DESIGN FOR BEHAVIOUR CHANGE:

Developing a communication campaign to influence household behaviour towards food waste reduction in Jordan

This thesis is submitted for the degree of
Doctor of Philosophy by

Qais Ahmad

College of Engineering, Design and Physical Sciences
Brunel Design School
Brunel University London



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DECLARATION

I declare that this thesis is the result of my own investigations and was written by myself, except where otherwise stated. This research has not been previously submitted, in part or whole, to any university of institution for any degree, diploma, or other qualification.

Signed: _____

Date: _____

Qais Ahmad
September 2022

ABSTRACT

Food waste poses unprecedented risks to climate change, food security, and the economy on a global, national, and regional level. Therefore, this issue is required to be addressed urgently.

This research focuses on understanding the current behaviour patterns of targeted households in Jordan and thus developing a communication campaign to shape households' behaviour towards food waste reduction. The overall aim of this research is to develop communication campaign guidelines to shape household behaviour toward food waste reduction in Jordan.

This PhD includes three phases. In the first phase, the research has carried out a review of the food waste issue, the Design for Behaviour Change (DfBC) background, outlining behaviour change models in behavioural sciences and design for behaviour change models and toolkits with a particular focus on communication campaigns.

The second phase of this research consisted of two parts. The first part aimed to understand the current situation, as well as future plan, on solid waste in general and food waste in particular in Jordan by interviewing experts and policymakers in Jordan. The second part was to understand households and provide a clearer picture of behaviours related to food waste practices and the determinants of these behaviours by carrying a survey, ethnographic observation, photovoice method, and semi-structured interviews with Jordanian households in West and East Amman.

The third phase of this research was dedicated to developing and testing a communication campaign to shape households' behaviour towards food waste reduction in Jordan. The last two chapters described how the research outcomes can be integrated, and how the research outcomes can fulfil the knowledge gap. A design process is also proposed, with guidelines developed for the adoption of learned lessons in other contexts, different scenarios of possible applications, limitations, and future research opportunities.

Keywords: Design for Behaviour Change, Communication Campaign, Food Waste Behaviour, Ethnographic Research, Action Research, Jordanian Households

DEDECATION

I would like to dedicate this thesis to my late father “Mohammad”, and my late grandmother “Nijmeh”. May their soul rest in peace.

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Pursuing a PhD degree is not an easy decision, it is a challenging journey filled with ups and downs, laughter, and tears, but in the end, it is all worth it.

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DEFINITION OF TERMS

DfBC: It refers to Design for behaviour change which is an intentional and strategic approach that employs design principles, techniques, and interventions to influence individuals' actions, habits, and attitudes in a way that fosters positive and desired behavioural modifications.

BCD: It refers to Behaviour Centred Design which is an approach to design that focuses on understanding and influencing human behaviour to address complex challenges and promote positive outcomes. In this research, the BCD approach was adopted to encompass the development of the communication campaign through providing five-step process in which intervention materials are designed and evaluated to shape household food waste behaviour in Jordan.

DwI: It refers to Design with Intent which is a design tool for influencing user behaviour that was developed by Dan Lockton. In this research, the DwI toolkit was applied to support the Creative Process.

TPB: It refers to the Theory of Planned Behaviour which is a psychological model developed by the social psychologist Ajzen. It is widely utilised in behavioural sciences to explain and predict human behaviour.

TRA: It refers to the Theory of Reasoned Action which is another social psychology model developed by Fishbein and Ajzen. It provides insights into understanding and predicting human behaviour.

GLOSSARY

FAO – Food and Agriculture Organization

WFP – World Food Programme

WRAP – The Waste and Resource Action Programme

LFHW – Love Food Hate Waste

WRI – The World Resources Institute

USEPA – United States Environmental Protection Agency

HLPE – High Level Panel of Experts

HCI – Human Computer Interaction

SDG – The Sustainable Development Goal

WHO – World Health Organization

Chapter 1 Introduction

1.1 Introduction to the chapter

As one of the greatest challenges facing the world today, food waste poses serious risks to climate change, food security, and the economy on a global, national, and regional level (Abiad & Meho, 2018; Hebrok & Boks, 2017; Patel et al., 2021; Thyberg & Tonjes, 2016). With an urgent need to design interventions to reduce food waste levels (Abdelradi, 2018; Abiad & Meho, 2018; Hebrok & Boks, 2017; Priefer et al., 2016a; Schmidt, 2016), some Global North countries have launched communication campaigns to increase food literacy at the household level (Rachman, 2018; ReFED, 2016; WRAP, 2020), whereas in some of Global South countries food waste research or interventions remains scarce (Abiad & Meho, 2018; Mousa, 2020; World Food Programme, 2020). Despite the potential of these campaigns in the Global North, there is a lack of knowledge regarding the effectiveness of the design interventions in influencing food waste behaviour (Hebrok & Boks, 2017; Soma et al., 2020). This thesis focuses on understanding the current behaviour patterns of targetting households in the country of Jordan and thus developing communication campaign guidelines to shape households' behaviour towards food waste reduction. It contributes to the Design for Behaviour Change field in both practice and research.

This chapter introduces the research by first discussing the background and its importance (Section 1.2), followed by the scope of this research: aim, objectives, and research questions (Section 1.3). Finally, Section 1.4 concludes with an outline of this thesis.

1.2 Research background

This section provides a relevant explanation for the following topics: the gravity of the food waste issue, a brief introduction to Design for Behaviour Change, communication campaigns, and Jordan and the research on food waste.

1.2.1 The global challenge of food waste

Food waste has become an increasing global concern across research, policy, and design due to combined environmental, economic, socioethical and political impacts

that arise from poor food practices and routines (Hebrok & Heidenstrøm, 2019; Patel et al., 2021; Reynolds et al., 2019). It has been estimated that approximately one-third of the edible parts of food produced for human consumption are wasted (Gustavsson et al., 2013). Environmental studies have proven that food waste is harmful to the environment (Venkat, 2012; WRAP, 2009, 2020), contributing extremely to global warming as it generates large amounts of greenhouse gas emissions (FAO, 2015). Furthermore, one trillion dollars of food is wasted every year worldwide, causing large financial burdens (Septianto et al., 2020).

By 2030, Sustainable Development Goal 12.3 aims to halve food losses along the production and supply chain, including post-harvest losses, as well as reduce per capita food waste (Lipinski, B., Clowes, A., Goodwin, L., Hanson, C., Swannell, R. and Mitchell, 2017). According to Beretta and Hellweg (2019) and Springmann et al. (2018), this level of ambition is insufficient and further reductions are necessary to create a food system capable of meeting the target by 2050. Nevertheless, the international community faces a major challenge in providing food for over 9.1 billion people by 2050 (Parfitt et al., 2010). Globally, around 800 million people suffer from undernourishment and food demand is intensifying, leading to major ethical dilemmas (Bravi et al., 2020). A crucial issue of food waste is a lack of understanding of food consumption (e.g., over-purchasing of food) and waste patterns. It has been reported that the majority of wasted food occurs during the consumption stage, with much of that occurring at the household level (Hebrok & Boks, 2017; Reynolds et al., 2019a). Household food waste is part of the total food waste that result from consumers' daily practices and routines, such as preparing extra-large meals, buying excessive food, and not reusing leftovers (Boulet et al., 2020). Thus, a better understanding of food waste behaviour at the household level will help scholars, designers, and practitioners in industry, government, and not-for-profit sectors develop appropriate solutions and interventions (Agbefe et al., 2019).

By reducing food waste, individuals will gain an economic advantage, social equity will be advanced by allowing more food to be available for those in need, and environmental sustainability will be enhanced since fewer resources are being consumed. In recent years, several studies have investigated food waste behaviour at the household level using the Theory of Planned Behaviour (TPB) and the Theory of

Reasoned Action (TRA) (Graham-Rowe et al., 2015; Karim Ghani et al., 2013; Stefan et al., 2013). These studies had modest explanatory power of their estimated models ranging between 70% and 80% not explained (Abdelradi, 2018). This can be explained by the fact that food waste is a multidisciplinary issue. Hence, exploratory research is still needed to better understand the food waste behaviour (Abdelradi, 2018; Katajajuuri et al., 2014).

The Global North is responsible for a substantial amount of food waste around the world, despite having the wealth to tackle the issue (Hodges et al., 2011). In these countries, the majority of food waste is generated by individual consumers. A large portion of this can be attributed to the ability of the average citizen to purchase more than enough food for their family (Schanes et al., 2018). Further, grocery stores contribute to food waste by promoting overconsumption among consumers. It is also common for restaurants to waste food due to improper inventory management, inadequate menu choices, or oversized portions (Quinton, 2019). However, efforts in the Global North are currently underway to reduce the amount of food waste generated in agriculture, aquaculture, fishing, food processing, and manufacturing, as well as in supermarkets, restaurants, schools, hospitals, and homes (Kymäläinen et al., 2021; Malefors et al., 2021; Pappalardo et al., 2020; Pearson & Perera, 2018; Principato et al., 2015, 2020; Schmidt, 2016; Soma et al., 2020; Young et al., 2017). A variety of strategies have been used in these initiatives, including improved communication of forecasting between retailers and agricultural producers; communication campaigns; programs to increase skills in the home and school; as well as changes in the way food is packaged and sold.

1.2.2 Design for behaviour change through communication campaigns

Design for behaviour change is intended to promote the understanding and application of design for behaviour change across a variety of disciplines such as health, safety, sustainability, and social issues (Niedderer et al., 2016). Many of the world's greatest problems can be addressed through design for behaviour change. According to Niedderer et al. (2016), the field of DfBC is still relatively poorly understood and fragmented, with few frameworks available for its successful implementation in a professional and public context. While DfBC covers a wide range of disciplines and

problems, there is still a challenge in creating a coherent understanding of practices and approaches. Accordingly, a shift from the present situation of high household food waste to a more sustainable future requires Design for Behaviour Change. Although there are no clear guidelines for using DfBC in communication campaigns, this research is planning to combine DfBC with a communication campaign in order to influence household food waste behaviours.

Communication campaigns have gained traction in mainstream media over the past decade and have become one of the most widely used interventions aimed at reducing food waste (Priefer et al., 2016b; Soma et al., 2020). Abrahamse et al., (2005) agreed that communication campaigns serve as an antecedent intervention that is designed to influence one or more behavioural determinants before an environmental behaviour is performed. In other words, communication campaigns are intended to increase knowledge about the effects of unsustainable behaviour and to inform people on how to change it. For instance, the United Kingdom launched a major food waste campaign entitled "Love Food, Hate Waste" in 2007 as part of WRAP (WRAP, 2009). The campaign strategy aims to educate and raise household awareness about food waste. According to a report by ReFED (Rethink Food Waste), communication campaigns are one of the most effective ways to reduce food waste in the United States (ReFED, 2016). "Food: Too Good to Waste" and "Save the Food" are well-known U.S. campaigns that provide a website with practical suggestions for reducing food waste at home and are distributed through outlets such as television, radio, web ads, and social media (ReFED, 2016). Meanwhile, there has been very little research on the effectiveness of communication campaigns interventions to reduce food waste at the household level (Reynolds et al., 2019b; Soma et al., 2020).

1.2.3 The focus on communication design

While some communication designers may disagree on what exactly communication design is, most would agree that communication design is the practice of influencing the human experience. This PhD thesis investigates the influence of communication design on household behaviour towards food waste reduction in Jordan. The researcher's personality and professional experience inform the need to undertake this research. In 2011 the researcher graduated in Graphic Design and Applied Arts

(BA) from Yarmouk University in Jordan and continued to study Communication Design (MA) at the University of Salford Manchester, UK in 2015. During my Master's studies, the researcher worked as a graphic designer at a not-for-profit charity organisation in Manchester, UK to create editorial designs to promote humanitarian and development support to vulnerable and conflict-affected people in Africa. This experience enabled the researcher to recognise the full worth of the communication design field through communicating messages and ideas effectively to persuade donors and supporters to take action across the world. Shortly after graduation, the researcher travelled to Jordan and worked there as a lecturer in Graphic Design at Yarmouk University, where he contributed to students' creativity and learning by providing expertise for developing communication campaigns for sustainable behaviours, and environmental awareness issues. These experiences influenced the researcher’s thinking and during this time, he realised his interest lay not just in the problem-solving activity of designing new communication campaigns, but in the problem-reframing activity of researching and understanding the environmental, cultural, and social practices that underline these communication campaigns.

The researcher's particular decision to focus on communication design in this PhD comes from a personal belief that communication design is fundamental for positive change. It is through communication design that the researcher can influence the behaviour, knowledge, and attitudes of people that occur after the communication takes place. The potential of communication design to solve problems or create solutions is well-recognised in different sectors (see section 2.4). There are several ways in which communication design can be applied. Initially, focusing on communication design provides a multifaceted interplay between visual design, information design, and strategic communication to create effective visual communication (Yates and Price, 2015). It involves using typography, graphics, images, and other visual elements to convey information and messages to specific audiences. Hence, two reasons can justify that this focus on communication design is promising.

Firstly, the researcher comes from a communication design disciplinary background and has the knowledge and experience to understand people’s behaviours and needs while also having the craftsmanship and expertise to interpret these needs into

practical and aesthetically engaging solutions. This in turn offers a combination of creative expression, strategic thinking, and impactful work that can be fulfilling in this research.

Secondly, all societies develop, evolve, and transform as a result of the constant exchange of information. There are numerous ways in which the urban environment, the public transportation system, and the mass media ecology contribute to the expression and construction of culture. As an example, advertising seeds cultural models of behaviour, appearance, and culture, which can be used to promote lifestyles, choices, and cultural values. Consequently, communication design offers many opportunities for creative expression. Further, communication design allows for a great deal of creativity, regardless of whether it be motion graphics, adverts, and physical and digital materials.

1.2.4 Jordan and its capital Amman

Jordan is a country steeped in history and culture located in the Middle East. The country is considered to be one of the most politically liberal in the Arab world. Its rulers have also expressed a commitment to maintaining peace and stability in the region despite the difficulties that affect the region. The current population of the country is 11.2 million inhabitants (Jordan Department of Statistics, 2022), and borders Iraq, Syria, the Occupied West Bank, Israel, and Saudi Arabia. Most of the population consists of Arabs, primarily Jordanians and Palestinians. Prior to the influx of Palestinians following the Arab-Israeli wars of 1948 and 1967, the Bedouins were by far the largest indigenous group. There are also a number of Syrian refugees who fled to Jordan due to the Syrian Civil War, as well as Iraqis who fled to Jordan following the Persian Gulf War and the Iraq War. Additionally, there are smaller communities of Circassians[1] and Armenians. The Jordanian population also includes a small number of Turkmen (who speak either an ancient form of the Turkmen language or an Azeri language). The official language of the country is Arabic, which is spoken by nearly all the population. Various dialects are spoken, each with its own inflexions and accents, but they are mutually intelligible and similar to the Levantine Arabic spoken in Palestine, Lebanon, and Syria. There is a difference exists between Modern Standard

[1] referred to locally as Cherkess

Arabic, the written language in the Arab world, and the colloquial, spoken language. It is common for Circassians to speak Arabic in their daily lives, although some still speak Adyghe[2]. Armenian and all minorities tend to be bilingual or to assimilate to Arabic as a whole.

The majority of Jordanians live in urban areas. The most populous cities are Amman, Al-Zarqa, and Irbid. Most of the smaller towns have fewer than a thousand residents. Several towns have hospitals, banks, government and private schools, mosques, churches, libraries, entertainment facilities, colleges, and universities. The larger cities such as Amman, Al-Zarqa, and Irbid, have more characteristics indicative of modern urbanization than smaller towns. Having its roots in the Arab world, Jordan shares a common cultural tradition with the rest of the region. In Jordanian culture, the family is of utmost importance. They still follow a more traditional way of life, preserving customs passed down from generation to generation, despite their numbers have declined as many have settled and adopted urban culture. Extended families, agriculture, and hospitality are the pillars of village life; motorized vehicles are the only means of transportation. On the other hand, urban Jordanians enjoy all aspects of modern, popular culture, including musical performances, operas, and ballets. Muslims make up most of the population, with Christians constituting the remainder. Jordanian people are known to be Master of Hospitality when it comes to welcoming guests. It is believed that this behaviour originated from the willingness of the town's inhabitants to house and feed rogue desert travellers who passed through the town.

Jordan is relatively small country, and its natural resources are limited. There are also several obstacles facing the Jordanian economy. One-third of Jordan's gross domestic product comes from trade and finance; one-fifth comes from transportation, communication, and construction; and nearly one-fifth comes from mining and manufacturing. Foreign exchange is largely provided by remittances from Jordanians working abroad. There is a wide range of salaries in Jordan, ranging from 410 JOD (the lowest average) to 7,190 JOD (the highest average, although the actual maximum salary is higher). The average monthly salary includes housing, transportation, and other benefits. There is a drastic difference in salary between different careers. However, there are approximately 25% of the population earns less than 850 JOD

[2] a Caucasian language

which causes parents to cut back on everyday necessities, social activities, and holidays, placing a strain on their parenting and family ties. Furthermore, 75% of the population earns more than 850 JOD per month. In addition, 75% of the population earns less than 3,990 JOD, while 25% earn more than 3,990 JOD per month.

The metropolitan area of Amman is the capital and largest city of Jordan and the country's economic, cultural, and political centre. As one of the few places in the Middle East that offers a unique level of religious tolerance, Amman is a haven of calm and peace. Amman is the largest city in the Levant region with a population of 4.007.526 and the fifth-largest city in the Arab World (Department of Statistics, 2015). It is a modern Arab city divided into West and East, areas that appear to exist in parallel realities. Choosing West and East Amman was the best place to observe different behaviours and cultures. Geographically, the high-income districts of Amman are situated in the Western parts of the city, whereas low-income households and refugees are concentrated more in the eastern parts of the city. West Amman represents wealth, social status, foreign investment, and the highest class of Jordanian society (see Figure, 1.1). In East Amman, you can touch and feel poverty and misery (see Figure, 1.2). Comparing household sizes, East Amman has more household members than West Amman households. A higher share of people residing in East Amman lives in larger families with more adults and fewer children than in West Amman households.



Figure 1. 1 Modern Amman. Photo by Mazadatours.com (2022) (Creative Commons licence)



Figure 1. 2 East Amman. Photo by Bogdan Nanescu (2022) (Creative Commons licence)

1.2.5 The current research on food waste in Jordan

From a Jordanian perspective, research on food waste is negligible and scarce with a lack of reliable data, sources, drivers, policies, interventions, and initiatives directed at reducing food waste. While it is estimated that one-third of the world's food production is wasted and never consumed (Gustavsson et al., 2013), Jordan's food waste is between 50% and 65%, higher than the international average of 33.3% (Jordan Green Building Council, 2018). The Hashemite Kingdom of Jordan is a low-middle-income developing country in the Arab world (The World Bank, 2017), surrounded by countries with ongoing conflicts, including Palestine, Syria, and Iraq. Consequently, the suffering nations sought sanctuary in this haven; thus, Jordan was put under additional pressure to meet not only the needs of its citizens but also more than three million refugees (Al-Soleiti et al., 2021). This increased burden is attributed to the semi-desert topography, the limited natural resources, and the high dependency on food imports (Prieto, 2018).

The persistence of instability has increased poverty rates in Jordan where 15.7% of the population lives below the national poverty line and a third is considered transient poor (WFP, 2020). A total of 0.5% of the population is food insecure, and 13% are at risk of becoming food insecure, putting them at risk for malnutrition (FAO et al., 2019). Hence, reducing food waste is essential for a sustainable food system and for food security in the country (Abiad & Meho, 2018). Jordan has no solid waste management policy and the Jordanian municipals' waste generation rate is more than 2 million tonnes per year, most of it is dumped in unsanitary landfills (AlMuheisen, 2021) which causes greenhouse gas emissions with a global warming potential twenty-five times greater than carbon dioxide (Abiad & Meho, 2018; Jordan Green Building Council, 2018; Oakes, 2009). It is estimated that Jordan generates around 210 kilograms of food waste per person annually and it ranks among the top 25 countries causing food waste (Abiad & Meho, 2018). Yet in Jordan, where the amount of food wasted is substantial at the household level (Khader et al., 2019), it is vital to understand the reasons why households waste food, to identify factors that influence food waste behaviour, and design a communication campaign to reduce food waste (Abdelradi, 2018; Abiad & Meho, 2018). Therefore, there is an urgent need to understand the current behaviour patterns of target households in Jordan, as well as design a coherent communication campaign to promote different approaches to reduce food waste.

This research is important for many reasons. First, it provides an understanding of the models of design for behaviour change and current food waste behaviour patterns of target households in Jordan, important for policymakers and future researchers interested in the design for behaviour change field. Second, it contributes to scholarly resources on design in both practice and research. The development of communication campaign and its intervention materials will provide a contribution to knowledge in design practice, while the process of the communication campaign development, and cycles of testing, will provide a contribution to knowledge in design research. Third, through its ethnography research, it explores inefficiencies, and opportunities and evaluates authentic behaviour. The methods and food waste behavioural model developed in this research could also be relevant to researchers in other fields. Fourth, it is the first theoretical and practical study of design for behaviour change to reduce food waste in Jordan and the Arab world. Finally, the result of this research provides communication campaign guidelines to support the adoption of learned lessons in other contexts.

1.3 Research scope

Given that research on design for behaviour change and food waste behaviour in the Arab world remains largely neglected and unexplored, this research focuses on Jordan and West and East Amman specifically. The scope of this research is limited to design for behaviour change, applied within the field of communication design, to influence food waste behaviour at the household level. The fieldwork engages relevant actors with the most at stake in the solid waste management, design for behaviour change and communication design: policymakers, communication designers and experts in behaviour change campaigns. Therefore, the focus is on understanding the current situation on solid waste in general and food waste in particular in Jordan; the current behaviour patterns of target households in Amman; and developing a communication campaign to shape households' behaviour towards food waste reduction in Amman. This research explores the theories, practices, models, and interventions of design for behaviour change that is appropriate; the current behaviour patterns of target households; and communication campaigns to shape households' behaviour towards food waste reduction.

1.4 Research aim, objectives, and research questions

The overarching aim of this research is to develop communication campaign guidelines to shape households' behaviour towards food waste reduction in Jordan.

To achieve the aim of the research, the following research questions have been developed:

RQ1: What are the best practices for changing user behaviour in relation to food waste reduction?

RQ2: What are the factors that influence household food waste behaviour in Jordan?

RQ3: How can design for behaviour change, applied within the field of communication design, be used to shape user and household behaviour?

In order to answer the research questions, the following objectives were defined to be fulfilled for reaching the aim:

a) To understand the current situation on solid waste in general and food waste in particular in Jordan.
b) To carry out a review of DfBC field with a particular focus on communication design.
c) To review successful and unsuccessful cases of interventions (communication campaigns) to shape behaviour around food waste reduction.
d) To explore current behaviour patterns of target households in Jordan.
e) To develop a communication campaign to shape households' behaviour towards food waste reduction in Jordan.
f) To implement, test and iterate the communication campaign to shape households' behaviour towards food waste reduction in Jordan.
g) To develop guidelines to support adoption of learned lessons into other contexts.

1.5 Thesis outline

This thesis is structured into four major phases. The first phase focuses on literature review and methodology. The second phase explores the food waste issue and household food waste behaviours in Jordan. The third phase encompasses development, implement, and evaluation. The final phase discusses and concludes the findings and presents guidelines to support the adoption of learned lessons in other contexts. Following is a description of each phase and the corresponding chapters, and Table 1.1 summarises the content of each chapter.

1) *Literature review and methodology:*

Chapter 2: Literature review

This chapter reviews the existing literature on three interlinking areas of extant research relating to: food waste issues and concerns, the conceptual frameworks related to households' food waste behaviour; DfBC and its background, the chapter also introduces the Behaviour Centred Design framework (BCD) and builds a rationale for why it has been applied to achieve the overall aim of the thesis; review successful and unsuccessful cases of interventions (communication campaigns) to shape behaviour around food waste reduction. The chapter concludes with a summary of findings and identifies gaps in the literature.

Chapter 3: Methodology

This chapter provides an overview of the research methodology and research design underpinning this research. It makes explicit reasoning behind the choice of a particular methodology selected to frame this research. It discusses the participants involved in the research, the methods used for data collection and data analysis, as well as summing up of the validity and reliability of this research.

2) *Research exploration:*

Chapter 4: Food waste in Jordan

This chapter outlines additional research activities carried out to validate the literature review findings regarding the current situation as well as a future plan,

on waste management in Jordan, including solid waste in general and food waste in particular.

Chapter 5: Understanding household food waste behaviours in Jordan

Chapter five presents the first theoretical contribution to this research. It provides a comprehensive picture of the ethnographic research conducted to understand users and get a clearer picture of their behaviours related to food waste practices and routines of everyday life such as cooking and eating. It describes the results from a survey, ethnographic observation, photovoice method, and semi-structured interviews with Jordanian households in West and West Amman in a range of settings. The purpose of the ethnographic research is to identify the most effective factors that seem to influence households' behaviour toward food waste reduction in Jordan which will be the main driver of the communication campaign.

3) *Development, implement and evaluation:*

Chapter 6: Developing and testing the communication campaign

This chapter describes the development and the iterative process of testing and evaluations of the communication campaign by carrying out a series of design workshops before running a two-month household food waste campaign in response to the volume of food wasted by Amman households. The chapter sets out the BCD framework and theory of change (ToC) to design the intervention materials (Aunger & Curtis, 2016). The communication campaign (and its interventions) provides a contribution to knowledge in design practice, while the process of the communication campaign development, and cycles of testing, provide a contribution to knowledge in design research.

4) *Discussion and conclusions:*

Chapter 7: Discussion

This chapter presents the results gathered during this research together with the methodology rationale. It also discusses the significance of the communication campaign and how its development filled the knowledge gap identified at the beginning of this research and acknowledges the limitations of the research.

Chapter 8: Conclusions.

This chapter presents the research conclusions of this PhD research. It describes how the aim was met and the objectives accomplished, indicating the results that contributed to both theoretical and practical conclusions. It also provides both theoretical and practical contributions to knowledge, includes research limitations and indicates areas where further research is needed.

Table 1.1 Outline of the thesis

Phase	Chapter	Contents
Literature review and methodology	1. Introduction	1.1 Research background 1.2 Research scope 1.3 Research aim, objectives, and research questions 1.4 Thesis outline
	2. Literature review	2.1 Food waste 2.2 Design for behaviour change 2.3 Communication campaigns
	3. Methodology	3.1 Research onion 3.2 Research design 3.3 Research paradigm 3.4 Research approach 3.5 Research purposes 3.6 Research methodology 3.7 Research data collection methods 3.8 Data analysis 3.9 Validity and reliability
Research exploration	4. Food waste in Jordan	4.1 Semi-structured experts' interviews 4.2 Discussion of the results 4.3 Reflections on the overall results
	5. Understanding household food waste behaviours in Jordan	5.1 Personas and scenarios 5.2 Demographics 5.3 Methods of the study 5.4 Data analysis 5.5 Results 5.6 Discussion

Development, implement, and evaluation	6. Development and testing the communication campaign in Jordan	6.1 Literature review on BCD framework 6.2 Design Process 6.3 Assess 6.4 Build 6.5 Create 6.6 Deliver 6.7 Evaluate 6.8 Overall reflection on the behavioural change campaign 6.9 Discussion
Discussion and conclusions	7. Discussion	7.1 Discussion of methodology rationale 7.2 Reflections on the campaign development process 7.3 The communication campaign guidelines
	8. Conclusions	8.1 Achievement of research aim and objectives 8.2 Contribution to knowledge 8.3 Research limitations 8.4 Recommendations for future work

Chapter 2 Literature Review

2.1 Introduction

This chapter discusses the theoretical foundation of this research, focusing on three subjects: food waste, design for behaviour change (DfBC) and communication campaigns. These subjects are structured as follows. Firstly, food waste is introduced by providing its definitions, highlighting its issues and concerns, followed by presenting behaviour change theories in behavioural sciences applied to food waste behaviour studies at the household level, and food waste reduction interventions. Secondly, the design for behaviour change approaches and models is introduced. Thirdly, a review of the successful and unsuccessful communication campaigns interventions that influence behaviour around food waste reduction. Finally, the chapter concludes with a summary of findings and describes the knowledge gap in the literature.

2.2 Food waste

The basic needs of humans are currently being met at the expense of trespassing the biophysical boundaries of the planet. The challenge of meeting these needs on a globally sustainable level is complex (Hajer et al., 2015; O'Neill et al., 2018; Raworth, 2017). The food system plays a prominent role in allowing both excessive consumptions of unhealthy foods, and extreme poverty at the expense of the earth's resilience (Foley et al., 2011; West et al., 2014). It is evident that food waste is not only an emerging issue but also an extremely controversial concept. This is due to the fact that approximately 8% of global greenhouse gas emissions are attributed to food waste (Gustavsson et al., 2013). Additionally, the production of food for human consumption consumes a considerable amount of land, water, and energy (Schanes et al., 2018; Xue et al., 2017). It is also important to note that these levels of food waste have serious social and economic consequences. Accordingly, this section provides an overview of the state of the art in food waste, including the definition, issues and concerns, household food waste behaviours, and food waste reduction interventions.

2.2.1 Food waste definition

The existing literature indicates a clear distinction between food waste and food loss concepts. According to the European FUSIONS project, "Food waste is any food, and

inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops lowed in/not harvested, anaerobic digestion, bioenergy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)" (Gustavsson et al., 2014, p. 6). Contrarily, food loss refers to a decrease in food quantity or quality in the early stages of the food supply chain food (Gustavsson et al., 2013). Food loss is thereby often related to post-harvest activities with the infrastructural capacities (Abiad & Meho, 2018; Ishangulyyev et al., 2019). On the other hand, food waste is often related to human behaviour during the consumption phase (Quested et al., 2013; Parfitt et al., 2010; Hebrok & Boks, 2017). It can be noted that there is a sharp distinction between the two concepts. Thus, the researcher focuses on the food waste concept in this thesis.

There are a multitude of definitions for food waste put forward by NGOs, practitioners, and academics in the last decade. Schneider (2013) and Gjerris and Gaiani (2013) claim that multiple terms such as food waste and kitchen waste are used interchangeably but possess different definitions. Although there are several definitions of food waste, there is no agreed-upon definition which makes studying and quantifying food waste difficult (Abdelradi, 2018; Ishangulyyev et al., 2019). Of the numerous food waste definitions listed in Table 2.1, the generic definition by the High Level Panel of Experts (HLPE) (2014) is adopted and used to describe the food waste issue in this thesis. It is important to note that the choice of the HLPE definition is in line with this research that focuses on household food waste behaviours, whereas the HLPE definition is also related to related only to consumer behaviour in the final stage of the food supply chain.

Table 2.1 Definitions of food waste

Source	Food waste definition
Kling, 1943	*Food waste is the destruction or deterioration of food or the use of crops, livestock and Livestock products in ways which return relatively little human food value.* (p. 849)
FAO, 1981	*Food waste is all food products allocated for human consumption that are instead discarded, lost, degraded, or consumed by pests at any stage of the food chain.* (p. 43)

FAO, 2013	*Food waste is food appropriate for human consumption that is discarded (generally at retail and consumption stages).* (p. 9)
European Commission, 2014	*Food waste is food (including inedible parts) lost from the food supply chain, not including food diverted to material uses such as bio-based products, animal feed, or sent for redistribution.* (p. 2)
USEPA, 2014	*Food waste is uneaten food and food preparation wastes from residences, commercial, and institutional establishments. So, food wastes from homes, grocery stores, restaurants, bars, factory lunchrooms, and company cafeterias are included. Pre-consumer food waste generated during food manufacturing and packaging are excluded.* (p. 6)
Buzby et al., 2014	*Food waste is a subset of food loss and occurs when an edible item goes unconsumed. Only food that is still edible at the time of disposal is considered waste.* (p. 1)
HLPE, 2014	*Food appropriate for human consumption being discarded or left to spoil at consumer level—regardless of the cause.* (p. 22)
WRAP, 2014	*Food and drink are thrown away that was, at some point prior to disposal, edible.* (p. 18)
Abeliotis et al., (2014)	*Composed of raw or cooked food materials and includes food loss, before, during or after meal preparation in the household, as well as food discarded in the process of manufacturing, distribution, retail, and food service activities.* (p. 237)
Aschemann-Witzel et al., (2015)	*Any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops plowed in/not harvested, anaerobic digestion, bioenergy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea).* (p. 6458)

All of these definitions listed above highlight the complex nature of the food waste phenomenon. It can be noted that there is a similarity among these definitions in that they describe the reduction in the quantity or quality of food intended for human consumption. On the other hand, they differ when it comes to considering the external causes of food waste and food loss as well as defining their relationship. According to the FAO (1981, 2013), Kling (1943), and the European Commission (2014), food waste occurs at the first three stages of the food supply chain. For instance, the European Commission (2014) describe food waste as some crops that cannot be harvested for unavoidable reasons including adverse weather conditions and crop diseases. In other words, fluctuations in demand, the shape of crops and damage during harvest and storage may cause crops to go to waste. For USEPA (2014), Buzby

et al. (2014), WRAP (2014), Abeliotis et al. (2014) and Aschemann-Witzel et al. (2015), losses and waste are defined as food waste, with no terminology for food loss.

In defining food waste, the researcher believes that avoidable food waste should be distinguished from unavoidable food waste. Unavoidable food waste includes types of food that cannot be consumed by humans in general, such as meat bones and the skin of watermelons (Ishangulyyev et al., 2019).

2.2.2 Issues and concerns related to food waste

Food waste is a serious threat to food security, the economy, and the environment (Abiad & Meho, 2018; Hebrok & Boks, 2017). In the entire food supply chain, roughly one-third of all food produced for human consumption (1.3 billion tons of edible food) goes to waste every year (Gustavsson et al., 2013). Despite the social and environmental costs that are borne by society, the financial value of food waste is estimated at about USD $936 billion (FAO, 2015). It is estimated that food waste can alleviate undernutrition for one-eighth of the world's population and meet the increasing food demand by 2050, which could reach 150-170% of current levels (FAO, 2015; Gustavsson et al., 2013). According to the FAO, (2013), food waste contributes to global warming by emitting large quantities of greenhouse gas emissions. As a result, many targets have been established for reducing food waste. For instance, the Sustainable Development Goal (SDG) 12.3 aims to reduce food waste per capita at the retail and consumer level by half by 2030 (Lipinski et al., 2017). It is argued, however, that the Sustainable Development Goals are problematic and have little to do with sustainable development. Several countries with the highest sustainability scores are among the most environmentally unsustainable countries in the world, including Sweden, Denmark, Finland, France, and Germany (Hickel, 2020). Sweden, for instance, scores an impressive 84.7 on the index, placing it at the top of the pack. According to ecologists, Sweden has the largest "material footprint" in the world, with 32 metric tons of natural resources consumed per person every year, right behind the United States (Hickel, 2020).

Scholars such as (Aschemann-Witzel et al., 2015; Gustavsson et al., 2014; Hebrok & Heidenstrøm, 2019; Priefer et al., 2016) emphasise that food waste entails the waste of all resources that are necessary to produce, transform, and distribute it, and

contribute to the destruction of ecosystems (e.g., greenhouse gas emissions, soil degradation, biodiversity loss). Alongside its environmental impact, food waste has economic, natural resources, and poverty implications (Buzby et al., 2014; Gustavsson et al., 2013; Lipinski et al., 2017). In addition, there are 805 million undernourished people, with 14.6 million of them living in high- and middle-income countries (5% of their overall population), whereas 790.7 million undernourished people live in low- and middle-income countries (13.5 % of their overall population) (FAO, 2015). As a result, the international community faces the challenge of providing safe food for over 9.1 billion people by 2050 (Parfitt et al., 2010). Although the emphasis is on increasing food production by 50-70% to achieve this goal, one factor that is often overlooked is the reduction of food waste (Hodges et al., 2011).

Food waste varies drastically among countries, depending on income, industrialisation, and development levels (Chalak et al., 2016). According to the World Health Organization (2016), there are approximately 1.9 billion overweight adults aged 18 and over in the world, however; more than 650 millions of these individuals were obese and there are at least 2.8 million people who die each year because of being overweight or obese. Being overweight and obese has serious health consequences, including diabetes, heart disease, stroke, and some cancers (Oliveira et al., 2016). The increasing global prevalence of overweight and obesity could have negative impacts on the environment since increased consumption will require more food production, which will increase greenhouse gas emissions from the additional production and transportation of food (Garnett et al., 2013).

Several studies have indicated that a large amount of food is wasted at the consumption level, with amounts varying among countries (Abiad & Meho, 2018; Fami et al., 2019; Kummu et al., 2012; Parfitt et al., 2010). According to WRAP (2009), approximately 25% of household purchases in the UK are wasted as a result of food waste. Moreover, some European countries are experiencing an increase of up to 42-50% of the total amount of food waste (Campoy-Muñoz et al., 2017; Stancu et al., 2016), and in one US county, up to 60% (Griffin et al., 2009). A study by Schott and Andersson (2015) found that around 35% of household food waste can be avoided. A study by Ju et al., (2017) has shown that the consumption phase has low efficiency

for food use when compared with other parts of the food supply chain since households lose a large amount of food.

Research conducted by Jordan Green Building Council, (2018) on municipal solid waste in urban areas in Jordan has shown that 51% of the waste generated comes from household food waste. Further, it is estimated that food waste generation per person in Jordan exceeds 210 kg annually (Abiad & Meho, 2018). These statistics are evidence that there is a huge amount of food waste in households which is a major concern. According to Porpino (2016), it is important to understand how to influence food waste during the consumption phase and within households in particularly, where the majority of food is consumed and wasted. As discussed in Chapter 1, there is negligible and scarce research on food waste research in Jordan with a lack of reliable data, sources, drivers, policies, interventions, and initiatives directed at reducing food waste.

2.2.3 Household food waste behaviours

Food waste issues and concerns were introduced in the previous section. This helped the researcher to leapfrog forward on the basis of findings that may transfer to understanding household behaviour related to food practices and routines are important in developing more sustainable behaviours. As previously mentioned, there is a lack of knowledge in certain contexts of understanding why so much food is wasted by Jordanian households. Furthermore, Jordan is still not aware of the quantities of food waste generated at the household level. Returning to the RQ1 of what the current situation in Jordan is, in terms of food waste reduction and household behaviour, the researcher, therefore, decided to begin: 1] Synthesising the existing work on households' food waste behaviours and 2] Developing a comprehensive theoretical framework model of household food waste behaviour to be tested later empirically in Jordanian households.

2.2.3.1 Reviewing household food waste behaviours

According to Roodhuyzen et al. (2017), it has been demonstrated that a household food practices and routines (i.e., the activities occurring from planning through preparation, consumption, and disposal of waste) is necessary to better understand

food waste behaviour. Elsewhere Aschemann-Witzel et al. (2015) concluded that households' skills in managing food provisioning and food handling as well as their trade-offs between priorities have a comprehensive influence on their food waste behaviours. Additionally, it has been shown that households who create shopping lists and plan their meals have less food waste than households who make spontaneous purchases of foods or overbuy foods (Janssen et al., 2017; Visschers et al., 2016). Several authors (Aschemann-Witzel et al., 2015; Hebrok & Boks, 2017; Stancu et al., 2016; Stefan et al., 2013) agree that households may waste food due to inadequate cooking skills and a lack of efficient methods of storing food items.

It should be noted that a number of other factors including sociocultural dynamics, demographics, economics, and food-related routines, impact consumption patterns at the household level (Hebrok & Heidenstrøm, 2019; Stancu et al., 2016; Thyberg & Tonjes, 2016). For instance, women's employment and education are major drivers of food waste at the household level in Iran because educated people have higher incomes but less time to better manage their food at home (Shahnoushi et al., 2013). This can have similarities to Jordan since more women than men now graduate from Jordanian universities, and they are one of the most educated female populations in the region (Robin, 2022). Additionally, household perceptions of food quality contribute to food waste. In other words, one of the main reasons to waste bread in Jordan is the tradition of families, who prefer to eat warm bread from bakeries at various times throughout the day (Obeidat et al., 2015). Furthermore, the amount of food waste is also influenced by economic and marketing factors, such as price and packaging (Hebrok & Heidenstrøm, 2019). For instance, the large portion size of family packages may result in food waste if families do not consume the entire package.

Reducing food waste requires an understanding of household behaviour related to food prior to its transition into waste (Quested et al., 2013). Therefore, household food waste behaviours are influenced by the contexts within which food is consumed and represent where food is wasted (Evans et al., 2017). According to Aktas et al. (2018), there is no single behaviour that defines food that is wasted, but rather a combination of behaviours that may be able to increase or decrease the likelihood of food being wasted. Theory of Planned Behaviour has offered predictive power of attitudes, norms, perceived control, and intentions on the behaviour (Ajzen, 1991). The work of Evans

et al. (2017); Stefan et al. (2013); Visschers et al. (2016); Waitt & Phillips, (2016) however has drawn on the theory of reasoned action to provide insights by scrutinizing food waste in relation to daily food-related procedures and processes at the household level. Nevertheless, Abdelradi (2018) indicates that these studies demonstrated modest degree of explanatory power ranging from 70 to 80% not explained. This may be because food waste is a multidisciplinary issue (Marangon et al., 2014).

The literature has indicated many factors relevant to household food waste behaviour. For instance, Díaz-Ruiz et al. (2015) have developed a theoretical framework model for Barcelona metropolitan area that incorporates six different factors influencing food waste behaviour including environmental awareness, materialism, purchasing behaviour, food choice, waste recycling, religion, knowledge of food waste problems, and waste prevention.

2.2.3.2 Behavioural change theories and models related to food waste behaviours

There are many theories that can be seen as influencing the developing domain of design for behaviour change, ranging from more traditional models to more recent models. For example, several theoretical explanations of how a communication campaign affects pro-environmental behaviour have been based on the Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB), despite their adequacy being questioned due to their assumption that intention directly influences behaviour and their omission of factors such as routines, socio-demographics, and context (Soma et al., 2020; Abdelradi, 2018). TRA and TPB models have been expanded to incorporate pro-environmental behaviour as an explanatory variable. In the context of food waste, Stefan et al. (2013) examined the role of food-related practices along with the TPB's core cognitive constructs. More specifically, they examined whether attitudes, subjective norms, and perceptions of behavioural control influenced intentions to reduce household food waste and whether these intentions were in turn predictive of household food waste behaviours. The results of the study indicated that only attitude, which is comprised of two constructs, moral attitude, and lack of concern, predicted intention not to waste food. It was found that neither subjective norms nor perceived behaviour control was associated with intention. Stefan et al. (2013) also found that an across-sectional self-report measure of food

waste behaviour was not associated with an intention not to waste food. Detailed descriptions of behavioural change theories and models are provided in the following paragraphs.

- **Theory of Reasoned Action**

The Theory of Reasoned Action (TRA) was developed to provide a better understanding of the relationships between attitudes, intentions, and behaviours (Fishbein, 1967). Based on the TRA, a human being's behavioural intent depends on his or her attitudes and beliefs (Ajzen & Fishbein, 1980). Consequently, behaviour is the result of a combination of the beliefs of an individual regarding the behaviour and the beliefs of those within the individual's social circle, which results in a larger inspiration, or intent to act. The TRA suggests that behavioural intent is a direct antecedent to behaviour and that behaviour is completely controlled by volition (Ajzen & Fishbein, 1980). Theory of Planned Behaviour (TPB) was developed in response to feedback that TRA fails to provide a reason or explain situational events or elements that prevent action (Ajzen, 1985, 1991). Additionally, The TPB takes into account the intent, attitude, and beliefs of the individual. The TPB includes three kinds of beliefs and attitudes that influence behaviour: behavioural, normative, control, and intent (Ajzen, 1985). Ajzen developed the TPB model to enhance the predictive capabilities of TRA. As a result, Ajzen proposed including perceived behavioural control in TPB, which was not included in TRA. Figure 2.1 illustrates the Theory of Reasoned Action.

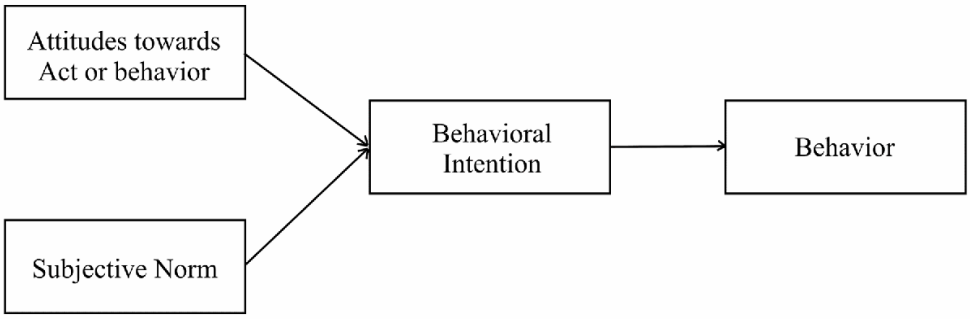


Figure 2. 1 The Theory of Reasoned Action (Ajzen & Fishbein, 1980)

- **Theory of Planned Behaviour**

First, the Theory of Planned Behaviour (TPB) model refers to a group of cognitive theories which view behaviour as an external expression of inner thoughts and

feelings. This model has been widely cited and applied to predict and explain environmental behaviours. It includes food waste behaviours (Evans et al., 2017; Stefan et al., 2013; Visschers et al., 2016; Waitt & Phillips, 2016) choosing a mode of travel (Bamberg et al., 2003; Gardner and Abraham, 2010), conserving water (Trumbo and O'Keefe, 2001), reducing energy consumption (Sparks et al., 2014) and choosing sustainable food (Han and Hansen, 2012). According to the social psychologist Ajzen (1991), behaviour is directly determined by intentions, which predict attitudes, which in turn are influenced by attitudes, subjective norms, and perceived behavioural control. Although this theory has been widely referenced, it can also be criticized. For example, it overstates the significance of intention without providing sufficient empirical validation (Sniehotta et al., 2014). Additionally, Reser and Bentrupperbäumer (2005) argue that TPB fails to explain consumer behaviour in light of situational factors (e.g., policy, financial incentives, and resource availability). Further, it has a modest explanatory power of 70 - 80% for predicting and explaining food waste behaviours (Abdelradi, 2018). The TPB model is illustrated in Figure 2.2.

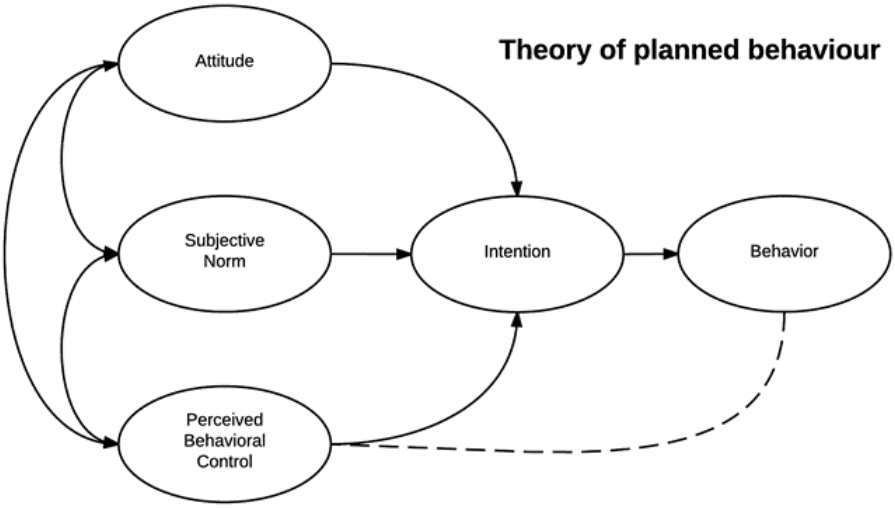


Figure 2. 2 The Theory of Planned Behaviour (Ajzen, 1991)

2.2.3.3 Reviewing the existing framework models related to food waste behaviours

To begin, the researcher attempts to compile the published research evidence relying on a variety of studies and present the existing framework models related to food

waste behaviour. These framework models are based on bringing together habits, practices and factors that were considered in recent literature on food waste behaviour. The reviewed framework models are based on the following three main issues: 1] Habits related to food; 2] Behaviours related to waste management and 3] Households values (see Table 2.2). It is important to highlight that the researcher reviews the following framework models and their hypotheses in line with critically assessing them and selecting the one is going to adopt and adapt in this research.

Table 2.2 A list of food waste behaviour hypotheses derived from the literature

Category	Identified food waste behaviour hypotheses	References
1) Habits related to food	H1. Food expenditures	(Abdelradi, 2018; Aktas et al., 2018)
	H2. Healthy and food safe choice	(Quested et al., 2013; Stefan et al., 2013)
2) Behaviours related to waste managements	H3. Waste avoidance	(Barr, 2007; Díaz-Ruiz et al., 2015)
3) Households values	H4. Generosity	(Baig et al., 2019)
	H5. Environmental awareness	(Watson & Meah, 2012; Williams et al., 2012)
	H6. Materialistic values	(Díaz-Ruiz et al., 2015; Hirsh & Dolderman, 2007)
	H7. Knowledge	(Díaz-Ruiz et al., 2015; Gustavsson et al., 2014)
	H8. Religion	(Abdelradi, 2018; Aschemann-Witzel et al., 2015)

- **Habits related to food:**

  Based on the existing literature, food expenditures and healthy diet hypotheses indicate that households waste food due to inefficient food consumption patterns. There are five types of behaviour that contribute to household food

waste, including food shopping, storing, cooking, consuming, and food-related lifestyle (Abdelradi, 2018; Buzby & Hyman, 2012; Parfitt et al., 2010; WRAP, 2009). According to Parfitt et al., 2010 and Principato et al., 2015, food waste generation may be influenced by households' attitudes, values, knowledge, and behaviour towards food. Social science scholars Stefan et al. (2013), claim that most of the variance in food waste in Romania can be explained by shopping habits and planning. Additionally, other studies have shown a strong connection between food waste and other issues related to food, such as food safety and nutrition (Hendriks & Maluf, 2014), preferences for food (Porpino, 2016), and households' routines and habits (Evans, 2012). According to Quested et al., 2011, a healthy diet was considered an important factor in reducing food waste by consumers. Quested et al., 2011 claim that a healthy diet was considered an important factor in reducing food waste by consumers and provide insights into household behaviours, such as keeping fruits in a fruit bowl to encourage family members to consume more fruits, rather than keeping them in a refrigerator to live a healthy lifestyle. Based on the existing literature, households waste food due to inefficient food consumption patterns.

Excessive buying and lack of planning and shopping habits may influence subsequent household management of food (Abdelradi, 2018; Aktas et al., 2018; Porpino, 2016; Stancu et al., 2016; Stefan et al., 2013). However, another factor that may influence the amount of food waste generated by consumers is the price of food. While this subject has not been extensively studied, some studies suggest that marketing attractions such as promotions, also referred to as offer temptation (2x1), can influence consumers' purchase decisions (Díaz-Ruiz et al., 2015; Parfitt et al., 2010; Quested et al., 2011). In sum, a recent study conducted by Mallinson et al. (2016) explained that households with higher levels of food waste cause were more influenced by promotions and were less price conscious. As the recent cost of living crisis has squeezed millions of households, it could be considered an opportunity to reduce food waste.

In light of the aforementioned studies, the researcher identified two factors related to food habits: food expenditures and food choices as indicators

contributing to food waste generation. The following are the first two hypotheses:

Hypothesis 1 (H1): Participants who are more concerned about food expenditures are expected to reduce the amount of food waste generated.

Hypothesis 2 (H2): Participants who are more concerned about healthy and safe food choices are expected to reduce the amount of food waste generated.

- **Behaviours related to waste management:**

  The third hypothesis is concerned with treating food waste behaviour as a special form of waste management behaviour. Although there have been no specific studies on food waste behaviours in connection with other forms of waste, Díaz-Ruiz et al. (2015) extend the previous literature that examined waste management behaviour in a broader context. Nevertheless, Quested et al., (2013) argued that food waste reduction generally reduces greenhouse gas emissions eight times more than directing the same amount of food waste to anaerobic digestion. To determine the extent to which prevention and recycling are related to food waste, the researcher describes food waste behaviour clearly as a waste management behaviour. Thus, the following hypothesis is considered:

  Hypothesis 3 (H3): Participants who show more positive waste avoidance behaviour are expected to reduce the amount of food waste generated.

- **Households' values:**

  Baig et al. (2019), emphasise that one of the most prominent characteristics of Arabs is their hospitality and this is most often expressed in the provision of ample food is a gesture of welcome to guests. For instance, Al-Buainain (2015), agrees that during special events in Saudi Arabia, 70 percent of the food is lost. In line with the nature of this research, the researcher' hypothesises that generosity might influence the food waste behaviour during everyday practices and routines such as shopping, cooking, and eating. The essence of generosity

can be summed up as the abundance and variety of food presented to a guest, as well as how well it is served.

When it comes to generosity, the researcher expects that households in the West and East Amman purchase and prepare more food than they can consume, which often results in a large amount of food waste. In addition, food plays an important role in many Arab cultural traditions such as Eid festivals, weddings, parties and informal gatherings, where hosts are expected to set up lavish food tables for guests. In other words, they yearn to organise extravagant banquets at which the likelihood of food waste is inevitable (Capone & Youssfi, 2015). According to Baig et al. (2019), it is considered impolite and miserly in Arab culture when people do not serve food to guests. Based on the mentioned evidence, the researcher proposes the following hypothesis:

Hypothesis 4 (H4): Participants who show higher generosity and social relationships are expected to produce high levels of food waste.

The fifth hypothesis focuses on the effect of environmental awareness on food waste behaviour. It is possible that the environmental concerns of family members may have a positive impact on food waste behaviour. Based on the existing literature (Abdelradi, 2018; Principato et al., 2015; Watson & Meah, 2012), increasing environmental awareness can contribute to the reduction of food waste. According to Barr (2007), environmental awareness has been directly linked to positive environmental behaviour and waste minimisation. Moreover, Williams et al. (2012) conducted an exploratory study to determine the relationship between household food waste and how packaging may impact the amount of food waste. Considering the importance of environmental values within family members on the development of specific waste prevention behaviours, the researcher proposes the following hypothesis to investigate its impact on food waste behaviour:

Hypothesis 5 (H5): Participants who show higher environmental awareness are expected to produce less food waste.

The sixth hypothesis focuses on the effect of materialistic values on food waste behaviour. According to Parfitt et al., 2010, consumption habits can influence food waste. It is known that the notion of materialism or consumerism is the value associated with material possessions. In other words, materialism is characterised by self-interested people and a lack of concern for others (Hirsh and Dolderman, 2007). Kilbourne and Pickett (2008) agree that materialistic values have a negative impact on environmental awareness. Lastly, Díaz-Ruiz et al. (2015) demonstrate that consumerism negatively impacts environmental awareness and shopping behaviour.

Hypothesis 6 (H6): Participants who have high materialistic values are expected to have a lower environmental awareness.

The seventh hypothesis considers the impact of knowledge on environmental awareness. As demonstrated by Gustavsson et al. (2014), awareness of the issue of food waste is identified to be an important factor. Therefore, a greater understanding of the food waste problem is expected to lead to greater environmental awareness.

Hypothesis 7 (H7): Knowledge about food waste issue can raise environmental awareness.

Finally, religious beliefs could also influence food waste. According to Agricultural economist Fadi Abdelradi (2018), the environmental ethics toward preventing food waste is bolstered by religious beliefs. Similarly, Aschemann-Witzel et al., 2015 identify religion as a critical factor, enhancing motivation to prevent food waste. Islam and Christianity are the two largest religions in Jordan where Islam represents more than 92% and Christianity 6% (Ebniya, 2020), and both religions emphasise food waste as a problem and encourage its avoidance. For instance, in Islam there is some evidence from the holy Quran where chapter 7 verse 31 states: ‘‘. . . and eat and drink, but don’t waste. Indeed, He likes not the wasteful”. The Prophet Muhammed stated:

> Nothing is worse than a person who fills his stomach. It should be enough for the son of Adam to have a few bites to satisfy his hunger. If

he wishes more, it should be: One-third for his food, one-third for his liquids, and one-third for his breath.

In Chapter 23 verses 20-21 in the Holy Bible[3], it states: ‘‘Do not join those who drink too much wine or gorge themselves on meat, for drunkards and gluttons become poor, and drowsiness clothes them in rags”. To sum up, the researcher agrees with Abdelradi (2018) that it is important to emphasise that this hypothesis represents the households' perceptions about the relationship between religion and food waste, but it does not represent their religious behaviour. Based on the evidence presented above, the researcher proposes the final hypothesis to the model, which states as follows:

Hypothesis 8 (H8): Religion is expected to have a positive effect on food waste behaviour.

In order to test the aforementioned hypotheses, several methods will be used in the metropolitan area of Amman. A summary of the literature supporting the theoretical framework model factors is shown in Table 2.2.

After identifying the main factors that influence household food waste behaviour in Jordan, the researcher will use design for behaviour through developing and testing a communication campaign to influence household behaviour to reduce food waste in Jordan. Consequently, this raises the third research question, how design for behaviour change and communication design can be used to shape household behaviour in Jordan?

2.2.4 Food waste reduction interventions

Design interventions that aim to reduce food waste are growing at their fastest rate after decades of neglect. Several scholars have attempted to categorize types of interventions designed to change behaviour in an effort to better identify and leverage their relative strengths (Nisa et al., 2019). To integrate collected knowledge into comprehensive design interventions aimed at household food waste reduction, there

[3] International version - Proverbs

is a need to review existing literature to identify food waste reduction strategies. There is an increased consensus among governments, regions, cities, businesses, organizations, and citizens regarding the urgency of addressing food waste challenges, and this has provided a catalyst for action (Reynolds et al., 2019b). The literature presents several design interventions aimed at reducing food waste in households; some are prototyped and tested, some are suggestions for improvement, and others are already available on the market (Aschemann-Witzel et al., 2015; Ganglbauer et al., 2013; Hebrok & Boks, 2017; Quested et al., 2013; Soma et al., 2020; WRAP, 2014).

Hebrok and Boks (2017) claim that the majority of literature is devoted to interventions related to packaging, bins, plate size, refrigerators, and freezers, however, other interventions were found in information campaign and mobile technology (Horton, 2017; Soma et al., 2020). Additionally, design interventions with the potential to reduce household food waste are discussed in grey literature (see Section 2.4.1). Each of these interventions aims to address different factors contributing to reduce food waste and found in journals covering sustainability, nutrition and health, psychology and consumer behaviour, environmental, human-computer interaction, food, and economics. Although the interventions were applied in different countries in the world, almost none of the Arab countries have published a single research article on food waste interventions (Abiad & Meho, 2018). The researcher noted that generally no study reviewed the effectiveness of interventions designed to reduce food waste at the household level.

Since design interventions show the potential to reduce food waste at the household level, their strategies are described in accordance with increasing knowledge, awareness, and attitudes. Based on the categorisation from Reynolds et al. (2019b) all collected design interventions are grouped according to two categories: 1) Information-based interventions and 2) Technological solutions. These are discussed in the next section.

2.2.4.1 Information-based interventions

A number of authors (Cohen & Sherman, 2014; Devaney & Davies, 2017b; Dyen & Sirieix, 2016; Jagau & Vyrastekova, 2017; Reynolds et al., 2019a; K. Schmidt, 2016;

Soma et al., 2021; Young et al., 2017) consider communication campaign interventions an information-based in order to change audience behaviour. Furthermore, Communication campaign interventions include presenting information through booklets, advertisements, leaflets, social media, online platforms, or swag such as fridge magnets, postcards, stickers, or grocery list pads (Soma et al., 2020; Septianto et al., 2020; Shaw et al., 2018; Young et al., 2017; Schmidt, 2016; van der Werf et al., 2021). In an assessment of the experience of Toronto households who participated in a communication campaign intervention, Soma et al. (2021) found that this information-based campaign had a positive impact and improved food waste practices in the home. It should be noted that an information-based campaign does not always have a positive impact, and it depends on the particular campaign. Shaw et al. (2018) suggest that initiatives to reduce food waste may be most successful if they focus on improving householders' efficiency in food use, based on insights gained from analyses of avoidable food waste within individual product groups and by considering the stages of life cycle. Some studies have shown a reduction in avoidable food waste (Devaney & Davies, 2017b; Soma et al., 2021; van der Werf et al., 2019), while others have found no statistically differences (Shaw et al., 2018).

