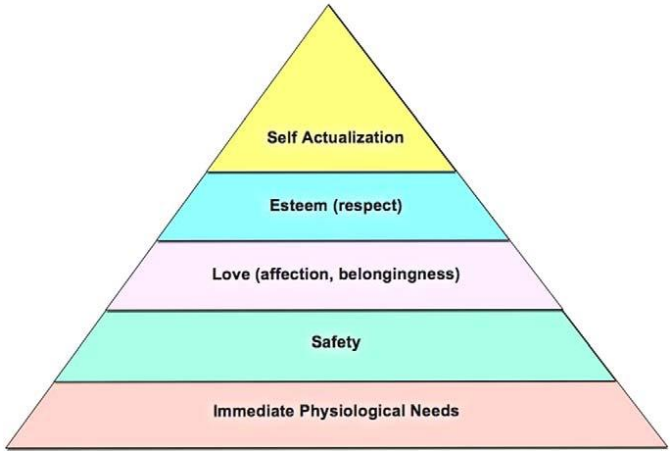


Figure 2.28: Maslow's classic hierarchy of needs (Source: Kenrick et al., 2010, p.293)

The book discussed the theory of human needs with the Maslow pyramid and was the most important theory in the last century. The pyramid is divided into three levels distributed into five layers (physiological needs, safety, belonging, self-esteem, and self-actualization). Each level has different stages (Ventegodt, Merrick, & Andersen, 2003). As shown in previous categories, the rationale behind the pyramid is that the hierarchy mirrors a lower degree of satisfaction. There is more need and satisfaction at lower levels, which are the basic needs, and gradually less at the higher levels.

Needs are necessary for survival while wants aim to improve the quality of life (Maslow, 1943). Accordingly, Heywood (2004) debated how self-esteem needs are more important than physiological needs. Heywood demonstrated how obtaining quality of life connects to situations of hunger satisfaction while Maslow questioned if belonging and love could be experienced if you also experience hunger or psychological satisfaction. Maslow's theory and other researchers such as McClelland, Atkinson, Clark and Lowell (1976) are similar in that they divide needs into basic and safety needs, love needs and growth needs whilst others are divided in terms of deprivation and gratification which means connecting needs with behavior attributes.

Many psychiatrists and researchers have debated the hierarchy of needs in Maslow's theory. Ventegodt *et al.,* (2003) argues that people can be creative even if they lack security and have financial obstacles. Children are still capable of playing even if they are hungry. Needs, therefore, may not follow a hierarchical order and different factors might direct motivations. Peoples' needs such as freedom, identity, idleness, participation and protection are vital but are not necessarily obtained by order of hierarchy. Wahba and Bridwell (1976) questioned how needs must have flexibility because people have experience of different situations and behavior might be in multiple positions.

2.9 Refugees' Needs

Refugees had their own lives before crossing borders and becoming refugees, they lost everything; their homes, indigenous location, their daily activities, so it is difficult to be part of a new community (Lambo, 2012). It is important that refugees continue their lives as normally as possible after the threat of war has disappeared. When they first arrive in a

host community, it may be enough to provide them with their basic needs, but over time, stress and psychological suffering lead to a more complex framework in providing for their needs.

In history, refugees' needs and satisfactions have shown an overlapping pattern in terms of obtaining needs. In this regard, the requirements of modern life have an influence on people, despite refugees' need for protection and security. Also they need to interface with modernity, for instance using modern devices such as phones and washing machines, and this explains another level of self-actualization needs. Additionally, Kesebir, Graham and Oishi (2010) mentioned how social and cultural aspects play a vital role in driving peoples' needs and show variability even in physical needs that cross culture features such as people's sleep or eating patterns which impact on satisfaction of living conditions.

2.10 Shelter as a Basic Need

One of the essential basic needs is shelter, which provides protection from the elements, climate conditions and other physical dangers such as animals and strangers. The provision of refugees shelters is influenced by several requirements and the lack of establishing basic living requirements and desire in existing shelters is apparent in most shelter solutions (Heywood, 2004).

The Growth theory (E.R.G.) by Alderfer (1969) argued that a lack of satisfaction of a certain need will increase the importance of such a need, that means if refugees are not satisfied with their shelter performance, their desire for shelter will increase accordingly.

Peoples' motivation is a crucial factor in promoting quality of life inside a shelter. Zavei *et al.,* (2012) shows the importance of finding the connection between peoples' motivations and the architectural elements that could lead to a suitable result of shelter satisfaction, it will be more appropriate to establish a framework of peoples' needs, environment aspects and the context then suggest a proposed design of a shelter by defining shelter performance, a suitable place would be formulated by person-environment congruence (PEC), and from different perspectives social acts would be affected if human motivations in shelter provision were indistinguishable. Shelter is not

just an object as mentioned in section (2.7), there are several factors that support the process of living outside and inside the shelter. In Maslow's pyramid of needs, people need not just a physical shelter, but also a shelter in which to carry out their cycle of daily activities and which establishes their satisfaction of basic needs (Kenrick *et al.*, 2010).

In short, although a shelter provides physical protection, it is also a place to engage in social and culture norms, dignity, identity, belonging and a way of living. It must, therefore, be appropriate for users to satisfy their need for stability, security and participation in the host community.

2.11 Adequate Refugee Shelters through Needs Understanding

One of the basic needs for refugees is a shelter, which is different than a home, shelters began as a temporary place for living when NGO established them in camps. In other words, to establish a better shelter, it is necessary to find the connection between requirements of a place used for daily activities with consideration of the social system.

The framework of the shelter's requirements is shown in a pyramid like Maslow's pyramid. The idea is to establish such a pyramid through layers of requirements, as shown in Figure (2.29) which shows dividing layers to three levels based on the hierarchy of connecting refugees' needs and local context.

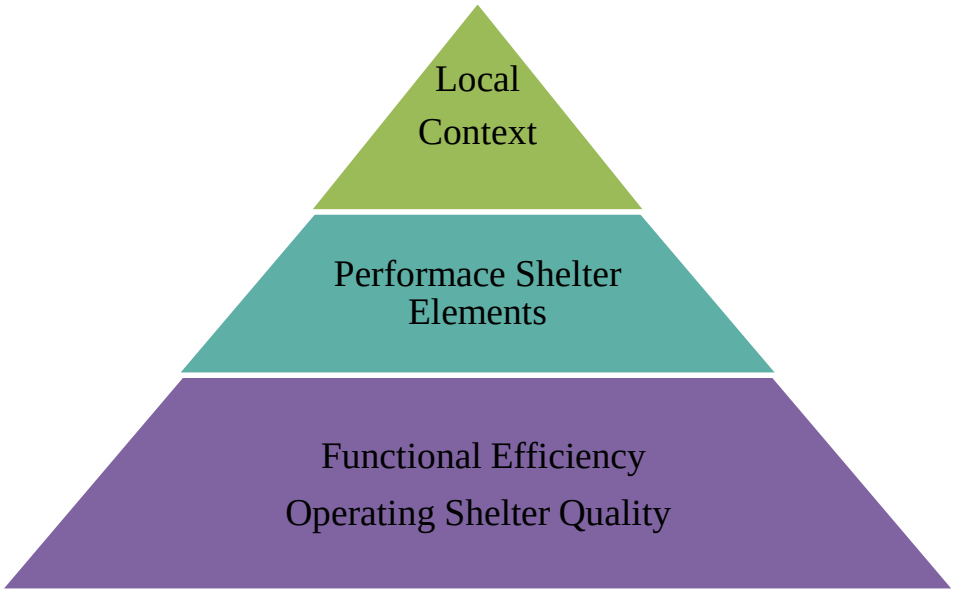


Figure 2.29: Shelter specifications in a hierarchy

The figure shows three levels of requirements that are divided between functional efficiency, performance shelter elements and local context. The upper level is based on the lower one. The three main levels are as follows:

2.11.1 Functional Efficiency

The functional efficiency of shelters refers to safety and security. Safety is established between refugees by different layers depending on gender, age, social state, ideology and beliefs (Lamond, Dye, Mills, & Weatherbee, 2005). In this regard, the research applies the meaning of security and safety as one of the basic needs of a shelter. Shelter functionality provides a space, support, safety and security from a precarious situation.

2.11.2 Shelter Performance

Shelter performance is presented in the second level of refugees' needs after safety and security. Applying comfort to shelter performance is presented through the efficiency of shelter elements which are walls, partitions, openings, floors, roofs and materials. This is required to provide comfort inside the shelter against climate difficulties and environmental characteristics (Zavei *et al.*, 2012).

2.11.3 Local Context

The local context is an essential aspect of understanding social context. It must take into account their satisfaction of environment, social, culture, customs, and beliefs in the local context (Maslow, 1943).

The three levels of shelter requirements cover primary criteria of human needs that formulate the research specification. Time is considered for improving refuges' needs and quality of living, at the arrival of the refugee into the camp, they start to get protection by considering the shelter but it must also consider the environmental and climate conditions; this research considers a hot-dry climate, which is representative of Jordan's weather, and the consequential concerns about daily living in such a camp.

2.12 Hot-Dry Climates

This research will consider a hot-dry climate where there are clear drawbacks in the quality of living for refugees in camps and who suffer from extreme climate conditions.

Such a climate has a hot summer and a cold winter and the more concentrated sun in summer means high summer aridity. This climate has an average temperature of between 0°C in winter and above 38°C in summer, and a large variance in temperature between day and night in the same season (Fuchs, Stark, Zeumer & Hegger, 2012).

This climate has a number of elements that formulate its conditions. These are: direct sun, low humidity, very low average precipitation with the possibility of sudden heavy precipitation, severe winds that cause dust storms, temperature fluctuations, clear skies and low cloud density and high levels of dust in the atmosphere (Fuchs *et al.,* 2012). There are fundamental building requirements that are obligatory in achieving internal comfort in buildings in a hot-dry climate. These buildings incorporate protection from high heat absorption due to high temperatures and building materials that offset direct heat and minimize temperature fluctuations.

Accordingly, the nature of such a climate must be clarified by orientation, formation, vegetation, materials and construction. Designers should limit the amount of dust entering a dwelling during sandstorms and prevent dust from blowing around inside. Also, the cold should be considered in terms of the nights being surprisingly chilly, especially in arid areas (Corsellis *et al.,* 2005). Dwellings must have materials with a high concentration of sun radiation to keep dwellings cool at night. Correctly oriented dwellings reduce the impact of solar gain and access during colder seasons and this may resist wind flow.

The way to construct dwellings so that sun radiation is minimalized is by using a double skin technique on the roof or by utilizing a suspended plastic shade net over the shelter to allow air to pass through and at the same time reduce the amount of sunlight, as shown in Figure (2.30).

Figure 2.30: Reinforced plastic tarpaulin of UNHCR (Source: www. Paramounttent.com)

The dwelling organization within a camp should be established as a compact design, although it must reach an acceptable comfort zone and allow narrow streets that provide cover as shade, prevent direct sunlight and blowing winds.

2.13 The Al Za'atari Camp Weather (Al Mafreq City)

Jordan is located in the Middle East and North Africa region. It is divided into three geographical areas; the Rift Valley in the west, the highlands in the center and the desert in the east, which is the location of the Al Za'atari camp. The weather during summer is hot and windy, with low humidity and reaches 45 degrees Celsius. In winter it is cold, dry and windy and temperatures of below zero degrees Celsius are common. Sandstorms begin in March and last until May. These are called *Khamaseen* south east winds. Another hot-dry wind is *Shamal* which is a north east wind that starts in June and lasts until to September (Scavino, 2013). August is the warmest month with temperatures exceeding 40 degrees Celsius. The driest months are June, July, August and September with precipitation 0 millimeters (see Appendix B). Hours of sunshine per day are between 5 hours in winter and 12 hours in summer.

In summary, climate difficulties in hot-dry regions must consider the variation of day and night as well as summer and winter to achieve suitable design solutions that provide acceptable comfort levels inside dwellings. The research takes into account the attributes of urban climates that use the benefits of sunlight and wind during particular months to reduce the consumption of energy and improve dwelling designs (Johansson *et al.,* 2009).

2.14 Climate Affecting Design Factors

In a hot-dry climate, the demand for a heating and cooling system is required due to the dramatically increasing and decreasing temperatures in summer and winter respectively. Fuchs *et al.*, (2012) point out that dwelling design factors influence internal comfort levels and these include the dwelling's skin, structure and system, all of which are taken into consideration in the research criteria.

In this regard, many factors must be considered to reduce energy demands; the high compact nature of the structure, a great degree of dwelling depth, the dwelling's shade by orientation away from direct sunlight, avoiding dwelling surfaces that have a high degree of reflection, and rearranging dwellings to be enclosed to a courtyard for obtaining shade (Corsellis *et al.*, 2005). Also additional surfaces to the facade that reflect sunlight away and having a close distance between neighbours is a good idea to ensure plenty of shade particularly for sides that directly face sunlight.

Regarding ventilation, systems might be used throughout some months of the year, however, a mechanical system of ventilation is essential especially when air contains particles of sand. The Renewable Energy Policy Network for the 21st Century [REN21] (2010) state how solar technologies have become widespread around the world and particularly for generating energy inside dwellings. This depends on room conditions which are dependent on the dwelling's skin and its structure and how it works with the heat, cold and humidity levels in the room. In short, the dwelling's system has a simple process for producing heating or cooling inside the dwelling through solar collection and generating energy.

2.15 Chapter Summary

This chapter has reviewed the literature in terms of the background to camps and requirements needed to improve living conditions and how camps typically develop from a formal layout to an informal layout. In relation to the Al Za'atari camp, the chapter explained the factors which have influenced the camp and embodies the individualities of camp layout and shelter design in the process of improvement. The chapter discussed the background to shelter programs around the world and relates the importance of shelters

as a basic need that support people after disasters. Many countries have experienced such disasters and delivered various techniques in terms of the design, materials used, technology and strategies employed. In addition, the chapter reviewed human needs as essential in providing secure and safe shelters for refugees. Over time these needs become more complex by requiring dignity and self-satisfaction for people which impacts on their quality of life. This is even more complicated when the sensitive situation of refugees is taken into account. As the research is focused on a hot-dry climate, this chapter described the difficulties people face when living in such harsh conditions. Furthermore, it presents design factors related to hot-dry climates, to mitigate the effect of temperature extremes during day and night, and summer and winter. The next chapter will explore the research methodology and describe the philosophical stance of the research in terms of research approach, strategy and method.

Chapter Three

Research Methodology

3.1 Introduction

The previous chapter reviewed the literature pertinent to housing refugees in terms of the background of camps, previous studies provided by humanitarian organizations and the importance of considering human needs in order to ensure an adequate quality of life, specifically in hot-dry climate conditions. This chapter addresses the philosophical stance and methodology of the research; it shows the reasoning for choosing a constructivism stance in terms of the research assumption, which depended on the nature of the research and circumstances, which is based on understanding refugee practices that are socially constructed in daily activities. It presents the strategy, approach and methods adopted, as well as explaining the design science method that was chosen as a framework for the research. It conducts different strategies regarding design science phases to answer research questions and achieve research objectives, plus the protocol of design and development of the research techniques to support the data collection. Since the research is concerned with social and cultural activities, the researcher has conducted an ethnography strategy to discover stories about the camp situation. This chapter shows how validity and reliability was addressed from a qualitative data point of view and how these concepts influenced the research results.

3.2 Purpose of the Research

Research projects can be exploratory, explanatory (analytical) and descriptive. Saunders, Lewis and Thornhill (2009) noted that exploratory research aims to answer ‘what’ type questions and attempts to understand the phenomenon from a new sight or direction, to explore other sides of the problem than what is already known. Exploratory research has a simple principle: to conduct research by searching the literature, or interviewing experts. Exploratory research is flexible to change if new data appears to follow a new direction as a result of iteration. Descriptive research illustrates an accurate framework of the events and situation, it describes details of the phenomenon as a prior step to exploratory research; it is a part of explanatory research but with detail considered. The

danger of descriptive research is whether or not the right choice of topic accurately describes the thesis and answers the research questions.

Explanatory research or analytical research seeks to find the relations between variables which influence the situation; quantitative data are the base for finding variables and explaining relations and qualitative data are applicable to collect data for explaining those variables.

Robson (2002, cited in Saunders *et al.*, 2009) said that the need for the research might change over time and as a result it is possible to combine more than one type of research to answer the research problems in order to achieve multiple research purposes. With regards to the previous explanation, this research is exploratory, since it aims to approach what refugees need for their shelters from different angle than the usual one, i.e. incorporating social needs in the specific context of hot dry climates; additionally, it is explanatory since it seeks to understand the relations between the variables related to refugees' needs and settlement challenges.

3.3 Methodological Approach

According to Saunders *et al.,* (2009), the research philosophy is a way in which world assumptions are viewed to guide the research strategy and define the methods chosen in a research study. In this regard, the ontological stance of this research is embedded in the social constructivism approach, since it is argued that multiple realities and relationships between variables must be understood because of their influence on the success or failure in the specifications list. Saunders *et al.,* used a definition of paradigm as the way of inspecting particular understandings of social phenomena gained by research questions and as a set of beliefs that make meaning of the world. Creating specifications to establish refugees' shelters in a hot-dry climate for improvement in the quality of living standards in camps is the motivation of this research and so the researcher embedded social constructivism as the assumption to focus on reasons behind socially constructed beliefs of refugees in daily activities. Thus, the creation of the overall meaning stems from the set of beliefs and meanings gathered from a variety of stakeholders present in refugee camps.

The research starts with explicating the problem through the literature review, outlining the requirements of stakeholders as a framework to create the specifications list, then demonstrating if the specifications solve some aspects of the problem for one case then finally validating the specifications list's effectiveness.

Researchers have developed many different models for understanding the nature of knowledge of the world. One example is the 'Nested' model, developed by Kagioglou, Cooper, Aouad and Sexton (2000), while the 'Onion' model was developed by Saunders *et al.* (2009), shown in Figure (3.1), which shows the stages of research represented by knowledge 'rings', with each ring being integrated and looped with the next to show the holistic research design of a study.

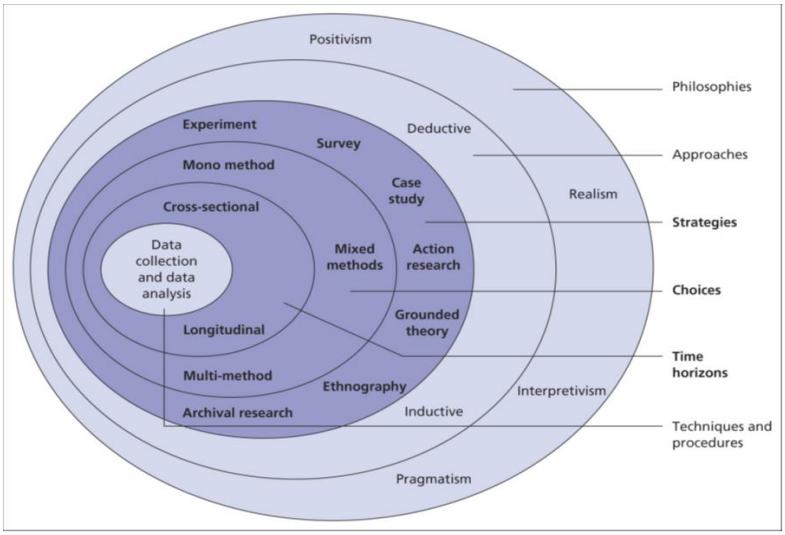


Figure 3.1: Onion model (Source: Saunders, et al. 2009, p. 108)

The outer ring of the research 'Onion' deals with the research philosophy paradigm that includes different terms, followed by approaches, strategies, choices, time horizons, and techniques, where each research study articulates the appropriate term for helping researchers to decide on suitable research designs to answer the research questions. The middle ring defines the research approach of theory, whether deductive (theory testing) or inductive (theory building). The inner ring is the research technique used to investigate the research questions with tools of data collection. Many researchers tend to use more than one approach to minimize the weaknesses of one single approach.

3.4 Connotations of Research Philosophy

The research paradigm is a broad framework telling researchers how the research is based and the nature of the research (questions, aims, and objectives). Collis and Hussey (2013) argued that a philosophical approach includes a coordination of understanding the world and reflects the research understanding of the knowledge and reality.

Saunders *et al.,* (2009) argued that the research paradigm includes natural science or social science, where the former believes the reality to be based on positivism, and the latter believes in social impacts on understanding the world and leads to interpretivism. Collis *et al.,* (2013) argued that the phenomenon positivism focuses on measuring social phenomena, while interpretivists focus on exploring the complexity of social phenomena.

In both cases, it is about understanding the world through important assumptions which will be adapted by the research strategy, methodology and methods. It is the main idea that the relation between knowledge and processes conducted develops the knowledge. Ontology and epistemology are two assumptions that have great differences and researchers adapt depending on their foundations and the research questions. The ontological assumption is about the nature of reality and the epistemological assumption is the way of accepting the world (Cohen, Manion & Morrison, 2011). Pragmatism adopts one position of ontology, epistemology and axiology that depends on the research questions. However, researchers do not always conduct one position and sometimes apply the research questions in opposing positions, where the research must be flexible in terms of a continuum position (Saunders *et al.,* 2009; Collis *et al.,* 2013).

The research philosophy paradigm includes three aspects of philosophical stance of a study: ontology, epistemology and axiology. Each concept explains the understanding of the phenomena from different directions. Collis *et al.,* (2013) explained that the approaches within a positivism paradigm include descriptors such as: quantitative, objective, scientific, and traditionalist; while an interpretivist paradigm includes: qualitative, subjective, humanist, and phenomenological. Before developing a research design it is essential to decide upon the assumption of the research, the ontological and epistemological assumptions.

Ontology is the assumption about the nature of reality, whether the world is viewed as idealism or realism. It is a way of seeing oneself inside the world and it represents the meaning of reality, it is about the assumption of the way that the world operates from the point of view of the researcher's understanding; the two consequent approaches are subjectivism and objectivism, depending on how the world operates from either the point of view of the researcher's perspective, or as stand-alone phenomena.

Bryman (2012) noted that objectivism is a position of ontological philosophy which leads to assess social phenomena separately from social actors, while *constructivism* leads to social phenomena being accomplished by social activities and actors, or people, as an intrinsic part of the research context.

Epistemology is the "theory of knowledge" and is another stance of research philosophy. Cohen *et al.,* (2011) discussed it as referring to how researchers accept the nature of knowledge represented by two opposite points of view - positivism and interpretivism, which refer to two different types of research; one leads to more tangible resources and the second leads to more intangible feelings, beliefs and actions to grasp meaning of the world.

Positivism is an epistemological position that is adopted by tradition of natural science. Producing the research most probably will be about generalizations or laws of natural and physical scientists. Myers (1997) argues that the positivist looks at the reality of objective events and this reality is used to measure the independent properties of what the researcher observes. Social phenomenon is used in this position to test the theory.

On the other hand, *interpretivism* leads to subjectivism, it respects the difference between people and the objects of natural science and grasps the different subjects' meaning. As Saunders *et al.,* discussed, interpretivism goes well with subjectivism, as a way to research social phenomena that are about perceptions and understanding of actions by social actors. As these phenomena are about people, it is the perceptions that individuals attach to it which the researchers need to search into, and details of why reasons such phenomena happened and the reality behind it, that guides towards constructivism or social constructivism, which means the researcher tries to understand the social reality

that is created by social actors, and thus must follow the interpretivist perspective to explore the subjective meaning that motivates or creates their actions in social reality.

The *Axiology* assumption in philosophical approaches investigates judgments about value. Axiological stance can therefore be viewed as a continuum with the extreme ends being either value-free or value-biased. Collis *et al.,* (2013) discussed axiological assumptions by positivists that believe the research is value free, positivists trust that objects that are studied in the research are not affected by studying, while social science studies are far away from the positivist view due to the behaviour and peoples' beliefs being affected by the study. This research rests on interpretivism assumption and is socially constructed as shown in Figure (3.2). Saunders *et al.,* (2009) argued interpretivist researchers' emphasis is to understand different people in their role and how people play the role of a social actor. In this regard, values are part of the study and the researchers believe that values support understanding and interpreting the research object.

3.5 Philosophy of this Study

The philosophical stance is the basis of grasping the knowledge of any research, and it can be expressed as standing on a continuum; this helps researchers to find their philosophical position for their research.

As anticipated, because of the characteristics of the research, the constructivism assumption has been adopted for this study. It takes an interpretivism assumption, as the research will develop specifications for establishing refugee shelters in a hot-dry climate by considering the different stakeholders' views. The profile of participants outlined in section (1.2) and the level of importance of stakeholders are measured by the researcher regarding their needs prioritizations, as discussed in section (4.12). The project needed exploration of the problem and explanation of the interrelation between the research variables derived from the participants. The research formulates specifications based on the social understanding of the refugees' situation and finds the solution through analytical variables, which are socially constructed to understand the nature of the problem. Social constructivism of refugees' situations and their understanding has not been tackled in the literature. Previous studies were descriptive and did not attempt to

build knowledge through participants, while this study fills this gap because it considers the subjective nature of the problem by considering refugees as the main stakeholders.

3.6 What is Constructivism?

Constructivism is an ontological view that refers to the organizations and culture influence on social phenomena which are accomplished by social actors and drawn in advance (Bryman, 2012).

As discussed by Wisker (2008, p.69), constructivism is "based on similar beliefs as interpretivism, it believes that humans construct knowledge and meaning from experience and from relationships between things, people, events".

The constructivism stance is that social actors construct their meaning and beliefs into social reality to understand the world, additionally external factors influence their situation, so their environment impacts on their perspective of social reality which leads to the meaning of social constructivism. The close theoretical perspective of constructivism is interpretivism where constructivism rejects the view that the meaning of truth is exclusively formulated through the external world, however, it stems the interaction of subjects that construct the meaning, it does not discover this in different ways even if it is relating to the same phenomenon, recognizing that if meaning is constructed differently the result on the phenomenon will be dissimilar. Gray (2013) mentioned the constructivism meaning does not emerge from the interplay between the subject and the outside world; it is imposed on the object by the subject. In terms of interpretivism being closely linked to constructivism, interpretivism states that social reality needs different methods for assessing, social reality deals with individual actions and the role on social science research is to focus on unique aspects by qualitative data, however, as mentioned earlier, other methods might be required for grasping social reality.

As the nature of the research indicates, there are no truths of reality regarding refugee studies or absolute measurements to discover meaning. The researcher argues that refugees' situations are constructed by human motivation and depend on individual meaning of the subject, thus, the researcher suggests this study is categorized as social

constructivism to understand the reality of refugees' situations in camps, individual beliefs and how they are perceived through their actions; these two factors allow establishment of the research specifications.

Creswell (2013) explained social constructivism as a complexity of interpretivism in which the researcher must explore participants' views. Social constructivism is a subjective complexity of meanings created through the interaction between participants and formulated in the form of history, tradition, beliefs. The researcher must discover these meanings by meeting and discussing with participants and consider the participants' context and their position in order to draw findings through interpretation.

Bryman (2012) argues phenomenology is a basis to follow how individual understanding makes sense of the world; however the research scope does not rely on a phenomenological stance as it is about assessing the human experience over time. The researcher will seek to make sense of refugees' interpretation of their existence inside the camp by laying on social practices of refugees and the implementation of shelter performance in a hot-dry climate and explore such events that are formulated by refugees' meanings and beliefs to understand their world or in other words to interpret their understandings into their environmental surroundings.

3.7 Research Approach

As clarified, philosophical knowledge plays a pivotal role in leading researchers to gear their study through their understanding of the real world and designing it appropriately. The research methodology can be developed through either quantitative or qualitative (or both) designs. This study opted for a qualitative design, as shown in Figure (3.2). The approaches have two types, inductive and deductive where the former relates to qualitative which is mainly used when the researcher is explaining the social practices and by proposition a discipline contribution of the theory, the latter is often a quantitative approach of the research and is basically working on testing the theory and explains the relation between variables (Cohen *et al.,* 2011). Qualitative research methods rely on the knowledge of researchers' experience for data analysis which focus on qualitative data such as interviews, documents and observation; it is a more subjective view of the world by building a new theory and view, while quantitative research methods rely on statistical

and numerical data collection and analysis by questionnaire and experiments and refers to objective points of view (Saunders *et al.,* 2009). Regarding answering research questions and achieving objectives, the research will be conducted with an inductive approach as shown in Figure (3.2) which is interested in the context and how social events take a place of understanding the nature of refugees' needs, and so the inductive approach is better in understanding what is happening by developing theory rather than describing the events as testing theory. In this regard, inductive research is more appropriate to a small sample which focuses on designing a qualitative method to explore the situation of refugees.

3.8 Research Strategy

Denscombe (2014) discussed the research strategy in the social science aim as distinct, logical and rational research, presenting the research design, achieving the goal as identified in the research problems. Many options are available in the research strategy, such as surveys, case studies, experiments, action research, grounded theory, ethnography and archival research (Yin, 2015). In this regard, the information is required to conduct the research and respond to the research problem, this is the concrete base to choosing the most appropriate research strategy (Cohen *et al.*, 2011; Bryman, 2012).

The significance of this research is that it views the problems and reality of accommodating refugees in camps considering stakeholders' opinions, moreover, the researcher had to understand the context carefully by investigating variables which impacted on the context of the accommodation, both socially and environmentally.

The iteration of the findings several times was compulsory to explore and investigate the reality of the refugees' needs and settlement challenges in a hot-dry climate. Thus, for this reason the research conducts design science as a framework of five steps that includes different tools and techniques depending on the aim of the phase. Johannsson and Perjons (2012) noted that to ensure that answers to the research questions are reliable and valid, it is essential to select research strategies and methods that depend on answering the research questions and size of the design science project.

The research adapts design science within the philosophical stance of the research; it is able to compose a multiple iteration position of its phases; explicate the problem, outline the requirements, develop a new artefact, demonstrate the artefact, and evaluate the artefact by contextual knowledge that results from the research to understand the world. Data is collected from the Al Za'atari camp in the north of Jordan to understand refugees' needs and settlement challenges that refugees faced in their context.

Regarding understanding stakeholders' views of camps, an ethnography strategy was conducted to present potential refugee stories and stakeholder practices regarding accommodating refugees in camps. Ethnography is a strategy that social anthropologists follow to describe social and cultural living requirements, an ethnography strategy maps culture and social activities and stories of people to support living conditions in a local context (Saunder *et al.,* 2009). The researcher conducted an ethnography strategy and spent time in the field of the Al Za'atari camp to study culture and social practices by discovering their stories, humanitarian organizations and experts were part of analysis regarding understanding the camp situation. The researcher analyzed refugees' situations through how people understand their local context and reflect that on constructed living practices of acceptance of the camp as a temporary site or as an informal city, as shown in section (2.4.2).

The researcher chose an ethnography strategy besides using the design science method and considered the design of collecting qualitative data as discussed in section (3.8). Ethnography is a holistic approach through investigating culture and social aspects of a context and avoiding isolating facts from the actual context (Denscombe, 2014). In this regard, the research used an ethnography strategy besides design science in terms of expending the richness of social and cultural stories and experiences collected by the researcher, and can be limited to use through a list of specifications.

Ethnography is about the access to the field where the researcher conducts interviews and group discussion with participants and takes a naturalism approach to access participants that is derived by investigating refugees' stories and practices in their natural situation and concerns simplicity of everyday living (Saunders *et al.,* 2009). In this regard, the research collected refugees' stories, humanitarian organizations and experts' practices

and described in particular the acts to link with a camp context in terms of the ability of being as a temporary situation or informal city. Cohen *et al.*, (2011) argues ethnography explains a subjective perception in context and allows for multiple perspectives.

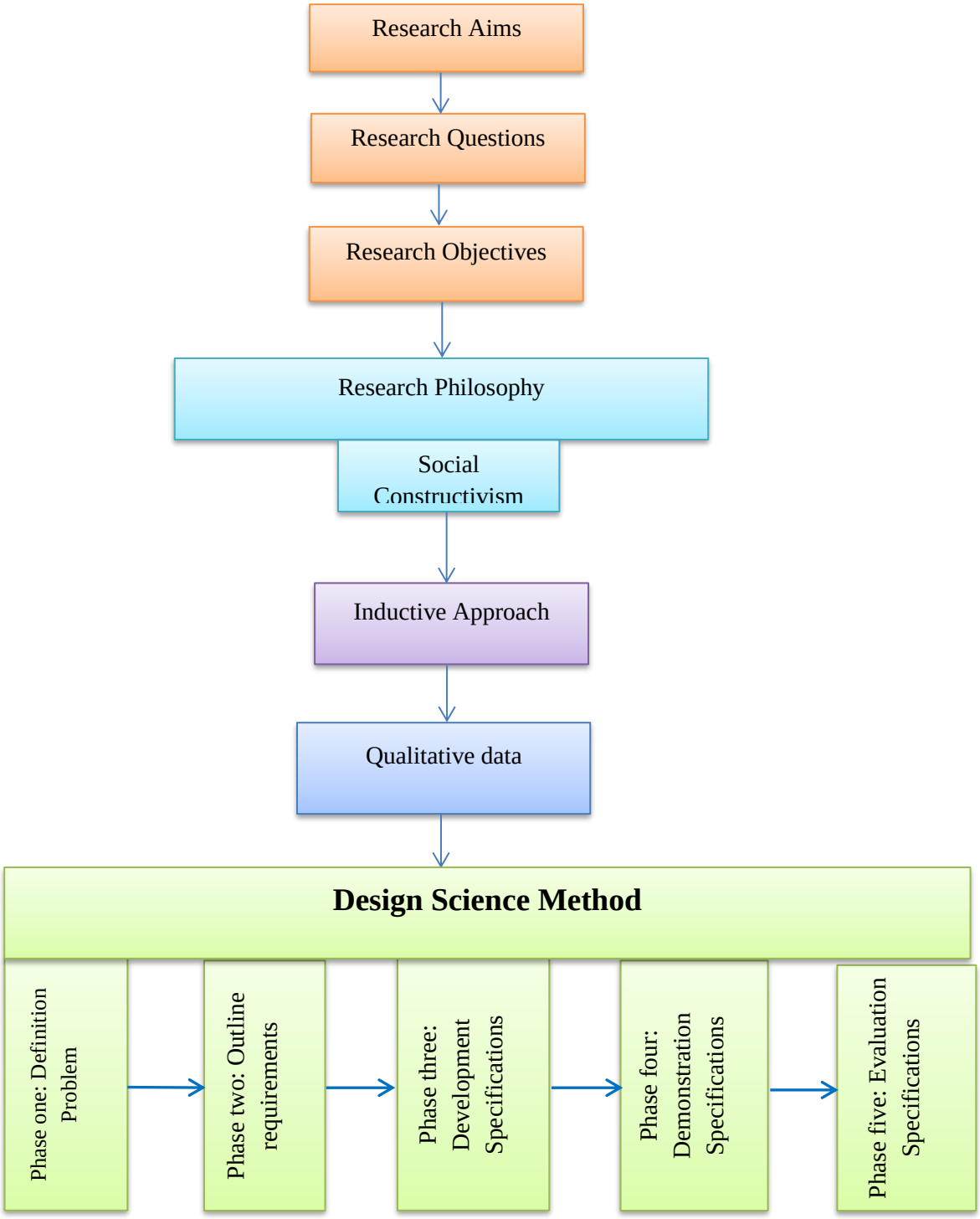


Figure 3.2: Research methodology and strategy

As Figure (3.2) shows, the research aim, answering the research questions, and achievingthe research objectives, requires application of a comprehensive methodology, strategies and method, that provides validity to, and originality of, the data collected and analyzed, based on the foundations of the research philosophy. The next section will discuss the 'Design Science' method of the research, to achieve the goals and increase the validity of the study.

3.9 Design Science Method

This research will adopt a Design Science (DS) method to describe and develop a new opportunity of understanding the world that can help people to obtain their needs. Johannsson *et al.,* (2012) explains design science is a new area in Information System (IS) which aims to create novel ideas, methods, models or other opportunities to solve practical problems of broad interest and support its knowledge under (IS). It also looks over other grounds of human studies, Hevner and Chatterjee (2010) argued the design science activities within information systems work to describe data under a conceptual framework of information systems.

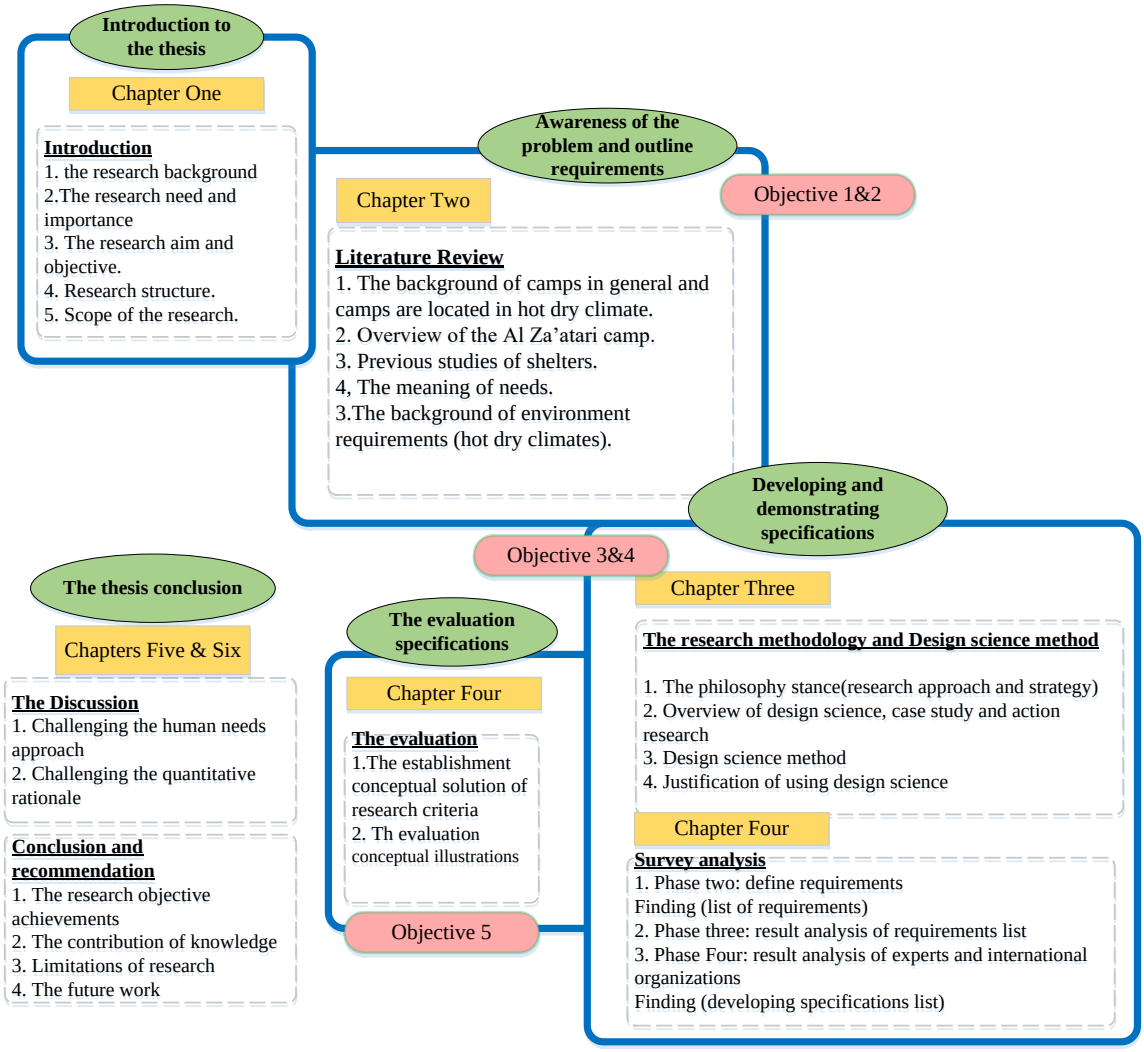


Figure 3.3: Relationship between design science, thesis chapters and research objectives

The design science method is considered in the research as the framework for achieving the research objectives as shown in Figure (3.3), in which the research objectives are established by conducting design science activities, at the beginning through awareness of the problem, the design science process and finally to the conclusion and recommendations.

Saunders *et al.*, (2009) mentioned that the design science aim is to develop an artefact by valid knowledge to support solving the problem in the context whether directly, such as a model, or indirectly like giving an instruction, in this regard it is a solution oriented in considering human activities.

Grand and Jonas (2012) showed that design science started in 1960, which was the start of the design science decade where the scientists were beginning with design movements to produce the process of rationality by the design process. Earlier, in 1920, architects and engineers were supporting the design as an objective way to show the productive knowledge such as the project "machine for living" for Le Corbusier.

"Design science refers to an explicitly organised, rational and wholly systematic approach to design; not just the utilisation of scientific knowledge of *artefacts*, but design in some sense a scientific activity itself" (Cross, 2006, p.98).

3.10 What is Design Science?

Lukka (2003) indicted that the design science method is to support a constructive innovation that solves a problem in the real world where the contribution of theory exists through the discipline of application. Johannesson *et al.,* (2012), stated that the result of design is relevant to a certain group, organization or individuals. In contrast, design science should affect a global community and involves creating a new artefact that does not exist. If the knowledge required for creating such an artefact already exists then the design is routine.

3.11 Design Science Explanation

The multiple research process is required in design science phases. Figure (3.4) shows the general design science research that appears in a sequence of stages beginning with awareness of the problem, suggestion, development, evaluation and finally the conclusion. This sequence is sometimes called improvement research. Johannesson *et al.*, (2012) stated that suggested solutions to a problem are formulated from existing knowledge or literature which can be used as a guide to developing an *artefact*. Johannesson *et al.*, stated that the sequence of artefact development is divided into initial stages as shown;

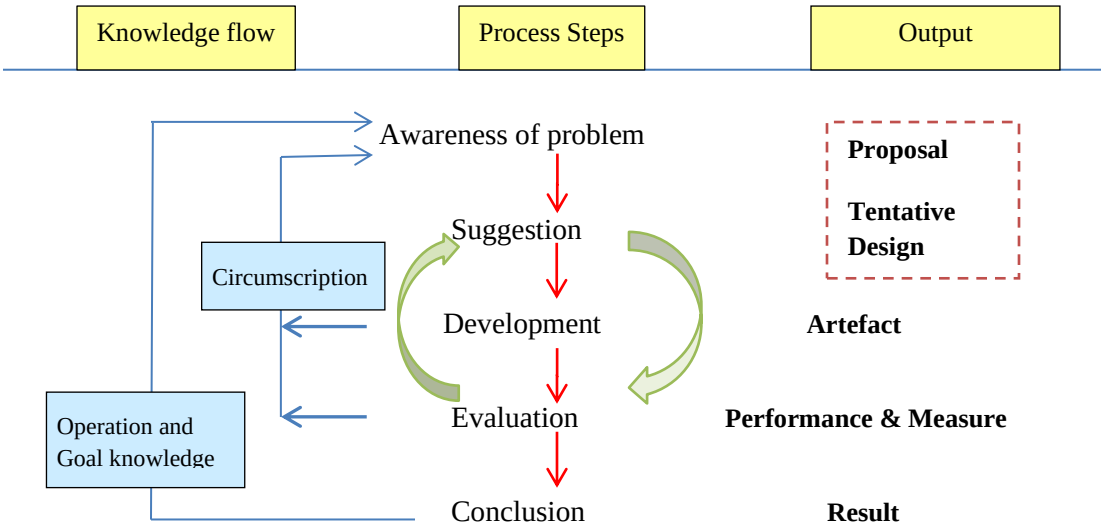


Figure 3.4: The general methodology of design science research (Source: Vaishnavi et al., 2007, p.20)

According to Vaishnavi and William Kuechler (2007) awareness of a problem comes from different sources which might deliver a new definition in the field and formulate a proposal of the output. The suggestion follows where tentative design is an output of suggestion. Other research models might suggest a proposal design, however this model is just a part of the design proposal, design science is connected and integrated with a design proposal and it is not one body of knowledge, thus if the proposed design does not answer the research problem after investigating in the field, design science researchers go back to the suggestion step for investigating the existing requirements. The artefact is an output of the development phase that constructs a new product implementation which is evaluated regarding the research criteria. The evaluation stage in other research models might recommend further research depending on the result, while the evaluation phase in design science presents further information and data of the artefact by experts which allows for another round of the suggestion phase and to formulate a new proposed design (Johannesson *et al.*, 2012). The conclusion phase is the final stage of the research cycle where the output is the result which might, however, still deviate regarding artefact satisfaction. Gregor and Hevner (2013) explained as shown in Figure (3.4) how there is an arrow between the conclusion and knowledge in the design science model which is

essential in testing the contribution of knowledge on the outcome of the research and if it makes a strong contribution to the body of knowledge.

3.12 Design Science via Behavioral Science

Information systems involve two types of discipline: behavioral science and design science (Hevner *et al.*, 2010). Natural and social science paradigms stand on problem orientation (Wieringa, 2013), it defines the problem that guides the hypothesis, collecting data and analysis of data then proves or disproves the hypothesis. Scientific methods are different when compared against design science methods and where many empirical research methods describe, explain, justify and predict the world as shown in Table (3.1). Typically, scientific methods adhere to the following steps: asking questions, reviewing literature, formulating a hypothesis, data collection, analysis and discussion (Geerts, 2011).

Steps/Research Strategy	**Step 1:**	**Step 2:**	**Step 3:**	**Step 4:**	**Step 5:**	**Step 6:**
Design Science Process	Explicate the practical problem	To define requirements and outline artefact	To develop artefact	To demonstrate	To evaluate	To communicate
Research Activities	*Examination*	*Discovery*	*Producing artefact*	*Justification*	*Testing*	*Knowledge Disciplinary*
Scientifics Methods	Ask question	Form a hypothesis		Deduce production from hypothesis	Check the production	
Research Activities	*Asking*	*Formulating-ng in form of hypothesis*		*Justification*	*Testing and result satisfactory*	

Table 3.1: Design Science vs scientific methods

The previous table shows a comparison between empirical methods and design science in terms of steps. It is clear that steps 3 and 6 of design science do not exist in scientific methods, developing an object and communicating the object respectively. In design science, the aim of the project is to address a practical problem by means of an artefact,

the project may develop a new artefact from scratch or refine an existing one. Moreover, the cycle of assessing the practical problem, outlining the requirements, creating an object then demonstrating and evaluating the object. Thus, to obtain a satisfactory new artefact it is required to finalize activities of design science and to achieve the knowledge base.

March and Smith (1995) argued that design science is solution oriented that produces an artefact and assesses the criteria of the research. The artefact is built, developed and evaluated by how it can address the problem and produce the most effective solution. It constructs an understanding of the process and effectively addresses the problem as a key issue of the philosophical paradigm.

In short, the design cycle of design science research has benefits in the fields of theory and practice rather than in other research processes. The iteration process during the first four phases of design science provides the opportunity for the research to revisit and refine the research results to address the explicated problem.

3.13 Design Science, Case Study and Action Research

The research methodology and its techniques must be justified at an early stage to determine its suitability in achieving the research questions and objectives.

Design science, case study and action research have different elements that must be considered when conducting a scientific science research project. This section presents the similarities and differences between these strategies and justifies the selection of the design science method in this research.

Dresch, Lacerda and Antunes Jr, (2014) showed the main differences between these methods in presenting objectives, evaluating results, generalization of knowledge, the researcher's methods, the requirements of the study and the collaboration between the researcher and participants. As shown in Table (3.2) the similarities and differences are characteristics of the approach of design science, case studies and action research methods.

Characteristics	Design science	Case study	Action research
Approach	Qualitative and/or quantitative	Qualitative	Qualitative
Specificity	Generalization to a certain class of problem	Specific situation	Specific situation

Table 3.2: Approaches between design science, case study and action research (Source: Dresch et al., 2014, p. 96)

Design science is an appropriate methodology in a qualitative and quantitative approach, depending on the objectives of the general interest research. Case study and action research is appropriate for a qualitative approach to a specific problem or situation.

Design science, or constructive research, produces an innovative construction in a variety of forms such as models, methods, commercial products, plans and specifications to solve problems in the field (Johannsson *et al*., 2012). It makes a contribution to the theory discipline and has potential not just to discover but also to innovate solutions (Holmström, Ketokivi & Hameri, 2009). Constructive research is based on the feasibility of the solution in practice and addresses the knowledge required. It has a unique design cycle process which allows two targets to be achieved - the identification of an innovative product and helping stakeholders to solve the practical problem (Dresch *et al.,* 2014). Additionally, design science or constructive research prevents the research subject or target from conflicting with the organization. It is an iterative process which allows potential solutions to be revisited within appropriate timelines.

Case study research is applicable in describing phenomena and for testing and generating theory. Case study activities include definition of the conceptual problem of the research, research planning by choosing methods of gathering data, analysis and justifying data, applying pilot tests, gathering data, analysis of data, and finally findings of the research report (Dresch *et al.,* 2014). By contrast, Lukka (2003) showed that case study research depends on discovering and explaining existing phenomenon without offering innovation solutions but establishing a hypothesis.

The goal of action research is to solve a problem in a certain situation and is, therefore, similar to the aims of a case study. However, the researcher observes actively the

phenomena. Many researchers define action research as resolving a practical problem in an immediate situation without producing or developing an artefact (Holmström *et al.*, 2009).

Lukka (2003) argued that action research might be similar to constructive research but differs as its aim does not create an explication construction but follows a strong, empirical design cycle that is not applied in action research. Additionally, the second and third phases of action research are different to the same phases of design science as the second phase offers alternative actions without investigating the criteria of *artefact* necessary to resolve the problem (Hevner *et al.*, 2010).

In short, the objectives of the research determine and guide which methods must be taken in the research. Descriptions and predictions predominantly involve case study and action research. In this regard, action research considers embedding the researcher's value within the context, however relating to investigating and explaining what happened in the context by users without influence from the researcher's values from one side and to iterate design cycles from the other side, the researcher chose design science as the most appropriate method, since the aim and objectives of the research are to create a design solution through an innovative the artefact of general interest.

3.14 Why use Design Science in the Research?

Design science investigates the reality of the problem and offers a practical understanding of the gaps between the theoretical academic research discipline and the practical field. Purao (2002) discussed that natural science research stands on existing and emerging phenomena without an effect on the phenomenon and the barriers to delivering an original solution.

The research conducts the design science approach and follows the process to achieve the proposed solution of formulating specifications for refugees' shelters in a hot-dry climate The design science method was selected for the following reasons:

- Most academic research on refugees currently points to a limited understanding of the refugees' situation with unclear evidence presented in the literature. The use of design science as a method to innovate a proposed solution leads to

understanding the challenges faced in accommodating refugees in camps. Ashmore *et al.,* (2003) mentioned that there is very little literature available that specifies the required standards for a shelter needed to improve refugees' living conditions. The publications of UNHCR, Medecins sans Frontieres, Sphere and the Shelter project include guidelines and standards that provide alternative emergency shelters as a product (see Appendix C).

- Unlike behavioral science research, design science is solution oriented, so the result comes from a scientific understanding of the theory and practical problems in the relevant field. As a result, the solution orientation can be used by professionals to formulate a design that addresses problems in the field by involving people in the solution which is driven through an iterative design cycle of data collection and analysis (Wieringa, 2013).

- Many research strategies have been conducted to achieve the research aims, objectives and results, although there are similarities between design science and other strategies including the case study and action research approaches. However, the difference appears in terms of the whole process of the design cycle as a main variance, clearly interpretivists' perspectives show a hermeneutic cycle of design but it focuses mainly on the interpretation history of text and documentation text of the researcher in certain points of the field (Bryman, 2012).

- Previous studies have shown that most shelter practices suggested several solutions in terms of prototypes that could implement design performance or urban planning strategy, however, there is an absence of solution that combines stakeholder requirements and as a result it produces a number of prototypes without considering a process. Turner (2011) discussed that developing an artefact (which is the specifications list in this research) occurs throughout the design science method that provides the process and connections between many factors in one process. The design science method provides the foundation for

conducting a process that supports the original solution by linking the literature and survey analysis.

Therefore, the point of interest divides into two directions; the first one is that there is a lack of successful shelters on the market as mentioned in section (2.6.1), the second one is that there is no clear strategy to develop a solution, hence, the contribution of this research is in filling the gap between literature and the field in terms of developing a process that provides specifications, as the artefact, as shown in section (4.7.1).

With regards to implementing the research objectives in design science activities, design science should investigate the problem through a process comprising five phases of activity. As shown in Table (3.3), there are many research techniques used throughout the research. Johannsson *et al.*, (2012) discusses each stage of the design science methodology which does not adopt a single strategy and is required to adapt to different strategies at each relevant stage. After this, it must consider an evaluation step to improve the problem solving process and the validity and reliability of the research findings.

	Research Questions	DS Phases	Research objectives	Research techniques
Awareness of the problem (explicated the problem)	1.What are the problems that refugees define as their needs?	Phase One	Objective1: To investigate refugees' requirements in a camp located in a hot-dry climate i.e. the Al Za'atari camp in Jordan.	1.Literature review 2. Informal interview (exploratory interview)
Design science process		Phase Two		1.Literature review, 2. In- depth interview 3. Structured interview (questionnaire) 4. Focus group discussion
	2. What are the challenges that are encountered when establishing shelters in hot-dry climates?		Objective 2: To examine the environmental and social difficulties that have an influence on the provision of shelters in hot-dry climates, with Jordanian camps being used as the case study.	
	3. How can the specifications be articulated to achieve a shelter that meets the needs of refugees?	Phase Three	Objective 3: To develop specifications in order to support appropriate design of a shelter that meets the needs of refugees in hot-dry climates.	Develop a list of specifications by requirements embedded in literature and field work
	4. What are the required specifications that can be used to address the design of refugees' shelters in hot-dry climates?	Phase Four	Objective 4: To demonstrate the formulated specifications of feasibility to meet refugees' needs in hot-dry climates.	In- depth interviews with experts involved in housing refugees
Evaluation	5. How well will the specifications be utilized for supporting the design of a shelter that meet the needs of refugees in hot-dry climates	Phase Five	Objective 5: To evaluate the ability of specifications to solve the explicated problem (meet refugees' needs).	1. Informal interviews with engineers and architects. 2. Design illustration of shelter by engineers and architects

Table 3.3: Research Methodology

The research adopts a design science method to meet the five research objectives by answering five research questions. Regarding techniques of collecting data and analysis, the researcher conducted a number of strategies depending on the phase to answer questions and achieve objectives. The strategies are conducted depending on the phases

of each situation, such as survey and case study, observation, document studies, interviews and questionnaires, as tools for collecting data as shown in Figure (3.5).

