PolyU Design

PhD

THESIS SERIES

XIAO JIA XIN

Designing for Sustainable Behaviour in High-density Space: Household and Community Participation in Waste Recycling in Hong Kong

2017

PhD

1999–2020 THESIS SHOWCASE

Environmentalists, researchers, designers and policymakers have made tremendous efforts to reduce and recycle waste. Yet, there is still a lack of systematic studies that investigate sustainable recycling behaviour in the field of design. With a contextual framework that encompasses the physical, social and socio-cultural contexts, this study addresses the significance of contextual factors for improving household recycling and design opportunities. Utilising the findings from a theoretical review and an empirical study on household recycling in Hong Kong, this research investigates the possible design opportunities for household recycling in high-density cities. The result identifies 'intervention' and 'collaboration' as two main approaches to influence human behaviour. The changing of human behaviour through design requires an in-depth understanding of people's needs, acceptances and responses, and the social effects of the interventions in the context of their particular situation. This thesis concludes with four behaviour models with suggestions on the applicability of design interventions and collaboration to impact user behaviour.

School of Design,
The Hong Kong Polytechnic University
PhD 2020.

Original copy: https://theses.lib.polyu.edu.hk/handle/200/8984

DESIGNING FOR SUSTAINABLE BEHAVIOUR IN HIGH-DENSITY SPACE: HOUSEHOLD AND COMMUNITY PARTICIPATION IN WASTE RECYCLING IN HONG KONG

XIAO JIA XIN

Ph.D

The Hong Kong Polytechnic University

2017

The Hong Kong Polytechnic University

School of Design

Designing for Sustainable Behaviour in High-density Space: Household and Community Participation in Waste Recycling in Hong Kong

XIAO Jiaxin

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy

September 2016

CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgement has been made in the text.

_____ (Signed)

XIAO JIAXIN (Name of student)

Abstract

In recent decades, recycling has been considered one of the most effective measures for tackling imminent environmental problems. Environmentalists, researchers, designers and policymakers have made tremendous efforts to reduce and recycle waste. Studies on education, management, economic incentives, social norms and policies have been developed to encourage public participation in recycling. As well as fiscal policies, regulations and economic incentives, design and management play important roles in changing human behaviour. However, studies of design for sustainable recycling behaviour referring to social culture and physical environment have not been examined systematically, especially with regard to high-rise and high-density cities.

The high-rise living situation and constructed communities in Hong Kong differ greatly from the neighbourhoods composed of single-storey or low-rise buildings, making it challenging to practise waste separation in both public and private spaces. Over the past few years, local authorities have implemented a variety of policies, strategies and ordinances including newly designed public facilities to encourage residents to participate in recycling. Meanwhile, various communities and non-governmental organisations (NGOs) have undertaken numerous campaigns and activities to facilitate public participation in waste recycling. However, due to a lack of consideration for local culture and human factors, current design and management for recycling have failed to change undesired behaviour. Compared to other developed cities, Hong Kong's household waste recycling rate is still low at only 40%.

This study takes design for sustainable recycling behaviour in Hong Kong as a case study and focuses on household recycling in high-density space. It explores design

opportunities for household recycling by answering four research questions: (1) What factors affect sustainable recycling behaviour? (2) What are people's perceptions of existing design and management of waste recycling in Hong Kong? (3) What are the limitations and challenges in public design for recycling, with attention to particular high-rise, high-density living environments? (4) How can human behaviour be effectively influenced through design?

This study used both qualitative and quantitative methods. Questionnaires were distributed to random participants to identify what factors influence sustainable recycling behaviour and people's attitudes. Observations and interviews were conducted across time and space dimensions in different research periods. Several cases were selected with the aim of gaining an in-depth understanding of people's behaviour and living contexts. Action research, which was the most time-consuming phase of the study, was adopted to test the model and identify how to improve design for behaviour change.

Through a theoretical review of influencing human behaviour from different perspectives, this study illustrates the significance of context and the challenges of influencing sustainable behaviour through design. It has been suggested that not only personal factors such as norms and attitudes but also the environmental setting, including social and physical factors, affect actual behaviour. Supported by a point proposed by Lilley (2009) and Lockton (2013), the balance between design interventions and user performance should be carefully configured because inappropriate or problematic interventions might lead to annoyance and frustration. People's experiences and responses must not be ignored because they ensure the effectiveness of design interventions.

Based on theoretical discussions and empirical findings, this study emphasises that residents' satisfaction with recycling networks and the perceived quality of environments are positively associated with sustainable recycling behaviour. It is suggested that not only the physical setting but also the social environment and the residents' satisfaction must be taken into consideration in sustainability studies.

This study provides a framework of contextual information encompassing physical, social and socio-cultural contexts. The significance of contextual factors for improving household recycling and design opportunities is addressed. Intervention and collaboration are identified as two main approaches to influence human behaviour. Moreover, changing human behaviour via design requires an in-depth understanding of people's needs, acceptances and responses along with the social effects of the interventions in the context of their particular situation. This study also identifies four behaviour models and the applicability of design interventions and collaboration in changing behaviour.

Publications Arising from the Thesis

Journal papers

Xiao, J. X., & Siu, K. W. M. (2016). Public design and household participation in recycling for sustainability: A Case Study in Hong Kong. *The International Journal of Environmental Sustainability, 12*(1), 27-40.

Siu, K. W. M., & **Xiao, J. X.** (2017). Public Facility Design for Sustainability: Participatory Action Research on Household Recycling in Hong Kong. *Action Research.* DOI: 10.1177/1476750317698027.