2.2.4.2 Technological solutions

Technological solutions refer to Another design intervention strategy was identified by Reynolds et al. (2019) is the technological solutions. Several authors (Bucci et al., 2010; Devaney & Davies, 2017b; Lazell, 2016a; Young et al., 2017) emphasise that technological solutions involve introducing or modifying objects that aim to change user's behaviour around food waste. Interventions include changes to plate sizes or portion sizes (Libotte et al., 2014), and the introduction of apps or cameras on fridges (Ganglbauer et al., 2013). According to Reynolds et al. (2019), food waste reduction has been measured by portion size and plate size. Although there was a 57% reported reduction in waste due to the use of smaller plates, the plate size shift also resulted in a 31% decrease in the amount of food consumed (Wansink & van Ittersum, 2013). Kallbekken and Sælen (2013) confirm that a reduction in the size of plates resulted in a 19% reduction in food waste.

In recent years, technological advancements have enabled affordable and intelligent solutions to combat food waste – particularly using the refrigerator. For instance, the

ZmartFri concept developed by Bucci et al. (2010) is an intelligent fridge, with an expiration date alert and the ability to send grocery lists via SMS or email. It was developed from insights from field methods and results from a participatory design process. According to the insight that expired food waste occurs because there is no visual overview of the contents of the refrigerator, Farr-Wharton et al. (2014) colour coded the refrigerator to increase households' awareness of what is in their refrigerator to reduce expired food waste. Hebrok and Boks (2017) reported that raising awareness of the contents of the fridge could reduce food waste by a quarter or a half. Similarly, Fridge-Cam identifies everyday practices related to food and their impact on food waste (Ganglbauer et al., 2013). Fridge-Cam is an innovative device that displays the contents of a refrigerator and sends images to a website. As part of the experiment, some users utilized the camera to plan their shopping by accessing the website while at work or while shopping.

Smart refrigerators may provide users with information about the stock and what products are about to expire and should be consumed. If successfully integrated into household routines, refrigerators may help address causes of food waste such as food storage, planning, shopping, preparation, and consumption. In contrast, food waste research indicates that smart refrigerators might not be yet ready for widespread adoption due to the importance of convenience (Hebrok and Boks, 2017). Furthermore, the development of mobile apps is also assisting consumers in planning their grocery shopping and meals by offering shopping lists and recipes (Hebrok & Boks, 2017). Technologies of a similar nature have been developed outside of the appliance industry as well. Several mobile apps and online sharing platforms have been developed to meet the needs of convenience and planning. For instance, through online sharing platforms, leftovers can be sold or given away.

Table 2.3 A list of food waste reduction information-based campaign and technological solutions interventions at the household level

Category	Intervention	Description	Source
Information-based campaign	Informational booklet	“Information on food waste was provided to participants in the form of a booklet as well as tips on how to reduce food waste at home.”	(Soma et al., 2020)
	Newsletter	“Newsletters were provided to households via email or (by mail for	(Soma et al., 2020)

		those without internet access) four times throughout the course of the campaign with tips for food storage, meal planning, shopping, understanding best-before dates, and recipes for using leftovers or slightly spoiled food."	
	Advertisements	"This intervention demonstrated an advertisement with a 'gratitude for having' message led to higher intentions to reduce food waste when paired with loss-framed implications (increased environmental damage) than when paired with gain-framed implications (less environmental damage)."	(Septianto et al., 2020)
	Magazine, social media, e-newsletter	"This study implemented three interventions with messages to encourage reductions in food waste. The first was a social influence intervention that used the retailer's Facebook pages to encourage its customers to interact. Two additional information interventions were used as a comparison through the retailer's print/digital magazine and e-newsletter."	(Young et al., 2017)
	Online platforms	"This intervention study was conducted to promote household food waste prevention in a sample of German households. The main objective of the study was to increase the likelihood of household food waste prevention in the participating households by improving household members' performance in relevant food waste preventing behaviours (e.g., planning grocery shopping in advance)."	(K. Schmidt, 2016)
	Postcard/Fridge magnets	"This study developed and pilot-tested a "Reduce Food Waste, Save Money" household food waste reduction intervention in London, Ontario, Canada, and measured its impact on total, avoidable, and unavoidable household food waste disposal in the garbage stream."	(van der Werf et al., 2021)
	Leaflets	"This study aimed to elucidate if and how householders' food waste behaviour might be changed via interventions in the form of a leaflet highlighting the impacts of avoidable food waste."	(Shaw et al., 2018)
Technological solutions	ZmartFri	"The ZmartFRI project aims at developing a seamless technology with an interactive fridge surface, assuring simplicity and intuitiveness of interaction."	(Bucci et al., 2010)

	Colour Coding the Fridge	"The concept of the Colour Coding the Fridge aims to raise people's awareness of what they have in the fridge, in order to reduce expired food waste."	(Farr-Wharton et al., 2014)
	FridgeCam	"The FridgeCam is a camera that is attached within the fridge displaying its content and sends images to a website. In the experiment, some users actually used the camera to plan shopping for instance by accessing the website from work or from within the store."	(Ganglbauer et al., 2013)

Although there has been a surge in studies of downstream food waste in recent years, they almost exclusively take place in the Global North countries, and most interventions are focused on small groups with time-limited evaluations. As previously mentioned, little to no academic research exists on food waste interventions in the Arab countries (Abiad & Meho, 2018). Moreover, substantial biases identified by Hanson et al. (2016) and confirmed by Reynolds et al. (2019b) is that most interventions were implemented on a low-cost method of survey-based measurements of food waste. For instance, some interventions did not indicate any waste weights, while others estimated food waste through visual analysis or photographs. In some cases, food waste was measured using weight. In sum, it is difficult to precisely quantify the amount of food waste prevented, owing largely to the costs associated with waste measurement (particularly at the household level).

It is clear from the extant literature that none of these studies have integrated a theoretical framework into any experimental design. As there is no explicit reference to theory, researchers must infer relationships between cause and effect in food waste behaviours. The results are intriguing for two reasons: first, it indicates that those working on food waste interventions are not aware of the theoretical frameworks developed for interventions in other fields; second, food waste reduction at the household level differs greatly from other areas of behaviour change and that many theories developed elsewhere might be insufficient without further development

(Evans et al., 2017; Quested et al. 2013). Similarly, there is a lack of theoretical integration in the design of interventions to reduce food waste, which may also imply that theoretically, rich discussions of household food waste have not yet considered the implications of their analysis for intervention design (Waitt & Phillips, 2016). Therefore, this confirmed the urgent need for the greater integration of theory and previous research findings into the design of interventions (Reynolds et al., 2019b).

These findings echo calls for the integration of the theoretical frameworks and methodological techniques that could be combined to better understand the current behaviour patterns of target households in Jordan. Section 2.2.5 contributes to this by providing the theoretical frameworks that have been applied to the downstream food waste intervention literature such as the Theory of Planned Behaviour and Social Practice Theory. While a number of interventions such as cooking classes (Dyen & Sirieix, 2016), fridge cameras (Ganglbauer et al., 2013) or food sharing apps (Lazell, 2016b; Lim et al., 2017), and advertising and information campaigns (Young et al., 2017) were reported as being effective, there is no accurate quantification provided. In addition, many information-based campaigns did not provide a sufficient amount of detail to evaluate and correlate the type of content (positive, negative, shocking, etc.) and tone of the campaign with the effectiveness of the campaign, which will be an avenue for further investigation in this research.

2.3 Design for behaviour change

Initially, design for behaviour change was developed under the concept of design psychology or behavioural design, a term first coined by Donald Norman in the 1980s regarding product design (D. A. Norman, 1988). Design for behaviour change involves a systematic process of understanding how individuals think and act; an understanding that provides the basis for designing interventions that promote ethical behaviours and attitudes. It is agreed by a number of authors that design has become widely accepted as playing a important role in influencing individuals' behaviour in a variety of forms, including objects, services, interiors, architecture, and environments (Lockton et al., 2010a; Niedderer et al., 2014; Tim Brown & Wyatt, 2010). Design can cause both desired and undesirable changes, both intentionally and unintentionally (Cain et al., 2014). For instance, food packaging has had a positive impact on protecting the food

from external factors, however, it contributes to a wide range of environmental problems, such as the overcrowding of landfills and the emission of greenhouse gases. This calls for a rethinking of both human behaviour and technology, promoting schemes for reducing the environmental footprint of packed food or encouraging people to buy more sustainable food packaging.

Despite that the notion of ‘design for behaviour change’ has been identified as a new domain of design research and practice to solve many of the world's most challenging issues, it is still barely understood (Niedderer et al., 2016). In other words, there are a limited number of frameworks available to facilitate its prompt implementation in professional and public contexts. For instance, some cases are emerging as having an impact on allowing individuals to recycle (Bakker et al., 2010), to improve the efficiency of energy use (Stephenson et al., 2010), to change children’s healthcare behaviour (Biran et al., 2014), and altering individuals perception of social interactions (Niedderer & Roworth-Stokes, 2007).

In order to design for behaviour change, it is essential to gain an in-depth intuitive understanding of users and their context (Daae & Boks, 2015) and to understand the factors that influence behaviour both intentionally and unintentionally (Niedderer et al., 2016). Lockton et al. (2010) and Niedderer et al. (2014) contribute to the design for behaviour change definition by highlighting the importance of influencing or shaping human behaviour and sustainable innovation. Substantially, design for behaviour change integrates design thinking process to create innovative solutions that reflect the thoughts, feelings, and behaviours of real users. To accomplish this, design for behaviour change draws on a variety of explicit approaches and tools that have been developed in to support pro-environmental and pro-social actions and lifestyles from designers and users (Cain et al., 2014). The next section summarises DfBC approaches, and models found in the literature to investigate their cohesion and select a potential approach/model that guide the development of the communication campaign.

2.3.1 DfBC approaches and models

Literature on DFBC approaches and models has been searched for using the following keywords: *Design for Behaviour Change, Design for Behaviour Change, Human Behaviour, Human Behaviour, Behavioural Design, Behavioural Design*. Scopus, Web of Science and Google Scholar search engines have been used to look for books, peer-reviewed journal articles, conference proceedings, and PhD theses.

The researcher found multiple approaches/models as they were cross-referenced whenever one approach/model was identified, until none were found. A small number of Design for Behaviour Change approaches/models appeared during this search. These approaches/models cover only a particular type of behaviour or were less relevant to food waste behaviour. This section describes five key approaches and models related to design for behaviour change field.

This section examines the five key approaches and models' contributions to determine which approach/model will be used to guide the development of the communication campaign in order to shape household's behaviour towards food waste reduction practices in Jordan. Table 2.4 shows a comparison of these approaches and models that address design and human behaviour.

Table 2.4 Comparison of five approaches and models that address DfBC

Approach/model	Point of view	Explanation	Implementation	Reference
Behaviour Centred Design (BCD)	Behaviour change interventions in applied science	Developing and evaluating effective behaviour change interventions	Surprise, Revaluation, Performance	(Aunger & Curtis, 2016)
Design with Intent (DwI)	Product design for industry	Compiled examples of design used across various disciplines to inspire designers	Enabling, Constraining, Motivating	(Lockton et al., 2010)
User-Centred Design (UCD)	Products usability	Design objects with the purpose of enabling natural interaction between the user and the object	Seven action stages, Affordances, Constraints	(Norman, 1986)

BJ Fogg's Behaviour Model	Persuasive design	Influence ability while triggering the performance of the desired behaviour	Facilitate the ability, Provide a Trigger	(Fogg, 2009)
The Behaviour Change Wheel (BCW)	Behaviour change interventions in the healthcare field	Design policy/ies that enable interventions to work	Examine Capability, Opportunity, Motivation	(Michie et al., 2011)

The researcher adopted Behaviour Centred Design (BCD) approach for this research. The BCD approach will encompass the development of a communication campaign through providing five-step process in which intervention materials are designed and evaluated to shape household food waste behaviour in Jordan. As part of the design process, it provides a series of steps and tools to guide the creation, implementation, and evaluation of a behaviour change campaign. However, Design with Intent (DwI) toolkit was chosen based on its potential to support the idea generation stage.

The researcher attempted to better understand this approach and its iterative process in order to determine whether it can be applied to any phase of the development of the communication campaign. Since this research aims to develop communication campaign guidelines to shape households' behaviour towards food waste reduction in Jordan, the User-Centred Design approach is rejected as its primary aim is to focus on physical objects. In other words, it is not focused to change user behaviour, but rather to enhance their natural interaction within their environment.

Fogg Behaviour Model (FBM) simplifies the understanding of behaviour by combining three elements that must converge at the same moment for a behaviour to occur (Fogg, 2009). These elements are Motivation, Ability, and Prompt. The absence of any one of these three elements causes a behaviour not to occur. BJ Fogg's Behaviour model is rejected on the basis of its strategy: that attempts to simplify the behaviour by either breaking it down into manageable parts or changing the environment. Fogg's model is linked with psychological theories, but these connections are not explained in detail. Further, it does not provide a design process that can guide the development of the communication campaign in this research and as such it will not be accepted.

The Behaviour Change Wheel developed by Michie, van Stralen, and West (2011) has been designed to assist in identifying and developing behavioural changes that are primarily focused on improving health outcomes. This model is formed of the following three key components. Firstly, three conditions are proposed at the hub of the wheel in order to elicit a change in behaviour: capability, opportunity, and motivation. Secondly, there are nine interventions that enable these interventions to take place, including education, persuasion, incentives, coercion, training, enablement, modelling, environmental restructuring, and restrictions. Various policy characteristics are identified on the outer sections, which may facilitate interventions; for example, environmental/social planning, communication/marketing, legislation, service provision, regulation, fiscal measures, and guidelines. The Behaviour Change Wheel will not be adopted since its primary aim is to design policies that enable interventions to work, which differs from the aim of this research. Its approach is not suitable for guiding the development of a communication campaign.

Each of these approaches and models assume that behaviour is influenced by how individuals experience a design. Nonetheless, the fact that there are some similarities among the approaches and models described in Table 2.4 does not preclude that BCD approach and DwI model are more appropriate to guide and inspire the development of the communication campaign in this research. In the upcoming two sections, the researcher elaborates on the two adopted approaches and models.

2.3.1.1 Behaviour Centred Design

Aunger and Curtis's (2016) Behaviour Centred Design provided a radical new approach to the design for behaviour change field. The approach integrates a theory of change of behaviour (De Silva et al., 2014; Retolaza, 2011; Vogel, 2012), into a practical process for developing and evaluating interventions. This approach combines the latest findings about how brains learn with a practical set of steps and tools for developing effective behaviour change programs, based on an evolutionary framework (Aunger & Curtis, 2016). The researcher recognised that science and creativity are incorporated in this approach, as behaviour only change because of new and challenging experiences. However, this approach has been successfully applied to a range of public health behaviours and commercial product design such as

handwashing, oral rehydration, food hygiene, and child nutrition (Chauhan et al., 2020; Rajaraman et al., 2014; Sands & Aunger, 2021; Schmidt et al., 2020).

As seen in the middle of the diagram, a series of events must occur for behaviour to change. Design thinking and creativity are applied to intervention design and a comprehensive evaluation process is based on best practices in academic research. The BCD process is inherently conducive to new, creative, and sustainable solutions, in addition to the accumulation of knowledge about what works. In summary, an intervention must change something in the environment, then something in the target individual's brain and/or body and, as a result, change the behaviour of the target individual. Consequently, the sum of these individual actions contributes to the state of the world. This causal chain describes the BCD approach to defining what is known as a 'Theory of Change'. Figure 2.3 illustrates this approach.

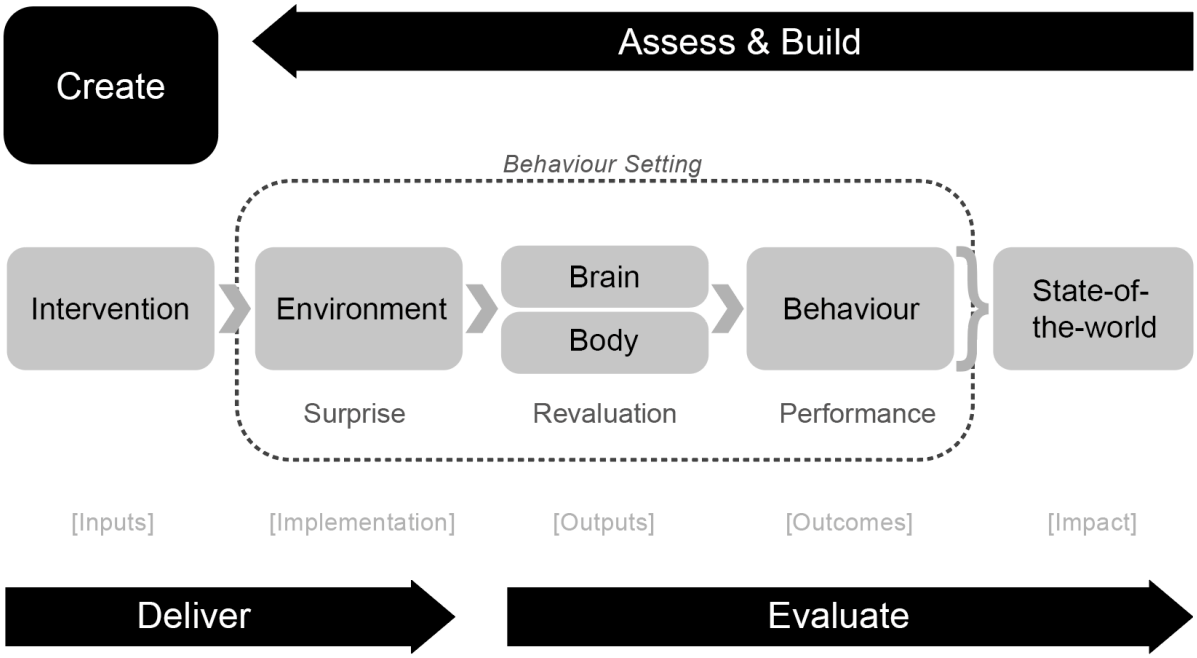


Figure 2. 3 The BCD process model

The researcher aimed to investigate how to develop and test a communication campaign through applying the BCD approach such that it has the desired behavioural outcomes and impact. The BCD approach process is depicted across the top and bottom of the diagram shown in Figure 2.3. BCD approach provides a five-step process in which interventions are designed and evaluated. Aunger et al. (2015)

referred to these steps as ‘ABCDE’ which consists of the following: *Asses, Build, Create, Deliver, and Evaluate* (see Table 2.5).

Table 2.5 The ‘ABCDE’ steps

Step	Description
Assess	This step concerns collecting data on the target behaviour, the target audience, the context, and the intervention parameters.
Build	As part of this step, formative research is conducted with a sample of the target audience to explore hypotheses regarding the likely factors behind change. Insights from this step feeds into the next step.
Create	In this step, insights are converted into interventions materials through multiple iterations to maximize the effect on target behaviour.
Deliver	This step involves implementing a series of intervention materials through a range of channels. As a part of this step, it is vital to monitor the implementation process to insure its effectiveness.
Evaluate	This step ensures the successful impact of the intervention materials using different methods and to demonstrate that the Theory of Change process are achieved. Lesson learned from this step should establish basis to develop new interventions using BCD process.

As seen in figure 2.3 of the BCD process, three key principles are introduced that should be included in the interventions. These are as follows:

- **Surprise:** The aim of this principle is to generate a new direction in behaviour, by creating a stimulus that shake behaviour. Getting exposure and grappling attention are two aspects to be considered in this principle.
- **Revaluation:** Revaluation results from the intervention that can be regarded as an output based on the Theory of Change. It is possible to revalue a target behaviour both at the moment of exposure and over time, with individual reflecting upon and continuing to learn about their experience with the unexpected stimulus over time.
- **Performance:** This principle is seen as the intervention outcome. Positive outcomes are expected as a result of undergoing the process of Surprise, Revaluation and Performance.

In this thesis, the researcher utilises the BCD approach to successfully guide the process of developing a communication campaign to shape household’s behaviour

towards food waste reduction in Jordan and to ensure that the end results meet the research expectation.

2.3.1.2 Design with Intent

This Design with Intent (DwI) toolkit was developed by Lockton et al. (2010) for the purpose of transforming theories into practical recommendations for tackling design issues. The intention of this toolkit is to inspire designers to approach designing for behaviour change in a more precise and less simplistic manner (Lockton et al., 2010a). A collection of 101 examples printed in card format from a range of disciplines provides inspiration for design concepts. Based on v.1.0 of the toolkit from 2010, eight design lenses are classified: 1] Architecture, 2] Error proofing, 3] Interaction, 4] Challenges and targets, 5] Perceived affordances, 6] Cognitive, 7] Machiavellian and 8] Security. This version of the toolkit will be used to help the researcher generating ideas in the creative process. There is a wide range of lifelike examples and suggestions to help stimulate behaviour change design ideas within each lens. The toolkit presents techniques from a variety of disciplines to encourage designers to think about behaviour change from a variety of perspectives (Lockton, Harrison & Stanton,2012). The cards act as prescriptions and/or inspirations for design solutions (Lockton et al., 2009). The DwI toolkit offers three ways to influence behaviour: 1) Enabling, 2) Motivating and 3) Constraining. Enabling provides the most convenient means of changing the behaviour. Motivating involves educating and adjusting attitudes. Constraining inhibits certain behaviours by making them challenging leaving the target behaviour as the default choice.

2.4 The choice of communication design

Communication design plays an increasingly important role in shaping people's perceptions and understandings of information, products, and services. It involves the use of visual elements and various media to convey information, ideas, or messages to a specific target audience. Basically, it is a creative process that combines art, design, and technology to communicate effectively and aesthetically. It aims to convey information, emotions, values, or concepts in a clear, engaging, and memorable manner. A wide range of media is covered in this field, including print design (e.g., brochures, posters, and magazines), digital design (e.g., websites, apps, and social media graphics), motion graphics, interactive media, branding, and packaging. The

following sections provide Buchanan's four orders of design, as well as supporting literature that situate the researcher's choice of communication design for addressing the household food waste issue in Jordan.

2.4.1 Buchanan's four orders of design

Design research somewhat describes the process that a designer utilises to better understand the implication and sometimes hidden desires, needs, and challenges of the target audience. Designers are not only concerned with understanding individuals but also with exploring the world around them and their experiences within it. According to Gabay (2018), designers take a distinctive approach to solving problems compared with typical business approaches. Thus, the design process emphasises human-centred, future-orientation and visuality (De Lille et al., 2012), prioritising the creation of new opportunities rather than selecting from existing alternatives and advocating co-creation (Aguirre et al., 2017) and prototyping (Carlgren et al., 2016). With designers facing increasingly complex problems (Muratovski, 2015), scholars have recognised the effectiveness of the approach due to its ability to reframe problems and solutions (Dorst, 2017) and its human-centeredness (Norman & Stappers, 2015).

Over the past three decades, the practice of design regularly extends beyond boundaries to encompass broader techniques, methods, and approaches. Many design educators, theorists, authors, and practitioners have been exploring the role and contribution of design. The focus of design in innovation, for instance, is more on what might be described as 'strategic design'. There are multiple levels and methods through which design can function. Design professor Richard Buchanan (1992) is credited with naming the shift in the challenges Design is applied to, where he outlines four orders with growing scale and complexity (see Figure 2.4). A variety of responses have been made to the Four Orders over the years, with key contributions from Golsby-Smith's (1996) article "Fourth Order Design: A Practical Perspective", which challenges the concept of domains, and emphasises how designers work as well as how they take responsibility for their actions' success or failure.

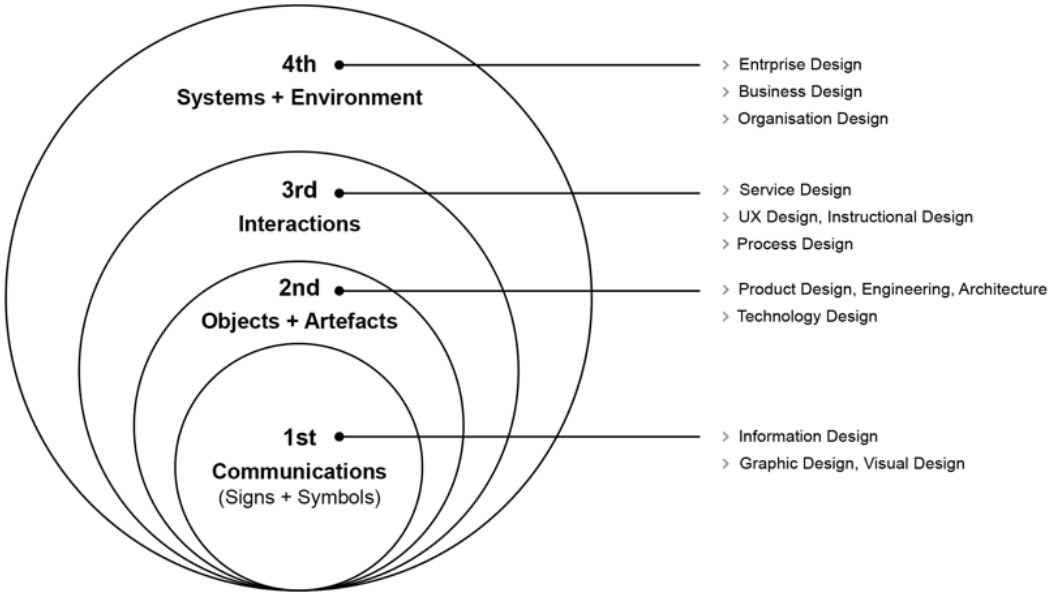


Figure 2. 4 Buchanan's Four Orders of Design Theory

Buchanan outlined these "four orders of design" to illustrate how design as a discipline has moved beyond the traditional concept of the tangible artefact to orchestrating interactions and experiences. In Wicked Problems in Design Thinking, Buchanan (1992, p. 9) identifies differences between four areas in “which design is explored throughout the world by professional designers and by many others who may not regard themselves as designers”. These areas are not hierarchical and may be considered working domains in practice (Golsby-Smith, 1996). Several authors have suggested that designers are increasingly engaging in System, Organisation, and Environment levels (Boland et al., 2008; Cooper & Junginger, 2009; Gruber et al., 2015; Kronqvist & Salmi, 2011; and Muratovski, 2015). Organisations are viewed at this level as products that can be designed (Buchanan, 2008). In this level of design, there is an emphasis on systemic integration, and the activities performed are geared toward establishing a new 'organising thought' and bringing about organisational change (Buchanan, 1998, 2001; Junginger, 2005).

Buchanan's Four Orders of Design theory discusses how design has evolved over time from a context of creating tangible objects to addressing intangible issues. These orders are structured as follows:

1. **Communications**

   As a first order, the principles of Graphic and Information Design are applied to develop the necessary symbols for the communication process. An important aspect of visual communication is the ability to project messages, persuasive arguments, syntax, and semantics, thereby enabling comprehension and facilitating information exchange. The scope of this design order includes typography, illustration, photographs, prints, and everything related to graphic design, visual design, and communication design.

2. **Industrial Design**

   In this order, the designer's intention is to design physical objects that are useful to people, such as those found in Industrial Design and Architecture. It involves selecting and incorporating different materials, design tools and technologies for use and interaction in the real world. It is a physical, tangible order that pertains to artefacts, objects, and space.

3. **Interaction Design**

   The third order is determined by people's behaviour, as is the case in interaction design and service design. This order is concerned with designing the processes involved in how people act; it includes designing transactions and activities over time as well as defining points of contact and options for choice. In this order, the design field is in action. Drawing experiences is the focus here rather than objects. The focus of this order is on interaction, services, and experience design.

4. **Systems Design**

   Lastly, the fourth design order is the most complex of all. The focus of this order is on designing dynamic environments and systems. It aims to design the transformation of systems and their structures. Additionally, it involves the design of their functions and flows, as well as the use of their dimensions and constraints. The last order addresses human systems, including the integration of information, objects, interactions, and social, work, and educational environments. This order focuses on the design of businesses, learning experiences, systems, cultures, organisations, and cities.

This PhD thesis focuses on the first order of design which is communication design seeking to shape household behaviour towards food waste reduction in Jordan. This decision comes from a personal belief that communication design can successfully deliver a message to motivate a specific target audience using multiple media of audio and visual resources to act on the desired action, such as spreading awareness about an environmental issue, making an informed decision, or instilling an attitude. Using communication design can draw attention to the issue of food waste and suggest ways in which it can be reduced. According to Percy (2014), the purpose of integrated marketing communications is to provide information and change people's behaviours. Based on the literature, some individuals do not consider food waste to be an issue that affects them. There are several reasons for this, including the fact that they do not realize they are wasting food, or they believe it is insufficient to justify changing their behaviour. Therefore, communication design can play a role in increasing awareness among individuals about how much food they waste, as well as the effect this has on the environment. In this case, a communication campaign can be an effective way, but it requires finding appropriate message framing and media delivery combinations (Young et al., 2017). It is likely that this will involve pointing out the economic costs for engaging some individuals, while adding negative environmental impact and social injustice appeals will increase engagement, particularly among the more affluent.

2.4.2 Communication campaigns

Communication campaigns bombard the public every day as many as 10,000 ad impressions per day-resulting in overstimulation and a limited ability to retain information (Kiely, 2021). Successful campaigns can, however, have a profound effect on brands that strive to break through the noise and be remembered. For instance, the Got Milk? campaign is an indelible example of advertising-turned-pop culture from the 90's. There were stars of film, television, sports, and politics involved in the campaign, including Van Halen and Dennis Rodman, as well as The Simpsons. The Got Milk? campaign convinced millions that drinking milk was necessary for healthy bones. There were more than 70 commercials on television in California alone during the three decades that Got Milk dominated the public consciousness and more than 350 milk mustache ads in print and on television nationally during this time. It is

estimated that 80% of all U.S. consumers come into contact with this innocent little question every day: Got Milk? (Daddona, 2018).

From the Got Milk? campaign example above, a communication campaign can be described as a campaign aimed at persuading people. In 2013, Atkin and Rice defined communication campaigns as “purposive attempts to inform or influence behaviours in large audiences within a specified time period using an organized set of communication activities and featuring an array of mediated messages in multiple channels generally to produce non-commercial benefits to individuals and society”. A communication campaign can be also defined as "an organised set of communication activities that seeks to bring about specific outcomes, is directed at a large audience, and has a defined time limit” (Roger and Storey, 1987; p. 821). Accordingly, communication campaigns are designed to reach certain objectives, convey messages, and influence the attitudes and behaviour of the target audience. Communication campaigns have contributed positively to the advancement of the health, safety, environment, and society and have frequently been considered a critical component of broad-ranging intervention campaigns such as food waste campaigns. Betz et al. (2015) agree that, despite the difficulty of changing consumption habits and food waste behaviours, communication campaigns can be effective in influencing household behaviour and increasing food waste awareness. Graham-Rowe et al. (2014) report that household members are completely unaware of how much food waste they produce. Therefore, communication campaigns have gained mainstream media coverage in the past decade and are now the most widely used intervention for food waste awareness (Priefer et al., 2016c).

According to GLAAD and MAP (2008), an effective communication campaign is built around the following key elements:

- **Campaign objective:** Setting a campaign objective by agreeing on what the campaign trying to achieve. This first element should clearly define the purpose of a campaign (e.g., Does the campaign aim to educate the public about an issue? change behaviour? win a short-term political fight?).

- **Target audience(s):** Identifying the target audience carefully (i.e., The general public is not a target audience). The campaign needs to be about people, the campaign should use imagery and messages to appeal to them with ad placements in media where they can read, watch, and/or listen to.

- **Messages and research:** Messaging and creative developments should be based on research. At the preliminary stage of message development, the creative team should use qualitative research to better understand the target audience. Next, the creative team should develop messages based on the research findings and prepare them for testing. Following by testing and refining the developed messages in order to develop the creative brief. Last but not least, testing the creative brief (quantitively), then refining and finalising the brief that most successfully reach the target audience. Afterwards, Market researchers should be hired to have a baseline idea about the market.

- **Media communications plan:** Effective communication campaigns need a media plan. A media plan allows clients to spend as little money as possible to reach the target audience and to ensure that the campaign message get heard. The media plan should clarify the following: 1) Media mix: what type of media should the client use? (e.g., Print, social media, TV, and/or radio); 2) Media vehicle: in which specific social media platform, TV show, or billboards should the ads be placed?; 3) Media schedule: when should the campaign run, where, and how long?

- **Budget:** A campaign budget should include funds for message development and testing, creative development and testing, the media buy and some sort of campaign evaluation.

- **Campaign evaluation:** Measuring the effectiveness of the communication campaign through its campaign activities, creative effectiveness, and outcomes (behaviours/ attitudes change).

A successful and effective behaviour change campaign considers several factors. These factors include culture, ethnicity, social status, gender, and class. Additionally, factors such as attitude, beliefs, and values affect how, when, and where communication is received (Akbar et al., 2021; White et al., 2019). For instance, a target population's age influences their information preferences. According to Chu et al. (2017), it has been reported that younger people prefer TV and the Internet as sources of information. There is also a relationship between gender and preference for sources of information. However, the preferred source of information may differ greatly from country to country and from culture to culture. The role of social determinants – particularly educational level – in communication is important and could cause inequality in the target population. It has been said that knowledge is associated with attitude, individuals with a deeper level of knowledge are more likely to be receptive to a change in behaviour.

In the next section, the researcher reviews several communication campaigns aimed at increasing knowledge, awareness, and attitudes through communication campaigns to promote food waste reduction at the household level.

2.4.3 Communication campaigns to shape food waste behaviours

The main purpose of gathering additional information about existing communication campaigns is to better understand used practices of changing households' behaviour in relation to food waste reduction. As previously mentioned, academic literature is not the only source of information about communication campaigns related to food waste (see Section 2.2.3). In the grey literature, communication campaigns related to food waste have become increasingly common. As an example, in 2016, the British supermarket chain Sainsbury's engaged in a year-long trial aimed at reducing food waste at the household level (Sainsbury, 2016). The 'Waste less, Save more' campaign is a strategy to help its customers to save more money by wasting less food. This trial campaign intervention materials include the Olio app which encourages food sharing amongst neighbours. Some of these interventions have included smart fridges equipped with internal cameras that allow residents to view contents from their

smartphones, preventing shoppers from having to double up on purchases during food shopping, a practice that costs the UK £1.5 billion yearly (Sainsbury, 2016).

A major example of a communication campaign is Love Food Hate Waste, lunched in the United Kingdom in 2007 under the leadership of WRAP (The Waste and Resource Action Programme). The campaign's aim is to inform individuals of the large amounts of avoidable food waste and promote useful solutions such as tips and recipes to manage leftovers and offer catchy marketing campaigns to combat it individually. As a part of the campaign strategy, consumers were encouraged to reduce food waste by saving money messages. The Love Food Hate Waste campaign includes a mobile application, social media promotion, and radio and television advertising in the hopes of educating households about how much food they waste and providing examples of improvements made.

According to a report by ReFED (2016), communication campaigns have been ranked among the top solutions for reducing food waste in the United States with an estimated food waste diversion potential of 584,000 tons and an economic value of $2.65 billion USD annually. In the same vein, the Natural Resources Defense Council's (NRDC's) 'Save the Food' campaign (EPA, 2016) and the US Environmental Protection Agency's (US EPA) 'Food: Too Good to Waste' campaign (ReFED, 2016), constitute large-scale national awareness campaigns in the United States. 'Food: too good to waste' is an innovative community food waste prevention campaign that launched seventeen community-based social marketing interventions aimed at reducing food waste at the household level. These interventions were mainly information interventions, which offered new information and tips to households. 'Food: Too Good to Waste', relied on almost exclusively small-scale implementation. According to ReFED (2016), within fifteen of the seventeen campaigns, food waste decreased by between 10% and 66%.

WRAP launched a food waste prevention campaign in 2012 aimed at households in London (WRAP, 2014). Analyses of waste composition revealed a 15% reduction in household food waste. Moreover, the French commercial supermarket chain Intermarché launched a campaign in 2014 titled "Inglorious Fruits and Vegetables." Using film, posters, and packaging, the campaign promotes the goodness of those fruits and vegetables that would not be accepted for placement on supermarket

shelves. The campaign also featured separate labels, aisles, and spaces on the receipt for fruits and vegetables. This resulted in consumers being able to get their regular fruits and vegetables at a 30% discount and talking about the fight against food waste in the media (FabNews, 2014).

Table 2.6 provides an overview of the existing communication campaigns aimed at shaping behaviour around food waste reduction at the household level from grey literature.

Table 2.6 Existing communication campaigns from the grey literature

Campaign Name	Context	Period	Aim	Routine	Motivation	Touchpoints	Impact
Love Food Hate Waste	UK Canada	6 months	To inform individuals of the large amounts of avoidable food waste and promote useful solutions.	Shopping Cooking Eating Managing leftovers	Saving money	Posters Social media content TV & radio ads Web tips Information in stores & food packages/ Mobile app	Average food waste reduction is 15%
Food: Too Good To Waste	USA	26 months	To encourage households to make small changes to the way in which they shop for, prepare, and store food to reduce food waste.	Planning food purchases and meals Managing leftovers	Saving money Sharing surplus food with others	Mobile app Web tips Food sharing box Social media content	Average food waste reduction is 10-66%
Save the Food Campaign	USA	3 Years	To increase awareness about the economic and environmental impact that caused by food waste and to encourage Americans to take simple and actionable steps to reduce food waste at home.	Planning meals Shopping Storing Cooking Eating Managing leftovers	Saving money Protect the environment Sharing food with community	Posters Web providing recipes and tips on storage and planning Social media content Amazon Alexa	-
FareShare's Let's Get Together	UK	3 months	Receiving and redistributing a variety of healthy and good quality foods across the UK schools, hospitals, charities, and shelters.	-	Sharing food with community	Digital ads Social media content	-
Intermarché	France	-	Promoting the goodness of misshapen fruits and vegetables.	Shopping Eating	Saving money	Film Posters Packaging	-

Communication campaigns identified from the grey literature showed a potential contribution towards food waste reduction by targeting the daily food practices and routines (i.e., planning purchases and meals, shopping, storing, cooking, eating, and managing leftovers). However, these campaigns made apparent that there is a vague

about how these campaigns developed their intervention materials and evaluated the effectiveness of their interventions. Despite the little information on the time period needed to impact households toward food waste reduction, it is unclear how long campaign intervention effects would last. There is further uncertainty as to whether the impact was caused exclusively by the intervention or by households taking part in the detailed survey. Through reviewing the campaigns, the process of selecting household groups was unclear. The fact that none of these campaigns included any information regarding the effectiveness of their measures aimed at reducing food waste in households should be noted.

As a whole, these campaigns do not alter the main conclusions of this review: there is a lack of evidence related to interventions designed to reduce the amount of food waste generated and the ease with which previous smaller interventions can be scaled up.

2.5 Knowledge gaps

In light of the literature review findings, the researcher compiles the gaps in knowledge for further research according to the following topics: 1] Food waste; 2] DfBC and 3] Communication campaigns.

1) *Knowledge of the food waste issue in Jordan is limited*

   It is likely that Abiad and Meho's (2018) paper represents the most comprehensive description of the scope, opportunities, and challenges associated with food waste in the Arab World. It includes a general summary from the Jordanian perspective that research on food waste is negligible and scarce with a lack of reliable data, sources, drivers, policies, interventions, and initiatives directed at reducing food waste. Factors related to food waste behaviour in the Jordanian context have not been identified. A more thorough investigation needs to explore what factors influence household behaviour towards food waste reduction in Jordan.

2) *Household food waste behaviour has not been exhaustively explored*

   Another gap in the knowledge is related to the behaviour change theories applied to understand food waste behaviour. The theoretical frameworks used

in these studies are predominantly based on quantitative data. Food waste behaviour has been widely investigated by several authors using the Theory of Planned Behaviour, which has a modest explanatory power ranging from 70-80% not explained (Abdelradi, 2018). Therefore, future research should explore food waste behaviour, using ethnography research to gain a better understanding of household food waste behaviours. This justifies the researcher's decision to adopt and adapt a theoretical framework model based on food waste behaviour factors evidenced in the existing literature. Integrating food waste behaviour theoretical frameworks with design intervention has relatively little work. It is important to explore what factors need to be considered to support the developing of the communication campaign interventions.

3) *An Implementation and evaluation for developing the communication campaign are required*

   Although communication campaigns have become one of the most widely used interventions for food waste reduction at the household level, it is not at all clear how these campaigns designed/tested their interventions. The relationship between the design process for these campaigns and their effectiveness is not well understood. It can be noted that none of these campaigns reported the process of measuring the effectiveness of their interventions aimed at reducing food waste at the household level.

4) *Appropriate DfBC approach/model is needed to support the development of the communication campaign*

   There are no clear guidelines for using DfBC in communication campaigns. A specific DfBC approach/model for developing and testing the communication campaign to shape household behaviour towards food waste reduction in Jordan is required.

2.6 Summary

The literature review was divided into three key areas: Food waste, design for behaviour change, and communication campaigns. Food waste review sought to identify a definition for food waste which was defined as “Food appropriate for human consumption being discarded or left to spoil at consumer level—regardless of the

cause". Concerns and issues related to food waste were addressed. However, it showed a paucity of research on food waste in Jordan. The combination of food waste behaviour models is then discussed, highlighting the need for further research in this field. Based on the literature, the researcher was able to develop a theoretical framework model consisted of multiple hypotheses.

The review of design for behaviour changes approaches and models resulted in adopting the BCD approach and DwI toolkit to guide the development of the communication campaign. A representation of the BCD process provides knowledge of how best to do design and evaluate the communication campaign. Integration of the BCD approach with the DwI toolkit is noteworthy to support the idea generation and inspire novel design solutions.

The following chapter explains the methodology adopted in this research and how this thesis intends to cover the identified gaps in the knowledge.

Chapter 3 Methodology

3.1 Introduction

This chapter highlights and justifies the methodological decisions made during the research project including the sampling strategies, methods for each study and the overarching analysis techniques used. The validity and reliability of the data collected are also discussed in order to support the conclusions drawn in this thesis. The researcher adapted Saunders et al.'s (2009) research onion framework to describe the research methodology in this PhD thesis. The layers of the research onion are devoted to exploring a particular aspect of the research, demonstrating various paradigms, strategies, and choices employed throughout the research investigation. The research onion consists of six levels of consideration that must be addressed during any research project: philosophies, approaches, strategies, choices, time horizon, and techniques and procedures. Therefore, the research onion framework is a useful tool for thinking holistically about the methodology that helps the researcher understand what decisions he needs to make regarding the research design (see 3.1).

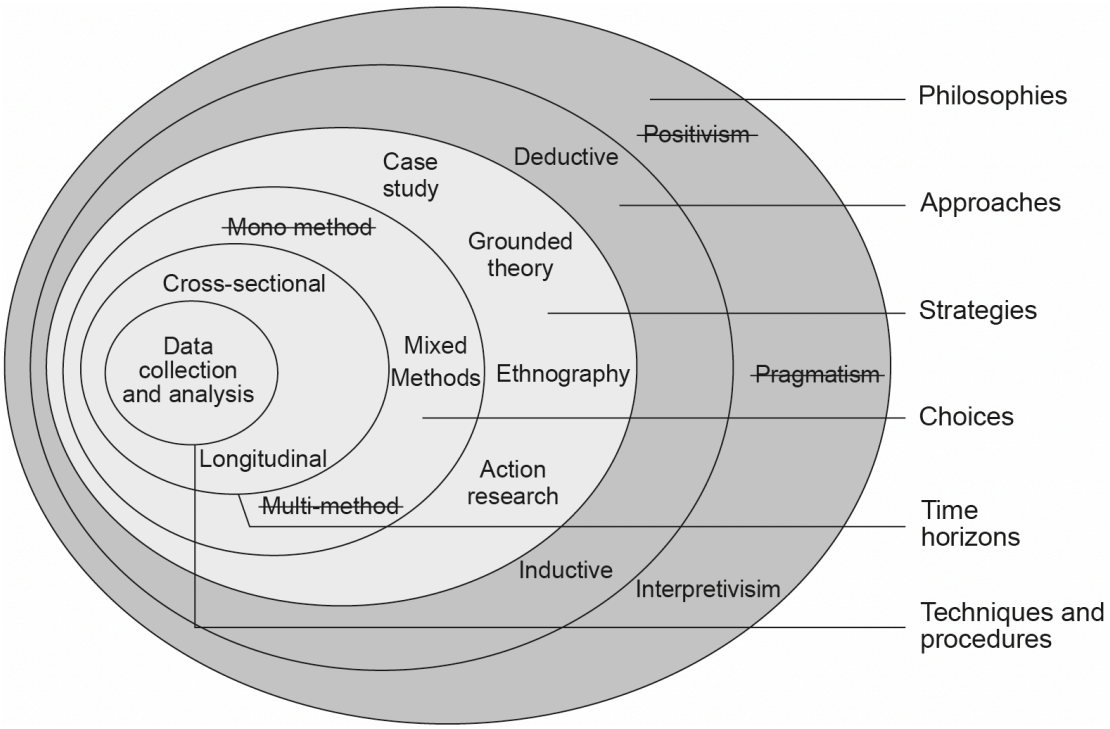


Figure 3. 1 Research onion adapted from (Saunders et al., 2009)

3.2 Philosophy

Research philosophy represents the very first layer of the onion and indicates the set of beliefs upon which the research is based. It can be viewed either from an ontological or epistemological point of view (Hacking, 1983). Ontology refers to the nature of existence and epistemology to the nature of knowledge. However, logic plays an important role in the legalisation of science. In other words, in order to ensure that a scientist's work stands up to scrutiny, they must comprehend this logic (Salmon, 1999). Based on Saunders et al. (2019) research philosophies can follow a variety of directions, from Positivism, Pragmatism, and Interpretivism:

- **Positivism:** In social sciences, positivist research is usually associated with experiments and quantitative research (Salkind, 2010). Positivism involves observing the real world through rigorous rules and procedures and testing hypotheses in an unvalued manner (Saunders et al., 2009). The outcomes of this Positivism philosophy include universal causal laws that can be generalised (Robson, 2011). There has been a criticism of the original Positivist research that it may be impossible to maintain objectivity “when working in real-life settings, where the researcher has or develops, an emotional involvement” (Robson, 2011).

- **Interpretivism:** According to Saunders et al. (2009), interpretivist perspective raises the concern that social phenomenon “is far too complex to lend itself to theorising by definite ‘laws’ in the same way as physical sciences”. It is imperative to understand that humans are social actors and that conducting research on humans is different from conducting research on objects. The interpretivist researcher must “enter the social world of the research subjects and understand their world from their point of view” (Saunders et al., 2009). The interpretivist viewpoint holds that humans are intricate, and everyone has a variety of different ways to perceive and understand the same objective reality. In other words, humans have their own reasons for behaving in life; therefore, a scientific approach is inappropriate in this situation. Based on the view of interpretivism, knowledge and facts are subjective and derived from a human's understanding and experience.

- **Pragmatism:** The philosophy of pragmatism emphasises practical experience rather than theory, concentrating on a problem and trying to solve it. (Robson, 2011) states that “The central idea is that the meaning of a concept consists of its practical implications”. However, pragmatism is defined as a link between knowing what a hypothesis means and knowing what the hypothesis will result in when it is true. Therefore, pragmatism negatively impacts the content of the hypothesis if no outcome has been obtained (Misak, 2004).

As interpretivism studies often use reliable data, the results obtained may be associated with a higher level of validity (Denzin & Lincoln, 2002). Interpretivism intertwines ontology and epistemology because knowledge is crucial in determining the ontological assumptions of the constitution of the world (Goldkuhl, 2012). Since this research is pursuing an understanding of households’ food waste behaviours and developing and evaluating interventions trying to shape households’ behaviour towards food waste reduction, an interpretivism philosophy was selected. The interpretive method of social study aims to provide a holistic understanding of human experience within a given social context (Denzin & Lincoln, 2002). In this sense, interpretivism guided this research by its main aspects and indicated the need to interact with participants and interpret the subject to construct meaning and knowledge.

3.3 Research approach

The next layer within the onion is the research approach, which can be either deductive or inductive (Saunders et al., 2009). The reliability and validity of this research are essential in a deductive approach, which indicates its consistency and accuracy. Research using the deductive approach focuses on identifying theories and concepts from the literature to formulate hypotheses, which are then empirically evaluated and either confirmed or rejected (Gray, 2014). Additionally, objectivity is sought, and a distance is maintained between the researcher and the participants. Deductive logic is used to test ideas or concepts. On the other hand, the inductive approach involves collecting data and formulating hypotheses based on the results of the analysis. Thus, inductive research results in theory as an outcome (Bryman, 2012), which means that

observation and findings are used to draw conclusions and build theory. Despite appearing quite different, inductive and deductive approaches can be complementary without following a linear or clear sequence (Bryman, 2016).

Researchers sometimes plan to combine inductive and deductive approaches to their research. In some cases, researchers conduct research with the intention of utilising only an inductive or deductive approach but discover along the way that the other approach is necessary to facilitate the elucidation of findings (Bryman, 2016; Gray, 2014). In this research, a combination of both research approaches is adopted. The reason behind choosing both approaches is the different types of research questions addressed in this investigation (see Table 3.3). For instance, the process for answering RQ1 follows an inductive approach. The outcomes of which provide the behavioural change theories that are applied in food waste behaviour, cases of interventions to shape household behaviour around food waste reduction and DfBC models and toolkits. The efforts to answer RQ1 start with data collection (literature review and semi-structured interviews) performed to gather information on the best practices for changing household food waste behaviours and the hypotheses related to household food waste behaviours). Therefore, this process can be described as an inductive approach.

A deductive approach is used to answer RQ2. First, the outcomes of the literature review are used to adopt and adapt an existing theory, which can be regarded as a generic theory. Some falsifiable hypotheses are then formulated based on an existing theory on household food waste behaviours. Subsequently, data is collected through ethnographic research to determine whether or not the hypotheses have been confirmed or rejected. To clarify, this process begins with a working theory (set of hypotheses related to household food waste behaviours) and then narrows that theory down to a specific theory (the theoretically validated factors that influence household food waste behaviours). Consequently, a deductive approach is followed in addressing RQ2. Gray (2014) describes this process of addressing RQ1 and RQ2 as a combination of inductive and deductive approaches.

An inductive approach is used to answer RQ3 because the aim is to generate a new theory, namely communication campaign guidelines to shape households' behaviour

towards food waste reduction in Jordan. In particular, the process for answering RQ3 starts with framing process, which involves inviting the participants to provide insights into how a behaviour change campaign might be implemented and to formulate an initial Theory of Change. Following formative research and an iterative process of developing and evaluating communication campaign materials, the collected data are analysed to generate communication campaign guidelines. As a result of this process, a new theory emerges from the data collection, therefore indicating the adoption of an inductive approach.

3.4 Research strategies

The third internal layer of the 'research onion' is the research strategy. These strategies include experiments, surveys, case studies, action research, grounded theory, ethnography, and archival research. Robson (1993) describes a research strategy as a framework to guide the researcher in carrying out the research. Similarly, a research strategy can be defined as the "type or model that provides specific directions for the procedures in a research design" (Creswell, 2008, p. 11). In this stage of the research process, the researcher develops the research strategy based on the kind of research that is needed (Robson, 2011; Saunders et al., 2009):

- **Exploratory:** to understand or clarify a phenomenon when the nature of the problem is unclear;
- **Descriptive:** to describe a particular phenomenon in detail;
- **Explanatory:** to explain the relationship between variables.

The ethnographic strategy supported this research to understand the typical behaviour patterns of target households in West and East Amman towards food waste in relation to daily food-related procedures and processes. Creswell and Creswell (2013) describe it as: "Ethnographers study the meaning of the behaviour, the language, and the interaction among members of the culture-sharing group". In accordance with the nature of ethnography, it tends to reflect an interpretivist research philosophy and involves an inductive, qualitative research methodology. Knowledge acquired during the ethnographic research followed by Aunger and Curtis' (2016) behaviour centred design (BCD) approach indicated the need for an action research strategy to inform

the researcher of problems or weaknesses related to interactions within the real-world. According to the action research strategy, three conditions must be satisfied for it to be met (Robson, 1993). First, the subject matter is usually situated in a social practice that requires change; second, it is a participatory activity in which researchers work together in a collaborative manner; and third, the project proceeds through a spiral of cycles of planning, acting, observing, and reflecting in a systematic and documented study (see Figure, 3.2). Finally, a food waste quantification containing explanatory research to assess and evaluate the effectiveness of the communication campaign interventions. Consequently, a mixed-methods approach was used.

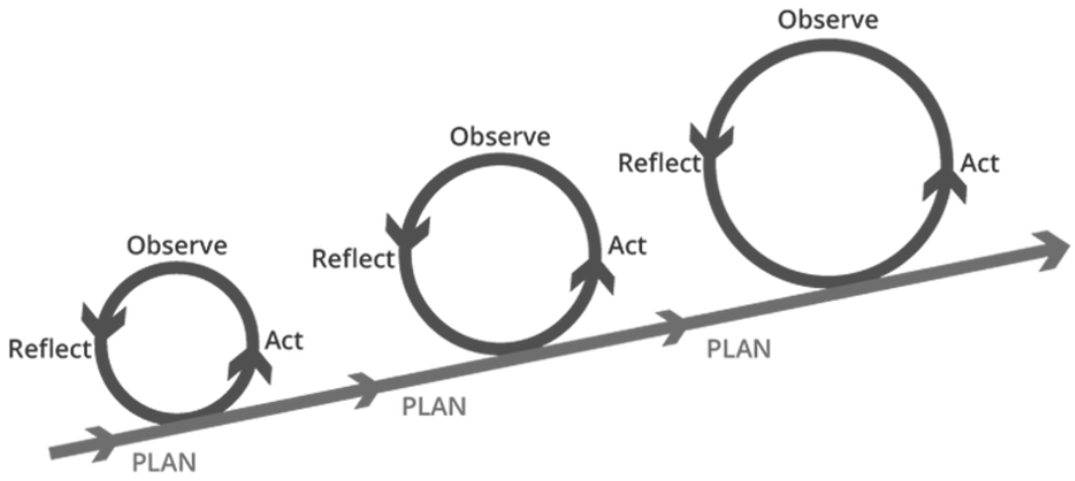


Figure 3. 2 Action research process (reproduced from (DHHS, 2012, p.10))

According to Yin (2014), case study research is useful for explaining, describing, and exploring events or phenomena in everyday contexts. It allows for an in-depth exploration of the complex and context-specific dynamics surrounding food waste in households. For this reason, part of this research is presented as a case study offering a conceptual framework for a communication campaign aimed at reducing household food waste. Thus, using case study research provides several advantages. First, case study research allows the researcher to gain a deeper understanding of household food waste behaviours in Jordan. By focusing on a specific real-world setting, such as the four household groups (see Section 3.9), this research will delve into the challenges and opportunities faced by individuals when it comes to managing food waste. This comprehensive understanding is vital for the development of a robust

conceptual framework that considers the factors influencing behaviour towards food waste reduction. A case study also provides the researcher with the opportunity to interact directly with households, gathering first-hand insights through interviews, observations, and interactions. Through this level of engagement, the proposed conceptual framework gains greater credibility and validity by incorporating the perspectives and experiences of those directly involved in the issue.

Secondly, a case study research design lends itself well to the development of a conceptual framework due to its exploratory nature and emphasis on the "how" and "why". This research not only describes the phenomenon of household food waste but also understands the underlying influences that drive behaviour. A conceptual framework can be employed to structure the research, guiding its exploration of specific factors and relationships relevant to food waste reduction. A case study design allows for an iterative and flexible approach. Thus, the researcher will be able to refine and adapt the framework based on the insights and findings. This adaptability is crucial in a complex area such as food waste reduction, where novel challenges and opportunities may arise over time. By providing a conceptual framework through case study research, this research aims to provide valuable knowledge and practical guidelines for designing effective communication campaigns that promote sustainable practices and contribute to reducing food waste at the household level.

3.5 Research choices

The fourth internal layer of the onion – choices – refers to the data types (qualitative and quantitative) a researcher uses in research. According to Saunders et al. (2009), there are three research choices: mono, mixed, and multi-method. The mono method approach proposes that one method is generally better than another (Martin, 1990), which refers to the collection of quantitative or qualitative data rather than the integration of both. In quantitative methods, the focus is primarily on representing information numerically (Martin, 1990), while qualitative methods, refer to the researcher's axiomatic beliefs (Van-Maanen et al., 1982). The mixed method approach involves the use of qualitative and quantitative methods. This approach is premised on the idea that the integration of quantitative and qualitative data provides for more comprehensive and collaborative use of data than either method alone can

provide (D. Creswell & Creswell, 2013). The measurement of one dimension of this experience can contribute to an enhanced qualitative description of the phenomenon under investigation. Finally, the multi-method approach involves using two or more research methods, each conducted rigorously and independently, as part of one study. Once all the results are collected, they are triangulated to form an entire picture (Morse, 2003). For this research, a qualitative research approach was used in this research for three reasons. First, this research involves qualitative data collection methods (e.g., interviews, observation, photovoice) with limited quantitative data. Therefore, it fits the characteristics of qualitative research. Second, the purpose of this study is exploratory, which is closely linked to qualitative research. Finally, this research contributes to providing new knowledge by investigating a complex issue, which is a characteristic of qualitative research.

3.6 Time horizons

Essentially, the time horizon refers to how many points in time a researcher intends to collect data. There are two possible time horizons: cross-sectional and longitudinal. In a cross-sectional study, all measurements are made at the same time or within a brief period. A researcher can measure relationships by comparing results from readings taken from different elements at the same time (Robson, 2011). A longitudinal study refers to the collection of data over a different period. Often in longitudinal studies, there is a pre-test and a post-test phase, meaning that measurements are taken before and after some sort of intervention being evaluated (Cohen et al., 2011).

The time horizons chosen during this research were both cross-sectional and longitudinal. The ethnographic research included a single observation of each household at a specific point in time, thereby constituting a cross-sectional study. During the development of the communication campaign phase, a longitudinal approach was taken in which food waste was quantified through data collected during and after the interventions, to provide an evaluation of the campaign's effectiveness. It is necessary to mention that the same sample was involved in the ethnographic research and the food waste quantification.

3.7 Techniques and procedures

The central and last layer of the onion is the techniques and procedures used for data collection and analysis. These encompass the tools to effectively collect information and knowledge about a phenomenon and measure the facets of reality that are being studied. For instance, when dealing with humans and seeking to understand their behaviours, it is possible to observe them in action (observation), ask them questions about the phenomenon (interviews, questionnaires, and tests) and assess their abilities (via standardised tests) (Robson, 2011). The research methods that are most appropriate depend on a variety of aspects, including the research questions and objectives. For this reason, this research study considered several data collection methods that are appropriate for a qualitative investigation. As the research progresses, different research methods are used in different phases of the research process to meet each research aim. The following section will describe briefly the techniques used during this research. A description of the methods utilised in each phase of the research will be presented in their respective chapters.

3.7.1 Phase 1: Literature review

This phase helped in building an understanding of some concerns addressed in **RQ1**: ***What are the best practices for changing household behaviour in relation to food waste reduction?*** and **RQ2: *What are the factors that influence household food waste behaviour in Jordan?.***

a) Literature review

An extensive literature review was conducted prior to all subsequent phases of this PhD research. This literature review was conducted using both academic and grey literature to identify the gap in knowledge, focussing the research on offered insights into behaviour change theories in behavioural sciences applied in household food waste behaviour studies, reviewing cases of interventions to shape household behaviour around food waste reduction and DfBC models and toolkits, with a particular focus on communication campaigns. This enabled the researcher to identify the gaps in current knowledge (Robson, 1993).

3.7.2 Phase 2: Research exploration

The purpose of this phase was to build a comprehensive understanding of the current situation on solid waste in general and food waste in particular in Jordan and also the behaviour patterns of target households in Jordan addressed in ***RQ2.*** This phase is discussed in Chapters 4 and 5.

b) Semi-structured interview

Robson (1993) describes interviews as a conversation intended to achieve a particular objective. An interview can be classified into several types based on its structure and formality. Interviews are a rich data collection method that can gather information that may not be collected through observation, questionnaires, or other non-contact qualitative techniques (Gill et al., 2008).

The purpose of the expert interview was to obtain additional unknown or reliable information, authoritative opinions, and serious and professional assessments of solid waste in general and food waste issue in particular in Jordan. The interviews have been conducted with experts from the Ministry of Environment and NGOs in Jordan with different backgrounds, such as solid waste management, food waste reduction, environmental awareness, and awareness campaigns to have high insights into aggregated information difficult to explore by other methods. The study had two aims: 1) to validate the literature review findings; 2) to update already collected data with the most recent knowledge related to food waste issues in Jordan.