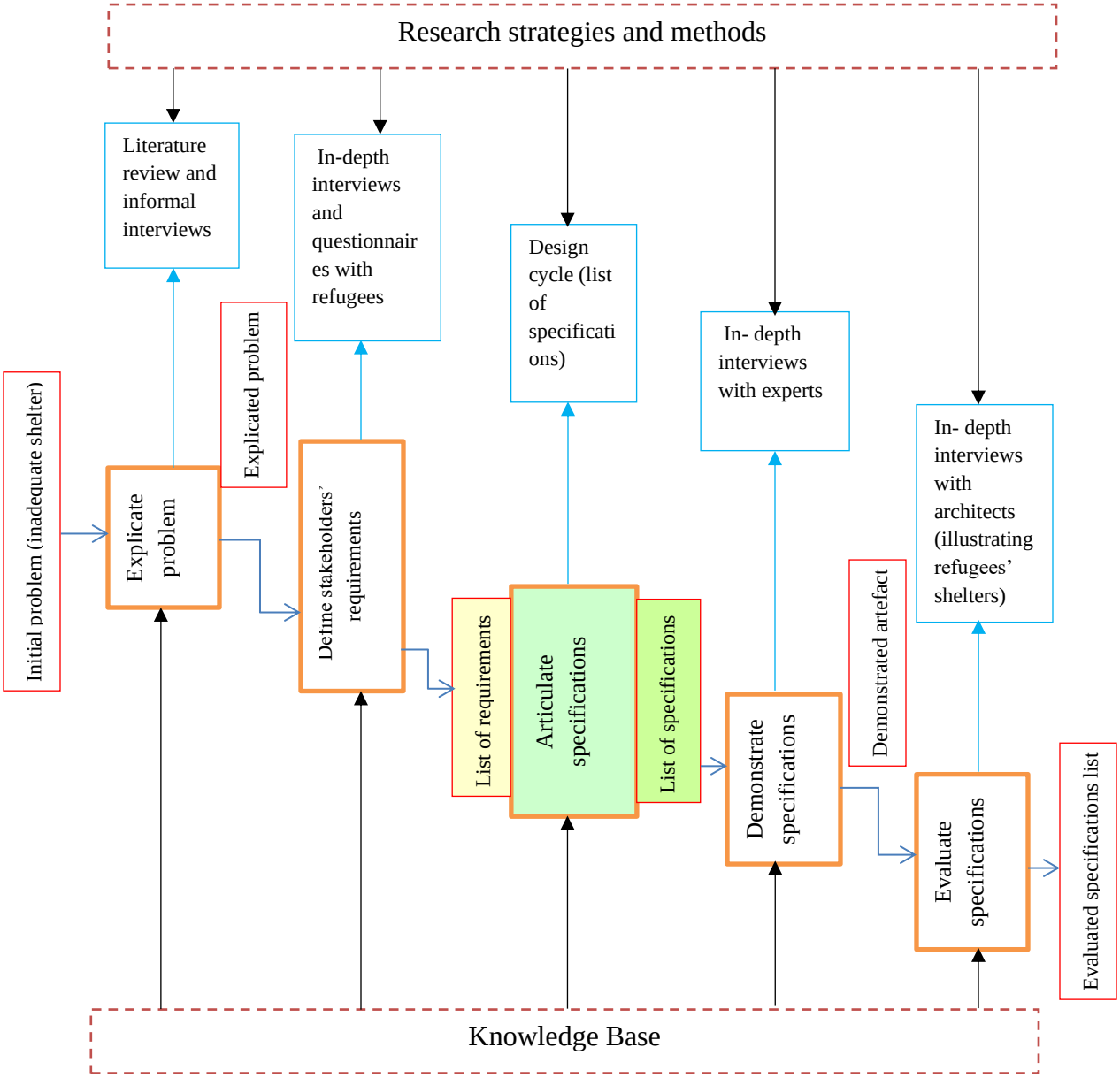


Figure 3.5: Suggested use of Research Strategies in the DS method (Source: Johannsson et al., 2012, p.44)

The research uses a literature review and explanatory interviews to clarify the awareness of the problem and establish it as solution oriented; also in depth interviews are conducted to formulate the initial list of requirements.

Peffers, Tuunanen, Rothenberger and Chatterjee (2007) indicate that there must be awareness of the problem that appears as a gap between the current state and the desirable state when using design science. The current situation of refugees is described as inappropriate with a lack of suitable shelters. Their desire is to establish a new state by obtaining an appropriate shelter to protect them from external factors such as the climate challenges, disease and poor sanitation and services. The specification presents the proposed innovation of the study to resolve the practical problem of providing refugees with a suitable shelter in a hot-dry climate. However, the evaluation phase of the solution is crucial in establishing why and how such a solution can address the problems faced by refugees in hot-dry climate camps, justifying the theoretical agreement in conducting scientific methods (March *et al.*, 1995). The next phase, the demonstrating phase, presents the opinions of professionals and experts in housing refugees in hot-dry climates by the list of specifications that the researcher created based on the research criteria.

Specifications need to be demonstrated in daily activities as contributing to real life and practices to see if some of the problems can be solved (Järvinen, 2007).The evaluation phase takes place by involving architects to illustrate proposed shelters depending on the list of specification to investigate the ability of the list to see if it is adequate to address the practical problem where the researcher is not involved in the production of the conceptual illustrations.

There are two sub-activities to evaluate artefacts. The first one is to choose an evaluation strategy which divides into two parts:

"Ex ante and ex post evaluation. Ex ante evaluation means that the *artefact* is evaluated without being used, while ex post evaluation requires the *artefact* to be employed. An ex ante evaluation often makes use of interviews, where experts express their views on an *artefact*" (Johannsson *et al*., 2012, p.90).

The advantage of the former evaluation is lower cost, while the drawback presents on the subjective judgment that depends on expert opinion.

3.15 Research Techniques

The research follows the techniques of the design science method. Techniques differ between design science phases and that depends on the purpose of each phase and the goal that the researcher wants to achieve. Johannsson *et al.*, (2012) points out that the researcher needs to determine which technique and tools are appropriate to produce knowledge needed for global practice and get the result discussed and evaluated, for this reason researchers use design science to determine appropriate tools and techniques applicable for each activity of design science to get sufficient knowledge and results.

The research techniques included interviews and questionnaires regarding the design science phases as shown in Table (3.4) as follows:

- Phase one aims to explicate the problem by conducting a literature review of previous studies to define and clarify the problem.
- Phase two aims to define the requirements of the problem, in this activity, the researcher conducted informal interviews, in-depth interviews and structured interviews. The informal interview was with local government in the Al Za'atari camp to explain the context of refugees besides allowing to formulate and design questions for the next step in phase two. In-depth interviews and structured interviews were conducted, where the former was with 29 refugees in their context to focus on their needs and requirements in the context and the researcher chose refugees for interviewing and questionnaires based on local government obligations, discussed in section (4.6.1.2). The result of interviews was continuous with the latter technique with 147 refugees explaining the connection between refugees' needs and settlement challenge variables. In the same phase the researcher lead in-depth interviews with local humanitarian organizations in the Al Za'atari camp, also the researcher conducted in depth interviews with local prefabricated manufacturing companies to explain the ability of shelter performance, challenges and barriers faced in this field regarding the refugees' situation, additionally the benefits and potential extent that these are influenced on accommodating refugees in camps in a hot-dry climate. Also, the researcher conducted in depth interviews with the responsible institutions that are located in

Jordan and they showed and raised points related to the situation of the Al Za'atari camp and settlement challenges. All steps in this phase led to formulating and defining the list of requirements of stakeholders to develop the list of specifications to provide adequate refugee shelters in a hot-dry climate.

- Phase three was about developing the list of specifications for refugee requirements by considering the output of the literature review and stakeholders (which are the local government, local prefabricated manufacturing companies and NGO in Jordan - mainly the UNHCR).
- Phase four aimed to demonstrate the requirements; in-depth interviews were conducted with 31 participants, including experts, professionals, architects, engineers, and researchers in housing refugees (see Appendix D). This provided the benefit to reformulate the specifications list regarding the iteration process of design science.
- Phase five was the evaluating phase where the researcher presented the specifications list to 7 architects that are not involved in housing refugees and allowed for illustration of the specifications list to validate the defined requirements.

Phases	Fieldwork / Direct Study Stages	Stakeholders	Data Collection Tools
Phase one: Explicate research problem	Reviewing and investigating literature		
Phase two: Outline requirements	First stage (4 visits to the Al-Za'atari Camp)	• Refugees • Local government	Unstructured interview
	Second stage (15 visits to the Al-Za'atari Camp)	• Refugees	➢ 24 in-depth interviews ➢ 146 completed questionnaires with refugees.
	Third stage (10 visits to the Al-Za'atari Camp) Manufacturing local companies	• International organizations • Local manufacturing experts	➢ 7 in-depth interviews with selected staff. ➢ 3 in-depth interviews with selected manufacturing specialists
Phase three: Develop specifications list	Generate specifications by result of reviewing literature and finding of the field study.		
Phase four: Demonstrate specifications	Fourth stage – online survey with experts	• Practitioners • Academics • Researchers • Planners	➢ 30 in-depth interviews.
Phase five: Evaluate specifications	Illustrate design proposals of shelters by local architects		

Table (3.4):Research interviews activities relating to design science phases

The contributors were selected by the researcher based on three conditions; the first was that they had to possess a wide knowledge of refugee situations concerning their needs and challenges regarding the environmental impact (in a hot-dry climate), social need and shelter implementation. The second condition that the phase requires to choose certain participants to obtain the aims of the phase, the last condition was all of the participants are part of accommodating refugees in camps whether they are the main stakeholders such as refugees or because of their experiences in this field, to improve and implement refugee shelters, such as researchers, architects and NGO.

3.16 Research Sample

Based on the research situation and limitations that the local government applied to the meetings, interviewing the refugees, distributing questionnaires and case study situation, this research used convenience sampling under non-probability sampling where the purpose of the sample is exploratory, the size of exploratory samples is ruled by considerations of obtaining the information not on the accuracy and to be sufficient in size to enable the researcher to be satisfied about the data collected (Denscombe, 2014). The expert interviews in this research took place by using a snowball sample and purposive sample due to the difficulties of finding members involved in housing refugees in the first place.

Saunders *et al.,* (2009) mentioned that it is problematic to prepare an initial list in snowball sampling. Although it is a simple process to find further members by asking for advising or identifying other contacts, the bias is huge when recent participants' advice from further members have the same interest and to find these contacts is another obstacle of snowball sampling. On the other hand, in some projects it is a dilemma to identify contacts if the researcher does not use snowball sampling that is the only possibility. In this regard, the researcher faced a lack of information about determining experts in this field so the snowballing method was the potential way to identify qualified participants. In summary, with refugees and experts, an accumulative sample size was used, and as the researcher conducted the design science method which allowed several strategies of collecting data and considered strategies of obtaining adequate information, the researcher stopped collecting data when information and stories were repeated by

refugees and stakeholders. Therefore, sufficient data were determined by the researcher in terms of discontinuing adding value and having the same answers presented.

3.16.1 Interview Process

The interview is a simple tool to collect qualitative data; it can give a wealth of information and knowledge to the researcher, yet the researcher must identify the participants in context (Stake, 2010). Marczyk, DeMatteo and Festinger (2005) argued that an interview is an inexpensive and efficient tool that can cover an endless number of participants without needing to formally test and at the same time can give an extent of data. Denscombe (2014) discussed that the researcher must be careful about selecting participants and if they understand the research project, also age, sex, education level and ethnic origin all affect the quality of information that interviewees deliver and their honesty about what they divulge.

Saunders *et al.,* (2009) showed that interviews are classified into three categories; unstructured interviews, semi-structured interviews and structured interviews. The structured interviews have standardized questions which are asked to all participants. Unstructured interviews are informally constructed throughout an interview and the researcher opens a conversation with participants to present their ideas and opinions. Accordingly, the semi-structured interview will be to explore events and from different views it gives flexibility to participants without missing structured questions by containing a variety of in-depth information. The researcher conducted semi-structured interviews and the results were gathered to formulate the structured interview for exploring and establishing the current and desired state respectively.

3.16.1.1 Interview Design

The researcher conducted semi-structured interviews in this study; Wisker (2008) acclaimed a design interview is the beginning of an interview process and to create an effective result, it should design questions and consider the following requirements:

1. Clear questions and wording;
2. Avoiding asking negative questions and using neutral questions;
3. Open-ended questions;
4. Asking questions only once.

The researcher constructed the questions for interviews considering previous design requirements; the nature of questions was based on the theoretical knowledge and literature review. After this in-depth interview questions were reviewed through pilot survey and the final questions were revisited, while structured interview questions were then formulated from data results of in-depth interviews with refugees and related stakeholders.

3.16.1.2 Online Interviews

The nature of the research in certain stages required interviews to be conducted virtually by phone or other communications technology such as Skype. Denscombe (2014) indicated several advantages of using online interviews in terms of time and cost, especially when the circumstances impose conducting the survey virtually, also reducing cost for unnecessary travel to meet interviewees, however, keeping questions simple and easy is another factor that might be a key issue in the choice of participant.

Regarding phase four of design science, which relates to demonstrating the artefact (the specifications list), the researcher conducted a number of interviews with experts, professionals, researchers and other organization members. Due to the geographical locations of experts, online surveys allowed the researcher to interview participants of any particular geographical area. Accordingly, Saunders *et al.,* (2009) mentioned that the researcher must elaborate on the introduction of the research aim and objectives and the findings that they wish to achieve at the end, guaranteeing to secure documents and protection of documents or recordings taken in advance before conducting the interview as part of compliance with the ethical approval requirements (see Appendix E). In short, conducting several meetings with experts as stakeholders was undertaken virtually, because they were involved in housing refugees in camps, however, they were from different geographical regions, and from different institutions, organizations, universities and some were independent. Conducting interviews in this way was a practical solution to solve such limitations but ethical requirements and technical difficulties were taken into consideration.

3.16.2 Questionnaire Process

The questionnaire is an effective tool to collect data which is equally suitable for qualitative and quantitative data. In this regard, Saunders *et al.,* (2009) stated that open ended questions are not required for a large population; however, a questionnaire is a tool for developing a representative image of a large population. Standard questions of questionnaires allow several advantages, such as speed, less money and being more reliable, because it encourages honesty due to the anonymousness, on the other hand, Cohen *et al.,* (2011) discussed the disadvantage that it is lower in return percentage compared with interviews, plus the difficulty of designing questionnaires can lead to people misunderstanding some of the questions.

According to Denscombe (2014), exploring standardized data in which there are connected variables of the context, such as regarding refugees' needs and settlement challenges, makes it applicable to use questionnaires and much easier to determine than by using interviews. In this regard, the researcher used the analyzed data from the in-depth interviews to design a questionnaire to obtain standardized data.

3.16.2.1 Questionnaire Design

The questionnaire tool for this research aimed to collect data under the design science method and was based on refugees in the sample to improve the possible knowledge of the related variables that influence the improvement of refugees' living standards, settlement challenges and shelter performance. Regarding the design of the questionnaire, several issues were considered as follows:

1. The formal agreement was asked from participants to sign if they agreed to complete the questionnaire list before presenting and starting the questionnaire.
2. The researcher gave the participants full instructions to guide how to answer and the questionnaire was written in Arabic as the official language in the Middle East region.
3. The participants had the right to withdraw from completing or even to refuse completion of the questionnaire if they wished.
4. Confidentially for participants of their responses in advance.

5. The participants who agreed to complete the consent form were given the researcher's contact details for further explanations if needed (see Appendix F).
6. The researcher used essential data that is related to the subject that depended mainly on qualitative questions.
7. Questionnaires were guided by the researcher from general and less sensitive questions to specific.
8. The researcher avoided embarrassing questions.
9. Questions were constructed objectively without any push for a desired response.

The questionnaires were conducted in phase two of design science for 200 participates and chosen based on the research situation as discussed in section (4.6.1.2.2) 147 participants had completed the questionnaire and were considered in this research.

3.17 Pilot Survey

A pilot survey is a test study which shows whether participants have any problems with answering the questions. Accordingly, it is possible to refine the questionnaires and so researchers are enabled to get an assessment of validity and reliability of the questions and data collection in the results (Saunders *et al.*, 2009). In this regard, Even (1984, cited in Omar, 2003) said that a pilot study supports the researcher to administer the test and find weakness points throughout the process. A pretesting or pilot survey purpose is to be sure that the questions are phrased, sequenced and structured in the right way to understand by the participants, then the result of the pilot survey is used to reconstruct the final questionnaires. Numerous points can be measured in pilot surveys as follows: testing ability of the questionnaire to do its job, measuring the time that the questionnaire will take to answer, measuring any weakness that could arise, improving the way of organizing the questions, and improving the clarity of questions that could be difficult to understand or respond to.

Furthermore, the pilot survey is needed for measuring the difficulty that the researcher would have found in the questionnaire and any further questions that are suggested and raised by the pilot testing. Saunders *et al.,* (2009) mentioned the validity and reliability of the questions must be taken into consideration in pilot testing besides analyzing the

preliminary data that has been collected. The preliminary analysis for pilot test data can be used to ensure that the data collected will enable the participants to answer the questions of the research.

This study focused on refugees' situations in camps and settlement challenges; it was estimated for completion by 200 refugees, although 147 were valid responses, and so the pilot was, in retrospect, actually distributed to 10 - 20% of the main sample in the form of 20 refugees from other camps (Al Baqa' camp and Al Wehdat camp which are Palestinian camps) and who have a similar situation and which included variations in the profile of the population that existed in the main survey.

In this regard, the analysis of pilot testing was done by using an excel spreadsheet because of the small sample, it showed that some questions were not completed, especially the ones that related to shelter performance due to the length of the questions besides some unclear words, additionally the pilot survey presented that there were some questions which had not been completed by the participants, and sub-questions were confusing the participants to understand where the result has shown an error in the total sample of sub-questions. In summary, the researcher considered revisiting and reviewing the questions based on these results of clarifying words related to specialized meanings, concentrating questions by grouping and transferring sub-questions to separate questions in order to limit question misunderstanding.

3.18 Reliability and Validity of Data Collection

Denscombe (2014) argued that the credibility of qualitative data in social studies is not easy like for quantitative data, to measure the social environment is quite difficult compared with measuring natural and physical science research, qualitative research is impossible to be verified as quantitative research since the social environment of qualitative research depends on time and people where both change. For this reason the research verification of reliability and validity is an essential all the time. According to Bryman (2012) the aim of reliability is that the research result could be repeatable and so reliability is more accessible in quantitative data due to the nature of data, while the

validity concerns the integrity and accuracy of the research conclusion which is more applicable in qualitative research. However, reliability is testing the research quality and shows understanding of the situation or it may cause confusion. For this reason, Golafshani (2003) explained opinions of interpretivist researchers about reality in qualitative research in terms of reliability and internal and external validity of data collection.

Internal validity is about measuring the accuracy of the conclusion relating to dependent and independent variables of the research where the external validity is to measure if the conclusion can be applicable beyond the specific research and extend to generalization. The purpose of validity is to demonstrate that the measurement measures what must be measured and it is possible to take many ways to achieve the data and because qualitative data is more about a subjectivism approach based on attitudes, beliefs and opinions, so validity is to be an approximate degree not an absolute degree of that (Cohen *et al.*, 2011). Regarding a constructivism stance, people have multiple realties in their mind and that changes over time, whether the surveyor wishes that or not, so it is essential to achieve the credibility and validity of multiple realities by using an appropriate method and tools of collecting and analysis of data (Golafshani, 2003). For this reason, the credibility and validity of the study is applied through the design science method as internal and external validity in which internal validity is presented by key factors of relating variables to specifications, while the external validity is shown by applying specifications in another context whether environmental or social. Wisker (2008) indicated that validity is central to measuring the comprehensive conceptual framework of the research by cohesion of a theoretical approach, methodology, method, techniques and finding answers to the research questions, the research here is about how to measure behavior and attitudes in social research and therefore inappropriate to set in charts such as documentation, thus some of these sensitive issues need to be captured through qualitative analysis.

Design science is an iteration method that allows for multiple project testing throughout its activities, explicating the problem, outlining the requirements, demonstrating, and evaluating the artefact. Vaishnavi *et al.,* (2007) revealed the solution needs to be

evaluated and validated regarding the research community, several ways are developed to achieve the validations, demonstrating, experiments, simulation, and others, however each approach has unique properties that might fit with specific research characteristics and its community. The research presents a new knowledge that formulates specifications for refugee shelters in a hot-dry climate; accordingly demonstration is a suitable validation pattern of such research characteristics based on providing a novel solution for an existing problem. Vaishnavi *et al.,* argued that demonstrating might show the solution as inappropriate or not, and in each case the iteration of testing will increase the confidence of the solution, additionally well designed testing construction is another factor to validate the constructed solution.

Regarding reliability and validity of the questionnaire, it must indicate the research stands on qualitative design data, however the research uses a mainly quantitative tool of data collection to analyze qualitative data. The research validated the stability of the quantitative tool of questionnaires through a randomized sample, context freedom, using check questions to see participants' responses and different target groups, besides measuring the consistency of participants' responses where the same responses must be given for the same questions. In addition, the research considers reliability through using the same questionnaire in other fields in the pilot survey process as discussed in section (3.17) which allows measurement of questionnaire data in different fields and compares the result by using SPSS software to analyze the data (Denscombe, 2014).

The research validates that the specifications are developed based on explicating the problem and outlining the requirements in phase one and two respectively, in this regard the research formulated validation questions in phase four for a group of stakeholders that are involved in housing refugees in camps; they are experts, researchers, and professionals. After one to one interviews with those experts, the complications and complexity were clear and the discussion opened further areas to look at and consider in the list of specifications.

According to Wieringa (2013) the validation questions asked should be contextual, in this case about the feasibility of the specifications list in its context, such as will it work, and

why might it work or not, and measuring the satisfaction of stakeholders about the specifications list which is presented on a prioritization of stakeholders.

Regarding the evaluation phase, the specifications list was not represented by an actual shelter, so the question here was how to evaluate something that does not exist. The validation of research in design science could be simulated in practice, so the research constructed validation by choosing architects that were not involved in housing refugees and asked them to illustrate refugee shelters depending on the specifications list as references to measure the result validation. However, the limitation in this validation is that it asked to illustrate a shelter located in a complex environment, yet revisiting the list of specifications makes it applicable as far as a validation conclusion.

3.19 Data Analysis

Analysing data is not limited to a particular number of analysis tools, Saunders *et al.*, (2009) mentioned each researcher has their own analysis that requires its methodology and method, additionally more than one analysis tool such as transcripts and taking notes throughout the interview is applicable (Collis *et al.*, 2011). Analysis of data aims to find the comprehensive information between the research factors whether it was qualitative or quantitative research.

Cohen *et al.*, (2011) mentioned the researcher needs to design interview questions and questionnaires carefully as they need to choose an appropriate strategy and layout in order for entry to the computer and assess the output, the researcher of a qualitative study must be aware of different aspects and techniques for analysis of data, such as coding and field notes, mapping, pattern of responses, people constructs and behaviour accounts; so data analysis in qualitative research is a combination process of strategy, layout of questions and collecting data in field work, analysis of the data and finally the outcome, the processing of data analysis is quite a complex process based on being back and forth between these factors. Catherine (2002) explained that it is possible to develop your own way to analyse data if that supports establishment of the research and there is no rigid and strict vehicle for analysis strategies, as in this regard.

The study considers transcripts of interviews with participants, however the task of transcripts is not considered separately, a time-consuming interview can run as the research needs, for as long as necessary, and it is not just what the participants say, it is how they act, tone of voice and attitude which are all taken into consideration (Saunders *et al.,* 2009). Accordingly, Bryman (2012) explained that qualitative data is a large unstructured data unlike quantitative data, organizing and cutting of data by clear approaches or procedure of analysing is required to achieve the developed findings. Creswell, (2013) described three main steps which are; organizing data for analysis, reducing it into themes by codes and sub-codes, and finally representing data into tables and charts for discussion. On the other hand, many researchers assumed thematic analysis as an activity that could be used in any approach, while others conduct it as part of coding data in qualitative analysis. Regarding questionnaire tools, researchers often use quantitative tools to analyse qualitative data that measures independent variables through four levels of agreement; strongly agree, agree, disagree, strongly disagree, also determining choices are considered to control catching dependents' variables besides some questions that allow participants to put their opinion for more clarification.

Regarding analysis of the questionnaire, the researcher used SPSS to analyse and explain dependent and independent variables by finding cross tabulation factors and showing the ratio of connection between certain questions that the researcher selected due to the relation directly or indirectly to the research questions. As the findings of the interviews with refugees and stakeholders showed, the importance of further explaining is the first stage of survey analysis. The researcher measured the level of connections between these questions based on cross tabulation formula which must be equal or less than 0.005 (Bryman, 2012). In this regard, the researcher chose those questions that showed as dependent variables and listed with refugees responses to present the highest ratio as shown in (Appendix G). In this regard, the researcher found some dependent variables between daily activities and social and cultural aspects which were considered in the list of specifications as a result, the connection between questions measured through a ratio of -value which typically means probability of connecting between selected questions.

Concerning the steps and approaches described above, these were taken when the researcher analysed the raw data for this study, it was appropriate in order to answer the research questions to find the right explanations. In this regard, the researcher divided the data analysis based on answering the research questions where each question had been answered by a certain group of stakeholders and constructed to answer the second, third and so on, by other groups of stakeholders as the phase required. Hence, the interpreting of data and discovering related variables by thematic framework are taken into account. Analysing the interview was based on developing nodes and discussion themes, which were the basis of the content of the interview. After this, the second stage was considered in the questionnaire analysis and finding relations and connections with requirements to represent a deeper understanding of the refugees' situation.

In terms of showing refugee practices and understanding peoples' stories in camps, the researcher conducted an ethnography strategy to clarify stakeholders' points of view of it being a temporary camp and informal city; the purpose of this was to guide the results methodically to a conceptual level and examine the related features of the participants' contributions. The research concerns the relationship between the data analysis phase and avoiding liner sequences to reduce bias in the conclusion, also time was a big challenge to collect all of the views of stakeholders and analyse the data, which took considerable time.

Regarding the importance of non-respondent error and increasing the rate of responses, the researcher used some techniques to reduce the rate of non-response. Dillman, 2011; Denscombe, 2014) suggested some techniques to reduce non-responses, such as using an accurate population, reminders and re-contacting people, prior notifications as a letter or emails of invitation to interview, topic capture of the contacts, showing their response made a difference in the research findings, keeping things simple, prior information of the meeting in advance, and so on. Also, the researcher considered that some responses did not meet the research criteria and requirements (Saunders *at el.,* 2009), therefore it was removed from the data analysis. Based on the previous explanation to reduce responses, bias and ineligible responses of those who did not complete the questionnaire properly or did not meet research requirements were also removed.

3.20 Chapter Summary

This chapter has discussed the research methodology and research philosophy, which is essential to track the research properly and get valuable research outcomes. Achieving the research aim and objectives and answering the research questions act as a guide to choose and justify the research approach, strategy, and methods of data collection, and analysis of data were fully discussed in this chapter with sources of evidence. This chapter has discussed the adoption of the design science method throughout the research process and design phases. It is a unique process, a design cycle which combines theoretical and artificial techniques that lead to a contribution towards knowledge of a practical problem. This chapter has viewed the decisions and justifications behind choosing the appropriate research design strategy to achieve the aim of the research; an inductive approach (qualitative) was taken due to the interpretative human activities in a social context (refugee camps) besides conducting an ethnography strategy to make a contribution to theory building and knowledge in terms of presenting social and cultural aspects of refugee practices. The next chapter shows how the primary data from the field work were analyzed through the design science method.

Chapter Four

Result Review and Analysis

4.1 Introduction

The previous chapter discussed the methodology of the research and design science method in terms of adoption of the research process, to achieve the research objectives and answering the research questions.

This chapter shows the findings and how this primary data from the field work were analyzed. Phases one and two are summarized refugees' responses, local companies and humanitarian organizations, located in Jordan, that formulated the list of requirements by conducting in-depth interviews and distributing questionnaires, which allows to discover independent and dependent variables of peoples' responses. The third phase of design science, which includes developing the specifications list, is based on the data analysis of the requirements list and supported by reviewed literature. Phase four of design science demonstrates the specifications list by in depth interviews with experts and international organizations. The research also uses an ethnography strategy to present peoples' practices in daily activities by conducting storytelling which was appropriate to add social value to meet refugees' needs and improve their quality of living standards.

The fifth phase evaluates the list of specifications by illustrating several design proposals for refugee shelters by local architects who are not involved in housing refugees. Regarding the field work findings, it presents the outcome of stakeholders' responses and their prioritizations and the last section shows the list of specifications as a result of the field work findings. The following Figure (4.1) shows the research stages of survey analysis within the design science phases.

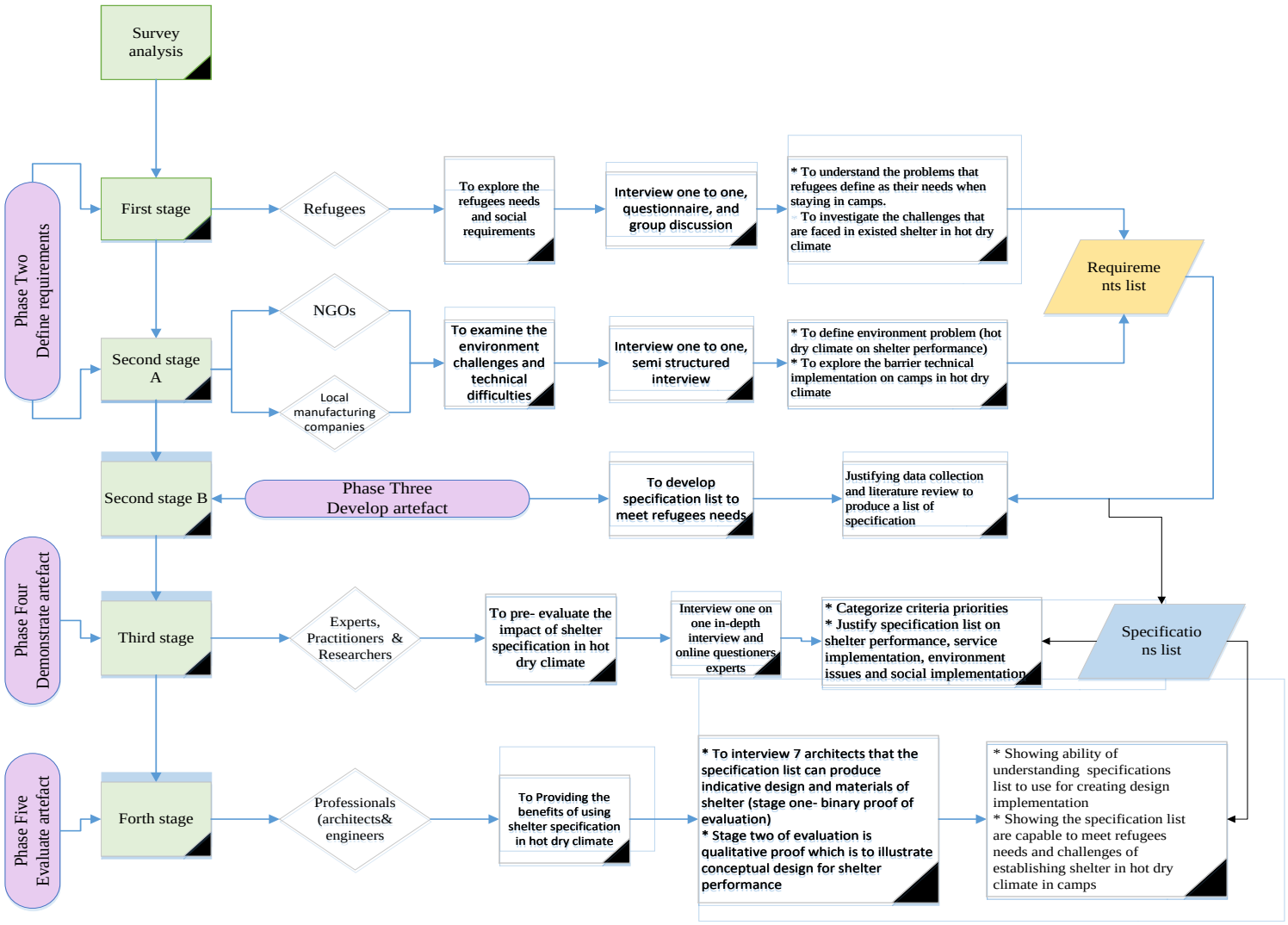


Figure 4.1: Research stages of the survey analysis based on design science method

This chapter covers the result analysis of four stages of mixed data collected using multiple data collection techniques, namely; one to one in-depth interviews, group discussions, and structured questionnaires that were distributed to the research stakeholders at different research stages. Saunders *et al.,* (2009) argues that there is no fixed data technique appropriate for each situation. Ultimately, the research is influenced by factors that formulate the audience for the findings and should encourage the researcher to commit to different techniques.

Cohen *et al.,* (2011) argue that social research is the 'container' for using interview techniques which construct knowledge and present different views between two or more people and highlights the interaction or conflicts of human interest and knowledge. In this regard the research investigates the social implementation of refugees in a hot-dry climate in camps, exploring in more detail their way of life in such situations and the interview techniques provides the collection of this data. Cohen *et al.,* explained that interviews enable multi-level communications between the heard, spoken, verbal and non-verbal and enables the interviewee to express complex issues of situations that may not appear directly within the question.

The researcher also conducted questionnaire parallels which answer the same sort of questions. Saunders *et al.,* (2009) mentioned that a questionnaire is suitable for explanatory research. In this regard, the research uses questionnaire techniques to measure variables of field work and explore the relationship between them. It is good practice to find the relationships between variables that appear from in-depth interviews. The variables in the research consider social and cultural implementation, settlement implementation, shelter performance and environment context conditions, additionally the questionnaires highlighted the variables by users' respondents precisely.

The researcher conducted unstructured interviews in the early stages, which is necessary to adopt a constructivism ontology of users in their environment, attempting to understand social meaning and beliefs and knowledge gathering. It was necessary to design a structured interview or questionnaire as part of the exploratory theme.

The research method is based on design science as described in the previous sections which includes five phases as follows:

4.2 Phase One: Explicate the Problem

Phase one is based on reviewing literature and investigating previous studies that relate to housing refugees in camps, which are presented in Chapter (2), after which the findings of literature were presented with the research criteria, whilst the other four phases will be discussed in this chapter, the following section shows the methodology of the literature review.

4.2.1 The Methodology of the Literature Review

The literature review is carried out to analyze all available resources, information and data related to the settlement of refugees of natural and man-made disasters. The review investigates what has been provided to accommodate refugees in this situation as well as looking at previous studies that have addressed this issue. Refugees' accommodation needs are considered relating to hot-dry climate conditions.

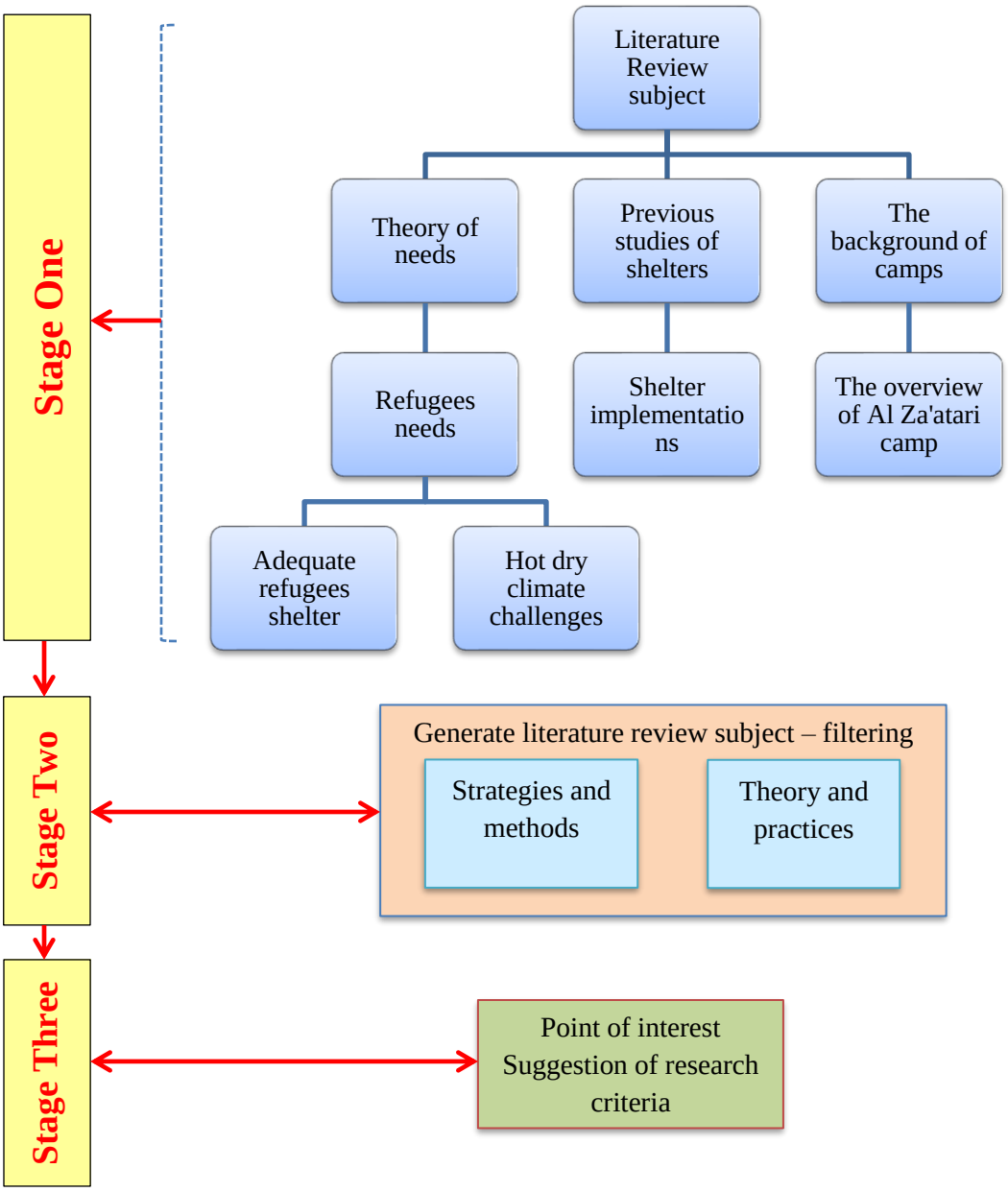


Figure 4.2: Literature review methodology

In the first stage, the literature review was carried out by using keywords, as shown in Figure (4.2) that related to the research subject, namely refugees' needs and climate conditions for all climate types. This was then narrowed to 'hot-dry climates' and previous shelter studies around the world were considered for natural and man-made disasters. All data was collected using the University of Salford's Solar system (library academic resources). Also, World Bank documents, humanitarian institutions, NGO such

as UNHCR, Norwegian Refugee Council (NCR), UN, and the United Nations Children's Fund (UNSEF) were investigated to reinforce knowledge about the situation of refugees in their locations around the globe and in affected areas.

The broad keywords were established in the first stage to enable an understanding of all relevant data related to the research subject. The broad keywords were followed and pointed to specific searches that focused on three main areas; theory of needs and shelter implementation are discussed under refugees needs, comfort and climate conditions and shelter practices under climate difficulties, while materials implementation under design practices and urban implementation under previous studies of shelters.

In the second stage, the literature review included the analysis of relevant articles, academic journals, books, conference proceedings and organizational reports. The review provides the opportunity to discover points of interest in the research subject by investigating other research methods, the design of the research strategy and a bibliography to augment understanding (Bryman, 2012). Endnote was used to export references to add to the research bibliography and to keep the review focused. Mendeley was used to organize and tag research documents.

The third stage examined the relationship between the direction of the research and the initial research criteria that formulated the final specifications criteria resulting from field work and observation. During this stage the research criteria is summarized based on the initial literature review and exploratory field work. This is then formulated with a number of specifications established in the previous stages. The aim of the formulated research criteria is to develop guides that establish the process of accommodating refugees. The literature review chapter focuses on three areas of theoretical contribution:

1. Theories of need covered by driving the principles of human needs generally and refugees' specifically.
2. Climate conditions generally and specifically in hot-dry climates.
3. The principles behind the provision of shelters in case studies around the world.

As the complexity of extracting specifications is considered as a guide to accommodating refuges in hot-dry climates, the literature review based on the three grounds stated above

helped to formulate the research criteria that worked as a framework for the specifications which is then combined between the literature review and field work outcomes.

4.3 What are the Criteria?

Criteria are principles that are needed to define certain requirements accurately, and are measurable or observable (Turner, 1997). This research was based on the design science methodology, as discussed in Chapter (3), whose core aim is producing and testing an artefact in the form of model, method, or construct. This research developed the specifications of a refugee shelter that reflects the needs of users in hot-dry climates. First, criteria were formulated from literature on the basis of theories of human needs, refugee studies and involved organization reports. Then, specifications were related to the following criteria: safety and security, social context, comfort, stability, flexibility and modularity, being demountable, durability and having constant energy. These specification criteria will now be discussed.

4.4 Criteria One: Safety and Security

Refugees flee from their original home in order to obtain safety and security in the neighboring countries by crossing borders. Such refugees would be attached to a place that is similar to their social and cultural circumstances, which means they would look to neighboring countries that have similar beliefs (Weisenfeld, 2011).

Martin (1990, cited in Clinton-Davis & Fassil, 1992) stated that when refugees decide to go, they would go to places which protect them from new circumstances, they do not move in one route, they follow unplanned movements to achieve their needs which include safety and security (Clarin, 2011).

Refugee movement follows several spontaneous steps for surviving from crisis, rebel groups, famine, or disasters, however, it happens in different stages until the refugee finds safety and security. When refugees stay inside their home country it is called ‘internal displacement’ and this happens because they are hoping to go back home shortly afterwards, however, if the situation does not enable them safety then refugees encounter

the second challenge of moving to a second country, which is often on or near the border until they settle in a second or third country of asylum, generally in each movement the motivation for refugees to change their location is safety and security (Clinton- Davis *et al.,* 1992). In addition, in some cases and situations refugees are persuaded to move from their home to a third country directly if safety and security do not exist in nearby countries.

Beyond survival, shelter is necessary to provide security, personal safety and protection from physical aspects such as undesirable climate conditions and to promote resistance to ill health and disease or strangers or physiological aspects such as establishing social privacy. It is also important for human dignity, to sustain family and community life and to enable affected populations to recover from the impact of disaster (Sphere Project, 2011). However, sometimes safety in camps is lacking due to the circumstances of the temporary situation which may lead to abuse, instability and insecurity. Thus, safety and security are related to physiological and psychological needs.

4.5 Criteria Two: Human Comfort

Comfort is about a person's well-being and is influenced by external factors which are combined between physical and physiological criteria. Comfort levels cannot be quantified exactly but it depends on the individual's empirical experience in their surroundings, as shown in Figure (4.3).

Auliciems and Szokolay (2007, cited in International Organization for Migration [IOM], 2012) stated that comfort is difficult to specify as optimal comfort, instead it describes comfort zones due to the variation of comfort level between people based on several variables. Factors affecting personal thermal comfort, for example, air temperature, humidity and others besides and other causative factors, such as clothing, age, and health situation. Comfort is affected by other operations which the human body does, such as exchanging heat, heat radiation, evaporation and condensation that allows heat release. These environmental factors refer to the heat balance such as air movement, vapor pressure; also individual factors influence comfort levels by metabolism. Furthermore, the rate of metabolic rate is changeable in each situation and obligatory for daily

activities of well-being; sleeping, light work, in a seated position, during hard work and other situations. With regards to their thermal comfort, this is related to levels of climate satisfaction which differs between people based on several factors in different categories, as shown in (Appendix H).

4.5.1 Comfort Factors

Auliciems *et al.,* (2007) stated that three factors affect the rate of comfort, as shown in Figure (4.3), it is the relation between the occupants' activities, climate factors and room situation.

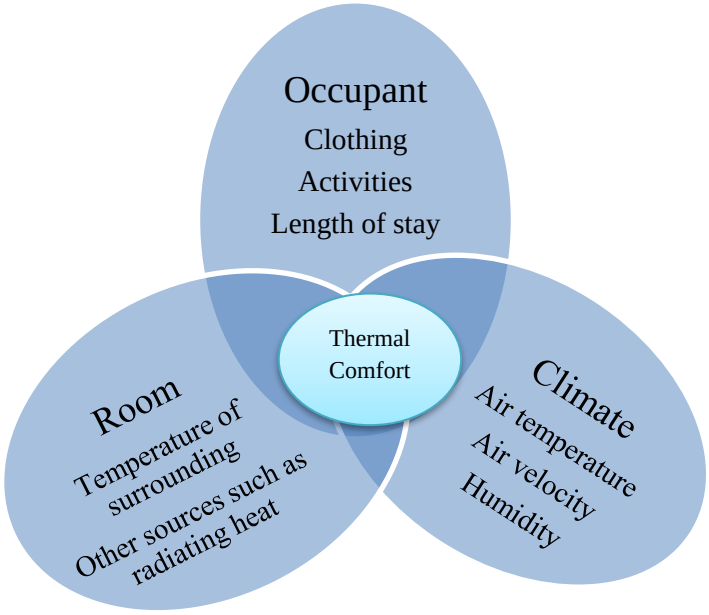


Figure (4.3): Comfort criteria (Source: Schittich, 2003, p.47)

Comfort is measured by many factors and elements as this section of the study has discussed, however the parameters of discomfort are gauged when symptoms of an unhealthy situation appear, ultimately it leads to the spread of disease and health issues. Crawford *et al.,* (2005) indicates that death could happen in extreme weather conditions such as very hot or very cold conditions that could be a cause of major illness or even death (see Appendix I).

According to Hegger, Reichel, Hartwig and Keller (2012) stated uncomfortable conditions, which include risks to human health; temperature (overheating and cooling), humidity (too dry and humid, dust, radiation, pathogens such as paint and equipment inside a dwelling, absence of daylight, and room dimensions, psychological effects).

The spread of insects and rodents as vector-borne illnesses is another cause of discomfort that refers to a wide range of dangerous diseases. Additionally, the climate condition of an area is another issue, either cold or hot, to raise drawbacks of health issues. Moreover, it is not just diseases that cause health problems, there are other factors: research has discussed that sandstorms, heat and humidity, dust, and cold air have an effect on human health.

4.5.2 Climate Comfort and Shelters

Climate elements have a bearing on shelter conditions through temperature, air humidity, solar radiation, and wind speed. The location of shelters and all climate elements are influenced by energy efficiency of the room inside the shelter. Most recent shelter provisions have faced conflict between climate conditions in summer and winter. They rarely achieve comfortable thermal levels and this is what the NGO and other international institutions have acknowledged, nevertheless some groups of local people in different regions share the same design criteria and as a result are provided with a good level of comfort by simple ways of construction and use of local sources of materials (Manfield, 2000).

Traditional experiences of existing shelters were considered for saving heating in winter and producing cooling in summer provided by using traditional materials with the absence of mechanical means to provide a comfort zone. Nepal is an example of a hot-arid climate that used compact dwellings and rectangular design shapes to reduce heat loss and prevent strong wind in the cold winter (Bodach, Lang & Hamhaber, 2014).

Also, resources are a vital factor in providing a comfort zone where this aspect determines a main criterion of distributing shelter solutions in relating climatic regions following altitude of location and weather, natural resources such as water, energy and power supply to produce electricity, also environmental diseases.

4.6 Criteria Three: Social Context

The social context combines several factors; it is what people bring to a place to establish their social and cultural characteristics. Researchers connect between social aspects and a place, by definition, place attachment or spirit of place, because they are sharing their daily activities, cognitive experiences, emotional feelings and beliefs in a certain piece of land. Gupta and Ferguson (1997) indicate that place is a social and cultural space that is bounded by social worlds. Also Brun (2001) mentions that place must be understood from the point of view of a person's situation. Place is a cultural construction and about embodied practices and activities that shape the identity and belonging. In addition, spatial space may be understood as a fundamental dimension of all social processes; social practices are situated in a space by certain time and all inherently involve a spatial dimension. The relationship between people and place leads to formulate identity, when people are uprooted that means they lose their culture and become powerless (Zavei *et al.,* 2012). Thus, when mobility happens, identity will be affected because the lack of communication between people and a host community especially if the host community is not as similar as the original home in terms of climate conditions, and social and cultural norms. Most camps have drawbacks in terms of the identity of refugees, Although, humanitarian organizations have tried to resolve the obstacles of identity in many camps by offering social facilities such as sports centers, women's centers, training centers, and clinics (Brun, 2001).

Refugees are by their nature "out of place", they live in a temporary situation in camps, and the only ideal solution would be to go back to their original home, yet if they are to remain in camps, any other solution would mitigate the drawbacks of this temporary situation.

Refugees have lost everything - their homes, indigenous location, their daily lives; for all these factors it is difficult to adapt to a new location, even if they are not staying for a long duration as they are supposed to be as refugees in camps. However, studies showed and emphasized the belief that a sense of belonging to their original home could never be replaced by a sense of belonging to another country regardless of the length of time

(Lambo 2012), thus refugees would not belong to a new place if the meaning of a safety route does not exist where this safety is sometimes lacking in camps and temporary situations which can be places of violence and insecurity.

The layout of shelters in camps could make a difference to the feeling of belonging to this place by memories; refugees reconstructed and shaped the camps in the image of the past, in addition, they restore their memories by naming streets and schools and organize their dwelling from inside and outside as per the original home, transforming refugee camps from their past to the present in any way is clear in many occasions (Shabaneh, 2010). The meaning of identity of refugees is taken into consideration when they move to a new place and whether or not the implications of stay duration would be affected by design guide and organization of shelters in camps. In summary, social context criteria should be considered in research by integrating physical elements and the environment to enable normal life in a new environment.

4.7 Criteria Four: Stability

This term investigates the route that refugees follow when they decide to go to a certain place rather than others. When people observe stability, it is very common to look out for familiar rather than unfamiliar things (Maslow, 1943).

As Brown (2003) stated, stability is a significant need for all humans. Appropriate economic conditions and religious freedom are the main conduits that lead to political stability. However, in many regions around the world, there are several obstacles to meet stability. Religion, poverty and deteriorating economic conditions appear as a result of political instability.

Stability combines physical stability, social stability, political stability, financial stability and environmental stability although governments and humanitarian agencies provide kits of basic needs, refugees' behaviors often present as their refusing to accept a current situation. People need to be stable physically by providing adequate places to live and continue their life normally, also they desire to be financially stable and do not want to wait for aid from humanitarian agencies, such as foods or clothes, Manfield *et al.,* (2004)

indicates structural requirements is also a factor of stability regarding dwelling types if it is a tent, emergency shelter or transitional shelter.

Stability is a reflection of obtaining needs, refugees flee from insecure situations; in the beginning they consider whether a place has the political stability to save their life, however over time this feeling of stability may not be constant if they cannot establish their satisfaction of financial independence and physical and social stability, thus all of these parts of stability must be taken into consideration when the humanitarian agencies provide a dwelling for refugees.

4.8 Criteria Five: Durability

Durability is defined as the ability and capability of design components to meet the target of a material's life span towards environmental effects and to fulfill its function (De Freitas & Delgado, 2013). It is a capability of a number of factors, which are; design life, maintenance, and repair.

Durability cannot be separated from flexibility; it defines levels of materials and structure strength, external and internal factors such as weather conditions and building operation and maintenance. Durability addresses the long term use of shelters as maintaining a safe and secure shelter from future impact (Bradford, 2004).

Durability is required for a long life span of materials, however, it must not deliver conflict between being permanent and temporary. In each situation a building must meet requirements that exist and should be considered as a normal building. Many factors influence building durability and must be taken into consideration which are; temperature, solar radiation, humidity, wind, dust and others. From different perspectives the robustness of materials is determined by material components and standards which are chemical and physical characteristics, such as the level of freezing, expansion, fatigue or contraction. Scavino (2013) indicates durability is a level of workability in terms of maintenance which is required in refugees' case due to the type of emergency solutions. This leads to the investigation of local materials as the best solution for fluctuating climates.

In short, durability is a needed criterion to provide adequate shelters, as are other requirements in harsh climate conditions, such as being demountable and flexible, thus the research will discuss it by requiring further specifications that cover the shelter skin and how it could be modified to meet the level of material strength, mechanical ventilation and material robustness that are strong enough in harsh weather conditions, such as a hot-dry climate.

4.9 Criteria Six: Being Demountable

Being demountable refers to the ability to take apart a structure and build it again within a period of time. As the Oxford dictionary defines "dismantle and reassemble". These types of structures are able to be dismantled and are often required at short notice based on the timescales of a local authority and contractors. A demountable structure is a temporary structure based on a type of material, structure, cost and time (Institution of Structural Engineers [IStructE], 2007). Demountable structures should be able to withstand high winds and large crowds; also the materials used must be reusable, lightweight, collapsible and within standard regulations (Ashmore *et al.*, 2003).

A demountable structure is often designed to be dismantled manually many times in different situations. Whilst a permanent structure provides reactions to vertical and horizontal loads by permanent foundations, depending on building requirements and the ability of local community of maintenance (Corsellis *et al.*, 2005). On the other hand, the pad bases on a demountable temporary structure will provide resistance to loads for a limited time depending on the purpose of the building itself. It is possible to add changes to the productivity of a temporary structure to transform it to being a demountable one based on the understanding of the meaning of dismantling and reassembling.

Also, a demountable structure includes guides which include using dry materials, modular dimensioning, adjustability of construction parts, integration and independence of insulation, weight bearing structures and interior finishing, 'layout freedom' for the building story, local value accidence for layout and surface, light structures and free wall shapes with consideration to horizontal and vertical pipes (Van Gassel, 2003). These structural concepts lead to them being the natural response in emergency situations such as war or group immigration, however, the concept here is to avoid modularity as a

solution (Jaillon & Poon, 2010). Accordingly, a ‘dismantle’ concept is required to reuse different elements for another location and purpose, although the productivity of the solution is attractive, many researchers believe that Industrial, Flexible and Demountable (IFD) has little interest from the market due to the shortage of construction practices (Timmeren, Dorst & Dobbelsteen, 2009).

In this regard, durability, integrity, the strength of materials and contracture components would be considered in a demountable structure. A demountable structure would also be a solution to the obstacle of site construction in a high density site. This is a significant issue, especially in dense urban settlements such as refugee camps when numbers of refugees flow into the camp constantly.