Siu, K. W. M., & **Xiao, J. X.** (2016). Design and management of recycling facilities for household and community recycling participation. Facilities, 34(5/6), 350-374.

Siu, K. W. M., & **Xiao, J. X.** (2015). Quality of Life and Recycling Behaviour in High-Rise Buildings: A Case in Hong Kong. *Applied Research in Quality of Life*. DOI 10.1007/s11482-015-9426-7.

The publications above are generated from the PhD study. Parts of the writings are included in this thesis that citations of sources are provided.

Acknowledgements

My deepest gratitude goes first and foremost to my supervisor, Professor Kin Wai Michael Siu. I deeply thank him for providing me a chance to study at The Hong Kong Polytechnic University and for his guidance and support over the past three years. His profound knowledge of design and total dedication to research always inspired me when I felt lost in the design research field. During the past three years, he taught me how to face different issues and how to become a creative and honest scholar with his knowledge and experience, which not only affected my PhD study but also my whole academic life. I am very appreciated of all the support he has given me, for showing me a possible path in academic, for encouraging me to finish my work towards a high quality and for pushing me onwards step by step. I will treasure this precious experience and knowledge for the rest of my life.

I would also like to acknowledge The Hong Kong Polytechnic University and the Hong Kong Research Grants Council for providing me with a studentship, which is the important base of pursuing my PhD study.

I would also like to express my gratitude to Dr Jackie Yan-chi Kwok in The Hong Kong Polytechnic University. Her insightful advice and profound knowledge guided me in the design research field during the whole PhD study. She also provided support for the research. Without her, the research process would not have been carried out so smoothly.

I would also like to acknowledge Caritas Mok Cheung Sui Kun Community Centre, Caritas Ngau Tau Kok Community Centre, Hong Kong Housing Authority and Creative Property Services Consultants Limited for providing full support for the research. My thanks also go to the Environmental Protection Department (EPD),

the Friends of the Earth (Hong Kong) and Kwun Tong District Councillor for providing a lot of useful information.

My thanks also go to my friends at the Public Design Lab, and anonymous people who participated and helped me in the data collection process. I especially thank the participants of Sai Wan Estate. I sincerely hope that this study will be beneficial for them.

I would also like to thank Prof. Ilpo Koskinen, Chair of the Board of Examination, and Prof. Xin Liu and Prof. Miaosen Gong, External Examiners, for their constructive comments and suggestions for the final revision of this thesis.

Last but not least, I would like to express my thanks to my husband Luo Mingjun, parents, family members and friends. Without their support, understanding and encouragement, I am definitely not able to dedicate to my PhD study. I love you all forever.

XIAO Jiaxin

February 2017, Hong Kong

Table of Contents

List of Figures

List of Tables

List of Abbreviations

CBPR	Community-based participatory research
CSD	Census and Statistic Department
DwI	Design with Intent Toolkit
EPD	Environmental Protection Department
FEHD	Food and Environmental Hygiene Department
H-C	Human beings and community
HCI	Human-computer interaction
H-D	Human beings and disposal
H-D-C	Human beings, disposal and community
HK	Hong Kong
HKHA	Hong Kong Housing Authority
HOS	Home ownership
IWMF	Integrated waste management facilities
MSW	Municipal solid waste
NENT	North East New Territories
NGO	Non-governmental organisation
PAR	Participatory action research
PRH	Public rental housing
SARS	Severe acute respiratory syndrome
SENT	South East New Territories
SSW	Source Separation of Domestic Waste
TPB	The theory of planned behaviour
UPRF	The use of public recycling facilities
UPRS	The use of private recycling sectors
WENT	West New Territories

CHAPTER 1 Introduction

1.1 Introduction

As environmental concerns have extended over the world, waste has become a vital issue in many cities. Although some researches have insisted that waste can be transformed into a valuable resource, in most cases, waste has been deemed to be a disgusting and annoying matter which must be eliminated as quickly as possible (Hawkins, 2006). To solve this social problem and to ensure that waste does not damage the stability of the ecosystem, people have become reliant on high technologies of waste elimination (Tammemagi, 1999). Incinerators and organic waste treatment facilities have been built one by one to dispose of the massive amount of accumulated waste. However, Heidegger (1982) criticised this attempt by human beings to manipulate and control technology. Although modern technologies, techniques and recycling equipment have been used to remove waste and to keep the world 'clean', for most people, their disposal practices have remained unchanged. The waste disposal rate is at a high level. In effect, governmental legislation and waste management alone have not been enough to solve the problem of waste disposal and to encourage sustainable practices. To evaluate why waste is not effectively reused or recycled and to explore design opportunities for household recycling, it is imperative that the nature of waste be examined in the context of household difficulties and community participation.

Researchers and experts have made tremendous strides dealing with environmental issues in the areas of policy, management and social norms. Studies of waste management and sustainable urban planning have become well developed in recent decades (Hage et al., 2009; Nigbur et al., 2010; Timlett & Williams, 2008).

However, these studies have not examined the origins of waste and the relationships among humans, disposal and community (H-D-C relationships) that could provide significant insight for disposal and recycling practices. Moreover, studies of design and management referring to the physical, social and cultural contexts have been nearly absent. A number of studies have pointed out that the massive amount of accumulated waste is attributable to the profligacy of excessive consumerism in the 'throwaway society'. Others have argued that it is simplistic to blame waste disposal problems on the 'throwaway society' without first examining the social and cultural contexts (Evans, 2012; Strasser, 1999). They contend the term 'waste' is not only related to material objects, but also represents the historical and cultural human practices engaged in during particular social activities (Hawkins, 2006; O'Brien, 2008). The failure of waste reduction and recycling, in their view, indicates that society has not yet realised the importance of H-D-C relationships. It is not only the personal factors such as norms and attitudes that influence pro-environmental behaviour, but also the contextual factors such as the availability of facilities and the physical settings (Steg & Vlek, 2009; Stern, 1999; van Diepen & Voogd, 2001). As Steg and Vlek (2009) pointed out, many contextual factors constrain human behaviour and motivation.