The researcher invited the potential interviewees via email and phone to take part in the interviews lasting up to 70-110 minutes. The researcher employed the quota and snowball sampling strategies where he relied on his professional contacts for referrals of other potential participants in the study. As Arabic was the native language of the interviewee, all interviews were conducted in Arabic to facilitate communication with respect to issues surrounding the topic of investigation. The procedure for expert interviews followed semi-formalised format interviews and consisted of various stages. These are preparation and planning, interview, transcript of records, translation, analysis and interpretation of data, and report preparation. A set of open-ended questions with ad hoc questions enabled the interviewer to explore the topic being studied. The clarity in understanding the situation is one of the advantages of an

interview (Ely et al., 1991). Thus, the interviewees had the opportunity to discuss what was important and relevant to them, and their answers were more thoroughly considered. In-depth interviews offered the possibility of investigating the exact situation, interesting responses, and exploring indirect motives. The structure of the interview was based on five major topics:

1. current situation on solid waste management and food waste
2. future plan on solid waste management and food waste
3. challenges and problems of FW
4. strategies and regulations
5. awareness campaigns in Jordan.

At the beginning of each interview, participants were introduced to the research topic while ensuring flexibility throughout the interview process to explore specific situations and understand the interviewee's subjective experience of the study topics (Gray, 2014). The researcher audio recorded each interview with the consent of the interviewees. As a result, the researcher was relieved from the burden of taking copious notes and was able to concentrate on the interview, knowing that a comprehensive and accurate record of what was discussed would be preserved (Miles et al., 2014). The interviews in this study were conducted on an individual basis: a one-to-one interaction between the researcher and the participant. Consequently, a good rapport was established with each interviewee and an open discussion of a wide range of topics was permitted (Alshenqeeti, 2014).

Before the interviews, the researcher developed a set of flexible questions which were provided to the participants depending on their expertise. Table 3.1 outlines the themes addressed in this study.

Table 3.1 Topics covered through the interviews

Topics addressed	**Interviewee number**												
	E1	**E2**	**E3**	**E4**	**E5**	**E6**	**E7**	**E8**	**E9**	**E10**	**E11**	**E12**	**E13**
Challenges and problems of food waste in Jordan	X	X	X	X	X	X	X	X	X	X	X	X	X

Strategies and regulations	X	X	X					X		X	X		X
Related awareness campaigns in Jordan		X	X	X				X	X				X

Although the study provided valuable insights from 13 participants, there were some limitations related to the expertise of interviewees. The interviewees in this study were specialists in specific areas relating to food waste, but none of them specialise on food waste as a whole. However, the interviewees covered all aspects relevant to the interview questions, but there were some limited answers due to a lack of sufficient information. For this reason, the number and range of interviewees may not be representative of the overall picture of food waste in Jordan.

c) Preliminary interview and open-ended survey

Face to face open-ended survey questionnaires were conducted with households to enable them to freely articulate their daily food-related practices and routines in their own words(Kumar & Alok, 2020). The use of open-ended questions is highly effective at measuring knowledge and providing more reliable and valid results (Converse, 1984). This method motivated households to be expressive without being confined to closed alternatives, thereby reducing the households' cognitive burden. The questions covered household food waste behaviours, shopping and planning routines, environmental beliefs, and attitudes (see Appendix II).

The researcher travelled to Jordan to start conducting the ethnographic research for this study. Participants were asked to meet with the researcher three times over the primary research activity. The first meeting introduced the study and provided a space for participants to ask questions. During this time, face to face questionnaires were conducted with the 20 participants to freely articulate their daily food-related practices and routines in their own words. A well-constructed and coded questionnaire allows results to be compared easily and covers a few areas in a short amount of time (Robson, 2002). The questionnaire included both closed-ended questions to get demographic information and open-ended questions to explore the main themes of the study. The questionnaires were completed by heads of households, married couples, mothers, and single-person households. A self-completion questionnaire

consists of a series of questions that give respondents the freedom to answer questions in their own words. It was designed to elicit more information than is possible in multiple choice. The demographic information was confirmed with the participants, and the results provided an initial assessment of participants' behaviours and beliefs in different areas, including food consumption and food waste.

The preliminary meeting also included an appointment for each household to participate in the observation, and participants were given a photo assignment. The participants were asked to take between 12 to 24 photographs of moments when they realised that they were wasting food or of anything else they considered relevant to the story of food waste in their household. The researcher created a black photovoice diary notebook with each family's name hand-written on the cover page to give a sense of familiarity to the households (see figure 3.3). Participants were asked to keep track of any thoughts they had about their food waste which are related to the photos they were asked to take. Figure 5.1 highlights the content of the photovoice diary notebook, which is divided into 18 days of note space for participants to record their notes. It was explained to participants that they were the experts and curators of their story and that no photo was incorrect as they would be explaining their reasoning during the interview. Participants were encouraged to focus on food items rather than food packaging materials.



Figure 3. 3 Photovoice's diary notebook

d) Ethnographic observation

The ethnographic observation method refers to the process of observing and/or interacting with participants in a study in the real world (Robson, 1993). An important characteristic of social science is the observation of people's behaviours and actions in their natural environment, so it is attractive to use a technique that records what people do in their natural environment and then records the results in some descriptive way for analysis (Robson, 1993). This technique is subjective since it involves the use of participants' perceptions to describe another's actions. The purpose of ethnographic observation is to identify inefficiencies, and opportunities, and to evaluate current household food waste behaviours.

Ethnographic observation has been carried out to capture and understand the typical behaviour patterns of target households in West and East Amman. A coding scheme (checklist) was designed to track household food waste behaviours and to report whether actions had been done or undone (see Appendix II). There are no known studies documenting the use of participant observation techniques in food waste behaviour research with Jordanian families. The ethnographic observation was carried out to capture and understand the behaviour patterns of target households in West and East Amman. A structured observation study was designed in which a checklist was used to track household behaviour and report activities as done or undone (Kuniavsky, 2003; Sharp et al., 2007). The checklist used in this study was developed in accordance with Robson's (2011) suggestions: the items (should be focused on the sense that they report what is going on and provide useful data), objective (without the need for inference from the observer) and easy to record (by just ticking a box) (figure 5.4). These codes included daily household food-related practices and routines. The checklist consisted of the following items:

- If the participants planned purchases and meals
- If the participants followed a shopping list and purchased food items wisely
- If the participants had knowledge of how-to best store food to prolong shelf life
- If the participants cooked precise portions to avoid wasting food
- If the participants balanced between food bought and food eaten within a certain time frame

- If the participants managed leftovers to produce less food waste and properly assessed the durability of leftovers when considering them for reuse



Figure 3. 4 Structure observation checklist

e) Photovoice method

Photovoice is a qualitative community-based participatory research method developed to assist individuals in documenting their everyday conditions (Lechuga-Peña et al., 2021; Wang & Burris, 1997). This method was applied to offer more in-depth data on households' food waste behaviours in West and East Amman. It was useful for studying household food waste behaviour since it enables them to self-identify moments of waste and curate their food waste story. It involves the households having control over what images they choose to document. While the photograph itself can be used as data, it is frequently the rich description that comes along with it (i.e., responding to participants' reflexivity) that provides the most valuable insights. The use of cameras in photovoice allows for discoveries to be made without the researcher's presence. Participants can take photographs to "capture a moment" that includes feelings, moods, and contexts associated with the visual imagery depicted in the photograph and discuss them later during the interview (Latham, 2004). For this

reason, studying food's conversion to waste is useful since waste is often the result of emotional, practical, and circumstantial matters (O'Brien, 2008). As part of the assignment, the participants have been asked to use their own mobile cameras to capture the moments when the food is being wasted and to record them in the given diary notebooks. The participants then took photos of food waste over a two-week period. Two check-in/reminders (in the form of WhatsApp messages) were sent to keep the project fresh in participants' minds. All participants used their phones to take pictures, which were sent to the researcher via WhatsApp. The households had control over what images they chose to document. These photos were developed and brought to the semi-structured interviews by the researcher. Most participants took between 12-24 photos. The least number of photos taken was 12, and the most taken was 87 (see Figure 3.5). All participants agreed and signed the sample consent form to release their photos for use in publications and knowledge dissemination.



Figure 3. 5 Some of the photovoice images

f) Semi-structured interview

Semi-structured interviews allowed the participants to express their views relating to their food waste behaviours. Photovoice studies are typically coupled with focus groups; however, due to the quarantine and COVID-19 restrictions, the researcher was unable to travel to Jordan to conduct a focus group with the households. For this reason, the researcher conducted online interviews with 14 participants. Interviews

were conducted based on photographs taken by participants. Based on Wang's (1999) SHOWed acronym, an interview guide was developed for use in photovoice studies. The SHOWed acronym represents the progression from descriptive to analytical (see figure 3.6). It starts by asking: What do you see here? It then progresses through: What is really happening here; How does this relate to our lives? Why does this situation, concern, or strength exist? and finally, what can we do about it? Sample questions are provided below:

Q1. What is this a picture of?
Q2. Why did you pick this picture to share?
Q3. What was the lead-up to this food-wasting event?
Q4. What are the main food waste activities and items you found from taking pictures of your food waste?
Q5. Is there anything you could have done to prevent this waste?



Figure 3. 6 SHOWed and its considerations when analysing photos

At the time of the interview, six participants apologised due to the COVID-19 pandemic and other circumstances. The released photos have been incorporated into this research so that the complexity of responses can be synthesised with the aid of visuals. Participants were given the opportunity to look over the transcript of their interviews and provide any final thoughts or clarifications and make corrections if necessary. Finally, the participants were adequately compensated for their time without being overly incentivised to participate based on compensation.

3.7.3 Phase 3: Development, implement and evaluation

In this phase, Aunger and Curtis' (2016) Behaviour Centred Design (BCD) framework was applied to develop, implement, and evaluate a communication campaign to shape households' behaviour towards food waste reduction in Jordan addressed in ***RQ3: How can design for behaviour change, applied within the field of communication design, be used to shape user and household behaviour?.*** The Design with Intent toolkit was used to support the idea generation (Lockton et al., 2010). The researcher started the idea generation stage by using different methods including brainstorming, sketching ideas, adapting a tried-and-tested design that already exists and co-design workshops with communication designers across the Arab World. This phase is discussed in Chapter 6 and 7.

g) Design workshops

In this phase, a series of workshops have been set up as the main qualitative data collection method via Mural and Miro platforms. Workshops might be useful in understanding the needs and preferences of individuals in generating design ideas, and people might be better able to make appropriate judgments in a workshop (Westerlund, 2007). The framing process workshop was used to convert the second phase findings into the theory of change by following a sequence of nine phases, starting with analysing the findings from the field and concluding with a creative brief that explains the focus of the intervention. As part of idea generation activities, four workshops were employed to test and iterate new perspectives, ideas, and rationales to help create potential solutions before running the food waste communication campaign. The overarching methodology was action research, and the data for this step is primarily gathered in the four workshops. Every time the researcher came up with an idea and it was implemented with the help of the households. The next workshop was held with the households and communication designers to discuss how the intervention might be improved. This process was involved action research to ensure all intervention materials worked just right for running the communication campaign. Thus, a practical solution to the food waste issue was generated by combining the researcher and the participants' feedback.

h) Food waste quantification

Food waste quantification was used to measure the level of food waste. The researcher was able to calculate the weekly volume of food waste from the beginning of the campaign, through the three main interventions and a one-week period after completing the campaign. This method combined with semi-structured interview and determined which factors and interventions influenced reducing food waste.

i) Semi-structured interview

Semi-structured interviews were conducted with the households who took part in the communication campaign to evaluate the impact of the communication campaign interventions and gain valuable insights beyond those found in the food waste quantification analysis. The interviews were used to better understand what stage of the campaign contributed most to the change in behaviour around food waste reduction and to what extent.

Table 3.2 Research overview

Research question	Research purposes	Objectives	Chapter	Research methods	Sampling strategy
RQ1: What are the best practices for changing user behaviour in relation to food waste reduction?	Exploration	1. To carry out a review of DfBC field with a particular focus on communication campaigns.	2	• Literature review	N/A
		2. To review cases of interventions (communication campaign) to shape behaviour around food waste reduction.	2	• Literature review	N/A
RQ2: What are the factors that influence household food waste behaviour in Jordan?	Exploration	3. To understand the current situation on solid waste in general and food waste in particular in Jordan.	4	• Semi-structured interviews	• Quota • Snowballing
		4. To carry and understand current behaviour patterns of target households in Jordan.	5	• Survey • Observation • Photovoice • Semi-structured interviews	• Quota • Purposive • Snowballing
RQ3: How can design for behaviour change, applied within the field of communication design, be used to shape user and household behaviour?	Development, implement, and evaluate	5. To develop a communication campaign to shape households' behaviour towards food waste reduction in Jordan.	6	• Creative idea generation (BCD approach) • Design workshops with communication designers, households, and experts in behaviour change campaigns	• Quota • Purposive
		6. To implement, test, iterate, and evaluate the communication campaign to shape households' behaviour towards food waste reduction in Jordan.	6	• Design workshops with communication designers, households, and experts in behaviour change campaigns • Food waste quantification • Semi-structured interviews	• Quota • Purposive
		7. To develop guidelines to support adoption of learned lessons into other contexts.	6	• Use the BCD approach to set assessment indicators	N/A

3.8 Data analysis

A combination of qualitative and quantitative data collection methods was applied in this research, and for each instance, a specific method for the analysis was used (Miles & Huberman, 1994). NVivo was used to analyse the qualitative data in a thematic way (Braun & Clarke, 2006). Microsoft Excel and R software were used to support the statistical analysis process (e.g., food waste quantification). The following paragraphs describe the data analysis employed to each method.

The analysis of the interview data (see Chapter 4) involves working to uncover patterns and trends in data sets. Based on Lichtman (2010), analysing qualitative data aims to minimise unnecessary bulky information in producing data that is relevant and meaningful. A thematic analysis approach was employed to facilitate understanding of the results. Creswell's (2009) data analysis process in qualitative research, as illustrated in Figure 3.7, was used during the data analysis process.

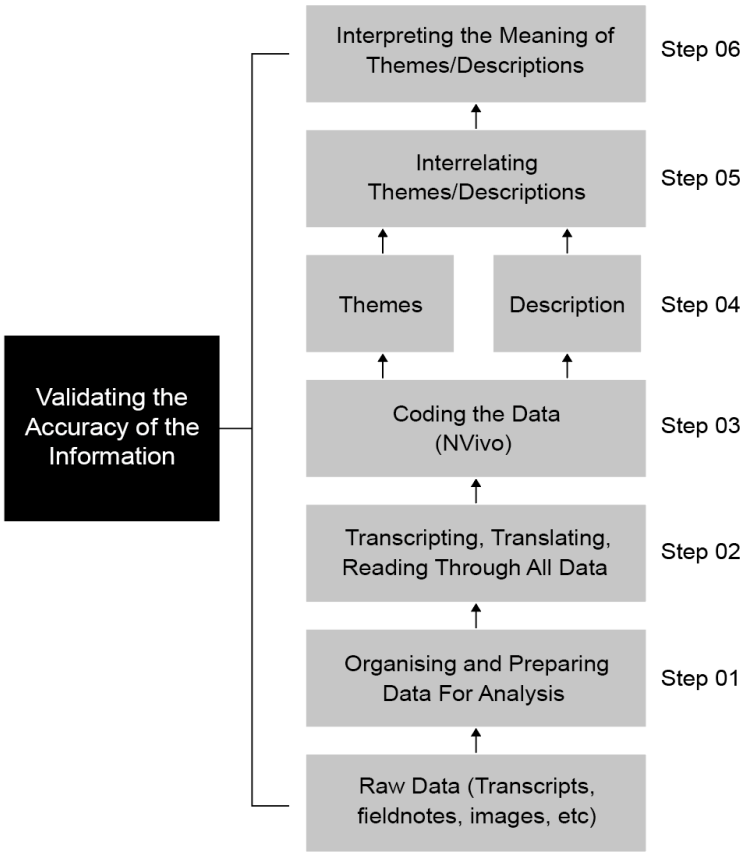


Figure 3. 7 Data analysis in Qualitative Research (Creswell, 2018)

As seen in figure 3.7 of the Creswell's (2018) data analysis process, six steps are outlined that were adapted in this study. To begin with, raw data was required. The following is a description of each step:

- **Step 01:** Data was organised in a way that enabled accurate transcription of the data by typing.
- **Step 02:** Data was transcribed, translated from Arabic to English and imported to the qualitative data analysis software NVivo.
- **Step 03:** After the transcriptions were completed, the researcher read all transcriptions carefully. Then, the researcher created codes (nodes in NVivo) based on the preliminary codebook and developed new codes based on the data.
- **Step 04:** Each of these codes was then grouped or categorised into themes. The researcher reduced the overlapping and redundancy of codes into a smaller group of codes before the codes were collapsed into themes.
- **Step 05:** The researcher decided the themes that were going to be depicted to produce a qualitative narrative.
- **Step 06:** During this final step, the data has been interpreted through comparing the findings from existing literature findings as well as the researcher's interpretation.

In Chapter Five, the researcher aims to investigate factors that influence households' food waste behaviours in West and East Amman by creating ethnographic research based on theoretical concepts and existing literature. This provides insights into food practices and routines and how they are affecting households' food waste behaviours. Figure 3.8 shows how existing theories and literature (Chapter 2) have been used as sensitising concepts in this ethnographic research (Chapter 5) to develop a theoretical framework model on household food waste behaviours in West and East Amman. It illustrates how a theoretical framework will be used to contribute to develop the communication campaign intervention (Chapter 6). Charmaz (2003) describes sensitising concepts as "those background ideas that inform the overall research problem". The researcher used sensitising concepts to guide the reflections on empirical data based on data, ideas, or concepts drawn from existing theories and

literature as well as in providing a basis for the development of thematic categories from the data (Bowen, 2006; Granbom et al., 2014).

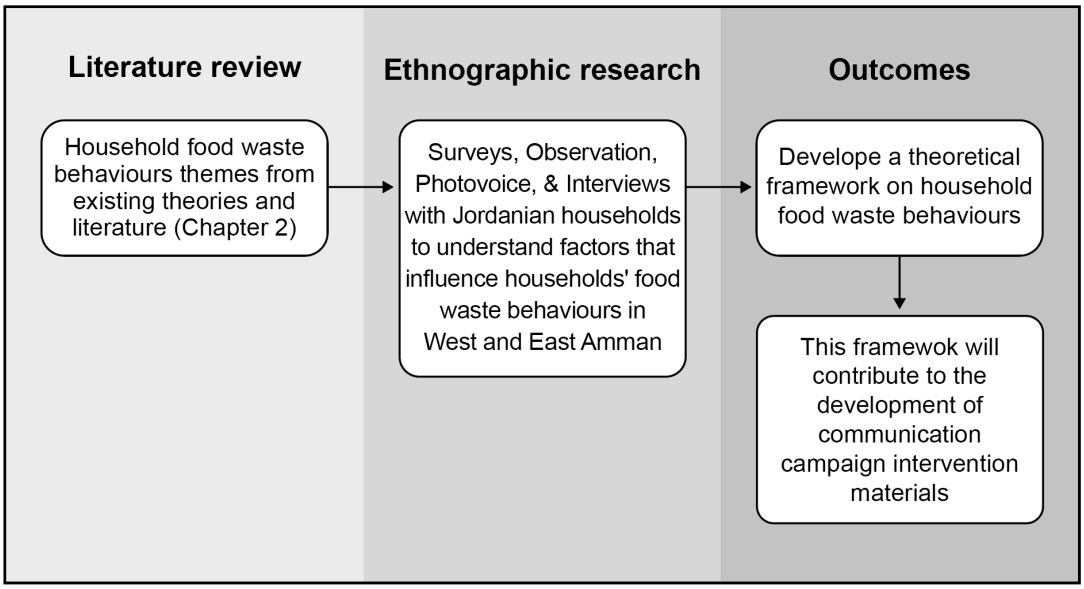


Figure 3. 8 Approach for developing a theoretical framework model on household food waste behaviours in West and East Amman

Four distinct steps were involved in the process. First, participatory methods such as survey, observation, photovoice and interviews guides were developed in line with the themes the researcher gathered from the existing theories and literature. Second, the researcher collected data with the theoretical concepts in mind but remained open to new empirical and theoretical concepts that may occur during the ethnographic research. Third, a thematic analysis approach was employed to facilitate understanding of the results. Fourth, the researcher allowed inductive codes to emerge from the data, as these codes could provide new insights into participants' views and theories. All data were translated from Arabic to English, transcribed, and then open-coded using the software program NVivo (see Appendix II). The two most fundamental uses of NVivo were to store and manage transcripts and memos, as well as to create and manipulate documents. Prior to any analysis, the collected data were merged into one dataset. The single dataset was then sorted by the targeted group and participant name.

3.9 Study population and sampling

Participants for this research comprise nonfamily and family households in West and East Amman in Jordan. Four key groups were targeted: single-person household, single-parent family, couple without children and couple with children. The reason behind the choice of the four key groups to guarantee integrating all segments of the Jordanian society. It was vital to only recruit Jordanian households from two very diverse locations to guarantee utterly disparate demographics and cultural differences, which otherwise could interfere with the results, as different culture plays a crucial role in shaping food, eating, and nutrition, as well as waste generation (Rozin, 2005). Since the households possess different lifestyles, the differences in behaviours due to food-related practices and routines could be most evident in West and East Amman. According to Punch (2014), researchers use sampling strategy to collect data from the sample, analyse the data to draw conclusions, and then generalise the findings to the population as shown in Figure 3.9.

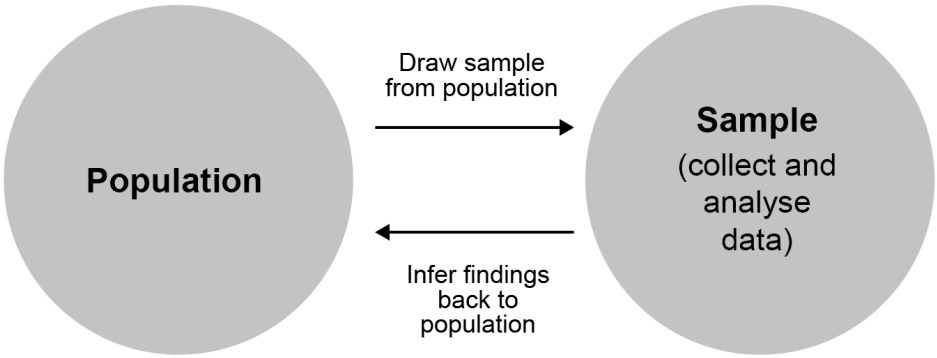


Figure 3. 9 Population and sample (reproduced from (Punch, 2014 P. 244))

The different phases of this research required different methods of sampling. Based on Punch (2014), three questions were considered when selecting each sampling strategy:

1) What will be the size of the sample, and why?
2) How will it be selected, and why?
3) What claims were made for its representativeness?

The sampling strategy for each stage of the research is presented in Table 3.2, and a detailed explanation of the strategy given below.

Table 3.3 Overview of sampling strategy

stage	Sample recruitments	Sample size	Recruitment method
Research exploration 1	Policymakers and experts in solid waste management, environmental awareness fields from the Ministry of Municipal Affairs, Ministry of Environment and NGOs in Jordan	13	Through professional contacts, via email and phone calls. Some policymakers' recommendations.
Research exploration 2	Jordanian family and nonfamily households living in West and East Amman	20	Through the researcher's family friends and family friends of friends.
Communication campaign development and implement	Communication designers, Jordanian households, and experts in running social and behaviour change campaigns from the Arab World	13	Through design network, via email and phone calls. Some designers' recommendations.
Communication campaign evaluation	Jordanian family and nonfamily households living in West and East Amman	14	Through the researcher's family friends and family friends of friends.

In the research exploration 1 stage a selection of policymakers and experts was required to understand the current situation on solid waste in general and food waste in particular in Jordan. A quota sampling strategy was used to obtain a representation of policymakers and experts in solid waste management, environmental awareness fields from the Ministry of Municipal Affairs, Ministry of Environment and NGOs in Jordan. According to Robson (2011), convenience sampling is the most common method of quota sampling. Accordingly, the researcher used his professional contacts to approach suitable policymakers and experts. A snowball technique was employed, with some policymakers recommending other experts to take part, until the adequate uncontrolled quota was reached. The recruitment strategy used to define the number of policymakers and experts involves recruiting, studying, analysing the data, and stopping the recruitment of new participants once the data is saturated. The number of policymakers and experts was set to 13 as no more remarkable variations were coming from the data; thus, a larger sample size would not have been beneficial. The convenience sampling strategy was used to recruit participants, and theoretical

saturation was used to collect data continuously until no new information was able to emerge.

The interviews took place in Amman, Jordan with one exception: three interviews took place over Skype in July 2019. The interviews were conducted at the offices of policymakers and other experts, whichever location was most comfortable for the interviewee. Policymakers and experts took part in the interviews. They specialise in solid waste management, environmental awareness, and sustainability fields from the Ministry of Municipal Affairs, Ministry of Environment and NGOs in Jordan. It was necessary to continue the interviews until the theoretical saturation was reached. A theoretical saturation occurs when no new information category can emerge during the data collection process (Eisenhardt, 1989). In other words, the interviews found no additional data and similar instances repeatedly of the current situation of solid waste management in Jordan. Hence, the researcher became empirically confident that the interviews were saturated. Table 3.4 summarises the expertise and position of the interviewees.

Table 3.4 Experts profiles

Expert ID	Area of Expertise	Expert position
E1	Solid waste management, Environment, Sustainability, Policies, and regulations.	Minister of Water and Former director at Water, Energy, and Environment Centre, the University of Jordan.
E2	Solid waste policies and regulations.	The director of solid waste management at the Ministry of Environment, Amman, Jordan
E3	Solid waste policies and regulations.	Chairman of Greater Irbid Municipality Committee and the Ministry of Municipal Affairs.
E4	Developing a national solid waste management training program, Improving solid waste management in the hotel industry and Moderate focus groups with stakeholders.	Specialist at Federation of Canadian Municipalities, Amman, Jordan.
E5	Soil fertility, Plant nutrition and Composting food waste.	Professor in Natural Resources and Environment, Jordan University of Science and Technology.
E6	Solid waste management, Waste treatment, Converting waste to energy.	Professor in Civil Engineering, Jordan University of Science and Technology
E7	Food processing, Sustainability, Recycling, Food waste.	Associate Professor of Food Processing, Jordan University of Science and Technology.

E8	Environmental protection and governance with specialised expertise in policies and programmes, participation and communication, environmental integrated management.	Managing Director at ArabEnv Environmental Solutions and Sustainability.
E9	Recycling and Upcycling.	Founder & CEO the Recycly Initiative in Amman, Jordan
E10	Livestock policies and regulations.	Assistant Secretary-General for Livestock
E11	Agriculture policies and regulations.	Head of the Directorate of Agriculture's Irbid.
E12	Environmental awareness.	Researcher at Jordan University of Science and Technology.
E13	Solid waste policies and regulations.	Ministerial assistant at Ministry of Environment.

In the research exploration 2 stage, a selection of Jordanian family and nonfamily households living in West and East Amman was required to understand food-related behaviour patterns in their daily household routines. The strategy to define the households for the survey, ethnographic observation, photovoice, and semi-structured interviews included the use of quota sampling. This strategy was utilised to reach the desired number of representatives of the population (Robson, 2011). The sample for the study was comprised of four key groups for a total of 20 households:

- 4 single-person households
- 4 single-parent family
- 4 couples without children
- 8 couples with children.

20 households in the West and East Amman were selected for their accessibility. Potential households were observed at their kitchens and grocery stores to identify the factors that influence their food waste behaviours. Households were invited to take part through the researcher's family friends and family friends of friends. The intention was to recruit participants who expressed interest in discussing their household's food waste behaviour. Purposive and self-selection strategies bias toward individuals who are most interested in the study and willing to commit to the amount of time and self-reflection was needed to provide articulate insight (Elliott et al., 2012).

12 participants responded to the initial call for participation via email and WhatsApp, and preliminary meetings were set up to discuss the aim of this research. Once they had participated in the study, participants were asked to pass along the researchers' contact information to other classified participants from West and East Amman who they thought might be interested in participating in the study. After requesting that participants put out another call for new participants, eight additional study participants were recruited through the family friends of friends. Table 3.5 presents the number of households involved in this study.

Table 3.5 Participating groups in this study

Household ID	Group	Location
HW1	Couple with children	West Amman
HW2	Couple with children	West Amman
HW3	Couple with children	West Amman
HW4	Couple with children	West Amman
HW5	Couple without children	West Amman
HW6	Couple without children	West Amman
HW7	Single-parent household	West Amman
HW8	Single-parent household	West Amman
HW9	Single-person household	West Amman
HW10	Single-person household	West Amman
HE1	Couple with children	East Amman
HE2	Couple with children	East Amman
HE3	Couple with children	East Amman
HE4	Couple with children	East Amman
HE5	Couple without children	East Amman
HE6	Couple without children	East Amman
HE7	Single-parent household	East Amman
HE8	Single-parent household	East Amman
HE9	Single-person household	East Amman
HE10	Single-person household	East Amman

The communication campaign development and implement stage included 13 participants in total five communication designers, four households, and four experts in developing social and behaviour change campaigns from the Arab World. The researcher ensured that the maximum number of participants should attend to ensure the accuracy and success of the development of the communication campaign. A quota sampling strategy used a convenience and purposive sampling since it involved choosing the most convenient participants to act as respondents (Robson, 2002). The

researcher used his design network to approach potential participants. Table 3.6 presents the number of households involved in this study.

Table 3.6 Participants profiles

Participant ID	Area of expertise	Participant position
CD 1	Communication Design	Art Director at Retrodict Agency
CD 2	Communication Design, Social media marketing	Communication designer at Outline Agency
CD 3	Motion graphics, Illustration	Freelancer
CD 4	Advertising, Social media marketing	Graphic designer at Chain Reaction
CD 5	Corporate identity, Concept development	Graphic designer at Lapix Studio
BCC 1	Awareness campaigns	Solid waste management specialist at Federation of Canadian Municipalities
BCC 2	Social and behaviour change campaigns	Advisor at PERSGA.org
BCC 3	Awareness campaigns, Social media marketing	Graphic designer at Rebellion Art
BCC 4	Awareness campaigns	Senior designer at Memac Ogilvy Advize
HW1	-	-
HW2	-	-
HE3	-	-
HE4	-	-

The communication campaign evaluation stage also used a convenience sampling approach: Jordanian family and nonfamily households living in West and East Amman were selected to test and evaluate the communication campaign intervention materials. These households were approached and asked if they would take part in the campaign. 14 households of the original four key groups who previously participated in the research exploration two stages were selected. There was a need for more intensive interaction with households, to perform specific tasks, and evaluate the intervention materials (e.g., food waste quantification, semi-structured interviews). Consequently, the researcher believed that this group was an adequate group for the purposes of this PhD research. Some key target groups were excluded due to the Covid-19 pandemic as the internet and digital devices played an important role in allowing households to interact with the campaign intervention materials and evaluate them later. Table 3.7 shows the number of participants involved in the campaign.

Table 3.7 Participants involved in the communication campaign in Amman

Household ID	Group	Location
HW1	Couple with children	West Amman
HW2	Couple with children	West Amman
HW3	Couple with children	West Amman
HW4	Couple without children	West Amman
HW5	Couple without children	West Amman
HW6	Single-parent household	West Amman
HW7	Single-person household	West Amman
HE8	Couple with children	East Amman
HE9	Couple with children	East Amman
HE10	Couple with children	East Amman
HE11	Couple without children	East Amman
HE12	Couple without children	East Amman
HE13	Single-parent household	East Amman
HE114	Single-person household	East Amman

3.10 Validity and reliability

Research validity and reliability are concepts intended to respectively evaluate the accuracy and consistency of the data collected throughout the research (Gibbs, 2007). The extant literature provides examples of research validation techniques including reviewing data collection with study participants; involving multiple researchers in the data collection process; an accurate description of participants and the environment; triangulation of data; identification of researcher's and participants' biases; more time spent in the research environment; and external auditing of the entire project (Creswell, 2014). The validation strategies used within this investigation comprised some methods to articulate the accuracy of the research (Creswell, 2007). These methods were used throughout the research, each of which will be explained in more detail below.

Triangulation of data

Researchers use a triangulation strategy to enhance the rigour of their research by using multiple sources (Robson, 2011). In other words, it aims at using a variety of sources and data collection methods to establish codes and themes based on the data collected (Creswell & Creswell, 2013). According to Robson and McCartan (2011), there are four types of triangulations. Table 3.8 presents these types which also explains how the method was applied in the present study.

Table 3.8 Defining and applying the triangulation methods

Type of triangulation	Application to this research
Data triangulation: The use of more than one method of data collection (e.g., survey, observation, photovoice, and semi-structured interviews)	Used in the research exploration phase and the development, implement, and evaluate phase.
Observer triangulation: Using more than one observer in the study	Used in the communication campaign implementation. Another observer in addition to the researcher followed the food waste quantifications practice with the households.
Methodological triangulation: Combining quantitative and qualitative	Used in the development, implement, and evaluate phase, combining food waste quantification method and semi-structured interviews.
Theory triangulation: Using multiple theories or perspectives	Used in theory building in the development of the communication campaign.

Methodological data triangulation has been used multiple data collection techniques to complete the development, implement and evaluate phase to ensure data reliability (Yin, 1994). Therefore, in this research, data was triangulated by using data collected from the ethnographic research and combining it with the development, implement, and evaluate results to triangulate the households evidenced food waste behaviours and reasoning behind their actions. This allowed the researcher to identify the most factors and intervention materials that are more likely to influence the households' food waste behaviour in Jordan.

Rich descriptions and mechanical data recording

Researchers are advised to precisely record all elements and experiences that occur during studies to obtain realistic results (Creswell, 2014). All data collection activities conducted for this research were documented by taking notes and/or by using digital recording equipment.

Non-random sampling

Applying non-random sampling strategies is another way to ensure validity in quantitative research (Gray, 2014). Purpose, quota, and snowballing sampling strategies applied in this research are all considered to be non-random, improving the validity and consistency of collected data.

3.11 Ethical considerations

Researchers should reflect constantly on ethical issues when collecting, analysing, reporting, sharing, and archiving data (Creswell & Creswell, 2018). Since this research involved human participants, it was inevitable to follow qualitative research ethical standards. During the research process, the researcher had an obligation to protect both the experts and households (see Appendix IV). For this reason, an ethical approval form and risk assessment form were submitted to the Brunel Research Ethics Online (BREO) prior to conducting the methods. These forms provided detailed information about the following: the research purpose, possible advantages and risks associated with participating, the involvement required from participants, the consent process, and arrangements to ensure confidentiality and anonymity. Participants were asked to consent under no pressure.

The participants' personal data was protected through data storage. A full pseudonymisation of the data has been accomplished, which indicates that the data cannot be attributed to participants without obtaining additional information. Photographs, audio transcripts, field notes, and other documents were stored in a secure folder to prevent accidental data loss. In accordance with the agreement made with participants, these data may only be accessed by the researcher.

3.12 Summary

This chapter provided an overview of the methodology used in this research. The presentation began by describing the research framework and how the aim and objectives, in conjunction with the background of the research, led to the research questions that needed to be addressed. Therefore, this research identified the appropriate research methods and sampling strategies for addressing the research questions. Saunders et al. (2009) research onion is adapted to demonstrate in detail the approaches that were applied during the different phases of this PhD research. Research philosophies are discussed along with the specific details of data collection and analysis methods, ranging from broader aspects to the most detailed.

Chapter 4 Food waste in Jordan

4.1 Introduction

This chapter describes the activity undertaken as part of the exploration research phase, which aims to understand the current situation and the future plan on solid waste in general and food waste in particular in Jordan. The extant literature on food waste reviewed (see Section 2.2) is limited and literature on food waste in Jordan is negligible and scarce with a lack of reliable data, sources, drivers, policies, interventions, and initiatives directed at reducing food waste. This research attempts to address the food waste issue in Jordan. Therefore, semi-structured interviews with experts were conducted to gather information concerning food waste issues and concerns, household food waste behaviours and interventions. This comprehensive information would support the subsequent research steps. The interviews with experts were crucial for the identification of the current and future plans on food waste issue in Jordan.

The structure of this chapter is as follows: first, the protocol and findings of semi-structured expert interviews are presented in detail. Second, the comparison between the literature review findings and outcomes from the expert interviews are highlighted.

4.2 Results and findings

The findings described below provide a complete understanding of the challenges and problems facing Jordan in addressing the food waste issue, strategies and regulations, and related awareness campaigns. A purposeful sample of 13 eligible participants was utilised for the interviews, before reaching thematic saturation (see Section 3.7.2). All interviews were conducted between 28 July and 22 August 2019. At the beginning of each interview, interviewees were briefly introduced to the aim of the study and asked to read the participant information sheet to understand the aims of the interview and of the study in general. They were also given an opportunity to raise any questions or concerns, before signing the consent form. The interview protocol can be seen in Appendix I.

The participants were asked to discuss their opinions on food waste issue. All of the experts agreed that the issue of food waste remains a serious concern, and urgent action needs to be taken to reduce its impact: "… in my opinion, food waste is one of the biggest problems which requires the cooperation of all nations" (E2); "… it is not only the international community's responsibility to tackle food waste, but also the responsibility of local and regional governments" (E1); "Jordan has been experiencing an increase in the amount of food waste over the past few years, resulting in increased environmental and economic stress" (E8). Three interviewees described the consequences of food waste issue in Jordan: "… as a rapid population and economic growth in Jordan, as well as unsustainable consumption and production patterns, waste generation has become increasingly recognised" (E3); "… managing solid waste properly is one of the biggest challenges facing Jordan as a low- and medium-income country, with the majority of efforts directed toward reducing final waste volumes and establishing adequate funding sources" (E4).

4.2.1 Challenges and problems

Several challenges and problems related to food waste were revealed by in-depth interviews with policymakers and experts. To contextualise findings, it is important to note that the most common difficulties included by all interviewees were **(i) environmental concerns**, **(ii) limited governmental financial resources**, **(iii) socioethical issues, (iv) a lack of partnerships between governmental institutions and NGOs at the national level, and (v) a lack of awareness campaigns about the problem.**

The interview participants confirmed the existing literature that challenges, and problems linked to **not having a solid waste management policy yet in Jordan** (E1, E2, E3, E10, E11, and E13): "In the country, there is no policy regarding solid waste management" (E2). **Challenges in improving solid waste management at the national level** was identified by: (E2, E3, E6, and E12): "I can personally tell you that solid waste management has been gradually improving over the last 20 years since it was among the issues that had to be addressed urgently" (E3). E1 and E2 affirmed that **the amount of municipal solid waste has rapidly increased every year putting Jordan under pressure**: "Based on the recent statistics, the estimated solid

waste generated in our country is over 2.2 million tons with a significant growth in solid waste of 9% annually which put persistent financial and environmental strains" (E1). E1, E2, E3, and E13 confirmed what has been discussed in the literature (see Section 1.2) that **solid waste does not undergo segregation** and **ends up in unsanitary landfills**: "Unsanitary landfills has been used for many years as the most common mean for solid waste disposal generated by different communities" (E3). All interviewees emphasised the **urgent need for the separation of wet waste and dry waste** because of its **environmental and economic importance**: "I mean, from my perspective, the waste segregation is imperative in order to protect the environment and economy of the country" (E5). Half of the participants confirmed the literature (see Section 1.2) that **two-thirds of the municipal solid waste is comprised of food waste**, which produces liquid and gaseous emissions that are harmful to the environment: "[…] the predominant fraction in Jordanian MSW is food waste which makes up as much as 60% of the solid waste stream, which poses a threat to groundwater, surface water resources and soil which decomposes and releases methane" (E1).

The **population growth** and **influx of refugees** contribute substantially to a rise in food waste were identified by E2 and E12: "[...] in my opinion, industrialisation, and high population growth rate as a result of recent forced migration in the country have led to a sharp increase in food waste generation, putting additional pressure on the existing waste management infrastructure" (E2). Further, **financial constraints** and **equipment shortage** were pointed out by all interviewees: "[…] the main challenges Jordan faces are financial constraints, shortage of adequate equipment and skilled manpower have contributed to Jordan's poor solid waste management programs" (E1).

Lack of information on laws and **ineffective public awareness campaigns** on the implications of food waste were identified by all interviewees: "I believe the low level of awareness campaigns concerning the environmental, economic and social impacts of improper waste management has made it difficult to implement recycling and disposal programs that require the cooperation of the communities to be successful" (E8). Nearly all interviewees emphasised that **the highest priority is to develop a national action plan for sustainable solutions and understanding the Jordanian**

society's behaviour in order to launch effective awareness campaigns: "[...] if we talk about food waste issue, it is a fact that a national action plan is urgently needed and that society's behaviour towards food waste reduction must be observed prior to implementing an effective awareness campaign" (E8).

4.2.2 Strategies and regulations

Regarding strategies and regulations, the interviewees confirmed the literature review and discussed the difficulties that they encountered due to the **shortage of information** about the strategies and regulations in Jordan (E1, E2, E3, E11 and E13): "Jordan currently does not have a comprehensive national waste management strategy" (E11). **Lack of governmental and non-governmental actions** was identified by E1, E2, E8 and E10: "a request for proposals to develop a national MSW strategy was issued in 2012 as part of the Regional and Local Development Project funded by the World Bank and implemented by the Ministry of Municipal Affairs, but no action has been taken" (E2). E1 and E3 highlighted that there will be **a new municipal solid waste strategy in 2034, which is the first of its kind in Jordan:** "It is not good enough to be good but a first nation-wide plan to set up separate collection systems for recyclable materials by the year 2034" (E3); "… it is intended to achieve, as a first step, the transition to sustainable patterns identified in the new national strategy and action plan for mainstreaming sustainable consumption and production into the food production, transportation, and waste management sectors in Jordan" (E1). According to E1 and E3, **Jordanian community plays a important role in the success or failure of such strategy**: "As part of this strategy, Jordanian citizens will play an important role in the development process; the extent of the progress made at the individual level determines success and failure, as well as the social welfare of the community as a whole" (E1).

4.2.3 Related awareness campaigns

It was identified by all interviewees that Jordanian municipalities and NGOs **have not implemented awareness campaigns or other interventions related to food waste reduction in Jordan**: "[…] Although it is an urgent necessity, there are currently no awareness campaigns focused on food waste issue" (E8). E4 and E9 highlighted that there is a **very limited number of awareness campaigns on the implications of**

solid waste: “[…] There were very few awareness campaigns to reduce plastic waste in Jordan, but they showed lack of effectiveness” (E9). E4, E8 and E9 agreed that such awareness campaigns were **randomly located, flashy and designed in an ineffective manner**: “[...] During the last few years, only a few campaigns have been implemented, and they are randomly located, flashy and designed unprofessionally” (E4). E4 and E8 identified that **governmental and non-governmental organisations failed to launch effective awareness campaigns** can make a fundamental change and produce well-defined benefits for several reasons, the main one **being technically unqualified to design and implement effective awareness campaigns**: “[...] municipalities, NGOs and generally the local authorities have been generally proved to be technically underqualified to effectively design and implement awareness campaigns, situation which is also deteriorated by their insufficient financial capacity" (E8).

4.2.4 Summary: comparison between literature and Semi-structured interviews findings

Building upon the results obtained through the literature review and semi-structured interviews, Table 4.1 below summarises the current situation and the future plan on solid waste in general and food waste in particular in Jordan. Table 4.1 explains the themes mentioned in the literature and confirmed by expert interviews. In addition, it identifies findings that are unique to the expert interviews but never discussed in the literature.

To summarise the literature review findings and the outcomes of the semi-structured interview, a fully comprehensive understanding of the food waste challenges, strategies, and relevant awareness campaigns is provided in this section. All of the interviewees confirmed the majority of the literature review findings linked to food waste challenges and problems. For instance, a solid waste management policy does not yet exist in Jordan. In contrast, experts introduced some food waste challenges previously unidentified in literature. E5 added that: “… the problem of food waste is one of the most alarming environmental problems facing Jordan's groundwater, surface water, and soil”. Additionally, all strategies and regulations linked to food waste and named by the interviewees were not previously observed in literature. Further,

noticeable shortages of information named by all experts are related to the strategies and regulations in Jordan. Finally, all interviewees confirmed the literature review findings that there are no awareness campaigns, or any other interventions related to the issue of food waste in Jordan. On the other hand, awareness and educational campaigns related to solid waste in Jordan previously unidentified through the literature review and introduced by four experts is very limited number of awareness campaigns on the implications of solid waste: "… there are a small list of awareness campaigns that have been implemented by Municipalities on solid waste" (E2). In spite of this, these campaigns did not succeed in launching effective awareness campaigns.

Table 4.1 A complete list of the current situation, as well as future plan, on solid waste in general and food waste in particular in Jordan

Theme	Findings	Literature review	Expert interviews
Challenges and problems	Jordan does not have a solid waste management policy yet	X	X
	Challenges in improving solid waste management at the national level		X
	The amount of municipal solid waste is increasing steadily every year, which puts Jordan under pressure		X
	Municipal solid waste does not undergo segregation	X	X
	Municipal solid waste ends up in unsanitary landfills	X	X
	A separation of wet and dry waste is urgently needed due to their negative effects on the environment and economy in Jordan		X
	Jordan's groundwater, surface water, and soil are seriously threatened by food waste mixed with other solid wastes		X
	Over 60% of the municipal solid waste is comprised of food waste	X	X
	Population growth	X	X
	Influx refugees	X	X
	Financial constraints	X	X
	Equipment shortage	X	X
	Lack of public awareness campaigns	X	X
Strategies and regulations	Lack of information on laws		X
	Shortage of information about the strategies and regulations in Jordan		X
	Lack of governmental and non-governmental actions		X

	New municipal solid waste strategy in 2034, which is the first of its kind in Jordan		X
Related awareness campaigns	No awareness campaigns or any intervention related to food waste issue in Jordan	X	X
	Very limited number of awareness campaigns on the implications of solid waste		X
	Awareness campaigns were randomly located, flashy and designed in an ineffective manner		X
	Governmental and non-governmental organisations failed to launch effective awareness campaigns		X

4.3 Summary

This chapter discussed the findings of the food waste issue in Jordan. It provided a description of the current situation and the future plan on solid waste in general and food waste in particular in Jordan. Initially, it presented the challenges and problems of food waste in Jordan. Then, it described the strategies and regulations that are relevant to food waste. Further, it explained the awareness campaign related to food waste in Jordan. Finally, the researcher provided a comparison between literature and Semi-structured interview findings.

Chapter 5 Understanding household food waste behaviours in Jordan

5.1 Introduction

This chapter addresses the objective of understanding households and providing a clearer picture of behaviours related to food waste practices and the determinants of these behaviours. To understand the ways in which this research can change households' behaviours, it is necessary to understand how they generate food waste at the household level. Upon completion of the expert interviews, the importance of understanding households' behaviours was recognised as a pivotal point prior to developing an awareness campaign (see Section 4.2.4). Therefore, it is imperative to understand Jordanian householders' behaviours in a broader context. Given that there is modest publicly available data on the composition and amount of food waste produced in different food systems, this chapter will provide a more detailed understanding of the current behaviour patterns of target households in the West and East Amman. This information helps answer the second research question: **What are the factors that influence household food waste behaviour in Jordan?** and provides material that informs the development of the communication campaign aiming at motivating households to reduce food waste.

Extant literature indicates that no conclusive evidence available in the literature regarding household food waste behaviours in Jordan (see Section 2.2.4). In other words, different contexts may produce different behaviours regarding household food waste. For instance, family composition and household size have an impact on food waste generation in relation to food practices and routines. A household with children wastes more than a household without children (Cox & Downing, 2007; Parizeau et al., 2015). It is common for children to not finish their meals, which may contribute to household food waste. However, larger households generate less food waste per capita than smaller households (Parizeau et al., 2015; Williams et al., 2012b). In contrast, it has been found that household size has no major impact on waste per capita, but single-person households generate the most waste per capita (Jörissen et al., 2015; Koivupuro et al., 2012a). Despite food being wasted at all income levels, low-income households waste less food than high-income households (Cox &

Downing, 2007; Pearson et al., 2013). Furthermore, food waste has also been shown to increase household income (Baker et al., 2009). It is important to highlight that some authors found that income had little or no correlation with generating food waste (Koivupuro et al., 2012b; Wenlock et al., 1980). This chapter attempts to identify the factors that influence household food waste behaviours in Jordan and use these factors systematically to feed the subsequent phases of this research.

This research provides a substantial amount of data regarding food waste practices and routines by using four methods (see Section 3.7.2). First, open-ended surveys have been conducted with the households and the questions covered their food waste behaviours, planning and shopping routines, environmental beliefs, and attitudes. Second, an ethnographic observational method was applied to understand and specify the context of food waste practices and routines. Third, photovoice method has been applied to offer more data on household food waste behaviours on a daily basis. Fourth, semi-structured interviews have been conducted to allow the households to share their opinions regarding the photographs they took. Combining the household's observation study and the photovoice method with in-depth attitudinal questions can create a richer set of data for analysis (Kuniavsky, 2003). For this reason, the researcher decided to use a joint approach rather than rely on only techniques such as surveys to avoid discrepancies between observed and actual behaviours (Robson, 2011).

The four methods have been integrated and combined with the literature findings to adapt and adopt an existing theoretical framework model to identify factors related to household food waste behaviours in Jordan which are then tested to be confirmed or rejected. Data from this study provided information about the food practices and routines, household food waste behaviours and helped to explain why people behaved as they did. Results provided comprehensive data on household behaviours influencing food waste, identified which behaviours should be modified to reduce food waste and listed the determinants of these behaviours.

5.2 Results

The data analysis from the ethnographic research showed diverse results regarding households' food waste behaviours in West and East Amman. The results are discussed in this section.

5.2.1 Socio-demographic characteristics of the participants

A total of 20 family and non-family households in west/east Amman participated in this study. In both West and East Amman, the number of participants was similar, with 10 families for both locations. The overall demographic distribution of the participants was multigenerational including 36 females and 39 males (75 household members in total). The average household size was four while there were nine households with five or more individuals. In addition, the 24-54 age group dominated (32 individuals), and the 65 years and over age group comprised a minor portion (one person). A more detailed distribution of the respondents' demographic information is presented in Table 5.1.

Table 5.1 Distribution of the households based on their demographic information

Gender	Male	39
	Female	36
Age Group	0-14	18
	15-24	20
	24-54	32
	55-64	4
	65 and over	1
Location	West Amman	33
	East Amman	42
Education	Pre-school education	4
	Primary school	14
	Secondary school	13
	Bachelor's degree	38
	Master's degree	2
	Doctorate	3
	Illiteracy	1
Household composition	Single-person household	4
	Single-parent family	4
	Couple without children	4
	Couple with children	8
Monthly income	JOD 500 or under	6
	JOD 500 - 1000	4
	JOD 1000 - 1500	1
	JOD 1500 - 2000	3
	JOD 2000 or over	4
	Prefer not to say	2

The socio-demographic characteristics of the participating households showed some differences between the two sites. In West Amman, 15 of the participating individuals were 14 to 24 years old, while in East Amman the age groups were mostly 24 to 54 years old (21 individuals). Age and gender were attributed to the entire households, whereas data about food waste and consumption habits, and especially about food waste generation, were collected from individuals of different ages and genders. In both sites, couples with children have the highest composition (4 families for each location). The other three household compositions were equal (2 families for each location, 12 families in total) and there were slight differences between both locations in the share of households. Couples without children were two families in both locations and households with five or more individuals were two families in West Amman and seven families in East Amman. The number of couples with children households with five and more individuals was almost in East Amman.

Regarding the monthly income, households in West Amman earned more money on average. The highest income group earned around JOD 2000 per month was represented by four households in West Amman, while East Amman had no representation of the same monthly income. Most households in the income groups earning below JOD 500 were in East Amman (6 households).

5.2.2 Food-related practices and routines

Extant literature has investigated food-related practices and routines in the context of food waste generation. For instance, Hebrok and Heidenstrøm (2019); and Schanes et al. (2018) provided valuable insights by considering food waste in relation to daily food-related procedures and processes at the household level. In light of the complexity of food waste, household food practices and routines play a crucial role in food waste generation (Evans, 2012; Waitt & Phillips, 2016). With the purpose of understanding the current behaviour patterns of target households in Amman, six tasks were given to all households. The following activities have been covered respectively: 1) Planning purchases and meals; 2) Shopping; 3) Storing; 4) Cooking; 5) Eating; and 6) managing leftovers. Hence, participant observation has been emphasised as the main method of primary data collection to cover the activities. However, Rodríguez et al. (2006) argue that observation by itself is not sufficient to

identify the complexity of behaviour. Open-ended questionnaires, photovoice and semi-structured interviews offered an advantage in supplementary data collection. Combining these methods provided a way to overcome the limitations of forming conclusions based on a particular type of research. Thus, multiple methods were chosen for this study to give a better representation of food waste behaviour as well as to provide an in-depth profile of households' values and intentions behind the daily practice. The following sub-sections describes the results of the six practices and routines in this research (see Figure 5.1).

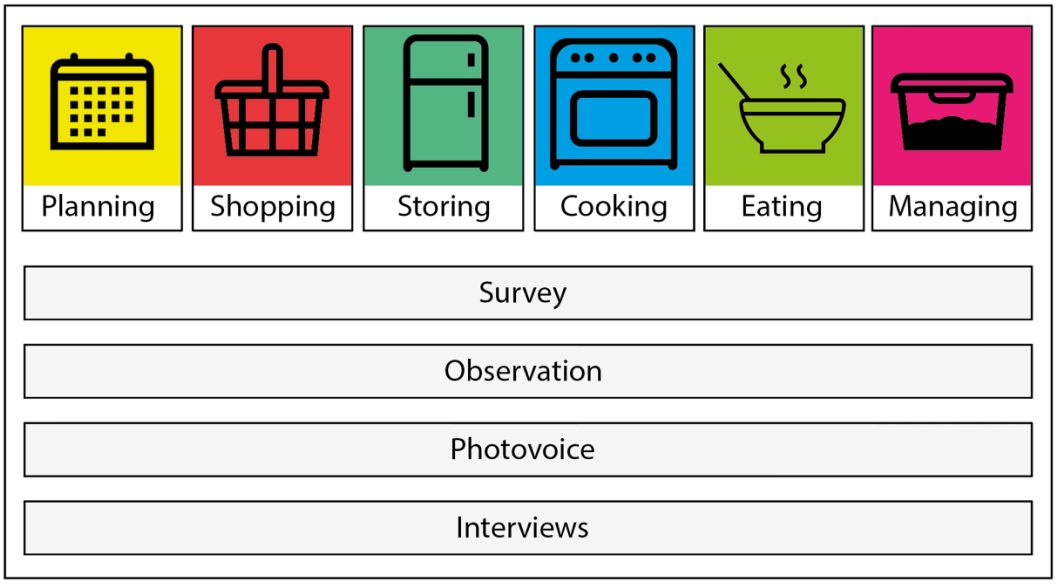


Figure 5. 1 The linkage between food practices and routines and data collection methods

5.2.2.1 Planning purchases and meals

Studies have shown that planning food shopping carefully can reduce overbuying and food waste (Parizeau et al., 2015; Principato et al., 2015). The following strategies have been suggested as effective planning strategies: writing a shopping list, preparing a meal plan in advance, and checking inventories before shopping (Jörissen et al., 2015). While some studies suggest that planning meals and purchases results in less food being wasted (Farr-Wharton et al., 2014; Jörissen et al., 2015; Quested et al., 2013; Stefan et al., 2013), other studies have not shown an evident link between proper planning and food waste reduction (Stancu et al., 2016; Visschers et al., 2016). Nevertheless, more effective planning routines are related to lower spontaneous purchasing items and buying in bulk (Stancu et al., 2016).

Observations from this study indicated that both West and East Amman's households lack planning for family meals and purchases. These families included three groups (couples with children, couples without children, and single-parent households). These housewives are responsible for checking the food and other necessities in the refrigerator, freezer, and pantry. Based on the results of the survey, some households stated that they regularly jot food necessities down in a little notebook to go shopping later or inform their husbands on a mobile phone by sending the shopping list as a message. However, the researcher observed that most housewives forgot to check the rotten and expiry dates of food items they have on hand. Observation revealed that most households do not plan their meals and purchases for the next few days or a week in advance, which could save time and money and ultimately reduce food waste (Parizeau et al. (2015); and Schmidt (2016)), instead they plan in the morning or the night before depending on what the family members desire. The researcher was able to view the shopping list that some families made previously (see Figure 5.2). Families who listed their purchases of food items did not include the quantity for each food item, resulting in purchases greater than those needed.

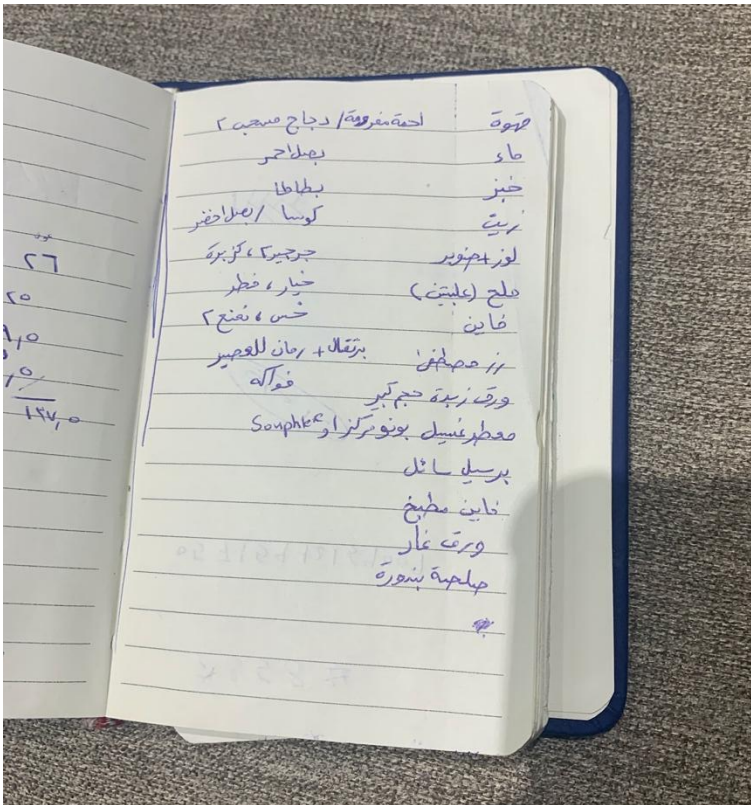


Figure 5. 2 A shopping list from a couple with children in West Amman

Single-person households in West Amman showed a lack of planning where they rarely check their kitchen before shopping, and they are more likely to buy something already in their kitchen. These individuals (i.e., Single-person households in West Amman) seldom cook or eat at home due to their work or academic commitments. Since they eat in cafeterias and restaurants, they do not have a meal plan. On the other hand, single-person households from East Amman are most likely aged 50 years old and over based on the research participants. They do not have a meal plan, and cooking and eating are based on the food available in the kitchen.

In general, most families check food stocks and use a shopping list scarcely but without specifying quantities, while more detailed food planning behaviours (such as meal planning and food budgeting) are implemented less frequently.

5.2.2.2 Shopping

Interestingly, a substantial proportion of the existing literature on food waste focuses on provisioning and shopping routines. Although most households claim to buy an accurate amount of food, they often purchase more food than they need (Evans, 2012; Parizeau et al., 2015). Thus, food overprovisioning is considered one of the most prominent causes of surplus food (Evans, 2012; Mallinson et al., 2016). A study by Jörissen et al. (2015) found that shopping frequency appears to affect the amount of food wasted. Social science scholars Williams et al. (2012), conducted a study in Sweden entitled "reasons for household food waste with special attention to packaging". This study reported less food waste in households that purchase groceries more often in Sweden. On the contrary and through the observations, the food shopping routine involves housewives and/or their husbands shopping for food provisioning after work most weeks or during weekends, which results in more waste being generated. A study conducted in Italy by Setti et al. (2016) revealed that households who regularly purchase local products tend to reduce food waste up to 90%. All West Ammani households and half of East Ammani households purchase their food items from major supermarket chains such as Carrefour, Safeway, and C-town, which supports Jörissen et al. (2015) who indicated that food waste is highest

when people exclusively shop in large supermarkets. The other half of East Ammani households shop at open-air markets, supermarkets, farmer's markets, and bakeries.

The shopping list does not consider how many meals the household will eat at home and when the next shopping trip will occur or if some family members plan to eat out during the week. As stated previously, most households in both locations admitted they do not include quantities on their shopping list to make sure they buy just what they need. Furthermore, West Ammani households primarily choose the most expensive food items due to the belief that expensive items are of the highest quality. They select food items based on quality, freshness, and appearance, whereas East Ammani households select food items based on price, freshness, and quality. Moreover, West Ammani households sometimes make some spontaneous purchases that happen without much contemplation, for instance, buying good looking non seasonal fruits or vegetables that end up in the bin, while East Ammani households are price-oriented and are attracted to promotions and special offer items. In light of the fact that both routines exist in both locations.