4.10 Criteria Seven: Flexibility and Modularity

Flexibility is used in different fields of engineering; one of these fields is the design of buildings that could be adapted for change immediately. It also refers to the ability of a design construction system that can respond to unexpected situations considering less time and cost. The need for flexibility is to reduce wasted time and materials by changing used spaces and increasing building longevity. Flexibility, rapidity, simplicity and security are needed in camps. and refer to circumstances that appear throughout the operation, such as adding elements to a shelter because of expanded families or repairing shelters.

Corsellis *et al.*, (2005) stated, that the second generation of tents that are provided have an improved modularity, flexibility, and reparability by using synthetic materials such as nylon, plastic and canvas. A closed structure is a rigid structure that has a lack of flexibility and modularity that presents the ability to add further elements in different stages as required and are needed in order to meet the requirements of providing security through adding design elements to increase safety or size or to satisfy any other social and cultural impact.

Bradford (2004) states that there are various aspects to determine the shape or geometry of shelters in term of flexibility and modularity, it must consider structural performance in term of capability against force winds or any other loads, and anchorage performance

is applicable for multiple usages proposed for the shelter. Construction simplicity is required in the shelter by considering local skills and sources. Geometric adaptability is also applied to flexibility and modularity which the shelter must fit by allow users to add or subtract shelter units to meet specific needs.

UNHCR (2014a) states modularity presents the ability to add further elements in different stages as required according to what refugees need at the time, in order to meet their motivation of providing security through adding structural elements to enhance safety or settle extended families. Modular solutions are a consolidated solution; which means including design and technology where this solution is easy to build after which it can be dismantled and adapted to several environmental and social contexts; there are many kinds of structures in transition exhibitions and military situations.

In short, flexibility and modularity are two factors considered by international organizations for providing refugee shelters. Such research will cover this area as one of its criteria which delivers a number of specifications that investigate types of required materials, obligatory dimensional and technical construction as needed.

4.11 Criteria Eight: Constant Independent Energy

Energy is the capacity of a physical system to do work or produce a change. Young and Center (2001) defines energy as coming from natural resources of the environment such as sunlight, wind movement, rain and wave motion. Geothermal heat and renewable energy can replace conventional fuel such as oil in various areas which generate electricity, in the main for hot water, but also for any other modern human activities. It provides for direct basic human needs for daily activities in modern life such as lighting, hot water sterilization, heating, communication, medical and education (Fuso Nerini *et al.*, 2015). Renewable energy uses biomass, wind and wave power instead of the old ways as the process for fossil fuels began to rise in the mid-1970s (Fuchs *et al.*, 2012). Solar energy comes from renewable energy which is an important source of energy on the earth and could provide up to 99.9% of the total energy required for us, as shown in Figure (4.4).

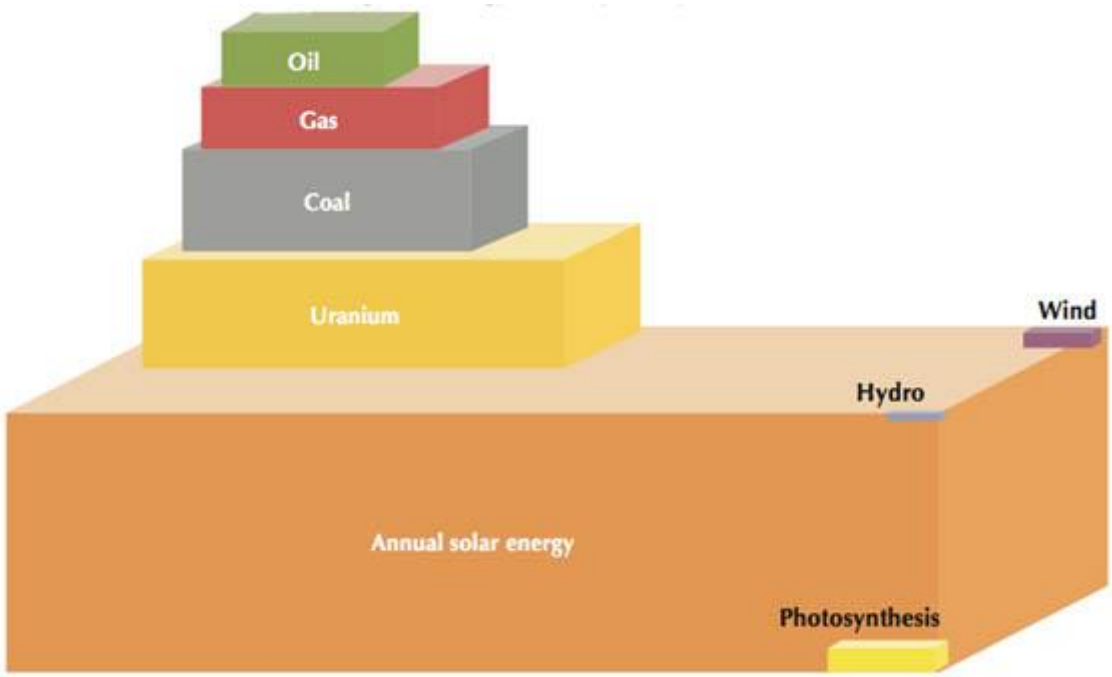


Figure 4.4: Solar energy comparing to other source of energy (Source: www.google.jo)

The sun is an obvious and vital energy source compared with other energy sources such as petroleum, natural gases, coal, and uranium. Energy can be generated from various forms including wind, heat, waves, rivers, biomass and others.

4.11.1 Sources of Renewable Energy

Sun and wind are the main climate elements that produce energy as renewable energy in the hot-dry climate zone which is the research zone. The hot-dry climate has a high amount of concentrated sunlight in daylight hours, however, it is efficient to store energy either as heat or electricity. The sun, wind and waves could produce energy 15,000 times more than that we are using from fossil fuel (Fuchs *et al.*, 2012).

Hot-dry climates have unique elements such as high radiation averages, and wind power. It is possible to rearrange such elements to reduce energy by considering building direction and building skin, by orienting a building for a façade to save sun protection and gaining sunlight to produce heat if thermal storage exists, which is another solution for an efficient building concept.

4.11.2 Challenges of renewable energy in camps

The literature review showed a lack of focus on the impact of conventionally generated energy in refugee camps from the standpoint of health and basic needs. Increasing refugee numbers and their needs for energy have led to inappropriate energy production such as conventional burning of wood, agricultural waste, and fossil fuel for heating, which are not an effective solution for obtaining the required energy (Franceschi, Rothkop & Miller, 2014). It is necessary to find a suitable solution to face energy demands especially in communities that have a sensitive situation like a refugee camp and costs the host countries millions of dollars per year.

A UNHCR report in 2012 showed that many camps around the world are without electricity or have trouble in obtaining electricity. Refugees use candles to obtain lighting although there is a risk of fire when using such sources. The NCR showed examples of solar lamps that were used in Somalia and Kenya funded by IKEA. In 2012, UNHCR lead the Koung Jor Shan refugee camp in Thailand to become the world's first solar-powered refugee camp.

Providing energy to camps must be an acceptable solution for local authorities due to the refugees' residency in host countries. Many countries refuse to agree to permanent structures of producing energy and so a mini-grid of a solar system could be a solution to produce energy in these camps. Fuso Nerini *et al.*, (2015) indicates renewable energy has many challenges as a source of providing energy in camps including cost, poor security, and recovery of cost in the long term, and black markets. Alternative household energy could ease such challenges (see Appendix J).

Constant renewable energy needs to supply energy on the ground; the case of supplying energy by conventional means has problematic issues such as the black market or unofficial energy production. Many essential factors, including sourcing availability, affordability and ease of access, culture, and social activities must be considered. Where there is a good supply of energy it is possible to not rely on important fossil fuels which can help the world achieve a constant supply of independent energy. In this study the hot-dry climate is a potential resource option to establish renewable energy sources by using a high concentration of solar energy and wind power.

The next phase will discuss the findings of the literature review in phase one and establishing refugees' requirements where local government and humanitarian organizations are responsible in the camp to outline the list of specifications.

4.6 Phase Two: Define Requirements and Outline Artefact

Phase two is about defining requirements and outlining the artefacts by the design science method, as shown in Figure (4.5); the researcher interviewed local government, refugees, and NGO in Jordan. Interviews were distributed between two stages. Stage one included local government and refugees who were housed in the camp in Jordan and was designed to explain their situation and difficulties. The second stage was with NGO located in the Al Za'atari camp and headquarters mainly with UNHCR as it is the main institution responsible for refugees.

Figure 4.5: Define requirements and outline artefact

The refugees were asked descriptive questions, to discuss functional requirements that would address problems and requirements from a refugees' viewpoint and assess how environmental factors and shelter performance could be accomplished by the list of specifications. With regard to the limitations of this stage of the research, it became apparent that because of the diversity of the refugees in terms of country (or even village) of origin, their climatic expectations, social needs, and cultural norms varied, leading to various opinions, meanings and beliefs expressed in the research.

4.6.1 First Stage Result

In the early stage of collecting data the researcher used unstructured interviews with local government in order to clarify the general situation of refugees in the camp and to understand the future situation from a local government perspective. An unstructured interview is one of these techniques and aims to allow people to give their view about the

situation (Cohen *et al.*, 2011), the unstructured interview is useful if the researcher is not sure about the situation, thus the researcher started with unstructured interviews to understand and let the respondent tell a story.

Interviewing refugees to tell their stories through in-depth interviews is the next step of explication of the problem. Wisker (2008) stated that understanding participant's opinions, feelings and experiences is necessary to develop a grasp of the situation and linking between the research design process. It must involve their environment and ask them about their surroundings to outline the requirements. Carrying out interpretivistic inductive research is a form for exploring users' feelings, privilege, sensitivities and insight into issues (Cohen *et al.*, 2011). Interviews from a small numbers of participants can lead to subjectivity and bias, but if a researcher conducts the interview this bias might have gone unnoticed, however preparation is crucial to a successful result and depends on choosing the right wording. It is a conversation between interviewer and participant where the interviewee experience can be collected and the data required can be extracted (Bell, 2010). Preparing interviews needs to be more than just fishing for certain basic information and is more complex than finding a simple answer. Patience, using experience, consideration of research objectives and questions are crucial elements to obtaining a worthwhile outcome.

A questionnaire is effective in explanation of certain points missed by the interview. The researcher organized delivery and collection of questionnaires filled in by the participants as there are security issues inside the camps. These questions had simple wording and direct meaning to avoid misleading the participant.

4.6.1.1 Local Government Informal Conversation Interview

The initial stage was meeting two police officers that work in the Al Za'atari camp and their titles were General Manager of the police station in the Al Za'atari Camp, and public relations officer. Clarifying the general situation of refugees under local government was a vital point in the research questions. Local regulations for conducting studies in the Al Za'atari camp demanded that it was necessary to meet those involved in housing refugees, to identify the aim of the research and as a result get permission orally for conducting the next stages of the research in the field work. The researcher gained

knowledge of the procedure by collecting data about refugees together with local government implementation strategy regarding refugees' circumstances recently and in the future.

Local government described the situation regarding the refugees from the political perspective relating to the Middle East and Jordan in its region; the general manager was insistent about security, he mentioned Jordan started to welcome migration over 50 years ago when Palestinians crossed the border and settled in Jordan, Jordan has good relations with its neighbors, and is a welcoming country as well as being medically advanced. When local government introduces refugees it considers logistical problems, education challenges, medical, infrastructure and energy supply. Regarding basic needs, local government showed interest of providing food and shelter relative to other camps around the world, the strategy of planning refugee settlement for a specific determined time was considered a priority. The interviews revealed that in the beginning local government did not get involved with or understand refugee challenges and barriers for a moderate quality of living but it was aware of providing a planning a strategy to protect local benefits and interests that reduced their stay in the camp whilst preparing a strategy that aims to control investment in camps and the use of energy sources. Interviewees showed refugees had an opportunity to live better than Jordanian people due to the aids obtained from donors. Unstructured interviews with local government officials showed a strong subjective view, the government strategy is to control using source of energy, directing economics, employment limitations and construction and infrastructure are taken into consideration.

In short, local government is a competent authority for providing safety and security that endeavors to protect refugees from any kind of danger. Local government understands what refugees need in terms of implementation safety and security framework, however social barriers and performance shelter limitations were not an issue from their point of view, thus it is producing gap between refugees needs and settlement challenges on the real land. Unstructured interviews in the early stage with authority provided an opportunity to clarify connecting and disconnecting points between refugees and local

government, which helped to formulate the next step for explicating the problem from the refugees' point of view.

	Requirements responses											
	Refugees needs				Settlement challenges							
	Adequate shelter	Back home	Quality of living	Security and protection	Climate difficulties	Discontinuous electricity and water	Inadequate shelter	Population density vs services	Sanitation difficulties	Shelter performance	Social and culture differences	Instability
Local government requirement	X	✓	X	✓	X	X	X	X	X	X	X	X

X Unrequired requirements

✓ Required requirements

Table (4.1): Requirements responses of local government

The researcher conducted interviews with refugees and stakeholders where interview questions were categorized based on human needs and settlement requirements for improvement in living conditions for refugees, as shown in Table (4.1), Table (4.17), and Table (4.18). In this regard, the research considered Maslow's theory as discussed in section (2.8.2) and utilized requirement responses based on what refugees need in their new community and taking into consideration refugees' sights and stories that were collected in the field work. In addition, the researcher measured refugees' basic needs at the top of needs and as discussed in section (2.9) other hierarchal needs considered as changeable needs based over a period of time.

Table (4.1) shows what local government considered as basic needs for refugees based on providing safety and security for a limited period of time. From their point of view, there is nothing to provide for refugees other than safety and security, while food and health services are provided by NGO. The other requirements presented in Table (4.1) which

were raised by refugees did not raise any interest and were not discussed by the local government perspective.

In the next section, the research conducted in-depth interviews and structured interviews with refugees. The aim of the next section is to investigate the refugees' stories of reality.

4.6.1.2 Refugees –In depth Interviews and Questionnaires

The in depth interview was conducted with refugees in the Al Za'atari camp who were different in terms of gender, social status, and educational level, and type of accommodation in the camp (see Appendix K) after which 200 questionnaires were distributed to refugees (see Appendix L).

The following Table (4.2) shows the relation between answering on the first research question and objective for the first stage result.

Objectives	*Research area*	*Survey questions*
1st Research Question: **What are the problems that refugees define as their needs?**		
To investigate refugees' requirements in a camp located in a hot-dry climate i.e. the Al Za'atari camp in Jordan.	The effect of requirement are refugees needed to improve their quality of living in camps located in hot-dry climate; -Clarifying and explicating problem in phase one of design science by literature review that allows the design of interview questions for refugees. -Conducting in depth interviews with 29 refugees in the Al Za'atari camp in Jordan to outline their requirements. -Conducting questionnaires with 147 refugees to explore variables and interrelated variables regarding refugees requirements in hot-dry climate	Many questions are asked to refugees, however it summarizes as following; -To explore the quality of living in camps generally. -To explore the relation with international institutions and NGO, and reflecting on their settlement in camps. -To investigate their requirements for living in camps. -The impact of hot-dry climate in quality of living. -The influence of context (social, shelter performance and environmental) with settlement in camps. -Exploring the relationship between variables of surroundings that influence the quality of living in camps that are located in hot-dry climate.

Table 4.2: The relation between answering on the first research question and objectives for the first stage result

Table (4.2) aims to understand and answer the research questions 'How' and 'What' which are based on a type of exploratory research which needs an explanation as to the unclear problem (Saunders *et al.*, 2009).

Regarding the obligation of local government about meeting refugees and determining the number of participants before starting interviewing, the researcher considered this limitation and organised to meet refugees based on the phase of study needed and purpose, with 15 visits to the camps where 29 refugees were interviewed inside and out of their accommodation, and in their work (shops and restaurants, education school and nursery, health care center, and charity organization). Refugees interviewed were distributed almost equally across gender. The various sample selected provides an opportunity to explore the story of daily activity needs from different perspectives.

4.6.1.2.1 Interview Responses of Refugees

The interview questions were formulated based on the research criteria that were established in phase one of the design science method through investigating literature and previous studies of accommodating refugees. Vaishnavi *et al.,* (2007) indicated that the output of phase one could be a proposal for the problem to start phase two of design science.

The questions in the interview were guided by criteria in the set of questions (see Appendix K) to answer the research questions related to refugees' interest. The researcher analyzed the collected data by Nvivo and coded the interview. Notes were taken within nodes which are connected to research questions as shown in Table (4.3). So, coding is tagging information that may be tagged many times depending on the richness of information. Each node includes a number of child nodes that the researcher coded whilst recording interviewees. This allows maximum flexibility of interview input. In contrast, Zikmund, Babin, Carr and Griffin (2012) mentioned the research must contemplate node wordings carefully to ensure control word bias where it might lead to negative or positive meanings and be reflected as a result on data analysis.

Criteria	Node wording	Research questions
	Refugees needs	What are the problems that refugees define as their needs?
➢ Social context ➢ Safety and security	Adequate shelter	
	Back home	
	Quality of living (providing freedom, economics opportunity)	
	Safety (social and security)	
	Settlement challenges	
➢ Comfort ➢ Shelter performance (Modularity and flexibility, demountable, durability) ➢ Stability ➢ Independent constant energy	Difficulties living conditions (economic, security, and social)	
	Climate difficulties	
	Discontinuous electricity and water	
	Inadequate shelter	
	Population density vs sectors	
	Sanitation difficulties (Insects and rodents)	
	Shelter performance	
	▪ Functionality- flexibility-shelter performance	
	▪ Manufactured and materials- durability-design elements	
	Social and culture differences- urban compatibility	
	Instability	

Table 4.3: Interviews coding of the first stage

As shown in Table (4.3) general thematic questions are related to the research question that is "what are the problems that refugees define as their needs?"

Coding the research questions was through two groups; refugee needs and settlement challenges. Such groups are related to the research question and each group branches out to comprehensive classifications.

Requirements responses	Interview number	Responses percent (%)
Refugees needs		
Adequate shelter	16	55
Back home	14	48
Quality of living (providing freedom, economics opportunity)	22	75
Security and protection	23	80
Settlement challenges		
Difficulties living conditions (economic, security, and social)	12	41
Climate difficulties	29	100
Discontinuous electricity and water	29	100
Inadequate shelter	22	75
Population density vs sectors	15	52
Sanitation difficulties (Insects and rodents)	24	83
Shelter performance		
Functionality- flexibility-shelter performance	23	80
Manufacturing design elements and materials of shelter	29	100
Social and culture differences- urban compatibility	24	83
Instability	23	80

Table 4.4: Requirements response of refugees

Table (4.4) shows that most refugee needs and settlement challenges are documented in more than 50 percent of the responses. However, security and protection of needs reached the highest ratio of responses with 80 percent while all participants responded to questions that related to climate difficulties, discontinuous electricity, water and manufacturing design elements and materials of shelter recorded the highest ratio of responses with 100 percent.

The first analysis shows (in Table 4.4) that 80 percent of interviewees agreed safety as a priority when asked about needs, and the second need recorded 75 percent which was providing a quality of living that they defined as an opportunity to work and moving in and out of the camp freely as they felt imprisoned. Additionally, gender safety is one of the refugee's concerns as there is no special attention for women who are single or divorced relating to going to the bathroom outside a shelter and the provision of water. This was the same with the elderly and disabled refugees. Another problem that refugees defined was obtaining an adequate shelter. This was in 55 percent of the responses and 48 percent of the respondents preferred to return home due the inadequate situation in the camp. It is clear that refugees prioritize protection and safety in terms of social and

economic issues; participants do not need just protection from war and conflict, they need also safety and support and a decent quality of life.

With regard to the challenges affecting refugees when establishing shelters in a hot-dry climate, all responses were agreed that inefficient electricity and water systems in the camp was an important challenge to obtaining decent living conditions. In addition, the poor quality of shelter manufacture, poor material durability and shelter structures were mentioned by all of the respondents. When investigating further settlement challenges, 83 percent of refugees asserted that sanitation difficulties caused increasing insect populations due to the distribution of toilets between shelters by refugees themselves and without supervision. Surprisingly refugees created ways to keep insects and especially flies away such as using gasoline to wipe their shelter to prevent flies. Also as refugees mentioned that flies have increased as they are attracted to the water that is used to lower temperatures and reduce dust (this water is splashed on the floor).

The background of refugees also plays a role of their acting toward settlement difficulties where their experience of public bathing is dependent on their social and cultural background. Additionally, 83 percent of respondents agreed that social and cultural differences themselves are another challenge which can cause conflicts relating to ideological or political beliefs, 80 percent of refugees mention instability and shelter functionality or flexibility. 75 percent mentioned inadequate shelter particularly climatic inadequacy. Also, they fear the impact presented by rodents spreading between shelters due to the climate conditions. Some rodents are big, so when a shelter is only 10 cm off the ground, the rodents touch the back of the shelter and chew on the wooden structure. The sound of this chewing prevents refugees from sleeping and increases feelings of fear for women and children. Responses recorded 52 percent of refugees were not satisfied with the population density and who was in charge in each sector.

Table (4.4) addresses responses of other daily living difficulties and challenges that recorded the lowest percent with 41 percent.

The research showed the refugees responses about their needs or challenges are connected to or caused by particular circumstances. According to Festinger, Marczyk and DeMatteo (2005) the basic variables are not enough to understand the phenomenon and the exploratory research is to explore the correlational statistics between two or more variables which compares its groups and measuring in terms of dependent or independent variables (Creswell, 2013). Moreover, the research considers the relationship between the requirements of settlement challenges and refugees needs that obtained the highest refugees responses versus other requirements.

Table (4.5) explains the finding relation between refugees' needs and settlement challenges by exploring where highest connection existed between needs and settlement. The highest connection was measured by number of participants' responses that was a correlation between these two groups (needs and settlement). The next Table (4.5) indicates which requirements of refugees' needs and settlement challenges are highly recorded by responses interlocking.

		Refugees needs (number of participants)			
		Adequate shelter (number of refugees)	Back home	Quality of living (providing freedom, economics opportunity)	Security and protection
Settlement challenges (number of participants)	Climate difficulties	6		3	4
	Difficulties living conditions (economic, security, and social)	1	2	5	2
	Discontinuous electricity and water		1	6	7(24%)
	Inadequate shelter	1		4	3
	Instability	2	2	6	4
	Population density via sectors				1
	Sanitation difficulties	1			2
	Functionality and flexibility of shelter performance	4		2	6
	Manufacturing design elements and materials of shelter	7 (24%)		2	3
	Social and culture differences			7 (24%)	4

Table 4.5: The relation between prioritization of refugees' needs and settlement challenges

It is clear that the highest percent of needs was referring to adequate shelter connected with manufacturing design elements and materials, quality of living (providing freedom, economics opportunity), social and cultural differences, and security and protection with discontinuous electricity. These were recorded at 24 percent.

With regards to variables, the research discovered the highest ratio of needs and challenges were recorded whether independent or dependent, by investigating the connection with other settlement challenges requirements. Saunders *et al.,* (2009) mentioned that explanatory studies emphasize the situation to explicate the relations between variables; it is another way to explain the reason behind the problems. Yin (2015) argued that explanation is a part of descriptive interpretation which represents clarification of which variables influence events and which do not. With regards to the explanatory research that investigates other variables that have influence on reaching the highest ratio, the research conducts complex analysis between the highest percentage regarding refugees needs in and other settlement challenges, as shown in Table (4.6).

No	The Responses Relation	Number of refuges	Repetitions	Ratio of responses (%)
1.	Relation between climate difficulties with settlement challenges	26	91	90
2.	Relation manufacturing design elements and materials of shelter with settlement challenges	24	71	83
3.	Relation between discontinuous electricity and water with settlement challenges	19	36	65.5
4.	Relation instability with settlement challenges	17	32	58.6
5.	Relation social and culture differences with settlement challenges	14	35	48

Table 4.6: The highest ratio of refugees needs and challenges

Table (4.6) presents five requirements that show the highest ratio of refugees' needs and challenges, these are; climate difficulties, discontinues electricity, manufacturing design elements and materials of shelter, instability and social culture differences. The analysis showed the highest connecting between climate difficulties and other settlement challenges requirements with 90 percent of responses and 91 response repetitions. Following the relationship between manufacturing design elements and the material of the shelter with settlement challenges with 83 responses and 71 responses repetitions,

then relationship between discontinuous electricity and water with settlement challenges with 65.5 responses and 36 responses repetitions, while relationship between instability and settlement challenges was 58.6 responses and 32 responses repetitions and the lowest percentage was related to social and culture differences with settlement challenges and recorded 48 responses and 35 responses repetition. The following Tables (4.7), (4.8), (4.9), (4.10) and (4.11) investigate the relationship between each of the requirements of settlement challenges with climate difficulties, manufacturing design elements and materials of shelter, discontinuous electricity and water, instability, and social and culture differences respectively.

		Climate difficulties	**Percent (%)**
Settlement challenges	Difficulties living conditions (economic, security, and social)		
	Discontinuous electricity and water	10	34.48
	Inadequate shelter	5	17.24
	Population density via sectors		
	Sanitation difficulties	9	31
	Functionality and flexibility of shelter performance	14	48.27
	Manufacturing design elements and materials of shelter	19	65.5
	Social and culture differences	1	3.44
	Instability	2	6.89

Table 4.7: The relation between climate difficulties and settlement challenges

As Table (4.7) shows, the connection between climate difficulties and each requirement of settlement challenges reached a highest ratio of responses with 65.5 percent between manufacturing design elements and materials of shelters and climate difficulties, while functionality and flexibility of shelter performance reached 48.27 percent of responses. Discontinuous electricity and water achieved 34.48 in relation to climate difficulties, other requirements fluctuated between 3.44 and 31. However, difficulties in living conditions (economic, security, and social) and population density via sectors were not connected with climate difficulties.

Table (4.8) shows the relationship between manufacturing design elements and settlement challenges which returned the highest ratio of responses with 65.51 percent and was followed by the functionality and flexibility of shelter performance with 37.93 percent. The rest of the requirements obtained a low ratio that was between 3.44 to 13.79 percent.

		Manufacturing design elements and materials of shelter (Number of refugees)	Percent (%)
Settlement challenges	Climate difficulties	19	65.51
	Difficulties living conditions (economic, security, and social)		
	Discontinuous electricity and water	2	6.89
	Inadequate shelter	2	6.89
	Instability	3	10.34
	Population density via sectors	1	3.44
	Sanitation difficulties (Insects and rodents)	4	13.79
	Functionality and flexibility of shelter performance	11	37.93
	Social and culture differences	2	6.89

Table 4.8: The relation between manufacturing design and settlement challenges

With regards to the relationship between discontinuous electricity and water with settlement challenges, Table (4.9) shows the connection between discontinuous electricity with each requirement of settlement challenges and recorded the highest ratio of responses with 34.48 percent with climate difficulties and 27.58 percent with social and culture differences and sanitation difficulties. Refugees' responses recorded 10.34 percent connection with inadequate shelter. Other requirements obtained a low ratio between 3.44 to 10.34 percent. However, there is no connection between the functionality and flexibility of shelter performance and discontinuous electricity and water.

		Discontinuous electricity and water (Number of refugees)	Percent (%)
Settlement challenges	Climate difficulties	10	34.48
	Difficulties living conditions (economic, security, and social)	1	3.44
	Inadequate shelter	3	10.34
	Instability	1	3.44
	Population density via sectors	1	3.44
	Sanitation difficulties	3	10.34
	Functionality and flexibility of shelter performance		
	Manufacturing design elements and materials of shelter	2	6.89
	Social and culture differences	8	27.58

Table 4.9: The relation between discounting electricity and settlement challenges

With regards to the relationship between instability with settlement challenges, Table (4.10) shows the connection between instability and each requirement of settlement

challenges and ratio of responses, which recorded the highest ratio with 31 percent. This connection decreased to 20.6 percent when connected to social and cultural differences. While other requirements connected instability with a low ratio between 3.44 to 17.24 percent. In contrast, population density via sectors and sanitation difficulties did not obtain any connection.

		Instability (Number of refugees)	Percent (%)
Settlement challenges	Climate difficulties	2	6.89
	Difficulties living conditions (economic, security, and social)	5	17.24
	Discontinuous electricity and water	1	3.44
	Inadequate shelter	9	31
	Population density via sectors		
	Sanitation difficulties		
	Functionality and flexibility of shelter performance	3	10.34
	Manufacturing design elements and materials of shelter	3	10.34
	Social and culture differences	6	20.6

Table 4.10: The relation between instability and settlement challenges

The next relationship between social and culture differences and settlement challenges is shows in Table (4.11) and recorded the highest ratio of responses with 27.58 percent for discontinuous electricity and water and achieved the same as instability and living conditions (economic, security, and social) with 20.68 percent. The balance of requirements gained a low ratio of between 3.44 to 13.79 percent of responses.

		Social and culture differences (Number of refugees)	Percent (%)
Settlement challenges	Climate difficulties	1	3.44
	Difficulties living conditions (economic, security, and social)	6	20.68
	Discontinuous electricity and water	8	27.58
	Inadequate shelter	4	13.79
	Instability	6	20.68
	Population density via sectors	3	10.34
	Sanitation difficulties	1	3.44
	Functionality and flexibility of shelter performance	1	3.44
	Manufacturing design elements and materials of shelter	2	6.89

Table 4.11: The relation between social and cultural differences and settlement challenges

Regarding the relationship between safety and security with each requirement of refugees needs, Table (4.12) shows the highest ratio as an adequate shelter as the same as quality of living with 10.34 percent responses, while returning home obtained 3.44 percent of responses.

		Safety and protection	Percent (%)
Refugees needs	Adequate shelter	3	10.34
	Back home	1	3.44
	Quality of living (providing freedom, economics opportunity)	3	10.34

Table 4.12: The relation between safety and protection and refugees' needs

In short, the previous result showed independent variables of refugees' needs and settlement challenges; however dependent variables were considered on refugees' needs and settlement challenges. Table (4.13) concludes the result of high percent between certain requirements of refugees' needs and settlement challenges which reach 65.51 percent of responses between manufacturing with climate. 34.4 percent of responses between disconnecting electricity with climate, 31 percent of responses between instability and inadequate shelter, 27.58 percent of responses between social and culture differences and disconnecting electricity and 3 percent of responses between security and adequate shelter as the same as the quality of living. The researcher prepares a number of questions which are closed questions.

Relationship		*Settlement challenges*						*Refugees needs*			
		Climate difficulties		**Discontinuous electricity and water**		**Inadequate shelter**		**Adequate shelter**		**Quality of living**	
		No	%	No	%	No	%	No	%	No	%
Settlement challenges	Manufacturing design elements and materials of shelter	19	65.51 %								
	Discontinuous electricity and water	10	34.48 %								
	Instability					9	31%				
	Social and culture differences			8	27.58 %						
Refugees needs	Security and protection							3	10.34 %	3	10.34 %

Table 4.13: The highest requirements between refugees' needs and settlement challenge

Thus, the researcher conducted the next step of analysis by distributing questionnaires to explore the relationships between dependents variables which have a high ratio of responses on daily activities by measuring field work. The questionnaire is used to investigate other variables in order to explain further influences on the phenomenon especially those connected with social and cultural understanding.

4.6.1.2.2 Questionnaire Responses of Refugees

This stage includes presenting the analysis of questionnaires that were distributed to refugees in the Al Za'atari camp. The questionnaire technique answers the explanatory research quotations by users in their context; Yin (2011) expressed participants delivered their attitude and beliefs when they are in actual context. The research conducts a

questionnaire analysis which was designed to test the relationship between dependent variables.

When designing questions for questionnaires, the researcher considers variable relationships in order to investigate further variables which were presented unclearly during interviews. It is also used to explore comprehensive variables when basic variables are not enough to clarify a situation (Saunders *et al.,* 2009). Open ended questions are considered in questionnaires to minimize yes and no questions. On the other hand, the researcher takes into consideration a number of issues; using simple words, the sequences of following questions and the context of field work. Questionnaires were distributed to 200 refugees (see Appendix L) who live in the camp and 146 participants completed questionnaires. The rest of the questionnaires were discounted due to incomplete answers. Questionnaires included 56 questions; 23 questions were chosen to investigate beyond basic variables (see Appendix G), and explore related variables which influence requirements and motivations. Such questions are related to certain requirements of refugee needs and settlement challenges, and requirements were taken from results of interview analysis, which are; climate difficulties, manufacturing design elements and materials of the shelter, discontinuous electricity and water, instability and social and cultural differences including settlement challenges, security and protection of refugees.
In this regard, the research considers understanding the ontological position of the phenomenon of refugees practice by relating these variables and representing assessing their requirements (Bryman, 2012).

As shown in Appendix (G), 5 questions were under the manufacturing design elements and materials of shelter, discontinuous electricity and water included 2 questions, 3 questions for instability, social and culture differences had 3 questions, security and protection contain 5 questions, and climate difficulties included 5 questions.

Regarding manufacturing, design elements and materials of shelter requirements, refugees answered questions about the modifications that were applied to their shelter. These were initially distributed between adding private bathroom, adding private kitchen

with 24.6 and 20.2 percent respectively. The answers show a lack of facilities for daily activities. The ratio of providing water tanks was approximately the same as extending the shelter with 12.3, 12.9 respectively. Refugees answered questions about which improvements they would want to maintain in their shelter permanently and the answers were to improve a collection of rain water with 40 percent followed by fixing the rot on shelters which causes undesirable air circulation and more water with 24.8 percent. Dismantling part of the shelter was 18.7 percent, and window and door damage was 11.7 percent. Responding to what is needed to maintain their shelter, 34.5 percent said manufacturing problems in the roof followed by 31.9 percent for manufacturing problems in the floor then 26.6 percent for windows and door problems, refugees were asked which factors influence their satisfaction of the shelters and the responses were a preference to be near to their relatives and friends followed by being closer to services with 38.5 and 22.3 percent respectively. Also, refugees answered questions as to why they extended their shelter and 41.3 percent was due to the shortage of space and 27.3 percent related to increasing their families and 23.8 shortage of services inside the shelter forcing them to extend their shelter.

Discontinuous electricity and water are important requirements for refugees in this context, 82.6 percent of refugees answered that they do not have electricity. Although, 41.4 percent answered that they can get water by the supplied system, there is no supply system in the camp, thus refugees did not understand their context. There is no stable water source, water is being brought in at great expense; we do not get water, or no answer got 34, 20.4, 2.5 and 1.9 respectively.

Accordingly, refugees responded to questions that are measured variables of instability which started by asking about their former occupations and 36.6 percent had professional occupations, 17.9 were students. Farmer and office occupations obtained 13.1 percent equally. The rest of percentages were scattered between housewife, no job and no answer. With regards to current work 69.4 percent were without work.

Social and cultural differences have an influence on a refugee's standard of living, so it is crucial to investigate what the elements of satisfaction are. When asked about the kind of problems that happen in the camp, they spoke about financial and family problems with

48.6 and 35.1 percent reported respectively which is more than half of participants. Sharing the outside area of the shelter with neighbors was more positively reported with 54.9 percent and answers if they live in the camp near friends and relatives reported as 60.1 percent, near public services, shopping areas, or living far from the center obtained same ratio with 13.1 percent. Finally, being near specific services such as electricity and water was 0.7 percent indicating how inconsistent the provision of water and electricity services are.

Security and protection was also an influencing variable. When asked about the most important need the answers were 37.3 percent for security and safety, 26.2 percent for a comfortable shelter, 20.4 percent for food and non-food item and 11.6 percent for social ponding, refugees after living in camp and suffering from bad situation, 40.3 percent of refugees said their feeling was decreased toward safety and security inside the camp, 30.6 percent their feeling was the same as they began living in the camp and 28.5 percent were feeling less safe when asked about their sense of safety in the camp. When asked if they heard about fires in the camp as a result of cooking, they agreed always with 55.6 percent and sometimes with 34.7 percent. Also 63.9 percent were agreed that they suffered from new diseases after moving to the camp, in contrast 35.4 percent said they did not agree. Asked about the four most important services needed to improve quality of life, they were, in order; water and sanitation with 15.7 percent, livelihoods and employment with 14.8 percent, type of shelter with 12.6 percent and medical services with 12.4 percent.

Climate difficulties are the next formulated dependent variables that have an influence on refugees' satisfaction and quality of life. Weather conditions that affect shelters were between high temperature and dust with 23.6 and 20.2 respectively. Surprisingly low temperatures were reported by 7.3 percent of refugees. While rain and wind were obtained evenly at 13.1 percent and 12.9 percent by snow. Refugees protect themselves from high temperatures in summer through electronic ventilation or going out of the shelter with 35.1 percent and 34.5 percent respectively. In contrast, refugees responded to the question of protection from low temperatures in winter was; 49.4 percent for gasoline heaters and 34.7 percent used blankets. Settling rain water also was a problem to settle in the shelters, 31.6 percent reported concerns that water was entering from doors and

windows of shelters, 26.1 percent of water pooling around the shelter, humidity inside the shelter was 21.7 percent and lack of the roof obtained 18.4 percent. Strong wind issues on the shelter was reported as 59 percent.

In summary, refugees' responses showed they are suffering from many problems, and evidently the most important requirements of refugees is protection.

4.6.1.2.3 Summary of Refugees' Responses

Refugees are the main part of this crisis, having left their homes due to the instability and insecurity of their home country. The research conducted in-depth interviews and distributed questionnaires to collect data that was analyzed to describe and explain the requirements and challenges that refugees face in camps in a hot-dry climate. The analysis of the collected data indicated that:

1. Most refugees were fleeing from conflict and looking to find **security and safety** as essential needs. Unacceptably, although most refugees came from villages that have a simple way of life, the relation between refugees' backgrounds, and the technology appeared covariant by time passing in a new environment, they desire remote technology even if it does not satisfy other basic needs. With regards to this result, Alderfer (1969) mentioned that human needs change in time, it is possible to jump from another desire or even need even if the basic needs in the foundation were not yet met, thus it must consider the difference between people and such differences present mostly in social and cultural backgrounds, which means it is necessary to include these with other requirements of refugees' needs.

2. Interviews showed that refugees have a feeling of **instability** that is a foundation of stress and depression, fear of continuous moving between homes until settlement and safety is reached, self-satisfaction regarding money and ability to earn it; no work can be stressful and depressing because settlers had professorial occupations in their home. One of the consequences is an increasing ratio of violence in the camp generally and within a family particularly.

3. **Social context or return to home.** Two choices confront refugees, however returning home is their priority if they cannot adapt to a new community. Social bonding makes a difference to the ability to adapt and live a normal life. Responses showed they are satisfied about their shelter depending on social factors. In other words. Although refugees are looking to stay closer to their relatives and friends, a number of them prefer to stay in the same place rather than moving to another spot in the same camp and that may lead to instability.

4. **Climate difficulties** are another factor that were highlighted in refugees' responses. It seemed their shelter is not appropriate enough to protect them from weather fluctuations which encourages them to spend money in order to improve conditions inside their shelter in summer or winter. In this regards, inadequate shelter performance pushes refugees outside the shelters for many hours.

5. Environmental difficulties influence **shelter performance** which can produce heavy rain, leaking water and strong wind. Refugees explained that most manufacturing problems were in roofs. They mentioned inadequate shelter materials being used and that performance in a hot-dry climate was difficult. The size of the shelter prevents privacy for family members and especially between genders; in addition, there is a shortage of basic services such as bathrooms, washing areas and kitchens.

6. Refugees' responses pointed to shortages of **services and especially electricity and water** that are provided by humanitarian organizations. Many fires occur because of discontinuous electricity when refugees are using dangerous tools such as candles inside shelters. Also, they must go to bed early to avoid darkness because their children are afraid and that leads to other psychological and mental problems.

7. Medical services lead them to feel insecure in a new community, responses showed that they suffer from new diseases when they settle in camp due to the climatic difficulties especially dust and inadequate ventilation inside shelters,

however, interviews showed that there might be other health conditions of refugees whether physiological or psychological depending on their needs including some physiological diseases such as Asthma which affect refugees. Furthermore, they are facing problems regarding sanitation and hygiene.

In short, it is clear from the initial meetings with refugees in the field that **security and safety** are the most important needs which forced them to abandon their home and cross the border to a nearby country. Although some of them stay more than two years in camps, they are unable to adapt to the new environment due to the **inadequate shelter and social contexts** due to limitations of performance of shelters and the surrounding environment, lack of services such as **provision of electricity and water,** which leads them to feel **unstable** and as a result minimizes or prevents normal daily activates whilst the spread of diseases happens easily because of the hot-dry climate and other **climate difficulties.** The results shows proposed requirements that are a foundation for a specifications list in the following phase (phase three of analysis) as showing in Appendix (M), these were articulated in questions in the interviews and questionnaires, in the literature and in previous practices. The initial outcomes are presented by a measured ratio of response in each column, which divides agreement, disagreement and those which give no answer.

The researcher considers refugees' responses as the main factor to formulating requirements because they are the key issues of the crisis and the study is based on researching refugees' needs while other stakeholders in this stage are considered.

The result showed the requirements include groups of questions that are summarized when interviewing refugees. The researcher summarized refugees' responses from in-depth interviews and questionnaires to groups of requirements as following; safety and security under protection, comfort under climatic difficulties, social context under social and culture differences, stability, durability, demountable and flexibility under manufacturing design elements and materials of shelter, and independent constant energy under discontinuous electricity and water functionality.

The researcher listed those concerns and challenges (see Appendix M) and recorded the ratio as follows; refugee responses about inadequate hygiene recorded the highest ratio with 84.2 percent under safety and security. Comfort reached 84 percent under shelter comfort which presented inappropriate shelter manufacturing regarding climatic difficulties, while social context noted the highest ratio under social bonding of nearby relatives with 60.1 percent. 79.9 percent of refugees wished to return home under stability. The manufacturing standards of shelters were important to refugees; the highest ratio documented 76.5 percent regarding durability of shelter materials against climatic difficulties, and 68 percent of adding elements under flexibility. With regards to discontinuous electricity and water functionality, 85 percent mentioned discontinuous electricity services, 75 percent concerned to services relating to overcrowding.

Refugees expressed several requirements that are added to the research criteria and proved by literature and previous practices which help to refine the next stage of the incorporated list of specifications under such criteria. Refugees' priorities regarding their establishment in a new community are hard to determine because of interrelated multiple variables of requirements concerning social and environment context, however undoubtedly protection was an essential priority and other priorities were fluctuating between other requirements; climate difficulties, social and culture differences, stability, shelter performance and services difficulties (discontinuous electricity and water).

The next section provides the results analysis of interviews of a number of NGO that are in Jordan which are mainly UNHCR because it is the main humanitarian organization dealing with refugee settlements in Jordan such analysis aims to explore the priorities of other stakeholders.

4.6.2 Second Stage Result

The second stage of phase two involves in-depth interviews with NGO to investigate their requirements in addition to those of refugees. This is a vital step in developing the list of specifications.

4.6.2.1 Humanitarian organizations located in Jordan responses

The previous section discussed the results of refugees' needs and settlement challenges based on the connection between these two categories. Interviews and questionnaires presented independent and dependent variables of the needs and settlement challenges in their context. Additionally, it presents how refugees' priorities differ than humanitarian organizations or experts as the research will discuss later in this chapter in section (4.12). The researcher conducted interviews with 6 members of the UNHCR where the organization is the main institution that considers refugees in Jordan and the sample was circulated between members in the Al Za'atari camp and the headquarters office.

The researcher carried out interviews with UNHCR personnel because the organization has a direct influence on the Al Za'atari camp. The interviews were conducted with different members of staff to obtain a wide view of the research. Staff members were met at UNHCR's headquarters and in the field where the same questions were asked in the same sequence. The aim of interviewing humanitarian organizations in Jordan was to clarify opinions within the regional framework and to investigate any added variables related to refugees' needs or settlement challenges. In this regard, the research question "what are the challenges that are encountered when establishing refugees shelters in a hot-dry climate?" is considered. Table (4.14) shows how the research is focused on the relationship between the research question and the objectives of the first stage result.

Objectives	*Research area*	*Survey questions*
2nd Research Question: **What are the challenges that are encountered when establishing shelter in hot-dry climate?**		
To examine the environmental and social difficulties that have an influence on the provision of shelters in hot-dry climates, with the Al Za'atari camp in Jordan being used as the case study.	Impact of environment difficulties and social aspects on quality of refugees living in camps in hot -dry climate. -This Conducting in-depth interviews with five members of UNHCR located in Jordan in headquarters and in the field (the Al Za'atari camp) -Investigating refugees needs from their point of view is considered during running interviews	-Exploring facts about other camps around the world placed in hot-dry climates. -Exploring environmental challenges that NGO face when establishing shelter in hot-dry climates. -Discovering social differences and their influence on refugees' needs. -Investigating the performance of shelters in providing for refugees in hot-dry climates -Examining the effects of the environment and social aspects on refugees' needs -The variables are located between environmental aspects and social and culture norms.

Table 4.14: The relationship between the second research question and the objectives of the first stage result

The research considered groups of UNHCR staff running different positions in the field or headquarters (see Appendix D). The interviews were conducted with five staff members whose positions ranged between HR officers/ X registration and social assistance, external relation- mass –info, senior admin assistance, senior settlement and

shelter officer and site planner associate. The research considered a variety of job positions that have a direct connection with refugees to investigate their desires and needs through external relation position, and to identify their stories from the beginning of crossing borders to registration and social assistance. Understanding and clarifying refugees' stories from different perspectives is crucial in the context of the challenges by settlement and shelter officer position.

The second stage of the research analysis covers the primary responses of humanitarian organizations through in-depth interviews which direct questions from the NGO' perspective, the researcher allowed unstructured parts to allow participants to relate their experiences and stories. In contrast, the same group of coding is used to avoid bias and establish reliable and valid comparisons between stakeholders at a later stage. Saunders *et al.,* (2009) indicated that research design questions are influential on the validity and reliability of the research.

Collected data was organized by using Nvivo where the initial outcome was a discussion by answering interview questions and analyzed data by coding the research questions through three groups; refugee needs, settlement challenges and specification benefits as shown in Table (4.15).

The researcher coded the interview and notes were taken within nodes which are connected to research questions, as shown in Table (4.15). Each node included a number of child nodes that the researcher coded by recording interviewees and noted whether it constructed an interesting idea or concept that was no longer on node wording which allows a maximum flexibility of interview input. In contrast, the research must contemplate node wordings carefully to ensure it is free of bias. Podsakoff, MacKenzie, Lee and Podsakoff (2003) noted that positive and negative wordings are an essential and applicable scale to avoid bias in the research method.

Criteria	Node wording	Research questions
	Refugees needs	**What are the problems that refugees define as their needs?**
➢ Social context ➢ Safety and security	Adequate shelter	
	Back home	
	Quality of living (providing freedom, economic opportunity)	
	Safety (social and security)	
	Settlement challenges	**What are the challenges that are encountered when establishing shelter in hot-dry climate?**
➢ Comfort ➢ Shelter performance (modularity and flexibility, demountable, durability) ➢ Stability ➢ Independent constant energy	Difficult living conditions (economic, security, and social)	
	Climate difficulties	
	Discontinuous electricity and water	
	Inadequate shelter	
	Population density vs sectors	
	Sanitation difficulties (insects and rodents)	
	Shelter performance	
	▪ Functionality- flexibility-shelter performance	
	▪ Manufactured and materials- durability-design elements	
	Social and culture differences- urban compatibility	
	Instability	
	Specifications control	
Applied Requirements	Climate control	
	Environment control	
	Services control	
	Shelter performance control	

Table 4.15: Response coding of humanitarian organizations

The group of specifications control was applied to the third research question: "How can the specifications be articulated to achieve a shelter that meets the needs of refugees?" The question is applicable in this section to enable humanitarian organizations to present their point of view and expert opinion in the next section. Humanitarian organizations were asked several questions. Answers are classified depending on the related node wording which are; refugees' needs, settlement challenges and specifications benefits. Each node wording branches out to comprehensive classifications to answer the research question.

Requirements responses	Interview number	Reponses percent (%)
Refugees needs		
Adequate shelter	4	80
Back home	3	60
Quality of living (providing freedom, economics opportunity)	4	80
Security and protection	5	100
Settlement challenges		
Climate difficulties	5	100
Discontinuous electricity and water	5	100
Inadequate shelter	4	80
Population density vs sectors	5	100
Sanitation difficulties (insects and rodents)	3	60
Shelter performance		
Functionality- flexibility-shelter performance	4	80
Manufacturing design elements and materials of shelter	4	80
Social and culture differences- urban compatibility	5	100
Instability	5	100
Specifications control		
Climate control	2	40
Environment control	1	20
Services control	4	80
Shelter performance control	2	40
Social context control	5	100

Table 4.16: The response of humanitarian organization located in Jordan

As shown in Table (4.16) the responses from UNHCR whether in the field or in the headquarters, were limited to a small sample of participants, however the researcher decided to investigate interest by using in-depth interviews and unstructured interviews to allow interviewees to relate their experiences from the humanitarian organizations' point of view. Additionally, a small sample of participants might be a limitation in considering the ratio of interest for certain requirements regarding responses as shown in Table (4.16). Cohen *et al.*, (2011) noted that a small sample is good practice to obtain a relation between requirements and connecting with the requirements of other groups, however it is not necessary for a large sample to give a specific answer and a small sample may be more accurate. With reference to dependent variables, and due to the limitations of the small sample, the connection between requirements is not applicable, so the research considers interviewees' experiences rather than investigating numerical responses by using ethnography strategy as discussed in section (4.9). However, the experiences of humanitarian organizations staff make also a boundary for their interests and priorities on the subject of refugees' priorities.

4.6.2.1.1 Summary of Humanitarian Organizations Responses

In the previous section of humanitarian organizations which was the UNHCR, the results of the analysis showed that the organizations paid more attention to certain classifications than others, such as safety and protection as priorities. Less attention was paid to refugees' needs such as an adequate shelter and their quality of living. While more attention was paid to settlement challenges such as discontinuous electricity and water, social and cultural differences, instability, population density and climate difficulties did not obtain the same ratio of attention. However, with reference to the understanding of UNHCR in Jordan, It is clear that humanitarian organizations recorded some interesting points which are important to refugees such as climate difficulties and social context and that might be as references because the group of humanitarian organizations staff who were met, have realized the importance of refugee stories and settlement challenges.

	Requirements responses											**Applied requirements**				
	Refugees needs				**Settlement challenges**							**Specifications benefits**				
	Adequate shelter	Back home	Quality of living	Security and protection	Climate difficulties	Discontinuous electricity and water	Inadequate shelter	Population density vs services	Sanitation difficulties	Shelter performance	Social and culture differences	Instability	Climate control	Environment control	Service control	Shelter performance control	Social context control
NGO requirements	X	X	X	✓	✓	✓	X	✓	X	X	✓	✓	X	X	X	X	✓

✓ Required requirements
X Unrequired requirements

Table 4.17: Humanitarian organizations requirements

Table (4.17) indicates that humanitarian organizations consider the refugees' requirements in the previous section, however some requirements have arisen which were population density versus services, while another requirement not mentioned is shelter performance. In this regard, refugees' responses state that inappropriate services are provided in each sector against population density under discontinuous electricity and water services. Thus, humanitarian organizations identify as a priority the need to obtain continuous services if organizations are to have a clear strategy of urban organization. The researcher considered such requirements when developing phase three (the list of specification). Humanitarian organizations noted certain requirements as Table (4.17) shows, such indicted requirements are vital from the NGO' point of view, additionally that will reflect positively on the social context of refugees in their new community which is a key feature and neglected factor by other stakeholders. Thus, NGO' priorities are shared between protection and stability and discontinuous electricity and water. The next priorities are social and cultural differences, with climate difficulties.

In the next section, interviews with members of local manufacturing companies who provide shelters for refugees in the Al Za'atari camp are carried out to understand the difficulties faced in providing improved prefabricated shelters in a hot-dry climate.

4.6.2.2 Local Manufacturing Companies Responses

The researcher interviewed local professionals who were involved in manufacturing shelters and specifically provided caravans to the Al Za'atari camp, the sample was with 4 members that were the biggest companies in Jordan in prefabricated shelters. The research attempts to develop serious discussions with those involved regarding climate difficulties and the related safety and protection manufacturing complications and limitations and which are outside the control of the risk mitigation strategy.

4.6.2.2.1 In-depth Interview with Local Manufacturing Companies

Interviewing local manufacturing companies aimed to clarify their point of view about the second research question: "What are the challenges that are encountered when establishing shelters in a hot-dry climate?" The researcher interviewed a number of local companies involved in the manufacturing and supply of prefabricated units to the Al Za'atari camp. The units are prefabricated in manufacturing factories specializing in

prefab houses and are called caravans that are used in the local market for different purposes such as offices, storage facilities, and housing for refugees. The research involved in-depth interviews with three main companies qualified in this area. The interview aims were to explore manufacturing challenges and the main standards of prefabricated units as well as the strategy of improvement for manufacturing units. The interviews were conducted with personnel in different positions of three companies; technical mangers, general managers, site engineering and sales managers.

The questions asked of participants considered the technical and engineering areas regarding prefabricated units, engineering terms about unit performance, insulation, materials and construction positions required to explore the efficiency of units and the related variables within a camp in a hot-dry climate. Also, the interview had combined unstructured questions aimed at clarifying certain areas.

Regarding the interviews, it was reported that most of the units required by organizations and donors are not constructed to adequate standards. The unit's frame is made with sandwich panels and the space does not have self-contained kitchens and bathrooms. Discussions lead to clarify points of the use of certain materials which are not suitable for a hot-dry climate besides the lack of supporting post strategies.

As far the unit's durability is concerned, interviews clarified that the longevity of prefabricated units depends on the materials used for filling walls and the roof, however manufacturing companies did not consider the heavy load of filling materials and its negative impact on the structure of the unit over time. Commenting on the construction area of units the interviewees identified many problems which had arisen when refugees decided to dismantle the units and they needed rebuilding. This led to the risk that the units might become damaged or structurally defective.

Interviewees pointed towards the local market and the lack of suitable building materials. There was also a shortage of personnel to supervise the work and the lack of specialists in the local markets placed further limitations on productivity. Using units for a long time was not desirable due to the standardization of the manufacturing process; beginning with the design components and raw materials used and which were a factor in units' size, the

joining structure elements, insulation, painting for humidity, water leaks, fire resistance and transferring the limited size of units which must take into account the size of tracks which carried units on the street.

Interviewees indicated that the absence of clear standards is an obstacle to efficient manufacturing. Charitable organizations checked that specifications with local manufacturers and or suppliers were applied but there was no comprehensive testing of the units, or a standard test was undertaken on items such as electricity switches and door locks. They mentioned that the same structural elements, materials and insulation were used whether constructing for use in cold or hot climates. Interviewees stated that their companies were completing 30 -40 units at 5 meters x 3 meters per day to meet the needs of the local market. Units manufactured within a short period of time and with less funding from donors could compromise standards for future human use and settlement.