Even though some researchers have emphasised that design can be used to nudge human behaviour towards more sustainable practices, influencing human behaviour can be challenging. Despite a decade or more of waste reduction programmes and legislation exhorting change to consumption and disposal habits, people have been slow to adopt more sustainable practices. Further, changes to behaviour have often been short-lived. To some extent, interventions can influence human behaviour, and design interventions should be able to steer human behaviour towards sustainable practices without diminishing the people's willingness and ability to interact with

public design. However, trying to alter human behaviour in an inappropriate way may be unacceptable and lead to annoyance and frustration. The balance between intervention and users acceptance must therefore be carefully configured to ensure the continued use of a design and to avoid irritation. To increase user acceptance, designers should encourage public participation in developing designs. Community participation in design is crucial because those who are the most affected by a decision should be able to express their own views about the specific conditions and problems related to it. It is axiomatic that the best solutions must be found to increase user acceptance through appropriate product interventions and collaboration.

With the rapid development of consumer markets and high population density, waste generation has increased at an alarming rate in Hong Kong. Millions of tonnes of waste are not effectually reused or recycled but are disposed of in inappropriate ways (e.g., landfilled or exported) everyday. To tackle the imminent waste disposal problem, in 1989 the local government initiated its 10-year Waste Disposal Plan (EPD) aimed at developing new facilities and strategies. During the 1990s, three strategic landfills were built, one after another. In addition, for over ten years, recycling facilities have been provided in the neighbourhoods to encourage household and community participation. Reviewing the development of the recycling policy and practices in Hong Kong, it is obvious that local government has wanted to change people's environmental behaviour. Much discourse such as 'We are all to blame' (Tammemagi, 1999), 'nature in crisis', 'zero tolerance to littering' and disenchantment stories, has been promoted to increase human awareness of the environmental issues. Although people's environmental awareness has gradually risen through a long period of education, most continue to dispose of their waste without any classification.

Addressing recycling in Hong Kong through case studies of household and community participation, this study pinpoints the limitations and difficulties of design and management within this densely populated space. H-D-C relationships are socially and culturally formed in any society, and it is therefore necessary to understand the particular physical, social and socio-cultural context of Hong Kong holistically. Moreover, Hong Kong is also typical of other cities, with its high-rise, high-density buildings and fast pace of modern life, which provides a viable laboratory for researchers to examine waste recycling. By conducting in-depth case studies and action research in Hong Kong's households and communities, the challenges and strategies inherent to the design of recycling facilities and built environments can be identified. Hence, the study of recycling practices and design in the social and cultural context of Hong Kong has both theoretical and practical significance.

1.2 Aim and Objectives

The aim of this study is to explore design opportunities for influencing sustainable behaviour in high-density spaces by identifying the physical, social and cultural factors, and investigating the limitations and constraints of design for household recycling. The research aim will be achieved through four objectives as follows:

1. Review and explore the origins of waste and H-D-C relationships.
2. Review the development of policy and design for household recycling in Hong Kong.
3. Identify the limitations and constraints of design and management for recycling in Hong Kong within a particular context including the physical context, social context and socio-cultural context.

4. Suggest possible directions and provide insights for designers and policy makers to improve design and management related to household and community participation in recycling in Hong Kong.

1.3 Scope and Research Questions

In dealing with environmental issues, many researchers, environmentalists and policymakers have exerted effort on behalf of waste recycling. In general, the local authorities have relied on different levels of intervention to change unsustainable behaviour, from enabling to constraining behaviour. Strategies such as education, management, economic incentives, discipline and regulations have all been adopted to increase public awareness of environmental issues (Hage et al., 2009; Nigbur et al., 2010; Timlett & Williams, 2008). Admittedly, fiscal policies, regulations and economic incentives influence household and community participation in recycling, and design and management also play important roles in changing human behaviour. However, studies of design and management referring to physical, social and cultural contexts are nearly absent, especially with regard to high-rise and high-density cities. Further, some scholars have recognised changing human behaviour could be a challenge. Lockton (2013) pointed out that design might constrain sustainable behaviour and motivations. For example, low-quality and inefficient public designs for recycling could fail to mobilise the general public to participate in it. Considering the research aims of this study, it is, thus, necessary to holistically investigate design and management associated with the contextual factors.

Pajo (2008) argued that existing studies of environmentalism have mainly focused on scientists and experts rather than on the local citizens. In general, government officers, managers and designers assume that they share a common understanding of design. Due to a lack of clear consideration from the habitants' perspectives,

however, many public designs do not meet their requirements and preferences. In a long-term study of public space in Hong Kong, Siu (2003) emphasised that designers cannot impose their own preferences on users because the users have their own personal responses and needs. Thus, it is important to understand users' responses and behaviour on the basis of in-depth observations and then encourage them to behave in a more sustainable manner.