There are some households in East Amman that go shopping at night, and when supermarkets offer discounted food, which leads to purchasing additional items because it is discounted. There is evidence from studies related to factors that promote consumer behaviours causing expired domestic food waste reported that promotional offers such as "Buy One, Get One Free" encourage consumers to buy more than they actually need and thus contribute to food waste (Farr-Wharton et al., 2014; Graham-Rowe et al., 2014; Porpino, 2016). The majority of households buy extra quantities of vegetables and fruits because it is cheaper when purchasing in quantity and also because of their generosity. They do not include quantities on the shopping list to make sure they buy only what they need, and they usually estimate the quantity depending on the price. It has been observed in both locations that having surplus food at home signifies generosity (Figure 5.3). The generosity factor is characterised both by the desire to provide an abundance of food and the desire to serve food that is perceived to be “proper”. Through this, parents express affection and love to their family and visitors.



Figure 5. 3 Surplus food shopping for a couple without children in East Amman

5.2.2.3 Storing

During the observations, the researcher noticed participants forgetting rotting food items hidden in the back of the refrigerator and/or cupboard at both locations. The photovoice results revealed that a large number of photos taken by households reflect a lack of knowledge on how best to store food. A number of authors confirmed that systematically storing and categorising food products (i.e., systematic stacking of newer and older foods, or according to the frequency of use) in combination with periodic reordering can lower food waste generation (Farr-Wharton et al., 2014; Waitt & Phillips, 2016). The use of organising practices therefore can enhance visibility and prevent food from being forgotten in the back of the refrigerator (Waitt & Phillips, 2016).

The researcher accompanied 18 participants from the four groups in both locations to shop for groceries. Following the shopping excursions, the participants started storing food items in their refrigerators, freezers, and cupboards. Surprisingly, most participants stored new vegetables like tomatoes and cucumbers together with the old ones which negatively affects the new items due to mixing. The initial interview and survey results revealed that nearly all households in both locations never checked the temperature of their refrigerator although they found large amounts of rotten vegetables like tomatoes, cucumbers, and parsley (see Figure 5.4). It demonstrates

how participants are unsure of storing food safely in the refrigerator, and as a result, they throw away large amounts of fruits and vegetables since they are unable of preserving them from rotting and how-to best store food to extend its shelf life. Contrary to this, there were few participants who used traditional methods to store and preserve food to extend its shelf life such as using mesh net breathable hanging storage bags to store onions, garlics, pomegranates, and potatoes (see Figure 5.5). Space constraints in the refrigerator, together with a lack of knowledge about where certain types of food should be stored, often prevent systematic storage from taking place. Indeed, the majority of households fail to use storing strategies to increase food longevity in their households and have their fridges set to a higher temperature than recommended which can accelerate the decay of food products.



Figure 5. 4 Rotten cucumbers in West Amman as a result of poor storage



Figure 5. 5 Hanging mesh storage bags used in East Amman by a single-person housewife

It has been demonstrated in some studies that freezing food is a good strategy for preventing food from going to waste (Principato et al., 2015; Quested et al., 2013). As of yet, most households in both locations have not fully realised the potential of the strategy. Therefore, the researcher believes that knowledge about proper storage may have indirect effects on food waste behaviour.

5.2.2.4 Cooking

The observation of cooking practices for food waste revealed several key aspects. First, both West and East Ammani households serve a large amount of food compared to the number of family members and often too much food is prepared which ends up being thrown away. There is evidence in the literature that more frequent cooking is likely to improve cooking skills, such as portion control, since estimating portion sizes is one of the most promising approaches to reducing food waste (Graham-Rowe et al., 2014; Jörissen et al., 2015). A better estimation of portion sizes has been identified by Principato et al. (2015), as one of the most promising strategies for preventing food waste. The observer noticed that both West and East Ammani households lack cooking skills such as precise portion control (see Figure, 5.6). The interview results showed that families with children (couples with children and single-parent

households) in both locations found it difficult to predict whether their family members will eat at home at all, which results in an increase in food amount. The researcher observed that most Ammani households cook more than one dish for lunch, which results in food being accumulated in the fridge and then disposed of. In both locations, these households insisted on cooking a new dish despite the fact that there are leftovers in the refrigerator. It was observed in both locations that working mothers who have jobs prepare lunch dishes the night before.

Interestingly, the researcher found a common thing that binds all families in both locations. These households exaggerate serving a large number of pickles, salad and yoghurt and also decorate the dishes by using different shapes of carrots, radish and cucumbers which are thrown away afterwards. Moreover, some households disposed of the excess food (e.g., chopped onions and used cooking oil) in the bin because there is no preference for freezing as it diminishes taste and sometimes because there is no place for it in the refrigerator. Some negative cooking practices have been observed by throwing edible food away which can be used for other dishes. In some instances, households have accidentally squashed the walls of courgettes and disposed of them later. Most households use large plates, which leads to people eating more and wasting more food. It is common for some households to discard onion wedges and lemon slices that have been used in boiling chicken in order to enhance the aroma. This emphasises the lack of cooking knowledge that households use when it comes to preparing food that is intended to reduce food waste. Finally, single-person households in West Amman who mostly rely on food delivery and ready-made meals, waste more edibles than others.



Figure 5. 6 A couple with children housewife cooks a large amount of Malfouf in East Amman

5.2.2.5 Eating

A limited number of studies have explored the role of eating practices in the generation of food waste. Evans (2012) found that households with children create more waste from meals as a result of their unpredictable eating patterns and preferences. The observation revealed that all household groups in Amman usually eat their breakfast meal outside the home (school, university, and work) except for the weekends they have their breakfast at home. Therefore, the researcher was able to observe breakfast meals six times during weekends in the observation phase. In a typical week, housewives usually sip hot coffee/tea alone or with the neighbours in the morning as breakfast while their family members are outside the house.

As previously stated, households with children generate a greater amount of waste from meals due to the unpredictable eating patterns and preferences of children. The photovoice and interview results revealed that some families cook meals that other family members do not enjoy, which leads to an increase in the number of other meals that already exist in the fridge which then end up in the bin. Ammani household lunch meals are usually served on a large tray with a green salad and over a dozen pickles,

including fresh chillies, pickled lemons, radishes, carrots, and spring onions (see Figure 5.7). Households typically serve lunch anytime between 15:00-18:00. There was an incongruity between food bought and cooked with food actually eaten within a certain time frame. The researcher noticed that some West Ammani household groups directly throw leftovers in the bin after they have lunch/dinner at home. Five families stated that:

> "… to be honest, there is an inner conflict that revolves around finishing all the food provided on our plates to reduce food waste on the one hand, and avoiding eating too much to maintain a healthy, slim body on the other hand" (HW1).

Single-person households in West Amman spend more money eating out in restaurants report wasting more and express lower levels of guilt for wasting compared to single-person households in East Amman and other household groups.



Figure 5. 7 The whole meal is served on a large tray by a family with children in West Amman

5.2.2.6 Managing leftovers

Management of leftovers is an important aspect of food practices and routines where household food waste can be reduced by reusing leftovers (Principato et al., 2015).

Findings from the survey indicated that 18 households regularly have leftovers from the meals they eat at home, whereas two households do not have leftovers at all. These 18 households indicated that leftovers are usually eaten at another time or are immediately thrown away due to smell or taste. However, 10 households indicated that leftovers are sometimes

"Fed to animals at home".

Additionally, two single-person households from West Amman do not have leftovers at all because they do not cook to have leftovers at home. Hence, the participants who regularly eat leftovers produce less food waste and this is consistent with what has been found in previous literature (Stancu et al., 2016; Stefan et al., 2013). In the survey question *How do you make judgments about whether leftovers are safe to eat?* It was found that sometimes households have difficulty assessing the durability of leftovers and are concerned with safety issues when considering their re-use. This result is confirmed by previous studies wherein people who perceive a lower risk of food poisoning when consuming leftovers throw away less food (Principato et al., 2015; Visschers et al., 2016). The findings showed a total of 18 households in both locations used multiple strategies for assessing the edibility of their food, including smelling, tasting, and appearance (see Figure 5.8).



Figure 5. 8 A housewife in West Amman threw away an entire jar of olives (pickles) because it was sour and nobody in the family liked that flavour

Contrary to the results of the survey, the observation found that the 20 families in both locations dispose of what remains of food on the family member's plates in the kitchen bin (see Figure 5.9). By comparing the results from the photovoice method, leftovers were often misplaced, forgotten, and/or stored for a long time in the fridge and therefore thrown away in the kitchen bin (Figure 5.10). The researcher noticed that families with children (Couples with children and single-parent household groups) separate the large quantities of uneaten leftovers into a large container to place later into the refrigerator to eat on another day or they keep them outside the fridge until other family members come back from university and work. The observation and photovoice results showed that households in West Amman often find it boring to eat the same meal repeatedly or have an aversion to reheating leftovers because those are perceived to offer less quality and freshness (Figure 5.11). In the survey question *If food is thrown into the rubbish bin in your household, to what extent (if at all) does this bother you?* the 20 households stated their agreement with the measurement items on a five-point scale:

1. A great deal
2. A fair amount
3. A little
4. Not very much
5. Not at all).

18 households replied: "A great deal", one replied "A fair amount", and one replied with "A little". The observation captured that most households usually feel guilty about binning food that may still be edible or simply has aesthetic flaws. A HE15 said that

> “I frequently feel guilty over how much food I waste where I can save money or donate this food to the needy”.

Finally, the survey showed that serving leftovers is not acceptable when visitors are invited for a meal as it is important to present the family in the best possible light which increases food waste (Figure 5.12).



Figure 5. 9 A HW4 dispose of what remains of food on their son's plate

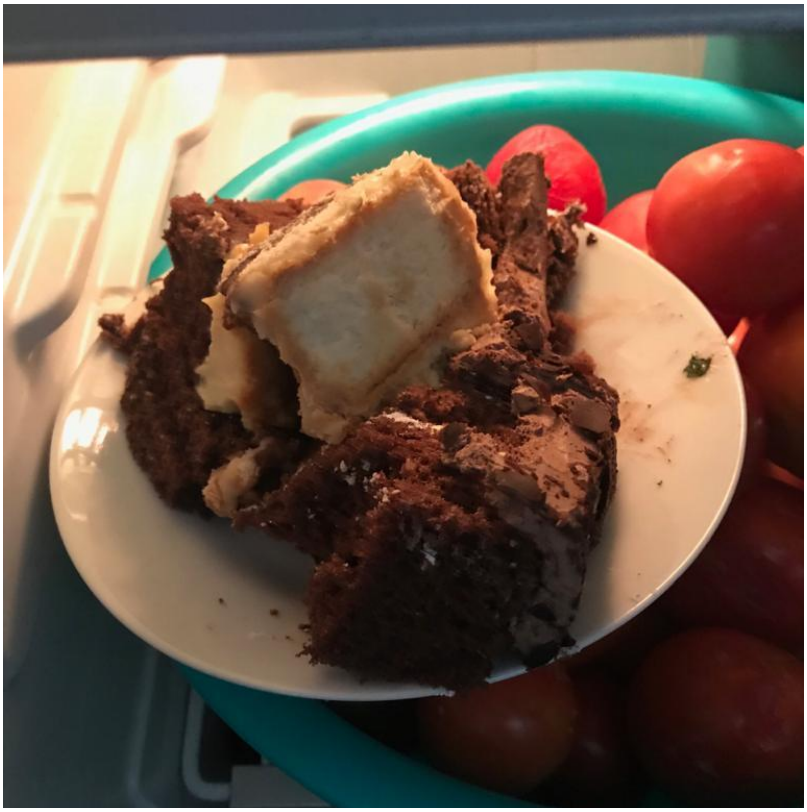


Figure 5. 10 Some pieces of cake that were left in the fridge for more than a day were thrown away due to worrying about its safety



Figure 5. 11 Several bread loaves and falafel were discarded by a HW7 because they only consumed fresh foods



Figure 5. 12 Surplus portions at a lunch feast in East Amman

5.2.3 Household food waste reasons

Upon analysing the data collection methods (survey, observation, photovoice, and interviews), the researcher found that there is a diverse range of information regarding reasons for wasting food at the household level in both locations. Moreover, participants' responses from the survey were compared with the other methods of data collection (observation and photovoice) representing a set of the most thrown away food items. These findings from the observation and photovoice methods demonstrate that there are no large differences in terms of the portion of the household's total food waste between both locations. Foods commonly thrown away at both locations include fruits and vegetables, rice, bread, and cooked leftovers. Relatively higher amounts in East Amman include bread, rice, cooked leftovers, and fruit and vegetables, relatively lower amounts mainly affect meat and fish, dairy products, and meal ready-to-eat food. When higher amounts in West Amman concern cooked leftovers, fruit and vegetables and rice, relatively lower amounts mainly affect meal ready-to-eat food and dairy products. Figure 5.13 shows an estimation of the most wasted food items often and sometimes in West and East Amman. This estimation is based on the observation and photovoice results and does not have any kind of measurements.

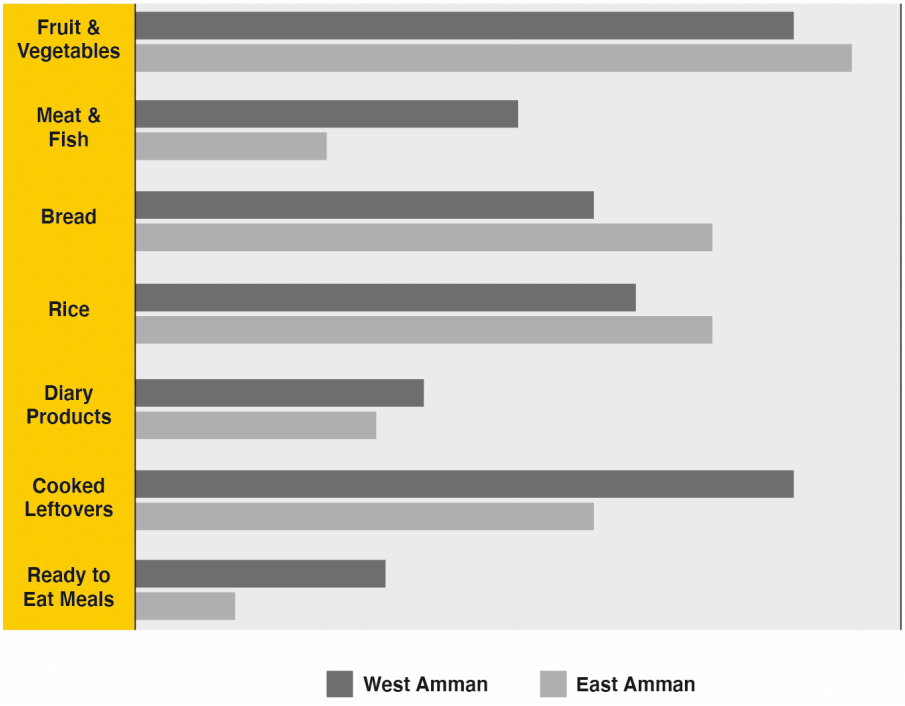


Figure 5. 13 An estimation of the most wasted food items per household in West/East Amman

During the observation, the researcher realised the interrelations between household characteristics and reasons for food waste. Food waste was slightly influenced by household composition and family size. For instance, adults waste more food in absolute terms than children in West Amman while the opposite happens in East Amman. This may be attributed to income differences being lower in East Amman which increases responsibility for important commitments, and the number of children was higher which was obvious throughout this study in East Amman.

The results of this study agreed with what was reported in the literature in both locations – that larger households generate more food waste than smaller ones, while the amount of food waste generated per capita decreases with increased household size (Jörissen et al., 2015; Koivupuro et al., 2012; Parizeau et al., 2015; Quested et al., 2013; Stancu et al., 2016; Visschers et al., 2016). With respect to the reasons why food is wasted, this research indicates that there are no large differences between the four household compositions in both locations. However, single-person households in west Amman tend to throw away more food per capita due to busy lifestyles and as a result, food is not being used in time, whereas single-person households in east Amman have the lowest average levels of food waste among all household compositions. Furthermore, families with children (couples with children and single-parent families) tend to waste more than families without children in both locations, even if the rates vary according to the size and age of the children.

A study conducted by WRAP, a climate action NGO, in 2009 examined the causes of food waste generation through 15 focus groups and concluded that a lack of management and planning for meals and purchases, storage, preparation, and reusing food and meals is at the root of this problem. Aschemann-Witzel et al. (2015) argues that the problem is rooted in time constraints, low priority being given to food waste reduction behaviours, and a lack of knowledge and skills regarding food storage and preparation. Through ethnographic research, the researcher was able to confirm findings from the literature with respect to the six practices and routines – planning purchases and meals, shopping, storing, cooking, eating, and managing leftovers – as the main reasons for food waste. By doing so, the researcher was able to not only

identify existing factors from other contexts that were mentioned previously in the literature but also explore new factors related to the Jordanian context which are affected by the six practices and routines that influence household food waste behaviour in both locations. These will be discussed further in the upcoming section.

5.3 Discussion

Food waste is a real and serious issue in Jordan. With 210 kg of annual food waste per capita, it ranks among the top 25 countries causing food waste (Abiad & Meho, 2018). The hypotheses of wasting edible food are the depicted explanation for certain reasons which might occur or vice versa under a defined situation (see Section 2.2.3.3). These hypotheses were confirmed or rejected based on data collected from survey, observation, photovoice, and interview (Figure 5.14). Drawing on the results discussed in chapter 5, this section will provide the outcome of the results in either rejection or acceptance of the identified factors for a pre-specified level of significance from the literature (see Section 2.2.3.3).

In this chapter, the researcher adapts and adopts an existing theoretical framework model that combines the outcomes of the ethnographic research and factors considered in the existing recent literature to understand the households and get a clearer picture of behaviours related to food waste practices and the determinants of these behaviours in Jordan. This framework will be then used to inform the development of the communication campaign intervention. Results demonstrated that these factors were found to be relevant in explaining these behaviours for the data collection sample. In the next section, the researcher discusses the factors that appear to influence household food waste behaviours in Amman in more detail and relates them to the theoretical framework.



Figure 5. 14 photovoice results

5.3.1 Food Expenditure

Based on the literature, households waste food due to inefficient food consumption patterns. A number of authors (Abdelradi, 2018; Buzby & Hyman, 2012; Parfitt et al., 2010; WRAP, 2009) have identified five types of behaviour that contribute to household food waste, including food shopping, storing, cooking, consuming, and food-related lifestyle. According to (Parfitt et al., 2010; Principato et al., 2015), food waste generation may be influenced by households' attitudes, values, knowledge, and behaviour towards food. Moreover, food waste behaviour can be explained by shopping habits and planning (Stefan et al., 2013) and excessive buying and lack of planning and shopping habits may influence subsequent household management of food (Abdelradi, 2018; Aktas et al., 2018; Porpino, 2016; Stancu et al., 2016; Stefan et al., 2013). However, another factor that may influence the amount of food waste generated by consumers is the price of food. While this subject has not been extensively studied, some studies suggest that marketing attractions such as promotions (also referred to as offer temptation for example two-for-one), can influence consumers' purchase decisions (Díaz-Ruiz et al., 2015; Parfitt et al., 2010; Quested et al., 2011). In sum, a recent study conducted by Mallinson et al. (2016) explained that households with higher levels of food waste were more influenced by promotions and were less price conscious.

The researcher confirmed what has been reviewed through the literature that households who are more concerned about food expenditures produce less food waste. It is worth discussing the revealed by the results of the ethnographic research, which demonstrate a positive relationship between food expenditures and food waste in West and East Amman. The findings showed that households' food expenditures are directly associated with their planning and shopping routines, leading to increased food waste (for example failure to write up a shopping list and purchasing the items in bulk without quantifying). All household groups in both locations showed difficulty to act upon planning purchases and more impulse purchases of food. While most East Ammani households purchase their food from different local places such as open-air markets, supermarkets, and bakeries (see Figure 5.15), most West Ammani households purchase their food from supermarkets chains. The findings revealed that East Ammani households are more price-oriented and attracted to promotional and special offer items than West Ammani households. For instance, a HE12 stated:

> "[…] my husband is a night shopper because he knows exactly when markets discount food (Figure 5.16) .... he buys what I ask of him on the mobile phone, but he often buys extra items because the seller offers him a cheap price at the end of that day" (Figure 5.17).

A HE17 stated:

> "Price of food is very important to me at the time of purchase …. I always compare the prices of products on a purchase".

Furthermore, the majority of East Amman households affirmed that they do not include quantities on the shopping list to make sure they buy just what they need but instead they estimate the quantity based on the price and special offers. In contrast, the observation showed that the shopping list in the West Amman location was not based on how many meals they would eat at home and the timing of their next shopping trip or if their family members eat out this week. A HW2 in west Amman explains:

> "...sometimes we make some spontaneous purchases that happen without much contemplation, for instance, buying good appearance non seasonal fruits or vegetables that end in the bin".

When comparing the observation results to those of the survey, it reveals that 16 households (10 households in East Amman, six households in West Amman) in both locations affirmed that food expenditures are the second factor influencing their behaviour in relation to food waste reduction. For households of a similar type, on average households in West Amman spend more money on food than households in East Amman. Single-person households in West Amman admitted that they spend a lot of money eating out in restaurants. A HW10 revealed that

> "I find it more challenging to buy and prepare food because of the larger package size of the food product while the package sizes might favour larger families, they pose a disadvantage to single-person household" (Figure 5.18).



Figure 5. 15 Open-air markets in East Amman. Photo by Yazeed Hijazi (2019) (Creative Commons licence)



Figure 5. 16 In a night market in East Amman, tomatoes are on sale at a reduced price. Photo by Yazeed Hijazi (2019) (Creative Commons licence)



Figure 5. 17 A shared photo from HE12 depicts a large number of rotten frozen tomatoes in the fridge due to buying extra quantities at a cheap price



Figure 5. 18 As a result of buying a large amount of rotten cucumber and parsley were thrown away

5.3.2 Healthy Food Choice

Some studies have shown a strong connection between food waste and healthy food choice, such as food safety and nutrition (Hendriks & Maluf, 2014), preferences for food (Porpino, 2016), and households' routines and habits (Evans, 2012). A healthy diet was considered an important factor in reducing food waste by consumers. Quested et al. (2011) provides insights into how to encourage a healthier diet in households, by keeping fruits in a fruit bowl to encourage family members to consume more fruits rather than keeping them in a refrigerator for example. The results from this ethnographic research showed a modest relationship between food choice to food waste behaviour suggests that some household's food choices are linked with their shopping, cooking, and eating routines in both locations (i.e., they would consciously decide what to buy, cook and eat). The observation showed that some household members in West Amman are rather picky in their choices while the majority of East Amman households enjoy a wide range of food. Two households prefer to throw away the leftover food as they think it is unhealthy to eat or they do not want to eat the same food twice, as a housewife (single-parent household) from West Amman explains:

"To me, it is important that the consumed food is always fresh … I was worried about the safety of the bread stuffed with ground meat meal after purchasing it the next day, so I threw it in the bin. Regarding the aubergines stuffed with garlic and nuts [Makdous] and olives, I threw it away because I forgot to return it to the aubergine jar after I finished eating my meal" (Figure 5.19).

Similarly, a West Ammani family with children showed this aspect as children are more selective than adults when it comes to food consumed. These West Ammani parents buy food that matches the preferences of their children, but this may sometimes result in food waste, as explained through the photovoice method by an East Amman housewife (Single-parent household):

"Usually, I try to avoid the yoke of the egg because of health issues and my youngest child refused to eat it so I threw it outside" (Figure 5.20).



Figure 5. 19 Leftovers were thrown away in the bin due to safety concerns



Figure 5. 20 A housewife in East Amman throwing the yoke of the egg outside the house because of health issues

5.3.3 Generosity

The researcher found a strong relationship between generosity and food waste in all Ammani households. One of the contributions of this research is being the first to include generosity in a theoretical framework model. There has been no explicit consideration of this hypothesis in any study to date, thus making it one of the main contributions to the literature. Baig et al. (2019) emphasises that one of the most prominent characteristics of Arabs is their hospitality and this is most often expressed in the provision of ample food as a gesture of welcome to guests. In line with the nature of this research, the researcher hypothesises that generosity might influence food waste behaviour during everyday practices and routines such as shopping, cooking, and eating. Even though some families might not have a lot of food to spare, visitors often have an abundance, and are often fed with a surplus. In a report on food waste, economist Al-Buainain (2015), agreed that over 70 percent of food is wasted during

special events in Saudi Arabia. The Arab world is therefore characterised by a shared set of traditional cultures. Accordingly, Jordanians and Saudis share similar practices such as large amount of food served at weddings.

When it comes to generosity, the researcher noticed that households in West and East Amman usually purchase and prepare more food than they can consume, which results in large amount of food waste. Moreover, Arab countries have a tradition of setting up lavish food tables during Eid festivals, weddings, parties, or informal gatherings, extravagant banquets at which the likelihood of food waste is inevitable (Capone & Youssfi, 2015). According to Baig et al. (2019), it is considered impolite and miserly in Arab culture when people do not serve food to guests.

All Ammani household groups produce high levels of food waste due to their generous manners. There is a positive relationship between generosity and food waste, which indicates that social gatherings and special occasions result in higher levels of food waste as households may wish to show their hospitality by serving more food than is necessary. It showed that generosity is positively associated with shopping, cooking, and eating routines leading to an increase in food waste. The findings from the observation and photovoice demonstrated that there would always be much more food than can be consumed by the family members and/or guests to show how much the guests are valued by the hosts (Figure 5.21). Through the photovoice method, a housewife from East Amman (Couples with children group) asserted:

> "My husband and I invited relatives for dinner; however, I cooked a varied and large amount of food (Zucchinis stuffed with ground meat and rice, rice, grilled chickens, bread, pickles, and salad) and I found a large number of spillages in their plates and on the tables which led to being thrown away (Figure 5.22).



Figure 5. 21 Surplus portions at a lunch feast in West Amman



Figure 5. 22 Food spillages after visitors completed eating which led to being thrown away

5.3.4 Waste Avoidance

The waste avoidance factor is concerned with treating food waste behaviour as a special form of waste management behaviour. Although there have been no specific studies on food waste behaviours in connection with other forms of waste, Díaz-Ruiz et al. (2015) extend the previous literature that examined waste management behaviour in a broader context. Nevertheless, Quested et al., (2013) argued that food waste reduction generally reduces greenhouse gas emissions eight times more than directing the same amount of food waste to anaerobic digestion. To determine the extent to which prevention and recycling are related to food waste, the researcher describes food waste behaviour clearly as a waste management behaviour. It was expected that households who show more positive waste avoidance behaviour are expected to produce less food waste. The positive relationship between waste avoidance and food waste behaviour suggests that if household groups think food waste should be reduced, then their intention to reduce food waste will be higher. Regarding waste avoidance, the 20 households in both locations were asked in a survey: *Are you interested in reducing the amount of food waste produced in your household?* The result showed that 100% of the sample (20 households) replied "Yes". On the contrary, the observation revealed the opposite, merely three households in East Amman (two Couples with children and one Single-parent household) reuse glass jars from the sauce, salsa, and Nescafe to store food items such as lentils, and cardamom (Figure 5.23).



Figure 5. 23 A household in East Amman reuses glass jars to store food items

5.3.5 Environmental Awareness

Increasing environmental awareness can contribute to the reduction of food waste (Abdelradi, 2018; Principato et al., 2015; Watson & Meah, 2012), where environmental awareness has been directly linked to positive environmental behaviour and waste minimisation (Barr, 2007). Moreover, Williams et al. (2012) conducted an exploratory study to determine the relationship between household food waste and how packaging may impact the amount of food waste. Based on the literature, the researcher found that households who show higher environmental awareness are expected to produce less food waste. In the survey, all households were asked: *What is/are the main factor(s) influencing your behaviour in relation to food waste reduction?.* The results indicated that two households (one household from East Amman, and one household from West Amman) considered environmental awareness as a major problem, which represents the degree of motivation to avoid food waste. The observation and photovoice method showed that food packaging affects the amount of food waste and increased environmental awareness can help reduce food packaging. The results indicated that the majority of the household's food waste in both locations could be related to packaging. For instance, "Best before and use by dates" is a reason why one household from West Amman was wasting food. Through the observation method, a housewife from West Amman said:

> "I forget to check the expiry date before purchasing the dairy products, so I found the expiry dates have passed and therefore discard the products" (Figure 5.29).

Hence, awareness around expiry dates can help reduce avoidable food waste. Furthermore, a single-person household from west Amman said:

> "To me, packaging leads to waste more food as it forces me to buy in predetermined quantities; often more than what I would otherwise purchase".



Figure 5. 24 Yoghurt that was left in the fridge reached its expiry date and was thrown away

5.3.6 Materialistic Values

This factor focuses on the effect of materialistic values on food waste behaviour. According to (Parfitt et al., 2010), consumption habits can influence food waste. It is known that the notion of materialism or consumerism is the value associated with material possessions. In other words, materialism is characterised by self-interested people and a lack of concern for others (Hirsh & Dolderman, 2007). Kilbourne and Pickett (2008) agree that materialistic values have a negative impact on environmental awareness. Lastly, Díaz-Ruiz et al. (2015) demonstrate that consumerism negatively impacts environmental awareness and shopping behaviour.

Based on the literature, the researcher discovered that households who have high materialistic values are expected to have a lower environmental awareness. The observation and photovoice method results asserted that West Ammani households

are more materialistic than East Ammani households through shopping and eating habits which influence food waste. Through the observation, a housewife from west Amman (Couple without children group) asserted that

> "... Unconsciously, I purchased some good-looking nonseasonal mangoes that happened without much contemplation and end in the bin" (Figure 5.30).



Figure 5. 25 Nonseasonal mango that was rotten and not safe to eat due to it being stored in the fridge for a long period

Through the photovoice method, a single-person household in West Amman said that

> "I invited my friend over to the house ... carrots were used as a certain form of formality to decorate the plate and was not meant for consumption which ended in the kitchen bin" (Figure 5.31)



Figure 5. 26 Carrots were used to decorate a plate and was not meant for consumption which ended in the bin

5.3.7 Knowledge

Being aware of food waste is an important factor, and a greater understanding of the food waste problem is expected to lead to greater environmental awareness (Gustavsson et al., 2014). The literature revealed that individuals who possess knowledge about food safety and how to best store food to prolong shelf life and increases environmental awareness. In the survey question, *Are you confident in your knowledge of how to best store food to prolong shelf life?* Results showed that nine households replied “No", two households replied "Yes", and nine households replied, "Not sure". In addition, through the observation, nearly all household groups from both

locations showed lack of knowledge about the food waste problem which is expected to have a positive effect on environmental awareness. A HE11 shows some knowledge about storing leaves:

> “I’m not sure how to best store some food to prolong shelf life but as you can see if I have a larger number of herbs, I bundle smaller batches individually to better control moisture levels and make sure to re-moisten the paper towels as they become dry over time” (Figure 5.32).

Hence, results indicated that environmental awareness can be increased by having more knowledge about the food waste problem.



Figure 5. 27 A housewife from East Amman storing herbs in paper towels

5.3.8 Religion

In agreement with a study in household food waste behaviour in Egypt, Abdelradi's (2018) findings which found that environmental ethics toward preventing food waste is bolstered by religious beliefs., the researcher noticed that religious beliefs influence food waste. In another study based on a literature review and expert interviews around consumer food waste behaviours in general, Aschemann-Witzel et al. (2015) found that religion is regarded as a critical factor, enhancing motivation to prevent food waste. Islam and Christianity are the two largest religions in Jordan where Islam represents more than 92% and Christianity 6% (Ebniya, 2020). Nevertheless, both religions emphasise food waste as a problem and encourage its avoidance. For instance, in Islam there is some evidence from the holy Quran (Chapter 7 verse 31), which states ‘‘. . . and eat and drink, but don't waste. Indeed, He likes not the wasteful" and the prophet Muhammed (PBUH) stated:

> ‘Nothing is worse than a person who fills his stomach. It should be enough for the son of Adam to have a few bites to satisfy his hunger. If he wishes more, it should be: One-third for his food, one-third for his liquids, and one-third for his breath. (Sunan Ibn Majah, Book 29, Hadith 3349)

In Christianity, the Holy Bible (international version - Proverbs) chapter 23 verses 20–21, state ‘‘Do not join those who drink too much wine or gorge themselves on meat, for drunkards and gluttons become poor, and drowsiness clothes them in rags". To sum up, the researcher agrees with Abdelradi (2018) that it is important to emphasise that this hypothesis represents the households' perceptions about the relationship between religion and food waste, but it does not represent their religious behaviour.

The results of the data collection showed that religious beliefs regarding food waste have a strong positive contribution to reducing food waste. In the survey, all households were asked: *What is/are the main factor(s) influencing your behaviour in relation to food waste reduction?*. The results showed that 100% (20 households) of the participants chose "Religious beliefs" as a first choice. Reflecting on the findings of the survey, the observer found that Muslim households in Jordan think that throwing bread is an insulting act. A Muslim housewife (HE18) said:

"I believe that bread should never be wasted as one day we may be poor and be in need of bread and regret the waste of bread".

The observer noticed that bags of bread were left hanging on gates or left where others may take it for those that cannot afford to buy bread or feed for livestock (Figure 5.33).



Figure 5. 28 Bread is left where others may take it for those that cannot afford to buy bread or feed for livestock

To summarise, the researcher found that food expenditure, religious beliefs, and generosity were the most noteworthy factors associated with food waste behaviours and routines in all household groups. Consequently, they were confirmed as factors

influencing household food waste behaviour in the Jordanian context. In light of these three factors, the researcher adopted and adapted a theoretical framework model that brings together habits, practices, and routines from the ethnographic research among households in Amman (see Figure 5.34). However, the following factors – Food choice, Waste avoidance, Environmental awareness, Materialistic values, and Knowledge – were rejected due to them not being of a major effect amongst the majority of the household groups. As they only appeared in one to three households in both locations, results that emerged from these factors cannot be generalised to the Jordanian context.

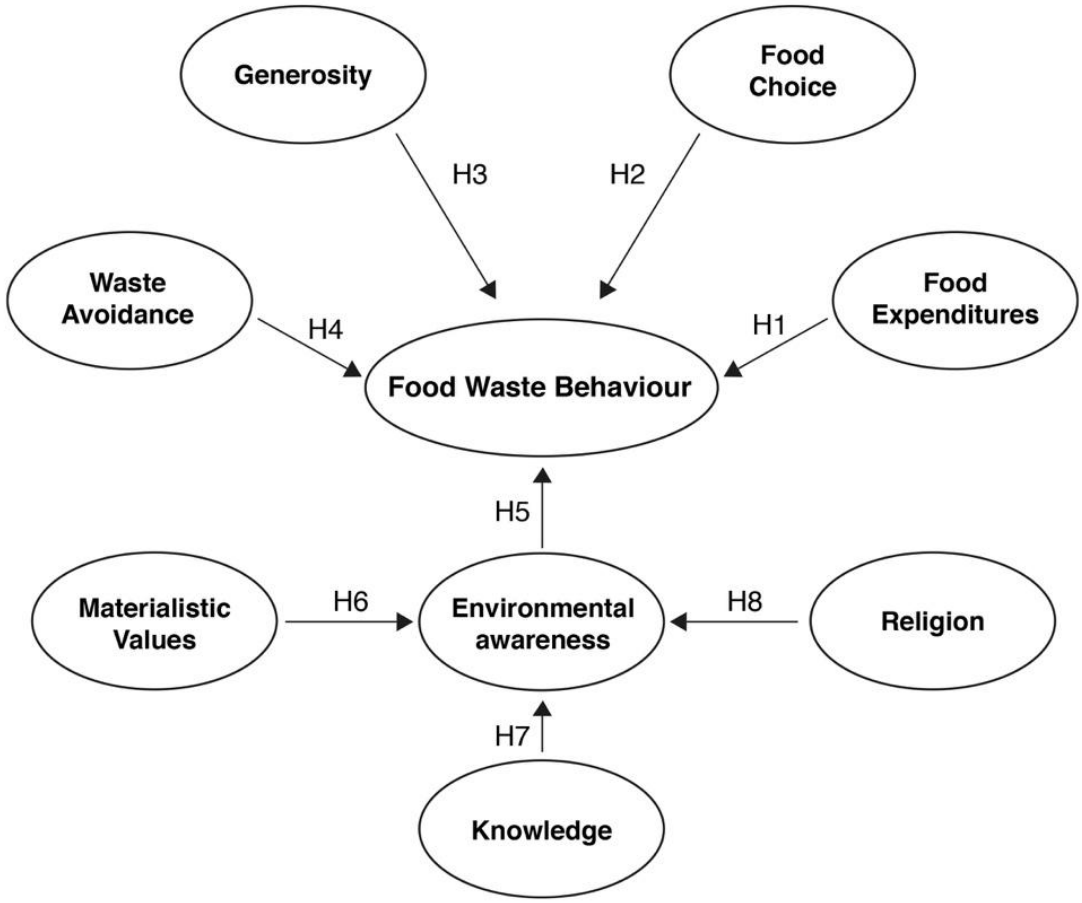


Figure 5. 29 Theoretical framework model for household food waste behaviour in Jordan (adapted from Abdelradi (2018))

5.4 Personas

Personas are “fictitious descriptions of users” which are created based on research to represent the different user types that might use a service or product in a similar way (Cooper, 2004). Although it is an imaginary character, it incorporates real-world

qualities such as characteristics, goals, frustrations, and other relevant characteristics of target users. For this research, personas have been used in the following research stage (in particular in the design interventions) to make the assumptions based on the ethnographic data collected in the research process more explicit. With the help of the data, the researcher focused on creating eight types of personas based on participants' attitudes and reactions (see Figure 5.35 for West Amman personas and Appendices for all personas in both locations). The eight personas represented the four household groups for each location. Creating these personas was an integral part of the research process as they helped focus feature decisions on the frustrations or concerns and motivations or expectations that each household group face in both locations. Thus, the researcher was able to prioritise what is truly important.

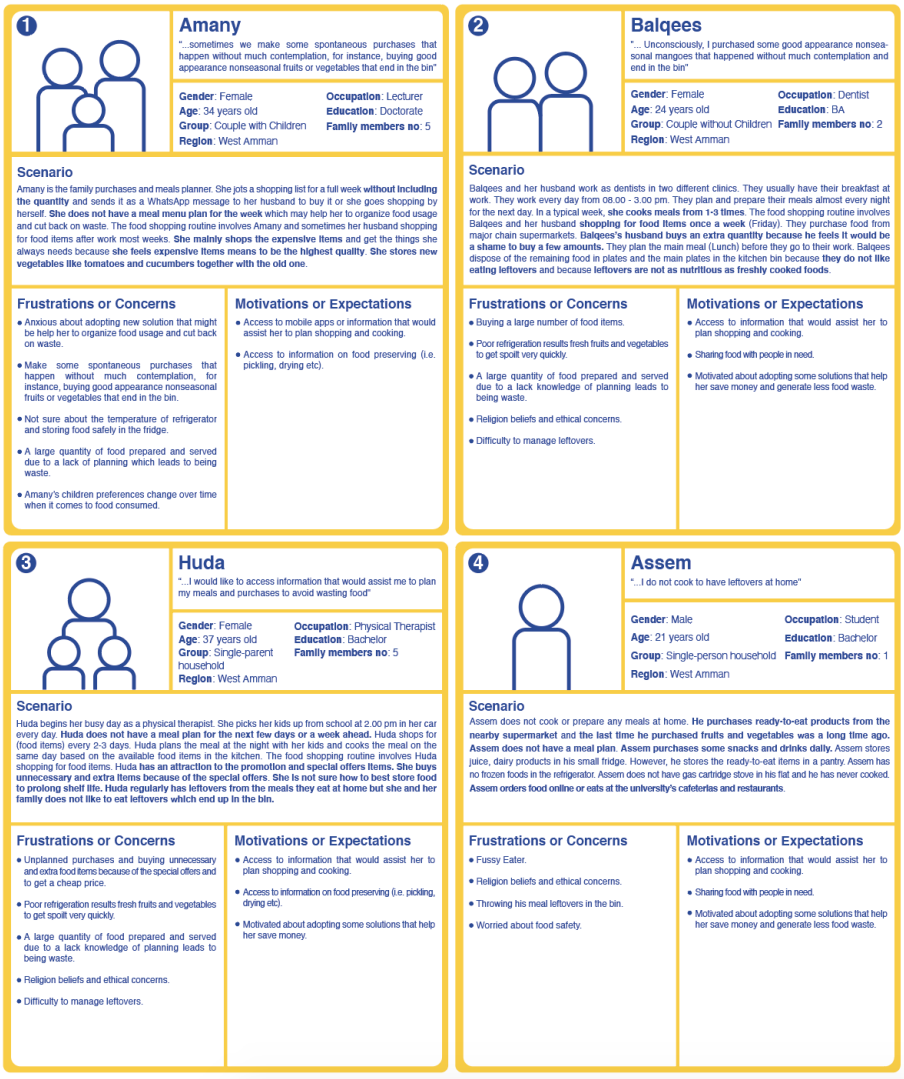


Figure 5. 30 Personas from West Amman

West Amman:

Persona (1): Amany was chosen to represent the couples with children households from West Amman. They shop primarily for expensive food items, believing that expensive food items are of the highest quality. They do not have a meal and purchase plan for the week, which may help them better organise food usage and reduce waste. Occasionally, they make spontaneous purchases that occur without much contemplation, such as buying non-seasonal fruits and vegetables that end up in the trash. Lack of planning results in a large amount of food being prepared and served. Young members from those families often order too much food via food delivery apps. It appears that these families lack knowledge about the best method for storing food safely. This matches the findings from the literature review that excessive buying and lack of planning habits may influence the amount of food waste generated by these families. These families are unsure about what to improve and where to begin.

Persona (2): Balqees represents the couples without children households from West Amman. It is common for these families to be committed to full-time jobs. The meal preparation for the next day is almost always done at night. These families frequently buy surplus food due to two main reasons: 1) they are unable to go grocery shopping daily because of their busy work-life schedule; and 2) they believe it is essential not to enter the house empty-handed regardless of the item they purchase.

Persona (3): Huda represents single-parent households from West Amman. A busy lifestyle is a norm for this family group. Typically, a single mother or father is only able to plan meals with their children the night before. They are price-oriented and attracted to promotions and special offers to buy excess groceries. However, as they sometimes depend on food delivery due to their busy life schedule, fruits and vegetables end up rotting in the fridge. These families are concerned about wasting food which makes them feel guilty about people who do not have enough food. This is driven by religious beliefs and ethical concerns.

Persona (4): Assem represents the single-person households from West Amman. Households of this group rely primarily on prepared meals or food delivery, as they do not have cooking equipment or knowledge of how to cook. The majority of their meals are consumed at places of education or work. They are known to be fussy eaters,

resulting in some of the contents of their meals being thrown away. There is a lower level of guilt in this group.

East Amman:

Persona (1): Nisreen represents the couples with children households from East Amman. They seldom plan meals to cook, as they depend on what their family members want to eat or what food items are available in the kitchen. Among the members of this group, the husband purchases groceries. They primarily target open-air markets on Fridays or late after work. Due to their price-oriented nature and generosity, they are mostly night shoppers, which results in them purchasing large quantities of food that ends up in the garbage because they are offered discounts on fruits and vegetables. These families feel guilty about people who lack sufficient food. The motivation for this is based on religious beliefs.

Persona (2): Ola represents the couples without children households from East Amman. There is little planning involved in their meal preparation. These families are often working full-time jobs. Most meals are prepared at night for the following day. These families sometimes buy surplus food since they are unable to go grocery shopping daily because of their busy work-life schedules.

Persona (3): Tamara represents the single-parent households from East Amman. They are price-oriented and have an attraction to promotions and special offers, causing excessive food item purchasing. Planning meals depends on what their family desires and not on the availability of food items in the kitchen. Leftovers are usually fed to pets or thrown in the bin. They purchase the majority of the fruit and vegetables from major chain supermarkets or different local places such as open-air markets.

Persona (4): Um Khalifa represents the single-person households from East Amman. Sometimes, some of the neighbours share food with each other. They do not have a meal plan for the next few days or a week ahead. They plan and cook the meal on the same day. They regularly have leftovers from meals which are sometimes thrown in the bin or given to pets. They are price-oriented and are attracted to promotions and special offers items, where they buy in bulk to keep down costs. The shopping list is

not based on how many meals they would eat at home or the timing of the next shopping trip.

5.5 Summary

This chapter established a theoretical framework model that incorporates the most important factors in generating household food waste. It explained the household's perception of food waste that related to food quantities wasted at the household level. The findings suggest considering these factors when developing the communication campaign intervention for food waste reduction. The household size for this research is relatively small. As a result, it is difficult to identify a trend and a reliable benchmark. However, the current research indicates that food waste arises differently in different types of household compositions and locations. Most participants were concerned about food waste and confessed to feeling guilty when they throw food away, yet their behaviour suggested otherwise. While there is no simple relationship between attitudes to food waste and behaviour, household size and income have a direct influence on levels of food waste. In general terms, the higher a household's income and the lower its number of occupants, the greater the amount of food waste generated per person. A considerable number of those who say that the best way to avoid waste is to take a shopping list to admit impulse purchases. In addition, many of those who think that the best way to avoid waste is to plan meals around the food that is already in the house showed that they often plan meals around what they want to eat and not the food they already have.

A majority of survey respondents expressed concern about the amount of food thrown out by their household and most also reported feeling guilty about it. While it is possible to reduce food waste and, in turn, reduce the impact of food production on the environment, the results suggest that food wastage will continue to be a problem unless interventions to address it. In fact, without awareness changes, it is likely to increase. The results presented in this research reveal a strong link between household income and levels of food waste. Given expectations of continued increases in household income, it is likely that food waste will also increase. This research shows that the desire to reduce food waste is thrice as likely to be motivated

by religion, food expenditure, and generosity as by ‘altruistic’ factors such as the environment or poverty.

After identifying and developing a theoretical framework model that includes the factors that most influence household food waste behaviour in Jordan, the researcher will use design for behaviour change through developing and testing a communication campaign to influence household behaviour to reduce food waste in Jordan, discussed in Chapter 6.

Chapter 6 Developing and testing a communication campaign in Jordan

6.1 Introduction

This chapter describes the design for behaviour change process of the communication campaign developed in this research. The overall purpose of this communication campaign is to learn how to influence households' behaviour towards food waste reduction in Jordan. During the first year of the doctoral research journey, the researcher investigated a wide range of design for behaviour change approaches to intervention development, including but not limited to the Behaviour Centred Design (BCD) Framework for developing and evaluating complex interventions, the Behaviour Change Wheel (BCW), and the Design with Intent (DwI) toolkit (see Chapter 2 for details). Despite the differences in approach and philosophy, there are some similarities in how researchers conduct a research study, develop an intervention, implement a solution, and evaluate it. The lack of agreed-upon practical guidelines on creating interventions contributes to the shortcomings in intervention design (Colquhoun et al., 2017). Moreover, the process of linking behaviour analysis to the design of an intervention is seldom discussed, hence the steps detailing how to use creative insights in actual intervention materials are not as clear.

As stated in Section 2.3.1.1, the researcher used the BCD framework and the Theory of Change (ToC) to design the interventions (Aunger & Curtis, 2016). According to Aunger and Curtis (2016), BCD's theory of change is a systematic way to develop and evaluate the communication campaign through five steps:

1. Assess: review and identified the factors that are more likely to influence the households' food waste behaviour in Jordan
2. Build: gather data from the field to understand design opportunities for behaviour change
3. Create: work with a creative team to identify a novel, surprising insight about the target behaviours, incorporated into intervention materials
4. Deliver: implement the components of the intervention

5. Evaluate: determine the effectiveness of the implementation vis a vis behaviour change

This process is unique to each of the steps and depends on the steps before it. The researcher describes the processes that are undertaken for each step; the results of each step follow in the subsequent section, with a discussion afterwards. Therefore, this communication campaign and its interventions contribute to knowledge in design practice, while the process of the communication campaign development and cycles of testing contribute to knowledge in design research.

The BCD framework integrated many strategies and mechanisms for influencing behaviour through design. For instance, Lockton et al. 's (2010) Design with Intent (DwI) supported the idea generation process by using the inspiration mode to connect intervention materials with relevant Design with Intent toolkit lenses (Cognitive, Interaction and Ludic lenses). Essentially, the DwI method suggests techniques and examples applicable to target behaviours by inspiring design solutions. Even though the DwI method is not aimed at replacing domain expertise, insight, or creativity that experienced professionals can bring, it is intended to assist designers to explore possible responses to a brief and learn from others' experiences with similar issues. By conducting a series of co-design workshops with experts from the Arab world, several techniques have been developed to facilitate creativity. Moreover, the researcher explored the realisation of these strategies, via an action research methodology, comprising an iterative process of developing and evaluating the campaign through a spiral which are plan, act, observe, and reflect approach (Robson, 1993). Figure 6.1 displays an overview of the design process used in the communication campaign, which I explain in detail in the following section.

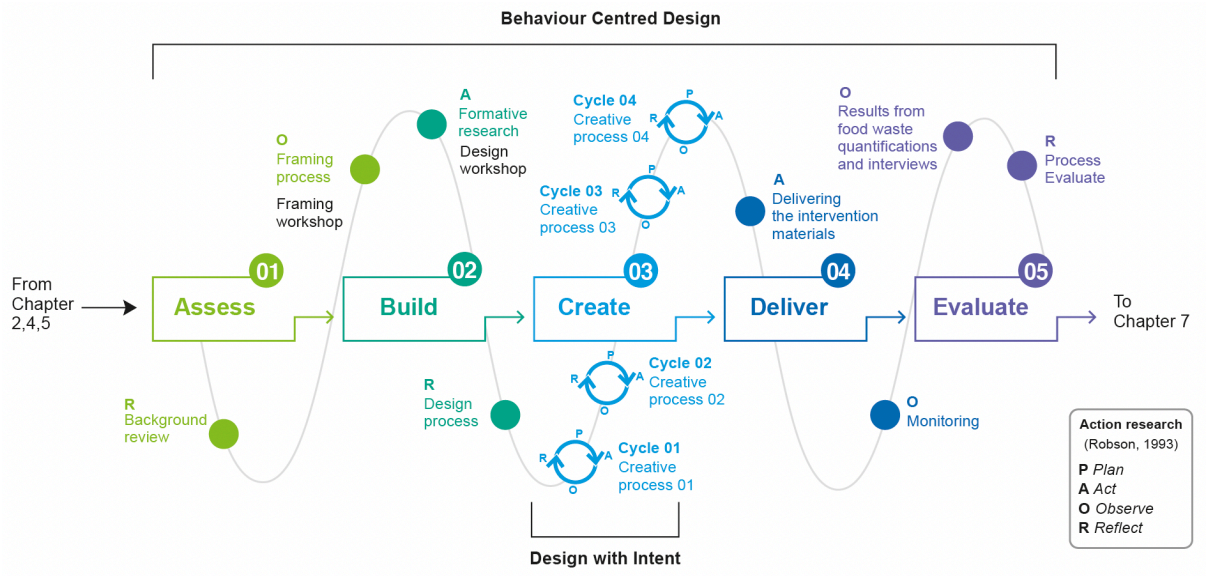


Figure 6. 1 An overview of the design process and approaches used in the communication campaign

6.2 Design process

In the following sections, the researcher discusses the design process for developing, testing, and evaluating the communication campaign intervention by employing the five steps in BCD. As an important part of the design process, a Theory of Change is developed that encapsulates the campaign assumptions regarding how Ammani households' food waste behaviour can be changed. Theory of change primarily assists in delivery and evaluation so that lessons can be learned and extended to other situations.

6.2.1 Assess

In the Assess step, the researcher focused on determining the scope of the communication campaign and revisiting what is known about household food waste behaviours in Amman. Based on this, the researcher moved on to the next step 'Build', which addressed any remaining knowledge gaps from the developing Theory of Change. The researcher collated all information concerning the households' food waste behaviours from the ethnographic research (see Chapter 5), and then, through a framing process, this information was developed and organised into a Theory of

Change. The researcher divided the Assess step into two phases: background review (section 6.2.1.1), and framing process (section 6.2.1.2).

The target behaviour in this step seeks to understand the household's behaviour in the context of food waste. Several insights, such as those from surveys, observation, photovoice, and semi-structured interviews, are presented in Chapter 5. In the process of selecting the household groups, many parameters were considered and assessed. However, the purpose of the framing process is to define what is within the scope of the intervention through investigating the design opportunities for behaviour change. Personas and their "journey to food waste behaviour" were introduced and supported visually.

6.2.1.1 Background review

The researcher identified what is known already from the ethnographic research conducted in the early stage of this research (from Dec 2019-March 2020). This provided a clearer picture of behaviours related to food waste practices and the determinants of these behaviours in the Jordanian context. As stated in Chapter Five, the researcher adapted an existing theoretical framework model that is based on bringing together habits, practices and factors that confirmed the findings from the ethnographic research and with the recent literature on food waste behaviour, and relations among these factors are represented in one framework (see Figure 5.34).

The methods used in Chapter Five provided a substantial amount of data regarding food waste practices and routines by using four methods. First, participants filled out surveys where questions covered household food waste behaviours, shopping and planning routines, environmental beliefs, and attitudes. Furthermore, ethnographic research was carried out to capture and understand the typical behaviour patterns of target households in West/East Amman. An ethnographic observational method was designed and applied with a coding scheme for tracking the household's actions and reporting their food waste practices and routine (see Appendix II). This information was combined with photovoice and semi-structured interviews to offer more data on user behaviours and determinants. This integrated approach was chosen rather than relying solely on surveying techniques to avoid discrepancies between reported and

actual behaviours (Robson, 2011). The observation has been emphasised as the main method of primary data collection to cover the following activities:

- planning purchases and meals
- shopping
- storing
- cooking
- eating
- managing leftovers.

In short, the researcher found that religion, food expenditure, and generosity are more likely to have a high impact and motivate the desire to reduce food waste than ‘altruistic’ factors such as poverty or the environment. Hence, these three factors will be the main drivers of the communication campaign.

The researcher reviewed the findings of formative research into communication campaigns from other contexts to shape behaviour around food waste reduction targeting households in Jordan (see Section 2.4). The findings provided insights into the current state of the communication campaigns in the food waste behaviour context in many countries such as ‘Love Food Hate Waste’ campaign by describing how interventions have changed behaviour and identifying areas for improvement in intervention design. For instance, the researcher learned that saving money from buying less food was an important factor in driving food waste reduction campaigns around the world.

6.2.1.2 Framing process

In this stage, the researcher relied on his design network to invite experts to attend a framing workshop to ascertain what is known and what needs to be found and then frame the overall task. In January 2021, the researcher invited four experts (with experience in running social and behaviour change campaigns from the Arab world) to run a framing workshop. The purpose of this workshop was to discuss the communication campaign aim and grounding the communication campaign development into practical reality. The workshop was held via the Miro collaboration visual platform (Appendix III). During the framing workshop, the BCD Process Model diagram was used as an early insight of what the behaviour change campaign might

look like and to formulate an initial Theory of Change: What are the desired impacts, behavioural outcomes, changes in brains, environments and settings and how might this causal cascade be brought about through an intervention? In this regard, the participants answered five questions that derived from the BCD guidelines to fill in the Theory of Change (see Figure 6.2):

- What is the **state-of-the-world** the communication campaign wants to change?
- What exactly are **the current household food waste behaviours in Amman**?
- Who is **the target population**?
- Why **is the behaviour performed** (i.e., what psychological mechanisms cause it to be enacted)?
- How can **the target individual's situation be influenced so that they might be induced to change their food waste behaviour**?

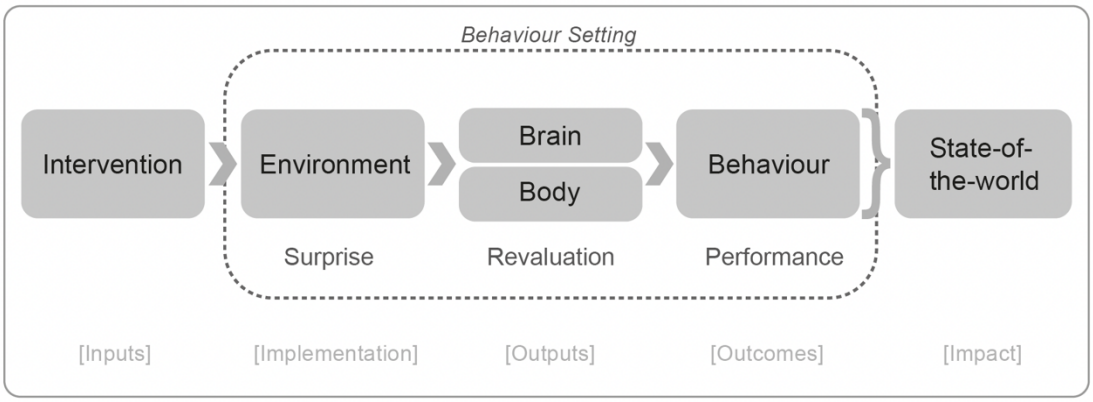


Figure 6. 2 The Theory of Change (reproduced from (Aunger & Curtis, 2016))

After the discussion, the researcher and participants developed the framing statements by engaging in an affinity diagram exercise (see Figure 6.3). The responses were written on 'electronic' sticky notes for each question. The notes were attached to the frame in Miro and grouped together under the question they were trying to answer. There was a clustering of similar ideas within these groups. The participants discussed each group carefully until they had a clear understanding of the answer to each question, resulting in a framing statement that serves as the foundation on which

the rest of the campaign is built. Next, the researcher outlines the answers to the questions in more detail and in reverse order as it is in the Theory of Change due to the way the causal links are built-up.

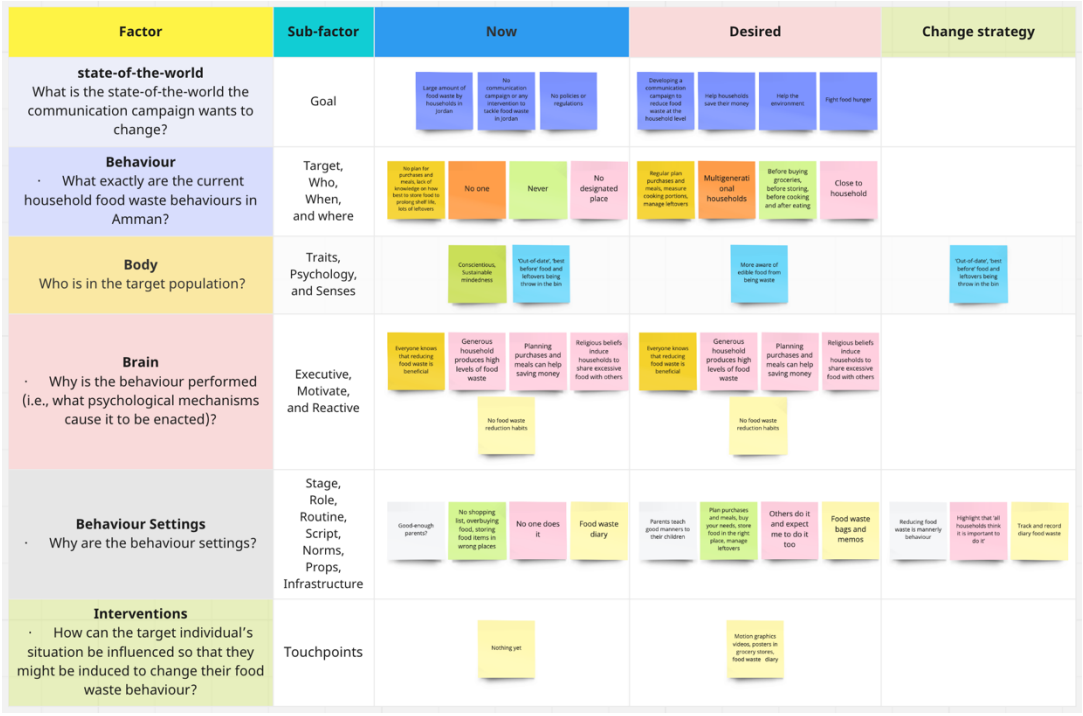


Figure 6. 3 Using an affinity diagram to develop the framing statements

State-of-the-World

The best achievable goal of a behaviour change campaign is usually the starting point for its development. A long-term goal has an impact that can only be realised over time and many behaviour settings need to be aggregated to achieve impact. For instance, the communication campaign goal could be to reduce food waste in Jordan by 30% by 2030. However, it is not certain how the campaign can measure this, but that goal is what guides its logic. Hence, the environmental, economic, and social problems addressed by this campaign were to reduce food waste. The goal is to influence Jordanian households toward food waste reduction. After much discussion with the experts, the following objective was agreed at the campaign Framing process:

- To sustainably reduce baseline levels of food waste in the Jordanian households around West and East Amman.