In short, participants disclosed that different variables influenced the efficiency of prefabricated units and the variables that affected time and cost influenced the variety and productivity of prefabricated units.

4.6.2.2.2 Summary of Local Manufacturing Companies' Responses

The research clarified that several issues influence the suitability of the units for human habitation. Participants indicated that these were time and cost, the quality of production, the absence of supervision, local market forces and obtaining financial benefits for local manufacturing companies.

The interviews showed that units are suitable for hot-dry climates, however refugees referred mostly to problems related to the lack of manufacturing usability, whereas local manufacturers preferred to use one kind of insulation for water leakages and fire resistance. Refugees complained about humidity, dust and mold inside the units due to water leaks, permeability and various fire incidents which happened because flammable materials had been used in the construction of the units. Participants responded that the manufacturing process was based on the crisis situation and factories did not have ability to manufacture units from the beginning, so they collected raw materials from the local markets or as they became available and constructed the units separately.

Dismantling and rebuilding units was raised by interview participants. They reported that units were dismantled; however, the technique for doing so required skills and special tools, especially for the main frame of the unit, and electricity was needed for the mechanical tools to function. Simplicity is absent in manufactured units due to a lack of understanding of the climate context and the technical challenges posed by time and costs. A shortage of supervision of local manufacturing and the unavailability of pre-management organization had a negative impact on the construction standards of the units.

Regarding social aspects, participants presented a subjective understanding that refugees must go back home, the interviewees mentioned that they were not happy building these units for refugees, the ontological constructivism view here is presented through obtaining refugees' views in that many incentives that local people do not have their own land, so the ontological act of local companies based on experiences with refugees over many years and their settlement became constant rather than temporary (Bryman, 2012). The social constructivism view leads local manufacturing companies to not understanding refugees' stories or rights.

	Requirements responses											
	Refugees needs				**Settlement challenges**							
	Adequate shelter	Back home	Quality of living	Security and protection	Climate difficulties	Discontinuous electricity and water	Inadequate shelter	Population density vs services	Sanitation difficulties	Shelter performance	Social and culture differences	Instability
Local companies requirements	X	X	X	X	X	X	X	X	X	✓	X	X

✓ Required responses
X Unrequired responses

Table 4.18: Local companies' requirements

From the perspective of local manufacturing companies, providing shelter for refugees was mainly about the financial benefits. A lack of clear standards in manufacturing units is obvious when interviewing local companies that do not have a direct connection with refugees, so the attention of local companies was concentrating on cost and available aid by volunteers funding at that minimum cost.

The lack of supervision on this sector from responsible institutions and humanitarian organizations meant that the refugees had to adapt to living in inappropriate shelters. Table (4.18) shows local manufacturing companies consider shelter performance depending on donor funding and it did not depend on standards or requirements of settlement challenges such as climate difficulties, instability or quality of living for refugees.

In summary, local manufacturers have clarified that their priority has been to meet suitable shelter performance based on meeting their finance targets and that the absence of supervision by organizations and little contact with refugees in order to understand their needs has had a negative impact on the standards of recently manufactured units.

4.7 Third Stage: Results Analysis of Requirements List

To develop specifications, as shown in Figure (4.6), this stage considers developing the artefact based on defining the requirements of the proposed solution.

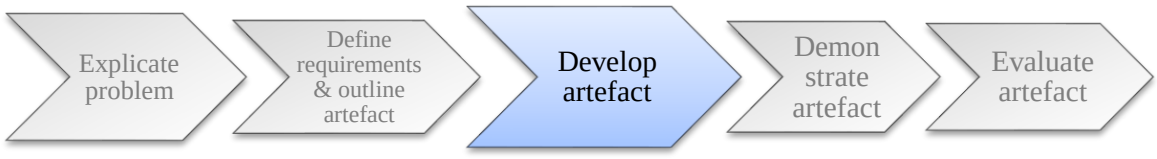


Figure 4.6: Stage three –development specifications list

The following Table (4.19) shows the objectives, the areas of research and the survey questions which are regarded as phase three of design science.

Objectives	*Research area*	*Survey questions*
3rd Research Question**: How can the specifications be articulated to achieve a shelter that meets the needs of refugees?**		
To develop specifications in order to support appropriate design of a shelter that meets the needs of refugees in hot-dry climates.	Discovering the requirements of literature review and previous studies Discovering the requirements of field work (refugees needs) Creating, developing and fulfilling a specifications list of requirements embedded in literature and field work.	Depending on phase one of explicating the problem (literature review and previous studies), and phase two (outlining requirements) by collecting data in field work.

Table 4.19: The relationship between the third research question and the objectives of the first stage result

In this stage, the researcher defined a draft artefact, which is a list of specifications in this study, as shown in Table (4.19). The researcher reformulated the results of the previous section and categorized them based on the requirements in relation to the literature and theoretical sources of evidence.

4.7.1 Developing Specifications

This research developed a number of specifications under related criteria that guide the process of establishing shelters in a hot-dry camp. These specifications could control design implementation of shelters in terms of a reconstruction program, as shown in Figure (4.7). In fact, previous examples in affected countries have shown that the two approaches aim to build temporary shelters in less time and with lower cost. However, the two established approaches to providing appropriate shelters had differing points of view.

As reported by a mission of the UNHCR (2013b) there is a lack of human need attendance on its aim which is concentrated on providing a shelter by technical assessment of prefab emergency shelters using a number of standard specifications for the prefab shelter. Specifications from organizations such as the UNHCR and local government are required; however, it lacks consideration of refugees' needs where this study covers this discussion through such criteria.

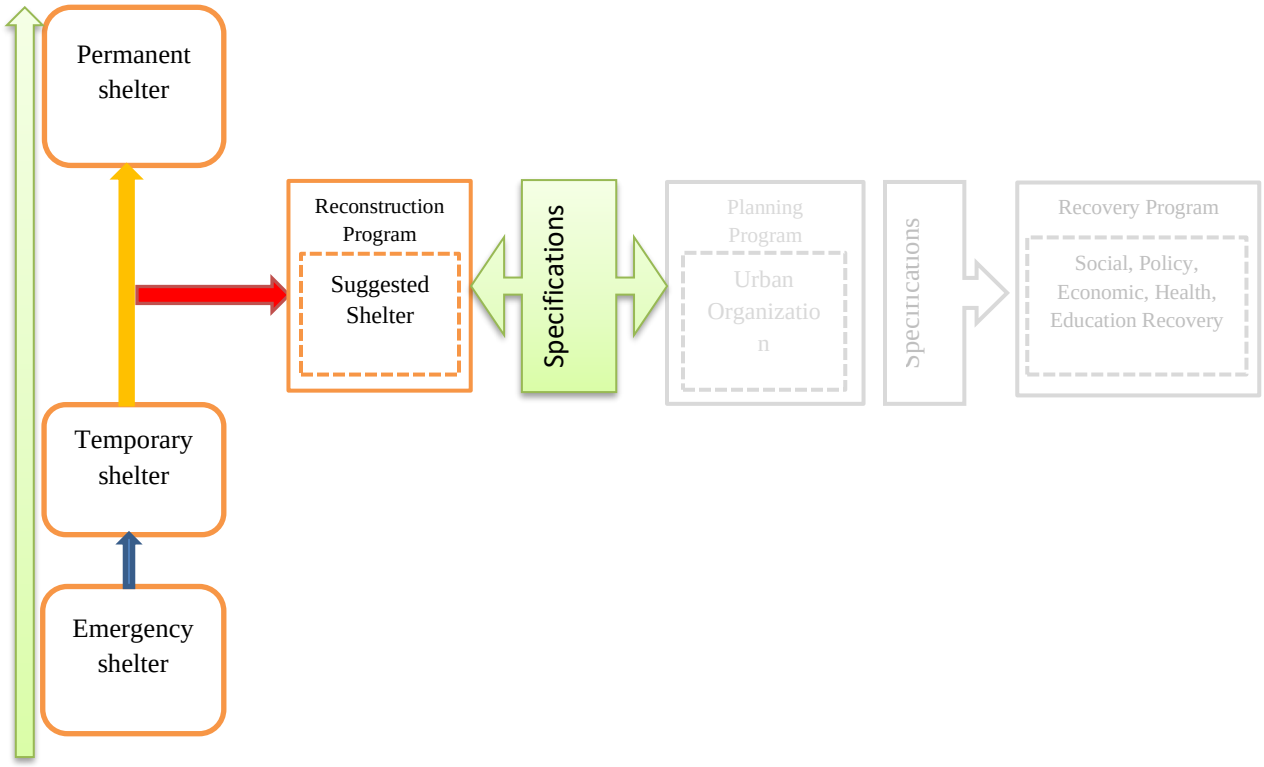


Figure (4.7): Linking specifications between reconstruction, planning, and recovery

The research will discuss provision of specifications in terms of the shelter itself. There is a gap in the published research on the link between shelter performance and refugee needs.

Specifications are guidance and instruction support designers and engineers to frame design problem and reach design objectives (British Standard Institution [BSI], 2001).

"A specification provides a description of the proposed artefact. In turn, this provides substance to their logical role which is to provide a criterion of correctness or malfunction for purported artefacts" (Turner, 2011, p.140).

Thomas (2004, cited in the National Building Specification [NBS], 2008) that specifications have numbers of types such as standard descriptions and performance. Performance specifications describes how you achieve the result without giving the details technical description, while description specifications require these technical details (BSI, 2001), the research will follow performance specifications that lead to effective refugee shelters in hot-dry climate conditions. Also, project specification, are divided to different subjects such as architecture specifications, hardware or software specifications, mechanical specifications and others. However, these specifications are classified by types like target specifications, materials specifications, design specifications, handing specifications, and others. Regarding the research, target specifications will guide the formulation of a shelter through performance of materials, design and function of the shelter.

The research will set a number of specifications that institutions and organizations should consider for providing the characteristics of a better shelter. Specifications will be classified by criteria through the table which include; reason for the specification, scope or range of specifications and main body of specifications (see Appendix N).

Specification methods are the way of writing specifications, the NBS showed two methods of specifications which are either performance-based (open), or prescriptive-based (closed). A specification is a likely blending of them where the research will follow the performance method of specification due to the continuous change that happens for refugee cases in terms of finance regulation, time management, social and culture limitation, environment determination. In short, the research will follow specifications that grasp criteria of existing refugee shelters by considering what users need, in order to continue human daily activities in their shelter.

The research will establish specifications by producing outline performances of main specifications in the first stage after which refining of these specifications will be more descriptive, as shown in the following Figure (4.8) in the second stage.

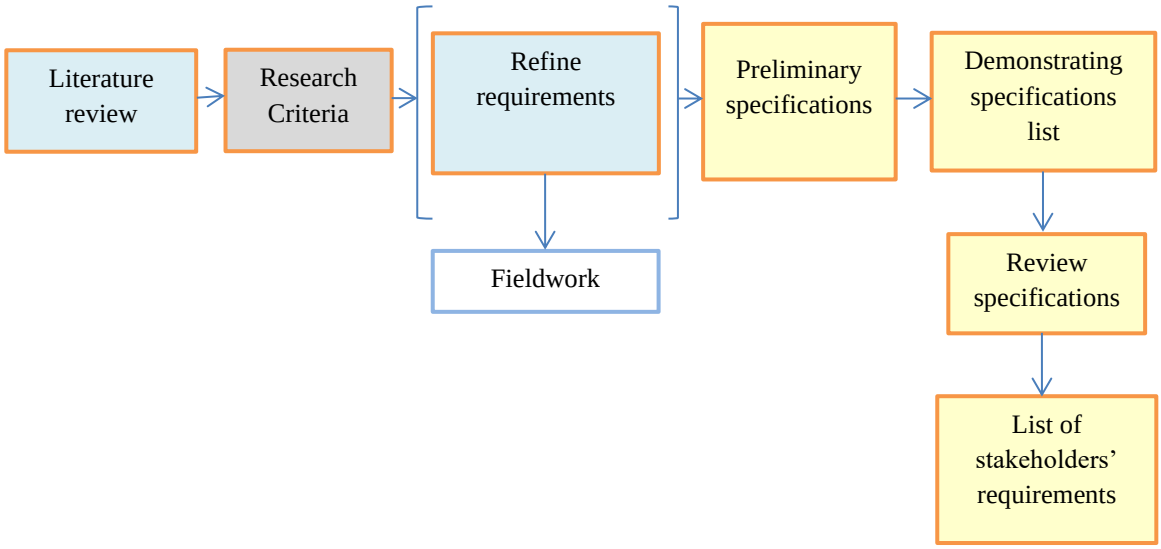


Figure 4.8: Cycle of establishing specifications

Specifications will be provided in two stages; in the first stage the outline specifications will be offered by criteria based on literature review and the results of interviews with stakeholders, such a result gives a list of participant requirements after which the list is refined to narrow requirements by justifying from literature and previous research about human needs, shelter applications, and shelter structures including social and cultural effects. In the second stage, preliminary specifications will be formulated covering the problem definition and outline requirements for clarifying specifications. Demonstrating specifications list by experts and institutions also conducted in second stage and presented as list of specifications as showing in section (4.8)

The researcher developed the list of specifications as the outcome of a results analysis of phase two (list of requirements) formulated by prioritizations of refugees and humanitarian organizations located in Jordan together with local manufacturing companies and local government. Therefore, the researcher developed the list of specifications in phase three of design science and used eight research criteria; comfort, being demountable, safety and security, durability, stability, sense of place, flexibility and modularity, and independent constant energy. This was presented at the Internal Evaluation stage in the second year of the research and included 43 specifications, however some of the specifications received NA due to incomplete information as data

was collected later in phase four by interviewing experts, international organizations and researchers. Additionally, the prioritization of research criteria was changed based on prioritization of stakeholders. Adding, refining and reviewing a number of specifications was also considered in phase four of the demonstration of the specification list. The researcher categorized these requirements into certain specifications which are grouped under certain criteria. Furthermore, the categories reflect the range of specification boundaries, explanation of need, fundamental shelter requirements and the performance or parameters of the specifications for application. Obviously, some criteria are divided into sub criteria that include related specifications. The results of this stage showed a correlation between specification performance of several positions and the ability to control variables such as construction and social and environmental issues. However, the arrangement between administration and users and the control arrangement between some inconsistent variables such as social and cultural aspects and political obligations might be a specification barrier. In this regard, the next phase demonstrates the specifications list from meetings with experts and international institutions, thus, the result analysis of experts' responses to formulate the specifications is addressed, besides adding further specifications, and considering prioritization of stakeholders with consideration to the specification's ability to solve practical problems.

4.8 Fourth Stage: Results Analysis of Experts and International Organizations

Phase four, as shown in Figure (4.9), aims to demonstrate the list of specifications are developed in phase three by meeting people involved in housing refugees.

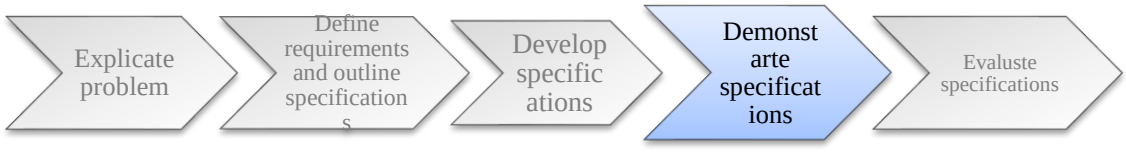


Figure 4.9: Stage four –demonstrating specifications list

The research demonstrates specifications by interviewing experts who are actively involved in this field. Phase four in DS aims to demonstrate and illuminate *artefact* in

phase three. In other words, it must show and prove that specifications can solve and address the research problems (Johannsson *et al.*, 2012). The next sections of the demonstrating phase explain how the specifications list can solve the addressed research problem. The feasibility of using a list of specifications to establish refugee shelters is shown by achieving refugees' needs and avoiding settlement challenges. The fourth research question "What are the required specifications that can be used to address refugees' shelters in hot-dry climates?" is considered in interviews with experts. Table (4.20) shows how the research is focused on the relationship between the fourth research question and the objectives of the results survey.

Objectives	***Research area***	***Survey questions***
4th Research Question: **What are the required specifications that can be used to address the design of refugees' shelter in hot-dry climates?**		
To demonstrate the formulated specifications of feasibility to meet refugees' needs in hot-dry climates.	Demonstrating the specifications feasibility of answering on some aspect of the research problems, thereby explaining how the specifications work and why work to meet refugees' needs in camps located hot-dry climates -The research conducted in-depth interviews with 32 participants including experts, independent researchers, engineers, architects, NGO and responsible institution; interviews were run virtually.	The same sequence of questions was asked of participants covering the following; -Examining the feasibility of formulated specifications regarding settlement, social, shelter implementation and context conditions to meet refugees' needs in camps in hot-dry climates. -Measuring the dependent and independent variables relating to settlement, social, shelter performance area and context conditions. -Explaining why and how the specifications work in hot-dry climates.

Table 4.20: The relationship between the fourth research question and the objectives of the first stage result

The research considered experts in administrative positions in different institutions, universities, international NGO, independent researchers, architects and engineers (see Appendix D). The interviews were operated with 32 experts from around the world in positions of interest on refugee studies, shelter, settlement and humanitarian innovation. The interviews were carried out with experts and PhD candidates recently in the field in Nepal and Afghanistan. Two experts enrolling with UNHCR Jordan were interviewed in phase two of defining requirements and again in phase four as their positions were directly connected with refugees in the Al Za'atari camp.

4.8.1 In-depth Interview with Experts and Responsible Institutions Responses

The researcher conducted interviews with experts by using an online survey that saved time and money. The information was processed without delay and reached a wide range of participants (Denscombe, 2014). An email sent in advance of the interviews explained the nature of the research, why it was important and a short biography of the researcher. The researcher sent hundreds of emails to those involved in housing refugees around the world and had the opportunity to conduct 32 interviews, 29 interviews were coded under nodes and three interviews were excluded due to the nature of the interviewee's interests. Interview questions focused indirectly on the feasibility of using specifications developed by the researcher in hot-dry camps. A list of interview questions were aimed at demonstrating a specifications list and node wording was formulated to construct a list of specifications. The flexibility of responses was considered and prevented bias.

Interviews were recorded by the researcher after the completion of a consent form from the interviewee. Each interview took between 30 - 60 minutes. Virtual communication was a barrier to extending interviews in some cases of more than 60 minutes as a connection interruption or poor quality of communication lines interrupted the interview. Notes, therefore, were taken during interviews and recorded in Nvivo. The interviews and notes were coded within nodes connected to the fourth research question, as shown in Table (4.21). Some nodes included a child node if applicable; notes are coded also if it constructs an interesting idea to support interview litheness.

Criteria	Node wording	Research Question
	Settlement Implementation	What are the specifications are required that can be used to address the design of refugees' shelter in hot -dry climates?
➢ Social context ➢ Independent constant energy ➢ Stability ➢ Safety and security	Logistic plan (transfer requirements vs design implementation)	
	Management control (time and cost)	
	Service control;	
	▪ Water supply, hygiene promotion and sanitation	
	▪ Electricity supply	
	▪ Livelihood	
	▪ Health services	
	Social Implementation	
➢ Stability ➢ Social context	Considering background diversity (culture, traditions)	
	Dignity and identity consideration (meaning, ideological, believes)	
	Social conditions (relatives and friends)	
	Self- satisfaction (financial security-bottom-up strategy)	
	Shelter implementation	
➢ Shelter performance	Construction and structural requirements	
	Performance consideration against environment context	
	Materials	
	Performance consideration against social implementation	
	Skill requirements	
	Context conditions	
➢ Comfort ➢ Social context ➢ Shelter performance	Environment context (climate condition- land condition	
	Social context (local community)	
	Longevity	

Table 4.21: Experts responses coding

Table (4.22) shows four main nodes; settlement implementation, social implementation, shelter implementation, and context conditions. Interviews are coded under the main nodes and child nodes.

Requirements responses	Interview number	Reponses percent (%)
Settlement Implementation		
Logistic plan (transfer requirements vs design implementation)	14	48
Management control (time and cost)	21	72
Service control;		
▪ Water supply, hygiene promotion and sanitation	12	41
▪ Electricity supply	10	34
▪ Livelihood	10	34
▪ Health services	7	24
Social Implementation		
Considering background diversity (culture, traditions)	20	70
Dignity and identity consideration (meaning, ideological, believes)	17	59
Social conditions (relatives and friends)	9	31
Self- satisfaction (financial security-bottom-up strategy)	13	45
Shelter implementation		
Construction and structural requirements	18	62
Performance consideration against environment context	16	55
Materials	20	70
Performance consideration against social implementation	18	62
Skill requirements	11	38
Context conditions		
Environment context (climate condition- land condition	22	76
Social context (local community)	17	59
Longevity	14	48

Table 4.22: Experts responses

Table (4.22) addresses responses from experts about demonstrating a list of specifications developed by the researcher. Experts are asked a group of questions aimed to clarify point of views regarding several requirements.

Regarding nodes that are standing, each node was divided to child nodes that answers interview questions of some experts. Those nodes are developed based on the list of specifications and applied as follows: under settlement implementations nodes are logistic, management and service control, and under the social implementation node are users' background, dignity, social conditions and self-satisfaction. The subject of shelter implementation considers construction and structural requirements, performance consideration against environment context, materials, performance consideration against social implementation and skill requirements, and finally the context conditions node includes environment, social context and longevity.

The highest ratio of experts' responses under settlement implementation was the importance of management control with 72 percent, whereas 24 percent of experts identified health services under services control. Social implementation recorded the highest ratio with 70 percent of responses about background diversity (culture and traditions) and the lowest response recorded was 31 percent relating to social conditions (relatives and friends). Shelter implementation received a 70 percent response in relation to materials used while the lowest ratio recorded was 38 percent for skills requirements. Relating to conditions, experts scored the environment context as the highest ratio with 76 percent and the lowest ratio was 48 percent with longevity.

It is clear that the highest ratio of responses was between settlement and shelter implementation, context condition, social implementation. In order to identify the relationship between requirements located in each node, and to find which are dependent or independent variables, the researcher investigated the correlation between requirements under nodes together.

		Settlement implementation					
		Logistic plan (transfer requirements vs design implementation)	Management control (time and cost)	Electricity Supply	Health Services	Livelihood	Water supply, hygiene promotion and sanitation
Context conditions	Environment context- (climate condition-land condition)		5	2		1	1
	Longevity	1	1	2		1	2
	Social context- local community		1			2	
Shelter implementation	Construction and structural requirements	2	5 (17%)	1			1
	Materials	5	2				
	Performance consideration against environment context		2			1	
	Performance consideration against social implementation	1		1			
	Skills requirement	3	2				
Social implementation	Considering background diversity (culture, traditions)				1	1	1
	Dignity and identity consideration (meaning, ideological, believes)					2	1
	Self- satisfaction (financial security- bottom-up strategy)	1		1	1	2	2
	Social conditions (relatives and friends)	1				2	

Table 4.23: The relation between settlement implementation and other requirements-part one

Table (4.23) connects the settlement implementation and other nodes (social and shelter implementation and context conditions) and presents five responses which mean 17 percent of the sample connected between management control (time and cost) and the environment context (climate condition- land conditions), construction and structural

requirements, and materials. In contrast, the connection was nearly absent with other requirements such as social implementation. Even though the ratio of experts' responses was not high the correlation between settlement implementation and shelter implementation obtained the highest ratio with several requirements, followed by context conditions. Obviously, the requirements under settlement implementation are dependent variables and are influenced by requirements under shelter implementation and context conditions.

		Shelter implementation				
		Construction and structural requirements	Materials	Performance consideration against environment context	Performance consideration against social implementation	Skills requirement
Context conditions	Environment context- (climate condition-land condition)	4	1	2		
	Longevity	2	6 (21%)	1		2
	Social context-local community		5 (17%)		1	
Social implementation	Considering background diversity (culture, traditions)	3	3	2	6	2
	Dignity and identity consideration (meaning, ideological, believes)	2	1		3	4
	Self- satisfaction (financial security-bottom-up strategy)	1	2	1	1	3
	Social conditions (relatives and friends)	1	1		4	1

Table 4.24: The relation between settlement implementation and other requirements-part two

Table (4.24) shows that the connection between shelter implementation and other nodes was clear with context conditions which recorded between materials under settlement implementation and longevity and social context (local community) with 21 and 17 present respectively. The correlation between shelter implementation and social

implementation was noted between performance considerations against social implementation and background diversity (culture and tradition) under social implementation, also with 21 percent.

		Context conditions		
		Environment context- (climate condition-land condition)	Longevity	Social context- local community
Social implementation	Dignity and identity consideration (meaning, ideological, believes)		2 (7%)	1
	Self- satisfaction (financial security- bottom-up strategy)			
	Social conditions (relatives and friends)			

Table 4.25: The relation between context and social implementation

Table (4.25) shows that the relationship between context conditions and social implementation is so close as to be no relation. Unexpectedly, 7 percent of responses identified the longevity of being refugees in the context conditions and their feelings of dignity and identity under social implementation.

Regarding the result analysis of demonstrating the specifications list, the researcher divided interviews between responsible institutions and experts to allow understanding of their responses regarding their background in terms of prioritization. Experts and responsible institutions interviews were almost equally divided and as a result have different categorizations for priorities, as shown in Table (4.26).

Criteria	Requirements and sub- requirements	Responsible institutions		Experts	
		No.	(%)	No.	(%)
	Settlement Implementation				
• **Social context** • **Independent constant energy** • **Safety and security** • **Stability**	1. Logistic plan (transfer requirements vs design implementation)	6	40	9	64
	2. Management control (cost and time)	13	87	9	64
	Service control:				
	▪ Water supply, hygiene promotion and sanitation	6	40	6	43
	▪ Electricity supply	2	13	8	57
	▪ Livelihood	8	53	2	14
	▪ Health services	5	33	2	14
	Social Implementation				
• **Stability** • **Social context**	1. Considering background diversity (culture, tradition)	12	80	9	64
	2. Dignity and identity consideration (meaning, ideological, believes)	7	46.6	10	71
	3. Social condition	5	33	4	29
	4. Self-satisfaction (financial security-bottom-up strategy)	8	53	6	43
	Shelter Implementation				
• **Shelter performance**	1. Construction and structural requirements	6	40	14	100
	2. Performance consideration against environment context	8	53	10	71
	3. Materials	10	67	12	86
	4. Performance consideration against social implementation	8	53	12	86
	1. Skill requirements	4	27	9	64
	Context Conditions				
• **Comfort** • **Social context** • **Shelter performance**	1. Environment context- (climate condition-land condition)	11	73	12	86
	2. Social context (local community)	11	73	6	43
	3. Longevity	7	47	7	50

Table 4.26: Comparing between NGO and experts responses

Table (4.26) shows that the priorities of experts and responsible institutions are different. Settlement implementation, social implementation, shelter implementation and context conditions are the four main requirements although experts and responsible institutions made different responses to these four groups as Table (4.26) shows. Each group has a

number of sub-requirements (referring to the survey questions) and as result each group of requirements connects with related criteria. There was, however, a barrier to precisely filter experts and responsible institutions' priorities. All requirements have a number of multiple variables that are difficult to separate by prioritization of experts and responsible institutions.

With regards to settlement implementation, responsible institutions had the highest ratio of responses with 87 percent for management control and the lowest ratio of 13 percent for electricity supply. Experts showed the high ratio with 64 percent for logistics plan (transfer requirements vs design implementation), management control and the lowest ratio of 14 percent was distributed evenly between livelihood and health services under services control.

Social implementation by responsible institutions reached 80 percent for considering background diversity and the lowest ratio was 33 percent for social conditions (relatives and friends). Experts reached 71 percent as the highest ratio for dignity and identity consideration and the lowest ratio was 29 percent for social conditions.

As for shelter implementation, responsible institutions recorded a high ratio with 67 percent for materials and the lower ratio with skill requirements was 27 percent. On the other hand, experts noted 100 percent as a high ratio where all responded on agreed construction and structural requirements and the lowest ratio was 64 percent for skill requirements. Responsible institutions' responses on context conditions reached the highest ratio of 73 percent for the environment context which related to climate and land conditions. Social context (local community) and longevity rated 47 percent, whereas experts' responses reached 86 percent for the environment context whereas 43 percent was the lowest ratio for social context (local community).

It is clear that shelter implementation recorded the highest responses from experts where the responses reached 100 percent, followed by context conditions. However, responsible institutions focused more on settlement implementation with a high percentage of responses.

The analysis of results for phase four raised a further requirement of experts, professionals and responsible institutions, in terms of management control. This was mainly concerned with time management in preparing and delivering shelters and cost control. Thus, management control and materials for shelters are a priority, however differences were shown between experts and responsible institutions in other priorities. There was a barrier to determining priorities, and interrelation between multiple variables of their requirements was a reason of fluctuating priorities of experts and responsible institutions depending on the community context.

4.5.1.1 Summary of Experts and Responsible Institutions Responses

The relationship between the nodes' requirements of interviewing experts and responsible institutions were mainly between settlement implementation and shelter implementation, materials and construction and structural requirements. Two factors influenced the logistics plan of transferring shelters in addition to time and cost. Experts' and responsible institutions' interviews noted that it is necessary to consider types of design and materials when donors commit to certain shelters as well as timing, delivery and cost. Some points were made that to find solutions for refugees from local markets, using local materials and techniques for construction can prevent high logistical and labour costs. Despite experts mentioning management control strongly as a key factor of establishing refugee shelters, it is a barrier to consider managements requirements due to the difference of funding that is distributed by donors and which fluctuate from one year to the next, the research tries to develop specifications that address adequate shelter for human use in a hot-dry climate. As for shelter implementation within *context conditions*, experts explained that the second important issue of operating an adequate shelter within a certain context is to consider the characteristics of context to avoid environmental challenges. They explained that insisting on the use of local materials to deliver shelter longevity may achieve improved social bonding through daily activities if refugees were placed in an adequate shelter with adequate materials besides respecting environmental context. Evidently, experts and responsible institutions were more concerned with settlement implementation and management control and some interviewees described how it was difficult to apply social requirements within a list of requirements due to the cultural and traditional differences between communities. In this regard, the research

covers these concerns through the specification of social requirements which is flexible and can be adapted for different groups. The case study here is just a guide to follow social requirements within its context.

The research assesses the specifications that are justified from fieldwork and literature and which will be refined by interview with practitioners who are actively involved in housing refugees as discusses in section (4.8.1).

The following section discusses social and cultural aspects of the camp situation from the refugees and stakeholders' point of view, as the researcher conducted an ethnography strategy that has the potential to add value to the list of specifications, in terms of social and cultural positions.

4.9 Ethnography Analysis

An ethnography strategy was used to describe rich details about real life of context and used to check the ability of existing theory on real life. Denscombe (2014) indicates ethnography fieldwork is about collecting qualitative data by observation and interviewing, and the researcher studies unusual situations or even normal situations that could be an unfamiliar situation. The research study takes a social constructivism stance, and the social and cultural part is essential in understanding daily living activities in camps and the research includes several stories and practices of users and other stakeholders regarding the camp situation (Saunders *et al*., 2009). The researcher considered an ethnography strategy to add related stories to the findings of the qualitative data analysis that are limited to insert social meanings and values as numerical findings. The researcher followed steps in collecting data by ethnography which are selected related stories of refugees and other stakeholders that connect to the subject of camp situations in terms of being temporary or being an informal city.

The validity of ethnography presents a legitimacy of the speaker comprehensive to the interview; the actor is an appropriate person to identify feelings of interviewees (Denscombe, 2014). Checking themes of data collected from ethnography with primary data to ensure validity ensures that if the researcher leads to any individual opinion or bias regarding selecting data, the neutrality of gaining the research in the field presents

ecological validity. Also several other validity steps are considered which are checking the consistency of recording interviews, matching recordings with participants' opinions and avoiding questions that have influence on participants' answers.

The methodology steps of conducting ethnography in the research was through conducting open ended descriptions in field work and taking notes from transcripts in the first stage. The following step was supporting stories by extracting information from documents about refugee camp situations around the world. The step after was the analysis process which considered analytical categories that capture related aspects of data to cover stakeholders' views about camp situations and their future improvement (Hammersley & Atkinson, 2007). The ethnography analytical stage stands on axial coding where it is divided to two main categories of a camp as a temporary situation and a camp as an informal city, also the researcher coded the common cross of interviews with one of the categories. Schutt and Chambliss (2003) argued ethnography fieldwork stands on participants having the same characteristics and is appropriate when the researcher shares the same language of the participants, also they indicate ethnography fieldwork does not determine a specific methodology to collecting qualitative data, however it relies on the researcher in the field and tells stories like it is. In this regard, the researcher uses a storytelling technique to show potential of practices and stories of refugees and stakeholders to ultimately improve refugee camps (Cohen *et al.,* 2011). The following section shows some collected stories of refugees, humanitarian organizations and experts where they may agree or disagree with the categories. The next step presents a diagram that is divided into two parts, the upper part refers to refugees' responses and locates between two concepts of a camp as a temporary situation and as an informal city as the continuum, while the lower part is as the same as the upper one, however, it relates to stakeholders' responses. In this regard, the ethnography strategy allows the gathering of qualitative data and using notes from the field study, however, the researcher conducted coding to analyze qualitative data from interviews with refugees and stakeholders and coding as one of two concepts which are listed as the camp being a temporary situation and an informal city, as shown in Figure (4.9).

Ethnography relies on the direct observation of people in their place and comes up with the event, while ethnography limitations present stories as sole experiences, and storytelling is not an analytical approach and might veer away from the research sole purpose, however using a design science method to collect and analyze data would support the data regarding settlement challenges as shelter performance and establish the research reliability by checking the research findings. In summary, the research design as a qualitative data approach under the design science method and ethnography strategy, allows the use of the knowledge of stakeholders' experiences without the technical approach of a specifications list, however it is applicable to use storytelling in ethnography and adding strength to the provisional list of specifications for adequate shelter.

The following section shows a number of refugees' stories and stakeholders experiences regarding their opinion about camps.

A woman shows her satisfication to her block of caravans as she likes to spend the night with relatives and talking even in darkness, the only thing she is concerned with is that insects and animals increase when the mall was established on the camp increasing goods and foods.

A man was a trader of goods and foods, he described the current situation in the camp as bad. At the early stage he tried to sell products from his tent, however, refugee poverty was a limitation of his continuous trade. He argued refugees always want to sleep through the day because they know they will get assistance (30 USA dollar) per month from humanitarian organizations which is maybe more than what they could earn from working any kind of work for a week inside the camp. Also he mentioned most men do not work compared with women who work outside and inside the camp in order to provide for the family and to run away from conflict and violence with men who are unemployed. He was frustrated as a refugee because he felt that he was imprisoned and had limited human rights. He did not want his children to grow up in a camp and everyday see just desert and white shelters everywhere, he believes the camp leads to bad ethics and he insisted that he will go to back to Syria, even if they will die.

A volunteer told the story of his daughter who was afraid of the darkness because the darkness inside the camp is more scary than other places as it is in the middle of the desert. He also told a story of plastic bathrooms that are replaced at the early stage of the camp and due the strong wind might become unstable and move off its place.

Another story was of a man who used to sleep outdoors of his shelter in bad climate conditions in summer and winter to allow privacy for his wife and teenage daughter because he has just one shelter. His ethics and beliefs prevent him from sleeping in the same room as his daughter.

A disabled man stated that if a boy wants water he will ring many caravans to get a glass of water, he said ethics and traditions and values of cultual and social aspects do not exist anymore due to the mixing of cultures inside the camp. He also complained about medical care where he mentioned that doctors used to give patients painkillers for all kinds of illnesses. He also complained that they were eating, drinking, sleeping, and using bathrooms in the same area.

A volunteer of a humanitarian organization argued in his interview that he bought two caravans from his own money because he wanted privacy for him and his single sister, he mentioned rodents have lived inside his caravan for more than 17 days.

A female volunteer mentioned how scared she was on the first night at the camp when she lost her family. She can adapt to the temporary situation of the camp but she wanted to finish her educational journey as she has a scolarship to finish her bachelor degree.

A man stated that each street has a master who is chosen by humaintarian organizations, however, the masters are sometimes not fair when distributing water, solving problems and so on as they give their relatives and friends priority while other refugees are suffering.

An owner of a mini shop argued that refugees fight because of poverty, he mentioned the last fight was at a mall and was due to overcrowding and people suffered from the

situation where he indicated sometimes refugees spend many hours inside the mall to get their provisions, and they have to go to the mall more than three times per a day to collect the main items of food that the UNHCR provide. They bought their provisions but keep part of it to buy for other refugees to get cash for milk, clothes, medicine. etc., which the UNHCR does not provide.

The next section discusses experts and humanitarian organizations' experiences regarding their opinion of being in a camp as a temporary situation.

A humanitarian member in the IFRC indicated that Bangladeshi people want shelters that include their animals under their shelter, also Bedouin people cannot stay in a shelter and they prefer a wool tent.

An expert related a story about refugees refusing shelters provided by the UNHCR in Haiti due to their traditions and beliefs preventing them to stay in shelters containing only one level. He mentioned that refugees refuse the provided shelters from humanitarian organizations and they were afraid of windows because they believe that bad spirits will enter the shelter.

Another member in the UNHCR related his experiences in the Al Za'atari camp. Refugees were very happy at the beginning of their arrival to the camp after which they started to complain about inadequate living conditions such as the lack of provision of electricity and water, however, even though refugees suffered from their living standards, their families grew due to two main reasons, which are; each new member in a family can get extra aid from the UNHCR which is 30 USD and the second reason, in spite of the temporary situation, they still prefer to live as normal humans and refuse to accept the temporary situation.

A member of the UNHCR explained that refugees who hope to go back to Syria stay in nearby countries such as Jordan and Lebanon while others prefer to move further away to areas such as Europe.

A man indicated that refugees exploit each other due to poverty and in order to survive. He said that many cases of conflicts between refugees are recorded, many of them were between women who were fighting due to less privacy between shelters or multiple wives.

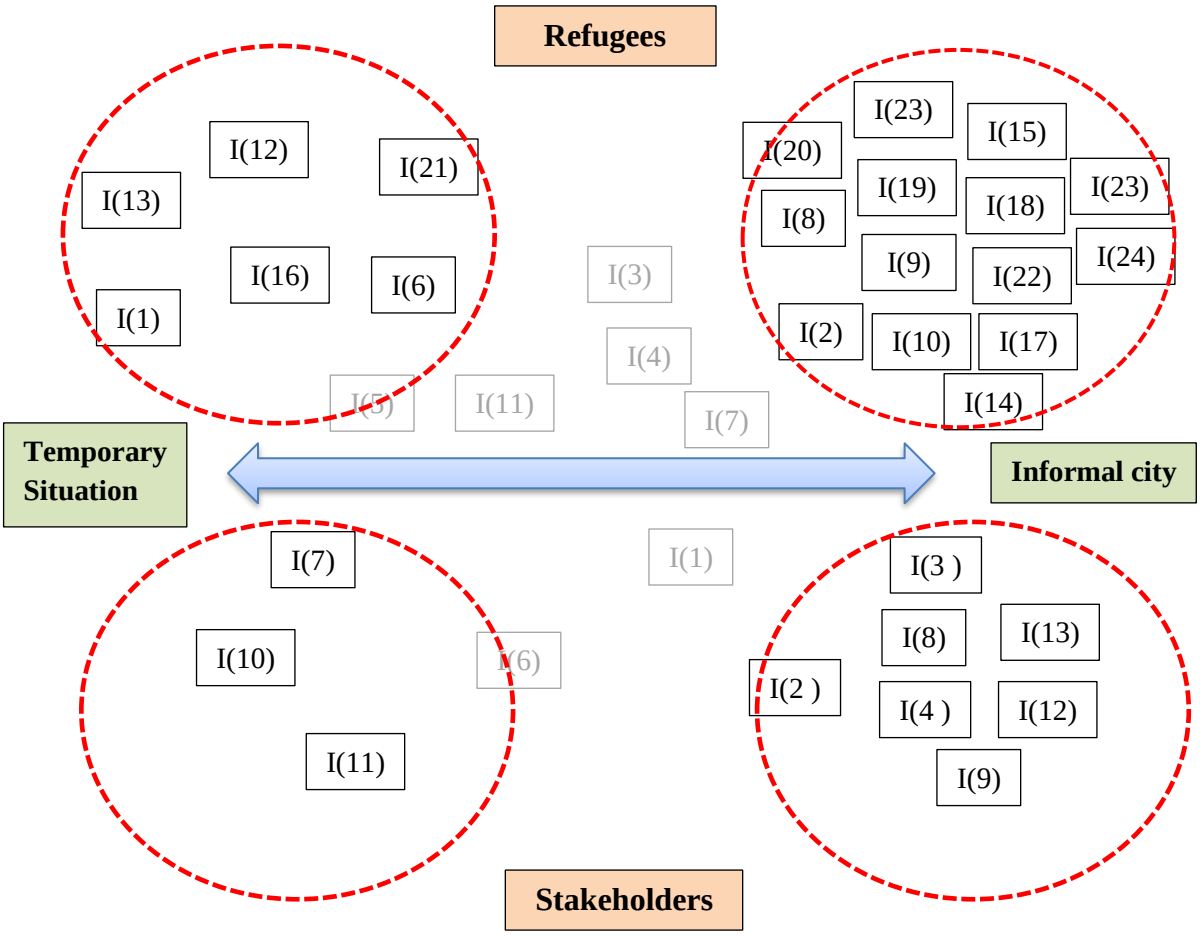


Figure (4.10): Responses of refugees and stakeholders regarding camp situation

The researcher interviewed and collected stories which are discussed in the previous section, which shows how some of the refugees suffer from the camp situation, due to the temporary situation and from inappropriate context conditions. The experiences of humanitarian organizations and experts at several camps around the world were collected. The research coded stories and experiences of refuges and stakeholders respectively and considered the axial that links camps as a temporary situation and as an informal city. As a result four main circles are shown that include the number of responses in two impressions of the camp where the upper part refers to refugees and the lower part refers

to stakeholders. In summary, the upper circle on the right side of the axial shows most refugees' experiences of daily activities accept the camp as an informal city because it leads to normal living conditions, while the upper left circle included fewer responses compared to the right, which shows refugees accepting of the temporary situation. In this regard, those refugees who accept a temporary situation have an opportunity to create an informal city because most of them are either working as volunteers in the UNHCR or are employed as masters by the UNHCR. They have the opportunity to continue their education or permission to work outside the camp.

Humanitarian organizations' responses are presented in Figure (4.10) the lower right circle is most of the interviews with stakeholders indicating that refugees have the right to live like normal people and must change a temporary situation of camps into an informal city. They argue that tents or transitional shelters must be for a short period of time only. The challenges are to find links between technical specifications and differences of social and cultural aspects. While the lower left circle shows fewer responses which means they are satisfied to leave refugees in a temporary situation.

The research presents some of stories and experiences by using an ethnography strategy to show the richness of the collected data using stakeholders' opinions and refugee stories about their situations. Specification lists are provided by the researcher and support the technical requirements of adequate living conditions for refugees in a hot-dry climate, however, stories and experiences in the field support social and cultural elements that are difficult to present by standards or technical requirements. The ethnography strategy enables clarification of the research knowledge depth.

4.10 Fieldwork Findings

The analysis leads the investigation of social implementation, settlement implementation, shelter performance and context conditions of refugees in a hot-dry climate and explores living situations in their camp.

The interviews aim to show the required specifications that are needed for addressing refugee shelters in hot-dry climates in terms of the relation between refugees' needs and with relation to context conditions, adding new specifications, revisiting specification

parameters and consideration of prioritization. All are taken into account in terms of improvement of the strategy for refugee living conditions.

4.11 Outcomes of Stakeholders' Responses

Nvivo software is used to analyze data into codes and nodes to answer research questions and to achieve the research objectives as shown in Table (4.2), (4.14), (4.19), and (4.20), stakeholders' responses are presented as follows:

1. The refugees' requirements pay more attention to social and cultural difficulties and shelter performance than other stakeholders' requirements. While more attention is paid to protection, population density and policy of providing services.
2. The lack of understanding of refugees' needs and their priorities in terms of improving their living conditions in the camp.
3. Some interesting points to humanitarian organizations are the same as the priorities of refugees' requirements, humanitarian organizations have direct contact with refugees and are involved in their stories due to their position in the field.
4. Local manufactures indicated that these were time and cost as the first priority.
5. Experts and responsible institutions' interviews noted that it is necessary to consider types of design and materials when donors commit to certain shelters as well as timing, delivery and cost. Data has been compiled from the results analysis for stakeholders throughout the research phases. It shows different concerns for each group (local governments, refugees, humanitarian organizations, local manufacturing companies, responsible institutions and experts). Such differences depend on the interest and points of view regarding the problem of housing refugees in hot-dry climates. Obviously, stakeholders' responses noted varied priorities on the subject of the research questions. In other words, the lack of communication between stakeholders' clearly is evident in the results analysis and prioritization.

4.12 The Prioritizations of Stakeholders

The priorities are different between stakeholders as shown in Table (4.27) in terms of the research criteria; safety and security, comfort, social context, stability, shelter performance (durability, being demountable, flexibility and modularity) and independent constant energy. An analysis of the results presents the differences in stakeholders' priorities, the different priorities helped in considering further requirements when demonstrating specifications.

As indicated in the refugees' sections, protection is the first priority while other priorities fluctuate between other requirements in relation to the social and environment context, as for local government priorities. The establishment of security inside camps is a vital part of the political issue in host countries, whereas local manufacturing companies' priorities are mainly concentrated on financial income. The priorities of humanitarian organizations located in Jordan are primarily the protection of refugees as well as minimizing service difficulties (discontinuous electricity and water). These priorities are followed by social and cultural differences, climate difficulties and shelter performance.

Experts and professionals noted that their priority is construction and the structural requirements of shelters, which refer to durability under shelter performance. They stated their priorities as the following; at first construction and structural elements must be obtained from a local market for adapting the environment context and decreasing the high cost of transfer / movement, the second consideration is the environment context (climate and land conditions) which refers to comfort and dignity. Identity consideration is the third priority which relates to social context, other priorities varied between stability, safety and security, and independent constant energy. Responsible institutions noted that the first priority was management control (cost and time) which relates to settlement implementation and is outside the research criteria. Considering background diversity is the second priority, which refers to the social context, the third priority is environment context (climate and land conditions) under comfort, then stability, safety and security, shelter performance and independent constant energy are the next priorities that fluctuated depending on the context situation.

			Prioritization					
			Priority 1	**Priority2**	**Priority3**	**Priority 4**	**Priority 5**	**Priority 6**
Stakeholders	**Local government**		Safety and security	NA	NA	NA	NA	NA
	Refugees		Safety and security	Shelter performance, climate difficulties, social context, independent constant energy, and stability				
	NGO in Jordan		Safety and security, Stability Services difficulties (discontinuous electricity and water)	Social and culture differences	Climate difficulties	Shelter performance		
	Local manufacturing companies		Financial income	NA	NA	NA	NA	NA
	International experts and NGO	**Experts and professionals**	Shelter performance	Climate difficulties	Social context	Stability, safety and security and independent constant energy		
		Responsible institutions	Management control (time and cost)	Social context	Climate difficulties	Stability, safety and security, shelter performance and independent constant energy		

Table 4.27: Stakeholders' prioritization

Accordingly, the results analysis presented that stakeholders' priorities focused on one or two priorities, as shown in Table (4.27). The rest of the priorities are ignored or unnoted, possibly because of time constraints and focusing on one or two priorities, although other priorities exist in their perspectives, however priorities fluctuate and it did not reach a constant level of understanding regarding refugees' needs.

4.13 The List of Specifications

The specifications list to be demonstrated, as shown in Figure (4.10) is formulated from a review of literature and the results analysis that were collated through interviews that

articulate stakeholders' prioritizations. In general, 75 specifications are detailed under related criteria. For further details about each specification (see Appendix N).

Figure (4.11) shows the structure of distributing specifications under research criteria. Several sub-criteria also exist, and although these refer to the same criteria, it specifies certain dialogue relating to the main areas; the fundamental requirements and specifications, which are now discussed.

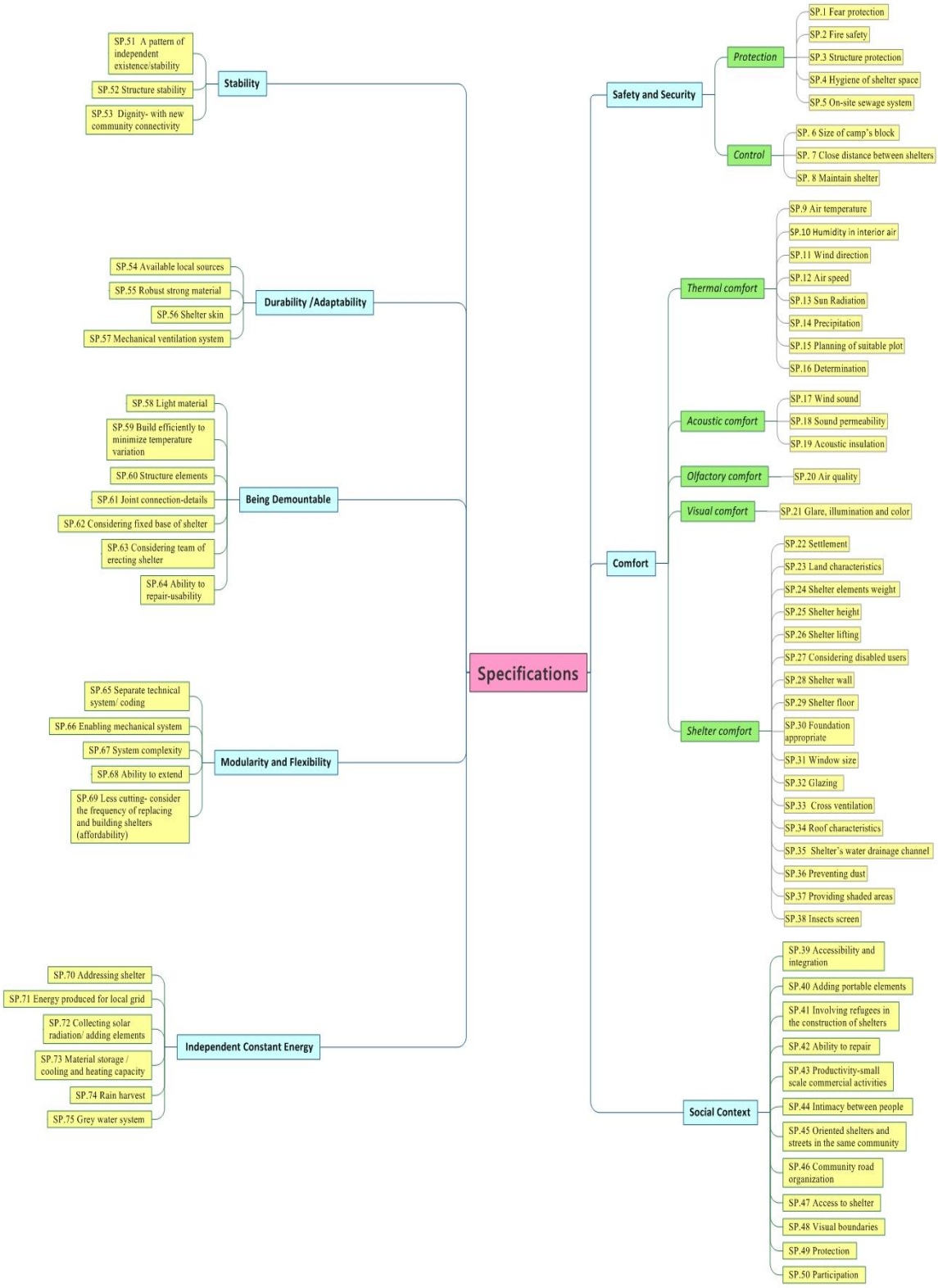


Figure 4.11: The specifications list

Some criteria extend to sub criteria in order to prevent duplication. Such criteria are presented under the safety and security sub-criteria of protection and control. The sub-criteria of comfort are thermal comfort, acoustics comfort, olfactory comfort, visual comfort and shelter comfort, while other criteria exit without any sub criteria. Three main questions are considered in relation to the specifications list as showed in (Appendix N). To answer these questions, the research justifies information in the list by connecting literature and related studies with a results analysis of data collection. Additionally, filling the gaps between the stakeholders that the research explored is considered when formulating the specifications list.

The next stage addresses phase five of design science which is concerned with evaluating the *artefact* (list specification). The evaluation is done by architects by giving them a list as the only source of information to illustrate a model for refugees' shelters. The evaluation aims to measure if the list is applicable and includes enough data and understanding to produce an adequate shelter for refugees by addressing the solution for the problem considered by this research.

4.14 Phase five: Evaluation list of specifications

The evaluation phase includes the proposed designs of shelters in a hot -dry climate based on the specifications list that the researcher provided to several local architects. The proposed designs contain different illustrations of refugee shelters such as plans, sections, details, concept diagrams and 3D images. This section of the chapter contains the evaluation of the specifications list by showing alternative proposals based on the architects' understanding and showed the feasibility of the specifications list to solve the practical problem.

Table (4.28) shows the fifth research question and research objective that is required to be achieved in the evaluation phase.

Objectives	*Research area*	*Survey questions*
5th Research Question: **How well will the specifications be utilized for supporting the design of a shelter that meet the needs of refugees in hot-dry climate?**		
To evaluate the ability of specifications to solve the explicated problem (meet refugees' needs)	Evaluating list of specifications by providing 7 architects and engineers to illustrate design of shelter. Informal interviews conducted with architects and engineers from outside the area of accommodating refugees without an explanation of list of specifications.	Asking architects and engineers to illustrate the design of shelters to describe how the specifications illustrate design and explain the specifications' suitability for illustrating the design of shelters as follows; -The research conducts preliminary prove of specifications list by illustrating design of shelter that includes sort of materials and proposed design. -The research makes another iteration of specifications and come with some of qualitative prove of materials and proposed design. -Providing the possibility of practical involvement in the specifications list without evaluation of the design.

Table 4.28: The relationship between the fifth research question and the objectives of the first stage result

4.14.1 Evaluation Phase in Design Science

This phase conducts an evaluation of the list of specifications based on the design science method which aims to determine how the specifications list deals with the problem of

refugees being provided with adequate shelters in hot-dry climates, and to what extent the list meets the requirements of refugees' needs identified in the literature review chapters and field work section where the research followed the ex- ante in evaluation phase. The input of this phase is the specifications list, whereas the output is how and why such a list works in terms of design proposals by architects. To answer the question of how well the specifications list solves the refugees' problem, the architects' proposals offer descriptive information on the design elements in the form of plans, elevations, sections, three dimensional views, materials, structural and constructional solutions and required services.