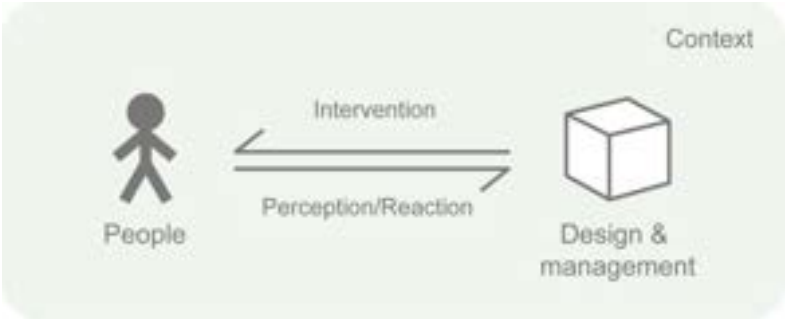

Figure 1.1 Research scope of the study

Figure 1.1 shows the research scope of the study. It focuses on identifying the interaction between design and people within the context of this study. This study not only analyses how design affects human behaviour but also explores people's perceptions and reactions towards design and management. It aims to explore how to alter people's behaviour through design and management in a proper way.

In further detail, this study expects to explore:

1. Question 1: What factors affect sustainable recycling behaviour?
2. Question 2: What are people's perceptions and reactions towards existing design and management of waste recycling in Hong Kong?
3. Question 3: What are the limitations and challenges in public design for recycling, with attention to particular high-rise, high-density living environments?

4. Question 4: How can human behaviour be effectively influenced through design?

1.4 Significance and Value

Studies on waste management and sustainable urban planning have been well developed in recent decades. However, the studies of design and management for household recycling in the context of environmental, social and cultural factors are seldom discussed. This study emphasises that understanding the contextual factors, including the physical, social and socio-cultural factors, are helpful to developing recycling behaviour that is effective and sustainable. Through empirical research with a theoretical perspective this study aims to show that H-D-C relationships affecting human behaviour is socially and culturally formed by the society. By means of empirical research, this study expects to come to a holistic and in-depth understanding of the contextual factors and strategies that re-establish H-D-C relationships through design intervention and collaboration.

Farrelly and Tucker (2014) suggested that action research could enable researchers to find solutions to practical problems in collaboration with stakeholders through the cyclical processes of reflective learning. Although action research has been widely used in the field of health science, qualitative research methodologies designed to examine actual recycling practices and to improve public design through action research have been few (Fahy & Davies, 2007). In this study, by conducting PAR, the challenges to household and community participation in recycling and design opportunities are identified through the 'plan-act-observe-reflect' approach. This approach provides insight into how recycling facilities and environments should be designed in accordance with the particular situation in Hong Kong. A design framework is a tool that enables designers to liberate

themselves from preconceived design notions (Forlizzi, 2008). Because design frameworks and theories referring to public participation in recycling are relatively new, this study contributes to the development of a framework for a holistic understanding of the phenomenon by articulating the elements involved in the design process.

1.5 Framework of Study

The framework of this study is shown in Figure 1.2. This study includes five main parts: introduction, literature review, methodology, findings and discussion and conclusions.

Chapter 1 introduces the research issues. The research aim and objectives, hypothesis, scope and research questions are proposed. The significance and values of the study are discussed. Chapter 1 also provides a brief outline of the study.

Chapter 2 and Chapter 3 provide a literature review from an historical perspective and a theoretical perspective, respectively.

Chapter 2 begins with a theoretical discussion of the terms related to the research topic. The discussion includes a review of the definition of waste (Mary Douglas, Gay Hawkins, and Martin O'Brien), household (Susan Gregory and Jon Bernardes) and community (Richard Sennett and Doreen Massey). After defining the terms, the development of waste management and recycling practices in Hong Kong are reviewed. Concurrently, waste management and recycling practices in other regions of Asia are compared. These reviews provide an overview of the development and current waste recycling practices in terms of policy, management, strategy and

recycling facilities. Following the review and discussion, the research scope is formulated.