The identified goal takes the target behaviours and elevates them to the target population level to give an indicator, given the state of food waste behaviour is known from the academic literature to be associated with food waste reduction (the state-of-the-world the campaign wishes to influence).

Behaviour

The next step after defining the desired change in the state-of-the-world is to define the behaviour that needs to be changed. This was a challenging task; the researcher and participants were not able to reach the final formulation until after the Build step was completed. It was crucial to select the exact behaviours that the campaign wants to change. To identify such target behaviours, the researcher used Aunger and Curtis's (2016) criteria:

- **Causal significance:** The selected behaviours should be strong and have an impact on the campaign goal.
- **Incidence:** Enough people should enact the behaviour to influence the campaign's objective.
- **Feasible to change:** The targeted behaviour should be able to perform with the available resources and the campaign should be able to influence this behaviour through the available means.

Based on the theoretical framework model and the findings from ethnographic research on food waste practices and routines (Chapter 5), the experts agreed on the following definition:

- That religion, food expenditure, and generosity are more likely to have a high impact and motivate the desire to reduce food waste (by multigenerational household members in the target population).

Body (population)

The more firmly defined the target group the easier it is to develop the campaign. Although the researcher defined the target groups in Chapter Five, it was important to discuss them with experts to determine which particular target groups will be involved in the campaign. Behaviour change efforts were inevitably directed toward the

households whose behaviour needs to be changed to achieve the desired impact. The researcher with experts determined that to increase the chances of food waste reduction, for instance, the campaign should target multigenerational households to set up an effective impact on food waste practices and routines. Some questions were raised in the workshop, for instance, would it be feasible to target just the new generations? and do adults or mothers play an important role in influencing their household members toward food waste reduction? (see Chapter 5 for details on the daily life of the target groups which can influence them positively).

Nevertheless, this workshop covered the process of choosing target groups to take part in the communication campaign through different parameters. The decision was made to the multi-generational households' target audience in West/East Amman that is open to exploring more sustainable behaviour opportunities. According to Easthope et al. (2015), a multigenerational home is one where two or more generations of adults live together under the same roof. As stated before, the target groups for this campaign comprised nonfamily and family households. Four key groups were targeted: single-person household, single-parent family, couples without children and couples with children. The selected participants were Jordanian, in the attempt to guarantee a homogeneous demographic and limit cultural differences, which otherwise could interfere with the results. Key considerations that led to this decision are:

1) **Sustainable mindedness of the households**

The researcher addressed the households who are more likely to change their behaviour as this is where the communication campaign can have the largest impact. Ajzen's (1991) Theory of Planned Behaviour emphasised that the action is predicted by intention as noted in Chapter 2. Therefore, if households already have a high intention for sustainable behaviours, it should be easier to encourage them to continue with them. For this reason, the target audience in this campaign should be open towards sustainable behaviour.

2) **Interacting with various social media platforms**

The researcher and experts selected multigenerational households who showed interest in using and interacting with various social media platforms when implementing the campaign.

3) **The target group is easy to reach**

Lastly, given the time and financial constraints of the communication campaign process, an easy-to-reach target audience was chosen.

In the Framing process, the following was agreed upon:

- **Primary target:** multigenerational households
- **Secondary target:** younger generation

Brain (Psychology)

The workshop touched upon a number of psychological drivers to motivate the households to undertake the desired changes to their own environments and the serious barriers that can be removed by modifying the environment (e.g., by providing food waste bags and memo support). The researcher briefly summarised the psychology of change hypothesis for this campaign as follows:

- Reducing food waste is motivated by feelings of guilt and empathy towards people who do not have enough food. It is also important that reducing food waste becomes part of a household's sense of identity to make sure it is sustainably practised. Including food waste reduction as part of everyday habits – that is, behaviours engaged in to ensure social and environmental responsibilities (e.g., food sharing box) – could also be motivating, and be felt as a sense of social obligation.

Environment (Touchpoints)

The environment is the place where the campaign materials will be implemented. The workshop focused on the best ways in which the target audience might experience the campaign. For instance, it was discussed that posters may be placed in grocery stores, or motion graphics videos on social media platforms. The workshop covered the intervention's touchpoints and the places and times through which campaign activities come into contact with the target audience. However, the workshop did not finalise all these ideas and suggestions due to the COVID-19 pandemic. The experts suggested

that touchpoints can only be determined once a more complete picture of what the campaign will look like has been developed (i.e., after the Create step).

Intervention

The interventions were not fully discussed during the workshop; however, some suggested interventions were outlined because of knowing the behaviour settings and target groups. Given budgetary constraints, the researcher (even prior to the Framing process) decided to deliver the campaign to households via a travelling implementer conducting a series of activities over the campaign period (to allow for the campaign to be scaled up). It was suggested that the campaign be based on digital media (such as motion graphics videos) via social media platforms.

Lastly, the framing process workshop was drawn up as a list summarising the agreed suggestions and answers to the Theory of Change questions. The researcher ensured proper considerations of all factors that might determine households' behaviour (see Table 6.1). Moreover, the unknown factors required further research during the Build step that will be discussed next. The following filled-in checklist is a summary record of the Assess step which will provide the agenda for the next step, Build.

Table 6.1 Framing statements

Factor	Subfactor	Now	Desired	Change strategy	Unknowns
State-of-the-World	Goal	Large amount of food waste by households in Jordan	Influence households' behaviours towards food waste reduction	-	-
	Objectives	-	- Help the environment - Help households to save money - Fight food hunger	-	-

Behaviour	Target	No plan for purchases and meals, lack of knowledge on how best to store food to prolong shelf life, lots of leftovers thrown away	Regular plan purchases and meals, measure cooking portions, manage leftovers	-	Best means of measuring food waste reduction?
	Who	No one	Multigenerational households	-	-
	Where	Never	Before buying groceries, before storing, before cooking and after eating	-	-
	When	No designated place	Close to household	-	-
Environment	Physical	No places	Grocery stores, and Kitchen	-	-
	Biological	-	-	-	
	Social	Parents waste food	Parents reduce food waste	Induce parents to endorse reduce food waste to encourage their children	-
Brain	Executive	Everyone knows that reducing food waste is beneficial	Identity: Households		
	Motivated	Generous household produces high levels of food waste Planning purchases and meals can help saving money Religious beliefs induce households to share excessive food with others	Being wisely generous household reduces food waste levels Buying less food can help saving money Religious beliefs have a positive effect on social responsibilities and environmental awareness	Generosity, religion, saving money to be emphasised	Which of these motives is most important lever of change for food waste reduction?
	Reactive	No food waste reduction habits	Food waste reduction practised without thinking	Food waste diary, 'Eat Me First' box	How long does it take to inform a habit?

Body	Traits	Conscientious, Sustainable mindedness	-	-	What other characteristics are important?
	Physiology	-	-	-	-
	Senses	'Out-of-date', 'best before' food and leftovers being thrown in the bin	More aware of edible food from being wasted	Sight, smell, and taste to check your food	-
Behaviour setting	Stage	-	-	-	-
	Role	Good-enough parents?	Reducing food waste is mannerly behaviour	Parents teach good manners to their children	What other good manners are commonly taught?
	Routine	No shopping list, overbuying food, storing food items in wrong places	Plan purchases and meals, buy your needs, store food in the right place, manage leftovers	-	-
	Script	-	-	-	-
	Norms	No one does it	Others do it and expect me to do it too	Highlight that 'all households think it is important to do it	-
	Props	Food waste diary	Food waste bags and memos	Track and record diary food waste	How to overcome practical difficulties?
	Infrastructure	-	-	-	-
Intervention	Touchpoints	Nothing yet	Motion graphics videos, posters in grocery stores, food waste diary	-	What other touchpoints are important?
Context	Economics	Buying food in bulk is perceived as cheap (but is not)	-	Reduce perceived cost of buying in bulk	-
	Political	No policies or regulation yet	-	-	How far can gov be influenced?
	Social	Does religion influence the perception of food waste behaviour? Does generosity influence the perception of food waste behaviour?	-	-	-

6.2.2 Build

The Build step is necessary to fill in any missing information that was left unfilled during the development of Theory of Change. In the first phase in the Build step, it is advisable to conduct formative research that seeks to answer questions that those in the framing process were unable to answer how to change the targeted behaviours (Aunger & Curtis, 2016). In the second phase, the researcher turned the formative research findings into a Theory of Change for the campaign. This phase – called the Design Process – breaks down into nine steps (described in detail in section 6.2.2.2) which takes the process from a large number of findings derived from the field to the production of a creative brief that reflects the campaign focus. These steps are best achieved using a team with a variety of expertise with the campaign problem and population. Getting the relevant people to work together in a workshop is often an optimal solution to identify the best focus (Sawyer, 2017). The formative research phase has already been completed since the researcher has conducted ethnographic research to understand the behavioural change potential factors (see chapter 5) which helped in answering all questions that appeared in the framing process in the Assess step.

6.2.2.1 Introduction to the design workshop

After the formative research was completed, a design workshop was held via the Mural platform in February 2021 to develop a creative insight and brief (see Appendix III). The researcher invited three communication campaign experts who possess degrees of familiarity with the problem at hand. This workshop also included two experts who participated in the framing process workshop as well as two members of the target population. At this workshop, the findings from the formative research were presented and then converted into a Theory of Change for the intervention using BCD's creative design process. The design process was described as a sequence of nine phases, starting with analysing the findings from the field and concluding with a creative brief that explains the focus of the intervention (see Figure 6.4); this is a form of thematic analysis.

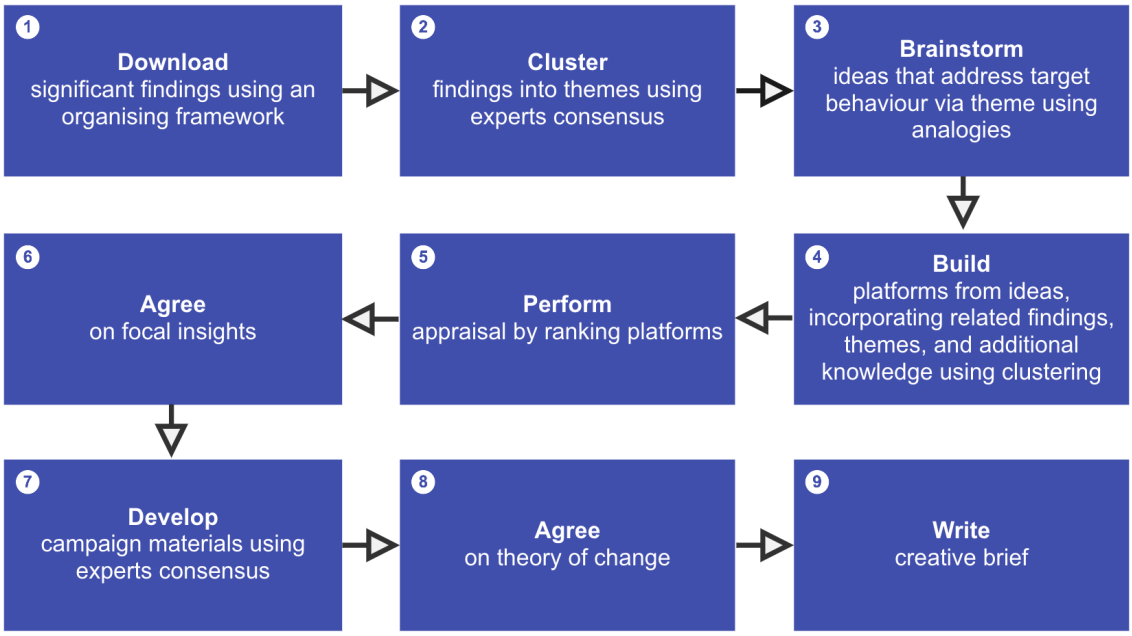


Figure 6. 4 BCD's design process for producing a focal insight (reproduced and adapted from (Sands & Aunger, 2021))

6.2.2.2 Design workshop activities

The researcher began the workshop with an ice-breaker session by asking the team to write their names on a sticky note and add it to the world map where they are located. The team took turns sharing how long they have lived there and what they like about the city/country. Following this session, the researcher summarised the salient findings from formative research, which was done by listing the important points from existing knowledge and the formative research findings in a box. The findings included the traits of the target population, their motivations, and habits. These findings were clustered together by the entire team per a common element and then appropriately named as a theme. Once all the findings had been organised into themes, the themes were themselves augmented with additional bits of supporting knowledge and creative insight into Ideas. Then, an elimination test was performed to keep only the relevant themes. The remaining themes were then placed by the assembled group in a grid per their level of impact and changeability (see Figure 6.5).

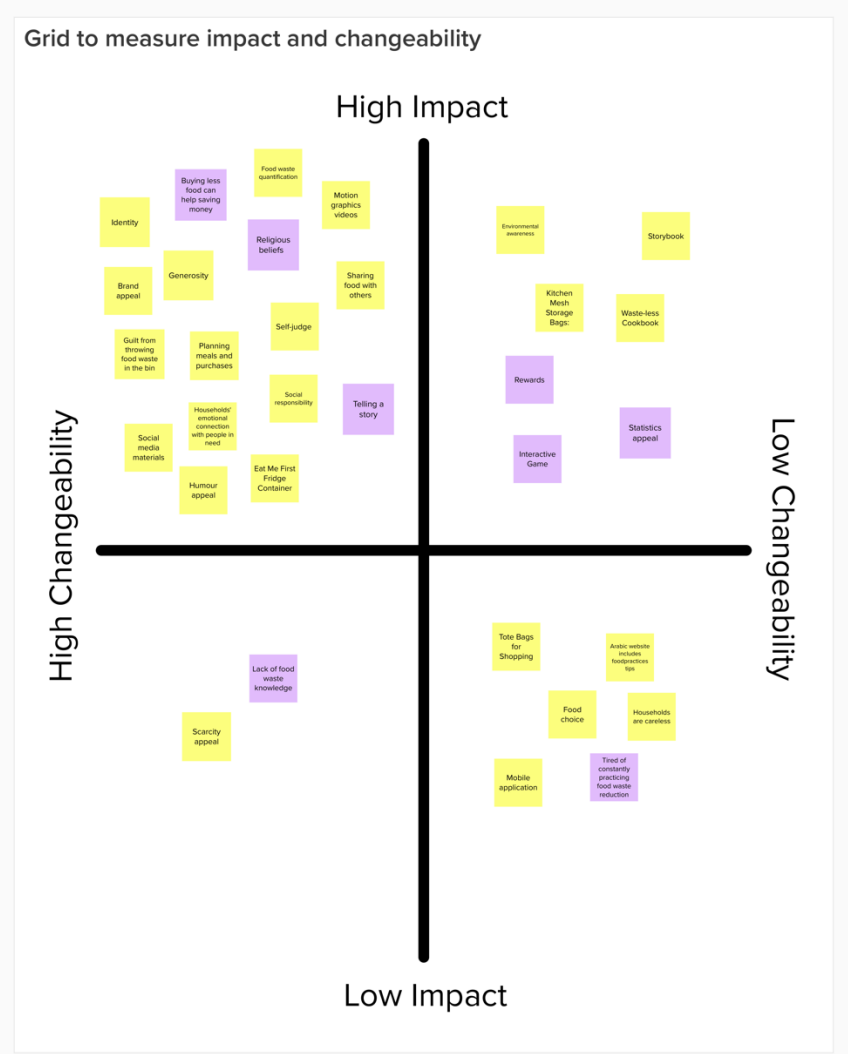


Figure 6. 5 Grid to measure impact and changeability

The themes that have low-impact or low-changeability were ruled out; only high-impact and high-changeability themes were considered. The group used the themes as guides to discuss ideas of how to influence households' behaviour towards food waste reduction. In the next phase, these ideas were developed into insights that would support the interventions. Next, the insights were assessed on their ability to cause a sustainable change in behaviour and their likelihood to be successfully implemented; this resulted in an additional clustering exercise. The most promising insights were selected, and the team further refined the focus. The researcher discussed with the team how to link the insights together into a focal insight, which is an enlightening deep truth about the behaviour and its causes (Srigley et al., 2015). The researcher devised the theory of change and wrote a creative brief to summarise the findings and highlight the behavioural insight that will serve as the core behaviour change principle behind

the interventions. Finally, the creative brief included the focal insight, the various interventions implementation and materials ideas, and the Theory of Change was written to start the creative process by the researcher.

6.2.2.3 Design workshop results

After analysing the formative research, the creative insight and brief were developed in a design workshop. The first step was to present the results of the formative research. Afterwards, the workshop team clustered the findings into groups and assessed their impact and changeability on a matrix (see Figure 6.6). For clarity, examples from each of the categories are provided below:

- **High impact and high changeability:** From the formative research, the researcher and the team found that religious beliefs can have a positive effect on social responsibilities and environmental awareness. Planning purchases and meals can help save money. Being a wisely generous household reduces food waste levels. Thus, promoting religion, saving money and generosity has the potential to lead to reducing food waste in Jordanian households.
- **High impact and low changeability:** It is often cited that environmental awareness is indicated that household food waste could be related to packaging (Watson & Meah, 2012; Williams et al., 2012). Directly promoting environmental awareness would not be feasible nor feasible in this research area, even if it would contribute to reducing food waste.
- **Low impact and high changeability:** Changing a household's lack of knowledge regarding the dilemma of food waste could be easily changed by providing a form of education. However, educating households about the importance of reducing food waste does result in noticeable changes (Gustavsson et al., 2014).
- **Low impact and low changeability:** Being concerned about food choices of healthy and safe food, tired of constantly practising food waste reduction or being careless that need immediate attention all impact households' food waste behaviours (Quested et al., 2011; Stefan et al., 2013). However, these situations cannot be easily changed given the serious barriers to practising food waste reduction, it could be argued that they are not the most consistent

barriers. As such, the efforts are better spent focusing on factors that have high impact and high changeability.

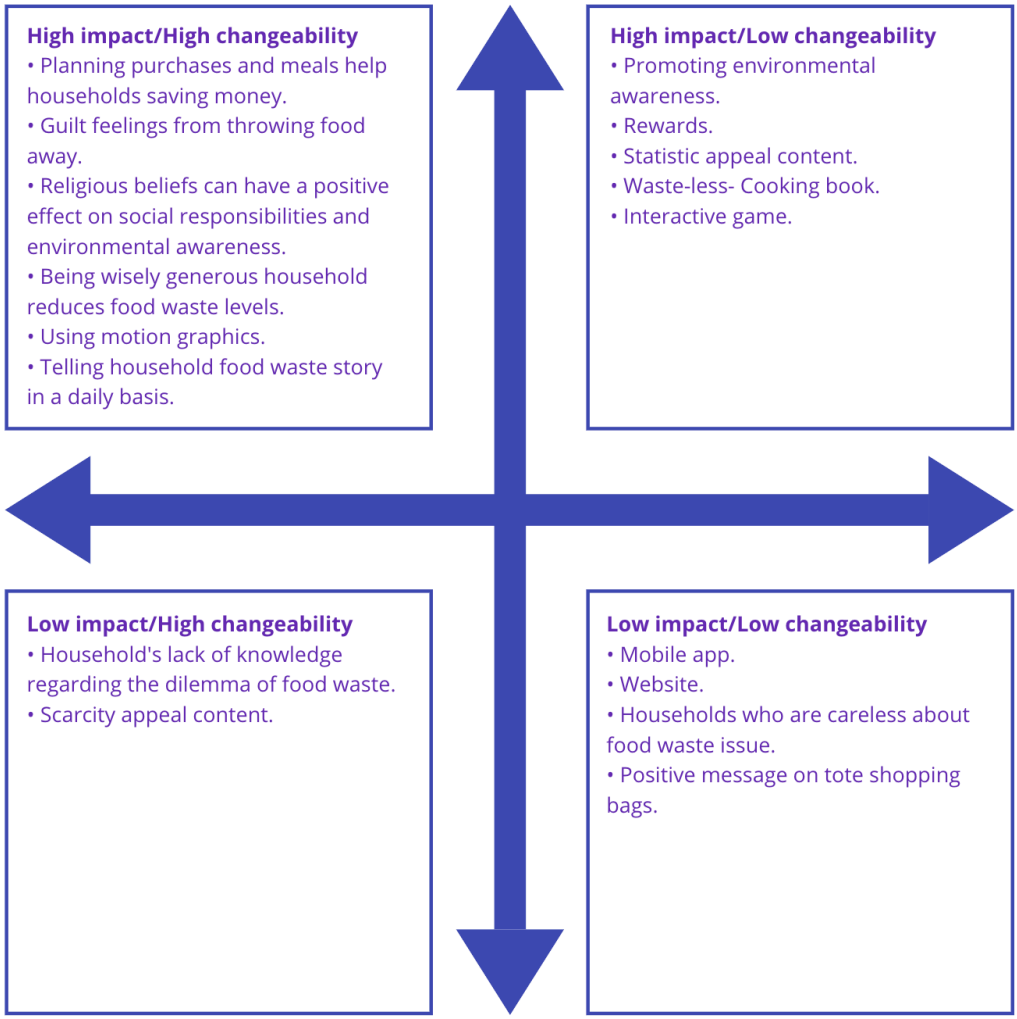


Figure 6. 6 The impact and changeability of themes

Through the team consensus, the most impactful and most changeable themes were selected, with two-thirds of the team were in agreement (see Figure 6.7). The following themes were considered to be the most impactful and most changeable:

- Religion has a positive effect on social responsibilities and environmental awareness.
- Food practices and routines can help save money.
- Being a wisely generous household reduces food waste levels.
- Household identity.

- Households' emotional connection with people in need.
- The feeling of guilt from throwing food away.
- Sharing food with others.
- Self-judgement by measuring the daily amount of food waste.
- Using motion graphics to engage households in telling stories about their daily food waste.

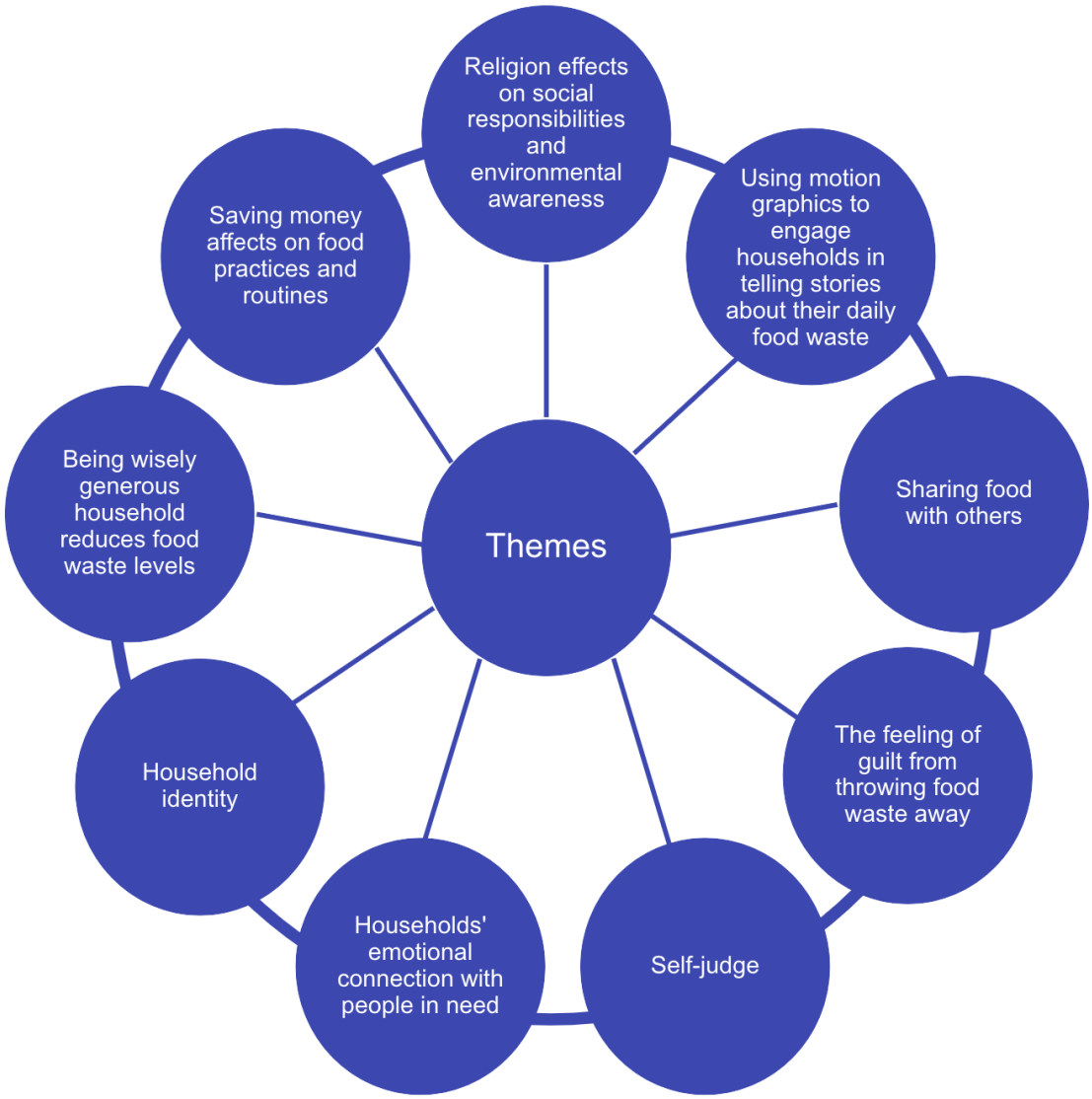


Figure 6. 7 The themes that have the most potential

For a deeper understanding of the determinants of behaviour, the themes were collapsed and combined into two insight types: motives and behaviour settings. The researcher discusses the two insights in detail below.

Motives

Aunger and Curtis (2016, p. 11) define motives as "evolved psychological mechanisms that lead to goal-directed behaviour". When a household performs a behaviour that results in a satisfactory outcome, they gain a rewarding experience, which encourages them to repeat that behaviour. By modifying the household behaviour's value, motives can influence behaviour change. In the case of food waste behaviour, rational and emotional messages that tie the behaviour to food waste level, household values, and the role of a good household are believed to motivate households to perform food waste reduction. It is possible to establish new behavioural patterns by attaching motives to the performance of a target behaviour. Three motives that could potentially be linked to household food waste behaviour are religion, saving money and generosity.

Behaviour settings

Behaviour settings relate individuals to their environment (both physical and social). A behaviour setting is a situation in which individuals have learned what to expect from their environment and the other individuals' behaviours. Throughout each set, there is a particular purpose, a designated location, an asset of objects, and a prescribed set of behaviours. It is implicit that each individual entering a setting expects others, who are also contemporaneous individuals, to fulfil their assigned roles. By changing some aspects of its behaviour setting, it is possible to change food waste behaviour in a sustainable manner. It is relevant to consider the role and norms in this situation.

- **Role:** Reducing food waste is an environmental, socio-ethical, and economic imperative for households. By emphasising the role of Jordanian parents in teaching good manners to their children towards food reductions.
- **Norms:** By making food waste reduction imperative, there is a drive to practice food waste reduction by highlighting that all Jordanian households think it is important to do it.

The focus

A facilitated engagement with the workshop team was then used to link the two insights, resulting in the following focal insight:

Reducing food waste can become habitual if inculcated early in life, and thus produce sustained behaviour change. The task of producing this kind of inculcation lies with the parents in particular and household members in general. In Amman, the identity of parents with the greatest social importance lies in being good role models for their family members, hence for the community.

Hence:

Very good parents are those who instil wise food habits.

For instance, enhancing social responsibilities and environmental awareness among their family members, through feelings of guilt from throwing food in the bin promotes emotional connection with those in need. This Focus thus encompasses the three main motives (Religion, saving money and generosity) to the basic identity of household members in this population, and links the performance of this identity specifically to the target behaviour of reducing food waste.

Linking the three main motives with three family identities emphasises hints at parents as family representatives, who have the job of not just rectifying the causes of food waste but teachers of the next generation. These concepts provide a specific mechanism for ensuring that the practice can spread, as parenting strategies can be mimicked, and will be automatically replicated in the next generation.

Materials development

The researcher and the team worked together in order to determine the basic kinds of materials that would be used in the campaign. The researcher sought to identify materials that are likely to have the greatest effect on behaviour change and that will have the greatest impact with the budget allocated to the project. To accomplish this, it was necessary to identify materials that are most effectively linked to the Theory of Change mechanism, whereby households are able to interact with the materials in

ways that produce the desired behaviour. Identifying which combinations of materials will result in the greatest synergy was the key question.

There was a reluctance on the part of the researcher and the team to rely solely on mass media. Therefore, it was decided to develop multiple materials, each addressing a different causal pathway, as this is better than relying on a single material, regardless of its power. Given the considerable unknowns that prevail in terms of whether the postulated Theory of Change is correct. In spite of the fact that the Focus was regarded as the key message to be conveyed, the campaign did not rely solely on the delivery of one message in one way, but rather on the use of multiple channels of communication. During this stage, the researcher and the team identified the basic types of intervention materials to be created in the next stage (Create Step).

A combination of touchpoint, activity, channel, and behaviour change techniques was used by the researcher and the team to categorise the materials used in the campaign intervention (see Table 6.2).

Table 6.2 Facet of intervention materials

Facet	Features	Theory of Change Link	Examples
Touchpoint	Time/place	Environment	Social media platforms at weekends, Kitchen, Food market
Activity	Situation or Context	Behaviour setting	-
Channel	Information transmission modality	Body	Aural, Visual, and Tactile
Behaviour Change Technique(s)	Psychological mechanism	Brain	Rational and emotional persuasion about capability, Storytelling, Adding objects to environment, Assuaging guilt

Touchpoints are essentially the place and time at which the intervention materials will be delivered. The researcher and the team agreed that the households will be reached via social media platforms (WhatsApp and Instagram) at the weekends while working in the kitchen, and while shopping at the food market.

Activities are situations within which to convey the information, making particular reference to the most relevant aspects of the behaviour setting. The workshop addressed this facet of households activities that will be created specifically for the campaign through situations in which a location is used (e.g., kitchen and food market) and the activity situation will be a regular, everyday context such as planning meals and purchases, shopping, storing, cooking, eating, and managing leftovers every weekday in the kitchen and/or food market in which nothing out of the ordinary occurs except the appearance of a food waste caddy, planning meals and purchases memo, food sharing box, and 'Eat Me First' fridge box.

Channel is how the information will be passed to the households. Households will be reached on a daily basis via motion graphics videos and posters on social media platforms, in their kitchen by planning purchases and meals memo, food waste caddy, food sharing box, and 'Eat Me First' fridge box, and/or in a food market via billboards or posters. In the Create step, the researcher will determine the most used mix of materials which will aid information about who in the target households make use of various social media platforms through multiple workshops.

Behaviour change technique(s) specifies the psychological technique by which behaviour change is expected to be achieved. Potential behaviour change techniques should be matched to the combined qualities of the touchpoints, activities and channels already chosen. Therefore, household visits are a site for in-depth social interaction. Being private and narrowly focused, although not likely to involve multiple visits, the facilitator will deliver intervention materials to households' houses and explain how to use them via social media platforms. It may actually be the site where the target behaviour is performed as well. Nevertheless, food markets are public places where the type of households visits cannot be controlled or managed but each one is short in duration and attention may be focused elsewhere. The reason behind excluding food markets, which was agreed upon during the workshop conducted, was due to the small-scale nature of the campaign.

It was helpful for the researcher and the team to consider materials as combinations of these four aspects (touchpoint, activity, channel, and behaviour change technique), which will facilitate the final task the design process team will have to complete in the

workshop (develop a draft Theory of Change). Formative research was required to ensure that all relevant aspects are known in sufficient, situated detail to inform intervention design, which is the next step (Create).

Drafting the Theory of Change and analysing the campaign

It was crucial in this stage to complete the Theory of Change, and for this reason, the researcher and the team considered how the Focus will progress through the stages of outputs, outcomes, and impact to achieve program objectives. As shown in Figure 6.8, it was agreed on logical links at this point in the development process. It was imperative to identify the materials that will be exposed to the households and get their attention, make them process the stimulus in a way that adds value to the target behaviour, and increase the opportunities for the target behaviour to be performed. Furthermore, it has been recognised that intervention materials can work similarly, through similar psychological mechanisms and behavioural change. The researcher and the team identified certain materials for specific roles. For instance, 'teaser motion graphics videos' which provide only vague indications of what is going to happen, can be effective in attracting the attention of households to the campaign (i.e., achieving a sense of surprise), while generating no additional changes (i.e., no revaluation or performance). It has been agreed in the workshop that most materials will rely on one specific mechanism to change one of the target behaviours (e.g., creating three motion graphics videos that represent three different households' identities will be about inducing the main three motives (religion, saving money, and generosity). The researcher determined that the combination of campaign materials would be able to work in a balanced manner throughout the causal chain and change households behaviour appropriately.

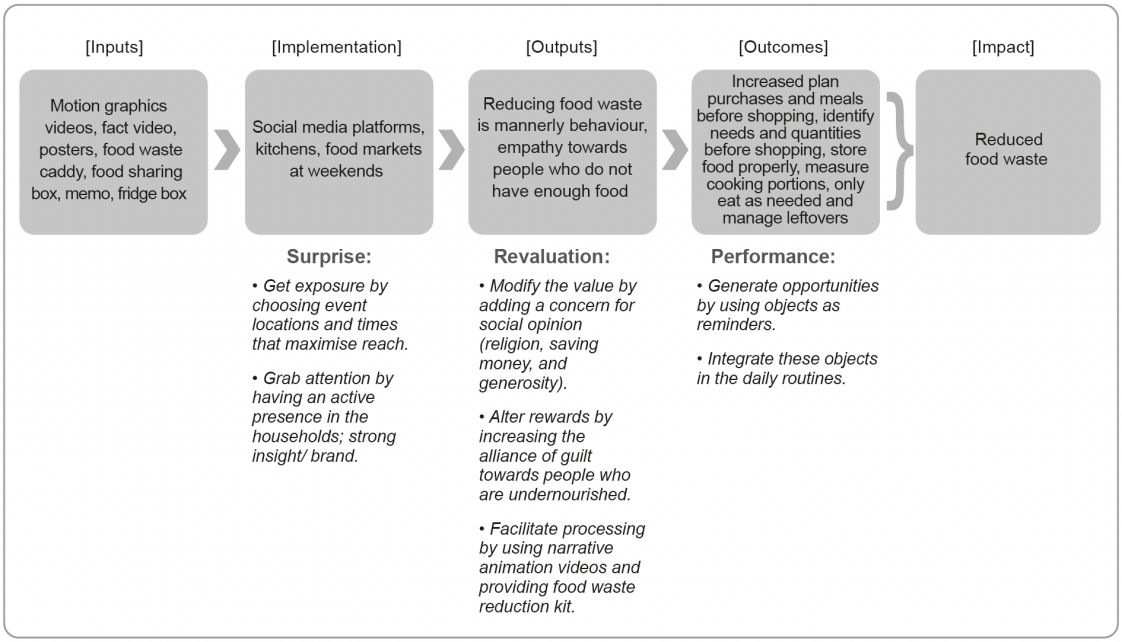


Figure 6. 8 First draft of the Theory of Change diagram for the campaign materials

The researcher and the team developed a framework to critique the overall design of the campaign. The researcher adopted a tool provided by BCD for this task with specific criteria for determining whether the current intervention materials are most likely to be effective. Only materials which have strong causal links in the Theory of Change were considered, and materials which could be economically influenced by means available to the campaign production. A limited number of materials was prioritised because multiple elements tend to quickly dissipate the power of the intervention. The researcher and the team excluded complex intervention materials that were difficult to implement and evaluate. It was necessary to concentrate on a small number of behaviours, using a unified brand theme (i.e., easily recognisable).

There were several characteristics related to the structure of a campaign that are essential for its success. These characteristics are listed in Box 1 which is used to compare potential designs. It was difficult to analyse some aspects in the Campaign Design Analysis Tool at this stage of the campaign development (e.g., designs cost). By estimating these aspects, the researcher was able to determine the campaign's overall 'look and feel'. However, the researcher and the team agreed upon branding (e.g., name, slogan, logo, colour, and typeface) that will be considered to ensure that the campaign has a unique identity that distinguishes it.

BCD Tool:
Campaign Design Analysis Tool

Simplicity:
This campaign has limited resources, the effect of which is diluted the more complex the communications/activities become.

Creativity:
Branding: It was agreed a central identity for the campaign. It was necessary for this campaign to allow all contacts with the households to be branded in a way that adds certainty about the source of the communication.

Deliverability:

Corruptibility (i.e., susceptibility to poor fidelity between planned intervention and implementation).

Dependence on a facilitator to deliver the physical intervention materials (e.g., deliver food waste caddies to the households).

Evaluability:
The researcher and the team ensured that intervention materials delivery and impact will be readily monitored and evaluated.

This will depend on:

Coverage: ensure number of recipients and numbers of contacts per recipient will be sufficient to reach desired impact.

Sustainability:
The workshop intended to use methods that ensure activities will continue without further injections of time/money from the campaign (e.g., institutionalize the activities).

Cost Effectiveness:
Measure of (expected) impact versus campaign cost.

Box 1 BCD Tool: Campaign design analysis tool (adapted from Aunger et al. (2015))

Creative brief

The final task of the Design workshop was to write a creative brief for the researcher as a designer and as a responsible for development of the intervention materials. This brief contains all the information necessary for those involved in the design of the intervention. It has been formulated through a rigorous process that incorporates behavioural information and insights. A pivotal part of the project involved moving from

gathering and analysing data to using relevant information to design a behaviour-changing intervention. This brief provides essential information regarding the design intervention principles and constraints on the type of channel to be used. This is illustrated in Box two.

The Creative Brief

Stakeholder
Project stakeholder: Qais Ahmad (Project Lead).

Background information

What are the facts about food waste and behaviour change?

Jordan generates around 210 kilograms of food waste per person annually and it ranks among the top 25 countries causing food waste.

What do we know about the target behaviours now?

No one practices food waste reduction.

Goal
The researcher aims to reduce food waste among households in west and east Amman. This means changing the following behaviours among households (e.g., planning their meals and purchases to avoid over purchasing food which may lead to throwing edible food as a result, thus will later has bad effects economically, and environmentally).

Objective
To sustainably reduce baseline levels of food waste in the Jordanian households around west and east Amman.

Focus
Very good parents are those who instil wise food habits through enhancing social responsibilities and environmental awareness within their family members

Intervention design principles
Must work for households in west and east Amman settings and be scalable for the rest of Jordanian households.

All implementations must work for multigenerational household members.

Must be consistent with Theory of Change (i.e., include the main three motives).

No knowledge transmission: motion graphics videos should communicate through common understandings, storytelling, feelings, not lecturing.

Tone: naturalistic.

Must demonstrate target behaviour.

Must show benefit/consequence.

Deliverable and requirements
The core outputs will be: 3 motion graphics videos with teaser for each, 1 fact video, 3 posters, food waste caddies, planning purchases and meals memos, 'Eat Me First' fridge box, food sharing box, instruction contents (images and videos) for social media platforms, and cashback gift cards.

Budget and timeline
Not included here

Box 2 The creative brief for this research project

6.2.3 Create

The Create step involves the development of the intervention materials. To facilitate the change mechanisms postulated in the Theory of Change, the researcher was eager to assure that these materials would initiate the change mechanisms. It is therefore important that the campaign creates a maximum amount of useful surprise. To achieve this, the creative insight (i.e., a surprising concept related to the Focus in the brief) will need to be transformed into a creative intervention (i.e., creative materials) and then implemented (i.e., activities that modify the environment) with the least amount of loss of surprise. As recommended by the BCD approach, the intervention should be surprising and disruptive to maximise its effect on the target behaviour. Otherwise, the old behaviours will persist.

In response to the creative brief, the researcher as a designer started the idea generation process to produce the materials for the intervention. Several brainstorming techniques were used to create the intervention materials. The purpose was to provide a better understanding of what the outcome will be and how it will be presented. Action research is the overarching methodology for this step, and the data for this step is collected primarily through four workshops (see Section 3.9). Through a spiral plan, act observe and reflect approach, the intervention materials were developed and evaluated iteratively (Robson, 1993). This step is an iterative process which was carried out by the researcher and a facilitator working closely from both locations (i.e., West/East Amman). Lockton et al.'s (2010) Design with Intent supported the idea generation process by using the inspiration mode to connect intervention materials with relevant Design with Intent toolkit lenses, and these are (Cognitive, Interaction and Ludic lenses). In essence, the DwI method offers techniques and examples that can be applied to target behaviour in order to stimulate new design concepts. After developing initial ideas, four rounds of workshops were

conducted with communication designers, behaviour change campaign experts, and members of the household.

6.2.3.1 Creative process 01

A) Plan

The researcher started this stage with an individual creative brand development which came up with a brand concept including the components which had been identified: name, slogan, logo, colour, and typeface. While writing the script for the 3 motion graphics videos.

Branding

- **Naming**

The first step in the naming process was conducting brainstorming to extract a large number of meaningful and distinctive names related to the Jordanian context and food value. Subsequently, the main names were deducted to express the exact meaning of food value. From the researcher's experience in branding, descriptive names were found to convey the nature of the campaign clearly communicate the intent of the campaign. The Arabic names considered include but were not limited to: *Baraka, Qoot, Namlia and Zad*. Such names indicate values related to food in general. A pilot test conducted with random households led the researcher to choose names which had the most potential, these were Baraka and Namlia.

Baraka is an Arabic word meaning “blessing”. It is not a state, it is a flow of blessings and grace. While Namlia is an Arabic word, with singular translation. It roughly translates to a vintage piece of furniture designed to store food items by Jordanian ancestors. This creates a story that aligns with the values and ethos of the campaign, as the campaign is intended to be acceptable by the whole household, making everyone feel included (see Appendix IV).

- **Slogan**

A slogan is a clarifier, mantra, company statement, or guiding principle that describes, synopsis, or helps create an interest (Govers, 2013). The tagline is a short phrase that

captures a brand's essence, personality, and positioning, and distinguishes the brand from its competitors. The best tagline has a long life, meaningful and memorable. The slogan is meant to be simple and comprehensible, as a result, the researcher created “Reducing Food Waste” to be derived from the aim of this campaign.

- **Logo**

The conceptualising process is the most vital stage of logo design. The researcher found that going straight to the sketchpad is problematic because there is no point in drawing if you do not have a practical and relevant idea yet. When faced with the daunting task of creating something new and unique, such as a logo, a creative block can be challenging to overcome. This section shows the strategies for overcoming creative blocks and the conceptualisation process. As a designer, the brief was the road map in order to show how the name attribute of the brand is linked to form the overall message. The names helped open the designer mind, expand creativity, and identify the overall brand image. Furthermore, writing down the keywords summarised the research and used those words as a starting point and a guide to form the basis for thinking.

B) Act

- **Logo**

As stated in the Plan stage, two names were selected (i.e., Baraka and Namlia). To avoid mistakes at the conceptualisation stage and before the pencil even touches the paper, it was worth that looked at many logos related to different campaigns. Prior to sketching out ideas for the campaign logo, the researcher created a mood board to gather inspiration (Appendix IV). There was no secret formula to sketching. As progressed with pencil, the researcher noticed that the final artwork that was produced on-screen improved noticeably. However, starting with thumbnails refined that the concept is deemed worthy of exploration. The quality of the initial drawing was not important as long as the researcher had a rough reference to the concept in my mind. The general census was that thumbnails were not polished drawings but quick and small sketches that allowed to quickly to see the ideas and develop them later. Thumbnail sketches were a crucial but exciting part of the creative process because they allowed the researcher to be as expressive as it can be. It was of a great deal

and saved time to have an informal talk with the researcher network of brand designers through the initial ideas and sketches.

After the informal discussion, the designers provided valuable feedback and recommended using a wordmark logo in order to extract a sense of importance. Both names 'Baraka and Namlia', were designed around the idea of representing both English and Arabic languages which were integrated professionally into the logo design. While making the logo to represent both the language in the design it was important to have a common integration of font style and graphics to bring synergy to the logo. The logo wants to show new and contemporary design styles while playing with repetitive uniform shapes that hold a rhythm visually and have the same charisma the name did. For a logo to meet all the criteria in the previous stages, all sketches were drawn by using vector graphics editing software, Adobe Illustrator. The Baraka logo displayed a Wheat as a symbol on top of the wordmark to reflect growth, hardwork, bounty, and religion. While Namlia displayed a Jordanian tile as a symbol of the place (see Figure 6.9).



Figure 6. 9 Baraka and Namlia logos

- **Colour**

The vibrant colours were chosen as a preliminary stage. The reason behind choosing vibrant colours is that they are being exciting and eye-catching.

- **Typeface**

Choosing a suitable typeface for the intervention materials was an essential aspect of the brand. However, this campaign depends on two main Arabic typefaces ‘Bahij Titer’ and ‘Questv1’ as well as ‘Helvetica’ for the English typeface to build an effective identity as well as a distinctive and consistent typographical style that is easily readable and used with purpose (see Figure 6.10).

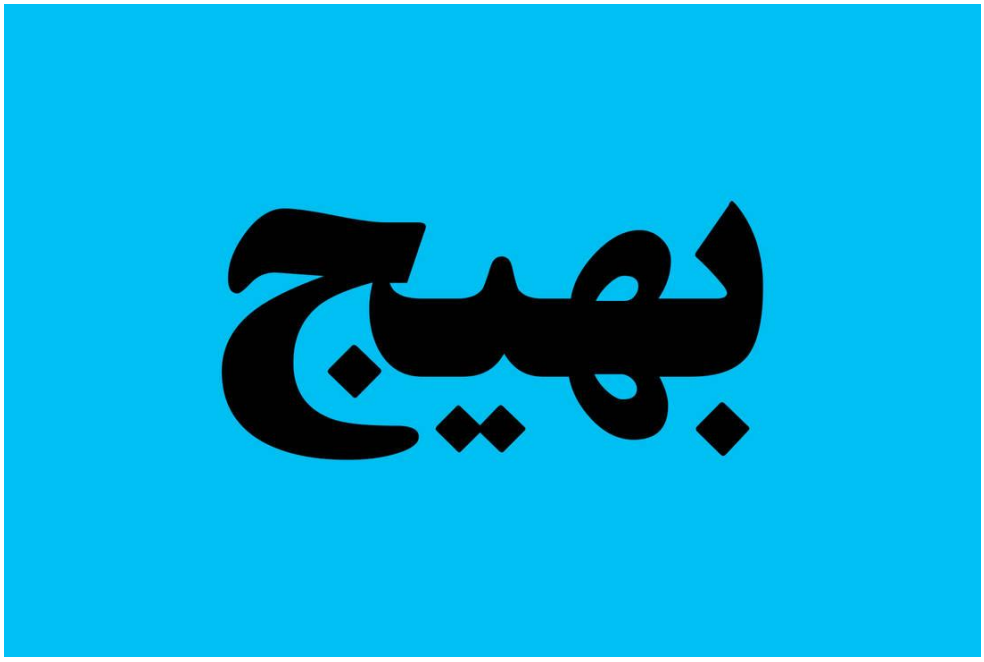


Figure 6. 10 Bahij Titer font

- **Iconography**

Iconography is a quick visual method for presenting ideas and communicating information. The researcher created special icons for the food practices and routines (i.e., planning purchases and meals, shopping, storing, cooking, eating, and managing leftovers) (see Figure 6.11).



Figure 6. 11 Icons represent food practices and routines

C) Observe

The aim of the workshop was to test the potential ideas and solutions for creating a unique brand for the communication campaign. This workshop was conducted online via Mural platform on the 3rd of March with nine participants, five communication designers and four households who were invited using digital leaflets via WhatsApp, as the researcher has already developed a good relationship with them.

The workshop lasted approximately one hour. The researcher started presenting the initial (i.e., two logo options, colour scheme, typefaces, and symbols). Participants had many comments in relation to the designs shown. For instance, regarding naming, they all agreed "Baraka" is overused, while "Namlia" is more related to the campaign goal. Regarding the logo, they all agreed on the wordmark and how it combined Arabic letters with English being readable from both sides (left and right). As for the logo itself, in "Baraka" some comments were raised regarding letter edges, and how some letters were unreadable, while in "Namlia" they thought that the edges used were cool. All participants agreed that both logos were well-balanced. However, symbols placed over logos were thought to be unnecessary and caused distraction from the main logo design. While the symbol used in "Baraka" was thought to be related to bakery shops and charity, the one used in "Namlia" was viewed as an overused symbol. As for

colours, it was recommended that more consideration is needed as the use of multi-coloured brands caused inconsistency and distraction, however, they were excited to see the "Namlia" wordmark reflected on a red background, as this colour is recognisable and brought excitement and energy. As for the slogan, they preferred a logo that had a slogan (which appeared with the "Namlia" wordmark), but the majority agreed that it should be concise and not too general. In general, a dynamic logo did not receive positive reactions (see Figure 6.12).

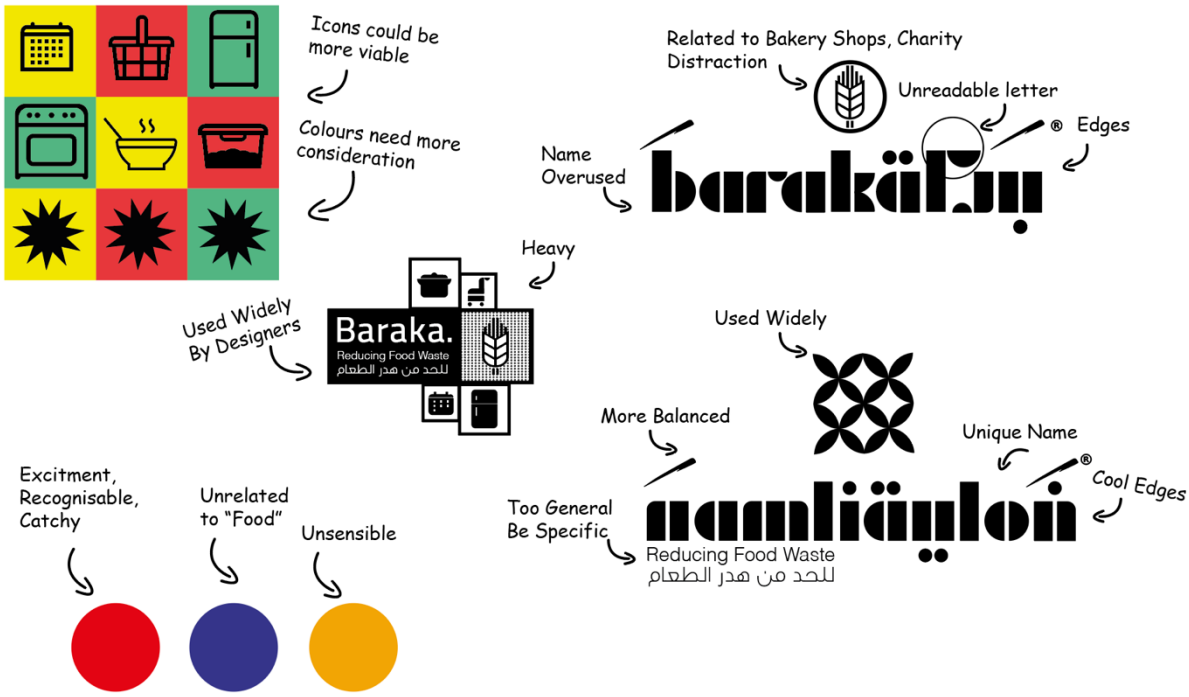


Figure 6. 12 Part of the branding iteration

D) Reflect

In this stage, the researcher started reflecting on comments received during the design workshop conducted with households and communication designers. The slogan was changed accordingly, considering more specific wording. A mono-colour was chosen as requested in the workshop, and the symbol placed over the "Namlia" logo was removed with some retouching on the wordmark edges. However, Arabic vowel signs that created more balance as viewed by the participants and the researcher were kept (see Figure 6.13). Afterwards, the researcher moved to the second phase of iteration.



Figure 6. 13 The final edition of Namlia logo design

6.2.3.2 Creative process 02

A) Plan

Motion graphics

- **Scripts**

Motion graphics videos were used Lockton et al.'s (2010) Cognitive lens (i.e., Emotional engagement and Storytelling) to engage household's emotions, or make them emotionally connected to their behaviour and tell a story via your design, which interests users and keeps them engaged. The script is the most important point of motion graphics videos as it will be translated into a storyboard. Based on the three main factors identified (food expenditures, generosity, and religion), the researcher wrote and developed three scripts for the videos. Each of the scripts detailed characters, settings and actions that spoke directly to behaviours performed by the Jordanian households presented in Jordanian dialect slang. Each script was created to tell the entire story in 30-seconds. This is ascribed to the motion graphics being precise and straight forward minimising any distraction from the main idea. Alongside

the intention of the researcher to broadcast the content on social media platforms making it easier to repeat with stronger impact.

The three scripts represented three different household families: Abu Jeebah representing the saving money motive, Um Yousef representing the religious motive, and Abu Hatem representing the generosity motive. The focus was on parents being good role models for their family members, and for the community. Character naming was derived from Arabic words each having a meaning related directly to the practices performed in the scripts (e.g., Abu Hatem is a well-known character "Hatem Al- Tai from Arabia who was known for his generosity). The researcher then sent out the three scripts to an animator to produce storyboards for each of the scripts with the intended duration.

Physical and digital materials

- **Factual video**

The aim of the factual video was to cause surprise to maximise the effect on the target behaviour. The plan was to introduce households to the food waste dilemma surrounding them by presenting current issues around the impacts of food waste. Through previously collecting data in the primary and secondary research, the researcher identified a series of issues to form the intended factual video. After watching several videos related to presenting facts to the audience, the researcher started gathering content (short videos, images from the Jordanian context) to form the initial video. The researcher identified the importance of combining voice-over, background music, text effects, and short videos.

- **Food waste bags and diaries**

The aim of providing households with food waste bags and diaries was to help in the evaluation step to determine the impact of the intervention material. Considering the limited budget of this campaign, the researcher considered replacing the food waste caddies with food waste paper bags. As for the daily recording of food waste quantification the researcher considered providing the households with paper diaries.

- **Social media content**

The researcher prepared a mood board for the social media content by looking at the big picture and selecting specific themes, and components.

A) Act

Motion graphics

- **Storyboards**

As mentioned before, the three scripts were sent to the illustrator to start sketching out the main characters (i.e., Abu Jeebah, Abu Hatem, and Um Yousef) and the storyboard before rendering it out. The storyboard is the second major step in the production of a motion graphic. It is a sequence of sketches meant to provide a visual reference for key scenes in motion graphics. The sketches that make up a storyboard are derived from written descriptions of what is happening on-screen. These descriptions are typically included in the script and are referred to as the scene direction (i.e., describes key details of each scene including subject, setting, and the general action on-screen). The researcher met with the illustrator regularly to ensure the creation of the intended visions see Figure 6.14).



Figure 6. 14 The food expenditures storyboard (one of the three storyboards)

Physical and digital materials

- **Factual video**

After obtaining the voice-over kit, the researcher started putting together materials collected in the Plan stage to form the video for the first iteration. The researcher prepared a proper environment to start recording using the voice-over kit and then recorded the video-over using his voice. Many attempts were made to reach the best quality voice-over outcome. Adobe After Effects software was used to combine all video components together (i.e., voice-over, background music, scenes, texture, and headlines) (see Figure 6.15).

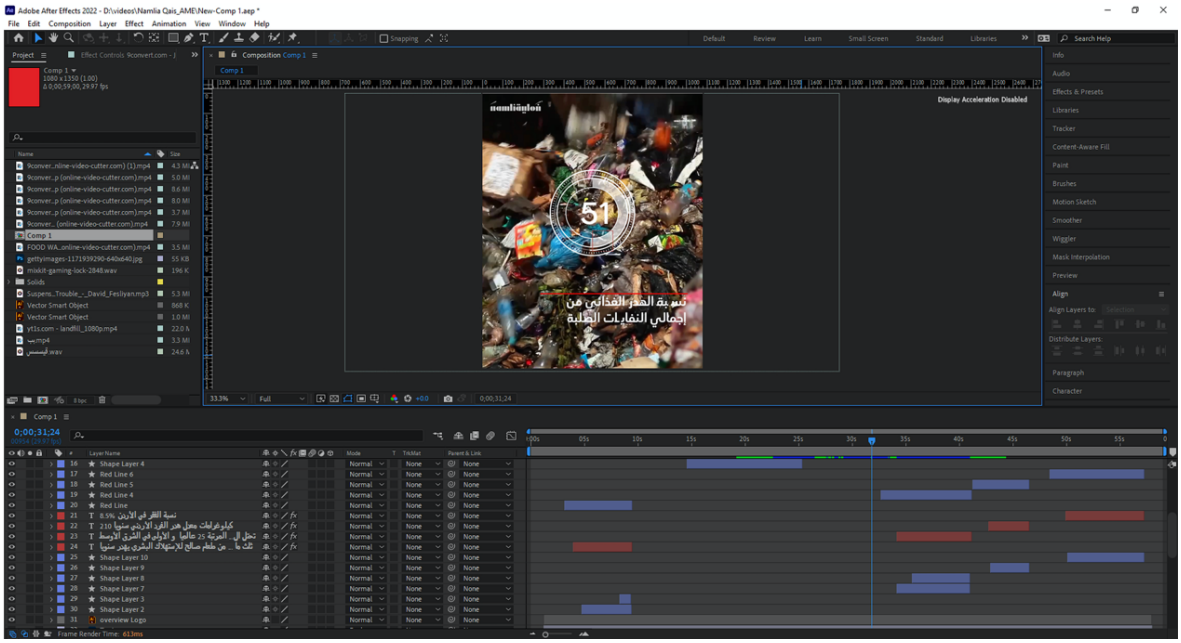


Figure 6. 15 An example of the fact video created with Adobe After Effects

- **Food waste bags and diaries**

Because the researcher was not able to be in Jordan due to Covid, the researcher contacted a print shop in Amman based on the researcher network, as well as based on materials that this print shop provides. Next, the researcher linked the facilitator with the print shop to help deliver the food waste paper bags and food quantification diaries to households. The researcher chose the most affordable materials for the bags and diaries. Hence, the researcher started designing the diaries and the form of a bag that has a scale to track and record the daily amount of food waste (see Figure 6.16). Food waste bags and diaries were distributed and were delivered by the facilitator to the households as a preliminary step to test the materials used.



Figure 6. 16 Food waste bags and diaries

- **Social media content**

The role of the social media content was to support displaying and communicate the three main factors to households. These were initial artworks to test the responses of the participants in terms of themes and styles. Three social media contents (i.e., posts) were designed in three different styles (e.g., photo manipulation, drawing style) inspired by the content created on the mood board (see Figure 6.17). The first content created was a manipulation of a rotten tomato melting down with the globe representing the climate change issue, this content was represented in two different styles (i.e., photo and cartoon). The second was an illustration representing "a shopping list" – a metaphor for planning meals and purchases memo.



Figure 6. 17 Initial social media content

B) Observe

The aim of the workshop was to test the potential ideas created and developed in the plan/act stage. The workshop took place on the 19th of June 2021 via Mural which provided effective interaction between participants and the materials presented. Participants could place sticky notes on artworks and write their comments as needed. A total of 13 participants attended the design workshop: seven households, two communication designers and two experts in behaviour change campaigns. Approximately 80-120 minutes were devoted to this design workshop. The researcher ensured that the maximum number of participants should attend to ensure that they all comment on the three factors represented in the second iteration round.

Motion graphics

- **Storyboards**

The researcher paid special attention to show not only the main character but all the family members in the three storyboards, as his main aim was to focus on a multigenerational household. The researcher explained each of the storyboards and their reflection on the main three factors (e.g., religion). The storyboards had positive responses from all participants and were thought to have fed the primary target of the campaign. The naming of the character was positively perceived, they liked how names were related directly to the three main factors. However, some comments were raised for improvements. The first storyboard that was presented is the “Abu Jeebah’s family” storyboard which represented food expenditures.

As demonstrated in Figure 6.18, comments included using more food items inside their fridge when the family came back from shopping in an attempt to exaggerate how much money they spend on food showing their lack of planning. To add a greater impact to the storyboard and the video later, more humour in how the storyboard is illustrated was suggested (i.e., tomatoes to look more playful). The second storyboard was “Abu Hatem’s family” storyboard which represented generosity (see Figure 6.19). Participants focused on the importance of presenting generosity showing Abu Hatem in a residential environment and coming back from work happy with surplus food items. They emphasised the presence of other family members at the dining table with an exaggeration of food items on the table and in other scenes to reflect on not being wisely generous. The third storyboard – “Um Yousef’s family” – represented the

religious factor. In response to this storyboard, participants have provided positive feedback pertaining to how the illustration sheds light on this issue. However, there was a common perception that the woman and the child should be seated on the floor, as this would complement their body posture and facial expressions to emphasize their poverty and increase the level of empathy in the scene. The researcher believes that this was suggested as this is the stereotype used in movies when poverty is prototyped which in some cases reflects real life.