The researcher met 7 local architects who have different backgrounds, including a professor in the architectural department at Petra University, four site architectural engineers, a postgraduate student in the architectural department in the German-Jordanian University in Jordan, and a project manager in the architectural sector at Jordan Green Building Council. In relation to the limitations of the research evaluation, the researcher engaged architects to be part of the evaluation phase and seven members agreed to be part of the evaluation phase, whereas the rest apologized as the evaluation activity would have involved a lengthy process in reading and illustrating proposals. The researcher considered providing the specifications list without any guidance, comments and suggestions (see Appendix O) or to influence the direction of the proposals in any way. In short, the outcome of the evaluation phase is presented through alternative design proposals and by extracting alternative proposals that fulfill the specifications list and define the requirements of refugees and solve the explicated problem of the research.

4.14.2 Methodology of the Evaluation Phase

The methodology of the evaluation phase is divided into two stages. Stage one aims to discuss each proposal broadly and individually in relation to the specifications list and research criteria with reference to points of interest and the researcher's opinions. The second stage reflects on the design alternatives and towards the specification list by grouping them under research criteria which include human safety, engineering safety, health and comfort, as shown in Table (4.29) where it is not feasible to apply all specification items. In summary, the researcher compared alternatives and measured

design proposals to show the opportunities that each offers, and extracts the results of the prototype as a model. The study shows how the appropriate prototype has the possibility of infinite design alternatives based on diversity of local context and not as one perfect design.

4.14.3 Overview of Architects' Samples

This section shows seven illustrations of refugees shelters that were presented by local architects in terms of the evaluation phase of the specifications list.

4.14.3.1 Proposed shelter design No. (1)

The proposed shelter design provides four alternatives of different sizes for shelter users as showing in Figure (4.12). The designer considers safety and security and applies this through structural elements which make the unit suitable for people. The design incorporates thermal comfort and natural ventilation is considered. However, visual and acoustic comfort is not obvious in the proposal in terms of isolated material of a shelter. It is possible that the solution could provide a level of stability for users with permanent materials in the form of concrete. In addition, the design does not incorporate modularity, flexibility and is not demountable. The designer presents information and data about utilizing solar power to produce energy as well as a system to harvest rainwater.

In short, the social context consideration is absent in this proposed design and there is a lack of data of regarding how the design will enhance social networking between internal and external spaces and how it relates to the community. Similarly, the connections between the unit and other shelters are not evident.

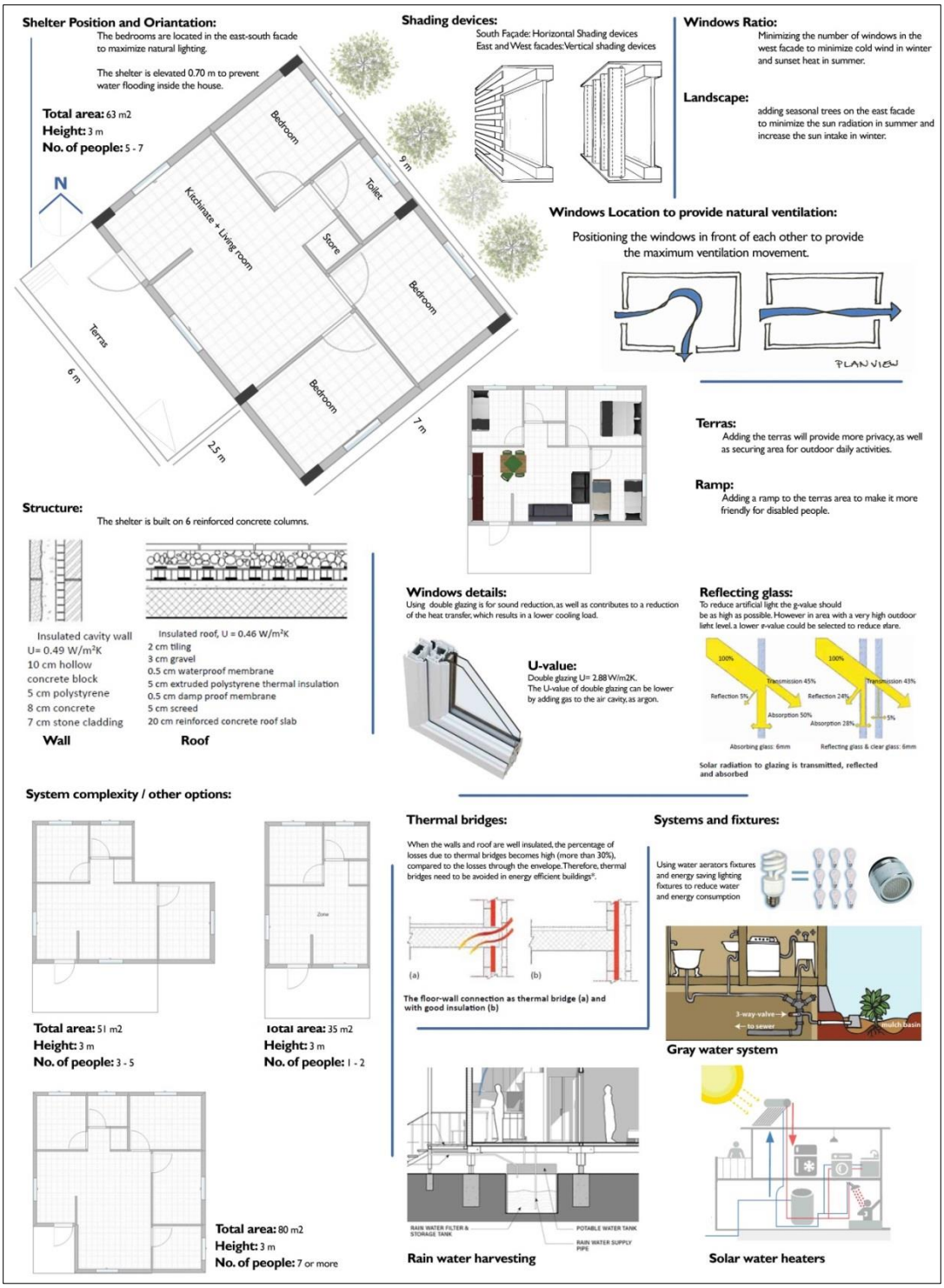


Figure 4.12: Proposal No.1 (Source: architect No.1)

4.11.3.1.1 Comparative discussion No.1

This section discusses the proposed design by comparing details of the design with the specifications list. This is shown Table (4.29);

Group of specifications	Check list
Human safety	✓
Health and safety	✓
Control context	
Thermal comfort	✓
Acoustic comfort	
Visual comfort	
Shelter performance comfort (functional aspects, structural elements)	✓
Adaptation	
Social – fabric cohesion	
Urban context	
Structural stability	✓
Durability	✓
Demountable	
Modularity and flexibility (simplicity, generality and minimizing)	
Independent constant energy	✓

Table 4.29: Comparative discussion of proposal No. (1)

Regarding the proposed design (1), the designer shows an understanding of how to distribute space inside a shelter by providing three alternative areas, however, adequate space is one of the challenges that must meet with other specifications especially the possibility of modularity and flexibility and way of applying the demountable criteria. In this respect the designer has paid attention to some important details of shelter performance, especially structural elements, but not others including shelter performance and comfort.

Human safety is acknowledged by the designer but the design cannot offer complete safety and security without applying other factors of visual and social comfort. It is clear that the designer has given good attention to the details of thermal comfort by offering shading devices located to shelter the façade, whereas details about what materials must be used in hot-dry climates are not provided. This could be a barrier towards costs of time and logistics. The designer describes broadly the system of solar water heaters, rainwater harvesting, a gray water system and the efficacy of thermal bridges in hot-dry climates.

Sadly, the urban side in this design is not present and no information or data is provided about what exactly the designer is looking for in terms of connections between the shelter, the block, and the community. In contrast, the designer pays attention to structural stability by using reinforced concrete but this may have disadvantages of cost and time consumption and may be unsuitable for shelters in hot-dry climates.

In short, the design shows that attention has been paid to several specifications on the checklist displayed in Table (4.29). There is, however, a gap between the proposed shelter and the urban community and the designer does not consider the suitability of materials to the local environment and cost efficiency. Also, no clear attention has been given to the dismantling, modularity and flexibility of the proposed shelter.

4.14.3.2 Proposed Shelter Design No. (2)

The designer incorporates multiple spaces. Each room takes the shape of an onion dome and each dome comprises eight segments that can easily be dismantled by sliding through channels on both sides of each segment as showing in Figure (4.13). Regarding thermal comfort, the designer considers this through a raised cylinder to allow hot air to escape through a hat-like top, which contains several blades and rotates along a circular base by the force of the external wind current. Each segment has a fixed side that can be added to or removed in response to users' needs. The designer arranges a connector unit between two units that contains a bathroom and small storage area on one side and a passageway on the other. For insulation, the designer inserts a sandwich panel of Plexiglas that contains heat and sound insulation. Colored patterns can be fixed to the external skin to make a colorful dome. Another component of the shelter's performance is achieved by

covering the ground with concrete and planting vegetables and herbs in a linear manner as shown in Figure (4.13).

However, there is no clear evidence of producing energy requirements for rain harvesting and gray water systems. There is information about the connections between the shelter and other shelters in the community via streets, pedestrian roads and shared spaces for social events.

Figure 4.13: Proposal No. 2 (Source: architect No.2)

4.11.3.2.1 Comparative discussion of proposal No.2

This section discusses the proposed design by comparing details of the design with the specifications list which is set out in Table (4.30) below;

Group of specifications	Check list
Human safety	✓
Health and safety	✓
Control context	
Thermal comfort	✓
Acoustic comfort	
Visual comfort	
Shelter performance comfort (functional aspect, structural elements)	✓
Adaptation	✓
Social – fabric cohesion	
Urban context	
Structural stability	✓
Durability	✓
Demountable	✓
Modularity and flexibility (simplicity, generality and minimizing)	✓
Independent constant energy	

Table 4.30: Comparative discussion of proposal No. (2)

The proposed design shows an adequate understanding of thermal comfort and proposes a very simple technique that allows hot air to go up and cold air to enter inside the shelter via an onion-shaped design. The design simulates a nomadic tent established in desert climates like Sahrawi and Touareg, however, the technical components and skills needed are not noticeable throughout the design. As a result, this information could be a barrier to understanding the construction in terms of users' skills and necessary tools. Despite the possibility of producing segments in the manufacturing field there is a financial concern and issues of time in transferring the two barriers of this shelter to meet the influx of refugees. The designer pays attention to flexibility and growth, accomplished through the method of arrangement. Adaptation is clearly addressed in the design by allowing users to add their meanings and values of their original home by coloring each room differently to create a personalized unit.

However, there is no evidence of an arrangement between shelters in the community and the areas left as void spaces and it is hard to understand how the space and urban organization might be rearranged. Thus, the arrangement as a group of huts might be a case of ignoring space organization regarding the community. Structural stability is addressed by using the onion form that leads to being heavy on the ground, however, it may be refused by local government relating to other political concerns.

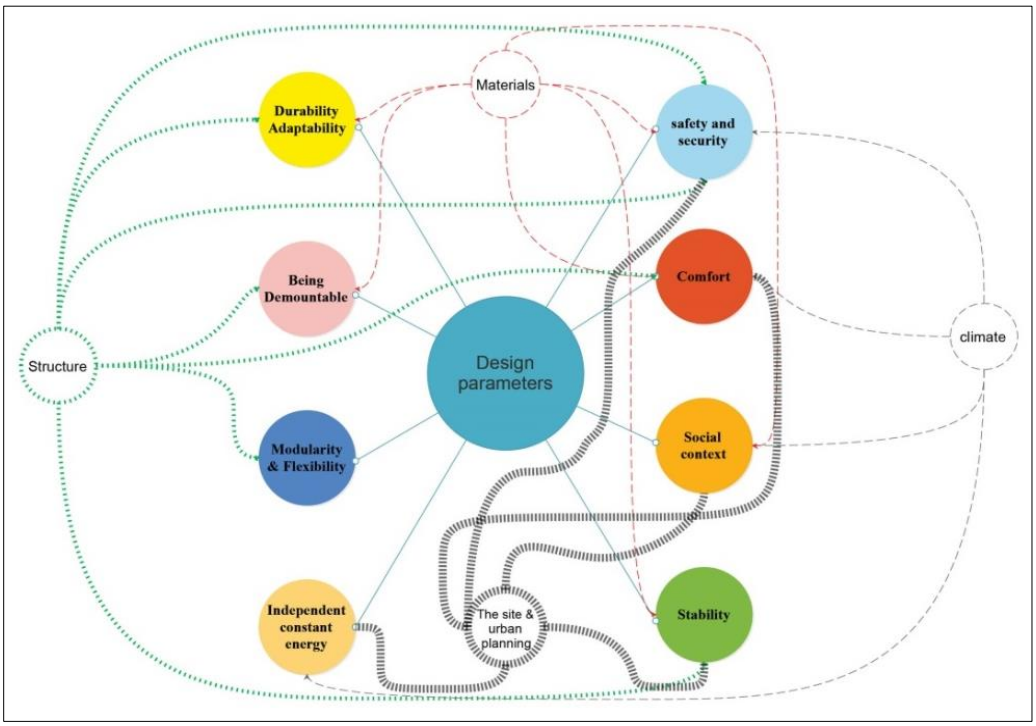
In short, the designer has succeeded in establishing belonging and stability by adding personal requirements and vegetation. The dome form supports the robust structure which leads to stability of having a normal life. On the other hand, the difficulty of arranging urban spaces between shelters could lead to irregular, void spaces and close distances that might create problems.

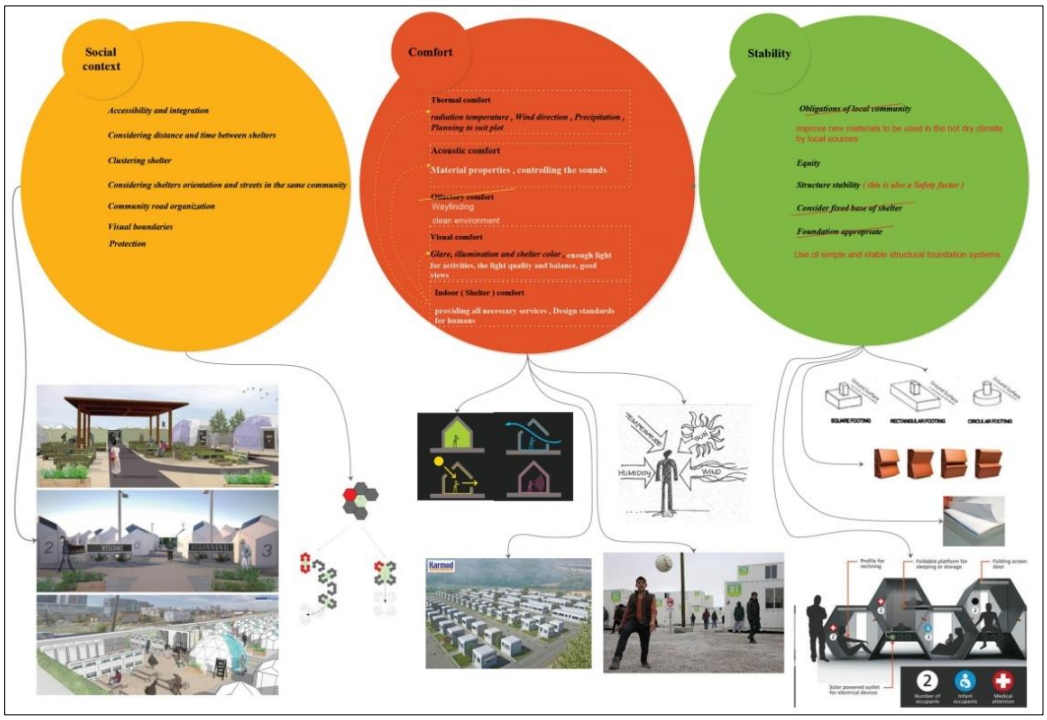
4.14.3.3 Proposed Shelter Design No. (3)

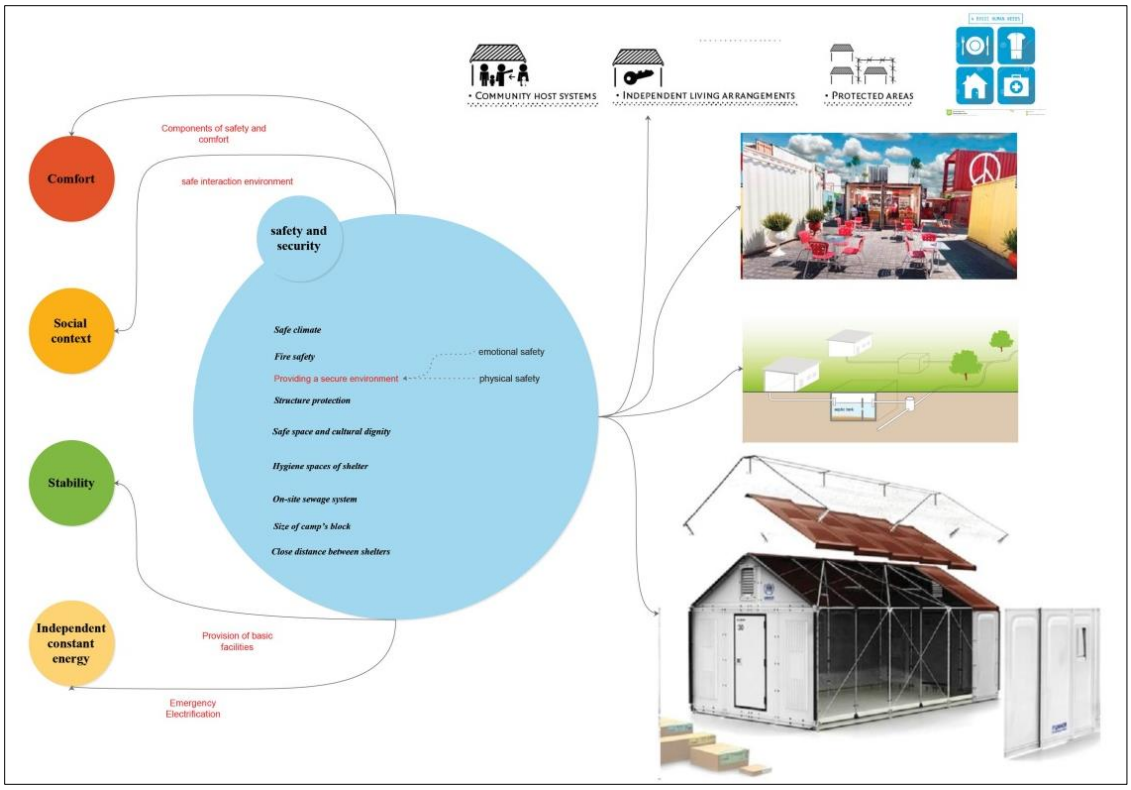
This case takes a different approach to providing a solution and depends on an information graphic diagram to demonstrate the proposed solution dividing the criteria into four main factors: materials, climate condition, structure elements, and site / urban planning, as shown in Figure (4.14). All these are related to design performance yet the designer addresses safety together with illustrating the provision of a secure environment in two ways: emotional safety and physical safety. An example is provided by coloured shipping containers, a water collection system and a framed structural system based on erected design elements.

Regarding other criteria, the designer makes a number of suggestions relating to specifications under each criterion. Under ‘social context’ there is the possibility of organizations and alternatives for shelter orientation. The comfort criterion is considered via thermal components and visual and outdoor accessibility. Two story shelters are another suggestion. Achievable and keen solutions are combined under the stability and the designer shows attention to users’ age, especially infant groups. A hexagon form is suggested that is flexible and easily dismantled. In the same regard, modularity and flexibility, demountability and durability are established whereby the modular unit is flexible to users’ needs and for disabled people. The light materials provide durability

and the shelter elements are easily dismantled. A multifunctional unit is considered and a resistant fly layer of fabric to guard against environmental factors.







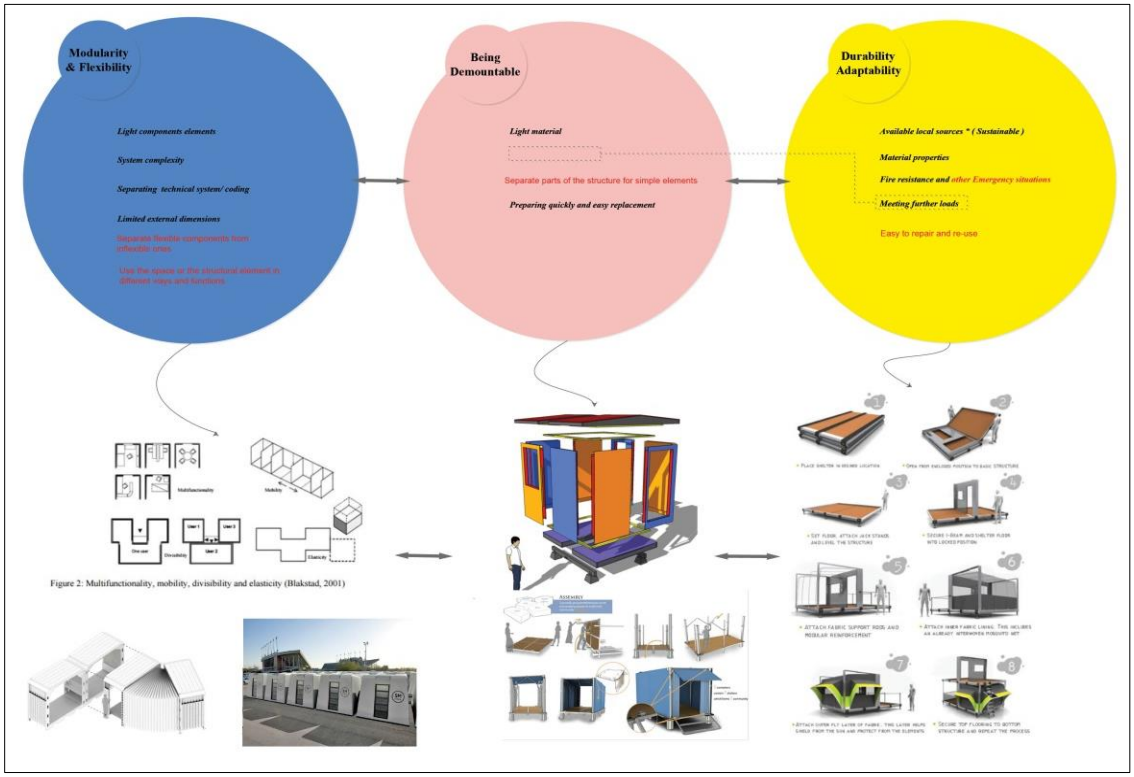


Figure 4.14: Proposal No.3 (Source: architect No.3)

4.11.3.3.1 Comparative discussion of proposal No. 3

This following comparative discussion shows point of interest in the proposed design in terms of specifications in groups as shown in Table (4.31).

Group of specifications	Check list
Human safety	✓
Health and safety	
Control context	
Thermal comfort	✓
Acoustic comfort	
Visual comfort	
Shelter performance comfort (functional aspect, structural elements)	✓
Adaptation	✓
Social – fabric cohesion	
Urban context	✓
Structural stability	✓
Durability	✓
Demountable	✓
Modularity and flexibility (simplicity, generality and minimizing)	✓
Independent constant energy	

Table 4.31: Comparative discussion of proposal No.(3)

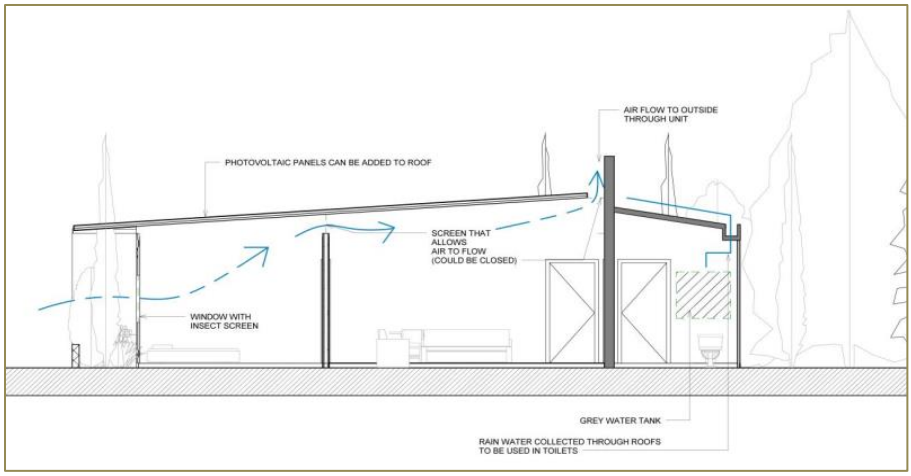
The designer provides an information graphic analysis to provide alternatives to adopt as solutions for refugee shelters in a hot-dry climate. However, the designer presents many design options which have drawbacks. The research criteria show interesting data about flexibility, modularity and demountable components of the design shelter, however, there is a lack of information about thermal comfort. Safety and security is broadly clarified by connecting with the social context in terms of social safety yet there is no clear evidence of how the community relates to the urban organization. In short, the suggestion of using an information graphic is limited in gathering information about design components. The

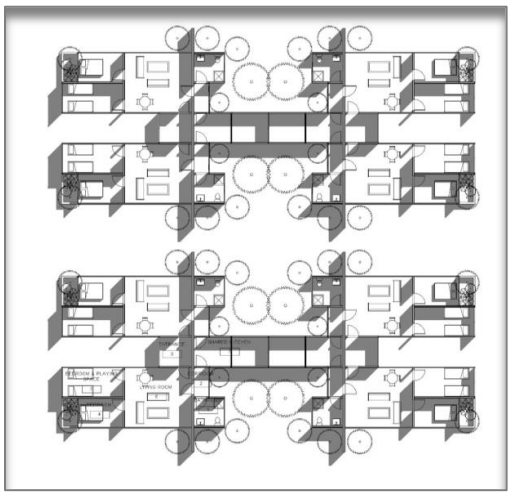
proposal is, however, useful as an analytical approach to developing alternatives which support the main idea of offering infinite prototypes that lead to solutions in providing adequate shelters for refugees in hot-dry climates.

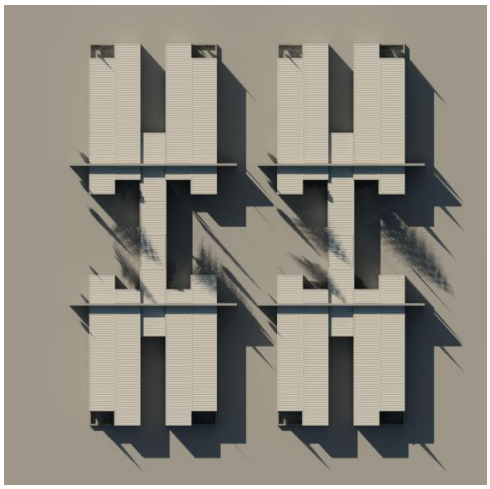
4.14.3.4 Proposed Shelter Design No. (4)

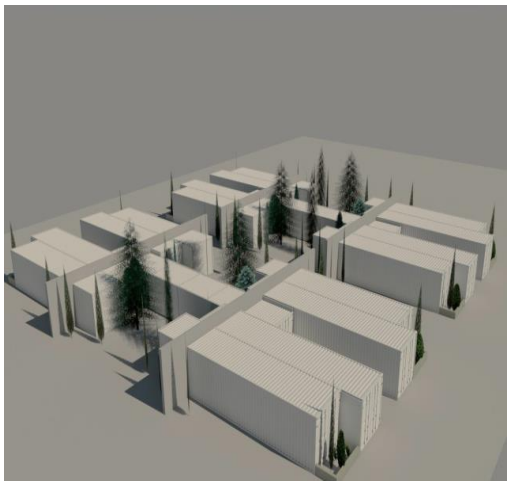
The designer creates a solution by using a shipping container as one of the main constituents of the housing module that could be repeated with some variations and iterations to make it more case specific as showing in Figure (4.15). Regarding structural stability, a shelter is fixed by a layer of concrete footings as a base. A wall is to be erected that separates the main housing functions (living and sleeping spaces) from services such as bathrooms. The heart of every house; the kitchen is to be shared - possibly by at least two families. As far as flexibility and modularity, the layout is done according to families of an average of 4-5 people. If the number exceeds this then the unit is to be enlarged by adding an extra container module. The materials of the shipping container wall must be considered in terms of thermal balance where the design is based on insulated walls. Air-way passages are to be provided to enhance the air circulation within the compartments. This would include openings in walls and slabs, those openings are to be covered with insect screens, and the possibility of opening and closing them at any time is valid.

In terms of energy consumption, roofs are to be tapered and the addition of photovoltaics (PV) is possible to achieve some energy reduction. The roof tapering would also make it possible to collect rainwater that could be used for toilet facilities. Regarding social context and adaptation, there is limited scope in the shared kitchen between two families and there is no extra information about social safety and fire reduction.









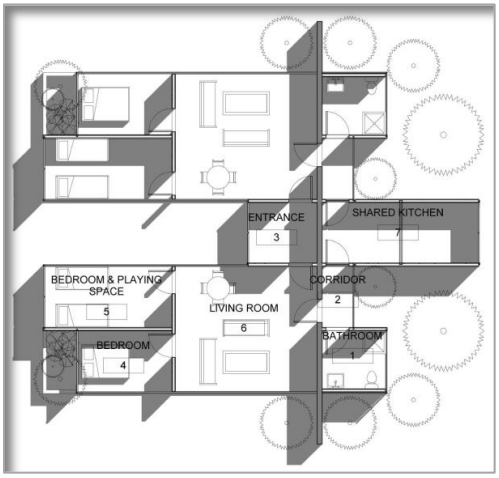


Figure 4.15: Proposal No.4 (Source: architect No.4)

4.11.3.4.1 Comparative discussion of proposal No. 4

This following comparative discussion shows points of interest in the proposed design in terms of specification groups as shown in Table (4.32).

Group of specifications	Check list
Human safety	✓
Health and safety	
Control context	
Thermal comfort	
Acoustic comfort	
Visual comfort	
Shelter performance comfort (functional aspect, structural elements)	✓
Adaptation	
Social – fabric cohesion	✓
Urban context	
Structural stability	✓
Durability	✓
Demountable	
Modularity and flexibility (simplicity, generality and minimizing)	✓
Independent constant energy	✓

Table 4.32: Comparative discussion of proposal No. (4)

The design is based on a shipping container and has a simple main frame structure supported by a secondary frame. However, it has limited availability on the local market and although it is a cheap solution as raw materials, there are logistical problems in its transfer and storage. The shipping container also needs improved insulation to achieve better internal air quality. The designer connects a shared space for kitchen and storage between two units by reducing the plot of each unit in size. However, there is the risk of fire, especially when occupants use ovens and other devices.

Regarding human safety, the designer considers this by offering a gathering area and a small community between eight units. In other words, the enclosed space is highly recommended and it succeeds in establishing social privacy and dignity with two gates that provide safety and security. Units are easy to install and maintain but there is a concern about their build complexity and the weight of the components as age and gender is a limitation. As far as reducing energy and water consumption, there is no clear evidence as to how this will be achieved.

In short, the proposed design is considered modular by the use of a shipping container which also has recycling advantages. The social context is considered in each community which supports the adaptation and personalization of living conditions as well as helping children to play in a safe community. The designer pays attention to privacy from inside the unit to outside the unit by using a hierarchy of scale for public to semi-public, semi-private then private and which has a positive influence on the quality of social control. However, there is inadequate information about installing insulation to the units, the environmental aspects, costs and transportation.

4.14.3.5 Proposed Shelter Design No. (5)

The following proposed design shows details of a structural system with a steel frame, and steel columns. Folded partitions are considered inside the unit which functions according to users' needs. Folded bunk beds are required because of the limited space. The design offers a mounted rail if internal separation is needed to provide social privacy and a small deck is shown for outdoor activities as showing in Figure (4.16).

In terms of environmental aspects, the design offers a grill to collect water and a solar panel on the roof opening which is covered with translucent materials with consideration to the roof slope. For collecting water there is a channel that slopes through a pipe and a light fabric material is suggested for shading. The proposed design provides technical information about the joint between unit components and details about used structural materials, cladding, insulation and covering surfaces.

A connection between units and a community based on urban organization is not evident in the design and, as a result, ways of enhancing social networks from inside to out are

not detailed. With regards to standardization, users' requirements and technical guides are not sufficient to reach an adequate level of personal input, adaptation and belonging.

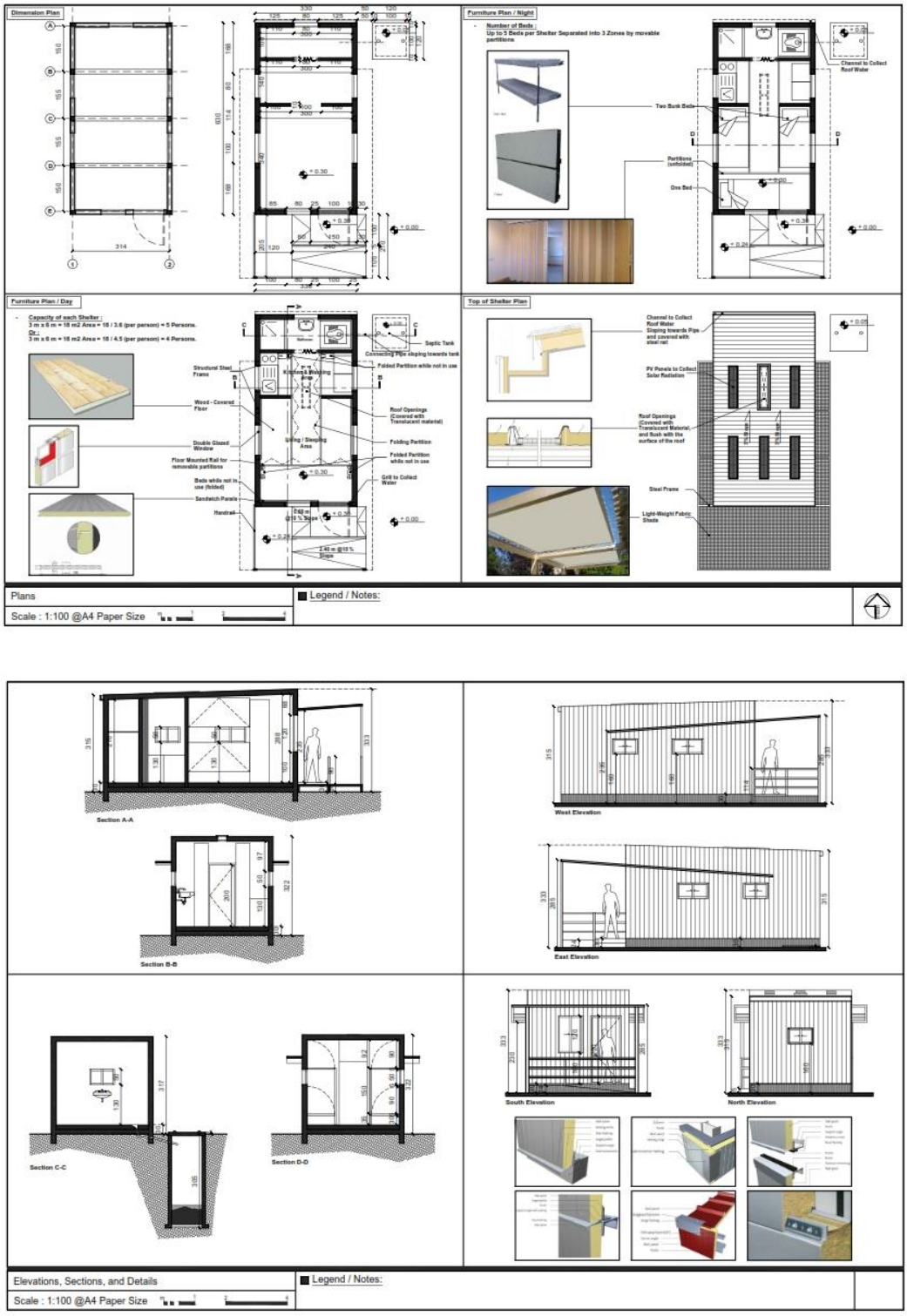


Figure 4.16: Proposal No. (5) (Source: architect No.5)

4.11.3.5.1 Comparative discussion of proposal No.5

The comparative discussion aims to illustrate the points of interest in the proposed design in terms of specification groups as shown in Table (4.33).

Group of specifications	Check list
Human safety	✓
Health and safety	
Control context	
Thermal comfort	✓
Acoustic comfort	
Visual comfort	
Shelter performance comfort (functional aspect, structural elements)	✓
Adaptation	
Social – fabric cohesion	
Urban context	
Structural stability	✓
Durability	
Demountable	
Modularity and flexibility (simplicity, generality and minimizing)	
Independent constant energy	✓

Table 4.33: Comparative discussion of proposal No.(5)

The proposed design shows an understanding of standardization, in terms of structural and functional components. The designer pays more attention to joints between components and in producing energy the design has considered water collection and location, although based on the available information it is difficult to determine the cost.

The design considers social concerns inside units by providing privacy and social safety by adding partitions and folded doors. In contrast, there is no detail on enhancing social privacy from inside units to outside and the relationship between units and the community is not clear. Openings to the roof is a solution to circulate air inside the unit,

however, the designer does not specify a size of opening or address the environmental challenges of hot-dry climates.

In short, the proposed design pays more attention to technical aspects and the space needed per person without considering extended families and the social impact of these very small areas. Also, energy consumption is not considered in detail while the social context is not evident in the design. The design pays limited attention to the specifications group, as Table (4.33) shows, and which was primarily about structural requirements of units.

4.14.3.6 Proposed Shelter Design No. (6)

The proposed design presents a hexagonal shape to offer a similar form to that of a tent. It concentrates on simplicity by integrating with the surrounding environment and offers shelter by lifting it off the ground to provide comfort and safety, as shown in Figure (4.17). The roof of the shelter is based on a hexagonal steel structure and the joints and interlocking parts are self-supporting. Regarding stability, the adjustable steel bolt anchors are fixed to the ground on a concrete slab. The designer considers thermal comfort inside through the use of sustainable materials to external walls. Based on the designer's view, the materials can control fluctuating temperature between day and night and so are able to deal with the cold air at night and the hot daytime temperatures.

Ventilation is mentioned by providing roof openings as well as solar panels, however, the information about the cause of providing openings on the roof does not exist. Rain collection on the roof is achieved via pipes and a refillable tank which is manually pumped. There is no evidence of how the roof will be able to withstand water load. Logistical control is indicated by the designer, in terms of the packaged shelter.

The design combines shelters together in clusters, in order to control social safety and other safety requirements. Each shelter has an irregular space for outside activities and shared exterior green spaces.

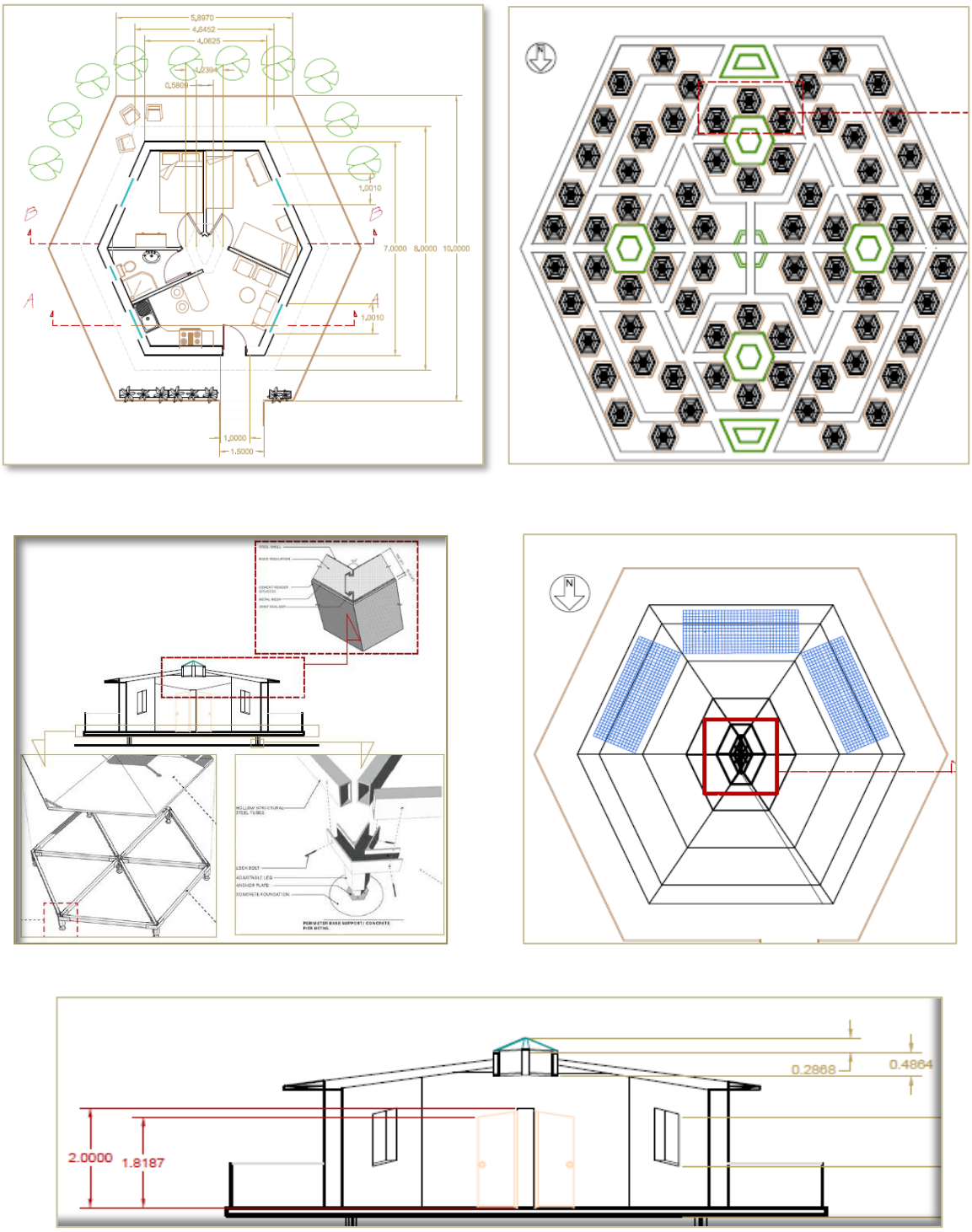


Figure 4.17: Proposal No.6 (Source: architect No.6)

4.11.3.6.1 Comparative discussion of proposal No. 6

The following Table (4.34) shows the comparative discussion through some points of interest in the proposed design in terms of specification groups.

Group of specifications	Check list
Human safety	
Health and safety	✓
Control context	
Thermal comfort	✓
Acoustic comfort	
Visual comfort	
Shelter performance comfort (functional aspect, structural elements)	✓
Adaptation	
Social – fabric cohesion	✓
Urban context	
Structural stability	✓
Durability	
Demountable	
Modularity and flexibility (simplicity, generality and minimizing)	
Independent constant energy	✓

Table 4.34: Comparative discussion of proposal No. (6)

The proposed design presents several points of interest in finding a solution based on the specifications list. The hexagonal form provides a sense of the nomadic tent and it might be that the designer has taken the inspiration from previous solutions of vernacular architecture. However, this may not be suitable for controlling social safety and privacy. Irregular outer spaces might cause social problems and impact on human safety. Additionally, the design must consider the hierarchy of spaces between private spaces to public spaces in terms of sectors, blocks, community and shelters.

The designer mentions that the structure performance of the unit is easy to build but without confirming that the units can be dismantled. The thermal comfort is met by using

special materials which are environmentally friendly and considering openings on the roof. Additionally, the design considered producing energy by solar power.

In short, the design shows an understanding of the structural requirements and energy consumption in terms of thermal comfort. It considers logistical issues related to packaging and storage, however, less attention is paid to the control context, social safety and privacy inside and outside the units.

4.14.3.7 Proposed Shelter Design No. (7)

The designer shows groupings of 16 shelters around a central activities area. Each shelter has its own plot and space and the systematic approach towards organization is clear. The design also presents the possibility of connecting each community with the main street through a buffer zone. The grid urban organization and hierarchy between spaces are established in the proposed design as showing in Figure (4.18).

Each shelter has a private entrance that presents with a ramp and handrail to gain access. The shelter is a modular structure which allows future expansion by adding an extra unit as the need requires. However, the materials used are not detailed in the design and leave this to donors. Two specific areas are a quiet zone towards the sleeping area and back yard which opens onto the bathroom and kitchen. The designer offers solutions for urban organization by ensuring that each shelter is integrated with the community and with other blocks in the camp.

Regarding accessibility, each shelter faces onto the back yard of the next shelter which may have drawbacks on privacy and acoustic comfort. Each adjustable unit has two openings and one door for each shelter. A number of solar panels are provided on the roof of each shelter. However, no additional information about the solar panel system operation and the roof's ability to withstand the load of these or indeed use of such energy is included in the proposal.

Figure 4.18: Proposal No. 7 (Source: architect No.7)

4.11.3.7.1 Comparative discussion of proposal No.7

The following Table (4.35) shows the comparative discussion through points of interest in the proposed design, in terms of specification groups.

Group of specifications	Check list
Human safety	✓
Health and safety	
Control context	✓
Thermal comfort	
Acoustic comfort	
Visual comfort	
Shelter performance comfort (functional aspect, structural elements)	✓
Adaptation	
Social – fabric cohesion	
Urban context	✓
Structural stability	
Durability	
Demountable	
Modularity and flexibility (simplicity, generality and minimizing)	✓
Independent constant energy	✓

Table 4.35: Comparative discussion of proposal No. (7)

Referring to Table (4.35) and a comparative discussion of the proposed design, it presents an understanding of urban context and organization by providing a hierarchy of spaces, shelter location, buffer zones and street planning. A disadvantage, however, could be that all the shelters face in the same direction and this impacts on social privacy and noise transference. The designers did not present information about thermal comfort inside the shelter and the challenges of local environmental conditions. Modularity and flexibility by adding units is possible based on the refugees' needs, however, the ability of doing so is limited due to the L shape design that adjusts units on one side. This could lead to inappropriate void spaces over time.

Openings are located on façades to ensure air quality, but, at the same time, the barrier could limit social privacy and undermine security. Also, there are no enclosed spaces between two or three shelters to enhance the social aspects.

In short, the proposed design focuses on offering a very systemic approach towards the urban context which leads to the standardization of shelters. This may, however, limit refugees' input in terms of inserting their wishes and needs. There is the provision of an activities area for social events but standardization may inhibit social privacy and social bonding. Also, thermal comfort and environmental conditions are not considered in detail and shelter performance is considered, in terms of modularity and flexibility but influenced by the availability of space.

4.15 Outcome of Proposed Designs

Seven proposed designs offered different solutions in response to the specifications list that was distributed. Two proposals focused on urban organization and control context, while two proposals emphasized the distribution of space inside the shelter to get maximum benefit from small areas and to improve the quality of life inside shelters. Structural stability and controlled construction was mentioned in one proposal. Social control and adaptation is presented in one proposal whereas the final proposal analyzed the specifications list with an infographic approach that presented alternative solutions, although this was inadequate for a design proposal.

To conclude, each proposal is shown in Table (4.36). The repetition number of the specifications group is based on the information in each proposal to clarify the designer's input or point of view.

Group of specifications	Repetition of specifications (check list)
Human safety	6
Health and safety	3
Control context	1
Thermal comfort	6
Acoustic comfort	NA
Visual comfort	NA
Shelter performance comfort (functional aspect, structural elements)	7
Adaptation	2
Social – fabric cohesion	2
Urban context	2
Structural stability	6
Durability	4
Demountable	2
Modularity and flexibility (simplicity, generality and minimizing)	4
Independent constant energy	5

Table 4.36: Comparative design proposals

As shown in Table (4.36), a recurring item was shelter performance in terms of the functional and structural elements. Structural stability and thermal comfort were placed second on the check list, while no attention was paid to acoustic and visual comfort. Social cohesion was mentioned by one proposal and the checklist items vary for the proposed designs.

In this regard, it is clear that the designers have an adequate understanding of shelter performance and show a grasp of connecting with the community and urban spaces, in terms of the specification list's feasibility. However, most of the proposals showed a lack of consideration of acoustic comfort and visual comfort. On the other hand, designers focused on human safety, thermal comfort, structural stability, and energy consumption. One proposed solution shows an understanding of social meaning (proposal No.2), while proposal No.4 presents a comprehensive understanding and explanation of shelter performance, in terms of structural requirements and its relationship with the urban

context. It includes a shared area to encourage social bonding and enhance social activities. It also supports social privacy and human safety by integrating social activities from inside the shelter to the outside with neighbours. Proposal No. 5 is a systematic solution that offers data about structure stability and modularity, however, the design takes a different approach by using a small internal space which is affordable through the use of folded design elements and furniture. It applied the demountable requirements easily by adding folding doors and beds which generated more space afterwards for other functions and activities.

In short, the designers have different views of creating a shelter proposal based on their background, which is bias free, because their area of interest is outside the refugee area. The research recommendation is to combine the proposed designs No.2, No.4, and No.5 for the reasons given to establish an adequate refugee shelter in a hot-dry climate; additionally the suggestion of combining these proposals was based on the requirements of the specifications list being adequately addressed. However, it is still incomplete and needs amendment for a comprehensive design, in the fact that it adopts the concept of combining between proposals, yet it aims to provide a prototype and it does not offer a perfect solution, there are plenty of alternatives that could solve the explicated problem of the research.

4.16 Chapter Summary

This chapter has shown the analysis of the collected data in several phases; phase one showed the results of the review of the literature by formulating the research criteria, which supports explicating the research problem, phase two is represented by interviewing refugees, local government and humanitarian organizations presented by the UNHCR to explore the connection between their prioritization and refugees' needs, also local manufacturing companies were included and the result of phase two formulated the requirements list. It was a foundation of the specifications list which refers to phase three. Phase four was represented by in-depth interviews with experts and responsible institutions and analysis was conducted through the use of NVIVO in both phases and coding requirements to answer related research questions and to achieve the objectives. An ethnography strategy was conducted after the demonstrating phase to present the

potential of practices and experiences of refugees and other stakeholders in the field, which was difficult to present using numerical techniques. The field work findings presented the prioritizations of stakeholders, after which such prioritizations are considered with the literature review section in presenting the list of specifications under the research criteria.

The last section showed phase five of design science, which refers to the evaluation phase by measuring the validity of the specifications list, in terms of the feasibility of solving the explicated problems by the proposed designs. The proposed designs have been formulated by architects to meet refugees' needs with reference to the specifications list.

The wider results and outcomes from the fieldwork in this chapter are a basis for exploring the stakeholders' requirements that are discussed in the next chapter, with consideration to the previous studies in the literature.

Chapter Five

Discussion

5.1 Introduction

The previous chapter focused on data analysis and showed the responses of stakeholders which were a foundation of the formulated requirements and demonstrating the specifications list by considering the design science phases. This chapter aims to bridge the gap between the literature review and the primary data results as presented in Chapters (2) and (4).

The chapter discusses these results in light of the literature, the primary data results and the validation by experts, in order to further validate the specifications. The chapter refers to previous interviews with experts, humanitarian organizations and refugees that were presented in Chapter (4) where fourteen interviews are coded and fifteen interviews with refugees are coded (see Appendix P). The chapter is divided into two parts, the challenges relating to refugees' needs, and the quantitative rationale behind the camp's urban organization in balance with social and cultural needs.

5.2 Part one: Challenging the Human Needs Approach

This part of the chapter covers the challenges of human needs in terms of differences between users which influence quality of life. It specifically looks at:

1. The standardization solutions of refugee shelters through indistinguishable visions of user needs in relation to types of disaster by humanitarian organizations and local governments.
2. The differences of stakeholders' needs towards the provision of shelters.
3. The impact of social and cultural needs on refugees' behavior and the consequent effect of shelter design and technical specifications of such.

5.2.1 Different refugees' needs in relation to the classification of disasters by humanitarian organizations

Accommodating increasing numbers of refugees causes many challenges to host countries. Humanitarian organizations lead on the task of housing people and providing basic needs, including food, drink, clothes, blankets and shelter. Humanitarian organizations cooperate with local governments to provide for the basic needs of people facing natural disasters such as famine, tsunamis, and earthquakes, and man-made disasters such as conflict caused by political instability, and base their responses on theories such as Maslow (1943), and Aldrefer (1969).

Interviewee (1) (an IFRC member) mentioned that Maslow's theory of human needs establishes how humans can be safe but that this depends on environmental, social and technical factors, as well as the local context, human needs are not just a grouping or aggregation of issues, however (Kesebir *et al.,* 2010; Bevan, 2012; Schaller, Neuberg, Griskevicius & Kenrick, 2010) show needs are influenced in certain points by context and integrate deeply with peoples' situations in social structures, such as the family system, cultural differences, economic development and political demands, of which the latter is a crucial controller tool in the process of migration systems of push and pull factors in modern societies and especially in the third world (Clinton-Davis *et al.,* 1992).

In this regard, interviewee (1) (an IFRC member) defines 'victims' as displaced people or refugees. According to theoretical basic needs there is no reflection of design specifications of shelters in relation to their situation whether it was caused by natural disasters or man-made disasters. The IFRC report of World Disasters in 2013 explained the comparison between displaced people, refugees, uprooted people and asylum seekers. The debate is about the differences between displaced people and other groups of people who flee from disasters; sometimes uprooted people stay as displaced people if they do not cross the international border, they may not register anywhere or claim their rights, which influences the accuracy of estimated numbers of people, as to whether they are categorized as refugees or displaced people. Clarke, Islam and Paech (2006) indicate there are unclear classifications of people who face a dangerous, insecure and unstable situation. NGO interviewee (2) mentions NGO and local governments do not classify

peoples' needs in relation to the type of disaster that affects them. Thus, the interesting point is that humanitarian organizations and local institutions divide refugees and other victims just in terms of terminology; however, they do not recognize their situation and related needs or deal with them as such.