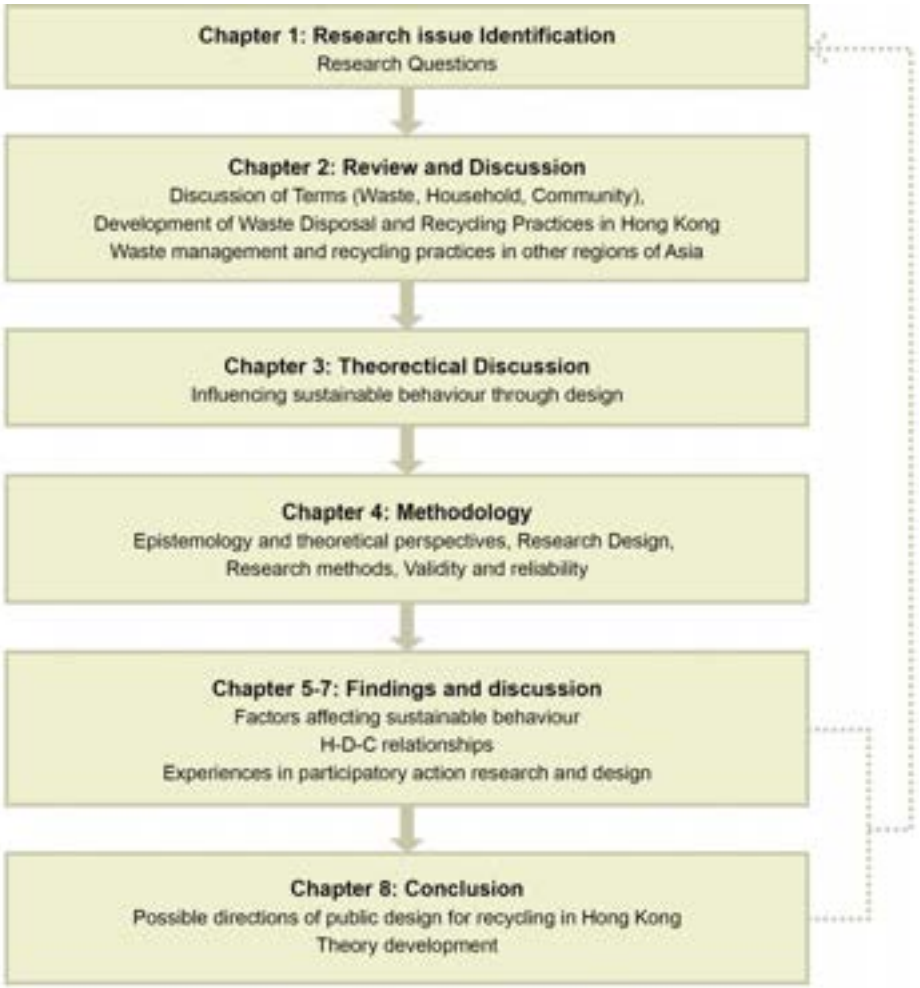

Figure 1.2 Framework of the study

Chapter 3 reviews the factors that influence human behaviour from different perspectives. The significance of context is identified and approaches to influencing behaviour are reviewed. By examining different models and strategies for interventions, the challenges of influencing sustainable behaviour through design are identified.

Chapter 4 describes the research methodology. To investigate for in-depth understanding of people's everyday recycling practices within a particular social context and to improve recycling practices and recycling design, case studies and action research are used as the main research strategies. This study deploys a mixed method approach including quantitative and qualitative research, using interviews, questionnaires, observations, workshops, and prototypes to test as research methods. Data and methodological triangulation are selected to validate the naturalistic research associated with the constructionist epistemology.

Chapter 5 examines the factors that affect recycling behaviour from the habitants' perspectives. Both personal factors such as norms and attitudes and contextual factors such as social and physical settings are analysed. Given that personal factors have been widely discussed by many researchers, this study mainly focuses on contextual factors. Context is further divided into three aspects: the physical, social and socio-cultural contexts. Based on empirical case studies, not only are physical aspects, such as the quality of the community (neighbourhood) and its facilities, identified as important factors affecting human behaviour, but the social aspects, such as human ties, are as well. By describing each aspect associated with recycling behaviour, this chapter analyses how these contextual factors facilitate or constrain human behaviour in daily activities.

Chapter 6 provides an analysis from a fundamental and philosophical perspective of why individuals arbitrarily dispose of waste in everyday life. Based on the findings from the empirical study and a review of the theoretical perspectives, this chapter investigates H-D-C relationships within the context of densely populated high-rise buildings. It is proposed that two forms of alienation result in unsustainable disposal behaviour. This chapter identifies applying interventions in

the H-D relationship and developing collaboration in the H-C relationship as two main approaches to change unsustainable behaviour. Design opportunities and limitations are also discussed.

Chapter 7 discusses how to apply design intervention and collaboration for behavior change via an action research methodology. It explores current barriers and appropriate design interventions for household recycling. This chapter addresses how the design of public facilities and built environments can be improved to influence sustainable behaviour. In collaboration with two Caritas community centres, different stakeholders including local residents, private recyclers, property management officers and cleaners in five public rental housing estates were recruited to voice their views on public designs for recycling. This chapter further discusses the experience of participatory action research and design. The limitations and future considerations are also discussed.

Chapter 8 concludes the study. Each of the questions proposed in Chapter 1 are answered. Chapter 8 also discusses the limitations of the study, reflections and contributions to knowledge.

CHAPTER 2 Literature review

The first part of this chapter is a theoretical discussion of the relevant terms: (a) waste, (b) household and (c) community (neighbourhood). The second part presents a brief historical review of waste recycling practices in Hong Kong, and compares them with the policies for and design of recycling practices and facilities in other densely populated areas in Asia. Recycling policies and designs reflect how governments deal with waste and recyclables over time.

2.1 Definitions and discussion of terms

Waste

Although Karl Marx criticises overproduction and capitalism, it is not easy to establish a critical theory in terms of waste from Marx's works. The term 'excretion' refers to supposed waste, which is recognised as refuse inevitably generated in the process of production and exchange. However, it is questionable to treat waste simply as the 'excretion' or 'leftovers' of production and consumption (O'Brien, 2008).

Generally speaking, 'waste' refers to something unwanted, discarded, dead and useless throughout the production and consumption process. However, the terms waste, dirt, detritus and dust not only relate to material objects, but also represent the historical and cultural human practices of specified societies (Hawkins, 2006; O'Brien, 2008).

In *Purity and Danger*, first published in 1966, Douglas (2002) shows that pollution and dirt relate to anomalies that cannot be classified within a classification scheme of religious taboos. There is an inextricable connection between dirt, cultural rituals

and their symbolic meaning. Waste is thus recognised as a result of the 'interplay between form and formlessness' (Douglas, 2002). If anomalous things are not well regulated by social practices, they become dangerous and contaminative. Consequently, cultural rituals such as cleansing are deemed positive and sense-making. In line with Williams James's assertion that 'dirt is matter out of place', Douglas shows that not only the 'outside' and problems but also the ways of organising social structures are created by society unconsciously. In her description 'where there is dirt there is system' (p. 35), Douglas (2002) emphasises that it is dirt that distinguishes between order and disorder in terms of rules, social norms, values and rituals. In this regard, the definition of dirt lies in cognitive order and the classification schemes of different cultures. For instance, bread is expected be on the plate; it is regarded as unclean matter if it is on the floor. This does not mean that the floor is dirty whereas the plate is clean. Rather, it is because the bread is 'out of place' and deviates from people's classification scheme based on the sanitary system.