Figure 6. 18 Feedback from participants during the design workshop



Figure 6. 19 Feedback from participants during the design workshop

Physical and digital materials

- **Fact video**

Participants were shown the fact video which as mentioned earlier should cause a surprise through the facts presented. Participants in the design workshop remarked mostly on the font used in the headlines and how it was presented (e.g., font size, placement, and colour). They also suggested using highlights on the headlines as they appear to emphasise the information's importance. The music used was considered too tragic for the topic and should reflect the nature of the problem. The overall texture that was applied to hinder proper vision in some senses, thus it was recommended that it should be removed to demonstrate the simplicity and avoid distraction.

- **Food waste bags and diaries**

After delivering the food waste bags and diaries to the households as a pilot test, they were asked to provide some pictures combined with feedback to demonstrate the effectiveness of the materials used. During the design workshop, the researcher presented the pictures and feedback that got from the households to get proper comments pinning out important points for potential solutions. Participants commented on the material used for the food waste bags and suggested that another material should be considered as it was unreliable in terms of throwing away food waste, however, they suggested plastic materials for their durability and being environmentally friendly. Furthermore, the designers suggested materials that could be used multiple times and not just once to minimise waste in general (e.g., kitchen bin). The diaries on food waste were well received and appreciated. However, they suggested converting it to a digital format instead.

- **Social media content**

The first iteration of three social media posts presented were not well received. Points were raised that these were not relevant to the Jordanian context, were overused in social media in general, and childish (i.e., use of illustration), and the food item used was not clear (i.e., the illustrated photo manipulation). The researcher raised the question aimed at households participating in this workshop “Which social media platforms do you usually use and interact with?”. The majority preferred using the Instagram platform.

C) Reflect

The researcher took time to consider the comments that received during the second design workshop to start reflecting as follows:

Motion graphics

- **Storyboards**

The researcher contacted the illustrator again to discuss comments received on the storyboards to have the best outcomes for the three motion graphics videos by adding colours and specific features to suit the Jordanian environment (e.g., adding landmarks which depict West/East Amman). The music to be used and the voice-over for each script was also discussed. The researcher contacted a specialized animator from his network to start the initial animation of the characters and scenes.

Physical and digital materials

- **Factual video**

The researcher started the reflection process for the factual video by removing any visual distraction (i.e., textures). Adjusting the overall settings of the fact video came next, this was demonstrated in voiceover clarity when combined with other sound effects. Comments on background music were taken into consideration by the researcher, replacing the tragic one with a more natural one to avoid distraction from the voiceover presenting the facts. Fonts were also changed accordingly.

- **Food waste bags and diaries**

After receiving comments regarding the material used for the food waste bags, the researcher restored using the original food waste caddy to institutionalise the activities to avoid further injections of money (see Appendix III). The researcher started creating a digital format of the diaries on food waste.

- **Social media content**

In response to participants' comments in the design workshop, the researcher started developing new social media content in different styles that reflected realism and connection to the three main factors identified in the Jordanian context.

6.2.3.3 Creative process 03

A) Plan

Motion graphics

- **Illustrations**

After reflecting on all comments received on the storyboards, the illustrator and the researcher started brainstorming scene contents (e.g., environment) and characters (i.e., physical appearances), to ensure that the results cause the strongest impact on the household members.

- **Animation**

The researcher contacted an experienced animator from his design network to start building the animation process to negotiate timelines and prices.

- **Voice-over**

The researcher started looking for specialised people for the voice-over to be contacted with several voiceover artists from both genders with different accents (e.g., Jordanian, Egyptian, and Syrian) since Jordanian households, in general, are exposed to such accents regularly through daily life and visual/audio media due to cultural similarities. This was in addition to voiceover artists with the English language due to its popular use in the Jordanian context (e.g., West Amman).

- **Music**

The researcher identified several platforms that offer music that can be used during video production.

Physical and digital materials

- **Food waste caddy/Digital diaries**

After considering the comments from the communication designers and households in the design workshop, food waste caddies appeared again to induce sustainable behaviour in reducing food waste. The researcher adopted Lockton et al.'s (2010) Ludic lens (i.e., Levels) to follow up and calculate the amount of food waste by measuring the volume of waste and writing it down on a digital memo on a daily basis.

The researcher looked for options in home stores in Jordan which sell food waste caddies. Afterwards, the researcher bought the most affordable food waste caddy that fits in with the campaign budget. The reason for choosing this particular food waste caddy was due to its flexibility being hung on a nearby work surface in the kitchen. The researcher had the intention of linking the caddy with food waste quantification techniques to get constant updates (i.e., tracking and recording food waste on a daily basis) using the provided digital diaries. This was to be achieved by placing a scale on the side of the caddy to record the volume of food waste in the digital diary. Lockton's Interaction lens (i.e., Progress bar) was used to let households know their progress towards achieving a goal. The researcher believed that a QR code labelled on the food waste caddy will add more interaction between the researcher and the households.

- **Planning meals and purchases memos**

The researcher believed that it is not enough to shed light on problems related to food waste but should also incorporate feasible solutions to minimise the issue. Lockton et al.'s (2010) Cognitive lens (i.e., Commitment Consistency and Habit) was used to make it easy for a new behaviour to become habitual, by building it into an existing routine. The "planning Meals and Purchases Memo" strategy was linked particularly to the food expenditures factor which gives households the chance to save money through planning what to cook and what groceries they need before purchasing any.

- **"Eat Me First" fridge box**

When the researcher conducted the ethnographic observation (see Chapter 5), the researcher noticed that one of the main issues that caused spontaneous purchases was that food was not put in an order in which to use first as well as some food items were hidden due to the fridge being overloaded with surplus food items which later become rotten. The researcher believed that the best way to minimise this issue that results in food waste was by looking for available resources. Lockton's Cognitive lens (i.e., Desire to order) was used to influence households to rearrange elements or take actions the researcher wants them to do. "Eat Me First" fridge box was selected to be provided later to households helping them arrange food in the fridge in terms of their close to expiry dates to save money when they plan their purchases and meals. This strategy walks hand-in-hand with the planning meals and purchases memo strategy.

It helps households eat better and reduce food waste since they will know exactly what's in the fridge, waiting to be prepared.

- **Food sharing box**

In an attempt to assuage guilt caused by food being wasted, the researcher used Lockton's Cognitive lens (i.e., Assuaging Guilt) (Lockton et al., 2010) to influence users by helping them reduce their feeling of guilt about their behaviour. This was done through an indirect link between households who have surplus and people in need through the facilitator. This strategy is directly linked to the Religion factor.

A) Act

Motion graphics

- **Illustrations**

During this stage, the illustrator started drawing and colouring scenes (e.g., environment) and characters (i.e., physical appearances) based on mood boards related to the Jordanian context testing what might and might not work. When all three illustration contents were received the researcher revised them to ensure the quality of delivery to the households. Some illustrations for the three videos are shown in Figure 6.20. These videos can be accessed via the following three weblinks:

- **Food expenditure video**: https://www.qahmad.com/work/pocketsdad
- **Religion video:** https://www.qahmad.com/work/endhunger
- **Generosity video:** https://www.qahmad.com/work/bewiselygenerous



Figure 6. 20 Some illustrations for the three videos

- **Animation**

Afterwards, the researcher sent these illustrations in the correct format to the animator to start the animation process and emphasised sticking to the 30 seconds duration for each video, since short motion graphics videos proved their efficiency as well as to make sure that it fits with the budget limit.

- **Voice-over**

The researcher contacted several voiceover artists of both genders with different accents (e.g., Jordanian, Egyptian, and Syrian) and languages (i.e., English) as intended. Subsequently, the researcher sent the script to the voice-over artists to deliver based on its content for better decision-making in terms of who presents it in the best way. The researcher ensured the choices should be made upon how persuasive each voice-over was while telling the story regardless of accent, language, and gender.

- **Music**

After identifying several platforms that offer music that can be used during video production. The selection of music was evaluated based on its suitability with the overall animation and voiceover, as well as the nature of the videos.

Physical and digital materials

- **Food waste caddy/Digital diaries**

The facilitator purchased the two samples of the food waste caddy suggested by the researcher, to test its effectiveness and durability. After that, the facilitator took dimensions for the front and sides of the caddy to allow the researcher to design a scale sticker to place on the caddy with the QR code alongside the Namlia logo, and another sticker (i.e., scale) to place on the side of the caddy for food waste quantification (see Figure 6.21). Digital diaries were designed to be delivered later at the beginning of the Namlia campaign (see Figure 6.22).



Figure 6. 21 Food waste caddy

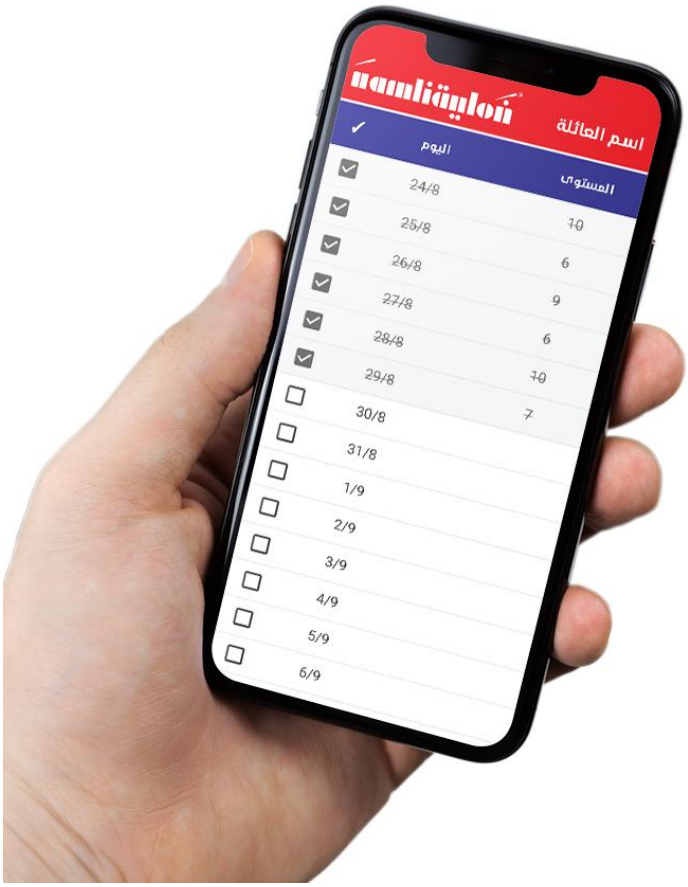


Figure 6. 22 Digital diary to record daily food waste quantifications

- **Planning meals and purchases memos**

The researcher started designing the two-month period “planning Meals and Purchases Memo” and sent it to the print shop in Amman to be collected by the facilitator.

- **“Eat Me First” fridge box**

The researcher found a suitable box in the Jordanian market and informed the facilitator to purchase two samples to test durability and effectiveness. Measurements were recorded by the facilitator and then sent to the researcher. After receiving the measurements, the researcher designed the “Eat Me First” sticker, which was printed out and collected by the facilitator.

- **Food sharing box**

The facilitator purchased two card boxes based on the researcher's recommendation. Measurements were recorded by the facilitator and then sent to the researcher. After receiving the measurements, the researcher designed a sticker with the Namlia logo that was printed out and collected by the facilitator.

B) Observe

The aim of the workshop was to test the potential ideas created and developed in the plan/act stage. The workshop took place on the 3rd of July 2021 via Mural online platform which provided good interaction between participants and the materials presented. A total of 10 participants attended the design workshop: six households, two communication designers and two experts in behaviour change campaigns. Approximately 90-140 minutes were devoted to this design workshop.

Motion graphics

The researcher presented three motion graphics videos related to food waste. The videos received positive feedback. In terms of language, all participants agreed that the three-motion graphics videos should be displayed in Arabic and not in English since the Namlia campaign targets Jordanian households. However, the Egyptian accent was better received than the other two accents (i.e., Jordanian, and Syrian), and believed that it was best presented by the male voice-over artist. Moreover, music was thought to be a good fit for the content presented, however, the participants preferred a certain type of melody than the one presented. Though, when the Qur'an verse was presented at the end of the religion video, they suggested it be read in a specific sacred tone. Furthermore, some sound effects were suggested, for instance, adding a playful sound to the tomatoes when placed in the fridge (Abu Jeebah's family video), adding a crying sound to a hungry child (Um Yousef's family video) and adding a scolding sound to Abu Hatem's angry wife when he walks in with more food in hand.

Physical and digital materials

- **Fact video**

The researcher presented the fact video with all suggestions taken into consideration by the participants. Participants did not have any comments on the amended video and were happy with the new revised version.

- **Social media content**

Two different styles of social media content (i.e., realistic, and animated) were presented in the workshop. Each style consisted of three contents that related to the main factors. Some points were raised on the realistic style contents in terms of them not being related to the Jordanian context through the bin style and colour, being overused in social media in general (i.e., Google search tool), and the handprints use not being clear (i.e., related to violence and criminal ads), whereas the animation style contents were well-received by the participants.

- **Food waste caddy/Digital diaries**

The food waste caddy received appreciation and admiration. Participants were excited about using the caddy and thought it was helpful and suitable for food waste. They also appreciated the scale and QR code placed in the right position on the caddy. The digital diaries were positively received, which encouraged the researcher to distribute more food waste caddies and digital diaries once the researcher quantified the right number of households interested in being involved in the campaign.

- **Planning meals and purchases memos**

The planning meals and purchases memo received positive feedback (see Appendix III). The researcher was therefore able to distribute more memos once he had determined the appropriate number of households to engage with the campaign.

- **“Eat Me First” fridge box**

The “Eat Me First” fridge box was hailed by the participants. They all thought the “Eat Me First” sticker was placed in the right position on the front of the box. This encouraged the researcher to distribute more “Eat Me First” fridge boxes once he quantified the right number of households interested to involve in the campaign.

- **Food sharing box**

The Food sharing box was appreciated by the participants. They believed that it was a good idea to share surplus food with those in need. Upon determining the right number of households to include in the campaign, the researcher distributed more Food Sharing Boxes.

C) Reflect

After considering the comments received during the third design workshop, the researcher began reflecting as follows:

Motion graphics

The participants were able to discuss whether the motion graphics videos were of a good impression. They expressed their excitement when watching the content and emphasised the impact it will have on the food waste issue. However, the researcher reflected on what they chose (i.e., choosing a specific type of music they heard) and incorporated it in the motion graphics videos, in addition to embedding the requested sound effects. The sound they chose was also confirmed by the animator.

Physical and digital materials

Overall, all contents related to the physical and digital media intervention materials were well received and no changes were requested. However, there was a discussion related to social media content, and the researcher took participants' comments into consideration to make sure that the content is presented in the best possible way for the next design workshop.

6.2.3.4 Creative process 04

A) Plan

Physical and digital materials

- **Social media content**

After reflecting on all comments received during the third design workshop, the researcher reached out to a 3D artist to redesign the three contents in 3D. The researcher and the 3D artist started the ideation session via Mural to ensure that the results cause the strongest impact on the household members.

A) Act

After the Plan stage, the researcher met with the 3d artist to review the results they came up with and there were three main feedback points around the contents. Two weeks later we met again to see how he incorporated the feedback. When the contents

were received, the researcher revised them to ensure quality before the Observe stage.

B) Observe

The aim of the workshop was to test the potential ideas created and developed in the plan/act stage. The workshop took place on the 6th of August 2021 via Mural which provided good interaction between participants and the materials presented. Participants could place sticky notes on artworks and write their comments as needed. A total of seven participants attended the design workshop: three households, two communication designers and two experts in behaviour change campaigns. Approximately 40-60 minutes were devoted to this design workshop.

The researcher presented the social media contents and all intervention materials. In an open discussion, the participants shared their thoughts on each intervention material and explained their preferences. The participants ensured that all intervention materials will be surprising and disruptive to maximise the effect on the household's behaviour.

C) Reflect

The intervention materials have been designed with the Jordanian households in mind. The researcher ensured that the campaign has the right 'look and feel' through multiple iterations with a group consisting of Jordanian households, communication designers and experts in behaviour change campaigns. This involved a piloting process (e.g., food waste bags) to ensure that the intervention materials will be delivered as intended, that key messages were understood and that materials (i.e., 'Eat Me First' fridge box) were adapted to improve effectiveness. This process was essential to ensure that the campaign was underpinned by an intervention's theory of change and had emotive appeal to enable sustained behavioural change.

6.2.4 Deliver

The 'Deliver' stage refers to the implementation of the intervention materials. The researcher considered multiple factors during this step including the exposure to the campaign, the length of the intervention, coverage, intensity, acceptability, fidelity, interferences, evaluability, and sustainability (Aunger & Curtis, 2016). Intervention

materials were delivered through different channels, from face-to-face contact to mass media campaigns. The Namlia campaign in Amman centred on households and was delivered over a two-month period to 14 households. The intervention's physical materials were delivered by a facilitator (e.g., food waste caddies), who had good communication skills which helped in building trust between him and household members, which is particularly important in behaviour change campaigns. Eight intervention materials were delivered by the researcher and the facilitator, and these were implemented from 14 August 2021 to 14 October 2021, followed by a food waste quantification period to determine at which stage the effects of the interventions happen (see Table 6.3). The researcher intended to deliver the intervention materials every Thursday[4] to provide households with time to reflect on the materials uploaded with an intention to induce them to consider their practices towards food (e.g., planning purchases and cooking). Each intervention material was designed around one of the three motivational factors – religion, saving money, and generosity.

Table 6.3 Delivery of the intervention materials

Date	Days	Content	Purpose
13 August 2021	**Introductory**	WhatsApp message & Instagram post	Introducing the "Namlia" campaign to the participants through a WhatsApp message, then posting a stop motion post presenting the campaign aim and objectives.
14-20 August 2021	**Day 1-62** (Long intervention)	Food waste caddy	The Namlia campaign team provided Food waste caddies to all 14 households. The caddy helps them to self-judge how much they contribute to the issue. This is done by following up and calculating the amount of food waste by measuring the level of waste and writing it down on the memo daily (shared excel sheet). Participants should scan the QR code on the caddy and send which number they have reached on the scale provided on the caddy via WhatsApp at the end of each week.

[4]Weekends start on Fridays in Jordan

	Day 6-7	Fact video	This video shows some facts related to Jordan's environmental situation and its socio-economic effects and how it is a major problem around the globe.
21 August-05 September 2021	**Day 8-17**	Food expenditure video	This motion graphic sheds light on the problem of bad planning purchases and spontaneous shopping habits. This is illustrated in a humorous way by showing a family who purchases food spontaneously without planning, ending up buying food they already have and as a result throwing old food in the trash to replace it with what they have purchased.
		Planning purchases & meals memo	Trying to help reduce this habit, a 2-months "planning purchases and meals memo" was provided as a hard copy by the Namlia team to allow participants to better plan their purchases by writing down their weekly meals and needed shopping list.
	Day 18-19	"Eat Me First" fridge box	Alongside this memo, participants were provided with an "Eat Me First" box. This is to be used inside the fridge to arrange food and products with a near expiry date in order to avoid throwing them away and make it easier for households to make a checklist of what they have before planning and purchasing.
	Day 20-23	Food expenditure poster	Lastly, in connection with food expenditures, participants were exposed to a poster that demonstrates how throwing away leftovers is similar to throwing away our own money as part of the intervention regarding food expenses.
06-21 September 2021	**Day 24-33**	Religion video	This motion graphic shows how society is divided into two categories one who does not value food unintentionally, while there are people who do not have the minimum amount of food to survive. The video quoted a verse from the holy Quran to shed light from a religious point of view trying to trigger people's emotions.

		Food sharing box	This box was delivered to participants by the Namlia team. This box allows households to think differently about their near expiry products and leftovers as things to be shared rather than thrown away.
	Day 34-39	Religion poster	This poster illustrates how leftovers which are mostly thrown away, are considered a meal for those in need.
22 September-07 October 2021	**Day 40-49**	Generosity video	This motion graphic introduces Abu Hatem's Character to shed light on people who exaggerate when buying groceries and when putting food on the table. while society calls this generous it is considered an extravagates.
	Day 50-55	Generosity poster	This poster illustrates how the generosity phenomenon can affect society as a whole by buying surplus food to express love and affection to other people as it is considered a sign of hospitality and wealth while the food is actually being thrown away as it is surplus.
08-14 October 2021	**Day 56-62**	Rewards	As a way to thank households for their participation, a cash back card was given to them at the end of the interventions.
		End of the campaign	Reaching the end of the campaign, the food waste tracking which lasted for two months has ended.

6.2.4.1 Intervention materials

- **Food waste caddy**

The purpose of providing households with food waste caddies is to help them self-judge how much food waste they contribute to the issue and determine at which stage the effects of the interventions happen at the end of the campaign. The interaction lens from Design with Intent was adopted in this intervention to allow households to know their progress towards achieving this goal. The food waste caddy was designed with two stickers, one in front with the campaign logo and QR code and one on the side with a scale from 1-10. The purpose of the QR code was to share a digital memo with the households and receive it at the end of the campaign and to provide them with a wide range of information. The households followed up and calculated the amount of food waste by measuring the level of food waste and writing it down on the provided digital memo on a daily basis for two months (Figure 6.23).



Figure 6. 23 A participant disposing of edible food in the food waste caddy

- **Factual video**

It is a short informative video that displays facts related to food waste impacts on Jordan and the world’s social, economic, and environmental situation. Although it is a short video and not related directly to the factors, it encouraged households to follow and find out more on the campaign's Instagram account where they can share and communicate their thoughts (Figure 6.24).



Figure 6. 24 A scene from the factual video showing the food waste percentage in Jordan

- **Motion graphics videos**

In the interventions featured in Figure 6.25, Lockton et al.'s (2010) cognitive and ludic lenses directed the scenarios in the videos through emotional engagement to engage the household's emotions and make them emotionally connect to their behaviour and tell a story by presenting the common mistakes related to daily food practices and routines. The first video represented the food expenditure factor by highlighting the problem of bad planning purchases and spontaneous shopping habits. Using humour, this video featured a family who purchases food spontaneously without planning and ends up buying food they already have and as a result throwing old food in the trash

to replace it with what they have purchased. The second video depicted the religious factor by showing how Ammani society is divided into two categories: one who does not value food unintentionally, and those who do not have enough food to survive. At the end of this video, a verse from the holy Quran demonstrates this from a religious point of view, in an attempt to trigger people's emotions. The third video demonstrated misconceptions about generosity and distinguished it from extravagance by showing a family who exaggerates in buying groceries as a kind of generosity and serving more food than required which results in higher levels of food surplus that ends up going to waste. At the end of each video, advice on reducing food waste was presented.



Figure 6. 25 Scenes from the three motion graphics videos

- **Posters**

The posters feature a simple concept that effectively captures the idea of food waste behaviour. The approach used the Ludic lens to create exaggerated graphics to reflect common food mishaps in the three posters. They depicted the three factors by highlighting the very real problem of food waste in Amman, with three Arabic taglines 'Recognize your food values', 'Your leftovers…a meal for others', and 'Your generosity is burying us' (Figure 6.26). In connection with the food expenditures factor, households were exposed to a poster that demonstrates how throwing away leftovers is similar to throwing away our own money as part of the intervention regarding food expenses. The second poster represented the religious factor and illustrated how leftovers which are mostly thrown away, are considered a meal for those in need. Lastly, the third poster illustrated how the generosity phenomenon can affect society as a whole by buying surplus food to express love and affection to other people as it

is considered a sign of hospitality and wealth while the food is actually being thrown away as it is surplus.



Figure 6. 26 The three campaign posters

- **Planning purchases and meals memo**

A two-month planning purchases and meals memo related to the food expenditure factor helps households change their old habits in an easy and achievable way. It was provided as a hard copy to allow households to better plan their purchases and meals by checking their pantry, refrigerator and freezer and thus writing down their weekly meals and shopping list (Figure 6.27).



Figure 6. 27 A 2-months planning purchases and meals memo

- **Eat Me First fridge box**

The Eat ME First box was another intervention related to the food expenditure factor provided to households. The box is meant to be placed inside the fridge to arrange food and products with a near expiry date to avoid throwing them away and make it easier for households to make a checklist of what they have before planning and purchasing (Figure 6.28).



Figure 6. 28 Eat Me First fridge box

- **Food sharing box**

This intervention is linked to the religious factor. The food sharing box was delivered to households to allow them to think differently about their near expiry date products and leftovers as things to be shared with people in need rather than thrown away (Figure 6.29). This helps in assuaging guilt that is derived from the cognitive lens.



Figure 6. 29 Food sharing box

- **Rewards**

At the end of the interventions, cashback gift cards were given to households as a way to thank them for their valuable participation and encourage them to continue reducing food waste (Figure 6.30).



Figure 6. 30 Handing in a gift card to a participant

6.2.4.2 Monitoring

Monitoring was essential to the management of the behaviour change campaign. The researcher conducted a comprehensive monitoring plan to track the delivery, the reach, the fidelity, and the household's response to the intervention materials along the Theory of Change. The researcher revised and pinned out improvement points where necessary at an interval, for example knowing when to deliver intervention materials (e.g., weekends) to keep the consistency of the household interaction (e.g., planning their purchases) throughout their engagement and comments on the social media platform related to the campaign (i.e., Namlia's Instagram page), and the food waste quantification sheet.

Being a small-scale campaign eased the delivery process. The researcher recognised the additional costs associated with delivering some intervention materials. For instance, some intervention materials were printed more than once (e.g., planning meals and purchases memos) due to some households losing their memos and/or usage mistakes. This was to ensure the maintenance of quality and motivation for the researcher to simplify management tasks. As it was a small-scale campaign, the researcher was able to avoid endless revisions and incur extra transaction costs in terms of the campaign timeline and budget. After implementation, the intervention materials were completed and all monitoring data collected, the researcher was keen to write a brief about the implementation problems experienced so that the researcher can have a better foundation for the process evaluation (see Box 3).

Namlia Implementation Issues

Delivery issues:

The communication campaign ran remotely due to COVID-19 which had a slight effect on delivering the intervention materials for households.

Being forced to deliver materials (e.g., planning meals and purchases memos) that has already been delivered due to loss and usage mistakes by the households.

Fidelity issues:

The facilitator learned as he went from west to east Amman that households were committed to the proper use of the intervention materials alongside getting used to using these materials regularly.

The researcher was able to notice households' fidelity from their engagement through Instagram comments and information recorded on the food waste quantification digital memo.

Households were happy to share photos from their new food practices and routines (e.g., using the 'Eat Me First' fridge box and food sharing box).

Box 3 Namlia implementation issues

6.2.5 Evaluate

The execution of the campaign was analysed to learn from the experience and develop guidelines to support the adoption of learned lessons in other contexts. This step was divided into two: first, showing that an impact has occurred because of the intervention materials (Food waste quantification and semi-structured interviews), and second, a demonstration that the hypothesised 'pathways' of causal influence in the Theory of Change were achieved by the campaign (i.e., Process Evaluation). The researcher shows through this section both the Impact and evaluation process. Hence, this step demonstrates the assessment and evaluation of the effectiveness of intervention materials and post-food waste quantification.

6.2.5.1 Food waste quantifications and its results

By measuring the level of food waste on the scale sticker on the food waste caddy, the researcher was able to calculate the weekly volume of food waste from the beginning of the campaign, through the three main intervention materials which are divided into food expenditure, religion, and generosity and one-week period after

completing the campaign. Since this research adopted the High-Level Panel of Experts (2014) definition of food waste as “Food appropriate for human consumption being discarded or left to spoil at consumer level—regardless of the cause”, the researcher asked the households to only use the provided food waste caddy for edible food waste. The researcher determined which intervention materials had a remarkable effect on reducing food waste by computing the median values of the weekly level of food waste for each household and then all values were converted into percentages. R software was used to conduct all the analyses. In the following bar chart, the researcher shows the percentage of food waste generated by 14 households in East and West Amman during and after the food waste campaign ended (Figure 6.31).

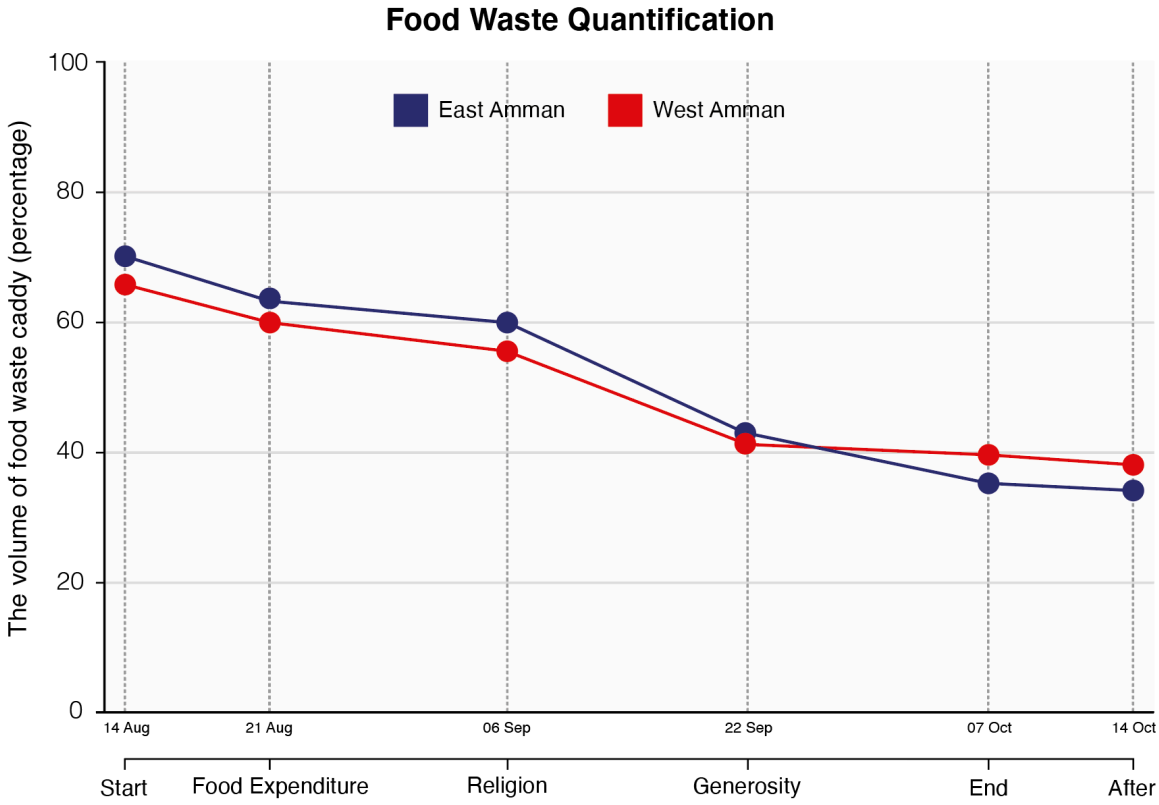


Figure 6. 31 Food waste quantification results

Overall, a prominent feature is that an incredibly low percentage of food waste was presented in both locations from day one of the campaign until the post-campaign period, a 47 percent reduction. The period between the start of the campaign and the start of the religion factor sought a decrease in food waste levels in both locations (around 14 percent decrease), although the difference in percentage in both locations

is approximately the same, West Amman had less food waste percentage. However, food waste levels decreased dramatically during the religion factor period up to the start of generosity factor as it was reported in East Amman (a 28 percent decrease), and West Amman reported a 27.5 percent decrease. This is attributed to the interventions included in the religion factor, the reason will be further discussed in the results of the semi-structured interviews.

Despite food waste levels in West Amman decreasing throughout the campaign, East Amman food waste levels sought a dramatic decrease when these levels were measured, especially after they were exposed to interventions in the religion factor mentioned previously, and this was assured in the semi-structured interviews. During the one-week post-campaign period (7 Oct-14 Oct), food waste levels recorded a slight difference in both locations, with a 2.6 percent decrease in East Amman and with a 2.5 percent decrease in West Amman.

6.2.5.2 Results from semi-structured interview

The aim of the online semi-structured interviews was to evaluate the impact of the communication campaign intervention materials and gain valuable insights beyond those found in the food waste quantification analysis. The interviews were used to better understand what stage of the campaign contributed most to changing behaviour around food waste reduction and to what extent. The researcher was curious to know whether any of the intervention materials were still having an impact on households two months after it ended.

Two months after the end of the campaign, a total of 14 participants agreed to participate in a semi-structured interview, before reaching thematic saturation. The interviews, conducted over Zoom and in Arabic, lasted about 60-80 minutes each. The interviews were audio-recorded to allow for translation from Arabic to English and transcription of the interviews, which were then coded using the software NVivo and checked for accuracy prior to thematic analysis. All interviews were conducted between the 22nd and 27th December 2021. All interviewees received participant information sheets before their interview to ensure that they understood the purpose of their interview. Before signing the consent form, they were given the opportunity to

ask any questions may they have. The researcher commenced the interviews with general questions about their overall impression of the campaign. The general questions were then followed by more specific questions based on each campaign intervention material (Table 6.4).

Table 6.4 Semi-structured interview questions

Topic	Semi-structured interview questions
General questions	1. What is your overall impression of the campaign? 2. During the campaign, what was the most effective part? 3. You were provided with a food waste caddy. Do you still use it? And what are your thoughts when using it? 4. By seeing the amount of daily food you waste, to what extent does that affect you to reduce food waste? 5. Did the campaign introduce new ways to deal with surplus food? (Please elaborate)
Food expenditure	1. What did you think about the video? (Please elaborate) 2. Has the motion graphics video changed the amount of food wasted at your house? 3. Did you find the 'planning purchases and meals memo' useful? (Please elaborate) 4. Has the 'Eat Me First' fridge box changed the amount of food wasted at your house? (Please elaborate) 5. What did you think about the poster? (Please elaborate)
Religion	1. What did you think about the video? (Please elaborate) 2. Has the motion graphics video changed the amount of food wasted at your house? 3. Did you find the food sharing box useful? (Please elaborate) 4. What did you think about the poster? (Please elaborate)
Generosity	1. What did you think about the video? (Please elaborate) 2. Has the motion graphics video changed the amount of food wasted at your house? 3. What did you think about the poster? (Please elaborate)

The results of the interviews demonstrate that participants expressed positive feelings about the interventions and were motivated to reduce food waste after they took part in the campaign. They endorsed the campaign objectives and found the motion graphics videos enjoyable. HW7 states: "I believe that being exposed to this campaign was very educational… materials used to shed light on simple actions in order to mitigate environmental and social impacts on food waste, which has never occurred to me."

Representatives of other household key groups claimed the campaign was eye-opening to an issue that needs to be resolved. According to HE13 said:

"It opened my eyes to an issue that we as a society suffer from, but do not actually take action towards it."

HE10 who has never been exposed to an awareness campaign in this context, asserted the effectiveness of this campaign targeting several issues:

"It was the first time that I was exposed to a campaign that concerned environmental, economic and social issues."

Character names in the three motion graphics videos created a positive impact on participants. For example, HW3 remarked that:

"My children and I were impressed with the way that this campaign addressed the issue of food waste. Using a sense of humour was really effective… Abu Jeebah, Um Yousef and Abu Hatem are names that they use regularly when playing."

All 14 participants assured the researcher that they still use the food waste caddy provided, as it helped them identify the amount of food they waste. HW5 explains: "Seeing how much food I waste made a difference, I was shocked at how much I waste without realising… I will always have the caddy in my kitchen."

HE8 consensus enhanced HW5's opinion:

"It is insane how much edible food we throw in the trash… it is a great idea to use such a smart solution in the kitchen."

- **Food expenditures**

Although this was ranked the least effective factor of the three, it helped reduce food waste, as it touched mainly on saving money. A small number of participants thought it was the most effective one, as HW6 states:

"I really enjoyed this video. Seeing what we do in the illustrated video was funny but made us think of our bad habits."

Similarly, HW1 said:

> “It induced smart purchasing through buying only stuff we need, which saves money, and thus reduces food waste… my kids still watch it”.

HE13 added:

> “Abu Jeebah exaggerated when buying his groceries and ended up throwing away food that he already had… I believe everyone should plan before buying food items they already have, to save money and reduce food waste.”

The planning purchases and meals memo delivered to participants as part of the “Food Expenditures” interventions was helpful in planning what groceries to buy before going shopping based on what meals are to be cooked for the week, which as a result saved money. HW4 stated:

> “This helped in remarkably reducing weekly expenses spent on groceries, thus following a clear purchasing plan for our necessities daily.”

Similarly, HE9 pointed out that:

> “[…] It helped save money, which made my husband very happy… It also made my children who hate eating leftovers very happy as well.”

The Eat Me First fridge box was an intervention aimed at helping people save money by arranging food inside the fridge to make a checklist of what households have before going shopping. Families described how the Eat Me First fridge box helped them rearrange their fridge shelves in a way that they were able to see food items that remained unseen and were expiring, as it is close to eye-level at the front of their fridge.

HW6 said:

> “I have saved so much money by using this box to prevent food waste resulting from storing surplus food inside the fridge.”

HE9 adds:

> “[…] I'm grateful for [you] providing me with this box... keeping this box for items that are close to their end of shelf life or are close to their used-by date is a great idea.”

Representing a couple with children group, HE8 said:

> “To be honest the “eat me first box” made my life easier. It prevented rummaging through items in the fridge… Now I keep green leaves, radish, and lemon that are cut in half, so they do not get lost in the back of the fridge.”

Participants had positive thoughts about the poster, because it was easy to understand and relate to the food expenditures factor. It embodied how edible food is wasted without realising that it is money spent on food that is being thrown away. HW7 stated:

> “It drew a clear picture of what we throw away in the trash, it is our money.”

HW5 said:

> “The poster illustrated my thoughts when I waste edible food.”

As noted from the quotes above, the two-week food expenditures interventions covered different materials including a motion graphics video, planning purchases and meals memo, the Eat Me First box, and a poster. The interventions related to this factor had useful and easy-to-follow tips on how to save money. It was evident that participating in such interventions had powerful and positive impacts on food practices and routines.

- **Religion**

Participants from both locations repeatedly identified religion as the most important factor in shaping their behaviour. Households showed the highest participation rates when they were exposed to an intervention from this factor. A participant remarked that this factor illustrated the sad truth most of them ignore, while HE10 said:

> “What fascinates me is the important factor in the campaign, which is the religious factor.”

HE10 also quoted a hadith from prophet Mohammed:

> “The one who sleeps satiated and knows that his neighbour is hungry has not believed in me.”

Illustrating a family who wastes large amounts of food carelessly while other people don’t have enough food on their plate, touches on feelings of empathy and those people should be aware of others who are starving

> “The crying kid scene broke my heart… I believe that food should never be wasted, as one day we may be poor and in need of this food and regret wasting it” (HE13).

> “This video left a strong impact on me and my family… unfortunately it represents the reality we live in” (HW2)

HW3 said:

> “To be honest, we brag and show off the variety of food we have on our table, although others may not have the least to satisfy their hunger”

The Food Sharing Box was delivered to participants to share with people in need. It helped households change the way they view leftovers and near expiry products from waste to sharing. HE7 remarked that:

> “To be honest, we brag and show off the variety of food we have on our table, although others may not have the least to satisfy their hunger.”

> “It left a positive [and] useful impression which helped in reducing food waste, and instead of throwing it away we should donate it to people in need…”

> “If we ever think of people in need, even for a moment, we will share more food.” HE9 said.

> “Although I usually share food, during this campaign, I was introduced to a better way to share it.” HE13 commented.

This poster was created by illustrating how leftovers that we throw away without thought might become meals for others.

> “Although I usually share food, during this campaign, I was introduced to a better way to share it.” HE13 commented.

> “It is upsetting how we throw away those food leftovers.” HE11 said.

> “Your less is more for other people… Food is God's gift that we should be more aware of.” HW1 said.

Interestingly, the quotes above mention how religious beliefs have been influential in shaping households’ attitudes toward leftovers and reducing food waste. It was clear that targeting their religious beliefs had a great impact on West and East Amman, thinking about people in need. The emotional response was evoked by the motion graphics video intervention, particularly when the kid was crying because of hunger. It is important to mention that, as the bar graph demonstrates, the results of this analysis match the results of the quantification of food waste.

- **Generosity**

This factor was second in influencing households’ behaviour towards food waste and surplus food. It draws the attention that people should distinguish the difference between being generous and extravagant.

This motion graphics video is illustrated in a humorous way, drawing a picture of how generosity is mixed with exaggerating when buying groceries which causes food waste. This is represented by Abu Hatem’s family.

> “True, sad and funny, all at once.” HW14 mentioned.

> “This video touches on bad habits that some of us practice daily.” HW2 said.

> “The fact that this video is related to reality, made me laugh especially when the fridge screamed at Abu Hatem for buying more food. His facial expression was priceless.” HW3 said.

In this poster, surplus food is shown rotting in the ground causing houses to be buried due to generosity. According to HW6:

> “It represents the Jordanian society… it should change our behaviour in viewing food.”

It is noteworthy that, as indicated in the bar chart (see Figure 6.13), food waste levels between the religion factor interventions and the generosity factor interventions continued to decrease even after the campaign ended, perhaps due to households linking both factors together through directing generosity towards people in need instead of bragging of how much food they have. In conclusion, participants in these interventions responded positively to them and had a powerful impact on their practices.

6.2.5.3 Process evaluation

In the process evaluation, the researcher sought which aspects and intervention materials have contributed to Namlia's campaign success. The process evaluation is meant to explain why the results of the impact evaluation were positive or negative. The researcher was determined to follow the logic of the Theory of Change by building an ongoing monitoring system for households’ activities from day one of the campaign, followed by conducting semi-structured interviews with the households. The evaluation of the Namlia campaign revealed several types of success with some intervention materials being stronger than others (such as the motion graphics video representing the religious factor). The proper management and structural design of Namlia's campaign proved evident in its success. Sufficient funds have been disbursed to conduct all activities, and the implementing actors (i.e., the researcher and facilitator) were skilled at conducting proper monitoring so that certain planned

activities were accomplished carefully. The following points describe how the researcher measured each of Namlia's campaign facets:

- **Touchpoint:** all households participating in the campaign were at the chosen time and place as believed during the campaign design (see Build step).
- **Activity:** all activities were being undertaken by the target households.
- **Channel:** all households at the touchpoints were mentally and physically capable of receiving information via the chosen mode (e.g., the visual transmission was bright enough to be seen and the audio transmission was noise-free).
- **Behaviour change techniques:** all communication activities have been conducted by the researcher and have been received by all households. The messages were surprising and produced a vivid impression on the households' minds. As a result, the selected behaviour change techniques were appropriate and the desired outcomes were achieved.

Since the Namlia Campaign intervention materials applied the BCD approach – based on an explicit theory of situations and settings – the guidelines from this campaign can be adopted by other campaigns in the same context. It was evident from the Namlia process evaluation that the campaign had widespread exposure and influenced behaviour (see sections 6.2.5.1 and 6.2.5.2). Accordingly, the psychological changes were consistent with the campaign's Theory of Change, which lends credence to the results of the evaluation.

6.2.6 Overall reflection on the behavioural change campaign

Being simple to follow, the intervention materials helped households better engage in the process of food waste reduction. Although the religious factor had the most impact on food waste behaviour, the researcher can conclude that the two other factors (food expenditures and generosity) contributed towards better behaviours. As demonstrated in the previous section, participants were still eager to reduce their food waste even after the campaign ended, which is a sign of the campaign's success.

Family bonds enhanced the success of the intervention materials through our belief from the beginning that such bonds will play a great role in this success. This

manifested itself in creating an interactive atmosphere, particularly in two key groups of families with children (couples with children and single-parent families) through their engagement with motion graphics videos creating a positive impact on their parents.

The DwI method helped generate creative ideas and understand the households' behavioural patterns through inspiration mode to influence their behaviour towards food waste reduction. Using emotional engagement from the cognitive lens (Lockton et al., 2010) played a crucial role in targeting families and motivating them to engage in each step of the campaign. This was evident in the way families responded to the motion graphics video particularly the one in the religious factor where a child was crying from hunger, which evoked emotional empathy. Moreover, the use of storytelling from the Ludic lens when designing intervention materials helped keep participants interested and engaged, where scenarios that exaggerated reality represented in the motion graphics and posters appeared to reflect common mistakes in dealing with food daily practices and routines.

Reflecting on both habit and commitment and consistency from the cognitive lens, other interventions helped in making new behaviours become habitual by building into an existing routine (Lockton et al., 2010), for instance, planning purchases and meals memo and the Eat Me First box. This was evident after the end of the campaign which appeared in the results where participants committed and behaved consistently. Furthermore, assuaging guilt in the cognitive lens was targeted through the "Food Sharing Box" representing the religious factor, which proved effective in helping participants reduce their feelings of guilt by sharing their food items with people in need.

6.2.7 Summary

This chapter has provided a description of the process of designing, testing, and evaluating the communication campaign that aims to influence households' behaviour toward food waste reduction in Jordan. The researcher has assessed information derived from the ethnographic research and theoretical framework model regarding household food waste behaviours (see Chapter 5), and developed and organised information into a theory of change through a framing process. The researcher has filled in the missing information during the Build step that was left unfilled during the

development Theory of Change. Thus, the researcher conducted formative research that answered questions that were left unanswered from the framing process. The researcher has turned the formative research findings into a Theory of Change for the campaign. This is known as the Design Process which was broken down into nine steps to take the process from a large number of findings derived from the field to the production of a creative brief that was reflected in the campaign focus. Next, the researcher has started the development of the intervention materials. The intervention materials were developed through a combination of brainstorming techniques. This step involves action research, and the data is collected primarily through four workshops. The researcher and facilitator delivered eight intervention materials, which were then implemented between 14 August 2021 and 14 October 2021, followed by a food waste quantification period to determine at what stage the effects of the interventions would be evident.

The researcher has evaluated the effectiveness of three factors through the implementation of a small-scale communication campaign aimed at raising awareness among Ammani households about the issue of food waste and encouraging them to reduce it. In this study, all interventions focused on the three factors were successful in reducing food waste, with reductions ranging from 70 to 37 percent, with results demonstrating that the religion factor had the most impact overall. Religion seems to be a factor easily targeted by the interventions, particularly by focusing on the cognitive lens through emotional engagement, habit, and assuaging guilt, as well as providing materials to improve engagement on food waste reduction behaviours. Therefore, it would be beneficial to generate new ideas using some behavioural approaches such as the Design with Intent method.

Chapter 7 Discussion

7.1 Introduction to this chapter

This chapter reflects on the outcomes obtained during this PhD research. To begin with, the research outcomes are summarised. Then, it discusses the significance of the research outcomes and how they filled the knowledge gap identified in this research. Finally, this chapter also presents the proposed design process, communication campaign guidelines and how different users can adopt these guidelines in different contexts.

7.2 Summary of the research outcomes

This research has responded to the problem of food waste in Jordan. This section summarises the outcomes of each research question.

The outcomes of **RQ1** provided evidence of a lack of reliable data, sources, drivers, policies, interventions, and initiatives on food waste research in Jordan (see Chapter 2 and 4). The exploration phase was required to understand the current situation, as well as future plans, on solid waste in general and food waste in particular in Jordan (see Chapter 4). It also confirmed that BCD approach and DwI toolkit can be well applied when designing a communication campaign to shape human behaviour in a social context (see Chapter 2). The outcomes of **RQ2** identified the three main factors that seem to influence household food waste behaviour in Jordan the most (see Chapter 5). This outcome has been used to inform the development of the communication campaign (see Chapter 6). During **RQ3**, emphasis was placed on developing, testing, implementing, and evaluating the communication campaign. The outcomes of RQ3 offered communication campaign guidelines to support designers and practitioners in the adoption of learned lessons when designing communication campaigns for behaviour change in food waste reduction (see Chapter 7).

7.3 The significance of the research outcomes

This section discusses the significance of the research outcomes for tackling household food waste in Jordan. First, this research responded to the lack of

information available about the food waste issue in Jordan. For this reason, interviews with policymakers and experts specialised in solid waste management, environmental awareness, and sustainability (see Chapter 4) resulted in the identification of the current and future plans on the food waste issue in Jordan. It also emphasised that understanding household food waste behaviours in Jordan is needed.

Second, a number of behaviour change theories have been developed to understand household food waste behaviour and have been extensively discussed in the literature (Abdelradi, 2018; Abeliotis et al., 2014; Aktas et al., 2018; Farr-Wharton et al., 2014; Lazell, 2016b; Marangon et al., 2014; Quested et al., 2013; Stancu et al., 2016; Visschers et al., 2016). However, these studies are predominantly based on quantitative data with modest explanatory power and none of them has been developed for the Jordanian context. As a result, this research adopted and adapted a conceptual framework related to food waste behaviour and identified the factors that influence household food waste behaviour in Jordan by combining ethnographic research and the literature findings (see Chapter 5). These factors were then confirmed or rejected before being integrated into the communication campaign development (see Chapter 6).

Third, the literature review (see Section 2.5) identified a knowledge gap in the process of designing and testing communication campaigns to shape household behaviour toward food waste reduction. It also highlighted that there are no clear guidelines for using DfBC in those communication campaigns. Consequently, the early research stage helped to identify the importance of using BCD framework as a systematic way to develop and evaluate the communication campaign and DwI for idea generation (see Chapter 6). Thus, this research developed communication campaign guidelines by using insights from the primary and secondary research in addition to the BCD framework to support designers and practitioners when designing a communication campaign to shape households' behaviour towards food waste reduction in the Arab world (see Section 6.2). In a nutshell, the aim of the communication campaign guidelines is to enable designers and practitioners to develop a behaviour change campaign to reduce food waste in the Arab world and thus facilitate its dissemination.

7.4 The proposed design process

The design process (see Section 6.2) evolved through several activities with communication designers and experts with experience in running social and behaviour change campaigns from the Arab world. Accordingly, the workshops that were undertaken during the Assess, Build, and Create steps (see Section 6.2.1, 6.2.2, and 6.2.3) contributed to the development of a step-by-step design process.

The researcher suggests that whether policymakers can properly apply the research outcomes should be premised on target users' knowledge of the guidelines of designing a communication campaign that targets household food waste behaviour. Moreover, if the target users are not fully aware of the challenges, strategies, and opportunities of the food waste issue, they will not be able to develop a proper solution to target the household food waste issue. Consequently, the first phase in the design process must help target users build knowledge on the food waste issue(s) and it must be situated in its context. Continuing with this argument, identifying the challenges and problems, learning about policies, strategies, and regulations, and exploring the opportunities associated with food waste enable target users to attain this objective, thus defining the first phase in the design process.

After this phase, identifying factors should be the second phase in the design process. Since target users need to understand household food waste behaviours, proper approaches, and data collection and analysis of the households behaviour and habits are crucial before developing a communication campaign. Although there are several approaches to understanding household behaviours, ethnographic research is the ideal method to gain insights into households' daily practices and routines relevant to food waste in their natural environment. The data collection methods during this phase can be included observation, photovoice, focus group, and semi-structured interviews to allow for the identification of behaviours within the given context to achieve the overall success. Once the targeted behaviours are thoroughly researched and understood, it will become possible for target users to identify factors with the most influence, and as a result start the next phase.

Developing and testing a communication campaign should be the third phase in the design process. After the household food waste behaviour factors with the most influence have been identified, target users should integrate them in the communication campaign development. This phase should provide target users with a wide range of creative solutions for meeting objectives. To make the most of the campaign intervention materials, it is vital to prioritise the BCD framework for this phase. This framework is a systematic way to develop and evaluate the communication campaign through five steps. First, target users should assess the most influential factors identified in the previous phase. This step includes the framing process to ascertain what is known and what needs to be found and ground the communication campaign development into practical reality.

Second, target users should conduct formative research that seeks to answer questions that those in the framing process were unable to answer about how to change the targeted behaviours. Further, target users should turn the formative research findings into a creative brief that reflects the campaign focus. Third, the creative insights need to be transformed into a creative intervention. During this step, target users should work with a creative team to start the idea generation process to produce the intervention materials. There are several brainstorming methods and techniques that can be used to create the intervention materials. Such tools may include those introduced in this thesis such as the DwI toolkit (e.g., Cognitive and Ludic lenses) which can help in stimulating new design concepts (see Section 6.2.3). The last two BCD steps (i.e., Deliver and Evaluate) are included in the next phase (see Section 6.2.4 and 6.2.5).

Delivering and measuring a communication campaign success should be the last phase in the design process. Once all intervention materials are agreed upon with the creative team, target users should deliver the intervention materials. During this step, target users need to consider multiple factors which include the exposure to the campaign, length of intervention, coverage, intensity, acceptability, fidelity, interferences, evaluability, and sustainability. Since target users are aware of what the campaign could achieve, some measures of success should be identified to prove the effectiveness of the campaign (i.e., food waste quantification before, during and post the campaign). Target users should evaluate the design process to explain if the

results of the impact evaluation were positive or negative. In this instance, target users should establish a robust monitoring system for households' activities on the first day of the campaign. Afterwards, conducting semi-structured interviews with the households.

The discussion above demonstrates step-by-step guidelines for target users to develop a communication campaign targeting household food waste behaviour in the Arab world. The communication campaign guidelines can be carried out iteratively. Figure 7.1 illustrates four phases in the proposed design process and the explanation of each phase is shown below:

1. **Scoping:** identify the challenges and problems, learn about policies, strategies, and regulations, and explore the opportunities relevant to food waste.
   Method: Semi-structured interviews with policymakers and NGOs experts
   Output: Understanding the current situation on the food waste issue for which target users seek to create a constructive solution.

2. **Identifying factors:** understand household food waste behaviours by identifying the factors with the most influence on household food waste behaviours. This phase aims to understand the behaviour patterns of target households by uncovering relevant factors within a specific context to which a communication campaign could contribute a behaviour-based solution.
   Method: Survey, ethnographic observation, photovoice, focus group or semi-structured interviews
   Output: Identifying the factors with the most influence on household food waste behaviour.

3. **Developing a communication campaign:** assess the most influential factors identified in the previous phase, conduct formative research, and turn its findings into a creative brief that reflects the campaign focus, transform the creative insights into creative intervention, generate ideas with a team to produce the intervention materials. In this phase, the aim is to develop, test, and iterate the communication campaign to shape households' behaviour towards food waste reduction.

Method: Creative idea generation (BCD approach), A communication design professional would be expected to have a team working under them and would conduct workshops with stakeholders to better understand the reactions to the visuals/textual content.

Output: Developing a communication campaign to shape household behaviour towards food waste reduction within a defined context.

4. **<u>Delivering and evaluating:</u>** deliver the intervention materials, evaluate the effectiveness of the campaign. In this phase, the aim is to implement and evaluate the effectiveness of the communication campaign.

   Method: Food waste quantification, Semi-structured interviews, process evaluation.

   Output: Delivering the communication campaign materials and evaluating the effectiveness of the communication campaign process (see Section 6.2.5).

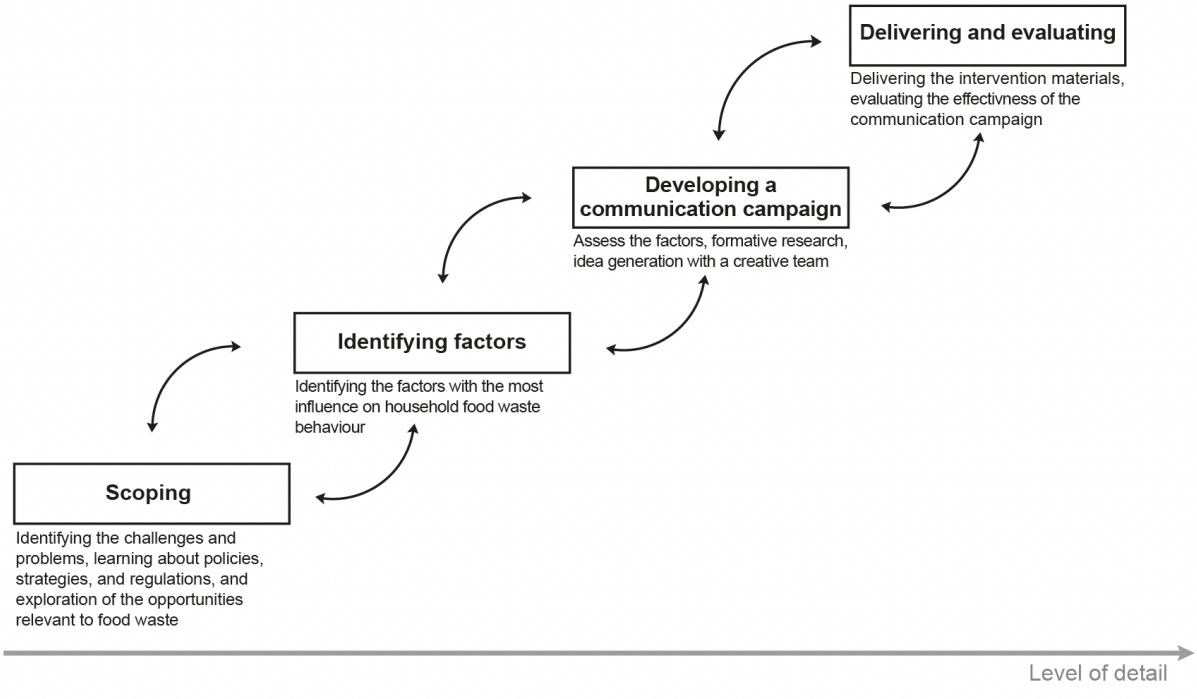


Figure 7. 1 The proposed design process

Furthermore, the British Design Council's (2021) Double Diamond model provides a process of how to explore an issue and take focused action to fix it. Based on this

model, there are four design phases: discover (explore the problem), define (decide what needs to be fixed), develop (test potential solutions) and deliver (refine final solutions). In accordance with the purposes of those four steps in the design process, it is suggested that the communication campaign guidelines can be mapped in the phases of Discover, Define, Develop, and Deliver (Figure 7.2).

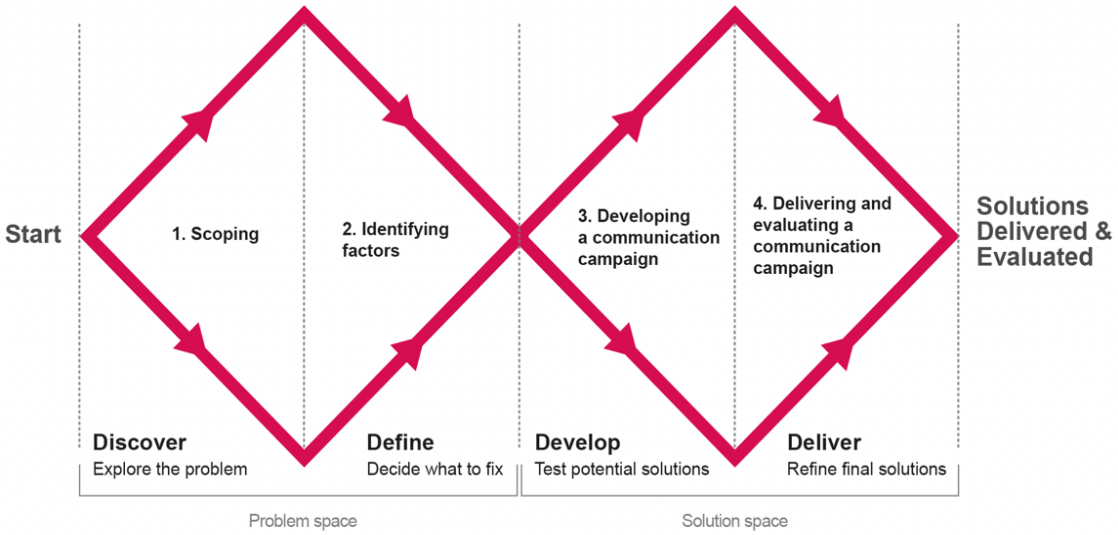


Figure 7. 2 Mapping the communication campaign guidelines into Double Diamond model

The communication campaign guidelines provide a starting point for developing a communication campaign to influence household behaviour toward food waste reduction. Nevertheless, the guidelines may be perceived as generic, and different users can apply it differently. As a result, it is important to consider the variation in the application of research outcomes as a form of generalisation.

7.5 The communication campaign guidelines

This section provides a list of practical design principles on how to develop a communication campaign for Arab countries. This list of principles is based on the lessons learned from designing the Namlia campaign (see Chapter 6). It is about generalising the Namlia campaign and organising it around the different elements of a communication campaign.