El-Masri and Kellett (2001) said that man-made disasters are continuous, the difference between natural disasters and man-made disasters is that people who face natural disaster have a hope of return. Skotte (2004) indicates they are forced to move to another location in their country or across borders because their houses are destroyed and demolished, while people that face man-made disasters have not a hope of going back because of political restrictions and that is, unfortunately, the case of many places around the world. By analysing the literature review it emerges that a gap in the current knowledge exists on the specific needs of long term disaster victims, such as refugees that escape man-made disasters like wars, also the primary data presented that refugees explained their desire to go back home while expert interviewees (1), (2), (3), (4), and (5) showed their understanding that man-made disasters are a long term disaster which influences victims' needs.

The same gap emerges in the operational tools for humanitarian organizations, as this defines refugees as people who need safety and protection. The Handbook for Emergencies of UNHCR (2007) and the Sphere Project's (2011) responses to disasters are in terms of minimum humanitarian standards such as protection of principles, water supply, sanitation and hygiene promotion, food security and nutrition, shelter, settlement and non-food items, and health action. On the other hand, the primary data with refugee interviewee (5) indicates NGO and the UNHCR have the same solution for all cases, and even caravan colours are the same, refugee interviewee (5) indicates refusing to wake up each day to see the white color and expressed the feeling that it looks like a prison, as shown in Figure (5.1).

Figure 5.1: The border fence of the Al Za'atari camp

Regarding the relation between shelter terminology and refugees' needs, a 'transitional shelter' was used by the Shelter Center after the natural disaster in Haiti. The solution was limited by financial support by the Shelter Center to provide a temporary solution until the reconstruction of destroyed homes could be undertaken (Corsellis *et al.*, 2005).

Such terminology has become standard in different places around the world such as Somalia, Jordan, and South Kyrgyzstan as a solution for displaced people and refugees and in spite of the different impacts of natural disasters and man-made disasters (Manfield *et al,* 2004). Transitional shelters are produced for a temporary purpose used until they go back home, however, it is difficult to apply such a solution for refugees that have faced man-made disasters, the problem is not just finding a type of shelter, but rather finding an appropriate process based on the situation not based on the terminology. Thus, humanitarian organizations and local institutions are standardizing a solution for the complete case by providing a product. The standardized solutions appear in humanitarian organization reports and handbooks, such a solution might be effective for a temporary situation but such a solution presents insufficiency in terms of environment, social and cultural aspects, and service effectiveness.

El-Masri *et al.,* (2001) mentioned that one solution for all cases has many obstacles in terms of the built environment, local conditions and users' needs. Manfield *et al.,* (2004) argues that people have different needs relating to the situation, so it must be involved in the process of providing solutions in the early stages of the process. In contrast, a shelter is a product of space to work, sleep, rest and for children to play. NRC member interviewee (3) presents the importance of design for social and cultural aspects without reference to the cost and time framework and humanitarian organizations consider time and cost of a shelter without taking into account the differences of disaster situations.

In terms of peoples' needs, Szczepanikova (2008) states that the settlement of refugees in a new community is complex, it is not just about providing a place to live that has the same social and cultural frameworks. It is a process involving many factors and which, ideally, leads to a comprehensive solution. It is unwise to impose the same solution in different situations, as happened with refugees when NGO and local governments do not properly consider differences of natural and man-made consequences on victims. In contrast, Crawford, Suvatne, Kennedy, and Corsellis (2010) show humanitarian organizations might consider several solutions for those people among a context based on a global perspective for obtaining a shelter without constructive attention to duration of stay, social and cultural aspects, age and gender.

According to (Sheu, 2007; Schilderman, 2004) in emergency situations, organizations are not supporting a specific design for refugees, besides they do not know for whom such shelters are used; most organizations have prototypes that are developed in advance based on received aid without consideration of social and cultural aspects, as well as any depth of understanding of local context challenges.

Humanitarian organizations' annual reports have no clear evidence of comprehensive provision of shelters for people with specific needs such as women, pregnant women, single mothers, girls, unaccompanied children or even children without parents. Although the handbook recognizes that

"Certain other groups or individuals may be at risk of malnutrition for social or economic reasons. These include unaccompanied children, the disabled, single- parent families, and the elderly, particularly those without family support" (UNHCR, 2007, p.305).

Thus, shelter design should not be an obstacle but finding an appropriate guide that covers the differences is a key issue for this research. It is difficult to establish such a guide through standardized solutions and producing prototypes as individual solutions, while the standardized solutions might be a global solution, they are not appropriate for various local contexts, as well as to be sufficient for more than a couple of months in tent solutions or a couple of years in prefabricated shelters.

5.2.1.1 The Relationship between Refugees' Classification and Time Taken

Humanitarian organizations consider the lifespan of a tent or shelter to be a couple of months, even though the experience shows that on average it will be occupied by users for two or three years and sometimes more. Expert interviewees (3), (4) and (5) and one staff member of the UNHCR in Jordan presented the timescale that is required to provide shelters to victims - it is to offer shelter immediately regardless of the context situation and durability of tents and shelters. The primary data shows, from refugee interviewee (5) that the UNHCR did not consider the situation of his wife who suffers from Asthma and they lived in a tent for more than two years where they awaited their turn to obtain a caravan. The UNHCR (2013b) however, states that the timescale for using the NGO shelters in practice should not be more than two years, due to factors such as funding, services, maintenance, the cost of the recovery program and local conditions and policies. The results from the research survey reinforce this gap, since victims said that NGO do not offer opportunities for people with special needs, including those of children and those with healthcare issues.

Humanitarian organizations provide a number of shelters as section (2.7) showed, in spite of refugees staying more than five years on average, the UNHCR (2014a) showed that shelters that are offered have a limited life span of use, based on the assumption that it is a temporary situation for most refugee cases, also without considering the differences between refugees' classification based on their situation. The researcher conducted an interview (1) with an expert in the IFRC who mentioned that the timescale for offering a

place to live is connected with the type of shelter. However, the Handbook for Emergencies of UNHCR (2007) showed the terminology of 'tent' used by humanitarian organizations as an immediate response for refugees and it has a limited lifespan, also the use of the word 'shelter' was vague terminology and meant 'living conditions' where the humanitarian organizations are using such terminology in annual reports without comprehensive explanation towards different cases and timespan.

In contrast, expert interviewees (1), (19), and (7) indicated that the humanitarian organizations have different terminologies of shelter relating to type of situation and at the same time ignoring users' needs. Quarantelli (1995) showed the sheltering and housing terms for refugees are used in inconsistent ways in literature reviews relating to humanitarian reports. In short, different levels of attention are paid toward temporary and permanent situation meanings, without mention of refugees' classification or needs. The literature review showed differences of definition between organizations, such as the IFRC reports having the same definition of temporary and permanent shelter terminology as UNHCR annual reports, while UN-HABITAT and HUMAN AID COMMISSION have different definitions, that functions as a barrier to formulate guides or specifications for developing refugee shelters leading to problems, thus with the increasing number of refugees and the diversity of terminology without clear explanations, there is no clear understanding between humanitarian organizations and other stakeholders regarding what refugees needs and the challenges of context.

5.2.2 Differences in Stakeholders' Prioritizations

Providing shelters for victims, whether displaced people or refugees, depends on all parts of the operation, and which was clear in the stakeholders' responses. Meir *et al.,* (2012) and Szczepanikova, (2008) state each part has a different view of establishing shelters relating to its prioritization as discussed in section (4.12). It can be noted that stakeholders' prioritizations are not yet clear for each other in the literature review of refugees' studies. International organizations provide temporary shelters that are durable and comfortable for a period of time but at the same time it does not meet users' needs in terms of social and cultural aspects, and those organizations provide the same solutions for all regions that have a variety of climate challenges. Tom Corsellis mentioned in

interview with UNHCR innovation (2015) that the point of debating it is not just providing a piece of plastic or canvas to cover a head from climate elements or to protect from dangerous humans or animals, it is about a complete system of living where humanitarian organizations establish a comfortable place to live from its perspective that it does not mean reaching usability and compatibility and can lead shelters to become very uncomfortable places for living, in terms of providing services such as clean water, constant electricity and social and cultural aspects (Borge-Diez, Colmenar-Santos, Mur-Pérez & Castro-Gil, 2013). The prioritization of providing a shelter as a product and completely discounting the relevant social and cultural terms and local conditions, can be time consuming and cost more money in the long run (Hany Abulnour, 2014).

Manufacturing companies are one of the stakeholders that have a prioritization of providing shelters under donor requirements and financial aids and with the absence of connection with users. The researcher conducted interviews (1), (2), and (3) with local manufacturers. Their prioritization is based on their aims to provide units that meet donor requirements and the financial framework. Local manufacturer. Interviewees (1) and (3) mentioned that the host community thinks that because refugees must go back home in any case after a couple of years that justifies providing temporary units.

Additionally, the literature review showed in sections (2.6.1) and (2.7) that there is no obvious regulation of humanitarian organizations in terms of shelter organization or camp planning. Previous examples have followed the regulation of minimum standards of living conditions as applied by the host countries (Gunning, 2014). The findings of the survey analysis in Chapter (4) showed local governments are not happy to set regulations for establishing shelters. While interviewee (3) with a UNHCR staff member argued if local government set regulation for housing refugees it would be clear permission for residency as a permanent situation. This gives refugees and humanitarian organizations a hidden message that the host country is happy to provide land for refugees or has a strategy to welcome more refugees and for this reason, and as shown in Figure (5.2) local government in the Al Za’atari camp demolished one of permanent structure solutions.

Figure 5.2: A shelter demolished by local government in the Al Za'atari camp

The survey analysis in Chapter (4) showed, and relating to refugees prioritizations, they need more than basic needs over time as refugee interviewee (7) said when asked about what she wanted to improve her living condition, she answered if it was possible to obtain a washing machine because her hands became weak. As the Alderfer (1969) theory, discussed in section (2.8.1), Heywood (2004) indicates the hierarchy of obtaining needs could be the only choice of needs and desire and clarifying the strategy of refugee settlements must present things such as context control, dignity and other needs support and access to safety and stability, rather than just a human right of obtaining food, clothes and shelter.

Users have the prioritization of obtaining a place that provides a level of comfort as a simple definition, however the complexity presents in terms of it being impossible to meet the level of comfort if other stakeholders provide standard shelters where different situations need different solutions. Ultimately, providing units should be designed with consideration to involve stakeholders in the process and not just to produce a prototype, consulting with users in order to bridge the gaps with other stakeholders' ideas and

involving the local community. El-Masri *et al.,* (2001) indicate involving users in the process of production supports the bottom-up strategy and demonstrates the reconstruction stage rather than just development of a shelter as a product. The bottom-up strategy leads to a design process which is centrally supported and attempts to redefine the project according to users' needs. In the same regard, Maak (2015) argues spreading settlements as a financial issue leads to alienate people and that presents a top-down risk which is to transform the community to a machine model regarding social organization. The top-down strategy supports local government prioritization and humanitarian organizations for several reasons, such as time and cost, however, the inefficacy of such a strategy for producing an adequate shelter is indistinguishable between social and physical needs.

Schilderman (2004) discusses the top-down strategy as a barrier to participants and users to be a part of the project, due to the complexity of humanitarian organizations, local institutions and local government policies, as a result it might be an appropriate strategy for a temporary solution, however, it costs more expense and high demand of construction technology for a permeant solution. In contrast, Davis (1980) mentions it must understand the priority of victims' needs regarding their social mechanism and variables of disasters. The barrier of offering an adequate place is involving several connecting requirements of stakeholders' prioritizations where individual solutions do not offer a global solution which meets local conditions. In addition, an independent researcher in Coventry University interviewee (3) mentioned the requirements of users are highly significant in terms of social and cultural background, also the appropriate technology is demanded to prevent frustration leading to possible violence inside camps.

The researchers (Hadafi *et al.,* 2010; Manfield *et al.,* 2004) discuss considering inequality between users' needs, local regulation and humanitarian organization standards might be a barrier to have a comprehensive solution relating to disaster situations and impact on living conditions environmentally, socially and financially.

In the result findings of the survey analysis in Chapter (4), the prioritization of needs differs between stakeholders where refugees have several priorities and face different

challenges than others. Thus, considering stakeholders' prioritization is crucial to establish a comprehensive solution of refugee shelters which is a part of the process production not just creating a prototype depending on individual cases supporting certain local contexts.

5.2.3 The Impact of Social and Cultural Needs on Refugees' Behavior

Refugees have usually faced conflict, death and brutal crimes, the population ratios divide almost similar between males and females between the ages of 18-59, however, women and children are more vulnerable than other groups. Social aspects might be an effective factor to support them and continue their normal life, as shown in Figure (5.3). Clinton- Davis *et al.,* (1992) mentioned many reports of refugees around the world that having social environments affect their quality of life as well as camp policies, communication difficulties, host government trends and human rights, that means it is not just sanitation that has an influence on health but also integration between social practices with environmental ability, all of these may be a factor to positively influence living conditions.

Figure 5.3: Group of children play football in the Al Za'atari camp (Source: www.google.jo)

The result of survey analysis in Chapter (4) shows one of the major problems for refugees is insufficient shelter performance to meet social aspects. Refugee interviewee (8) presented his modifications on shelters through adding a small indoor pool called (*bahra*) that is a tradition in Syrian houses where families meet each other every day for singing or just gathering, as shown in Figure (5.4), he expressed his feeling by saying: I cannot live without (*bahra*), it feels I am in my home again. Also, he shares with neighbors' spaces in the backyard of shelters for cooking and washing, besides adding a second door in the backyard of the shelter to get more privacy than the main one. Many stories show that current shelter performance does not support social needs.

Figure 5.4: Al Bahra inside a shelter in the Al Za'atari camp

Sections (2.4.2) and (5.2.3) showed in previous studies of refugee shelters several examples of providing adequate space for living and which aims to simulate the refugees' original home. As has been shown in examples in different countries, different

environmental conditions have created spaces as an important element of their normal life. Space inside a shelter has a negative impact on social activities if it does not consider users' needs and their social and cultural norms as shown in Figure (5.5).

Figure 5.5: Sharing kitchen with a bathroom inside a shelter in the Al Za'atari camp

Another example indicated by expert interviewee (2) in Nepal and Haiti in 2015, when displaced people refused shelters that organizations provided because they did not meet their needs, in Haiti the organization built better houses, however people refused to live in them because it was raised from the ground and they believed that spirits would enter the houses, the interviewee reflected that this is one of their religious thoughts, another example in Nepal when displaced people used to stay in two story houses where their animals must be on the ground floor and people in the first floor as in their tradition, also interviewee (2) indicated the influence of disasters on psychological matters of people by presenting examples of refusing people to live in houses that have big windows because they fear breaking windows, because of rain and fear from the sound of the wind, simply their stress from disasters influences the way of finding comfort, so peoples' values, meanings, traditions and spiritual customs dictated the way of living.

Szczepaniková (2008) mentions the social impact has two levels of integration, the first one which is the outer force that directs refugees to a host country that has a similar social, religious and demographical background. The second level is the inner force which presents inside the shelter for integration with a community. When refugees keep moving from place to place, it has a negative impact on their dignity because humans are starting to make a relation between physical spaces and belonging after a period of time, so for this reason, organizations must consider solutions that support social and cultural norms as an emergency response, as shown in Figure (5.6).

Figure 5.6: Refugee family started a garden in their outer space for joining the outside and inside of their shelter (Source: www.nytimes.com)

Tom Corsellis mentioned in the interview with UNHCR innovation (2015) that it is an impossible job to create or design a shelter that fits to global circumstances because social aspects change in relation to gender, age, education and social status. With regards to the differences between regions around the world, so it is impossible to create a shelter that adapts globally. Etzioni (1968) argued principles, guides or specifications developing an aim to establish a process of design is possible to follow globally acceptable standards, based on local variables whether technically or socially. Tom Corsellis also mentioned

there are many examples of shelters in UNHCR, so developing a prototype is a non-stop process, such as the latest production of an IKEA prototype designed by Johan Karlsson in 2013 by institution investment, as a result manufacturing companies compete to give different kinds of materials and structure for non-stop design alternatives for the same problem - to provide the product that has the technology and innovation process. However, those companies and institutions do not consider social and cultural impact needs of refugees in many regions around the world and they assume one solution fits all cases.

The literature review and field evidence shows users' behavior and social norms are influenced by spaces inside a shelter over time; however, it is extremely hard to reflect such social experiences by technical specifications and to produce an appropriate global prototype which led the researcher to present stories and experiences by using an ethnography strategy, as shown in section (4.9). Manfield *et al.,* (2004) argues the provision of an adequate shelter is not providing technical specifications without mentioning the explication of the social impact and cultural value under their local circumstances. Social aspects are a key feature of adapting in different contexts, which could be stimulated by the development process of design that adapts to the local situation.

In spite of the previous practices of shelter design, as Chapter (2) showed, some examples have happened of innovation in the process by a bottom up or self-help strategy, however each camp has different situations and requirements from others, and the diversity of refugees' needs is not considered in the standardized designs by humanitarian' organizations. Conditions in the Sahara are different to those in Kosovo or in the Philippines; for instance. Manfield (2000) argues it might be that a group of criteria needs to provide the same shelters that are appropriate for several local conditions around the world, however, considering differences of social customs and cultural values of societies leads to the design of much more successful shelters.

Tay and Diener (2011) discuss social factors must be considered in terms of what people need to appreciate and understand, together with the environment conditions. That would lead organizations and institutions to establish a process of developing refugee shelters by involving users as well as manufacturing expertise – it must follow such a process to meet users' needs.

In short, the literature review and field work show the challenges that humanitarian organizations and local governments face to offer shelters for refugees, the problem is in which sense those shelters meet refugee needs considering needs diversity, so part one of the discussion indicates establishing standardized solutions by humanitarian organizations, local institutions and local governments, to provide shelters as a product does not meet refugees' needs over time and the consequences are high expense, because the solution was constructed as prototypes not as a process with the absence of stakeholders' prioritizations. The social impact must, therefore, be considered in the process of production in terms of social and cultural diversities of societies, that is a limitation to adopt in the process as principles or specification, thus it might give an opportunity for each affected society to contribute through their practices in the field.

5.3 Part Two: Challenging the Quantitative Rationale

The following of the chapter part details a number of points based on the influence of the built environment on social relationship in the community which specifies:

1. The importance of linking between inside and outside a shelter for settlement stability and in relation to urban theories. The research presents an assessment of the social impact through a discussion of the shelter itself and where considering the community perspective is recommended for future research.
2. Providing temporary situations as a quantitative solution behind the camp's organization and ignoring environmental challenges.
3. Logistical requirements (cost and time control) lead to standardization of refugees' needs by humanitarian organizations.
4. Alternatives for transforming a camp to a productive development project in terms of environment usability (in a hot-dry climate) and social stability.

5.3.1 Link between Inside and Outside a Shelter

Urban organization offers several ways to arrange units in relation to safety, security, risk reduction, services control and health requirements. Social activities, however, are indistinguishable with regard to reports by humanitarian organizations and local government. Corsellis *et al.*, (2005) notices regarding UNHCR The Handbook for Emergencies, that self-urban settlement is the most challenging option when refugees decide to settle wherever they want, so refugees move from place to another place and follow informal settlement that leads to spatial organization such as cluster or central organizations as a result of their needs (Kostof, 1992). Regarding the research criteria where a shelter is an individual object rather than a physical element inside a community settlement whether in a block, in a district, in a camp, in a city, which brings together consideration on how to control different backgrounds of users. Regarding discussions in section (5.2.3) on social norms and the need for appropriate spaces inside shelters, Mumford (2002) explained that the process of establishing normal living activities is not complete without linking with external urban spaces. However, this research study is related to the social ability inside a shelter, while research relating to social ability outside the shelter concerns the urban context in a camp, and so this could be studied in further research.

In this regard, the functionalist approach as formulated by The Congrès Internationaux d'Architecture Moderne (CIAM) aims to standardize human needs, the approach was mainly about reducing and minimalizing housing units to great number of users (Mumford, 2009). Accordingly, any place is a set of social meanings, cultural values and physical environment and it is impossible to accept as just a portion of space. The Unité d'Habitation (1952) is another example of a housing unit that was in Marseille which was developed by La Corbusier, that established a large complex in one community. In this regard the NGO approach is very close to previous examples and the functionalist one and the camp pattern can be assimilated to the Siedlung rationale, as shown in Figure (5.7). Functionalist was an architectural theory aimed at, among other goals, providing housing for a massive amount of workers based on a sociological model around functionalist neighborhoods and minimized social factors. It provides many houses for users trying to maximize the quantitative issue. Functionalism in architecture implies how

things function in specific spaces or fields and also refers to apply premise things related to society in the field for a certain purpose (Schalk, 2007).

Figure 5.7: CIAM grid (Source: www.transculturalmodernism.org)

Schalk (2007) directed Mumford's view about technics and civilization in 1934, which presents the impact of mechanization on society, he argues for a cultural machine age instead of a machine age, the argument of Mumford is based on the materials basis and culture for connecting together and modifying the machine age, however, the artefact does not only concern social patterns and cultural values in the society, but the impact on space hierarchy of social meanings and values, which present another side of the operation. In contrast, Mumford (2009) indicates that the garden city of tomorrow is a different approach adopted in the United Kingdom, which is a reaction against urban planning and aims to surround communities with greenbelt land, focused on public spaces and recreational gathering opportunities. Schalk argued an organic city is not a spontaneous metaphor related to peoples' behavior to enhance city complexity, but it is a transcription of early society and community of social meanings and values, integrated

with the image of a city refers to the city's functions in terms of physical elements, such as the city center, gardens, parks and others.

Accordingly, the field survey result shows the Al Za'atari camp as a recent case revealing a similar approach to the functionalist one, as shown in Figure (5.8), interviewee (5) with a staff member of UNHCR mentioned the shelters' shape and form are the same. Although users add modifications to their own shelters, the camp is similar to a massive machine with the absence of identity and belonging, and due to the organization and similarity of streets and units, visitors can feel the camp is like a prison camp. Furthermore, section (4.6.2.2.1) mentioned the caravans and tents arrive with completed manufacturing to users without attention to their personal needs. The result is standard units with inflexibility of modifications and in fact that the limitation of safety and security requirements leads to apply more standardization on such units (Ledwith, 2014). In contrast, Verderber (2001) mentioned that overcrowded shelters lead to less safety, privacy and security and this approach is the same in relation to space inside a shelter when mixing between spaces inside the shelter in terms of gender and age mixing which presents a barrier towards social needs.

Figure 5.8: The Al Za'atari camp (Source: www.zeroundicipiu.it)

Also, the results of interviews with refugees (11), (12), and (13) showed that although the grid organization of the camp leads to a functionalist approach, refugees rebelled against such an approach through applying the organic approach (social impact) by establishing a main street of the camp called the Champs-Élysées street. Refugees refused to accept their situation in the camp, and created the name evoking luxuries and providing alternatives of living goods. Shops in the street support cultural values and social practices such as marriage preparing services and circumcision shops, as shown in Figure (5.9) where these two kinds of shops are strongly related to Arabic cultural and Islamic religion respectively. The result is that shelter organization is not just as a functionalist or quantitative approach but an enhanced organic approach.

Figure 5.9: Wedding shop in the Al Za'atari camp (Source: www. poeticsofdesign.blogspot.com)

More attention must be given to social reconstruction because people do not just need physical reconstruction, enhanced social aspects are not less important than the provision of schools, a sewage system, water sources and other services. In fact, the whole process is sufficiently complicated and it must work within one framework (Arslan *et al.*, 2008). The suggested approach is to develop a camp site as an image of the social and cultural

aspects of the refugees' original home. This has a positive impact on the mental health of refugees. Such an approach seeks to provide more interactive points to enhance the sense of place and space. Ellis and Barakat (1996) argue that even temporary planning must consider the holistic camp to avoid long-term obstacles and unbalance within a community. Zetter (2012) indicates gathering points inside camps is important such as water collection points because it allow people to meet each other and enhance social interaction from inside a shelter to outside a shelter, also it helps to maintain social practices (Hany Abulnour, 2014).

Subsequently, social bonding and family connections lead refugees to stay together and move from one place to another, which has a positive influence on their living conditions. Refugees are looking to find relatives or friends which mean they might rearrange their shelters and the way of living based on a new social connection such as marriage or extended families. When refugees decide to move, they go closer to their relatives or to establish new spaces with neighbors, which means creating social connections moving from inside the shelter to the community. Interviewees (5) and (6) with staff members of UNHCR discuss a lack of awareness of humanitarian organizations to refugees' needs and social connections encourage refugees to find their own solution by moving their shelters from one place to another without noticing responsible organizations or institutions and the result presents as mixing urban organization and misleading services control.

Mason (2011) indicates social aspects would be filled by celebrations on certain occasions, giving more attention to social reconstruction besides the attention on physical reconstruction would be beneficial. So, many faces of social relations could inform the cultural meaning of nations, such as traditions, folklore, and beliefs, by providing the right spaces and places to establish all these social meanings. Thus, it must consider social aspects from inside a shelter to the community because the social bonding is the bridge connecting between individuals' meanings and background of customs and traditions, which reflect on a community.

5.3.2 Temporary Solutions (materials and environmental aspects)

Temporary shelters are applicable for a short period of time and emergency solutions, it is appropriate for keeping danger away from people when it is not possible to build a permanent solution. The literature review shows economic and political interests direct the operation of settlement of refugees. In this regard, Quarantelli (1995) argues sometimes humanitarian organizations and local governments do not offer permanent solutions because they want continuous financial aid from donors and external relations.

In fact, the response of agencies and local governments for recovering refugees is usually too expensive and long lasting, so temporary shelters offer more practical solutions for accommodating people. However, (Hadafi *et al.*, 2010; Corsellis *et al.*, 2005; Sinan & Sener, 2009) discuss temporary shelters have drawbacks in durability and covering physical and non- physical needs. In many situations, temporary solutions aim to quickly settle victims; however, time pressures, reducing costs and shortage of labour skill all influence the result in the long term.

Another factor that affects temporary shelters is the environmental aspects and local materials. The challenging hot-dry climate is a concern of the research which explains in fluctuating temperatures, as discussed in section (2.12). However, the Corsellis *et al.*, (2005) report shows humanitarian organizations consider the requirements of weather conditions just regarding tent solutions, although a tent is an emergency solution and with consideration environmental aspects is still a temporary accommodation. Scavino (2013) shows with the same regard that humanitarian organizations have a lack of standardization on climate considerations towards shelters and prefabricated unit performance, so humanitarian organizations do not extend practices to transfer temporary solutions to permanent solutions, which is a barrier in The Handbook for Emergency.

The material conditions influence providing comfortable shelters, dwelling efficacy is measured by offering the level of comfort inside and outside the dwelling through using appropriate materials for each climate. Regarding the interview of Tom Corsellis with UNHCR innovation (2015), he mentioned the main challenge is using local materials and being careful in a fragile environment. The reality is not just building a house but finding a materials solution to support users' needs to move quickly and settle for a period of

time and know how to maintain a shelter. The survey analysis results in Chapter (4) from interviews with manufacturing experts (1) and (2) explained financial aids and donors need two factors to formulate shelter performance where environmental requirements and particular materials used are absent from rules on prefabricated unit production. Furthermore, interviewees mentioned labor skills of unit producers, they are sometimes not qualified to produce good quality prefabricated units where many laborers in the local market have experience in different sectors such as restaurants and electronics shops.

In fact, a temporary situation is the ideal solution for humanitarian organizations; however, it should be considered how such a situation leads to many problems inside a community. Temporary shelters provide less stability and safety for refugees with passing time, interviews with refugees (7), (9), (11) and (13) present that a great number of refugees decided to go back home even with instable situations in their home, where interviewees indicated inadequate situation of shelters and services were behind this pull out factor. Verderber (2001) indicates many studies which show how the temporary situation of refugees encourages them to pull out from their comfort zone by feelings of 'victimization', people see themselves as victims of an imposed conflict compared with others staying in their homes. Subsequently, they feel more secure and safe when living and using their properties in original homes. Accordingly, Sinan *et al.*, (2009) presented refugees add their modifications on shelters to simulate their original homes whether they settle for a short or long time, the difference is just about the materials and techniques used.

As a result, the inconsideration of local context conditions and materials usability by stakeholders besides the characteristics of temporary shelters lead to temporary solutions that present in temporary shelters to settle refugees' influx in terms of quantitative approach instead of user needs requirements, which have severe drawbacks on living conditions.

5.3.3 Logistical Requirements (cost and time control)

The Handbook for Emergencies discussed the demand for logistical requirements, accessibility of shipping times and cost of production process, while cultural and social norms and in-depth challenges of climate conditions are almost absent from the report

(UNHCR, 2007). Scavino (2013) argues that the long list of tent fabric and prefabricated shelter details in the handbook does not show the ideal solution in terms of a socio-economic approach. Also the Sphere Project (2011) insists shelter production follows cost and time control where users' needs are not involved in the process of production of units. In contrast, Zetter (2012) presents many previous studies that shows the expensive permanent solution based on the cost of materials and labour skills as well as the other economic and political challenges.

The survey analysis in Chapter (4) with expert interviewees (3), (10) and (11) highlight the challenge of providing shelters should not be seen in terms of reducing cost and time as humanitarian organizations and manufacturing companies have done. On the contrary, those two factors could influence the effectiveness of shelters as a temporary shelter in terms of safety, fire reduction and financial maintenance rather than reducing risks. Also, time and cost as logistics control requirements are inconstant factor because funds are based on donors' financial aid, even though changing of grant funds, organizations and institutions are utilized to formulate more units for in-fluxing refugees.

Thus, if those organizations focus on time and cost control without considering user needs the result must be a temporary solution and quantitative approach of tents, or units, in this regard the research does not include cost and time factors in the research criteria due to changing of aids assistance which could be the focus of future research.

5.3.4 Alternatives for Transforming a Camp

One of the most expensive items in camp establishment is providing services such as infrastructure, water and electricity. Humanitarian organizations and aid agencies support the provision of basic sources of energy inside a camp. The high cost divides between main services such as water sources, electricity and sewage systems. The literature shows many camps around the world do not offer constant electricity and continuous water sources as discussed in section (5.2.2).

In 2013b the UNHCR report mentioned that the Al Za'atri camp needed to install additional capacity for powering energy to meet the demand of using electricity by an increasing number of refugees. The survey analysis in Chapter (4) indicates

organizations' reports show camps that are located in harsh climates cost millions of dollars per year cope with climate difficulties. In spite of thousands of US dollars paid to provide electricity to the Al Za'atari camp and planning for future development of energy, insufficient electricity supply is the main obstacle that influences refugees' living conditions (Ledwith, 2014).

Refugee interviewees (7) and (12) said that electricity is a big concern for the whole camp, they mentioned the camp does not have electricity for more than seven months because of non-payment of electricity bills. Furthermore, other refugee interviews (11) and (13) stress many sectors have informal electricity by paying refugees their own generator or connecting their shelter directly with street wires as shown in Figure (5.10), they mentioned the danger of connecting their shelter to street wires as completely unsafe. As a result, a number of refugees die because of electric shocks through insufficient electricity connections or fires caused by electricity.

Figure 5.10: Illegally connecting electricity in the Al Za'atari camp (Source: www.google.jo)

REACH informing more effective humanitarian action (2014) shows that people suffer from inadequate living conditions, they are facing danger and even death when using insufficient utilities such as electricity. In this regard, organizations should enhance using environment sources such as solar and wind energy and establish planning to encourage refugees to be part of the productive program. Herz (2013) illustrates an example of a Saharan camp where people use the opportunity of collecting energy from long hours of sunshine during the whole year. Thus, as indicated in section (5.3.4) the research criteria for a productive camp needs to enhance peoples' productivity within the host community.

The UNHCR mission to Jordan (2013b) report shows a number of projects that plan to be established by aid assistance, which would mean increasing supplies to the area in terms of constant energy and water. However, Gunning (2014) argues that rearrangement of communities inside the camp through a standardization approach such as the ICAM in section (5.3.1) approach can intensify spaces for massive units and distribution of inconsistent electricity and water are not a good practice, but involving users in decision making, looking carefully at users' needs and operating the camp based on productive strategies of utilizing environment resources are a good base for improving living conditions and preventing unexpected local circumstances.

Furthermore, the survey analysis results show deteriorating economic conditions due to the lack of job opportunities and political obligations towards allowing refugees to work. In addition, refugee interviews (3) and (15) confirm the story about inappropriate refugees' economic conditions, the UNHCR provides an amount of basic foods per month, however, refugees find such an amount is enough for a few days besides they want other needs such as cigarettes and clothes for children for special occasions and in order to provide for such needs, they keep a part of their food to pay for it for other refugees and using money to get such needs. This interviewee ended the interview by saying that refugees just want to live a normal life.

Regarding the literature, present stories of suffering from poverty, Un ponte per [UPP] and Jordanian Women's Union [JWU] (2012) indicates poverty leads families to force young girls under the age 18 to marry older men (Jordanian and from Gulf region), it is an accepted practice between Syrian refugees in order to get a little money. Despite it

being important that girls are protected from rape, there is a group of women responsible for finding a way to organize these illegal marriages. Also, the report indicates poverty is the main reason for violence, crime and unstable behavior. Hence, the Cooperative for Assistance and Relief Everywhere [CARE] (2013) says that improvement of camp productivity must take into consideration establishing a process strategy development that stands on productivity and more effectively utilizing the environment opportunity which is a key feature of preventing widespread poverty.

In summary, the second part of the chapter presents two issues; the first one indicates the possibility of standardizing human needs in any place around the world. The answer is not applicable as a solution because of people's differences in terms of gender, age, social state, educational background and other factors as well as diversity of local context that is presented in environment conditions, social and cultural values, ideological meanings, economic situation, political interest and shelter performance. The second question is about the probability of applying urban theories of organization in camps if experts and professionals recognize the benefits of such theories rather than comparing drawbacks of the standardization approach, so camps must organize themselves based on an organic approach that is formulated by users' needs. Thus, people cannot obtain their needs (step by step) on the pyramid of needs because their needs change over time towards diversity of social and cultural aspects, their economic situation and environment requirements.

To conclude, standardized shelters means standardized people and producing a cheap product to attempt to solve the refugee influx. This solution might be applicable for a couple of years, after which humanitarian organizations will start facing barriers to continue this job in financial terms, social and environmental assistance. Thus, an improvement process to formulate guidelines or specifications could be an adequate solution that controls such barriers and assistance operation. The design science method supports such a process of formulating specifications as references to produce infinite prototypes regarding context diversity and circumstances of each area, such specifications combine several variables that influence producing refugee shelters that consider stakeholders' priorities and involving users with their desires and needs.

5.4 Chapter Summary

This chapter has discussed several points of connection between the primary data findings and the literature review, in terms of different views of previous research and the primary data findings of this study. It has highlighted diversity between refugees in terms of disaster circumstances that have an influence on users' needs, and discussed the challenges of standardized camp organization and the influences on the social and cultural aspects of refugees. Also, it indicates the usability of the design science method to support provision of a list of specifications for refugee shelters. To conclude, establishing refugee shelters based on a process approach is more effective instead of the established product approach by humanitarian organizations. The specifications allow the combination of a diversity of solutions regarding local context requirements and stakeholders' prioritizations, which is impossible to achieve through a quantitative rationale approach, in terms of temporary solutions and broad technical requirements, and without involving users and considering their needs. In addition, the discussion showed the feasibility of changing camps to becoming more productive camps by considering the connections between inside and outside the shelter with the local community.

The final chapter presents the conclusion and lessons learned and considers the limitations of the research, highlighting some areas that could be explored in future research studies.

Chapter Six
Conclusion

6.1 Introduction

The previous chapter included the discussion, in terms of highlighting the pertinent previous studies in the literature, the findings of the primary data results and the validation of the specifications list.

The purpose of this chapter is to summarize the research analysis and discuss the theoretical and practical contribution regarding the main findings, which leads to highlight the possibility for further research recommendations. It provides an overview of the main findings of the research. Also, it covers the lessons learned that were formulated in practice. The contribution to knowledge, in terms of theoretical and practical aspects is presented in this chapter, which also includes the limitations of the research, and recommendations for potential future research respectively.

6.2 Main Findings

The findings of this research bridge the gaps between the literature review in Chapter (2) and the results of the survey analysis in Chapter (4). The view of the research questions and connecting this with relevant theories and practices in the literature review supports the rational for the research, therefore, the framing of the research criteria was established by reviewing the literature. The research findings are discussed and validated in Chapter (4) which conducted phase two, three, four and five of the design science method.

This section will demonstrate how all the research objectives have been achieved, by relating the findings to the answers to the initial research questions.

Research objective 1: "*To investigate refugees' requirements in a camp located in a hot-dry climates i.e. the Al Za'atari camp in Jordan*"

Associated research question: "*What are the problems that refugees define as their needs?*"

Chapter (2) discussed the background of refugee camps, and previous studies of shelters and human needs. Also, the challenges of a hot-dry climate influence refugees' satisfaction in their living quality, which is not currently considered by humanitarian organizations for shelter standards. It is a combination of several factors that leads to satisfaction, however, the requirements were found to be different for displaced people and refugees who are forced to leave their original home. Additionally, the needs of people are often based on the circumstances of disasters – whether they have faced a natural or a man-made disaster; another factor is time, where it is a key issue for people to adapt with regard to social and cultural values, livelihood possibilities, and local conditions.

In order to explore the users' needs, the survey analysis in Chapter (4), which included informal interviews with local governments in section (4.6.1.1), and in-depth interviews with refugees in section (4.6.1.2.1) investigated the requirements that affect and improve the quality of life. This was followed by the next approach of structured interviews with refugees in section (4.6.1.2.2) to explore the variables presented, through in-depth interviews.

The complication of answering the research question was presented in determining what exactly the requirements were for all stakeholders. Two major factors of identification were presented on what stakeholders need, with consideration to limitations of its institution, such as local government and humanitarian organizations. The other factor was the difficulties of covering all requirements because of the sensitive situation of refugees inside a camp regarding political aspects. Thus, the research combined qualitative and quantitative data to answer the problems that users face in camps with consideration to independent and dependent variables presented in the questionnaire responses and finally producing a list of users' requirements as a starting point for the next level of exploring humanitarian organization principles. However, demonstrating such a list showed a need to investigate requirements of other stakeholders and find points in conflict and in common.

Research objective 2: "*To examine the environmental and social difficulties that have an influence on the provision of shelters in hot-dry climates, with the Al Za'atari camp in Jordan being used as the case study*".

Associated research question: "***What are the challenges that are encountered when establishing shelters in a hot-dry climate?*"**

The second research question intended to explore what the problems or obstacles are that humanitarian organizations face with regard to the reality of establishing shelters. Based on the nature of the question, which used technical terms, it was difficult to get precise answers from refugees. Chapter (2) of the literature review reflects the survey area of exploring the challenges for providing shelters in the same climate conditions (a hot-dry climate). The in-depth interviews were conducted with humanitarian organizations (UNHCR) which have a main role in producing assistance for refugees. Qualitative data was collected to explore environmental challenges, shelter performance limitations and to examine the effect of environmental and social aspects of refugees' needs. Humanitarian organizations showed understanding of the challenges related to refugees' needs. Spuriously, the humanitarian organizations added other requirements that considered time and cost, which are variable factors depending on donors and funding. However, these two factors are out of the framework of the research aim. With respect to another set of stakeholders, local manufacturers, in depth interviews were conducted in terms of technical and manufacturing standards in section (4.6.2.2.1). Ultimately, they showed a lack of awareness of what the challenges are that are faced by users and humanitarian organizations and inaccuracy in understanding local conditions.

Incomplete information about the guides that manufacturing companies follow and how they connect with humanitarian organizations makes it difficult to answer the research question. However, the researcher considered challenges mentioned by manufacturers and humanitarian organizations that have a direct connection with users' requirements and influence on shelter performance, besides using an ethnography strategy to show experience of this issue. Such requirements are listed under a group of criteria which can be combined together to answer the next research question of determining the required specifications that meet users' needs.

Research objective 3: "*To develop specifications in order to support appropriate design of a shelter that meets the needs of refugees in hot-dry climates*"

Associated research question: "*How can the specifications be articulate to achieve a shelter that meets the needs of refugees?"*

This research question was answered through reformulating the requirements between theoretical sources of evidence, the literature review in Chapter (2) and defining requirements of the survey analysis presented by stakeholders.

The complexity of developing a list of specifications was evident, since some specifications were in conflict with other specifications in terms of meeting users' needs. In this regard, the researcher clarified the matter through establishing questions of why, how and what, regarding the ability of meeting and considering users' needs, which led to summarizing the long list of requirements into a short list of specifications (a table of forty-three specifications). The list was demonstrated as a long list of seventy five specifications in Chapter (4) of the thesis. A limitation of the study was the incomplete information about some specifications that related to social and cultural aspects and political obligations, where the explanation of those specifications was left open depending on the local context conditions.

Research objective 4: "*To demonstrate the formulated specifications of feasibility to meet refugees' needs in ho- dry climates*"

Associated research question: "*What are the required specifications that can be used to address the design of refugees' shelters in hot-dry climates?*"

The fourth objective of the research was about demonstrating the list of specifications, and this was achieved by interviewing experts in section (4.8.1). This area of the data explored the feasibility of specifications to meet users' needs, measured dependent and independent variables, and explored how and why specifications work in hot-dry climates, by using tools that were appropriate to achieve objective (4) of the research.

The resulting findings showed a comprehensive understanding about what exactly users' needs are in hot-dry climates, and which measured the ability of providing adequate

shelters with cost and time factors considered. They indicated the key feature of providing shelters for refugees in a wider framework, which includes all stakeholders within one chain. In this regard, experts presented the difficulties of achieving such a framework with limited funding and assistance.

Experts showed a wide base of knowledge about understanding what is an appropriate solution for refugee shelters, they ensured the ideal solution must be through all-encompassing principles or specifications that respect diversity of local context variables. The qualitative data and ethnography findings showed strength of detailing, in terms of shelter performance, social values, logistics strategy, and lifestyle background.

The experts expressed difficulties of establishing fixed items about social and cultural implementation due to traditional differences; also, the data showed the key issues of previous failures in prototypes, and the need for an individual solution with consideration of social and cultural terms.

The challenge here, therefore, was in answering the research question of what the required specifications should be, by combining all the stakeholders' priorities, which were sometimes conflicting with each other. As a result of this study, around seventy five specifications demonstrated by the experts explained what the users' needs are, which were listed under the research criteria, and then the sequence of listed specifications was supported by considering stakeholders' prioritizations, as discussed in section (4.12) and in Appendix N.

Finally, the specifications were evaluated by architects, with a high degree of flexibility allowed in their design, since infinite design alternatives are made possible within such a specification framework, as an expected outcome of research objective 5.

Research objective 5: "*To evaluate the ability of specifications to solve the explicated problem (meet refugees needs)*"

Associated research question: *"How well will the specifications be utilized for supporting the design of a shelter that meet the needs of refugees in a hot-dry climate?*

This stage of evaluation was focused on asking architects to establish shelter prototypes based on their understanding of the framework of the specifications list, and explaining the suitability for illustrating the design for refugees' shelters. The findings associated with the fifth objective concluded by illustrating seven different prototypes from architects who have diverse practices.

The findings showed suggestions for adding new items in the specifications from the point of experts' visions, which were in materials and smart technology alternatives. The production of a prototype clearly demonstrates that the objective has been achieved. Producing any prototype means understanding and grasping the list of specifications in terms of language explanations, technical requirements, and methodological approach of the list. The objective has been achieved, not because of what the prototype looks like or which materials it uses, but because it has proven feasible that a suitable process has taken place in both understanding the users' needs and taking into account the diversity of needs according to the context conditions.

The complexity of answering the research question was in terms of focusing experts' concentration on certain criteria rather than others, because their experiences differ in this field. However, when looking positively at this aspect, the solutions provided a new opportunity to combine these solutions together as a bonus.

This thesis allows the advancement of current knowledge about developing a refugee shelter in a hot-dry climate, by providing tools, principles and specifications. Eventually, the success and limitations of the thesis are measured by building a process of creating adequate shelter solutions that are globally applicable for different contexts. The wisdom of demonstrating the process is to use a comprehensive method that can cope with the complexity and sensitivity of refugees' situations. Furthermore, this thesis advances the current knowledge on the possible application of Design Science to the architectural field.

To maximize the impact of the research findings, the conclusions are complemented by a set of lessons learned, targeted to decision makers involved in the process of providing refugees with shelters in hot-dry climates. By providing stakeholders with an evidence-

based analysis on gaps, needs and trends in refugees' shelter sector development in hot-dry climates and relating urban organization of settlements, this thesis aspires to exploit the potential of the research findings in terms of concrete applications to current issues.

6.3 Lessons Learned

Lessons learned refers to knowledge and understanding of the matter by experience and recommendations for a future project. Lessons learned are therefore gained by experience and it is possible to be successful and positive in the future, through learning these lessons. Weber, Aha, Muñoz-Avila and Breslow (2010) argued that many humanitarian organizations and institutions have developed a report of shelter implementation as lessons learned, however, the challenges were in adapting the technical solutions in the environmental context and evaluating reports and annual reviews, yet, such reports must strongly document progress year on year and be adopted in several local conditions. Various projects lead to the idea of lessons learned which support good and bad practices of shelter projects by key issues of findings; the lessons are a guideline or checklist to what is going right or wrong in certain situations (Stewart & Ruckdeschel, 1998).

With this regard, the lessons learned are those from the research supported by literature and field work, which included interviewing refugees, humanitarian organization members and experts. The broad findings of the research showed gaps of understanding of users' needs from one side and standardization of such needs in different cases by humanitarian organizations on the other side. Humanitarian organizations have formulated reports or annual reviews with lessons learned that are rigid to add new knowledge and updating the lessons.

Drawing from all the evidence gathered through the research, it can be concluded that:

1. **It is difficult to find a balance between financial viability that leads to standardized solutions, and community needs, that require a customized and tailored response, however a good balance is paramount in order to avoid situations of discomfort in living conditions.**

It has been proven that humanitarian organizations tend to provide refugees with standardized shelters to reduce cost. The lack of recognition of the specific social needs

of the community may lead to provide them with inadequate shelters. However, the constant of standardization protection does not agree especially with increasing refugee numbers. The success of the intervention is therefore a lottery in which losers have to bear further discomfort. Examples from the secondary and primary data are: 1) the literature from humanitarian organizations discussed in section (2.7) from which a gap in the concept of tailored solutions emerges; 2) empirical data gathered from the interviews with experts confirmed the gap discovered in the literature and expert interviewees (1), (2), (3), and (11); 3) empirical data gathered through the survey in the camps, from which a gap emerges between what refugees consider important and what the humanitarian organizations provide.

2. **Recognizing the actual timeframe for recovering from disasters is essential in organizing appropriate solutions.**

Both secondary and primary data confirm that, though shelters are supposed to provide refugees with a home for a maximum of 6 months, actual usage contradicts the predicted timeframe and is significantly longer, up to 3 years. Coping with harsh climatic conditions for so long is extremely challenging. Either shelters should be considered less "temporary" solutions, or intermediate solutions following the initial emergency should be found. Lack of awareness of refugees' needs in terms of time needed to recover, as discussed in section (2.9) means that refugees modify their living over time and the shelters' performance and services are not appropriate for more than a few months.

3. **Overcoming the rigidity of the current shelter performance is essential to fill the gap of the variances between shelter elements, users' requirements and camp layout.**

The design science approach which was discussed in section (3.9) allowed the researcher to design and test a prototype, which demonstrates the feasibility of a less rigid and more adaptable approach to the shelter's design. Humanitarian organizations offer a group of standards for settlement of refugees that might be suitable for temporary situations and provide a global solution to reduce time and cost, yet the literature showed a gap from the expert view of Tom Corsellis interviewed with the UNHCR innovation (2015), who

explained that producing a new shelter does not mean creating a solution because the flexibility of such a shelter demands changing materials by producing offers from manufacturing companies and meeting diversity of social and cultural aspects by over time. The primary data of interviewee experts (17) and (18) argued that being unaware of the failed methodology has the ability to create a system or process of producing and testing frequently regarding the context, and this is the only way of solving rigidity.

4. **Donors' awareness on the actual refugees' specific needs should be elicited by humanitarian organizations.**

Primary data collection showed a significant discrepancy among the perception of the essential features of shelters among different stakeholders. In particular, what refugees actually need is not consistent with what donors and humanitarian organization believe is important for them. Donors and local manufacturing organizations have priorities to produce units that should stick to financial aid regardless of the standards of peoples' needs. Reviewing literature in Chapter (2) indicated a lack of awareness of actual needs, even with better standards refugees need providing with what they need in certain situations and specific contexts and it is not just about standardized needs. The primary data in Chapter (4) was presented through interviewing local manufacturing companies in Jordan, they said that donors' needs take into consideration the high speed of productivity and implementation as the key issue of successful assistance.

5. **Lack of integration between social and physical well-being in shelter negatively influences users' daily activities and leads to social instability.**

Humanitarian organizations cater for independent needs where well-being is the core of refugees' needs, yet there is an overlap between needs and wants, as wants refer to improving the quality of life and having a healthy life. The literature review in section (2.8.1) of theories of human need showed that people cannot satisfy their living requirements if their well-being does not exist, so the sense of well-being is a result of the judgments of motivation. Section (4.5) also indicted the comfort level is based on human well-being physically that reflects on social instability. The primary data showed through interviewee expert (2) that, for example, some refugees had refused certain shelters

because of a lack of demonstrating well-being; peoples' need can be effective for a short period of time, however, people need transformation over time, it is about integration between physical and social well-being.

6. **Shifting from the shelter to the camp is often a merely quantitative issue, while more attention should be paid to the social dimension of the camp.**

Duration of stay affects the factor of belonging; however, the other side leads to insecurity if the differences between groups happen. Section (2.4) indicated that the camp is a complex mechanism even when trying to establish systems relating to urban organization which leads refugees to refusing such systems in order to obtain freedom. Examples from primary data collected showed several units within a block or sector were refused by refugees, they have a dream of better living conditions, refugees' interviewees (5) and (16) argued it is impossible to achieve such a dream if they were treated as a unit number. Expanded in the literature, as shown in section (2.4.2) showed that social spontaneity is a factor of leading changes that refugees stick with, while humanitarian organizations follow the same camp layout without considering required changes.

7. **It is still possible to design an architectural prototype that meets both the requirements of the producers and the needs of the users**.

Transitional solutions as discussed in section (2.6), are the practices for refugee shelters, however, the standardization of that transitional stage does not consider improving the quality of living standards. There is no clear strategy to transfer from one situation to another relating to shelter type.

8. **This prototype is designed through a participatory method involving experts, designers, users, donors and humanitarian organizations that has financial value but also can be tailored to specific needs**.

Different prioritizations between stakeholders meant it was difficult to confirm one standard list, besides the difficulties of confirming a social framework. The interpretation of local policy and rigid annual reviews of humanitarian organizations leads to a top down strategy, which mitigates providing users the right of self-settlement; to contribute

to a bottom-up strategy throughout the duration of stay allows users to be involved in the process of choosing a way of life and allocating shelters within a plot inside a camp. This thesis can address lessons learned by contributing to knowledge that impacts on housing refugees in better circumstances.

6.4 Contribution to Knowledge

The research highlights challenges in providing refugees with shelters in a hot-dry climate. It enables, through perception gaps between the literature review and primary data, support of stakeholders such as users (refugees) and humanitarian organizations to face challenges. In this regard, the research focused on integrating between theoretical concepts and practical solutions. It supports theoretical contributions such as highlighting inadequate practices of institutions and humanitarian organizations towards refugees' settlement. Regarding the practical contribution, it stands on understanding knowledge by using design science as a unique method to explore and investigate the field, then conclude with a number of lessons learned.

The research therefore links the theoretical stance and practical solutions filled through the design science method. The connection between the two approaches (theoretical and practical) gives a foundation to improve tools or specifications that might be a solution for the settlement of refugees globally.

6.4.1 Theoretical Contribution

Regarding theoretical knowledge, the research develops specifications under certain criteria that were formulated based on the theory of human needs and previous practices. This work has not been attempted by researchers in the past. This has given the academic field a distinctive awareness to highlight previously unnoticed key issues for more investigation. The theoretical knowledge of the thesis is built on information gleaned from previous studies and practices of humanitarian organizations and debated logistics strategies. Many organizations have influence on refugees' lives, including dependent and independent institutions, humanitarian organizations, NGO and others. These organizations concentrate mainly on protecting their life, and local government looks to security; unfortunately social aspects have minimum concern, so the importance of the

research is that it is looking to a comprehensive way to collect all of these considerations at once and highlight social aspects through technical requirements.

The broad principles and guides of establishing refugee shelters which were shown in the review of the literature led the author to a comprehensive understanding, and showed that it is impossible to support technical or engineering issues through following such general perspectives already used by organizations, so the theoretical knowledge is constructed by an absence of the concept of specifications, while connecting between physical, technical approaches and social and cultural meanings. In this regard, the research developed performance specifications rather than detailed specifications that do not require application when there are different social directions in the same context. Thus, such flexibility of presentation is what people need in the same list of specifications, depending on the local context and environment conditions as another identification of theoretical contribution.

Engaging stakeholders in the process of producing refugee shelters in terms of building, testing and demonstrating prototypes, kept a balance between all needs of stakeholders and specifically users' needs. This led to highlighting the gap of awareness about stakeholders' prioritizations which is another key issue of considering appropriate solutions for refugee shelters. Finally, the criticism of the theoretical part showed alternatives of emergency, temporary and transitional shelters, however, such shelter requirements are limited regarding the specific concerns, which led the research to contribute a process of producing an adequate solution, not just producing a prototype.

6.4.2 Practical Contribution

The practical knowledge highlights facts and supports the grasping of unclear concepts that connect the theoretical knowledge; it is a way of constructing knowledge about certain apprehensions. The researcher conducted the design science method that identifies the originality of contribution, for the first time, that employs an adapted version of the design science approach as its primary research framework. It has never been applied in order to create, test and validate tools such as specifications for establishing refugee shelters.

The adoption of the design science method allowed the field work to uncover unique insights into connecting the theoretical aspect and the practical aspect. The connection between phases of design science is the key issue of the practical contribution in terms of iteration flexibility, being back and forth between phases, based on the situation, additionally, such iteration is a unique strategy of methodological stance compared to other traditional methods.

Finally, the other strength of the practical contribution is in terms of using the design science method for providing a generality of solution, which has previously been unseen. The thesis contains a general approach by developing the specifications list which was formulated by bridging the gaps between previous practices of individuals and combining stakeholders' needs and social and cultural aspects, which is completely absent in humanitarian organization solutions.