> There is no such thing as absolute dirt: it exists in the eye of the beholder. If we shun dirt, it is not because of craven fear, still less dread or holy terror. Nor do our ideas about disease account for the range of our behaviour in cleaning or avoiding dirt. Dirt offends against order. Eliminating it is not a negative movement, but a positive effort to organise the environment. (Douglas, 2002, p. 2)

However, there is no absolute dirt inasmuch as dirt is a by-product of a symbolic universe with different peculiar cultures. In other words, if there is no absolute dirt, there is no absolute purity either. Consequently, both dirt and cleanliness co-existed in primitive cultures. That human escape dirt in contemporary society is similar to the behaviour of primitive society because we fear disorder caused by dirt.

For Douglas, dirt exists symbolically and cognitively on the basis of the human mind. However, this definition of waste/dirt is questionable because it shifts the focus to symbolism and away from the medical and natural sciences perspective on pathogenicity, toxicity and hygiene issues. In contrast to the notion of dirt and the symbolic classification defined by Douglas, van Loon (2002) considers waste an ontological 'risk', 'bad' and 'environmental contamination' arising from the industrial excess of 'technological culture' in modern society. Thompson (1979) divides the objects into three categories: 'durable', 'rubbish' and 'transient'. Objects not only inhabit these realms but also cross the boundaries between them during human activities. For Scanlan (2005), garbage is the product of 'a will of order' related to the 'cleansing and refining impulse' of Western culture. People are 'blind' to the abundance of waste because society has deployed the means to enable individuals to forget.

> … garbage represents the shadow object world, the leftover of a life, a world, or a dream, created by the voracious speculations of commodity production and consumption. (Scanlan, 2005, p. 164)

For Douglas, pollution is contagion that threatens sacred value. Although Douglas's idealistic discourse on dirt is criticised by some scholars because it is scarcely applicable to waste management in modern society, the core debate around defining culture and an investigation of the daily rules of symbolic ordering provide significant enlightenment for researchers exploring the relationships between waste and humans. Hawkins (2006) and O'Brien (2008) shift the focus from primitive culture to consumer capitalism and point out that waste is a result of cultural and historical human practices. For instance, large amounts of fast food packaging expose the culture of convenience and the decline in home cooking due to the fast pace of modern life.

The existence of waste is directly relevant to human daily activities in contemporary society. It is thus imperative to examine waste throughout the production and consumption process. Many studies have focused on how societies produce and consume objects (e.g., Baudrillard, 1998; Featherstone, 1991; McCracken, 1988), yet there have been few theoretical studies on how societies deal with waste (Bekin et al., 2007).

In the theory of surplus value, Marx states it is capitalism that enables a large amount of overproduction. Superfluous commodities, which are far beyond what the market can digest, are produced in the pursuit of surplus value. In a capitalist economy, as there are 'two-fold' aspects to each commodity, exchange value makes it possible for overproduction even the products are 'unsaleable' (Giddens, 1971). Galbraith (1998) points out that needs and products are produced simultaneously. In Galbraith's discourse, the contradiction of contemporary capitalism is between 'unlimited productivity' and 'the need for disposal', rather than the contradiction between 'profit maximisation' and 'rationalisation of production' (Baudrillard, 1996). Baudrillard (1998) critiques Marx's social theory on production and emphasises that sign value is beyond exchange value and use value. Affluence eventually has its meaning in 'wastage', referring to abundance and superfluity – the opposite of scarcity. Consumption functions as a process of manipulating the system of signs. The real world is filled with signs and what individuals consume are not objects but signs. People consume these signs to communicate with others, construct their 'commodified identities' (Benwell & Stokoe, 2006) and display their tastes and social standing (Boudieu, 1984).

However, Baudrillard's (1998) analysis of consumer society is criticised by some scholars as it exaggerates the symbolic meanings of commodities. Szmigin (2006)

argues that people will consume products for their functional and utilitarian values even if they are saturated with symbolic meaning. Consumption activities cannot be recognised as purely semiotic, neglecting the fact that substantial and actual waste is generated (Donlan, 2002). Although objects are conceived as signs in social and cultural consumption processes, they are not in a purely semiotic system or merely in a language system embodying communication practices (Campbell, 1997; Rose, 1997). In effect, meanings cannot be communicated if they are detached from their 'vessels' (Bekin et al., 2007; Lastovicka & Fernandez, 2005).

Some researchers indicate that contemporary consumer society is a 'throwaway society' (Cooper, 2005; Packard, 1960; Thompson, 1979). 'Throwaway society' is a popular concept to illustrate the wastefulness and profligacy of consumer society. The massive waste in the throwaway society thesis is attributed to excessive and callous consumerism in contemporary society. A consumer-oriented and throwaway culture has resulted in a large amount of commodities entering people's homes. The presence of massive waste and people's disposal behaviour is reduced to a moral issue. However, some researchers argue that a one-dimensional understanding of waste disposal is too simplistic and neglects relationships within a social and cultural context (Evans, 2012; O'Brien, 2008; Strasser, 1999).

Household

Household is a fundamental institution and basic unit where everyday life begins and domestic waste is generated. Many contemporary sociologists and anthropologists deem family a micro society, not only providing a place for human activities but also defining the roles and related responsibilities of each family member (Bernardes, 1987). Gregory (1999) and Greham (1985) point out that the roles of 'wife', 'husband' and 'child', and their corresponding responsibilities, are

confirmed and reinforced through everyday practices. The term *housewife* defines the gender responsibility of 'wife'– not only in terms of the female reproductive system and *caring* (for husband and children), but also in terms of engagement in household chores, which are seen as the 'job' of the woman.