1. **Communication campaign objectives:** A vital lesson learned from the Namlia campaign is the importance of setting goals and timeline for the communication

campaign. Before developing a campaign, it is important to consider the following aspect when setting campaign objectives. The campaign objective(s) should be clear and concise about what the campaign required to achieve. Whether it should educate the households about the food waste issue and/or influence household food waste behaviours. For instance, reducing food waste is an urgent need for Arab countries in their efforts to climate action goals, since there are no food waste interventions in the Arab countries (Abiad & Meho, 2018). Therefore, the specific goal of a campaign can be to develop a communication campaign to influence household behaviour toward food waste reduction in a specific context. The objectives should be set, however, taking into account any cultural or ethical constraints associated with households in Arab countries. For example, campaigns that require social interaction in community activities may not be preferable in some households.

2. **Target population selection:** An effective campaign is more likely to be successful if the target population is firmly selected. The target population for the Namlia campaign has been selected based on three key considerations as follows: 1) Sustainable mindedness of the households, 2) Interacting with various social media platforms, and 3) The target population is easy to reach. It is worthy to engage the younger generation when developing intervention materials for food waste awareness campaigns when it comes to changing behaviours toward reducing food waste in Arab countries as they represent an important demographic since they exert a substantial influence on their parents and older relatives.

3. **Identifying target behaviours**: The Namlia campaign identifies three main factors to be considered when designing a communication campaign to influence household behaviour towards food waste reduction in Arab countries. These factors (food expenditure, religion, and generosity) can be embedded into the development of a communication campaign in Arab countries. The generosity and religion factors could also be applicable to Muslim countries. Governmental and NGOs in Arab countries designing a campaign may choose to focus on religion factor or may use them all.

4. **Key messages:** It is important to consider the key messages that the campaign is intended to convey to households. The accessibility of digital and written messages is essential. The messages should be written in a simple manner by avoiding lengthy paragraphs, stylization, or nonstandard symbols. A campaign should avoid too informal messages, as the audience may feel that the campaign is speaking down to them. The campaign should use clear, simple language that explains its goal(s) clearly and concisely. Moreover, it was clear when the Namlia campaign was evaluated, the three behaviour change factors that have great potential to reduce household food waste should be based on emotional drivers in order to imitate the Arab household vibes.

5. **Selecting communication channels:** The selection of communication campaign channels will depend on the campaign objective(s) and the selected target population. It should carefully consider what communication channels to be selected. Social media should be prioritised over print media to take into account the analysis of the campaign results quickly and easily. Moreover, the choice of channels to include in a campaign should be carefully considered in light of budget, intended reach, and campaign objectives.

6. **Timing and length of a campaign:** It is recommended that a campaign lasts for a period of four to nine months. During this period, materials should be prepared, planned, adapted, and ready for use, outreach and recruitment of households, engagement with households during the campaign, follow-up and analysis, and dissemination of the campaign results.

7. **Intervention materials:** To make the most of the campaign intervention materials, it is vital to prioritise the BCD framework for this phase. Trust in government and non-governmental campaigns may be lower in some households than in others. For this reason, it is noteworthy to build trust with the target population. A campaign should be designed to ensure that households are engaged throughout the campaign, particularly during the evaluation of its impact. Engaging households through design workshops that include communication designers and behaviour change specialists can be a successful strategy. Motion graphics videos should be

prioritised as they proved their effectiveness in creating a positive impact on households.

7.6 Generalisation of the research outcomes

This section aims to discuss how target users can apply the research outcomes differently. Research outcomes need to be understood by the various target users. Following is a summary of the profiles of the target users derived from the research activities.

7.6.1 Profiles of target users

In light of the participants who were involved in this research, the following types of users can benefit from the research outcomes.

- **Behavioural design consultants/professionals at NGOs for addressing the food waste issue:** this type of user provides data and solutions to clients. This can include information about legislative and regulatory policies on the governmental and local levels, challenges and problems, best practices, and opportunities relevant to food waste. These users can also apply the communication campaign guidelines to ensure that the campaign is implemented more effectively and contextually appropriate.

- **Communication design educators and researchers with a focus on behaviour change:** this type of user can apply the communication campaign guidelines for educational purposes. For instance, communication design instructors can use the guidelines to teach students how to identify the factors that influence household behaviour towards food waste reduction; communication design instructors can also facilitate the understanding of models (i.e., BCD and DwI) applied by guiding students through the design process for developing, testing, and evaluating a communication campaign that aims to shape household behaviour towards food waste reduction. Further, the guidelines can support researchers in developing their practical projects.

7.6.2 Scenarios of applications

In the following texts, the researcher discusses two different scenarios relating to applications that can be beneficial to the target users (see table 7.1 for different scenarios).

Table 7.1 Applications of the research outcomes based on the types of users

Target users	Scenarios of applications
Behavioural design consultant and NGOs professionals	● If users consult with policymakers to take action to influence household behaviour towards food waste reduction within a defined context, the research outcomes can support them in providing advice in addressing the issue.
Communication design educators and researchers	● If users want to teach students the knowledge of design for behaviour change with a particular focus on a communication campaign to influence household behaviour towards food waste reduction, the research outcomes can assist them in conducting teaching and researching activities.

7.6.2.1 Behavioural design consultants and NGOs professionals

If users consult with policymakers to take action to influence household behaviour towards food waste reduction within a defined context, the research outcomes can support them in providing advice in addressing the issue.

The behavioural design consultants and NGOs professionals can provide policymakers advice to address the household food waste issue within a defined context as follows:

Starting point: analysis of the current situation on food waste challenges and problems, best practices, and opportunities relevant to food waste. Conducting research to understand and identify current behaviour patterns of target households.

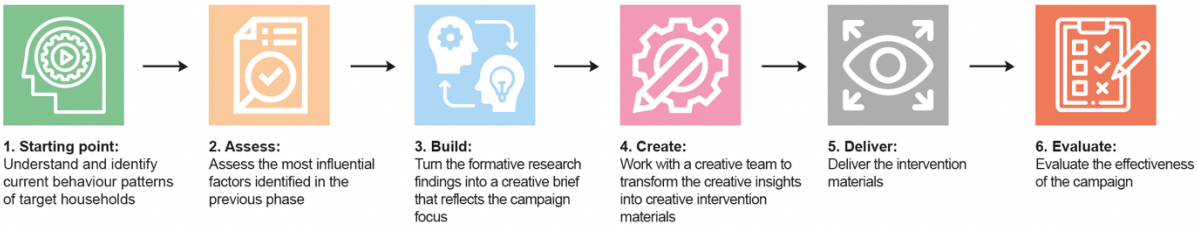
Assess the identified factors: use of the BCD framework to start the design process, then develop a framing statement to assess the validity of the most influential factors identified from the previous phase before integrating them in the design process.

Build a creative brief: conduct formative research and turn its findings to produce a creative brief that reflects the campaign focus.

Create the communication campaign materials: develop the intervention materials with a creative team through a spiral action: plan, act, observe and reflect approach, then

conduct workshops to generate ideas by using brainstorming techniques and the DwI method.

Deliver the intervention materials: consider the exposure to the campaign, length of intervention, coverage, intensity, acceptability, fidelity, interferences, evaluability, and sustainability.



Evaluate the effectiveness of the campaign: build a robust ongoing monitoring system for households' activities from day one of the campaign, use food waste quantification to measure the intervention materials impact, then measure the campaign facets (i.e., touchpoints, activities, channels, and behaviour change techniques).

7.6.2.2 Communication design educators and researchers

If users want to teach students the knowledge of design for behaviour change with a particular focus on a communication campaign to influence household behaviour towards food waste reduction, the research outcomes can assist them in conducting teaching and researching activities.

The communication campaign guidelines can be used in an academic context to teach students about how design for behaviour change can be applied within the field of communication design to shape user and household behaviour and to support researchers in developing their theoretical and practical projects.

Learning about ethnographic research: use of ethnographic research to inform students how ethnographic research methods (i.e., participant observation and photovoice) can be used to better understand household food waste behaviour and to identify the factors that influence household food waste behaviour within a specific context.

Learning about DfBC applied within the field of communication design: use of the BCD framework to inform students about how to systematically develop and evaluate the communication campaign, the user can also demonstrate to students how the BCD framework can be integrated into different techniques and methods to generate ideas (e.g., integrating the DwI method into the creative process to generate ideas).

Supporting design exercises: Using the communication campaign guidelines in practical design exercises, providing a brief for students, and suggesting possible paths.



7.6.3 Modes of applications

Based on the discussion above, it is evident that target users can apply the research outcomes differently. This can be accomplished in four major modes. A summary of key information regarding each mode of application is shown in Table 7.2.

Table 7.2 Summary of the applications modes

The application mode	Purposes
Scoping mode	● Understand the current situation on food waste issue within a specific context. ● Identify the challenges and problems, learn about policies, strategies, and regulations, and explore the opportunities relevant to food waste. ● Acknowledge the best practices for changing user behaviour in relation to food waste reduction.
Identifying factors mode	● Understand current behaviour patterns of target households. ● Identify the factors with the most influence on household food waste behaviour.

Developing a communication campaign mode	● Assess the most influential factors identified in the previous phase. ● Conduct formative research to produce a creative brief that reflects the campaign focus. ● Transform the creative insights into creative intervention materials ● Develop a communication campaign to shape households' behaviour towards food waste reduction. ● Implement, test, and iterate the communication campaign materials to shape households' behaviour towards food waste reduction.
Delivering and evaluating mode	● Deliver the intervention materials. ● Evaluate the effectiveness of the communication campaign.

Scoping mode: this mode indicates that the research outcomes can be used for building knowledge within a specific context. It was highlighted in the previous discussion that users can understand the current situation on food waste issues in different ways. For instance, some users can identify the challenges and problems, learn about policies, strategies, and regulations, and explore the opportunities relevant to food waste. Moreover, some users may already know about the food waste issue within a context but be in need to acknowledge the best practices for changing user behaviour in relation to food waste reduction.

Identifying factors mode: this mode suggests that the research outcomes can be applied to support users in identifying the factors with the most influence on household food waste behaviour. The above discussion shows that applying the research outcomes can be particularly beneficial for users who want to better understand household food waste behaviour and habits on a daily basis.

Developing a communication campaign mode: this mode indicates that the research outcomes can be applied to develop a communication campaign to shape household food waste behaviour towards food waste reduction. In the previous discussion, it has been demonstrated that this mode is particularly suitable for communication design instructors and researchers who are focusing on the behaviour change field in their teaching and researching activities.

Delivering and evaluating mode: this mode suggests that the research outcomes can be applied to support users in delivering communication campaign materials and evaluating its effectiveness. For instance, the research outcomes can assist users in

considering the exposure to the campaign, the duration of the intervention, coverage, intensity, acceptability, fidelity, interferences, evaluability, and sustainability of the campaign.

7.7 Summary

This chapter reflects on the findings from the research outcomes. It explores ways in which the research outcomes can be integrated to better support target users and to demonstrate the significance of these outcomes in addressing the food waste issue. Taking into consideration how different users can apply research outcomes in different ways. Finally, this chapter also explains the communication campaign guidelines and how different users can adopt these guidelines in different contexts.

Chapter 8 Conclusion

8.1 Introduction to this chapter

This final chapter summarises the research outcomes. It discusses the significance of the research outcomes and how they filled the knowledge gap identified in this research. Afterwards, it revisits the research questions and objectives and highlights the knowledge contributions and its limitations. Finally, it includes implications for future research activities.

8.2 Meeting objectives and outcomes

This research aimed to develop communication campaign guidelines to shape households' behaviour towards food waste reduction in Jordan. Three main questions emerged from the initial inquiry, which were used to guide the literature review. Thus, the following subsections discuss how the research questions have been addressed and Table 8.1 illustrates how the research objectives have been met to answer the research questions.

Table 8.1 The illustration of the research questions and defined objectives

Research questions	Objectives	Chapter
1.What are the best practices for changing user behaviour in relation to food waste reduction?	To carry out a review of the DfBC field with a particular focus on communication campaigns.	Chapter 2: Literature review
	To review cases of interventions (communication campaigns) to shape behaviour around food waste reduction.	Chapter 2: Literature review
2.What are the factors that influence household food waste behaviour in Jordan?	To understand the current situation on solid waste in general and food waste in particular in Jordan.	Chapter 4: Food waste in Jordan
	To carry and understand the current behaviour patterns of target households in Jordan.	Chapter 5: Understanding household food waste behaviour in Jordan

3.How can design for behaviour change, applied within the field of communication design, be used to shape user and household behaviour?	To develop a communication campaign to shape households' behaviour towards food waste reduction in Jordan.	Chapter 6: Developing and testing a communication campaign in Jordan
	To implement, test, iterate, and evaluate the communication campaign to shape households' behaviour towards food waste reduction in Jordan.	Chapter 6: Developing and testing a communication campaign in Jordan
	To develop guidelines to support the adoption of learned lessons into other contexts.	Chapter 7: Discussion

8.2.1 Meeting the objectives to address the RQ1

What are the best practices for changing user behaviour in relation to food waste reduction?

To carry out a review of the DfBC field with a particular focus on communication campaigns.

The literature review (Chapter 2) contributed to establishing the theoretical foundation for understanding the current state of the art in this field. By reviewing DfBC approaches and models with a particular focus on communication campaigns, it was obvious that behaviour is influenced by a variety of intertwined factors. It was evident that there are some similarities among the approaches and models in DfBC (see Section 2.3.1). However, the BCD approach was more appropriate to guide and inspire the development of the communication campaign in this research (see Section 2.3.1.1). Moreover, reviewing DwI models showed its potential to support idea generation through the BCD creative process (see Section 2.3.1.2).

To review cases of interventions (communication campaigns) to shape behaviour around food waste reduction.

This phase of the literature review aimed at identifying communication campaigns that show a potential contribution toward food waste reduction (see Section 2.4). In this phase, five campaigns were collected and categorised into a table based on the identified aspects (see Table 2.6). This review highlighted a lack of knowledge on how

these campaigns designed/tested their interventions. Further, none of these campaigns included information on the process of recruiting households, the time needed to impact their food waste, the effectiveness of their measures aimed at reducing food waste, or whether the impact was caused exclusively by the intervention or by households taking part in the detailed survey. Finally, this review provided insights into the importance of developing, testing, and evaluating a communication campaign taking into consideration the limitations that were identified while reviewing these campaigns.

8.2.2 Meeting the objectives to address the RQ2

What are the factors that influence household food waste behaviour in Jordan?

To understand the current situation on solid waste in general and food waste in particular in Jordan.

Semi-structured interviews were conducted with experts from the Ministry of Environment and NGOs in Jordan with different backgrounds, such as solid waste management, food waste reduction, environmental awareness, and awareness campaigns to gain insights on information that was difficult to explore using other methods. As a result, the experts emphasised the importance of understanding households' food waste behaviours as a crucial point prior to developing a communication campaign (see Section 4.2.4).

To carry and understand the current behaviour patterns of target households in Jordan.

Ethnographic research was conducted to investigate the factors that influence household food waste behaviours in Jordan. Four methods were used to collect data regarding food waste practices and routines (see Section 5). The analysis from ethnographic research and literature findings were combined to assess and identify the factors with the most influence on household food waste behaviour. This research used the identified factors systematically as a source of inspiration for the subsequent phase. According to the ethnographic research, religion, food expenditure, and generosity were factors that motivate people to reduce food waste in Jordan. Therefore, when developing the food waste reduction communication campaign intervention, these factors were taken into account.

8.2.3 Meeting the objectives to address the RQ3

How can design for behaviour change, applied within the field of communication design, be used to shape user and household behaviour?

To develop a communication campaign to shape households' behaviour towards food waste reduction in Jordan.

In this phase, the BCD framework guided the design process. The design process conducted a series of co-design workshops with experts from the Arab world. It started with assessing the factors that identified from ethnographic research (see Section 6.2.1). Further, it built a creative brief that reflects the campaign focus (see Section 6.2.2). Therefore, it started the idea generation stage by using different methods including brainstorming, sketching ideas, adapting tried-and-tested designs that already exist and four design workshops with communication designers across the Arab world in order to develop communication campaign materials (see Section 6.2.3).

Formative research was conducted after the ethnographic data and theoretical framework model had been analysed. During this process, questions that were left unanswered from the framing process were addressed. A Theory of Change for the campaign has been developed based on the formative research findings which were broken down into nine steps to take the process from a large number of findings derived from the field to the production of a creative brief that was reflected in the campaign focus. The development of the intervention materials has been started and involved action research, and the data was collected primarily through four design workshops. Afterwards, the communication campaign has been delivered with eight intervention materials followed by a food waste quantification period to determine at what stage the effects of the interventions would be evident. Finally, the effectiveness of three factors has been evaluated through the implementation of a small-scale communication campaign aimed at raising awareness among Ammani households about the issue of food waste and encouraging them to reduce it.

To implement, test, iterate, and evaluate the communication campaign to shape households' behaviour towards food waste reduction in Jordan.

The communication campaign materials were developed and tested with the households and communication designers to discuss how the intervention might be improved. This process was repeated through design workshops until all intervention

materials worked just right for running the communication campaign. Thus, a practical solution to the food waste issue was generated by combining the researcher and the participants' feedback. Two months were dedicated to the delivery of the campaign to 14 households (see Section 6.2.4). Finally, the campaign was evaluated through food waste quantification (see Section 6.2.5.1) and semi-structured interviews with the households (see Section 6.2.5.2) to show the impact of the intervention materials and the evaluation process (see Section 6.2.5.3).

To develop guidelines to support the adoption of learned lessons into other contexts.
This phase draws up a list of practical design insights on how to develop a communication campaign to shape household behaviour towards food waste reduction for Arab countries. These insights were organised around the different elements of a communication campaign (see Section 7.5), and they based on the lessons learned from designing the communication campaign.

8.3 Research contribution

The contribution of this research is divided into theoretical and practical. Below is a list of contributions to knowledge, with specific details discussed in subsections:

a. Understanding the food waste issue in Jordan: In terms of its theoretical contribution, this research helps academics and practitioners who are interested in the food waste issue in Jordan to understand the current situation of solid waste in general and food waste in particular in Jordan.

b. Understanding household food waste behaviours in Jordan: In terms of its theoretical contribution, this research identified the factors that influence household food waste behaviour in Jordan. Thus, designers/practitioners can integrate the following factors: religion, food expenditures, and generosity into the development of a communication campaign to have a positive impact on household food waste behaviour in the Arab world.

c. Guidelines to support the adoption of learned lessons into other contexts: In terms of its practical contribution, this research provides a better understanding of how design for behaviour change – applied within the field of communication

design – can be used to shape user and household behaviour. Thus, designers/practitioners can develop a communication campaign to shape households' food waste behaviour in the Arab world.

8.3.1 Theoretical contribution

This research identified a paucity of research on food waste in Jordan, including a lack of reliable data, sources, drivers, policies, interventions, and initiatives aiming to reduce food waste. For this reason, the researcher provides comprehensive information about the current and future plans on the food waste issues in Jordan. Accordingly, this research contributes to theoretical knowledge by identifying the challenges and problems related to food waste, strategies and regulations, and related awareness campaigns in Jordan.

Several previous behaviour change theories have been developed to understand household food waste behaviour and have been extensively discussed in the literature (Abdelradi, 2018; Aktas et al., 2018; Farr-Wharton et al., 2014; Marangon et al., 2014; Quested et al., 2013). However, none of these studies were conducted in the Jordanian context and they are predominantly based on quantitative data with limited explanatory power. Consequently, this research contributes to theoretical knowledge by identifying the factors (i.e., food expenditure, religion, and generosity) that influence household food waste behaviour in Jordan by combining ethnographic research and the literature findings. It is noteworthy that this research is one of the first to incorporate the generosity factor into a theoretical framework. Since this hypothesis has not been explicitly considered in any study to date, it represents one of the major theoretical contributions to the literature.

8.3.2 Practical contribution

This research contributes to the development of communication campaigns that aim to influence households' behaviour toward food waste reduction in the Arab world by providing designers/practitioners with guidelines to support the adoption of learned lessons in other contexts. As discussed in Chapter 2, it is not clear how communication campaigns relevant to the food waste issue designed/tested their interventions. For this reason, this research applied the BCD framework to achieve the overall aim of the thesis. The BCD framework encompassed the development of the communication

campaign by providing a five-step process in which intervention materials were designed and evaluated to shape household food waste behaviour in Jordan. The creative design process has several iterations of testing and refining the intervention materials demonstrating clarity, usefulness, and usability in the design process.

8.4 Limitations of this research

This thesis has tremendously advanced the understanding of DfBC with a focus on communication campaigns to shape household behaviour toward food waste reduction in Jordan. The interpretation of these findings must, however, take into account a number of limitations.

8.4.1 Covid-19

The outbreak of Covid-19 was unprecedented, and its impact was one of the main limitations of this research. Aside from changing the original research plan, it also hindered the progress of the research. One of the main impacts of Covid-19 is the inability to collect data in person. For instance, the researcher previously planned to conduct a focus group with households to express their views on the photos that were taken during the photovoice method since typically this is combined with focus groups. Alternatively, the researcher conducted semi-structured interviews with 14 households. Consequently, transcription and translation took longer than expected, as did the time required for the 14 households to respond positively to invitations. This research had to run the communication campaign remotely due to Covid-19 which affected the development and implementation of the interventions. For instance, design workshops were affected, as the plan was to conduct them in person to better inform the design process through face-to-face interaction with participants. As a result, the researcher had to conduct the design workshops online using platforms such as Mural and Miro. Moreover, another limitation caused by Covid-19 is the time difference between the United Kingdom and Jordan. This was challenging in terms of maintaining quality and consistency of work, for instance, when intervention materials were being implemented. The researcher found that recruiting participants for RQ3 was a challenging endeavour as many people were uncertain about the future or afraid of redundancy at their jobs. Therefore, it resulted in a longer start time to develop the communication campaign, which slowed down the research progress. Finally, the time spent developing the communication campaign could have been reduced if the

researcher was able to be in Jordan. For instance, it would have been easier and less time-consuming if the researcher handled everything himself rather than working remotely.

8.4.2 The role of the researcher

It is worth noting the potential limitation of the researcher's role. In all flexible design research, bias and rigour issues exist, particularly when dealing with qualitative data, where the researcher serves as the main instrument for the mediation of information (Robson & McCartan, 2016). For instance, conducting data collection and analysis activities, such as approaching the participants, recruiting the participants, and engaging in data collection and analysis, were all managed by the researcher. In the phase of design workshops, the role that the researcher played was to facilitate the activities such as presenting the research background information and explaining the communication campaign materials. Although the researcher's role was merely an observer when the participants assessed the potential ideas and solutions in these workshops, the presence of the researcher may have influenced the creation of potential solutions. The participants may generate different perspectives, ideas, and rationales for creating potential solutions. Additionally, in terms of addressing RQ2, the researcher observed and interviewed the participants individually, and the presence of the researcher could also influence the results of the ethnographic research.

8.4.3 The fieldwork and data

8.4.3.1 Cultural issues

Access to participants was among the limitations of this study. Cultural and ethical values in the composition of families in Jordan played an essential role in the sample size. The nature of this research is mainly qualitative and more importantly depends on ethnographic research, making it difficult to recruit higher numbers of participants as Jordanian families are mainly known as conservatives which results in them refusing a stranger to enter their houses and take pictures. Thus, building trust with the households was crucial for the process of co-design workshops. The researcher was keen on establishing relationships and explaining the purpose of these workshops helped the researcher gain cooperation and authentic behaviour. It was also

imperative that the researcher be aware of cultural taboos and sensitivities were essential to avoid unintentional offence. However, it is important to acknowledge that some cultural issues arose in the co-design workshops with Amman households. In Amman, as in many other Middle Eastern societies, privacy, modesty, and social norms are highly valued, particularly within households. These cultural factors influenced the dynamics of co-design workshops. The co-design workshops were culturally sensitive and respected the traditions, beliefs, and values of Amman households. For instance, some family members were hesitant to openly share their opinions or preferences. Thus, the researcher respected these cultural norms while still encouraging participation in a delicate balance. It was crucial to ensure that all participants, regardless of gender, had an equal opportunity to contribute and make decisions.

Being aware the ethnographic observations might intrude upon individuals' privacy and modesty, especially in private spaces such as Amman households, encouraged the researcher to choose the Photovoice method. This method allowed the participants to capture and share their experiences voluntarily, giving them control over what they choose to document. It is noteworthy to mention that observing households in Amman required the researcher to navigate gender segregation norms carefully. For instance, the observations were culturally uncomfortable for some households. Thus, the photo-voice method allowed all participants, regardless of gender, to contribute comfortably without compromising cultural norms. Overall, the lack of participation, although a limitation, did not undermine the validity of the findings.

8.4.3.2 Lack of co-design workshops

This research has shortcomings that needed to be considered when interpreting the co-design workshop process and findings. An important challenge was to identify suitable households and recruit them for participation in the co-design process. Many practical questions arose in this phase; for example, “How does the researcher get the ‘right’ households and communication designers to participate?”, “What do they need to know?”. There were also questions of an ethical nature, including “What degree of engagement do they want?”, “How can the researcher ascertain collaboration and

maintain respect for each other's viewpoints?", "What is legitimate to talk about?" and "Who controls this process of co-design workshops?".

Most workshops required too much time and human capacity from households and other stakeholders, also when taking into consideration that the researcher's goal was to engage representatives from all household groups. About half of the households who were approached declined to participate in the workshops. Reasons for declining included having a low level or non-existent knowledge of the handling and use of co-design tools. In this research, the non-engagement of policymakers in the co-design workshops was a considerable challenge. Most of the stakeholders agreed that the engagement of policymakers in the workshops was vital because of their authority and leadership roles in relation to discovering unique perspectives through collaboration and including user and stakeholder opinions in key decisions. There can be many reasons for their non-engagement, for instance, many do not think they have the time to participate in workshops and others did not respond to the researcher's emails and messages on LinkedIn. As a consequence of the policymakers being absent, stakeholders (communication designers and experts with experience in running social and behaviour change campaigns) had to discuss and select communication campaign interventions that they believed and had experience-based expectations that would shape household behaviour towards food waste reduction in Jordan. Another limitation was the small population of households and stakeholders in the workshops, which likely affected the co-design process. A further limitation is that some participants were more vocal, which hindered getting more insights from other participants. To ensure that households and stakeholders have a stronger voice in the research, the researcher could have organised one more workshop if more households had been engaged.

8.4.3.3 Evaluation of the communication campaign

The final limitation is related to evaluating the impact of the communication campaign intervention materials. This aspect can be found in the semi-structured interviews with households aimed at understanding what stage of the campaign contributed most to changing behaviour around food waste reduction and to what extent (see Section 6.2.5.2). A different data collection method may have been more effective in gathering

feedback on the intervention materials in this case. It may have been more effective to evaluate the effectiveness of the communication campaign materials using other methods, such as a one-day focus group. For instance, focus groups can positively enhance the quality of research outputs by observing the group discussion.

8.4.3.4 Service design and systemic design

It is noteworthy to mention that both service design and systemic design can strengthen the outcomes of this research. On one hand, the use of a systemic design approach can offer some advantages when tackling challenges that are complex and interconnected and extend beyond the scope of traditional design approaches (Jones & Kyoichi, 2018). The researcher would be able to gain a deeper understanding of the intricate relationships and feedback loops that exist within a system by adopting a systemic approach. Thus, this approach would enable the researcher to identify leverage points where the communication campaign interventions can create more positive impacts throughout the system, amplifying the potential for positive change.

On the other hand, both service design and systemic design can embrace interdisciplinary collaboration, bringing together experts from various fields to gain diverse insights and perspectives (Krippendorff, 2019; Sangiorgi and Prendiville, 2017). Therefore, these multidisciplinary approaches can enrich the design process, ensuring a comprehensive understanding of the problem at hand and fostering innovative and inclusive solutions that address all dimensions of the issue. In future research, the researcher would allocate more time to involving a diverse range of stakeholders in the systemic design process by including voices from different sectors, communities, and disciplines in the co-design workshops. This research would involve experts from various fields, including social sciences, engineering, economics, and environmental studies, to gain diverse perspectives and insights. Doing so can lead to more well-rounded and inclusive systemic interventions. This is important since the households are not the only ones being affected by service. In co-design workshops, for example, it is important to consider the viewpoints of policymakers. By using their knowledge in the co-design workshops, the systemic design can be sustainable and long-lasting solutions.

8.5 Future research

This research is a foundation for future research aimed at developing a communication campaign to shape household behaviour toward food waste reduction in the Arab world, and in Jordan specifically. The generosity and religion factors could also be applicable to Muslim countries. This work could be further developed and explored by researchers from a variety of fields. A number of promising areas for further research have been identified in the study, which is listed below.

First, this research has identified the factors that influence household food waste behaviour in Jordan for developing a communication campaign and provide guidelines to support the adoption of learned lessons in other contexts. However, this study and its results were affected by Covid-19 pandemic. Therefore, future work could explore and address the factors that affect household food waste behaviour outside emergency periods among different socio-demographic groups in order to understand to what extent results are similar to what this research got during Covid-19.

Second, the evaluation of the Namlia campaign revealed several types of success in reducing households' food waste for over a period of two months. However, there is a need for further research to determine whether the impact of the communication campaign intervention materials will persist over the long term; and whether it is actually transformational.

Third, this study could also be replicated in other Arab countries in order to assess the robustness of its findings. Moreover, such campaigns need to be implemented under a large-scale within the community for a greater degree of improvement and problem solving.

Finally, it is recommended that attention must be given in future research to the creation of the animation characters in terms of names, appearances, characteristics, and behaviours that are inspired by the surrounding community. Further, it is crucial to engage the younger generation when developing interventions materials for food waste awareness campaigns when it comes to changing behaviours toward reducing

food waste, taking into account the use of relevant social media platforms (e.g., TikTok) to deliver campaign materials.

8.6 Summary

Given the critical importance of the food waste issue, this study sought to identify potential antecedents of DfBC and communication campaigns within the Jordanian context. This chapter concluded the study by highlighting the key findings in relation to the research aims and questions. Notably, the food waste issue in Jordan and household food waste behaviour in Jordan were found to act as the primary antecedents, while the development of the communication campaign was found to act as secondary antecedents. Based on these findings, actionable recommendations were made. The chapter concluded with a review of overall limitations, from which future research recommendations flowed.

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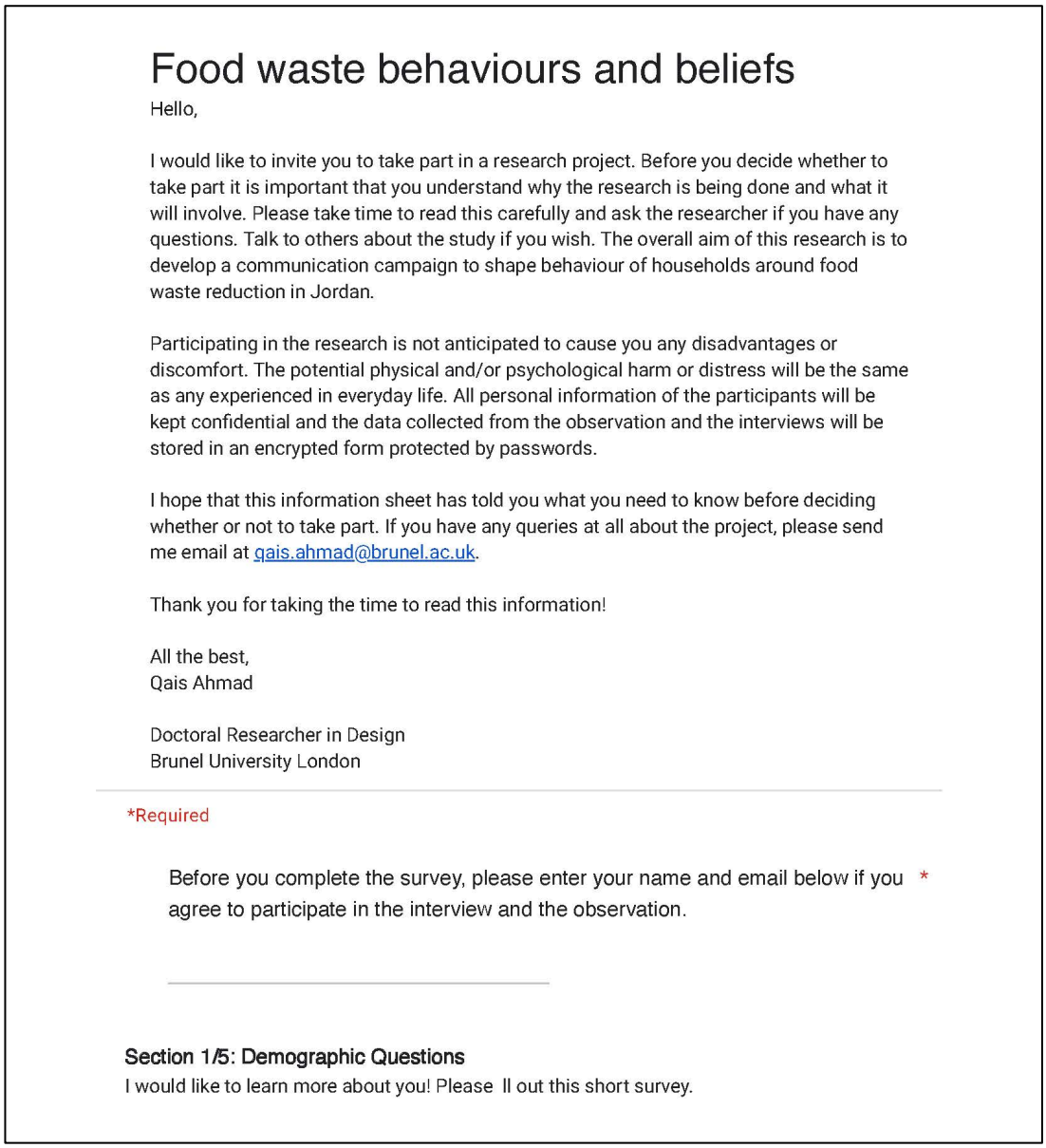
Appendix I: Policymakers and experts interviews

1. Interview protocol to understand food waste issue in Jordan

Topic	Semi-structured interview questions
Introducing the research and answering questions	The first phase of my research is exploring the current situation, as well as future plans, on solid waste in general and food waste in particular in Jordan. 1.1 Do you have any questions?
General question	2.1 Please tell me about your opinion on the food waste issue? 2.2 Can you give me your thoughts on the current situation, as well as future plan, on solid waste in general and food waste in particular in Jordan?
Challenges and problems	3.1 What are the challenges and problems of solid waste management in Jordan?
Regulations and strategies	4.1 What are the rules and regulations guiding waste management in Jordan?
Awareness campaigns	5.1 Municipalities and Non-Governmental Organizations (NGOs) have been implemented some public awareness campaigns to promote waste management in Jordan, to what extend do you agree or disagree with these campaigns?
Practices of changing food waste behaviours	6.1 Studies show that the predominant fraction in Jordanian MSW is food waste matter which makes up as much as 60 percent of the solid waste stream and the highest priority in the waste hierarchy is waste reduction. What are the best practices of changing Jordanian households' behaviour in relation to food waste behaviour?

Appendix II: Ethnographic research

2. Survey on food waste behaviours and beliefs



Food waste behaviours and beliefs

Hello,

I would like to invite you to take part in a research project. Before you decide whether to take part it is important that you understand why the research is being done and what it will involve. Please take time to read this carefully and ask the researcher if you have any questions. Talk to others about the study if you wish. The overall aim of this research is to develop a communication campaign to shape behaviour of households around food waste reduction in Jordan.

Participating in the research is not anticipated to cause you any disadvantages or discomfort. The potential physical and/or psychological harm or distress will be the same as any experienced in everyday life. All personal information of the participants will be kept confidential and the data collected from the observation and the interviews will be stored in an encrypted form protected by passwords.

I hope that this information sheet has told you what you need to know before deciding whether or not to take part. If you have any queries at all about the project, please send me email at qais.ahmad@brunel.ac.uk.

Thank you for taking the time to read this information!

All the best,
Qais Ahmad

Doctoral Researcher in Design
Brunel University London

*Required

Before you complete the survey, please enter your name and email below if you agree to participate in the interview and the observation. *

Section 1/5: Demographic Questions

I would like to learn more about you! Please ll out this short survey.

Food waste behaviours and beliefs

1. What age bracket are you in? *

- 18-24
- 25-29
- 30-39
- 40-49
- 50-59
- 60 and over

2. What is your gender? *

Mark only one oval.

- Male
- Female
- Prefer not to say

3. Where do you live? *

Mark only one oval.

- West Amman
- East Amman
- Other: _____

4. What is the highest degree or level of school you have completed? *

- ◯ High school degree or equivalent
- ◯ Bachelor's degree (e.g. BA, BS)
- ◯ Master's degree (e.g. MA, MS, MEd)
- ◯ Doctorate (e.g. PhD, EdD)
- ◯ Other: _____

5. Are you: *

- ◯ Single-person household
- ◯ Single-parent family
- ◯ Couple without children
- ◯ Couple with children
- ◯ Other: _____

6. How many adults currently live in your home? *

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ Other: _____

7. How many children do you currently have living in your home? *

- ◯ 0
- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ Other: _____

8. What is your monthly household income? *

- ◯ JOD 500 or under
- ◯ JOD 500 - JOD1000
- ◯ JOD 1000 - JOD 15000
- ◯ JOD 1500 - JOD 2000
- ◯ JOD 2000 or over
- ◯ Prefer not to say

Section 2/5: Food consumption

9. In a typical week, how often do you shop for fruit, vegetables and other grocery products that you use to prepare meals in your home? *

- ◯ Everyday
- ◯ Every 2-3 days
- ◯ Once a week
- ◯ Fortnightly
- ◯ Other: _____

10. Where do you purchase the majority of your fruit and vegetables? (please select only one answer) *

- [ ] Major chain supermarkets (visiting the store in person)
- [ ] Major chain supermarkets (purchasing online)
- [ ] Farmers' markets
- [ ] Farmer direct retail outlets
- [ ] Community Supported Agriculture Box schemes
- [ ] Grow your own
- [ ] Other: _____

11. What is/are your main reason(s) for selecting the fresh fruit and vegetables that you to buy? Please select as many as applicable: *

- [ ] Nice appearance
- [ ] Freshness
- [ ] Expiry date
- [ ] Price
- [ ] Organic
- [ ] Seasonal
- [ ] Locally produced
- [ ] Quality
- [ ] Other: _____

12. How regularly do you or other householders cook/prepare meals at home in a typical week? *

- ◯ Every day
- ◯ 1-3 days
- ◯ 4-6 days
- ◯ Never

13. Do you regularly have leftovers from the meals you eat at home? *

- ◯ Yes (please move to Question 14)
- ◯ No (please move to Question 15)

14. You answered 'Yes' in Q13, do these leftovers usually get: *

- ☐ Eaten at another time
- ☐ Composted/ placed in bokashi bucket/ placed in worm farm
- ☐ Fed to animals at your home
- ☐ Thrown in the bin
- ☐ Other (please specify below)/comments:
- ☐ Other: _____

15. If you don't eat the leftovers, why not? *

- ☐ Leftovers are not as nutritious as freshly cooked foods
- ☐ Leftovers are not as tasty as freshly cooked food
- ☐ I rarely feel like eating leftovers
- ☐ My family does not like to eat leftovers
- ☐ If they are more than 1 day old I am worried about food safety
- ☐ If they are more than 2 days old I am worried about food safety
- ☐ If they are 3 or more days old I am concerned about food safety
- ☐ Other (please specify below)
- ☐ Other: _____

16. Are you confident in your knowledge of how to best store food to prolong shelf life? *

- ◯ Yes (please specify below)
- ◯ No (please specify below)
- ◯ Other: _____

17. Are you confident in your knowledge about food safety? *

- ◯ Yes (please specify below)
- ◯ No (please specify below)
- ◯ Other: _____

18. How do you make judgements about whether food is safe to eat? *

- ☐ Smell
- ☐ Appearance
- ☐ Taste
- ☐ Length of time since purchased/cooked
- ☐ Best before and use by dates
- ☐ Other: _____

Section 3/5: Food waste

19. What is the most wasted food in your house? *

- [ ] Meat and fish
- [ ] Fruit and vegetables
- [ ] Dairy products
- [ ] Bread
- [ ] Rice
- [ ] Meal, Ready-to-Eat Food
- [ ] Cooked leftovers
- [ ] Other: _____

20. How regularly do you discard fruit and vegetables that are no longer edible? *

- ◯ Never
- ◯ Rarely
- ◯ Sometimes
- ◯ Often
- ◯ Always

21. How regularly do you discard meat and fish that are no longer edible? *

- ◯ Never
- ◯ Rarely
- ◯ Sometimes
- ◯ Often
- ◯ Always

22. How regularly do you discard dairy products that are no longer edible? *

- Never
- Rarely
- Sometimes
- Often
- Always

23. How regularly do you discard bread that are no longer edible? *

- Never
- Rarely
- Sometimes
- Often
- Always

24. How regularly do you discard rice that are no longer edible? *

- Never
- Rarely
- Sometimes
- Often
- Always

25. How regularly do you discard meal, Ready-to-Eat Foods that are no longer edible? *

- ◯ Never
- ◯ Rarely
- ◯ Sometimes
- ◯ Often
- ◯ Always

26. How regularly do you discard cooked leftovers that are no longer edible? *

- ◯ Never
- ◯ Rarely
- ◯ Sometimes
- ◯ Often
- ◯ Always

27. When the fresh fruit and vegetables in your home are no longer edible, are these usually: *

- ☐ Composted/ placed in bokashi bucket/ placed in worm farm
- ☐ Fed to animals at your home
- ☐ Thrown in the bin
- ☐ Other (please specify below)/comments:
- ☐ Other: _____

28. What is/are your most common reason(s) for fresh fruit and vegetables becoming inedible at your home? Please select as many as applicable: *

- [ ] Bought more than needed
- [ ] It went off more quickly than expected
- [ ] Didn't get around to eating it in time
- [ ] Forgot what items had been bought
- [ ] Items were hard to see in the fridge
- [ ] Didn't feel like eating it
- [ ] Other: _____

29. What is/are your most common reason(s) for fresh meat and fish becoming inedible at your home? Please select as many as applicable: *

- [ ] Bought more than needed
- [ ] It went off more quickly than expected
- [ ] Didn't get around to eating it in time
- [ ] Forgot what items had been bought
- [ ] Items were hard to see in the fridge
- [ ] Didn't feel like eating it
- [ ] Other: _____

30. What is/are your most common reason(s) for fresh dairy products becoming inedible at your home? Please select as many as applicable: *

- [ ] Bought more than needed
- [ ] It went off more quickly than expected
- [ ] Didn't get around to eating it in time
- [ ] Forgot what items had been bought
- [ ] Items were hard to see in the fridge
- [ ] Didn't feel like eating it
- [ ] Other: _____

31. What is/are your most common reason(s) for fresh bread becoming inedible at your home? Please select as many as applicable: *

- [ ] Bought more than needed
- [ ] It went off more quickly than expected
- [ ] Didn't get around to eating it in time
- [ ] Forgot what items had been bought
- [ ] Items were hard to see in the fridge
- [ ] Didn't feel like eating it
- [ ] Other: _____

32. What is/are your most common reason(s) for fresh rice becoming inedible at your home? Please select as many as applicable: *

- [ ] Bought more than needed
- [ ] It went off more quickly than expected
- [ ] Didn't get around to eating it in time
- [ ] Forgot what items had been bought
- [ ] Items were hard to see in the fridge
- [ ] Didn't feel like eating it
- [ ] Other: _____

33. What is/are your most common reason(s) for fresh Meal, Ready-to-Eat Food becoming inedible at your home? Please select as many as applicable: *

- [ ] Bought more than needed
- [ ] It went off more quickly than expected
- [ ] Didn't get around to eating it in time
- [ ] Forgot what items had been bought
- [ ] Items were hard to see in the fridge
- [ ] Didn't feel like eating it
- [ ] Other: _____

34. What is/are your most common reason(s) for fresh cooked leftovers becoming inedible at your home? Please select as many as applicable: *

- [ ] Bought more than needed
- [ ] It went off more quickly than expected
- [ ] Didn't get around to eating it in time
- [ ] Forgot what items had been bought
- [ ] Items were hard to see in the fridge
- [ ] Didn't feel like eating it
- [ ] Other: _____

35. Do you regularly freeze excess fruit and vegetables to prevent them from being thrown away? *

- ◯ Yes
- ◯ No

36. Do you regularly preserve excess fruit and vegetables to prevent them from being thrown away? *

- ◯ Yes
- ◯ No
- ◯ Other: _____

37. Do you use any websites or mobile apps to prevent your food to be waste? *

- [ ] Yes (please specify below)
- [ ] No (please specify below)
- [ ] Other: _____

Section 4/5: Food consumption and waste

38. Recently a number of supermarkets have introduced 'ugly food' ranges that offer blemished or misshapen food at a cheaper price than mainstream goods. Have you bought these? *

- ◯ Yes (please move to Q26)
- ◯ No (please provide reasons why not in the text box below then move to Q27)
- ◯ Not sure
- ◯ I haven't heard of these initiatives

39. You've answered 'Yes' to question 25, why did you buy from this range? Please select as many as applicable:

- ◯ Appearances don't matter to me
- ◯ It was cheaper
- ◯ It was fresh
- ◯ It was a novelty
- ◯ It is important to support farmers by buying 'imperfect' produce
- ◯ I am concerned about food being wasted on farms due to appearance
- ◯ 'Imperfect' produce tastes the same as mainstream foods
- ◯ Other: _____

40. Do you plan your food shopping to limit household food waste? *

- ◯ Yes (please specify below)
- ◯ No (please specify below)
- ◯ Other: _____

41. Do you plan your meals to limit household food waste? *

Mark only one oval.

- ◯ Yes (please specify below)
- ◯ No (please specify below)
- ◯ Other: _____

42. What percentage of food purchased/grown by your household has been thrown in the rubbish bin over the last week? *

- ◯ 0%
- ◯ 10% or less
- ◯ 11% - 20%
- ◯ 21% -30%
- ◯ 31% or more

43. If food is thrown into the rubbish bin in your household, to what extent (if at all) does this bother you? *

- ◯ A great deal
- ◯ A fair amount
- ◯ A little
- ◯ Not very much
- ◯ Not at all
- ◯ Other: _____

44. Are you interested in reducing the amount of food waste produced in your household? *

- ◯ Yes - please go to question 45
- ◯ No

45. You've answered YES to question 44, would any of the following assist you to reduce the amount of food waste thrown away into bins in your household? Please tick as many as applicable. *

- ☐ Access to composting/worm farming/bokashi workshops
- ☐ Access to mobile apps or information that would assist you to plan shopping and cooking
- ☐ Access to a community garden
- ☐ Access to an organic waste collection service
- ☐ Access to information/classes on food preserving (i.e. pickling, drying etc)
- ☐ Other: _____

46. What is/are the main factor(s) of influencing your behaviour in relation to food waste reduction?

- ☐ Food expenditures
- ☐ Religion beliefs
- ☐ Environment awareness
- ☐ Lifestyle
- ☐ Culture
- ☐ Other (please specify below):
- ☐ Other: _____

47. If you would like to make any other comments related to food waste, please do so here:

Section 5/5: Survey Completion

Thank you for your time!

You are now invited to participate in further stages of this research. This includes participation in ethnographic observation, focus group and face to face interviews.

If you would like more information about these next stages or wish to volunteer, please contact Qais Ahmad, directly at qais.ahmad@brunel.ac.uk.

I am not collecting contact details directly on this survey site so that we can maintain the anonymity of the data.

Information about the final outcomes of this research project can also be forwarded to you when it is completed. If you would like to request a copy, please contact the researcher, Qais Ahmad, directly at qais.ahmad@brunel.ac.uk.

3. Participant observation coding scheme

Observation Checklist

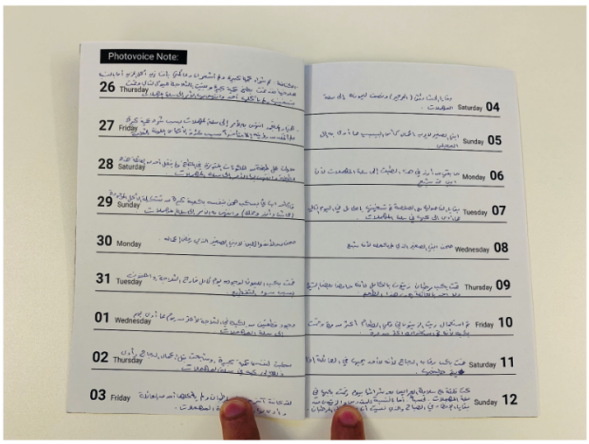
Household Name: Location:
Date: Group:

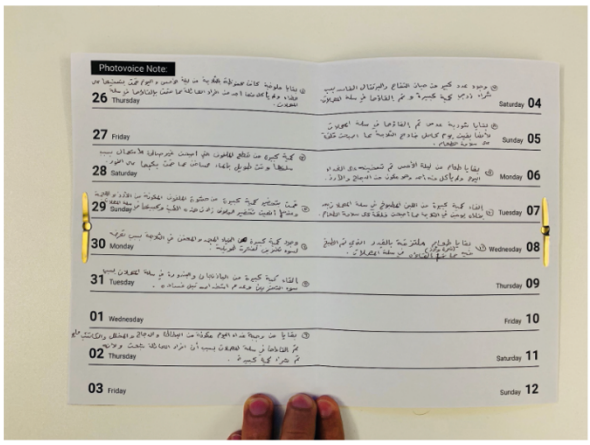
No	Observation Checklist Items	Achieved	Notes
01	Planning purchases and meals	☐	
02	Shopping	☐	
03	Storing	☐	
04	Cooking	☐	
05	Eating	☐	
06	Managing leftovers	☐	

4. Photovoice diaries




Shireen's family
Couple with children
West Amman
Majdi family
Couple without children
West Amman
PHOTOGRAPHS
Nour
Single-Person household
West Amman
Safaa's family
Single-Parent Family
West Amman


Photovoice Note:
26 Thursday
27 Friday
28 Saturday
29 Sunday
30 Monday
31 Tuesday
01 Wednesday
02 Thursday
03 Friday
04 Saturday
05 Sunday
06 Monday
07 Tuesday
08 Wednesday
09 Thursday
10 Friday
11 Saturday
12 Sunday


Photovoice Note:
26 Thursday
27 Friday
28 Saturday
29 Sunday
30 Monday
31 Tuesday
01 Wednesday
02 Thursday
03 Friday
04 Saturday
05 Sunday
06 Monday
07 Tuesday
08 Wednesday
09 Thursday
10 Friday
11 Saturday
12 Sunday

5. Some photovoice images



6. Personas from West and East Amman

1



Amany

"...sometimes we make some spontaneous purchases that happen without much contemplation, for instance, buying good appearance nonseasonal fruits or vegetables that end in the bin"

Gender: Female
Age: 34 years old
Group: Couple with Children
Region: West Amman

Occupation: Lecturer
Education: Doctorate
Family members no: 5

Scenario

Amany is the family purchases and meals planner. She jots a shopping list for a full week **without including the quantity** and sends it as a WhatsApp message to her husband to buy it or she goes shopping by herself. **She does not have a meal menu plan for the week** which may help her to organize food usage and cut back on waste. The food shopping routine involves Amany and sometimes her husband shopping for food items after work most weeks. **She mainly shops the expensive items** and get the things she always needs because **she feels expensive items means to be the highest quality**. **She stores new vegetables like tomatoes and cucumbers together with the old one**.

Frustrations or Concerns

- Anxious about adopting new solution that might be help her to organize food usage and cut back on waste.
- Make some spontaneous purchases that happen without much contemplation, for instance, buying good appearance nonseasonal fruits or vegetables that end in the bin.
- Not sure about the temperature of refrigerator and storing food safely in the fridge.
- A large quantity of food prepared and served due to a lack of planning which leads to being waste.
- Amany's children preferences change over time when it comes to food consumed.

Motivations or Expectations

- Access to mobile apps or information that would assist her to plan shopping and cooking.
- Access to information on food preserving (i.e. pickling, drying etc).

2



Balqees

"... Unconsciously, I purchased some good appearance nonseasonal mangoes that happened without much contemplation and end in the bin"

Gender: Female
Age: 24 years old
Group: Couple without Children
Region: West Amman
Occupation: Dentist
Education: BA
Family members no: 2

Scenario

Balqees and her husband work as dentists in two different clinics. They usually have their breakfast at work. They work every day from 08.00 - 3.00 pm. They plan and prepare their meals almost every night for the next day. In a typical week, **she cooks meals from 1-3 times**. The food shopping routine involves Balqees and her husband **shopping for food items once a week** (Friday). They purchase food from major chain supermarkets. **Balqees's husband buys an extra quantity because he feels it would be a shame to buy a few amounts.** They plan the main meal (Lunch) before they go to their work. Balqees dispose of the remaining food in plates and the main plates in the kitchen bin because **they do not like eating leftovers** and because **leftovers are not as nutritious as freshly cooked foods**.

Frustrations or Concerns

- Buying a large number of food items.
- Poor refrigeration results fresh fruits and vegetables to get spoilt very quickly.
- A large quantity of food prepared and served due to a lack knowledge of planning leads to being waste.
- Religion beliefs and ethical concerns.
- Difficulty to manage leftovers.

Motivations or Expectations

- Access to information that would assist her to plan shopping and cooking.
- Sharing food with people in need.
- Motivated about adopting some solutions that help her save money and generate less food waste.

3



Huda

"...I would like to access information that would assist me to plan my meals and purchases to avoid wasting food"

Gender: Female
Age: 37 years old
Group: Single-parent household
Region: West Amman

Occupation: Physical Therapist
Education: Bachelor
Family members no: 5

Scenario

Huda begins her busy day as a physical therapist. She picks her kids up from school at 2.00 pm in her car every day. **Huda does not have a meal plan for the next few days or a week ahead.** Huda shops for (food items) every 2-3 days. Huda plans the meal at the night with her kids and cooks the meal on the same day based on the available food items in the kitchen. The food shopping routine involves Huda shopping for food items. Huda **has an attraction to the promotion and special offers items. She buys unnecessary and extra items because of the special offers**. **She is not sure how to best store food to prolong shelf life. Huda regularly has leftovers from the meals they eat at home but she and her family does not like to eat leftovers which end up in the bin.**

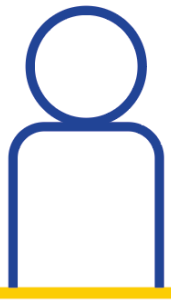
Frustrations or Concerns

- Unplanned purchases and buying unnecessary and extra food items because of the special offers and to get a cheap price.
- Poor refrigeration results fresh fruits and vegetables to get spoilt very quickly.
- A large quantity of food prepared and served due to a lack knowledge of planning leads to being waste.
- Religion beliefs and ethical concerns.
- Difficulty to manage leftovers.

Motivations or Expectations

- Access to information that would assist her to plan shopping and cooking.
- Access to information on food preserving (i.e. pickling, drying etc).
- Motivated about adopting some solutions that help her save money.

4



Assem

"...I do not cook to have leftovers at home"

Gender: Male

Age: 21 years old

Group: Single-person household

Region: West Amman

Occupation: Student

Education: Bachelor

Family members no: 1

Scenario

Assem does not cook or prepare any meals at home. **He purchases ready-to-eat products from the nearby supermarket** and **the last time he purchased fruits and vegetables was a long time ago. Assem does not have a meal plan**. **Assem purchases some snacks and drinks daily.** Assem stores juice, dairy products in his small fridge. However, he stores the ready-to-eat items in a pantry. Assem has no frozen foods in the refrigerator. Assem does not have gas cartridge stove in his flat and he has never cooked. **Assem orders food online or eats at the university's cafeterias and restaurants**.

Frustrations or Concerns

- Fussy Eater.
- Religion beliefs and ethical concerns.
- Throwing his meal leftovers in the bin.
- Worried about food safety.

Motivations or Expectations

- Access to information that would assist her to plan shopping and cooking.
- Sharing food with people in need.
- Motivated about adopting some solutions that help her save money and generate less food waste.

1



Nisreen

"my husband is a night shopper because he knows exactly when markets discount food .... he buys what I ask of him on the mobile phone, but he often buys extra items because the seller offers him cheap price at the end of that day"

Gender: Female
Age: 47 years old
Group: Couple with Children
Region: East Amman

Occupation: Housewife
Education: Bachelor
Family members no: 7

Scenario

Nisreen checks the food necessities in her kitchen and jots things down in a little paper before she provides the shopping list to her husband by hand giving or sending it on his mobile phone later. **She does not have a meal plan** for the next few days or week ahead. **She plans and decides the meal on the same day** depends on what her family desires and sometimes based on the available food in the kitchen. Nisreen's husband shops every 2-3 days from different local places such as open-air markets, supermarkets, farmers' markets, and bakery shops. **He is price-oriented and has an attraction to the promotion and special offers items.** The **shopping list is not based on how many meals they would eat at home** and the timing of their next shopping trip or if their family members eat out this week. He is a night shopper who knows exactly when supermarkets discount food. He buys the necessities but he often buys extra items because **the seller offers him cheap price at the end of that day.**

Frustrations or Concerns

- Nisreen regularly finds some frozen and rotten food.
- Buying unnecessary and a large number of food items because it is a cheap price.
- Poor refrigeration results fresh fruits and vegetables to get spoilt very quickly.
- A large quantity of food prepared and served due to a lack knowledge of planning leads to being waste.
- Religion beliefs and Food expenditures concerns.
- Difficulty to manage leftovers.

Motivations or Expectations

- Access to information that would assist her to plan shopping and cooking.
- Access to information on food preserving (i.e. pickling, drying etc).
- Motivated about adopting some solutions that help her save money.

2



Ola

"my husband and I work full-time, we buy surplus food since we rarely have time to go grocery shopping everyday."

Gender: Female
Age: 24 years old
Group: Couple without Children
Region: East Amman

Occupation: Housewife
Education: Bachelor
Family members no: 2

Scenario

Ola checks the food necessities in the fridge, freezer, and pantry, then she jots things down in a little note-book to inform her husband on his mobile phone later. **Ola does not have a meal plan for the next few days or a week ahead**. She plans and decides the meal based on the available food items in the kitchen. She shops from different local places such as open-air markets and bakery shops. **Ola's husband is price oriented and attracted to promotions and special offers items**. **Shopping list is not based on how many meals they would eat at home this week**. **The main reasons for selecting food items are price and freshness**. The fridge had some food items with **coloured bags which results in spoiling the food.** Ola cooks 4-6 times a week. A few amounts of **food ended up thrown in the bin specially the remaining food in the plates.**

Frustrations or Concerns

- Buying large amounts of food items.
- Poor refrigeration results fresh fruits and vegetables to get spoilt very quickly.
- A large quantity of food prepared and served due to a lack knowledge of planning leads to being waste.
- Religion beliefs and ethical concerns.
- Difficulty to manage leftovers.

Motivations or Expectations

- Access to information that would assist her to plan shopping and cooking.
- Access to information on food preserving (i.e. pickling, drying etc).
- Motivated about adopting some solutions that help her save money.

3



Tamara

"The meals I cook depends on what the family wants to eat and not on the availability of the food items needed for the meal.. I would love to access information about how to store food."

Gender: Female
Age: 44 years old
Group: Single-parent
Region: East Amman

Occupation: Housewife
Education: High School
Family members no: 7

Scenario

Tamara **does not have a meal plan for the next few days or week ahead**. **She plans or cooks the meal on the same day based on what her family desires.** She regularly cooks meals at home 5-6 times in a typical week. Tamara shops for food items once a week. She purchases the majority of the fruits and vegetables from major chain supermarkets, farmers' markets and she grow some leaves and plants in her house garden. Sometimes, she shops from different local places such as open-air markets and bakery shops. **Tamara is price oriented and has an attraction to promotions and special offers. Tamara was not sure how to store food to prolong shelf life**. **She regularly has leftovers** from the meals eaten at home. Leftovers usually get eaten on another day, fed to animals at her home and **sometimes thrown in the bin.**

Frustrations or Concerns

- Buying in bulk because of the special offers and cheap prices.
- Poor refrigeration results fresh fruits and vegetables to get spoilt very quickly.
- A large quantity of food prepared and served due to a lack knowledge of planning leads to being waste.
- Religion beliefs and ethical concerns.
- Difficulty to manage leftovers.

Motivations or Expectations

- Access to information that would assist her to plan shopping and cooking.
- Access to information on food preserving (i.e. pickling, drying etc).
- Motivated about adopting some solutions that help her save money.