6.5 Limitations of the Research

This section clarifies the main limitations in the thesis. The first limitation relates to using a new methodology that presented some difficulties. The design science method is a technical method which was one of the difficulties to overcome with the social issues relating to the thesis. The researcher addressed this by considering appropriate data collection methods for social activities before starting the phases and specially outlining the requirements of users, which included much more about social and cultural positions and using an ethnography strategy to show stories and experiences of stakeholders and formulate as a guide to consider, along with the specifications list.

Another limitation was that it was time consuming to reach participants, with respect to obligations and barriers that were required for security and safety reasons in terms of entering camps and engaging with people for interviews. This was a crucial barrier, the local government imposed very difficult obligations when meeting people, since it is considered a sensitive situation, and in an area that is geographically dispersed, so the researcher conducted a survey remotely due to the difficulties of meeting the experts at one specific place. In addition, the long list of specifications led to some architects refusing to be part of illustrating the design for the refugee shelter. To overcome such difficulties, the design science method is a robust method that is able to address

unforeseen issues and readjust the research program when some unforeseen circumstances happen such as targeting refugees and time consuming activities.

6.6 Recommendations for Further Research

Potential future research could consider other directions that might support urban organization or urban planning in refugee camps. This could be done through attending workshops organized by humanitarian organizations, attending conferences or undertaking doctoral study.

The area in which future research can be directed for improving refugee shelters and settlement requirements is listed below:

1. To investigate and explicate the difficulties of settlement of refugees in terms of urban organization, together with social and cultural aspects. These were not considered in the previous practices and review of literature. The research covers social areas regarding shelter performance; however, future research of transferring social aspects from shelters to the camps is required to meet refugees' needs in their context.

2. The time of preparing a shelter and cost variables fluctuate between years and the next donors and aid assistance, future research might be focused on the influence of those two variables on the result of settlement of refugees in camps.
3. Based on the substantial findings of the research, future research could be conducted on the differences of cultural values and social aspects regarding the environmental conditions and local context and its influence of providing stability for victims.
4. Regarding limitations of the study, further research might be extended to several directions of representing a specifications list in terms of the time factor, redeveloping the performance specifications to be descriptive or detailed specifications, readjusting the specifications list based on local context requirements, or deciphering the importance of the specifications.
5. There is a lack of data on urban planning and the connection between camps and the local community, therefore, further research is needed towards the city

perspective and the local community perspective and through studies on urban theories it might highlight the effectiveness in planning strategies of housing refugees around the world.

6. Future research could be expanded to further test and validate stakeholders' needs, in addition, different camps have different economical and ideological situations and these could be studied to provide additional variables.

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Appendices

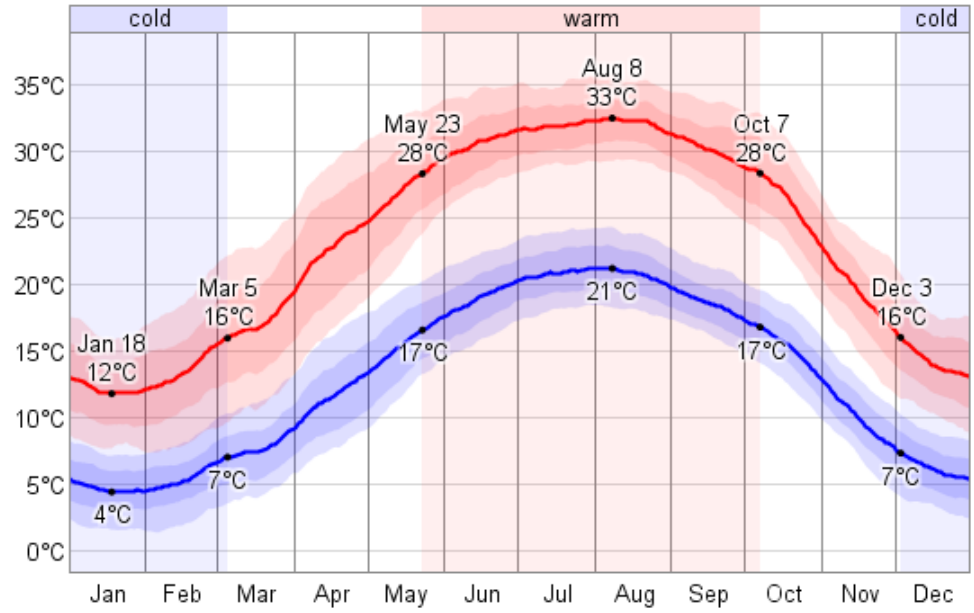
Appendix A: Common types of humanitarian organizations tents (Source: Corsellis & Vitale, 2008).

Type	Reinforced Plastic Tarpaulin	Family tent	Lightweight emergency tent	Ridge tent	Centre Pole Tent	Frame tent or transitional shelter	Nomadic tent
Image							
description	Made from high density polyethylene fibers	Stand by raised walls and fly sheets	Tunnel tent with fiberglass poles and synthetic fabric	Metal poles cover with cotton fly sheet	Canvas tent with one pole in the middle also may have a number of poles on side for raising wall	Metal frame filled with synthetic materials for walls	Tent using by nomadic people

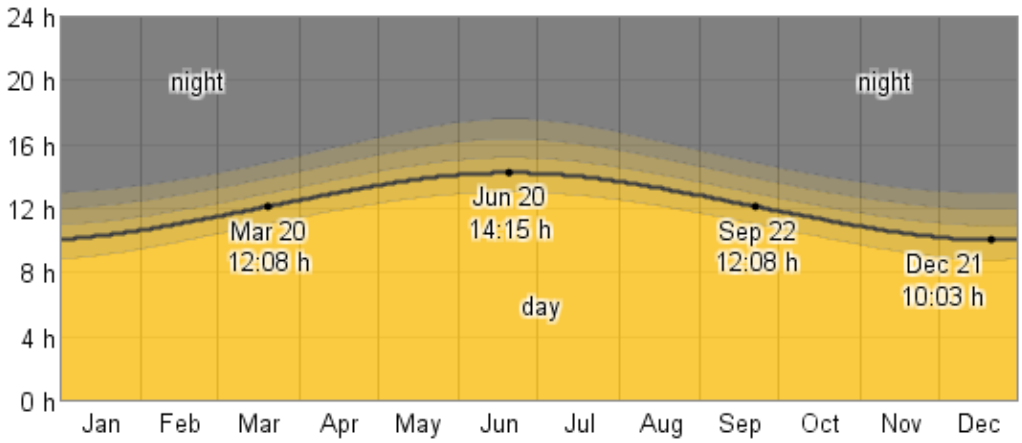
Covered area	4m*5m with +/- 1%	16 m2 plus two 3.5 m2 vestibules to be total area 23 m2, The Dimension size is 120 cm x 80 cm x 15 cm	15-21 m2	12-16 m2	12-24 m2	12-28 m2	10-30 m2
Weight	Minimum 190 gr/m2	55kg	42-60kg	75-85kg	50-120kg	50-120kg	200-300kg
Disadvantage	Requires maintenance and change in harsh climates	Tested as applicable for a few months	Appropriate height	Tested as applicable for a few months	The height inside is appropriate	Stable in strong wind and heavy rain	Large scale production in short time
Advantage	It protects from rain and wind and is useful for many years	Insufficient thermal comfort, limited wall height at sides	Poles need development technically	Insufficient thermal comfort, limited wall height at sides	It is possibly influenced by strong winds	It is more expensive for emergency response than a family tent	It is appropriate for local materials and climate

Appendix B: The report of Jordan weather during a year. Retrieved from https://weatherspark.com/averages/32846/Amman-Jordan [Accessed 22nd August, 2015]

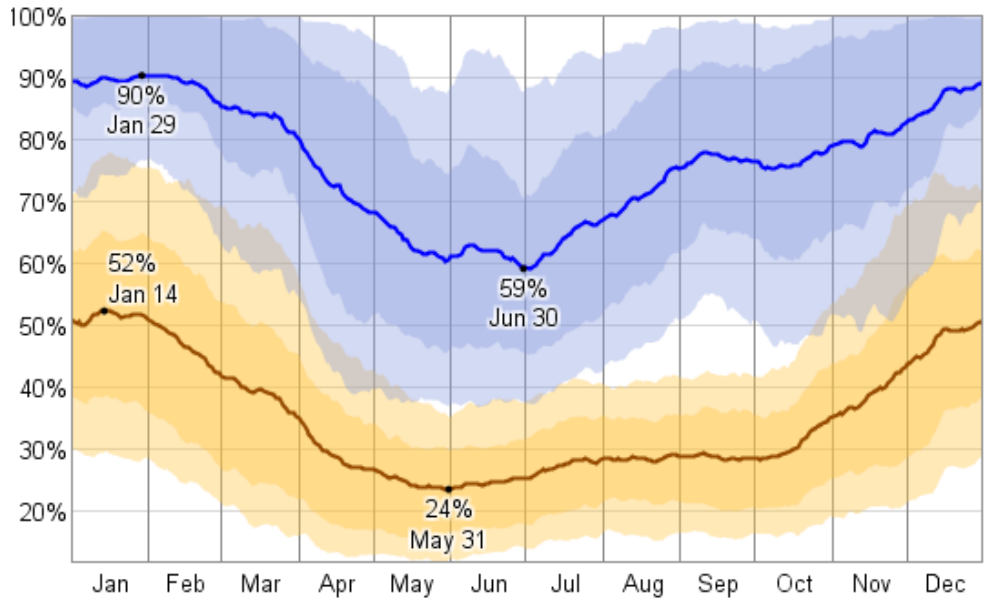
1. Daily High and Low Temperature



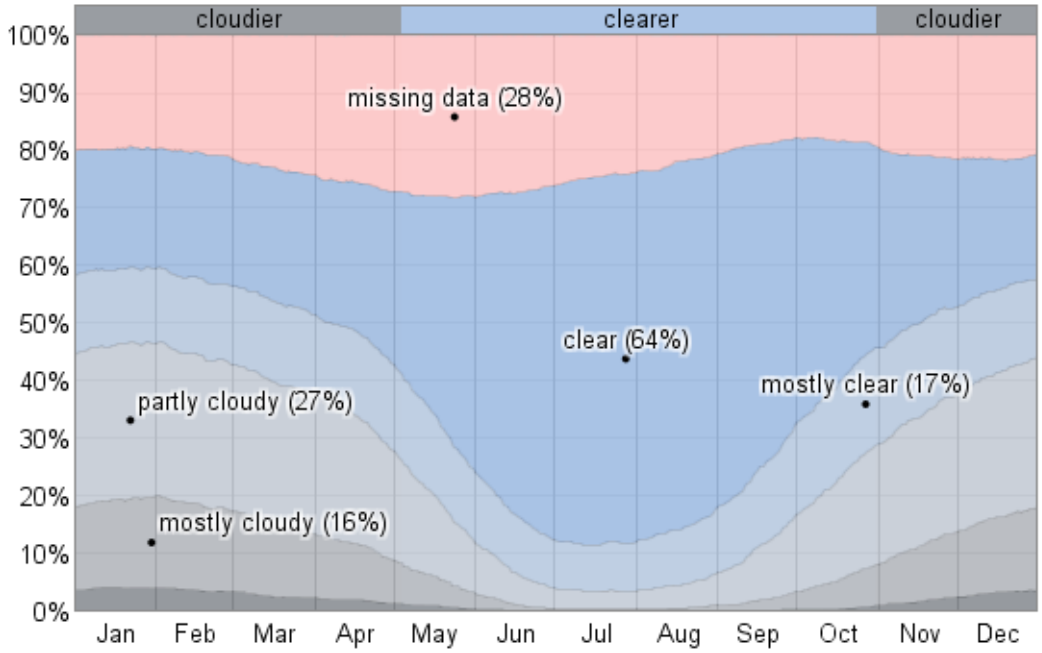
2. Daily Hours of daylight and Twilight



3. Relative Humidity



4. Clouds cover Types



5. Al Mafraq's weather. Retrieved from http://www.mafraq.climatemps.com/

Weather data		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unit
Wind Direction		190	130	210	230	280	290	250	300	290	250	110	290	Degree
Wind Speed/Avg Monthly		2	2	2	2	2	3	3	3	2	1	1	2	m/s
Relative Humidity		72	72	62	56	51	56	59	65	64	63	64	73	percent
Average Precipitation		36	33	21	9	3	0	0	0	0	3	16	29	mm
Average Sunlight		5h 56'	7h 11'	8h 11'	9h 02'	11h 21'	12h 10'	12h 42'	12h 01'	10h 18'	9h 17'	8h 18'	6h 13'	Hours/ Day
Percentage of Sunny (Cloudy) daylight Hours		59 (41)	66 (34)	70 (30)	71 (29)	83 (17)	86 (14)	91 (9)	91 (9)	85 (15)	83 (17)	80 (20)	63 (37)	Percentage
Sum altitude at solar noon on the 21st day		37.7	47	57.9	69.5	77.8	81.1	78	69.7	58.3	46.8	37.6	34.2	Degree
Temperature	Average Max Temperatur	12	14	18	23	29	32	33	33	31	27	21	15	Degree (C)
	Average Temperature	7	8.5	11.5	15.5	20.5	23	24	24.5	22.5	19	14	9.5	
	Average Min Temperatur	2	3	5	8	12	14	15	16	14	11	7	4	

Appendix C: Shelter project 2009 for accommodating displaced people and refugees.

Region or Country/ Year/ Organization	Shelter Construction	Implemented Method	Project Timeline
Afghanistan/ conflict /Qala camp/2009/Pakistan administered Kashmir	Tent then transitional shelter	Materials supporting implementation (prefabricated structure)	4 months, three phases; provided tent, construction start and construction completed
Gaza (Palestine)/conflict/ 2008/UN	Repairing houses	Urban organization method	13 months; five phases; early recovery reconstruction plan, project implementation, assessment start, assessment process 1, and project completion
Georgia/conflict/2009/NGO	Re pairing houses/ Permanent/ Core housing	Design functioning implementation	7 months; five phases; draft of shelter strategy, registration community, policy change, start construction and project completion
Rwanda/conflict/2008/ UN with local government	Permanent / Core housing	Material implementation/	14 months; eight phases;
Somalia/conflict and drought/2009/ NGO	Transitional shelter	Material implementation and urban upgrade	11 months; four phases; Planning recruitment, procurement, construction complete, and project complete
Sri-Lanka/conflict/2007/ NEO	Core shelter	Planning implementation	Three years; families return, project start, core shelter complete, and complete the rest of core shelters
Bangladesh/2007/cyclone Sidr/ International organization	Core shelter and repairing	Repairing shelter implementation	22 months; Six phases; assessment, test shelter, technical review, shelter construction, toolkit distribution, and project completed
India/ earthquake/2001/ NGO with local organizations	Transitional shelter	Design implementation to reduce masonry falling	10 months; three phases.
Italy earthquake/2009	Shelter construction/ Permanent housing	Design implementation(modular housing unit)/long life program	12months, however it is a small program for100 families
Peru/ earthquake/ followed with Tsunami/2007/NGO with non-government organization	Self-build Transitional shelter	Design implementation (using existing local structure and long life material), demandable shelter	3 months; three phases assessment, shelter prototype, funds, and project completed
Sri Lanka/2004/ tsunami/ national government	Construction Transitional shelter to bridge	Design and construction implementation	9 months; three phases; prototype shelter, shelter materials, shelter

	the gap until reach permeant one		complete
Uganda/Flood/ 2007/ international organization	Traditional round shelter	Design and local material implementation	The government started concrete block housing which is expensive comparing with traditional houses/ less attention to individual needs
Bangladesh/Conflict/1975/ CUNY center	Shelter and camp planning	Materials and planning implementation	4 years; 6 phases which are: displacement into camp, design shelter, field testing of prototype, consulting, and construction period and evaluation
India/conflict/1971/CUNY center	Planning housing and materials supporting	Planning organization method which are meet basic needs, sustainable upgrading and camp.	9 months; three phases;

Appendix D: List of interviewees' names and jobs

No.	Name	Organization	Interest
Independent Researchers			
1.	Roel Gijsbers	University of Technology/ Eindhoven	Researcher/ Architectural urban design and engineering
2.	Andre Ullal	University of Melbourne	PhD Candidate/ Architect Previous work is in Afghanistan with UNHCR (retrained housing settlement), and Australian Red Cross), also in Sub-Sudan (urban generation work)
3.	Catherine Bridge	Faculty of the Built Environment, The University of NSW	Catherine was awarded a plaque by the Sri Lankan Urban Development Authority for her input regarding the creation of a non-handicapping environment in the National rebuilding initiatives undertaken following the Tsunami of 2004.
4.	Charles Parrack	School of Architecture — Oxford Brookes	The research interests include: Shelter after Disaster, sustainable housing, social sustainability, public participation in regeneration and planning issues.
5.	Eefje Hendriks	University of Technology Eindhoven	Researcher and Doctoral Candidate/Teacher and researcher Avans Academy for Architecture & Infrastructure
6.	Erik Johansson	Civil Engineer/Lund University	Housing Development & Management-Currently doing research on climate-sensitive urban design and outdoor thermal comfort in cold as well as warm climates. Field experience from Sweden, Tanzania, Ecuador, Brazil, Jordan, Morocco, Sri Lanka, Ethiopia, Algeria and Tunisia.
7.	Gert ludeking	Architect, External Lecturer, Copenhagen University	UN-Habitat Director Geneva Office (Shelter and settlements in disasters)
8.	James Rooney	Independent Architect	Chartered Architect Ltd (Hexi-house)
9.	Katerina Pateraki	Lecturer in Humanitarian Engineering & Computing. Coventry University	Operational member of search in disasters
10.	Louise Bloom	Refugee Studies Centre, University of Oxford	Research officer- The research interest (bottom-up perspectives of humanitarian innovation and had several of field work in Jordan, Africa, India)
11.	Mark Cox	University of Technology/ Eindhoven	Supportive and management staff-Innovation Lab Organisatie voor Innovatiestimulering, Technology Transfer in Business Development

12.	Shaun Halbert	Independent researcher	ReciproBoo Shelter
13.	Stefano Scavino	Independent Architect	Italian NGO (INTERSOS organization-Al-Za'atari Camp) Architect/Previous work in interests: The Summarization of Jordan Shelters
14.	Steger Brigitte	Independent researcher	Research in tsunami hygiene and community issues in tsunami evacuation shelters
NGO (Non-Government Organizations)			
15.	Avery Doninger	All Hands Volunteers and previous in GOALS Haiti, Relief International	Shelter Program Manager/ Assistance to the technical Advisor
16.	Carlo Gherardi	NRC/the Al-Za'atari Camp-Jordan	Shelter/ NFI Project Manager Camps
17.	Cecilia Braedt	IFRC - Shelter Research Unit	Coordinator
18.	Corinne Treherne	IFRC-Geneva	Senior Officer, Shelter and Settlements
19.	Ghada Barakat	UNHCR/ the Al-Za'atari Camp-Jordan	Site Planner Associate
20.	Jake Zarins	Disaster Risk Reduction and Response- Habitat for Humanity International	Associate Director
21.	John Tzanos	Better Shelter	Head of services
22.	Joseph Ashmore	International Organization for Migration, Geneva	Shelter and settlement Expert and Global Cluster focal point
23.	Mohamed Abdel- Al	UNHCR/Jordan	Senior settlement and shelter officer
24.	Mohamed Houari	UNHCR/Jordan	External relation- Mass -info
25.	Mohmed dan dan	UNHCR/Jordan	Senior admin assistance
26.	Anne Buhaisi	UNHCR/Jordan	HR officer/ X registration and social assistance
27.	Mohamed Hilmi	Senior Coordinator and Technical Specialist for Shelter & Settlements	InterAction A United Voice for Global Change
28.	Nasr Chamma	UNHCR/ Jordan	Architect/Research and development intern (The UN Refugee Agency)
29.	Tim De Haas	Better Shelter	Head of Technology
30.	Tom Bamforth	Global Shelter Cluster Global Focal Point (Shelter Coordination), International Federation of Red Cross and Red Crescent Societies/ NRC/IOM	Research Assistance
31.	Tom Newby	CARE International UK	Emergency Shelter Team Leader

Appendix E: Ethical Approval

Academic Audit and Governance Committee
College of Science and Technology Research Ethics Panel

(CST)

To **Aburamadan, Rania Fayiz (and Prof Erik Bichard)**

cc: **Professor Hisham Elkadi, Head of School of SOBE**

From **Nathalie Audren Howarth, College Research Support Officer**

Date 1/05/2015

Subject: **Approval of your Project by CST**

Project Title: **Design Specifications of Refugees' Shelter in Desert Climate with being Jordan as case study.**

REP Reference: **CST 15/15**

Following your responses to the Panel's queries, based on the information you provided, I can confirm that they have no objections on ethical grounds to your project.

If there are any changes to the project and/or its methodology, please inform the Panel as soon as possible.

Regards,

Nathalie Audren Howarth
College Research Support Officer

Appendix F: Participant Information Sheet

Research Title

Developing User- Informed Specifications for Refugee Shelters in Hot- Dry Climates: A study of the Al Za'atari Camp in Jordan

Invitation Paragraph

I would like to invite you to take part in this research study and before deciding to be a part of the research it is important to understand the reason behind such research and what it will involve for you. Please take your time to read the relevant information about the research and ask any questions if any point is not clear for you, take your time to decide whether want to be part of the research or not.

The research study is to design specifications of refugees' shelters in certain climates (desert climate) to meet their needs and challenges they have faced in extreme climate conditions where the increasing number of refugees in the last twenty years have been an important issue and that organizations and local governments are concerned about.

Research Purpose

The research study is an important part to complete my PhD program at the University of Salford, interviews and questionnaires are part of this work and are necessary to complete the PhD program.

Why have you been invited?

You are being invited to take part in this research study because refugees, international organizations and local governments play a main role for formulating and determining this in depth research problem, in addition, the research will choose samples from refugees from different camp sectors who are above 18 years of age, including both men and women, in order to clarify quality of life issues that are faced. Since providing a shelter is conserved as protected elements for families, the study will include men and women over 18 as the main participant groups.

Furthermore, the research study will take participants from organization staff who are involved in the process of setting up a camp and participants will be chosen from those who have missions inside the camp.

Local government will be the third group of the study and will include those who are working inside the camp and have direct and indirect connection with refugees.

Do you have to take part in this research study?

It is up to you if you want to take part or not, if your answer is yes, you have time to read this information sheet carefully and ask any points you are not clear with, and I would ask you to sign an informed consent sheet that needs to be completed as the official papers.

Also I would like to clarify that our meeting could include more than one visit, depending on research workflow. I would also like to ask permission to record our interview and keep your questionnaire on file, where it will be kept in a safe place with confidentiality considerations. Furthermore, you are free to withdraw from the research study at any time without giving a reason. Data collected will be engaged and used as part of the research unless you request it to be deleted.

What are benefits and risks?

There is no risk from taking part in this research and such research will secure all data that is collected from meetings with strict confidentiality considerations.

The researcher is very grateful and appreciates your participation in this research study. You will not benefit directly from being part of the study but the information and results from the study will help to grasp the importance of finding solutions to provide better refugee shelters.

What will I have to do?

The research study looks at quality of life, social activities and environment requirements in camps by answering interview questions and filling out questionnaires that are part of the data collection tools.

What if there is a problem?

If you are unhappy with any issue in the research, please speak to the researcher directly on (contact number).

Will my data be kept confidentially?

The research will include data gathered by interviews, questionnaires and group discussions. All of this data will be kept anonymously and securely, so that no one can be identified. Electronic information will be kept in a password protected laptop, accessed only by the researcher and paper copies will be stored in a secure lockable cabinet at the University of Salford.

Collected data will be used in this research under ethical approval from the University of Salford where the authorization will be given to the researcher and supervisors to access and view data.

Data will remain securely stored for a minimum of three years as required by the ethics panel.

Who is organizing the research?

The research study is individual research to complete a PhD program at the University of Salford.

Contact details

If you have any questions or you need further information about the research study please do not hesitate to contact:

Researcher's Name: Rania Aburamadan
PhD Candidate, MERIT program
College of Science and Technology
School of Built Environment
University of Salford
Maxwell Building, The Crescent
Greater Manchester, UK M5 4WT
E-Mail: R.F.Aburamadan@edu.salford.ac.uk
Phone: +962796662044

If you have any complaints about the research study, contact:

Supervisor Prof. Erik Bichard
School of the Built Environment
Room 411 Maxwell Building
University of Salford
The Crescent
Salford M5 4WT
E-Mail: e.bichard@salford.ac.uk
Phone: 0161-295-6826

Appendix G: Selected questions of refugees' responses to investigate beyond basic variables.

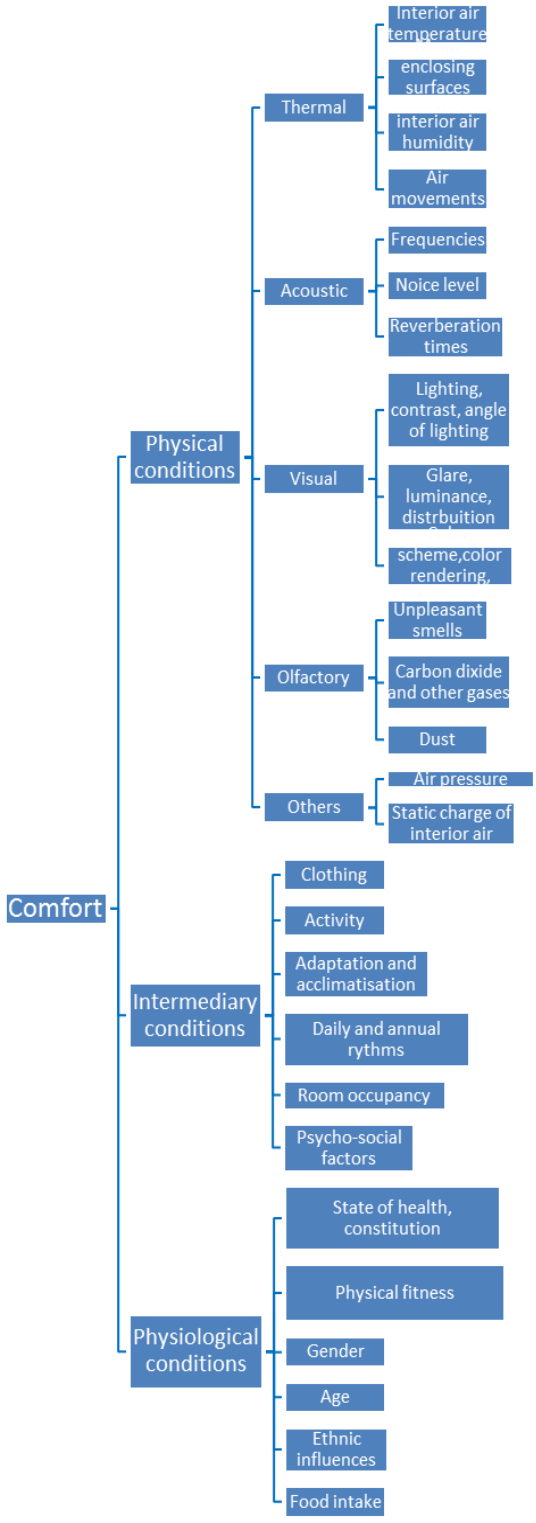
	Questions	*Options*	*Responses*
Manufacturing design elements and materials of shelter	1. What are the modifications that you applied in your shelter initially?	a. Adding private shower	1.7
		b. Adding private bathroom	24.6
		c. Adding washing area	7.0
		d. Adding private kitchen	20.2
		e. Water tank	12.3
		f. Extending by adding a tent	12.9
		Supporting insulation	3.9
		Supporting the electricity services	5.9
		Supporting security services	5.9
		No modification	4.5
		No answer	1.1
		Total	**100%**
	2. What are the problems that need to be maintained permanently in your shelter?	Rain water leak from any part of the shelter	40.0
		The dismantling parts of the shelter	18.7
		Rot in parts of the shelter	24.8
		Windows and doors damages	11.7
		Other (please specify)	1.3
		Sanitation Problems	0.4
		Rodents Problem	0.4
		No problems	0.4
		Electricity Problem	0.4
		No answer	1.7
		Total	**100%**
	3.What maintenance problems have you faced in your shelter?	Manufacturing problems in windows and doors	26.6
		Manufacturing problems in the floor	31.9
		Manufacturing problems in the roof	34.5
		Climatic manufacturing problem	0.9
		Manufacturing materials problems	0.9
		Nothing	0.9
		Everything	0.4
		No answer	3.9
		Total	**100%**
	4.Which of the following factors influence your satisfaction of your shelter?	Location of shelter to nearest services	22.3
		Location to the nearest relatives or friends	38.5
		Outside the related area	1.1
		Location of shelter area comparing to other dwelling areas	4.5
		Shelter atmosphere	15.1
		Providing services (sanitation, insulation) inside shelter	12.3
		No answer	6.1

		Total	**100%**
	5. The reason of extending your shelter is?	Shortage of spaces provided	41.3
		Shortage of internal existing services	23.8
		Increasing in the number of family	27.3
		Social and culture aspects	1.7
		Not clear reason	2.3
		No answer	3.5
		Total	**100%**
Discontinuous electricity and water	6. Is electricity provided to your shelter?	By supply system (network infrastructure)	41.4
		Water is being bought on our expense	20.4
		No stable water source	34.0
		We do not get water	2.5
		No answer	1.9
		Total	**100%**
	7. What is the water source for daily household use?	Yes	17.4
		No	82.6
		Total	**100%**
Instability	8. What was your occupation back in your home?	Farmer	13.1
		Professional occupations	36.6
		Office occupations	13.1
		No job	2.1
		Housewife	5.5
		Student	17.9
		No answer	11.7
		Total	**100%**
	9. Are you working now?	Yes	27.1
		No	69.4
		No answer	3.5
		Total	**100%**
	10. Do you see yourself living in the same shelter after five years?	Yes	20.1
		No	79.9
		Total	**100%**
Social and culture differences	11. What are kind of problems happen in the camp?	Financial problems	48.6
		Families problems	25.1
		Governmental problems	9.7
		Neighborhood Problem	1.1
		Services problems	6.9
		Psychological problems	0.6
		No problem	0.6
		No answer	7.4

		Total	**100%**
	12. Do you share the outside area of the shelter with the neighbors?	Yes	54.9
		No	45.1
		Total	**100%**
	13. Where do you live in the camp?	Near friends and relatives	60.1
		Near public services	13.1
		Near the center of the camp (shopping area)	13.1
		Far from the center	13.1
		Near specific services (water/electricity)	0.7
		Total	**100%**
Security and protection	14. Which of the following do you consider your most important need?	Security and safety	37.3
		Food and non-food item	20.4
		Comfortable shelter	26.2
		Social ponding	11.6
		Job	0.9
		Educational quality	0.4
		No answer	3.1
		Total	**100%**
	15. Have your sense of safety in your shelter changed by time?	Feeling safer	40.3
		Feeling the same	30.6
		Feeling less safe (explain)	28.5
		No answer	0.7
		Total	**100%**
	16. Have you heard about fires that resulted from cooking inside the shelters?	Always	55.6
		Sometimes	34.7
		Rarely	6.9
		never	2.8
		Total	**100%**
	17. Have you suffered from new diseases after moving to the camp?	Yes	63.9
		No	35.4
		No answer	0.7
		Total	**100%**
	18. What are the most four important services you need to improve your quality of life?	Food	9.4
		Water and sanitation	15.7
		Type of shelter	12.6
		Medical services	12.4
		Special medical services	6.7
		Education services	8.3
		Security / Safety	10.8
		Livelihoods and employment	14.8
		Legal rights and advice	7.5
		Back to my home	0.2

		Electricity services	0.4
		Everything	0.4
		No answer	0.8
		Total	**100%**
Climate difficulties	19. What are the weather conditions that affect the shelter?	High temperature	23.6
		Low temperature	7.3
		Rain	13.1
		Snow	12.9
		Dust	20.2
		Wind	13.1
		Humidity	9.7
		No answer	0.2
		Total	**100%**
	20. What means do you use to protect yourself from high temperature inside your shelter in the summer?	Electric ventilators	35.1
		Going out of the shelter	34.5
		Open windows and doors	5.4
		Nothing	8.8
		Staying at shelter	3.4
		Protection by using water	2.0
		No answer	10.8
		Total	**100%**
	21. What means do you use to protect yourself from low temperature inside your shelter in the winter?	Electric heaters	9.7
		Gasoline heaters	49.4
		Making fire	2.8
		Using blankets	34.7
		Wearing extra clothes	.6
		No answer	2.8
		Total	**100%**
	22. Do you face any problems concerning rain water?	Water entering from doors and windows of the shelter	31.6
		Water pooling around the shelter	26.1
		Humidity inside the shelter	21.7
		Leakage from the ceiling	18.4
		No problems	1.8
		No answer	.4
		Total	**100%**
	23. How much does strong wind affect the shelter?	Strong effect	59.0
		Average effect	32.6
		Weak effect	5.6
		None	1.4
		No answer	1.4
		Total	**100%**

Appendix H: Comfort Categories (Source: Fuchs et al., 2012).



Appendix I: Critical body

temperature (Source: Auliciems *et al.*, 2007)

Skin Temperature	Deep Body Temperature	Regulatory Zone
Pain:45°C	42°C	Death
	40°C	Hyperthermia
		Evaporating zone
		Vasodilation
31-34°C	37°C	Comfort
		Vasoconstriction
		Thermogenesis
	35°C	Hypothermia
Pain: 10 °C	25°C	Death

Appendix J: Example of sustainable energy solutions to meet household energy service needs household (Source: Gunning, 2014)

Household energy services	Renewable energy options
Cooking and Heating	Alternative fuel and stoves – Biomass Briquettes, Solar, Ethanol, Biogas
Shelter	Insulated shelter
lighting	Solar lanterns/ Pico solar
Other electricity Services and Communication	• Solar home systems Integrated PV
Water Pumping	

Appendix K: Refugees' In-depth Interview Model

General living situation:

1. What are the reasons that made you leave your country?
2. How was the arrival process to the camp you are living in today?
3. Is your stay in the camp subject to laws that affect your daily life?
4. How do you find the infrastructure in the camp?
5. Is the entry to and exit from the camp subject to regulations from the camp management?
6. Who is the authority in charge for your existence in the camp?

7. What are the types of shelters provided in the camp? Do you think it is meeting the purpose thereof?
8. How are the shelters being distributed?
9. Why is the reason the refugees enter and exit the camp?
10. What are the most common jobs inside the camp? Is it shared by all categories of refugees?
11. Are the types of shelters provided for the refugees appropriate for the climate conditions?
12. What are the difficulties the refugees face concerning the weather?

Shelter data:

1. Is there additional interior space in the shelter?
2. Is the inner space of shelters enough for daily life?
3. To what extent do you adapt the shelter provided?
4. Does every shelter have a direct extension of electricity and water?
5. How do you get warmth in winter? And coolness in summer inside the shelter?
6. How do you find the shelter you live in?
7. How much time do you spend inside the shelter?
8. How does the weather affect the time you spend inside the shelter?
9. Are the daily household works like preparing food and washing provided inside each shelter?
10. How long do you expect you will stay in this shelter?
11. What do you think about the shelter you live in?
12. How do you renew the air inside the shelter?
13. Are the services provided inside the shelter appropriate?
14. In hot summer nights how do you get a nice atmosphere inside the shelter?
15. Do the refugees face difficulties concerning the shelter maintenance?
16. How are interior spaces distributed in the shelter?
17. Do you wish for an amendment inside or outside the shelter?
18. Did any of the refugees amend their shelters? And why?

Population status data:

1. Do you have different relations with your relatives neighbours and friends?

2. Are the usual social practices available in the camp?
3. Are you in constant contact with your neighbors?
4. How do children spend their free time?
5. Is there any entertainment venues for young and old people in the camp?
6. Do neighbors share certain services within the same district inside the camp?
7. To what extent do refugees connect with the local community surrounding the camp?
8. What is the general nature of relationship between the refugees?
9. How are the social problems if occurred solved?
10. How do you find the social relations between relatives in the camp?

Camp urban situation data:

1. Does the movement between shelters at night differ from daytime?
2. How can a refugee change his place from one district to another inside the camp?
3. Why would you like to change your place of residence inside the camp?
4. How do you find the distribution of shelters and the services around them?
5. How do you find the ease of movement inside the camp?
6. How can the refugees recognize all sections of the camp?
7. What is the effect of number of refugees within the same district in your opinion?
8. How are spaces around shelters used?

Services and basic needs data:

1. Are the daily living requirements available in the camp?
2. How do you find reaching the basic needs from the markets in the camp?
3. How is the climate in summer and winter?
4. How do you find the availability of basic needs for the refugees like shelter food and drink?
5. How do you spend your time in summer and in winter?
6. Do you have a permanent job inside the camp?
7. What are the basic requirements a refugee needs inside and outside the shelter?
8. What kind of change you desire inside the camp in general? And inside your shelter in particular?
9. How are the shelters connected with the main roads of the camp?

10. How do refugees face winter? And what are the preparations they do to confront the weather?
11. How do the refugees deal with the cold weather and the hot weather?
12. Did you hear about any previous emergencies that occurred in the camp like fires?
13. How are the faults of basic services being repaired in the camp?
14. Are there any diseases spread between the refugees in the camp?
15. What is the main cause for disease spread in the camp in general?

Appendix L: Refugees' Questionnaire Model

This PhD research is taking place under the guidance and supervision of The School of Built Environment at The University of Salford and would like to invite you to take a part in this questionnaire survey through kindly asking you to answer the following questions. The purpose of this survey is to understand more the situation of refugees inside the camp in order to ensure a better future for finding solutions to provide better refugees' shelter, also to clarify the state of refugees and then to be transmitted to who is in charge or concerned. I would like to mention that the questionnaire survey will be totally anonymous and I would like to thank you for your time.

Arriving and settling in the host country

1. What was the main reason that made you leave your country?
    1. Financial instability 2. Security reasons 3. Forced migration4. Family pressures 5. Other (explain)
2. Where do you come from?
    1. Capital 2. Town 3.Village 4. Other (please determine)
3. For how long have you been living in the camp?
    1. Less than a year 2. 1 to 2 years 3. More than 2 years
4. Are you registered with the UNHCR or any other institution?
    1.Yes 2. No
5. Where did you reside before arriving to Jordan?
    1. Countries in your home 2. Countries in the host community 3.Borders 4. Other (explain)
6. How many persons do you have in your family including yourself?
    1. Less than 5 2. More than 5 3. More than 10
7. How many children do you have in your family?
    1. No children 2. 1-3 children 3.4-6 children 4. Above seven
8. What is your future plan of your accommodating?
    1. Stay in Jordan
    2. Return back to my home (no matter what)
    3. Return back when my whole country would calm
    4. Return back when the regime would fall
9. Where do you live in the camp?
    1. Near friends and relatives 2. Near public services 3.Near the centre of the camp (shopping area) 4.Far from the centre 5. Others (explain)
10. Which of the following aid list did you receive?

1. UNHCR or international associations 2. Local associations 3.Local people/families 4. Governmental services 5. Other (explain)

11. Which kind of aid did you receive?
    1. Food 2. Non-food items 3. Dwelling 4.Health assistance 5.Psychological assistance 6.Cash 7. Other (explain)
12. How do you obtain your food?
    1. By yourself 2. Institutions (UNHCR) 3. Yourself and institution
    4. Other (please explain)
13. How do you spend your financial aid that you receive from the institutions?
    1. Renewing your dwelling
    2. Providing the basic necessities such as electricity, water, solar….etc.
    3. Buying food
    4. Educational expenses
    5. Health care and buying medicines
    6. Other (explain)
14. Are you working now?
    1. Yes 2. No
15. What was your occupation back in your home?
    1. Farmer 2. Professional occupations 3.Office occupations 4.Others(explain)
16. What kind of problems happen in the camp?
    1. Financial problems2. Family's problems 3.Governmental problems 4.Other (explain)
17. What is your dwelling from the following list?
    1. Tent 2. Caravan 3. Tent and caravan
18. Do you have a private bathroom in your dwelling?
    1. Yes 2. No
19. Do you have a private kitchen in your dwelling?
    1. Yes 2. No
20. Which of the following factors influence your satisfaction of your dwelling?
    1. Location of dwelling to nearest services 2. Location to the nearest relatives or friends 3.Outside the related area 4.Location of dwelling area comparing to other dwelling areas 5. Dwelling atmosphere 6. Providing services (sanitation, insulation) inside dwelling 7. Other (explain)
21. What are the weather conditions that affect the dwelling?
    1. High temperature 2. Low temperature 3.Rain 4.Snow 5.Dust 6.Wind 7.Humidity 8. Other
22. What means do you use to protect yourself from high temperature inside your dwelling in the summer?
    1. Electric ventilators 2. Going out of the dwelling 3. Other (please specify)
23. What means do you use to protect yourself from low temperature inside your dwelling in the winter?
    1. Electric heaters 2. Gasoline heaters 3. Making fire 4. Using blankets 5. Other (please specify) _____
24. Do you face any problems concerning rain water?
    1. Water entering from doors and windows of the dwelling 2. Water pooling around the dwelling 3.Humidity inside the dwelling 4.Leakage from the ceiling 5. No problems
25. How much does strong wind affect the dwelling?
    1. Strong effect 2. Average effect 3. Weak effect 4. None
26. How long do you spend time inside your dwelling in during the day?
    1. 8-10 hours 2. 5-7 hours 3.Less than 4 hours 4. Not specified
27. Is there a possibility to provide a space for children to play inside the dwelling?
    1. Yes 2. No

28. Do you see yourself living in the same dwelling after five years?

1. Yes 2. No

If No please specify

29. What maintenance problems have you faced in your dwelling?

1. Manufacturing problems in windows and doors 2. Manufacturing problems in the floor 3. Manufacturing problems in the ceiling 4. Other (please specify)

30. Have you heard about fires that resulted from cooking inside the dwellings?

1. Always 2. Sometimes 3.Rarely 4.never

31. Do you share the outside area of the dwelling with the neighbors?

1. Yes 2. No

32. What is the water source for daily household use?

1. By supply system (network infrastructure) 2. Water is being bought on our expense 3. No stable water source 4. We don't get water

33. Is electricity provided to your dwelling?

1. Yes 2. No

34. How do you evaluate the roads in the camp?

1. Very good 2. Good 3. Bad 4. Very bad

35. How long does it take from your dwelling to the shopping area?

1. Less than 10 minutes 2. 10-30 minutes 3. More than 30 minutes

36. How many minutes do your kids need to reach their school?

1. 5-15 minutes 2. 16-25 minutes3.26-35 minutes4. More than 35 minutes

37. How do you evaluate your health conditions while living in the camp?

1. Very good 2. Good 3. Medium 4.Bad 5. Very bad

38. Have you suffered from new diseases after moving to the camp?

1. Yes 2. No

39. Is your dwelling secured from dangerous?

1. Strong agree 2. Agree 3. Strong disagree 4. Disagree

40. What are the most four important services you need to improve your quality of life?

1. Food 2. Water and sanitation 3. Type of shelter 4. Medical services 5.Special medical services 6. Education services 7. Security / Safety 8.Livelihoods and employment9.Legal rights and advice 10. Other (explain)

41. What are the modifications that you applied in your dwelling initially?

1. Adding a private shower 2. Adding a private bathroom 3.Adding a washing area 4. Adding a private kitchen 5.Water tank 6.Extending by adding a tent or caravan 7.Supporting the installation service 8. Supporting the electricity services 9.Supporting the security services 10. Others (explain) 11.No modifications

42. What are the problems that need to be maintained permanently in your shelter?

1. Rain water leak from any part of the shelter 2. The dismantling parts of the shelter 3. Rot in parts of the shelter 4. Windows and doors damages 5. Others (explain)

43. The reason of extending your dwelling is?

1. Shortage of spaces provided 2. Shortage of internal existing services 3. Increasing in the number of family 4. Other (explain)

44. From where do insects and rodents enter the dwelling?

1. Dwelling door 2. Dwelling window 3. Ceilings 4.Floor 5. Other (please specify)_____ 6. No insects

45. Do you have sewage system connected with a network system?

1.Yes 2. No

If No please specify _____.

46. How do you dispose your waste of sewage system?

1. Through international organizations 2. Sewage tanks 3. Dump it in the street 4.Other (explain) 5. No sewage hole

47. Have your sense of safety in your dwelling changed by time?
    1. Feeling safer 2. Feeling the same 3. Feeling less safe (explain)
48. Do you feel safe when visiting public bathroom?
    1. Yes 2. No
49. Do you feel safe when visiting public Kitchen?
    1.Yes 2. No
50. Did you move from your dwelling inside the camp to another place?
    1. Yes 2. No
    If your answer yes please specify _____
51. Which of the following do you consider your most important need?
    1. Security and safety 2. Food and non-food item 3. Comfortable dwelling 4.Social ponding 5. Others (explain)
52. What is your level of satisfaction about sewage system and hygiene?
    1. Satisfied 2. V. satisfied 3. Average 4.dissatisfied 5. V. dissatisfied
53. What is your social status?
    1. Married 2. Single 3.Single mother 4.Divorce 5.Widow 6. Other (please explain)
54. Which of the following age ranges is closest to your age?
    1. 20-30 2. 31-40 3.41-50 4.51-60 5.above 60
55. Gender
    1. Male 2. Female
56. What is your educational background?
    1. Primary 2. Secondary 3.University 4. Illiterate

Appendix M: List of Requirements

Requirements	Criteria	Refugees' concerns and challenges	Responses		
			Agree	**Disagree**	**No answe**
Protection	**Safety and Security**	**Reasons of leaving their country**-insecurity	63.2%	34.6%	2.2%
		Health safety- inadequate hygiene services	84.2%	15%	0.8%
		Environment safety- fire incidents	55.6%	34.7%	9.7%
Climate difficulties	**Comfort**	**Climate comfort** -undesirable weather; dust, high temperature, wind and rain respectively.	69%	29%	2%
		Shelter comfort- inappropriate shelter manufacturing regarding climate difficulties.	84%	12.1%	3.9%
		Hygiene and service comfort –availability of the sewage system.	66.6%	33.3%	0.1%

Social and culture differences	**Social context**	**Social activities with neighbors –** sharing area and activities	54.9%	45.1%	0.0%
		Social adaptation- social support makes difference in their life	38.5%	55.4%	6.1%
		Social bonding- living nearby relatives	60.1%	39.9	0.0
	Stability	**Home stability**- they want back home	79.9%	20.1%	0.0%
		Social Stability- urban compatibility	45.1%	54.9%	0.0%
		Financial stability- regulations and difficulties to find jobs inside and outside camps	69.4%	27.1%	3.5%
Manufacturing design elements and materials of shelter	**Flexibility**	**Spaces flexibility**- adding elements	68%	26.5%	5.5%
		Components flexibility- inadequate design elements- manufacturing problems that faced weather such as rain	60%	38.3%	1.7%
	Demountable and durability	**Shelter elements**- manufacturing problems that faced weather such as rain	58.7%	39.6%	1.7%
		Shelter functionality	20%	76.1%	3.9%
		Shelter materials and climate - shelter materials manufacturing problems that faced weather difficulties	76.5%	25.2%	1.7%
Discontinuous electricity and water functionality	**Constant Energy**	**Source of energy**- unavailable sources of energy to protect themselves	60%	29.2%	10.8 %
		Services difficulties –discontinuous electricity services	85%	13%	2%
		Services difficulties - discontinuous water services	40%	58.1%	1.9%
		Service control- overcrowded sectors against services control	75%	25%	0.0%

Appendix N: 1. Specifications List

The next table presents the list of specifications and following part describes each specification in details under research criteria

Requirements	Specifications			
	Range of Specifications Boundaries	Explanation/Function/ operation (Why)	Fundamental Shelter Requirements (How)	Specification performance (What)
1. Safety and Security				
A. Protection				
Human Safety	***SP.1 Fear protection*** *(NGO),* ***crime protection*** *(local governments)*	They were fleeing from dangerous weather, conflict or natural disasters	Providing food and non-food items	Considering people situation (age, gender, stats, disable, vulnerable people, ethical origin, religious and political affiliation)
	SP.2 Fire safety	Reducing fire accidents	Establishing urban organization for dwellings and providing non-flammable materials	Distance between dwelling is twice the height at least, there is fire breaks which is required between all parts of a camps as following; 2, 6, 15 and 30 of shelters, communities, blocks and sectors.
Engineering Safety	***SP.3 Structure protection***	To prevent collapsing or demolish structure due to climate difficulties	Leave an appropriate distance between shelters besides supporting structure elements inside shelters.	*.Determining distance between shelters *.Providing safety valve elements if demolishing or dismantling shelters

Healthy Safety	***SP.4 Hygiene shelter spaces***	To prevent diseases	Through separating spaces inside shelter	Specify separating services spaces such as kitchen, washing area, latrine and showers of other spaces inside shelter by determined hygiene covered area (door, curtains or others) Specify clean spaces between shelter and ground and using medicines for insects if it is necessary. Specify NGO supervision controlling for closing all covers of sanitation systems Specify fenced trash area with sewage containment tanks that are used temporary disposable plastic bags for waste materials within each community.
	SP.5 On-site sewage system	To secure infected users by smells, insects and flies and pollute source of ground water	Through providing pour flush latrine for each shelter	Specify construction separated partitions between latrine and the rest of shelter space. Specify diameter of pour –flush latrine is 1m across hole (circle, rectangular, or secure) and 3m or above pit in depth connecting directly or by plastic pipe slopes towards pit. Specify latrine slab rest whether on foundation of pit or on ground directly and calculating person and slab's cover weight and removable self-closing cover to prevent smell and entering rodents and flies. Specify pit walls depending on soil characteristics, specifying 10 cm of fried blocks or concrete wall in each side. Specify keeping 10m distance at least between

				water drinking point and latrine points. Specify sewage flow (190 liters- 42 gallon) per person, and range of 500-900 gm of faeces per person per day depending on type of food, 0.6-1.1 liters per person per day depending on climate conditions. Specify using grey water of laundry and washing for flushing. Specifying using vacuum tankers for emptying the pit by providing enough space for tanker passing and park and easy entering tanker pipe inside the pit. Specify raising latrine slab 150-30 mm (to prevent entering rain water inside latrine), slippery foot rest spot, and Specify shared tanks for hard durable cover of sewer tank (fixed permanently close with flexible open by galvanized screws) Specify removable waste materials (waste and gray water, liquid sewage) continuously depending on sewer capacity. Specify using durable materials for sewer tank to prevent sink water into ground
B. Control				
Small context	***SP. 6 Size of camp's block***	To prevent socio- economic conflict	Determine number of people in each block relating to area of shelter	Dividing into sectors, blocks and community (in each sector 5,000 refugees), each sector has 4 blocks and each block has 16 communities and each

				community has 16 plots and 16 shelters besides fire breaks are required from shelter to community, blocks and sectors as following 2, 6, 15, and 30 respectively. Each sector has a service area of water drainage and wash system to provide for recreation activities, clear access, clear fence with trees for security and mitigation wind effect also consider size of sectors, blocks and communities based on providing an appropriate space for person which is 3.5 m2 and roads and services such as school, healthcare and commercial spaces..
	SP.7 ***Close distance between shelters***	Preserve privacy for each dwelling	To compromise between less distance, obtaining privacy and fire safety	Maximum distance between dwellings and facilities for all ambulance camp residents no more 500 meter
	SP. 8 Maintain shelter	To increase shelter lifespan and reduce waste materials	Providing distribution maintain points	Distribution - one point for each sector which has a number of engineers with tool kits in each plot (200-300m2) based on monitoring problems of shelter performance (roof, joints, walls, windows and doors)
Comfort				
A. Thermal comfort				
	SP.9 *Air temperature or radiation temperature*	Human body needs a moderate degree temperature for daily activities.	Materials features are used in design requirements. Relating to number of people inside shelter	Specify (20 -26) °C by shaded east and west façade especially during morning and afternoon to minimize heat gain of external walls
	SP.10 *Humidity in interior air*	To prevent mold and dust accumulation	Through keeping balance between thermal degree inside and outside shelter.	Specify (40 – 60)%

	SP.11 *Wind direction*	To allow natural ventilation inside a shelter and prevent lost heat in winter while gaining solar radiation in summer	To orient shelter and opening. Considering close plan with a shared courtyard.	North-south facade is preferable during winter while protecting the west and east facade
	SP.12 *Air speed*	To prevent dust and undesirable wind	Providing resistance, structural elements and oriented shelter	Specify in level (0 – 3) where air speed; measure in certain level and specific time of day and night, in hot-dry is 3.4 m/s
	SP.13 *Sun Radiation*	To prevent over heat inside shelter	Providing shading elements	Specify the range between 900-1150kWh/m2a
	SP.14 *Precipitation*	To prevent mold	Dwelling orientation and types of materials	Prevention of heavy snow and rain in certain months
	SP.15 *Planning to suit plot*	To gain benefit from natural ventilation and solar radiation	Dwelling orientation	Suitable ratio of length is 1:2
	SP.16 *Determination*	To prevent direct sun radiation	Slight sloping roof, small windows, attached dwellings, high density of materials construction	To control hot-dry climates by considering dwelling design
B. Acoustic comfort				
	SP.17 *Wind sound*	To prevent psychological diseases due to high nighttime winds that contain particles of sand and generate noise	By considering glass materials that absorb the sound of particles	Specify double layers of glass, types of glass or prevention by vegetation breaks. Specify 500mm wall height (fence) to prevent animals from entering the shelter and keeping the space warmer because preventing wind and dust between floors and walls, especially if users sleep on the floor
	SP.18 *Sound permeability*	To provide social privacy	By considering shelters' materials and distance between shelters	Specify source of sound and distance between sound source and the surrounding environment. In open fields the sound pressure level decreases 6dB in each time and doubled distance relating to

				sound source. Specify buffer zone for each shelter and consider fire safety distance. Doors and windows are provided with rubber insulation (seal), and orientate quieter spaces of shelters towards each other and against the main road.
	SP.19 Acoustic insulation	To provide comfortable sound levels	Use of insulation materials for walls	Satisfy materials that reduce sound echoes and absorb sound waves and keep suitable levels of sound within rooms at 18-26dB
C. Olfactory comfort				
	SP.20 *Air quality*	To prevent bad smells and gasses from condensing and balanced ventilation inside shelter	Consider human activities (cooking, smoking ...etc.)	Specify air quality is (0.7-2.5)dp
D. Visual comfort				
	SP.21 *Glare, illumination and shelter body's color*	To create optimum daylight in daytime and provide limited artificial light at night	By building orientation, room depth, location and size of opening, glazing percentage, glare protection, design surfaces and coloring of shelter components	Comfort level is (50-300) lux To specify key control by using artificial light if reducing than 300 lux.
E. Shelter comfort				
	SP. 22 *Settlement*	To provide security and reduce climate difficulties	Through oriented street, street width and enclosed settlements	Specify narrow streets between shelters but consider fire distances Specify oriented streets that are perpendicular to the wind direction
	SP.23 *Land characteristics*	To prevent wind complexity and water flooding in rainy seasons	The condition of land (local government mostly is considered flat land)	Specify maximum 6% slope; , the lowest point of the site must consider water levels in the rainy season and be no less than 3m above estimated water levels.