As social structures and economics have dramatically changed, the roles of women have been extended even further from those in traditional society. Women have become highly progressive and participate in many workplaces in post-industrial society. Full-time and high-pressure work makes it difficult for women to spend a lot of time on household chores. Some studies indicate that the development of a societal ideology concerning gender egalitarianism, which influences people's attitudes and beliefs on family roles, is relevant to the phenomenon of more equal sharing of housework (Carlson & Lynch, 2013; Cunningham, 2008). Over time, more husbands have become willing to share certain household tasks with their wives, especially in families where the wife is employed while the husband is out of work. However, the general sense of family roles and gendered responsibilities is deeply ingrained in society. In most families, the woman is considered to be the person to deal with the household chores.

However, it is notable that the emergence of foreign domestic workers has changed the roles of housewives in some families. These domestic helpers take on nearly all household chores, including cooking, cleaning, ironing and child-care. Wives are thus able to eliminate boring housework and manage their time schedules for a new lifestyle.

In general, although domestic recycling practices are targeted at all people, those with primary responsibility for handling routine housework, especially housewives

or domestic helpers, are deemed the household members directly related to domestic recycling practices.

Community (and neighbourhood)

When studying domestic recycling practices, it is inevitable that community and households must be dealt with. Community plays an important role in people's everyday lives as the arena where citizens live, relax, consume, communicate, forge identities and form social networks. It is a specific public space combining diverse human activities. 'Public' is a spatio-temporal term with the nature 'mutable'. As expressed in Sennett's work (1977),

> The word 'public' had taken on its modern meaning, therefore, it meant not only a region of social life located apart from the realm of family and close friends, but also that this public realm of acquaintances and strangers include a relatively wide diversity of people. (p. 17)

The conceptual understanding of the term 'public' is 'equitable' and 'accessible to all'. Consequently, the space, along with the infrastructure, facilities, services and so on, should be unrestricted and available to all people in the community. Moreover, Bondi (1999) and Smith (1987) indicate that community not only constitutes various lifestyles but also provides particular groups of residents with particular qualities. When studying the community and everyday life related to domestic recycling, it is inevitable to focus on stratified citizens, not only the elite or well-educated people, but also the grassroots or uneducated people.

A neighbourhood is regarded as a small community in urban life, emphasising 'collective activities', 'resonance', 'social networks' and 'common practices' in a

'bounded place' (Castell, 1997; Simonsen, 1997; Vaiou & Lykogianni, 2006). In *Keywords: A Vocabulary of Culture and Society* (William, 1976), neighbourhood is described as

> The people of a district, the quality of holding something in common … a sense of common identity and characteristics … and a particular quality of relationship. (p. 75)

The Chinese for 'neighbourhood' is *lin li* – a combination of *lin* and *li*. Traditionally, five household units form a *lin* and five *lin* units form a *li*; *lin* and *li* represent different scales of household in terms of their boundary. However, in contemporary society, the boundaries of *lin li* are not as specific as in the traditional definition. Massey (1994) states that, 'the place is formed out of the particular set of social relations which interact at a particular location' (p. 168). Additionally, individuals forge identities and form habits of movement, communication and social relations in everyday life (Massey, 1994). People may imitate each other, as everyone is involved in social relations. However, an individual may behave totally differently, according to his or her own recognitions and perceptions. People's inherent rhythms, tastes and habitus orient social practices and lifestyles according to the condition of existence (Bourdieu, 1984).

Although studies of neighbourhoods and 'urban space' have been well developed by many theorists in recent decades, studies of public behaviour and social cultural factors in the neighbourhoods of Hong Kong are nearly absent. Neighbourhoods in Hong Kong are quite different from those in other cities due to the high-rise buildings and dense population. These neighbourhoods not only include public spaces such as the streets, crosswalks and parks that are often discussed by Western theorists, but also include distinctive corridors and platforms in every storey of the

high-rise buildings. Despite the particular nature of neighbourhoods in Hong Kong, the municipal recycling system is quite similar to that of cities with low population density. It is indisputable that the rate of recycling lags far behind other cities due to a lack of consideration of the particular character of the local neighbourhoods.

2.2 Review of waste recycling in Hong Kong

2.2.1 Waste in Hong Kong

In Hong Kong, solid waste is classified into several items with reference to the sources of waste and institutional arrangements for waste collection and disposal. Comparing the classification of solid waste in 2011 with that in 2001 (Figure 2.1), the major types have been reduced from five to three, by integrating some categories (Figure 2.2). In effect, although the major types have changed, the corresponding disposal arrangements are quite similar to what they used to be. According to the EPD (2012), solid waste is classified into three main types, as described below: (1) municipal solid waste (MSW), (2) overall construction waste and (3) special waste.