4



Um Khalifa

"... I don't have a meal plan, I cook based on what is available in the kitchen. I buy food items in bulk to save money"

Gender: Female
Age: 51 years old
Group: Single-person
Region: East Amman

Occupation: Housewife
Education: High School
Family members no: 1

Scenario

Um Khalifa lives alone in her house. She does not have **a meal plan** for the next few days or a week ahead. She plans and cooks the meal on the same day based on the available food items in the kitchen. She regularly cooks meals at home 1-3 times in a typical week. Sometimes neighbours send up food to her. Um Khalifa purchases the majority of the fruits and vegetables from major chain supermarkets, and farmers' markets. Sometimes, she shops from different local places such as open-air markets and bakery shops. **Um Khalifa is price oriented and has an attraction to promotions and special offers**. **The shopping list is not based on how many meals she would eat at home and the timing of her next shopping trip.** She **buys in bulk to keep down costs**. She has mesh net breathable hanging storage bags. Um Khalifa regularly has leftovers from the meals she eats at home. **Leftovers** usually get eaten on another day and sometimes **thrown in the bin.**

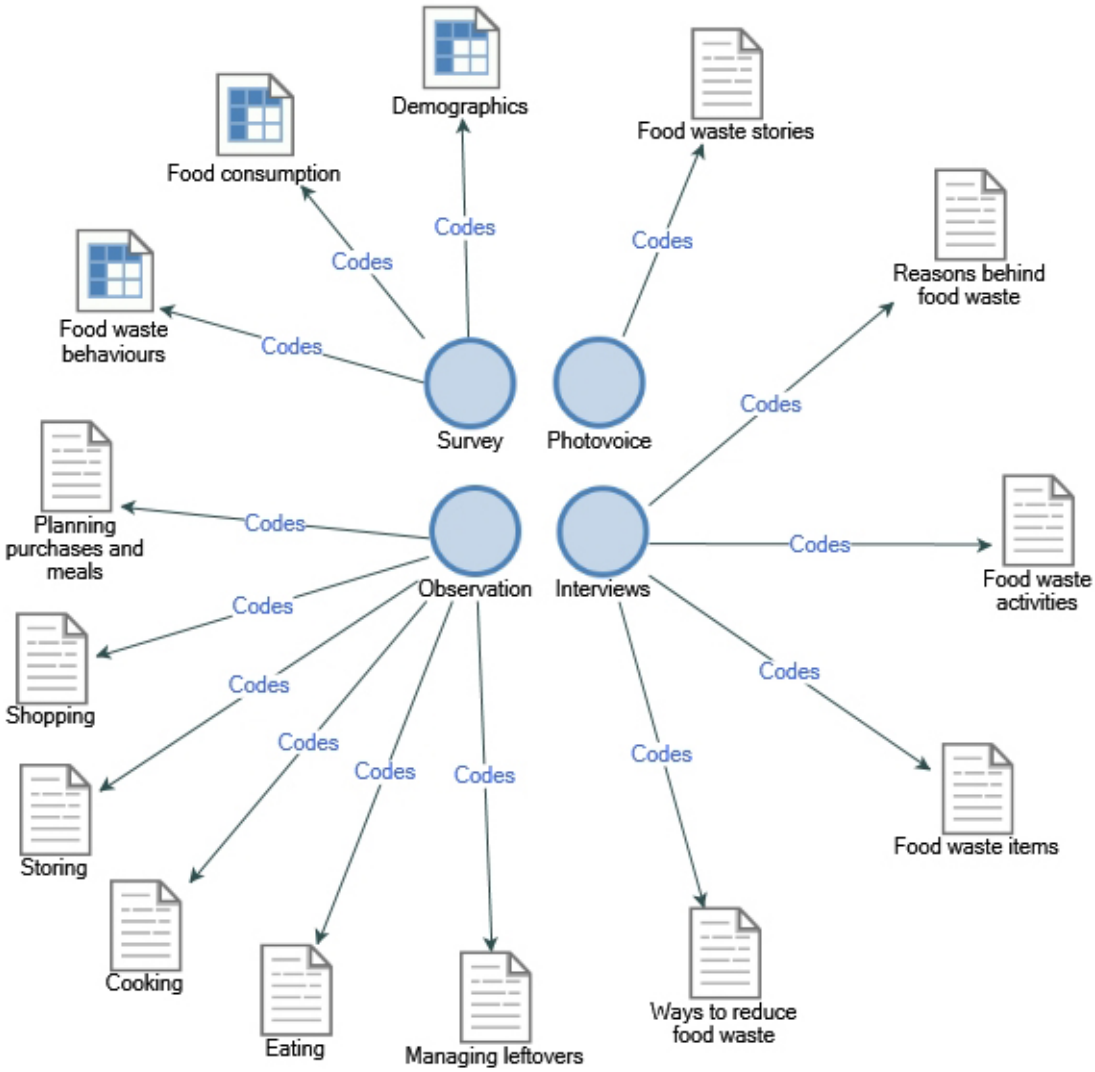
Frustrations or Concerns

- Worried about food safety
- Buying in bulk.
- Religion beliefs and ethical concerns.
- Buying unnecessary and a large number of food items because it is a cheap price.
- Difficulty to manage leftovers.

Motivations or Expectations

- Motivated about adopting some solutions that help her save money and share food with others.
- Would love to access information that would assist her to plan shopping and cooking.

7. NVivo node map and relationship



Appendix III: Design workshops and feedback

1. Co-design workshop invitation



CO-DESIGN WORKSHOP:

IDEATION TO DEVELOP A COMMUNICATION CAMPAIGN TO SHAPE HOUSEHOLDS BEHAVIOUR TOWARDS FOOD WASTE REDUCTION IN JORDAN

DATES

- FRIDAY 12 FEBRUARY – 16.00-18.00
- SATURDAY 13 FEBRUARY – 16.00- 18.00

Both workshops are the same, please choose the most suitable date for you
Workshops are scheduled for 2 hours. They might be shorter.

LOCATION

- MICROSOFT TEAMS , ZOOM, OR SKYPE

OTHER INFORMATIONS

- **CONTACT:** 00447393718610 I qais.ahmad@brunel.ac.uk
- **RECORDING:** Workshop will be recorded for transcription purposes only. All data will remain anonymous and is protected.
- **LANGUAGE:** Workshop is conducted in English & Arabic.

PURPOSE

The overall aim of this workshop is to build an understanding of how design for behaviour change and communication design can be used to shape behaviour of households towards food waste reduction in Amman-Jordan. TOGETHER, we will provide and develop different perspectives, ideas, and rationales for creating potential solutions.

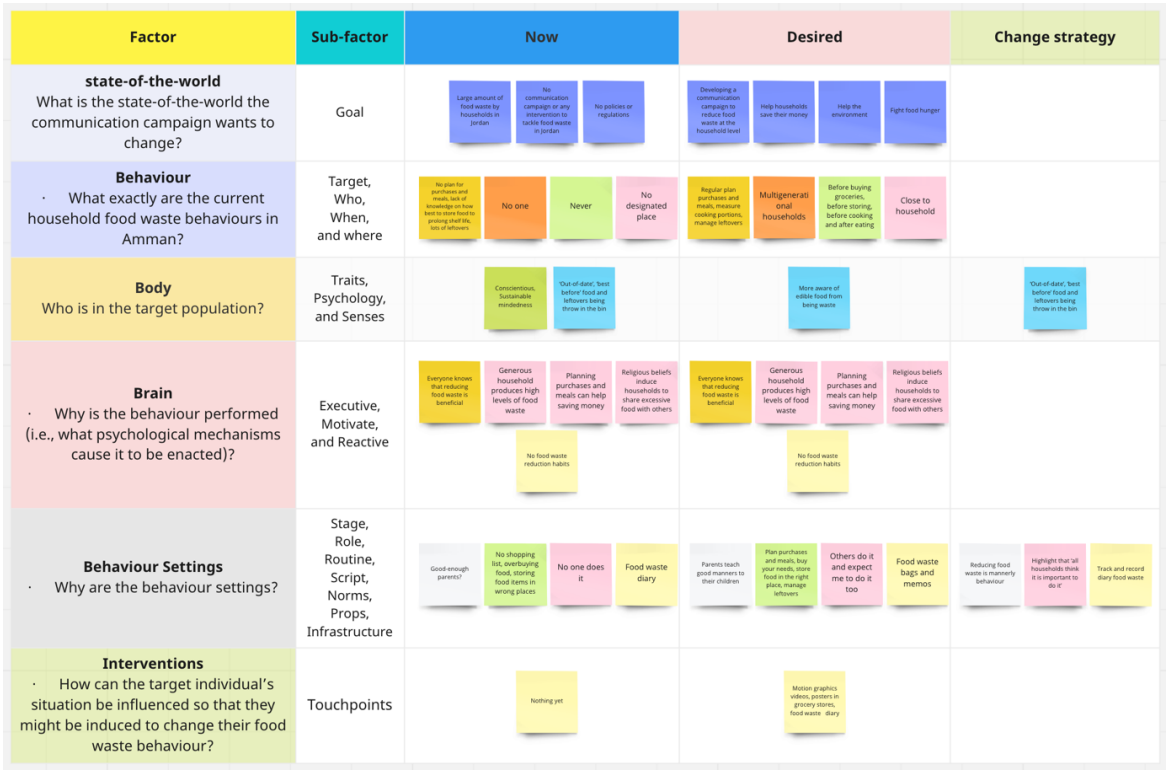
WHAT WILL WE DO?

We will explore a number of questions and problems in two groups through design research. The main purpose is to get participants to work together and provide their ideas and opinions. Participants are asked to prepare the following in advance:

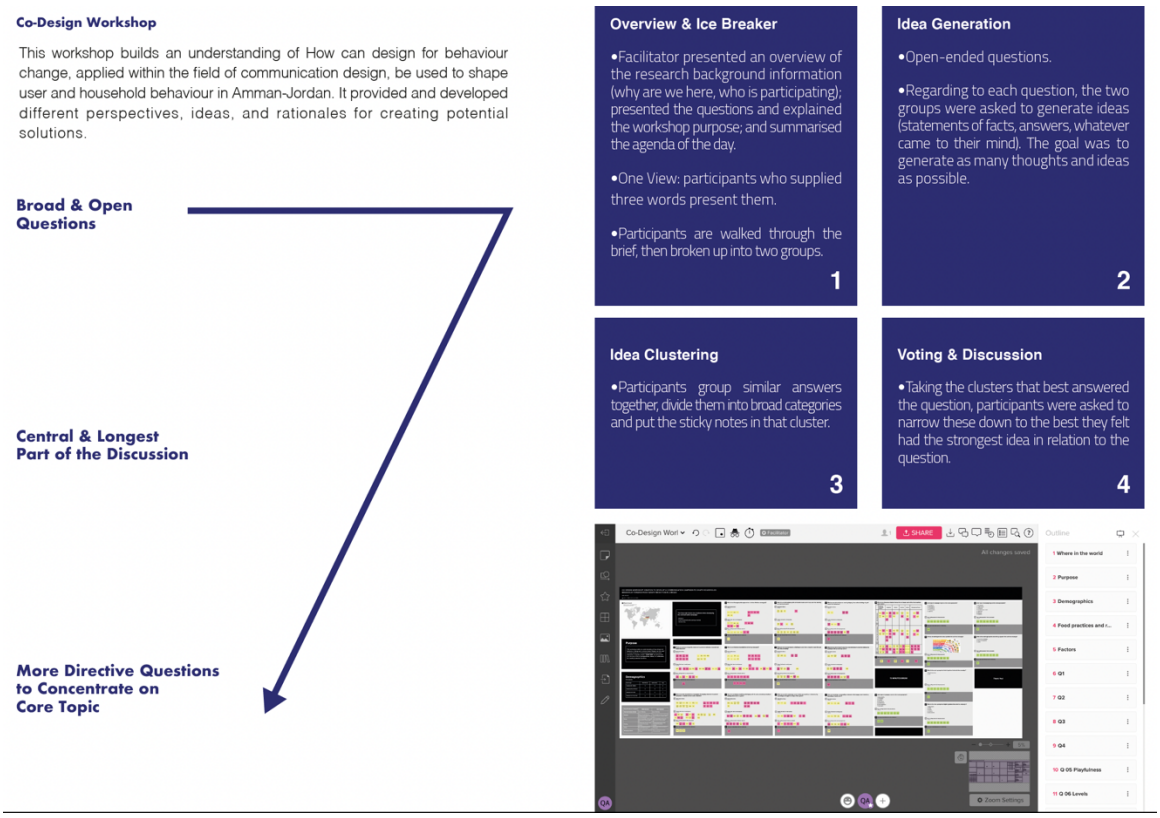
- One slide with three words based on this prompt: Three pointers for changing behaviour towards food waste reduction.
- Send me the slide via email prior to the date of the co-design workshops you are attending.

Thank you for your help and support!

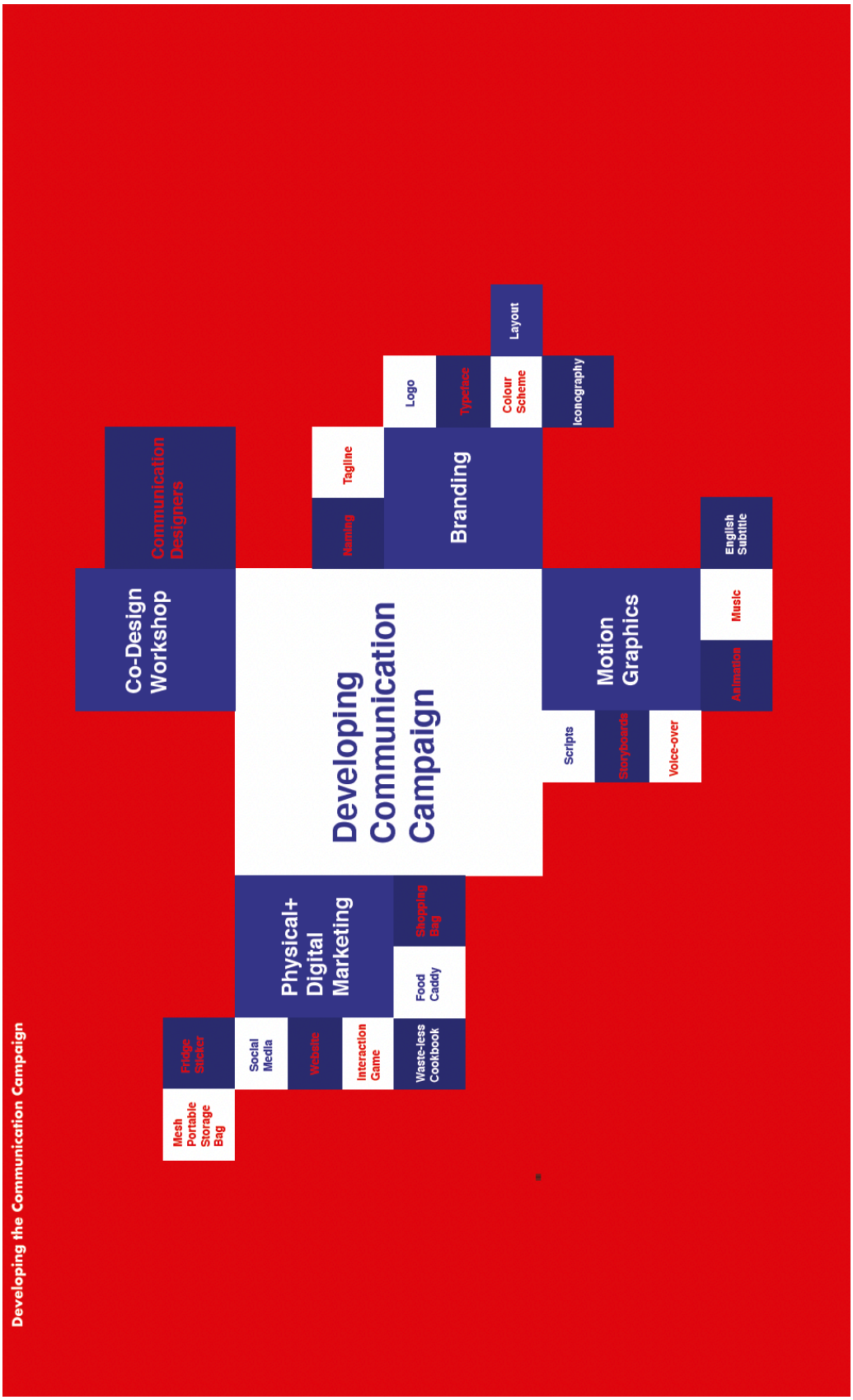
2. Part of the framing process workshop



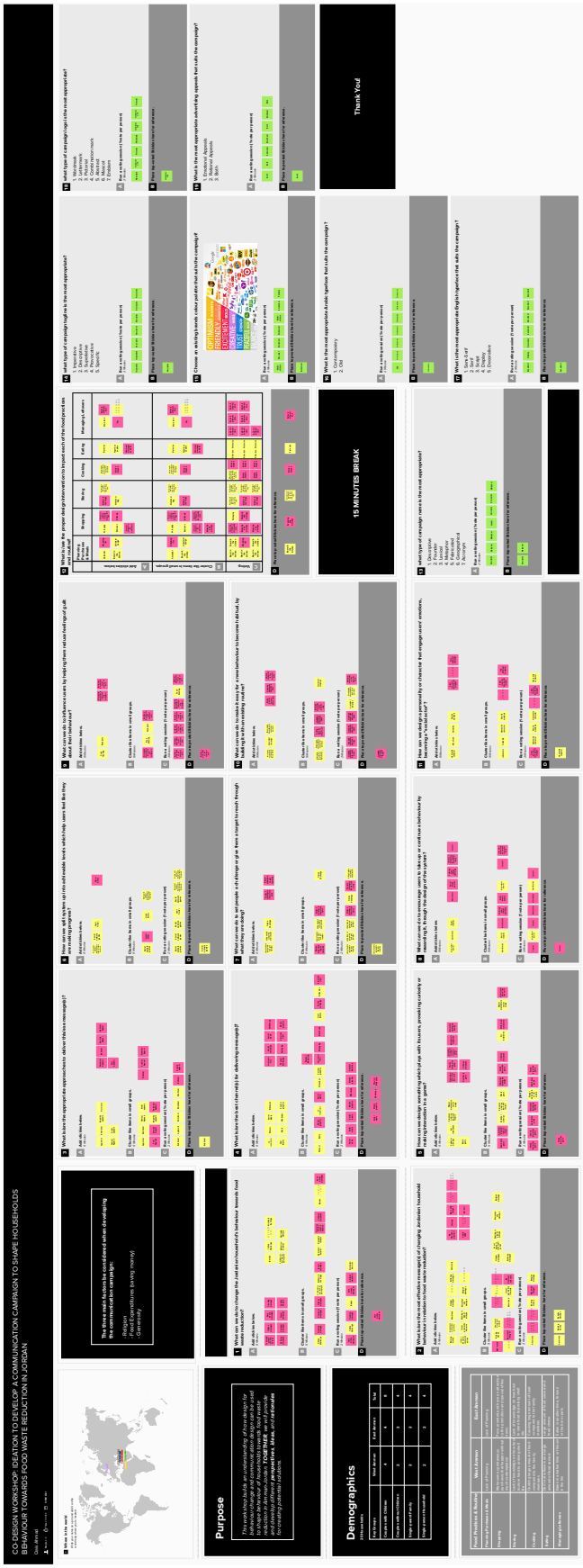
3. Designed workshop protocol



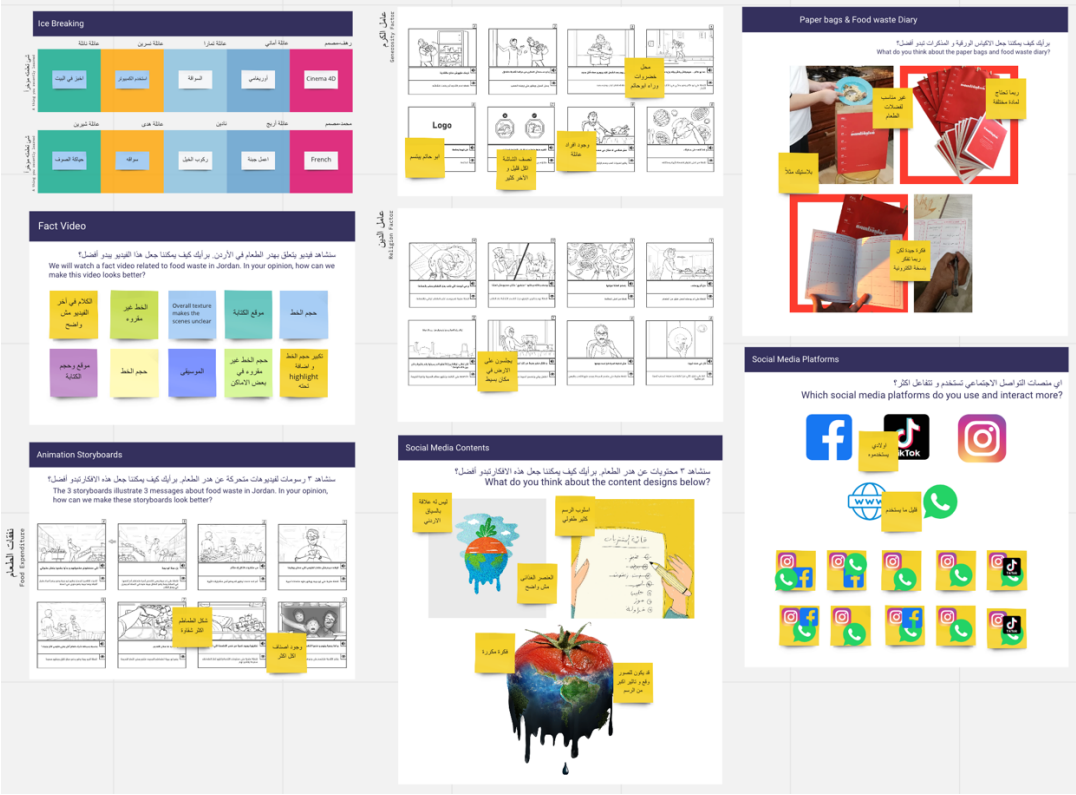
4. Affinity diagram to help developing the communication campaign

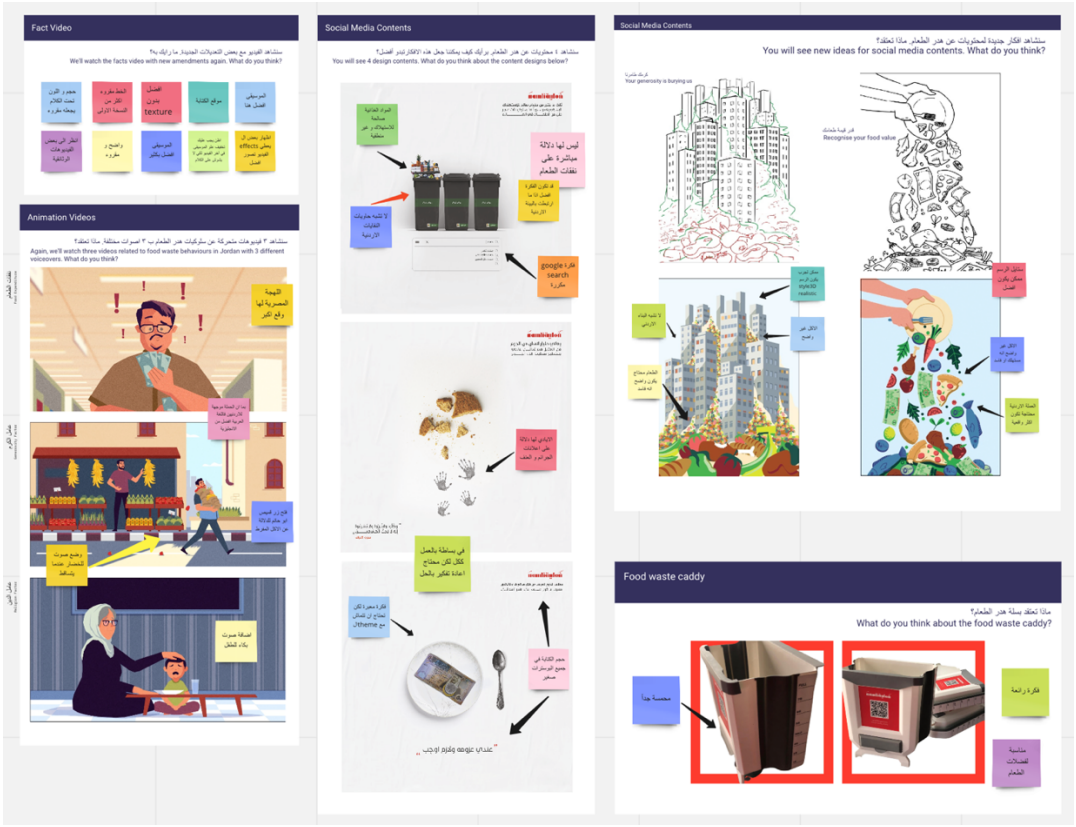


5. First design workshop was to develop a creative insight and brief



6. Examples of the design workshops





Social Media Contents

سنشاهد افكار جديدة لمحتويات عن هدر الطعام. ماذا تعتقد؟
You will see new ideas for social media contents. What do you think?

قدر قيمة طعامك

Recognise your food value



كرمك طامرنا

Your generosity is burying us



Paper bags & Food waste Diary

برأيك كيف يمكننا جعل الاكياس الورقية و المذكرات تبدو أفضل؟
What do you think about the paper bags and food waste diary?



Storyboard 1

Animation Storyboards

سنشاهد ٣ رسومات لفيديوهات متحركة عن هدر الطعام. برأيك كيف يمكننا جعل هذه الافكارتبدو أفضل؟

The 3 storyboards illustrate 3 messages about food waste in Jordan. In your opinion, how can we make these storyboards look better?

نفقات الطعام
Food Expenditure

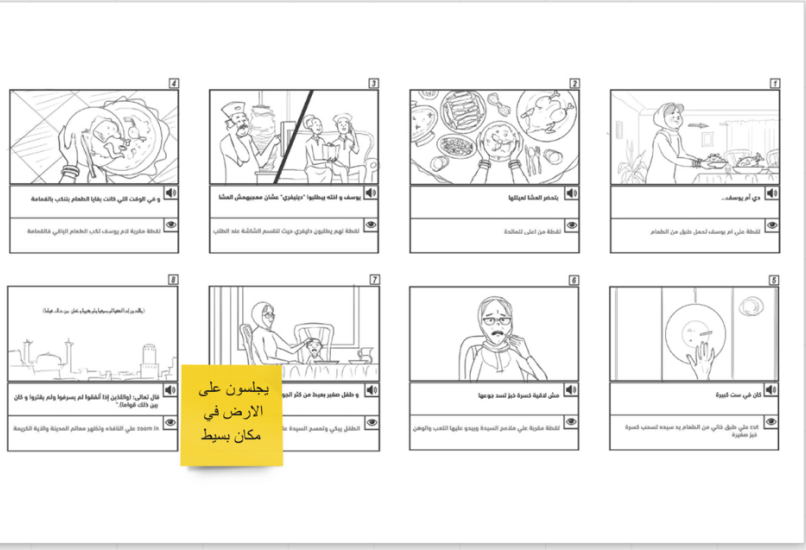


Storyboard 2

عامل الكرم
Generosity Factor



عامل الدين
Religion Factor

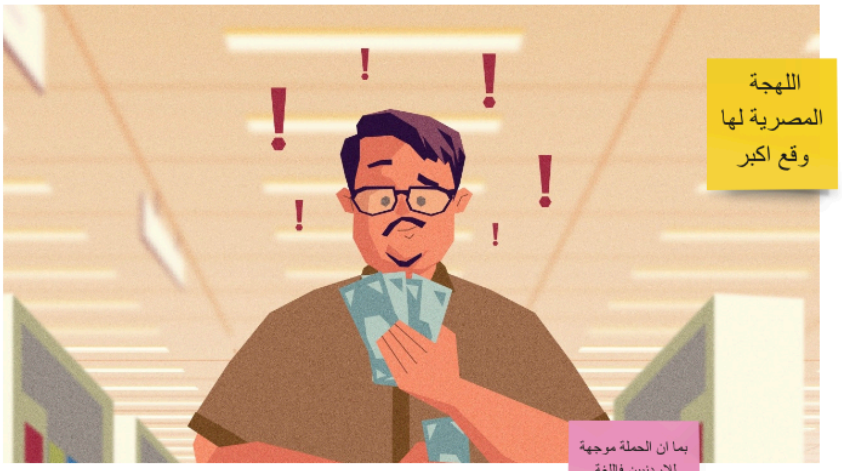


Animation Videos

سنشاهد ٣ فيديوهات متحركة عن سلوكيات هدر الطعام ب ٣ اصوات مختلفة. ماذا تعتقد؟

Again, we'll watch three videos related to food waste behaviours in Jordan with 3 different voiceovers. What do you think?

نفقات الطعام
Food Expenditure



عامل الكرم
Generosity Factor



عامل الدين
Religion Factor



Social Media Contents

سنشاهد ٤ محتويات عن هدر الطعام. برأيك كيف يمكننا جعل هذه الافكار تبدو أفضل؟
You will see 4 design contents. What do you think about the content designs below?







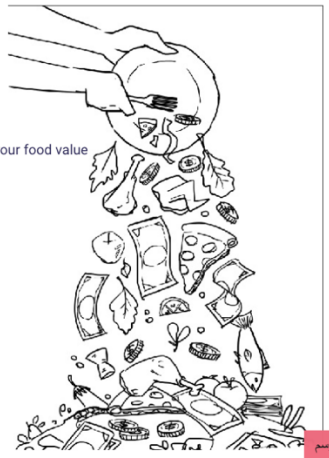
Social Media Contents

سنشاهد افكار جديدة لمحتويات عن هدر الطعام. ماذا تعتقد؟
You will see new ideas for social media contents. What do you think?

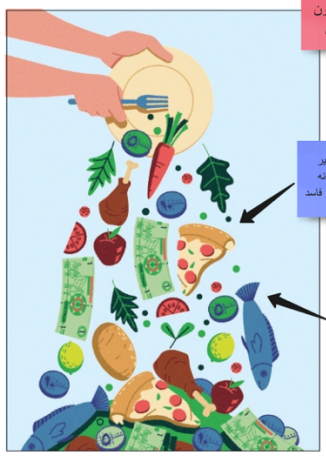
كرمك طامرنا
Your generosity is burying us



قدر قيمة طعامك
Recognise your food value



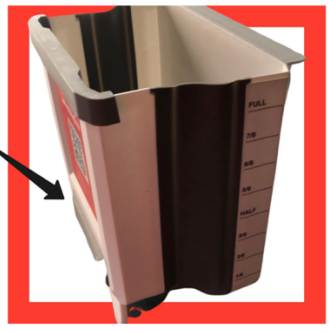




Food waste caddy

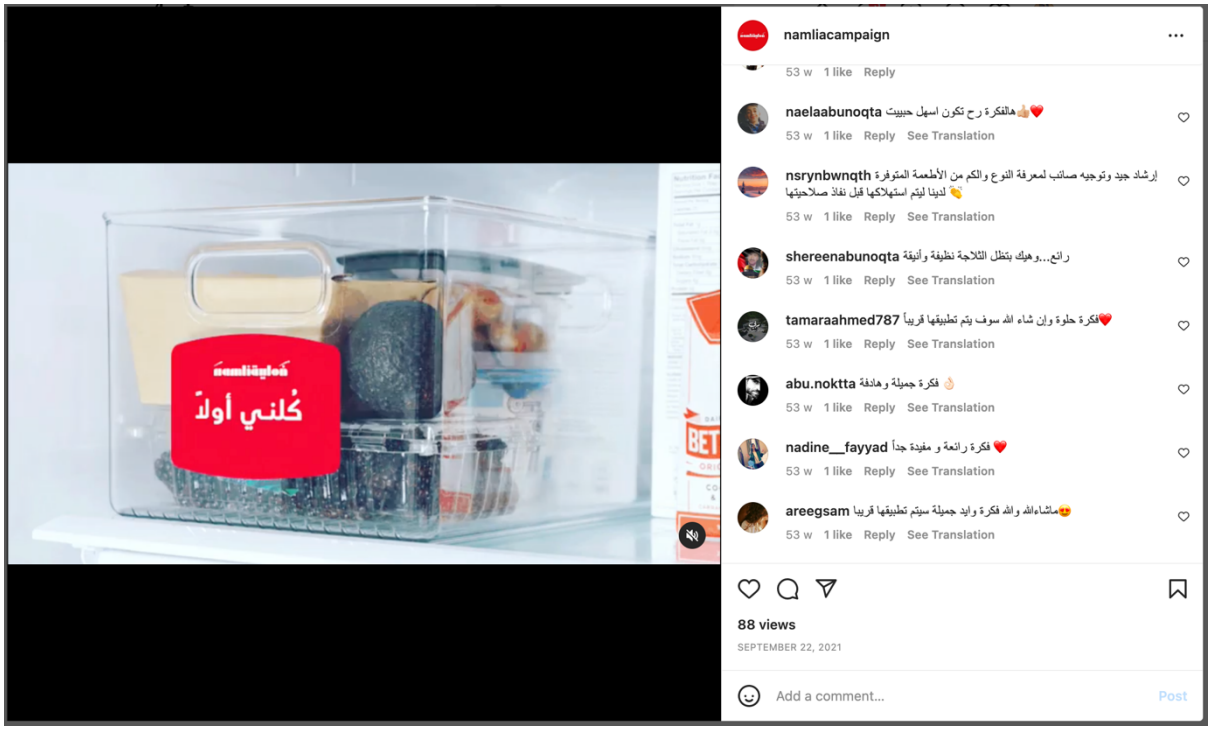
Food waste caddy

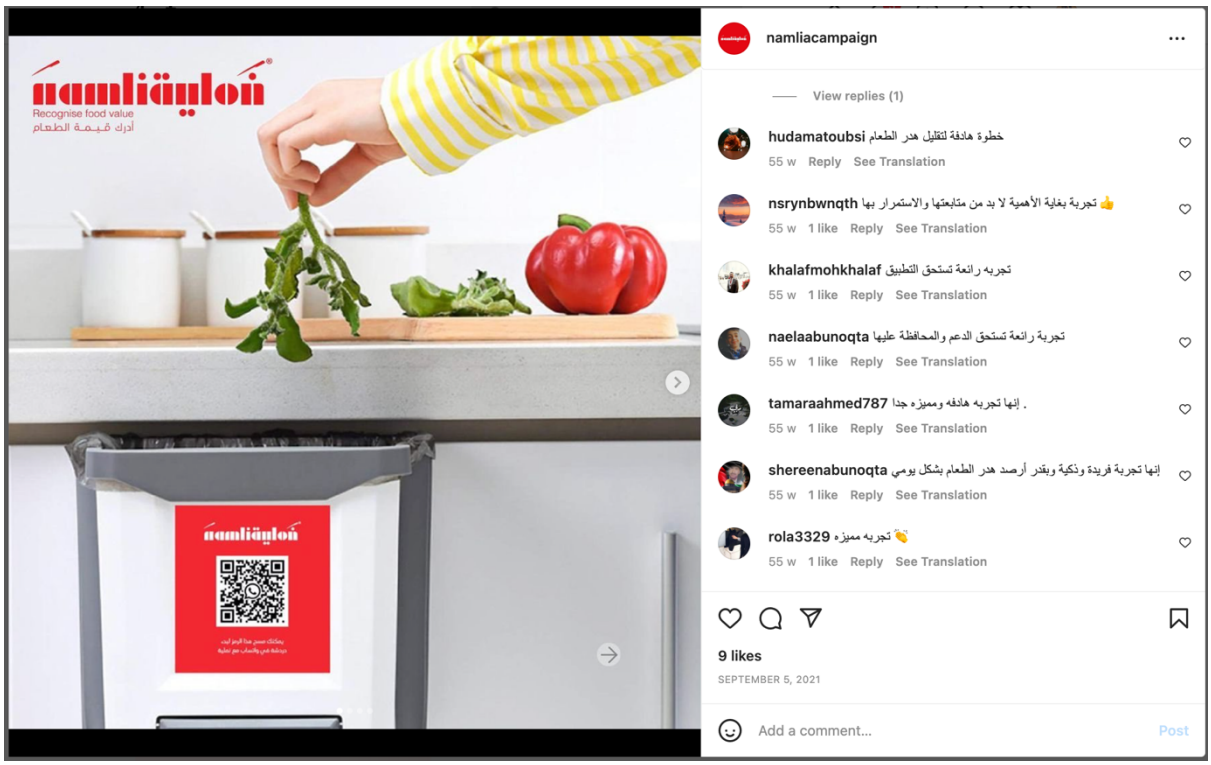
ماذا تعتقد بسلة هدر الطعام؟
What do you think about the food waste caddy?

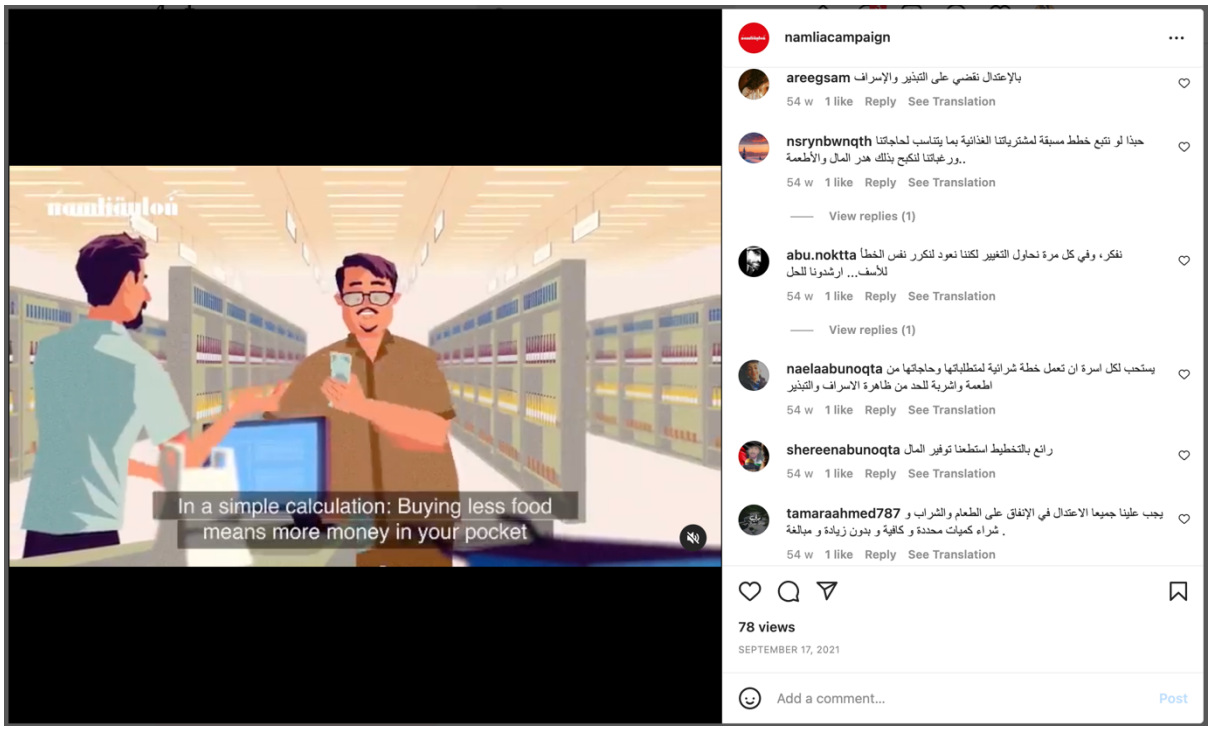


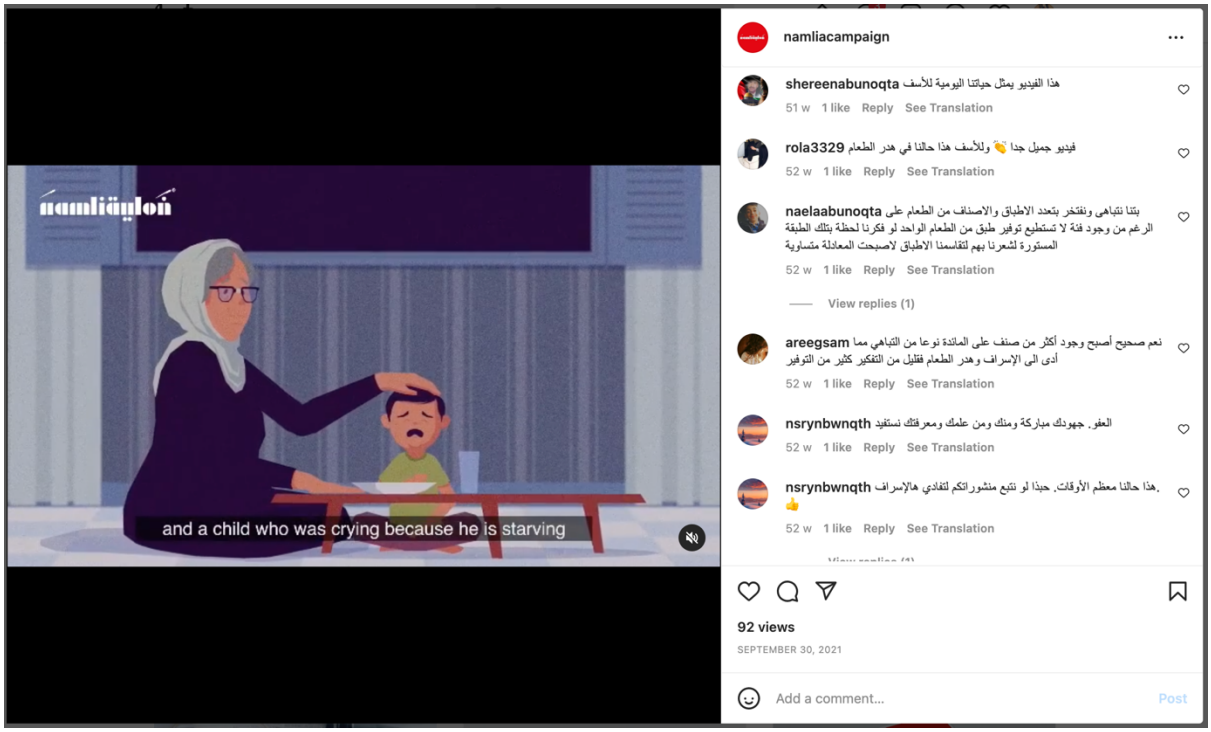


7. Examples on Instagram comments



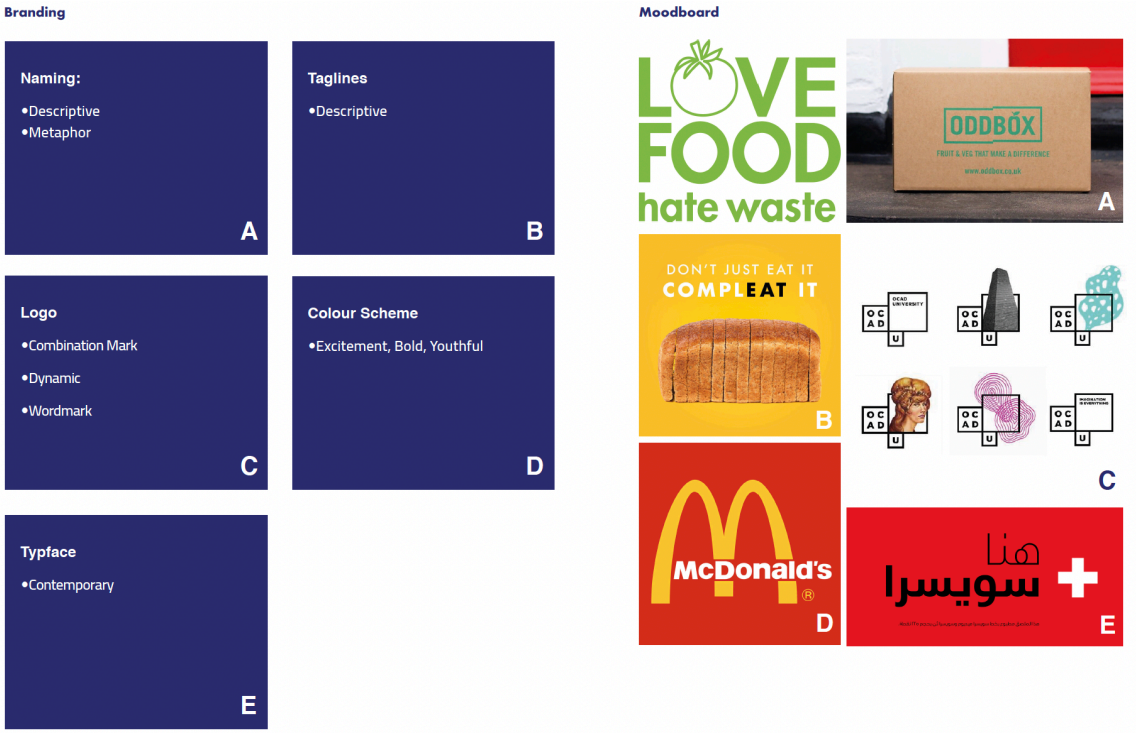



namliacampaign
In a simple calculation: Buying less food means more money in your pocket
areegsam بالإعتدال نقضي على التبذير والإسراف
54 w 1 like Reply See Translation
nsrynbwnqth حبذا لو نتبع خطط مسبقة لمشترياتنا الغذائية بما يتناسب لحاجاتنا ورغباتنا لنكبح بذلك هدر المال والأطعمة..
54 w 1 like Reply See Translation
View replies (1)
abu.noktta نفكر، وفي كل مرة نحاول التغيير لكننا نعود لنكرر نفس الخطأ للأسف... ارشدونا للحل
54 w 1 like Reply See Translation
View replies (1)
naelaabunoqta يستحب لكل اسرة ان تعمل خطة شرائية لمتطلباتها وحاجاتها من اطعمة واشربة للحد من ظاهرة الاسراف والتبذير
54 w 1 like Reply See Translation
shereenabunoqta رائع بالتخطيط استطعنا توفير المال
54 w 1 like Reply See Translation
tamaraahmed787 يجب علينا جميعا الاعتدال في الإنفاق على الطعام والشراب و شراء كميات محددة و كافية و بدون زيادة و مبالغة .
54 w 1 like Reply See Translation
78 views
SEPTEMBER 17, 2021
Add a comment...
Post

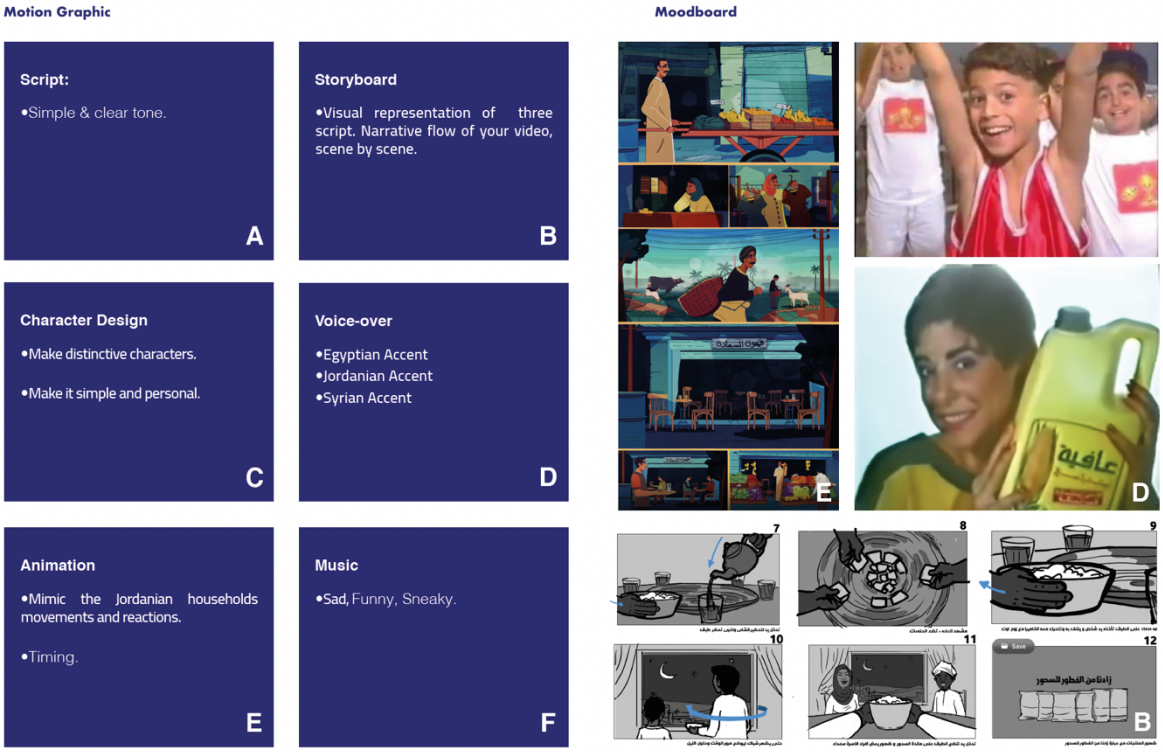

namliacampaign
and a child who was crying because he is starving
shereenabunoqta هذا الفيديو يمثل حياتنا اليومية للأسف
51 w 1 like Reply See Translation
rola3329 فيديو جميل جدا 👏 وللأسف هذا حالنا في هدر الطعام
52 w 1 like Reply See Translation
naelaabunoqta بدنا نتباهى ونفتخر بتعدد الاطباق والاصناف من الطعام على الرغم من وجود فئة لا تستطيع توفير طبق من الطعام الواحد لو فكرنا لحظة بتلك الطبقة المستورة لشعرنا بهم لتقاسمنا الاطباق لاصبحت المعادلة متساوية
52 w 1 like Reply See Translation
View replies (1)
areegsam نعم صحيح أصبح وجود أكثر من صنف على المائدة نوعا من التباهي مما أدى الى الإسراف وهدر الطعام فقليل من التفكير كثير من التوفير
52 w 1 like Reply See Translation
nsrynbwnqth العفو. جهودك مباركة ومنك ومن علمك ومعرفتك نستفيد
52 w 1 like Reply See Translation
nsrynbwnqth هذا حالنا معظم الأوقات. حبذا لو نتبع منشوراتكم لنتفادي هالإسراف 👍
52 w 1 like Reply See Translation
92 views
SEPTEMBER 30, 2021
Add a comment...
Post

Appendix IV: Intervention materials

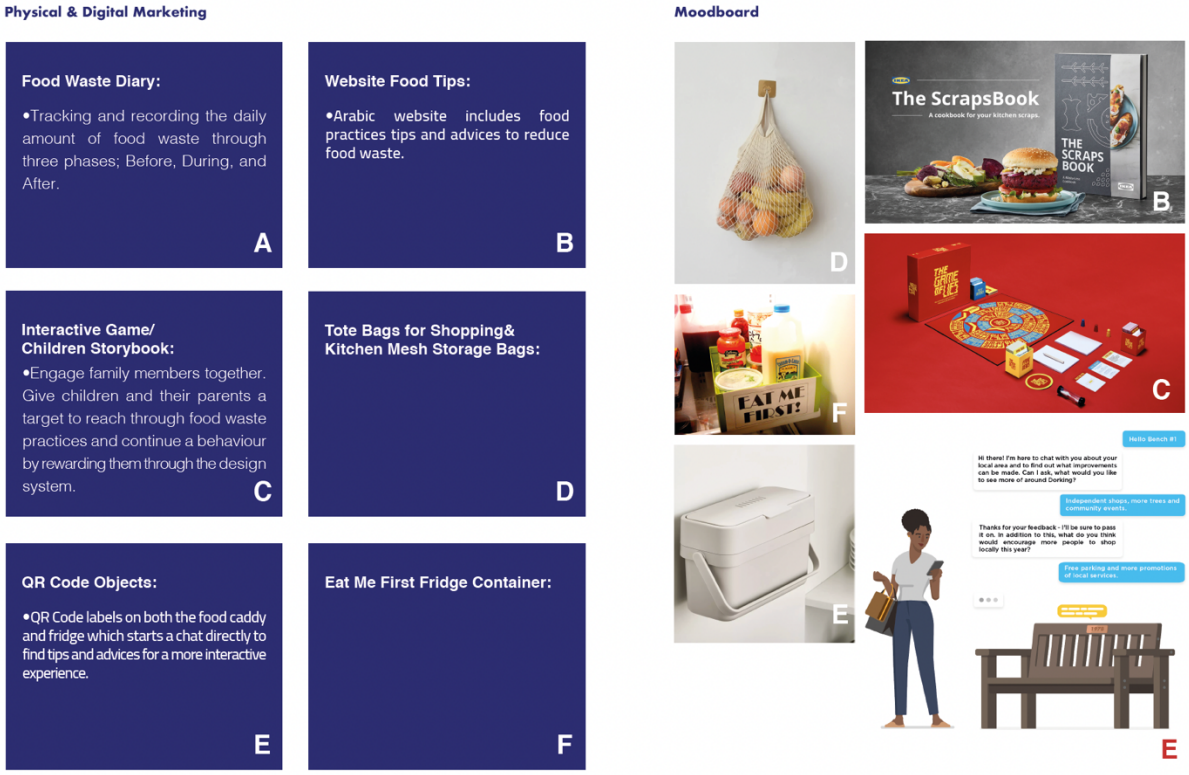
1. Branding mood board



2. Motion graphics mood board

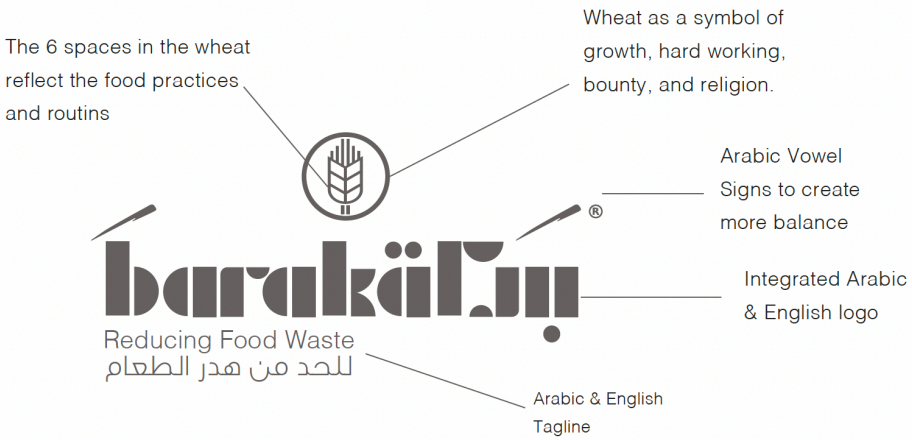


3. Physical and digital mood board

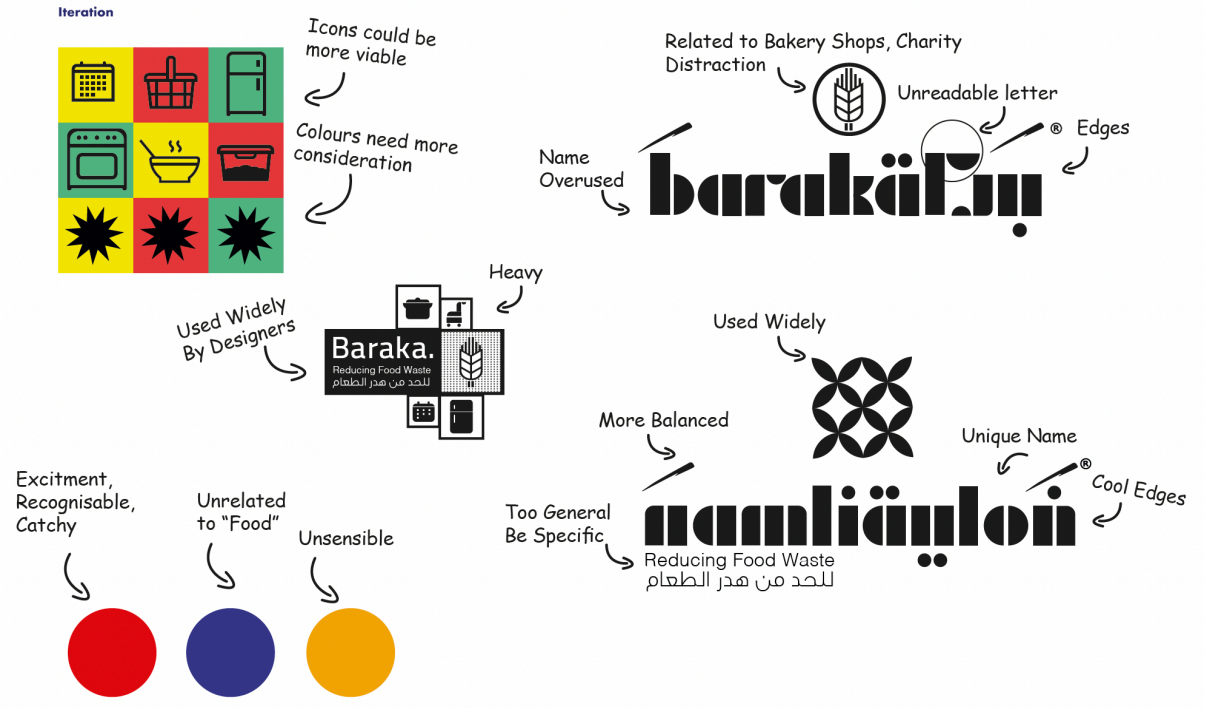


4. Description of Baraka name and logo

Baraka is designed around the idea of representing both English and Arabic languages which are integrated professionally in the logo design. While making the logo to represent both the language in the design it's important to have a common integration of font style and graphic to bring synergy in the logo. The logo desires to show some new and contemporary design styles while playing with repetitive uniform shapes that hold a rhythm visually and have the same charisma the name did.



5. Part of the branding iteration



6. Namlia logo



7. Food expenditure storyboard



8. Some illustrations for the three motion graphics



9. First iteration of food waste bags and diaries



10. First iteration planning meals and purchases diaries



11. Food waste caddy





12. Examples of the initial social media content iteration









13. Other iteration examples



Appendix V: Ethical approvals

1. Policymakers and experts' interviews

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

29 May 2019

LETTER OF APPROVAL

Applicant: Mr Qais Ahmad

Project Title: Design for behaviour change

Reference: 16972-LR-May/2019- 19232-3

Dear Mr Qais Ahmad

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Professor Hua Zhao

Chair

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London

2. Ethnographic research

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

22 October 2019

LETTER OF APPROVAL (CONDITIONAL)

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 30/11/2019 AND 22/12/2019

Applicant (s): Mr Qais Ahmad

Project Title: Using Design for Behaviour Change and Communication Design to influence household behaviour towards food waste prevention: An exploration in the Jordanian context

Reference: 18715-LR-Oct/2019- 20712-2

Dear Mr Qais Ahmad

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.
- Please consider your personal safety when visiting unknown participants in their homes, consider taking a friend or fellow researcher along.

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Professor Hua Zhao

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London

3. Design workshops

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

16 December 2020

LETTER OF APPROVAL (CONDITIONAL)

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 18/01/2021 AND 21/01/2021

Applicant (s): Mr Qais Ahmad

Project Title: Co-design workshops

Reference: 26543-LR-Dec/2020- 29259-1

Dear Mr Qais Ahmad

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **Approval is given for remote (online/telephone) research activity only. Face-to-face activity and/or travel will require approval by way of an amendment.**
- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- In addition to the above, please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.
- Please remove the Witness section from your consent form, as this is only relevant to vulnerable participants
- Please remove the 'checklist' from your Participant Information Sheet, and add a line at the end to state that for queries and complaints they may contact Professor Hua Zhao - chair of the CEDPS Research Ethics Committee. (These two points may be addressed outside of the BREO system)

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Professor Hua Zhao

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London

4. Online semi-structured interviews with households

College of Engineering, Design and Physical Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

14 December 2021

LETTER OF APPROVAL (CONDITIONAL)

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 24/12/2021 AND 06/01/2022

Applicant (s): Mr Qais Ahmad

Project Title: Online interviews

Reference: 35172-LR-Dec/2021- 36697-1

Dear Mr Qais Ahmad

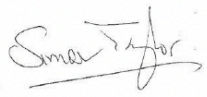
The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- **Approval is given for remote (online/telephone) research activity only. Face-to-face activity and/or travel will require approval by way of an amendment.**
- **The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.**
- In addition to the above, please ensure that you monitor and adhere to all up-to-date local and national Government health advice for the duration of your project.
- Please be advised that recruitment via social media is limited to you creating / sharing a post on your own channels, which participants can respond to or share if they are interested. It does not extend to direct messaging of large numbers of contacts, which can be considered spam.
- Please remove the 'checklist' from your Participant Information Sheet' before sending out to participants
- These two points may be addressed outside of the BREO system

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.



Professor Simon Taylor

Chair of the College of Engineering, Design and Physical Sciences Research Ethics Committee

Brunel University London