	SP. 24 *Shelter elements weight*	To be carried, constructed and dismantled and a balance of thermal control retained	By using either heavy construction or lightweight construction with insulation	Specify unit weight based on number of construction items which are steel structure, walls and roof, celling and partitions, and other starting from 140kg+ foundations and floor bedding Ensure easy to carry by family - each person to carry maximum weight of 35kg Specify shelter volume to be compact for transfer and cost witch specify target volume 0.5 m3
	SP.25 *Shelter height*	To be appropriate for human use and to enhance better air circulation	Through manufacturing minimum height standard.	Specify the minimum height which is between 2.75-3.00 m
	SP.26 *Shelter lifting*	To protect from flowing water, over heating from ground and nesting rats and rodents	Through elevated shelter to prevent small animals gaining access	Specify shelter to ascend by around 2-3 steps Specify steel mosquito nets on underneath space to prevent rodents Specify damp proof course to prevent moisture from penetrating shelter Ensure area under shelter is clear and close any holes greater than 6 mm diameter
	SP.27 *Considering disabled users*	To prevent injury and easy access to shelter	By adding construction elements	Specify using small (maximum 10% incline) ramp adjacent to shelter's door
	SP.28 *Shelter wall*	To provide basic security and privacy	By providing guides of structure construction system of shelter	Specify a certain clear distance between wall junctions and openings (more than 1 meter) Specify opening does not cover over 1/3 of wall depth Specify strong joints (horizontal and vertical reinforcement) and seals between walls and floor and roof to prevent structure deflection and water leaks Specify thick wall for preventing loss of heat in winter and heat gain in summer as well as day and

				night Specify inflammable, isolated materials for walls and insulation (around 15 mm/whether materials or leaving air space) Specify cladding size is around 0.35mm Specify length of wall to resist dead and live load of walls it-selves, considering floor load to prevent compression stress and tensile stress for preventing wall deflection Specify dense, stiff and stable walls and support corners with thicker structure framework Specify glued cladding materials in the same direction to improve insulation Avoid many angles in walls to minimize cost
	SP.29 *Shelter's floor*	To support shelter and provide an appropriate level of living inside shelter	By applying construction guides	Specify fixed floor suspended to foundation bedding by flexible anchors Specify multi-layered environment- friendly compacting materials ((including waterproofing layer between 5-10cm) and hanging with ground foundation by joists. Consider ceiling spaces under joists to prevent rodent infestation Specify plywood on the top of floor (a thin combination of wood layers glued together in the same grain direction) for increased durability Specify floor materials that resist water for washing and with slight slope to collect water outside shelter (as part of religious practices in certain cultures)

				Specify floor materials to be resistant to insects and rodents Specify non-slip floor materials and materials that do not absorb heat such as wood Specify a space between floor layer and the ground to prevent heat build-up and moisture problems Connecting floor with foundation should be fixed securely with a flexible anchor that can be dismantled under supervision Specify self- drilling screws for fixing floors to foundations
	SP.30 *Foundation appropriate*	To avoid shelter distortion, landslide and defective shelter	By determining soil conditions, structural form, climate conditions and calculating shelter loads (dead and live loads)	Specify mortar materials (concrete with steel grid) Specify filled strip foundation ny digging into ground a minimum thickness of 15 cm Ensure shelter frame is well anchored vertically (J shaped) to foundation and safety bolted to the foundation Specify drainage isolated water gutter to the main drainage system on the main road to protect foundations and walls from erosion Specify close drainage gutter to the foundations to reduce pressure on foundations and shelter floor. Specify isolating layers (plastic sheeting) between foot of foundations and ground for protecting structure
	SP.31 *Window size*	To prevent sun radiation and lost heat	Calculate appropriate openings shelter area to for windows and doors	* Specify opening of 15-20% of floor area in hot-dry climates depending on primary components of windows

				* Avoid large openings (over100 cm width) *Locate away from corners for vene distribution of wall loads (60mm distance from corner) * Specify two opposite openings in the event of fire.
	SP.32 *Glazing*	To prevent *infiltration * radiation * conduction	Use double glazing windows or double plastic sheets	*Specify U value resistance as maximum 5 % loss *Coat sides of windows with low emissivity film *. Light color glazing *. Use frames made from low-conductivity materials such as fiber glass instead of aluminum, the U factor of which determines the amount of heat transferred through glass
	SP.33 *Cross ventilation*	To provide good air circulation and prevent air condensation	By multi-opening and integrating openings and daily activities	Specify multi-located windows in upper parts of walls or on roofs. Specify the number of windows and distribution based on occupancy and range of exchange rate related to activities such as of sitting, eating and sleeping
	SP.34 *Roof characteristics*	To keep and adequate level of thermal comfort and resistance to dust storms	Through roof color, design, openings and insulation	* Specify light color materials SRI (solar reflectance index) of 50% or more and dark colors of between 5-20 % *. Specify roof openings *. Specify triple waterproof (wax painting to withstand 20-40 cm of water), fire proofing, rot proofing and resistance to UV layers of trampoline above roof. It must be rolled to keep the inside of the shelter cooler between day and night *Specify types of roof material - a frame of beams and columns covered sandwiched by two sheets and filling with insulation materials and ventilation between two layers. *. Flat roof with slight incline of 30mm per meter.

				* Specify roof load between dead load (structure), live load (people and machinery) and pressure of wind (positive pressure against shelter and negative pressure due to suction in different location , snowfall load and climate differences as secondary load which cause shrinking and expansion shelter Specify roof extensions in the direction of heavy rain and wind to protect walls and foundations. Specify ceiling materials to combat condensation and fire attached to the underside of the roof but leaving space for air ti circulate Specify minimum celling height of 1840 mm Keep away from high shelters to a roof height of around 2.00-2.30 m Consider land topography, wind direction and shelter design and structure. Specify special roof design to prevent standing on roof by people or objects Specify PVC gutters to collect rainwater and collect in plastic barrels Specify light sheet materials to reduce heat gain and air circulation
	SP.35 *Shelter's water drainage channel*	To prevent water leaks water inside shelter and damage to its structure	By considering drainage pipes and gutters in the structure's construction	Specify 2% incline to the point of drainage on the roof Specify a drainage channel made of light materials and attached to the edge of the shelter to carry water to a collection point away from the shelter's foundation

				Specify a covered drainage channel with steel net to prevent insects and rodents
	SP.36 *Preventing dust*	To prevent diseases caused by dust	By reducing wind speed	Specify wind break structures such as trees or structural elements and well-oriented streets Specify healthy trees and space between shelters and wind breaks for recreation activities and drainage systems
	SP.37 *Providing shaded areas*	To provide an external gathering or cooking area protected from direct sun, wind and dust	Planning for a front yard in each shelter	Specify type of shaded net. More dense aluminized material has high reflectivity fabric such as black shaded net with low heat transmission and which is right for light color. The optimum shading measure is a minimum of 50% and preferably 70-80% Specify UV light, incident radiation, reflection, transmission and absorption. Specify suspended shade netting with opening from each side of a minimum 50 cm Specify anchor system and fixing related to opening dimension to prevent blowing shaded net by wind load Specify materials, structure, weight, tensile strength to enhance the life span of the shaded net Plant trees that are healthy with a long life span, high strength and resistant to light and wind
	SP.38 *Insects screen*	To protect people against insects	By providing a screen net on windows and doors	Specify a metal net screen across doors (to prevent wood rot) which is fixed by a strong anchor to the main door frame. The size of the screen hole should be around 12*13 holes per square inch) Specify waterproof materials to screen net and

				stretched over windows.
3. Social context				
Social comfort	***SP.39*** *Accessibility and integration*	To keep privacy and deter strangers	By establishing different transferable spaces; public, semi public and private	Control access to urban community spaces between shelters
	SP.40 *Adding portable elements*	For adaptation and preserving the sense of place and help people adapt and to be happier.	Add elements of vegetation and good design	Allowing people to incorporate their own characteristics within specific spaces or areas under supervision Using identification materials to apply social facts under architectural traditions such as gravel in hot, dry climates
Adaptation	***SP.41*** *Involving refugees in the construction of shelters*	To enhance the relations with their shelters besides supporting their need and problems are faced in daily uses.	By involving users in the construction if shelters	Specify group working of users in each block based on users' previous professional experience Distribute spaces inside and outside shelters nearby to their old homes
	SP.42 *Ability to repair by users*	To reduce the cost of maintenance and labor and to extend shelters' life span	BY involving users in the construction process	Specify tool kits for repair under supervision aids Specify training for users regardless of gender
	SP.43 *Productivity-small scale commercial activities*	To enhance self-satisfaction and benefits and improve physical conditions in the camp, camp services and the fabric of the camp generally	Providing job opportunities	Specify certain areas relating to shelter for selling products (such as groceries) Specify an area to the front of shelter with enough distance to ensure privacy
Social fabric – Social cohesion	***SP.44*** *Intimacy between people*	To increase social cohesion	By enhancing social activities and groupings of people	Create one location in each community for people to gather for different events
Urban context	***SP.45*** *Oriented shelters and streets in the same community*	To provide privacy	By considering external and internal viewing angles	Specify rear sides of shelters Orientate the shelter so it is not exposed to

				pedestrians High window levels starting from 1.2 m and above Specify non-continuous viewing angles by locating the long side of the shelter perpendicular to the main street
Urban context	***SP.46*** *Community road organization*	To prevent climate difficulties such as wind and dust and to increase flexibility and privacy	By establishing cluster organizations	Eliminate no long straight road which adjusts 4-6 shelters (about 50 meter approximately intersection with another street)
Cultural sensitivity or opportunity	***SP.47*** *Access to shelter*	To provide visual privacy from strangers	By providing safe space	To specify internal privacy inside by establishing door and window stoppers for opening of no more than 30 degrees
	SP.48 *Visual boundaries*	To achieve social security and safety and allowing indoor and outdoor activities	By using vegetation and shading elements	To specify boundaries for each sector or block within the limitations of a tree's height for safety.
	SP.49 *Protection*	To prevent social problems such as sexual abuse	By the provision of partitions	Separate sitting and sleeping areas and consider dividing sleeping areas relative to gender and social bonding Specify flexible and movable internal partitions that divide shelters into three main areas; sitting and eating, cooking and washing; sleeping Specify folded partitions to reduce space with connecting anchor to the main wall by waterproof steel rail.
Inequality and expectation	***SP.50*** *Participation*	To reduce social stress and conflict about ideological differences	By distributing people based on their background and sociological characteristics	Specify one person in each community to represent the group
4. Stability				

	SP.51 *A pattern of independent existence/stability*	To establish balance between stability and mobility for refugees	By providing shelter ability to extend the structure	To obtain a specific calculated area around a dwelling or extended design elements
	SP.52 *Structure stability*	To prevent structural problems and demolition of shelter	Adding elements to structure joints with floor, bed and ceiling	*Specify shelter dead load and live load (wind and snow), in view of people and furniture inside shelter *To prevent dismantling parts of shelters' elements and use in somewhere else, *Avoid attaching structure to neighboring structures *Use same type of structure for expanding within a determined modular construction to prevent deflection, compressive and tensile stress due to difference in building standards and material types.
Social stability	***SP.53*** *Dignity- with new community connectivity*	To prevent increasing stress impact that leads to violence inside a family.	To support social aspects in a new community, through self-help labor (family undertakes required work) or direct labor (organization hires individually)	Specify place in each block for gathering and interacting and encouraging men to leave to a certain job or activities and giving salaries or food for work
5. Durability/Adaptability				
	SP.54 *Available local sources*	To reduce time, shipping costs and repeat maintenance	By identifying local sources of shelter construction	Specify existing materials on context and labor skills
	SP.55 *Robust strong material*	For thermal resistance, flammability and permeability, structural strength and safety requirements	Use this material in dwellings' components such as windows	Translucent materials are more effective than transparent materials
	SP.56 *Shelter skin*	To specify high protection from concentrated solar radiation	Install sun protection at suitable angles to generate UV protection shading	-The maximum solar permeability <30% - Considering U- values and using low conductivity materials
	SP.57 *Mechanical ventilation system*	Maintain balance in temperature and filter dust content in air.	By using materials that have high component compact	Providing mechanical ventilation inside a dwelling
6. Being Demountable				

	SP.58 *Light material*	Enabling shelters to be dismantled and rebuilt several times again within their lifespan	To determine materials' type (organic, artificial), materials components, and building structure system	One cubic meter is 450 kg *. Specify using Nano materials which are thin materials and have a resistance to at heat loss
	SP.59 *Build efficiently to minimize temperature variation*	To prevent heat loss between day and night	By controlling ventilation, using quality materials to all dwelling components (floor, roof, walls)	Limit of airtightness is 10 m3/h.m2 at 50 Pa
	SP.60 *Structure elements*	To prevent materials contracting and expanding and be able to dismantle again	*. By using breathable materials (local materials)	Providing cover structure elements from direct sun radiation
	SP.61 *Joint connection-details*	To resist wind loading	By joint connection and flexibility of dwelling components in x, y, and z access	Establishing constant strength of dwelling that could be affected by environment, storing and transfer
	SP.62 *Considering fixed base of shelter*	however it is possible to move such components as the anchor system but under supervision		Specify fixed foundation connecting with shelter through anchor system (galvanized)
	SP.63 *Considering team of erecting shelter*	To mitigate users stress by time management	Preparing shelters kit and civil engineering for each community	Specify four people to complete a shelter within 12-16 hours
	SP.64 *Ability to repair-usability*	To reduce labor costs, time management for repairing	Through identical repairing	Specify numbers of each shelter elements Specify tool kits for each shelter elements to repair to change and remove any design elements by users. Specify anchor or interlocking connection between non-based or fixed shelter elements such as doors and windows.
7. Modularity and Flexibility				
	SP.65 *Separate technical system/ coding*	To allow it to be modified without engineering	By coding each of the structural elements	Specify different serial numbers with symbols for each structural system and related elements separately such as walls, floor, roof,..

	SP.66 *Enabling mechanical system*	To establish a high level of benefit to shelters through effective use of modularity and flexibility	By avoiding multilevel floors in dwellings	To specify the mechanical system in a modular and flexible structure
	SP.67 *System complexity*	To establish flexibility by changing within the module	Based on time and construction skills from excellent to poor	To specify a classification of system complexity
	SP.68 *Ability to extend*	To prevent slum growth because of random population growth	By leaving enough empty plots	Specify shelter provision for a new emergency families (new families are formed in camps) Specify open main walls for extending spaces within same shelter Specify extending within the modular units Specify a modularity structure based on human ability to carry weight of each single part (35kg agreed by OXFAM)
	SP.69 *Less cutting- consider the frequency of replacing and building shelters. Affordability*	To reduce waste materials and prevent harm to the environment	By applying modularity	Specify interlocking connection when building shelters Specify used shelters in good condition for public spaces
8. Independent constant energy				
	SP.70 *Addressing shelter*	To prevent misleading an address and service system	Controlling service distribution based on the original address of shelter	Specify address for each shelter's plot in community, blocks and sector
	SP.71 *Energy producing for local grid*	To support supplying energy system for local grid and camp grid.	By connecting camp grid suppliers with main local grid	Specify producing energy to local grid by taking electricity from local grid within pre-determined hours of the day and, as a result, reducing energy costs to zero
	SP.72 *Collecting solar radiation/ adding elements*	To provide an adequate quality of life including the supply of electricity	By using walls, roofs, and windows	Using a variety of solar thermal collector components
	SP.73 *Material storage / cooling*	To provide a standard amount of heating in winter	By technical system combined between resize	To specify an efficient heating system and a cooling ground system through plastic insulation pipework

	and heating capacity	including the heating of water	window opening < 30%, and heat capacity of internal components considering spaces	
	SP.74 *Rain harvest*	To achieve self-sufficiency and improve water shortage	By adding construction elements to each shelter	Specify rain collection via channels from roofs with collection on the ground (specify PVC, copper, galvanized steel and polyethylene pipes with transfer to plastic barrels. The pipe is attached to the wall of the shelter and connected by metal clamps) Specify the avoidance of collecting water on the roof to avoid loads to the roof structure Specify using harvested water in washing and if treated to also use in drinking Specify the same types of metal in central and secondary pipes that connect to the tap and valves and connections to prevent electro-chemical reaction Specify gutters are 250mm*150mm in galvanized steel and bolted and central pipes are larger than secondary pipes connected to the tape Specify that each shelter has water plumbing and all systems of rainwater are equipped with filters
	SP.75 *Grey water system*	To reduce water consumption	Through adjustable construction elements (pipes) to washing tape	Specify using collected grey water for external washing and irrigation Use grey water immediately if not treated to avoid degradation in quality Collector tank must be around 1m3 for 5-6 people.

2. Detailed specifications under research criteria

Criteria one: Safety and Security

several specifications under safety and security are divided between protection and control requirements as the following;

Protection

Protection is the sub criteria of safety and security which includes number of required specifications.

Specification one: Fear protection (NGO)

People need to be provided with food and non-food items on arrival, to alleviate their fear and provide protection, however, the differences which present in terms of age, gender, mental state, ethical origin, religious and political affiliation must also be considered.

Specification two: Fire safety

To specify the use of non-flammable resistive materials in shelters. Furthermore, the specification provides a safe distance between shelters that is at least twice the height of the shelter itself in order to prevent fire spreading (The Sphere Project, 2011).

Specification three: Structure protection

To specify safety valve elements of the shelter structure for unexpected demolishing of the structure, the Sphere project report in 2011 insists on keeping distance between shelters as well as in the fore distance to prevent danger of the structure collapsing as shown in specification (3). Estrada (2011) shows special care of the roof element as it is possible to put users in danger if it collapses, so the roof must be considered its weight and elements to carry its weight and other external weight such as strong wind.

Specification four: Hygiene of shelter spaces

Providing a covered area is an element of safety required (UNHCR, 2007). The specification is to offer a hygienic covered area that is established by separating shelters

for enough living spaces, sleeping, clean service, and dirty service and to provide an appropriate air movement and moderate temperature.

Specification five: On-site sewage system

The atmosphere inside the shelter is required to provide a healthy place to live which is protected from bad smells and harmful insects. To specify separating latrine space and other spaces of shelters, a hole for each shelter for pour- flush latrine should be dug. A person's weight should be considered when constructing the slab for the latrine, and keeps 10 meters as a distance between the water point and the latrine point, and using grey water in laundry, washing and flushing (Estrada, 2011).

Control

This is a sub criterion of safety and security, which divides into the following specifications.

Specification six: Size of camp's block

Based on the socio-economic background and to prevent conflict because of social and ideological affiliation, divide the camp into sectors which includes 5,000 refugees, each sector is divided into 4 blocks, each block to 16 communities and each community to 16 plots and 16 shelters and regarding fire breaks between shelters, communities, blocks and sector are 2m, 6m, 15m, and 30m (Corsellis *et al.,* 2005). Specifies designating roads from public to semi-public to semi-private to private which is a cluster organization of sectors, blocks, communities and family plots. Also it must determine the number of units in each block to enhance social control and enable users to be aware of their neighbors which enhances security and safety in a camp.

The arrangement of shelter units in one sector or block can deliver a sense of strong security, social safety and belonging to the area of foreyard or backyard of a shelter, so to specify the arrangement of such units to be in a hierarchical organization and provide zones from public to private whilst permitting young children to play outdoors under adult supervision where each block has a determined unit number among certain urban organization such as central or cluster organization design (Abu-Ghazzeh, 1999).

Specification seven: Close distance between shelters and travelling time

Less distance is required between shelters and services and to keep distance to preserve privacy for each shelter. As the Sphere Project report in 2011 states that a compulsory minimum distance between a shelter itself and other services such as water points should not be further than 500 meters, also easy mobility to commercial areas, health, and educational sectors is required (Hany Abulnour, 2014). Corsellis *et al.*, (2005) said that acceptable walking distance is about 5 kilometers per hour for a normal person (Omar, 2003). To specify easy wayfinding through avoiding unseen corridors and establishing a grid or cluster shelter organization depending on the land slope. so it specifies less distance to walk which are two to three times height structure and providing well-lit roads and being straight to prevent any psychological impact.

Specification eight: Maintain shelter

To increase the life span of the shelter, it specifies a number of maintaining points or offices which have a number of experts and engineers, so in each 200-300 meters square has one maintenance point for monitoring problems of shelters in the roof, walls, joints and others (IOM, 2012).

Criteria two: Comfort

several factors must be considered: thermal comfort, acoustic comfort, olfactory comfort, visual comfort and shelter comfort, which are now explained.

Thermal Comfort

Thermal comfort is a sub criterion of comfort which divides into different areas of specification as follows:

Specification nine: Air temperature

A person needs a moderate degree of temperature inside a shelter. Corsellis *et al.*, (2005) mentioned that the normal temperature of the core body is 15-18°C for a healthy atmosphere. In hot dry climate the maximum temperature rises to 38°C and above (Fuchs *et al.*, 2012), however, the normal comfort level of skin temperature is 31-34°C and

inside the body is 37°C and keeping human heat balance of interior air temperature is a major influence on thermal comfort level. Although many standards such as Energy Conservation Act specifies range of comfort level between 20°C -26°C (Richarz, Schulz & Zeitler, 2007), instead just to use rigid number of temperature degrees, it must consider external factors that have influence of assessment level of comfort like type of activities, clothing, and physical factors. In a hot climate, many examples refer to settlement density, also the dwelling form plays a role in providing comfort such as a rectangular plan or elongated plan and the former is usually used in a sunny slope climate (Bodach *et al.,* 2014).

Specification ten: Humidity in interior air

The recommended level of acceptance ratio of water vapor in the interior air is between 40 to 60% for achieving a level of comfort (Fuchs *et al.,* 2012). Lower humidity than 35% causes dust accumulation. In hot dry climate conditions, humidity is recorded between10- 50% (Rosenlund, 2000).

Specification eleven: Wind direction

Wind direction is an important factor when people decide where to place a shelter for the prevailing wind. It differs from region to region; also, it must follow local prevailing wind (Rosenlund, 2000). Undesirable wind reasons sand storm that sources for drought in dry-hot climate. Wind direction has affects air temperature inside dwelling and avoiding undesirable wind is important to keep air temperature in balance (Hegger *et al.,* 2012).

Specification twelve: Air speed

Wind speed is about wind flow from high pressure to low pressure (Liedl, Hausladen & Saldanha, 2012). The research recommends keeping the range of influence wind speed between level 0 to level 3 and if wind speed is above 3.8 m/s, it must add elements of protection to dwelling. In hot-dry climates the average wind speed is around 3.4 m/s and sometimes it is strong wind that causes dustiness.

Specification thirteen: Sun radiation

Sun radiation explains the concentration of sun on a certain point, sun radiation is effected by various elements; climate region, environment conditions, and dwelling orientation. In a hot dry climate sun concentration is recorded at a high level due to clear sky, open topography and less precipitation (Liedl *et al.,* 2012). Protection is vital from high solar radiation that could reach above 2,000 kwh/m2 in some countries located in a hot dry climate. Dwelling orientation, dwelling skin and materials are taken into account, which could be used to generate energy and reduce the impact of solar radiation at the same time. The research endorses normal global radiation for direct and indirect solar radiation as about 900- 1150 kWh/m2a (Fuchs *et al.,* 2012).

Specification fourteen: Precipitation

Precipitation is the ratio of rain and snow depending on topography which relates to different factors; climate conditions, environment conditions, and sea level (Hegger *et al.,* 2012). In a hot-dry climate, the ratio of precipitation is very low < 250mm/a (Bodach *et al.,* 2014). Although there is much less precipitation in most months of the year on some occasions there can be heavy snow but it is a reason of dry climate that causes for allergic disease and asthma. The research recommends the use of a protective structure to minimize the effect of undesirable heavy rain and snow.

Specification fifteen: Planning of suitable plot

Shelters should be located to gain benefits from natural solar and wind resources, however, reducing any negative impact is also required. In a hot dry climate, it must benefit from solar radiation, low rainfall where small opening could reduce solar radiation, also heavy weight masses help such as stone or loam, condense dwelling help to shade each other and cut solar gain also using roof to collect low rainfall for moisture inside atmosphere. A suitable ratio of length must be 1:2 and the lengthiest part has the heavyweight (Fuchs *et al.,* 2012).

Specification sixteen: Determination

Shelter design differs depending on climatic conditions and will be controlled by design elements as follows:

Shelter roof specifications must consider hot, dry and cold climates as characteristics of a hot-dry climate, so a slight sloping roof would have a positive impact on drainage of rain and snow and to prevent direct sun radiation when compared to a horizontal roof (Liedl *et al.,* 2012). Furthermore, a lightweight material construction with high density would be able to reduce overheating of the above shelter roof. Small windows will prevent gaining undesirable solar radiation, also attached shelters or partly closed will reduce heat loss transmission of heat loss is distributed between shelters from 96 – 200% depending on three dimensional shapes (Fuchs *et al.*, 2012). In a hot dry climate, typology of dwelling is considered where specifies the heavyweight parts of the dwelling in largest side to reduce solar gain and atria will be specified for cooling and ventilation.

Acoustic comfort

It refers to the level of sound comfort as sub- criteria of comfort in general and divided as the following:

Specification seventeen: Wind sound

Noise pollution could have a negative impact on human health (Carroon, 2011). Poor distance between dwellings and prefabricated materials allow noise transmission. UNHCR (2007) mentioned it must follow standards of isolated materials and minimum distance between dwellings. On the other hand, natural ventilation could be a secondary factor of noise pollution depending on location and size of opening.

Specification eighteen: Sound permeability

To enhance social privacy from outsiders it specifies a buffer zone between shelters which is as that for fire safety and it must consider the source of sound outside the shelter and distance between the source of sound and shelters. Occupational Safety and Health Administration of the United. States Department of Labor (OSHA) standard of noise shows the sound pressure level decreases 6 dB in each time and double distance leads to decreases the pressure relating to the source.

Specification nineteen: Acoustic insulation

Noise level is measured by decibels and it describes sound pressure level. Many factors influence sound comfort level which includes; external sound, internal sound, room shape, size and materials, and room occupancy (Fuchs *et al.*, 2012). A quiet room with closed windows in the evening is recorded as 18- 26dB, whilst a lively urban area is noted from 65 to 75 (Ritchie & Thomas, 2009). This research will consider materials that are used to manufacture refugee shelters as well as distance between shelters including sound permeability.

Olfactory comfort

Olfactory comfort is about smell which is influenced by air quality

Specification twenty: Air quality

The level of air comfort inside a shelter is between 0.7 and 2.5 dp and that must be considered for human activities that produce smoke such as cooking (Fuchs *et al.,* 2012), also dust in a hot-dry climate must be considered as a ratio of comfort level by a reduction to suitable ratios of different gases. The level of oxygen required per hour depends on age and activities. Refers to changes of air inside a shelter where unhygienic air will cause diseases and building damage such as mold. A poor interior climate air can have a high level of water vapor and CO2 and bad smell, accordingly it will be a reason to mold. Thus, it must consider suitable ventilation concept based on climate condition. In addition, a good ratio of oxygen must be considered where one tenth is needed to maintain CO2 inside the shelter. Regardless of the number of persons inside a shelter, the shape of shelter and surrounding environment, there is the minimum amount of oxygen required which is 1.8m3/h (Hegger *et al.,* 2012).

6.13.2.4 Visual comfort

Visual comfort depends on the amount of sun radiation that the human eye receives; Visual comfort is based on glare, illumination and color.

Specification twenty one: Glare, Illumination and color

Illuminating Engineering Society of North America (IESNA) determines comfort level in residential areas between 50-300 lux based on type of spaces such as bedrooms, living room, bathroom and others (Fuchs *et al.,* 2012). California Lighting Technology Center

(2014) shows using direct daylight, indirect daylight or artificial light must be considered based on characteristics of region climate conditions where in a hot-dry climate the average illumination is 25,500 lux and illumination is light flux. To create optimum daylight and provide limited artificial light the following specifications determine the ratio of glare, illuminance and surface color by; shelter orientation, room depth, location and size of opening, glazing percentage, glare protection, design surface and coloring of shelter components (celling, floor, and walls).

Shelter comfort

Shelter comfort is divided into the following specifications:

Specification twenty two: Settlement

To specify security and reduce climate difficulties through narrow streets between shelters and oriented streets to be perpendicular to wind direction for mitigation of undesirable wind, rain and dust (Abu Ghazzeh, 1999).

Specification twenty three: Land characteristics

The land's characteristics are considered for preventing undesirable wind speed and rain flooding. To specify the maximum slope level is 6 % and if the land has a slope it must have the lower level no less than 3 meters from the water level (Estrada, 2011).

Specification twenty four: Shelter elements weight

Shelter weight is an essential factor for building and dismantling a shelter, so it specifies shelter construction and number of constructed items of the roof, celling, walls, and partitions. Corsellis *et al.*, (2005) has a shelter weight of around 140 kg and adding foundations and floor bedding where each person can carry maximum 35 kg, also it must consider the volume of the shelter for logistical requirements.

Specification twenty five: Shelter height

It specifies a minimum height of a shelter which is between 2.75-3.00 cm and that is required for good natural ventilation inside the shelter (UNHCR, 2007).

Specification twenty six: Shelter lifting

The shelter in a hot dry climate suffers from overheating that is possible to increase due to several factors and one of them is gaining heat from the ground, so lifting the shelter must be specified to prevent increasing the heat inside the shelter and flooding water during a heavy rainy season (Crawford *et al.,* 2005), two to three steps are required however, adding steel net around the shelter to prevent rodents and also keeps clean also specifies damp proof course to avoid moisture inside the shelter.

Specification twenty seven: Considering disabled users

IOM (2012) shows that housing disabled people is an important consideration, so it specifies the maximum incline as 10 % adjustable to the shelters' door.

Specification twenty eight: Shelter wall

The shelter wall is an important part of the shelter in terms of structural system, construction operation, opening, joining, cladding, and insulation. To specify a clear distance between wall junctions is more than one meter and opening does not cover one over three of the wall's depth (Estrada, 2011). Also seal spaces between walls, floor and the roof to prevent water leaks, the wall thickness is no less than 15 cm and specifies insulation materials of around 15 mm. Whether using materials or leaving an air space and cladding layer is around 0.35mm and glued in the same direction to improve insulation (Corsellis *et al.,* 2005). It specifies the length of the wall to prevent compression stress. It specifies dense, stiff and stable walls and support corners with a thicker structure framework, it also specifies not many angles in walls to minimize problems.

Specification twenty nine: Shelter floor

The UNHCR mission to Jordan report in 2013b argues to specify fixed floor to the foundation by flexible anchors, floor's materials are environmentally friendly and it specifies a waterproof layer of 5-10 cm, and the top of the floor is plywood. A slight slope in the floor is required and using materials resistant to water, rodents and insects, additionally they must not absorb water and must not be slippery, using a simple self-drilling screw between the floor and the foundation.

Specification thirty: Foundation appropriate

To establish stability for refugees in their shelter, fixed foundation is done by using mortar materials (concrete with steel grid) and filled strip foundation by digging into ground a minimum thickness of 15 cm (Estrada, 2011). Regarding the shelter frame, IOM (2012) displays it is well anchored vertically (J shaped) to foundation and safely bolted to the foundation, in addition specify drainage isolated water gutter to the main drainage system on the main road to protect foundations and walls from erosion and to reduce pressure on foundations and shelter floor.

Specification thirty one: Window size

In a hot dry climate 15-20% is required for an opening to prevent increased heat inside the shelter (Fuchs *et al.,* 2012), also avoiding large opening width more than 100 cm and leaving 60 cm between the opening and the wall corner for supporting the load structure and two opposite openings is better for natural ventilation.

and it specifies a translucent plastic sheet to function as double glazing besides providing internal shading cover which is at least shading 50 % (Corsellis *et al.,* 2005).

Specification thirty two: Glazing

It specifies the value of glazing as the maximum 5% loss and should be coated on two sides of the window with low emissivity film. Using a light color of glazing and instead of using aluminum as a frame on the window using low conductivity materials such as fiber glass (Bradford, 2004).

Specification thirty three: Cross ventilation

The IFRC (2013) shows good air ventilation is provided by specifying multi-located windows, in hot dry climate obtaining cross ventilation is by locating window in the upper part of wall or in the roof besides regarding number of windows to the area of shelter and the occupancy inside shelter such as sitting, sleeping, cooking and others.

Specification thirty four: Roof characteristics

Controlling several factors relating to roof characteristics helps to support thermal comfort level inside the shelter, which include determining the roof color where to specify solar reflection index (SRI) is 50% or more for light color and 5-20% for a dark color, to specify triple waterproof wax painting layers, and fire proofing. Rot proofing and the trampoline must roll between day and night to keep inside the shelter cooler (Johansson *et al.*, 2009). Specify types of roof material and filling with sandwich of two sheets and insulation materials incline the roof with 30mm per meter. Specifies roof extensions in the direction of heavy rain and wind is to protect walls and foundations.Specify ceiling materials to combat condensation and fire should be attached and a minimum celling height of 1840 mm, and roof height of around 2.00-2.30 m. It specifies the design of the roof to prevent people standing on it and also PVC gutters to collect rainwater into plastic barrels.

Specification thirty five: Shelter's water drainage channel

To prevent water leaking inside the shelter, it specifies 2% incline to the point of drainage and made the drainage channel from light materials and attached to the shelter wall to carry water to the ground and cover channel opening with steel (Corsellis *et al.*, 2005)

Specification thirty six: Preventing dust

Dust is a critical issue that causes lung diseases, so it is important to provide a protected area specified by wind break structures such as vegetation or structural elements (wood fences).

Specification thirty seven: Providing shaded areas

Social and cultural activities often take place outside the shelter, so a shaded space is required. The IFRC (2013) specifies a type of shaded net (UV light, incident radiation, reflection, transmission and absorption) which has high reflectivity fabric such as black shaded net with low heat transmission and which is right for light color. The optimum shading measurement is a minimum of 50% and preferably 70-80%, also specify suspended shade netting with opening from each side of a minimum 50 cm and fixing related to opening dimension to prevent blowing shaded net.

Specification thirty eight: Insect screen

Preventing entering insects inside shelter is specified by providing a metal water proof net screen across the doors which is fixed by a strong anchor to the main door frame. IOM (2012) presents the size of the screen hole should be around 12×13 holes per square inch.

Criteria three: Social context

Social comfort refers to control of shelters and improvement of the interaction between people, and will be established through adding urban spaces to be used for social activities., accordingly it reflects well on refugees' behavior and attitudes, and includes the following specifications.

Specification thirty nine: Accessibility and integration

Space barriers would control access to an urban community and assist in integration with neighbors providing a place for communication whether indoor or outdoor (Fuchs *et al.*, 2012). It would be accomplished through establishing different transferable spaces; public, semi public and private spaces and at the same time would be a barrier to strangers.

Specification forty: Adding portable elements

Allowing people to put their own characteristics and adapt the shelter style in various ways such as colors of shelters, adding elements of vegetation and adding elements of design would be under community supervision within their shelters and an urban community could preserve the strength of place sensibly (Karuppannan & Sivam, 2011). Also, using identification materials to apply social factors will help acceptance in a new community under architectural traditions. Outside the shelter identifies shelter geometry which can specify a sense of place by evoking characteristics of their local experience. Distributing spaces inside shelters similar to their old homes will provide a feeling of belonging to the environment. To specify certain public areas between shelters as gathering spaces (Brislin, 2012). That leads people to adapt and attach to camp community, furthermore encouraging their motivation to sense of responsibility towards a place.

Specification forty one: **Involving refugees in the construction of shelters**

Having a specified group of workers (refugees) in each block and involving them in certain programs to support their needs, using coloring and decorating their shelters can provide a new local identity and that would help people to adapt and be happier (Brislin, 2012).

Specification forty two: Ability to repair

The UNHCR (2014a) indicates shelter maintenance costs humanitarian agencies and local government millions of dollars, so to specify training users to maintain their shelters and provide a tool kit with each shelter to extend the shelter's life span besides involving users in the construction process.

Specification forty three: Productivity-small scale commercial activities

To enhance self-satisfaction for refugees it specifies an area relating to each shelter to use for providing users with a job with specifying enough distance to establish privacy inside the shelter.

Specification forty four: Intimacy between people

To specify a place in each community to creates an opportunity for people to build and bond in order to get to know each other and possibly become friends besides sharing their daily living activities (Abu-Ghazzeh, 1999).

Specification forty five: Oriented shelters and streets in the same community

To specify privacy through shelter orientation so as not to be exposed to pedestrians, the starting window level from 1.2 meters and above to provide privacy inside the shelter (Estrada, 2011). Also specify non-continuous viewing angles by locating the long side of the shelter perpendicular to the main street (Heggers *et al.*, 2012).

Specification forty six: Community road organization

Considering wind and dust storms when organizing a shelter through eliminating no long straight roads which has 4-6 shelters (about 50 meters long approximately at the intersection with another street) (Corsellis *et al.*, 2005).

Specification forty seven: Access to shelter

Establishing visual privacy through specifying door and window stoppers to prevent opening to the full angle and stop no more than 30 degrees (Hegger *et al.*, 2012).

Specification forty eight: Visual boundaries

To specify boundaries for each sector or block to achieve social security and safety that could be provided by using vegetation and shading elements within limitation of a trees' height for safety (Fuchs *et al.*, 2012). Also to allow activities from indoor to outdoor smoothly and gradually and that could be established by avoiding changing levels.

Specification forty nine: Protection

A camp community suffers from social problems such as sexual abuse, so specifications should consider separated spaces inside the shelter relating to daily activities such as establishing partitions between sleeping areas and sitting areas and the bathroom, also to consider distributing sleeping areas relative to gender and social relationships (Scavino, 2013). Specify flexible and movable or folded internal partitions that divide shelters into three main areas; sitting and eating, cooking and washing, and sleeping.

Specification fifty: Participation

For enhancing social bonding in different situations it must specify one person in each community to represent the rest of group in the same community.

Criteria four: Stability

People need to feel a suitable level of stability and exist in their new community as a crucial part of living, as described in the following specifications.

Specification fifty one: A pattern of independent existence/stability

To establish balance between stability and mobility in pattern which means that refugees have an opportunity to obtain a specific calculated area around a shelter that could be utilized for land agriculture or extended design elements under supervision environment protection (Chevalier, 2012). However, the stability in pattern appears by using the same special organization which allows them feel in stable and constant situation.

Specification fifty two: Structure stability

This is to specify shelters by structure stability and ability to add any further structural elements such as roofs, floors, windows, etc., to accommodate refugees in risk situations (The Sphere Project, 2011).

Specification fifty three: Dignity- with new community connectivity

The most important stress in a camp community is job shortage where men stay at their shelter without any benefit and this puts more challenges to adaptation in the camp (Duncan, 2011). It specifies a place in each block for gathering, interacting and encouraging men to work whether taking assistance from humanitarian agencies or families undertaking required work.

Criteria five: Durability/Adaptability

Durability refers to shelter resistance against external factors which are the harsh climate conditions (Bradford, 2004) and this is determined by the following specifications.

Specification fifty four: Available local sources

The high cost of shipping and running maintenance are issues to consider when establishing a shelter in a camp, to specify local materials and availability of labor skills.

Specification fifty five: Robust strong material

Specifies robust materials used for environmental performance such as thermal resistance, flammability and permeability, structural strength, and safety requirements (Manfield *et al.*, 2004), to specify type of material that has a high structural design content where using translucent material is the one that is more effective than transparent materials and could be used in windows and becomes like solar wall heating (Schittich, 2003).

Specification fifty six: Shelter skin

There is a dynamic system between permanent climate conditions and internal requirements and this aims to protect variations in thermal guides by using suitable

insulation solutions for a large context such as camps, to specify high protection from concentrated solar radiation through:

1. In a hot dry climate, glazing sun protection is considered the maximum solar permeability no more than 30% from east and west façade (Liedl *et al.*, 2012).
2. Regarding International Organization for Migration in 2012; Compact shading elements and UV protection is movable that have slats with suitable angles based to prevent the façade from undesirable sun concentration in summer and gaining solar concentration in winter (IOM, 2012).
3. Insulation thickness of shelters' walls relates to a materials thermal conductivity which is U- value (w/m2k), that specifies the use of materials that have as low conductivity as possible for example when comparing plastic foam and bricks or using monolithic structures, which is a solid structure (Liedl *et al.*, 2012).

Specification fifty seven: Mechanical ventilation system

A mechanical ventilation system is essential to keep a balance between internal and external temperatures and which provides natural ventilation (Corsellis *et al.*, 2005). Mechanical ventilation systems filter dust content in air that exists in a hot-dry climate and reduces its ratio inside a shelter. It is possible to use materials that have high component compact producing a buffer zone that can circle air inside a shelter and provide a gravitation cycle.

Criteria six: Being Demountable

Demountable shelters enable replacement components of shelters and can be built again within its lifespan. Relating to the difficulties of a hot-dry climate, material tightness and structural joints must be considered in a demountable structure which will be described in the following specifications.

Specification fifty eight: Light material

Light and strong materials are required for a demountable structure to enable it to be dismantled and built many times. In addition, it must take into consideration design joints and construction through details drawing for building operation. Environment impact is

required by considering materials dangerous substances. Research shows that one cubic meter of lightweight building contains 450 kg of materials while heavyweight building contains 650 kg (Fuchs *et al.,* 2012), and in order to specify a parameter of lightweight building it is necessary to determine materials' type (organic, artificial), materials components, materials internal operations and building structure system. Lightweight materials must be considered as good insulation materials in hot-dry climate to prevent flow heat movement in winter and keep cool temperature in summer which will be achieved through considering thermal conductivity, reduction transmission, and high mass condensing light weight material. That consists of insulation material which has a light weight and thin width of around 2 cm, however it insulates efficiently like 20 cm thickness (Schittich, 2003).

Specification fifty nine: Build efficiently to minimize temperature variation

A hot-dry climate differs in temperature degree between day and night and should specify building structure and materials to resist drought established by known air tight path inside and outside a shelter (Ritchie *et al.,* 2009). The study recommends <40% of heat loss for a suitable airtightness and reasonable limit for airtightness is 10 m3/h.m2 at 50 Pa (Jaggs & Scivyer, 2009).

Specification sixty: Structure elements

Structure elements are a crucial component of a building which will be specified to be able to be dismantled, be movable and transferred with less space, cost and time (IStructE, 2007). In a hot dry climate one must consider covers for such elements as direct sun radiation in order to prevent construction material from contraction and expansion and to be within limitations of world institutions. It should also consider a way to interlock in order to reduce time and effort (Yi & Özdamar, 2007).

Specification sixty one: Joint connection-details

Joint connections in demountable structures will specify constant strength before and after connections, flexible, rigid and stability in x, y, and z access especially against wind that exists in the hot-dry area and is dependent on wind loading (Hartkopf & Goodspeed, 1979).

Specification sixty two: Considering fixed base of shelter

Refugees used to move their shelters to be close to their relatives and friends however it specifies fixed foundation connecting with shelter through flexible anchor system (galvanized), it is possible to move under supervision of humanitarian agencies (IStruE, 2007).

Specification sixty three: Considering team of erecting shelter

UNHCR (2014b) indicates preparing and building shelter in its plot by specifying four people to complete a shelter within 12-16 hours.

Specification seventy four: Ability to repair-usability

Reducing waste materials and cost, the Corsellis (2008) claims it labels numbers on each shelter elements besides tool kits for each shelter and provides training for users to change or remove any elements in shelters. Burford and Smith (1999) indicates the usability of using interlocking connection and specifying an anchor or interlocking connection between non-based or fixed shelter elements such as doors and windows.

Criteria seven: Flexibility and Modularity

Flexible and modular buildings have separate components that allow them to be used again based on modularity, which can quickly change to a new geometry, as discussed through the following specifications.

Specification sixty five: Separate technical system / Coding

To code each element of a structural system for to allow it to be modified without engineering (Van Gassel, 2003).

Specification sixty six: Enabling mechanical system

Concerns the mechanical system in a modular and flexible structure to establish a high level of effectiveness, thus the specification will be to avoid multilevel floors in shelters (Van Gassel, 2003). This however will have a negative impact on the mechanical system that operates within a structure of flexibility and modularity.

Specification sixty seven: System complexity

To specify a classification of system complexity against time and construction skills from excellent, good, fair, and poor, based on the ability to change within the module (Bradford, 2004)

Specification sixty eight: Ability to extend

Refugees need a place to settle when they have crossed the border, to prevent settlement randomly it must consider extending specific walls within the shelter, by shelter module, for extending spaces within the same shelter (IStructE, 2007).

Specification sixty nine: Less cutting- consider the frequency of replacing and building shelters (affordability)

For reducing materials waste and harm to the environment, specify interlocking connections in building shelters (Burford *et al.,* 1999), using shelters that are in good condition for public utilities such as offices, markets or gathering points where such shelters are no longer used as shelters for refugees.

Criteria Eight: Independent constant energy

The validity required of constant energy that allows people to accomplish their daily activities, To specify and deliver renewable energy must supply energy on the ground as following;

Specification seventy: Addressing shelter

To provide appropriate services for each shelter, it must specify a full address for each shelter's plot in the community, block and sector, for clarity.

Specification seventy one: Energy produced for local grid

Providing energy is an essential factor to continuous daily activities by providing water and electricity, for offering a constant energy to a camp, the issue is producing energy to the local grid by taking electricity from the local grid within pre-determined hours of the

day (Kessides & Wade, 2011), as a result, reducing energy costs to zero, such project was planned to establish in certain hot dry climate camps.

Specification seventy two: Collecting solar radiation/ adding elements

To specify adding solar thermal collectors within fixed dimensions and technical specifications to collect sun radiation and that will be effective spatially in hot dry climate (Gunning, 2014).

Solar thermal collectors could be a mechanical system attached to a dwelling or could be separate devices such as wind collectors for producing electricity or a photovoltaics panel for sun radiation; alternatively, space between walls and collectors must take into account to prevent heat loss and thermal bridge, which will be determined depending on the funding that organizations and donors provide. It could use a variety of solar thermal collector components if needed in the wall, roof, and windows by considering the color of collectors' elements, using highly transparent glass, prefabricated elements with several angles available in size up to 30 m2, these collectors also benefit from diffusing uploaded heating that is not needed depending on space dimensions (Fuchs *et al.,* 2012), while roof collectors could be a tube vacuum collector whether it is part of the construction for flat or pitched roofs. It was noted that when integrating solar collectors with heat system collectors where flat plate collectors by air reaches temperatures of up to 80 degrees, flat plate collectors by water reaches temperatures of 80 degrees, while vacuum tube collectors by water reaches 150 degrees. (Hegger *et al.*, 2012), it must therefore apply vertical insulation for more efficiency operation due to the space distribution. To improve constant energy, it specifies using the roof of the shelter as an effective structural element to collect energy from wind especially between March to September by using low cost cells panels such as PV (Photovoltaic system) cells technology or solar fans which produce more effective energy than solar panels which look like a piece of A4 paper and gets 6 to 7 watts to produce light for the evening (Gunning, 2014).

Specification seventy three: Material storage / Cooling and Heating capacity

Regardless of the kind of energy, people need a standard heating amount for obtaining warmth in winter, and water heating. Thus, to specify a heating system that is an elaborate technical system combined between resize of the window opening < 30%, by

preferably using renewable materials considering thermal masses of materials that can store heating from solar radiation and heat capacity of internal components considering spaces (Estrada, 2011).

When specifying a cooling ground system “heat sink” which is that system operates by ground or water through a plastic insulating pipe, this system should allow the exchange of air in the cycle between inside and outside the shelter when the temperature changes. It also specifies the minimal artificial lighting for reducing overheating hours on the other side (Fuchs *et al.*, 2012).

Specification seventy four: Rain harvest

Water shortage is one of the hot dry climate difficulties and refugees are suffering during almost all the months of the year. To solve water shortages, several ways can be supported to obtain water for refugees. It specifies rain collection via channels from roofs with collection on the ground (specify PVC, copper, galvanized steel and polyethylene pipes with transfer to plastic barrels) (Corsellis *et al.*, 2005), however avoiding collecting water on the roof to prevent extra loads to the roof structure. The used pipe must be from the same types of metal in central and secondary pipes to prevent electro-chemical reaction and gutters are 250mm×150mm in galvanized steel, also it must each shelter has water plumbing and all systems of rainwater are equipped with filters (Estrada, 2011). In addition, in dry season organizations must consider supporting refugees with water tanks besides the previous ways are discussed.

Specification seventy five: Grey water system

The United Nations Environment Programme [UNEP] (2007) indicates to reduce water consumption, using collected grey water immediately for external washing and irrigation, and the collector tank must be around one cubic meter for 5-6 people.

Specifications are developed under research criteria as an *artefact* to follow when designing a shelter proposal in hot dry climates for refugees, such specifications are presented to involve architects and engineers to evaluate the ability of understanding and grasping specifications and formulating an alternative of design shelter proposal for refugees in hot dry climates. The outcome is specifications which are demonstrated and

evaluated by manufacturing expertise and architects; for details of the specifications list, as a guide for providing suitable refugee shelters in camps in hot dry climates.

Appendix O: Covering letter for participants (local architects) of evaluation phase

I am Rania Aburamadan, PhD candidate This PhD research is being undertaken under the guidance and supervision of the School of Built Environment at The University of Salford. I would like to invite you to take part in the evaluation stage by submitting proposed designs of refugee shelters in a hot dry climate based on a range of criteria that form a number of specifications that are detailed in the following table. The purpose of this evaluation is to test the specifications to establish adequate refugee shelters and to improve the quality of life of refugees inside the camps. I can confirm that the proposed designs and all other information you submit remain confidential. Please consider the following three points when formulating your submission:

- Marking up any part of the specification you do not understand or find misleading in a checklist table.
- Design your proposal to a scale of your choice but clearly state the scale on your submission drawings
- Mark the specification items you consider to be particularly important and add any additional specification items you consider to be applicable. Also, mark any specification items you consider to be unnecessary.

Contact details

If you have any questions or you need further information about the research study please do not hesitate to contact:

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The Crescent

Appendix P: Coded interviews

1. List of interviews is coded (NGO and Experts)

Number of interviews in text	Name	Organization	Interest
Independent Researchers			
No. 9	Eefje Hendriks	University of Technology Eindhoven	Researcher and Doctoral Candidate/Teacher and researcher Avans Academy for Architecture & Infrastructure
No.3	Katerina Pateraki	Lecturer in Humanitarian Engineering & Computing. Coventry University	Operational member of search in disasters
No.11	Louise Bloom	Refugee Studies Centre, University of Oxford	Research officer- The research interest (bottom-up perspectives of humanitarian innovation and had several of field work in Jordan, Africa, India)
NGO (Non-Government Organizations)			
No.2	Avery Doninger	All Hands Volunteers and previous in GOALS Haiti, Relief International	Shelter Program Manager/ Assistance to the technical Advisor
No.3	Carlo Gherardi	NRC/the Al-Za'atari Camp-Jordan	Shelter/ NFI Project Manager Camps
No.1	Cecilia Braedt	IFRC - Shelter Research Unit	Coordinator
No.4	Corinne Treherne	IFRC-Geneva	Senior Officer, Shelter and Settlements
No.6	Ghada Barakat	UNHCR/ the Al-Za'atari Camp-Jordan	Site Planner Associate
No.10	John Tzanos	Better Shelter	Head of services
No.16	Joseph Ashmore	International Organization for Migration, Geneva	Shelter and settlement Expert and Global Cluster focal point
No.5	Mohamed Abdel- Alal	UNHCR/Jordan	Senior settlement and shelter

			officer
No.19	Mohamed Hilmi)	Senior Coordinator and Technical Specialist for Shelter & Settlements	InterAction A United Voice for Global Change
No.17	Tim De Haas	Better Shelter	Head of Technology
No.7	Tom Bamforth	Global Shelter Cluster Global Focal Point (Shelter Coordination), International Federation of Red Cross and Red Crescent Societies/ NRC/IOM	Research Assistance
	Tom Corsellis- Coded	Shelter center	Operations experiences in Africa, Asia and Europe with humanitarian organizations UNHCR, IOM, OXFAM
No.18	Tom Newby	CARE International UK	Emergency Shelter Team Leader

2. List of interviews is coded (Refugees)

Type	Name	Memo Link	Nodes	References	Created On	Created By	Modified On
Audio	Abu ghyath (No.2)		17	29	7/21/2015 3:21 PM	RANIA	9/9/2016 7:48 PM
Audio	Abu Maher-f (No.1)		24	50	7/21/2015 4:31 PM	RANIA	9/9/2016 7:48 PM
Audio	Abu Mohamed-Lawyer (1)-f (No.4)	Yes	16	47	7/21/2015 4:33 PM	RANIA	9/9/2016 7:49 PM
Document	Abu nabeel (No.3)		11	22	5/26/2015 9:36 AM	RANIA	9/9/2016 7:48 PM
Audio	Abu Shadi (No.6)		4	5	7/21/2015 3:24 PM	RANIA	9/9/2016 11:03 PM
Document	Abu Wa'el (No.5)		22	59	5/26/2015 9:36 AM	RANIA	9/9/2016 8:12 PM
Audio	Ahmed Volunteer in (No.11)		24	77	7/21/2015 4:34 PM	RANIA	9/14/2016 11:23 AM
Audio	Khyrat volunteer in (No.13)		14	20	10/20/2015 12:42 PM	RANIA	9/15/2016 9:54 AM
Audio	Mohamed volunteer in (No.12)		18	40	7/21/2015 4:35 PM	RANIA	9/14/2016 11:24 AM
Audio	Um fadi-f (No.9)		24	39	7/21/2015 4:36	RANIA	9/11/2016 2:05

					PM		PM
Document	Um Hatem (No.16)		32	111	5/26/2015 9:36 AM	RANIA	9/17/2016 1:30 PM
Document	Um Lyath (No.13)		31	78	5/26/2015 9:36 AM	RANIA	9/16/2016 10:25 AM
Audio	Abu Mohamed and Um Mohamed (No.8)		13	26	7/21/2015 3:27 PM	RANIA	9/11/2016 1:19 PM
Document	Group of men (No.15)		14	39	7/21/2015 3:05 PM	RANIA	9/17/2016 1:30 PM
Document	Husband and wife (No.7)		16	36	7/21/2015 3:05 PM	RANIA	9/11/2016 1:15 PM