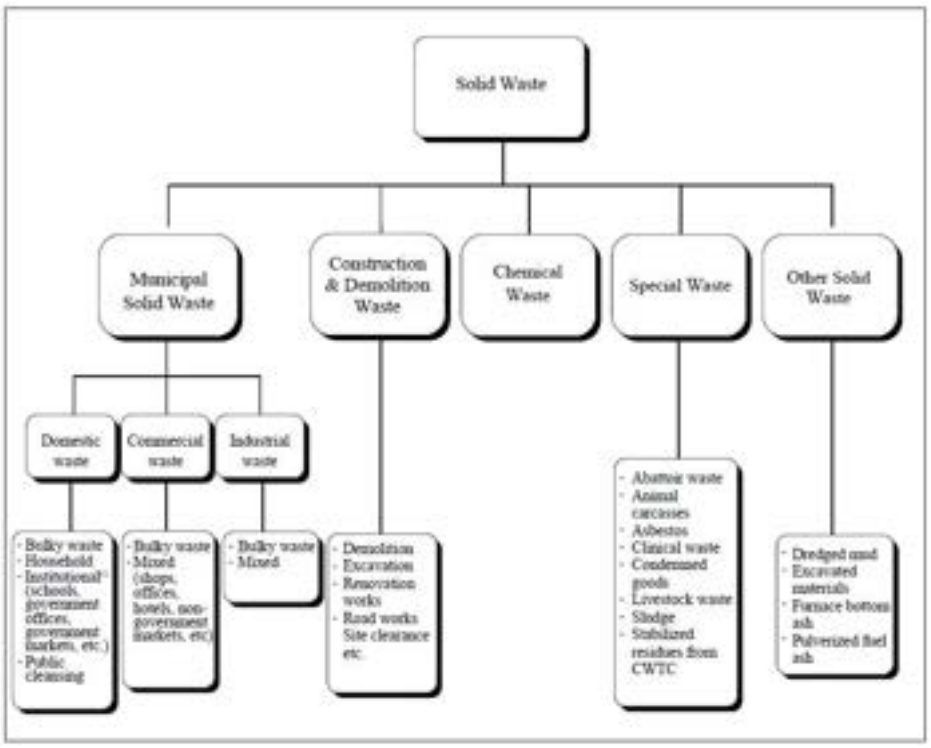

Figure 2.1 Classification of solid waste in Hong Kong in 2001 (Source: *Monitoring of Solid Waste in Hong Kong*, 2002)

(1) MSW comprises domestic waste, commercial waste and industrial waste, and accounts for a high proportion of waste disposed of at landfills (Figure 2.3).

- *Domestic waste* is waste generated from daily activities in household and institutional premises, and refuse collected from public cleansing services. Putrescibles, especially food waste, account for the majority of domestic waste. Public cleansing waste refers to dirt and litter collected by the Food and Environmental Hygiene Department (FEHD). Marine refuse and waste from parks is collected by the Marine Department and the Agriculture, Fisheries and Conservation Department, respectively.
- *Commercial waste* is waste generated from commercial activities in shops, restaurants, offices, hotels and markets in private housing estates. It is generally collected by private waste collectors.

- *Industrial waste* is waste generated from industrial activities, excluding construction waste and chemical waste. It is mainly collected by private waste collectors. Some of this waste is delivered directly to landfills by the industries that generate it, without proper pre-treatment.
- *Bulky items* such as furniture and large domestic appliances are only a small proportion of MSW, but they cannot be disposed of and collected in conventional ways. These items need to be collected separately.

(2) Overall construction waste refers to the waste or surplus materials generated from construction activities such as road works, excavation and site clearance. It also includes waste from concrete batching plants. This waste contains inert materials such as debris, rubble and concrete, which can be recycled for use in land reclamation and construction.

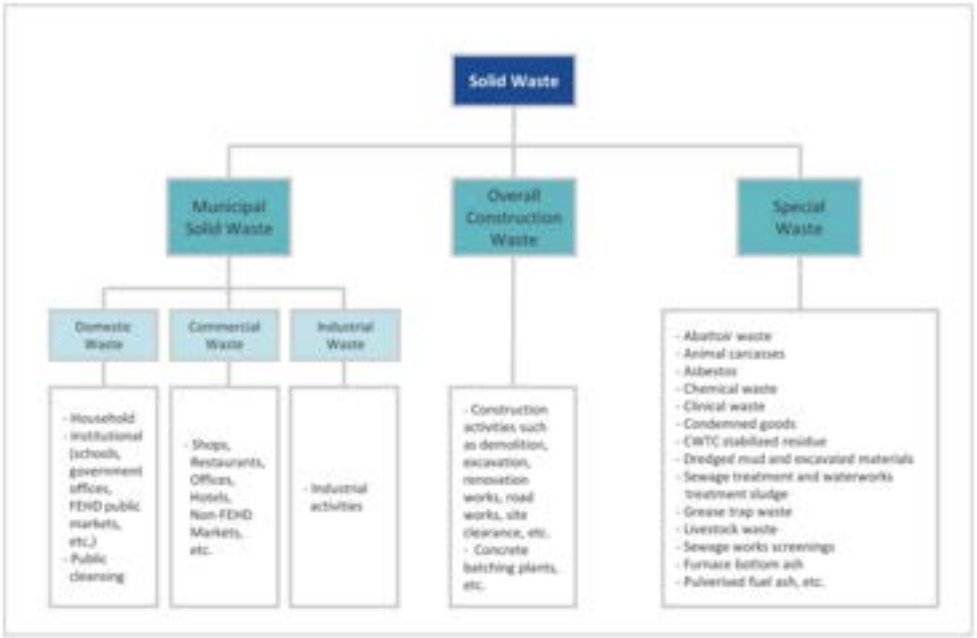

Figure 2.2 Classification of solid waste in Hong Kong as of 2011 (Source: *Monitoring of Solid Waste in Hong Kong*, 2012)

(3) Special waste is waste that requires special treatment, such as animal carcasses, chemical waste, clinical waste, livestock waste and old tyres. These types of waste must be handled cautiously otherwise they can cause environmental pollution or present a health hazard.

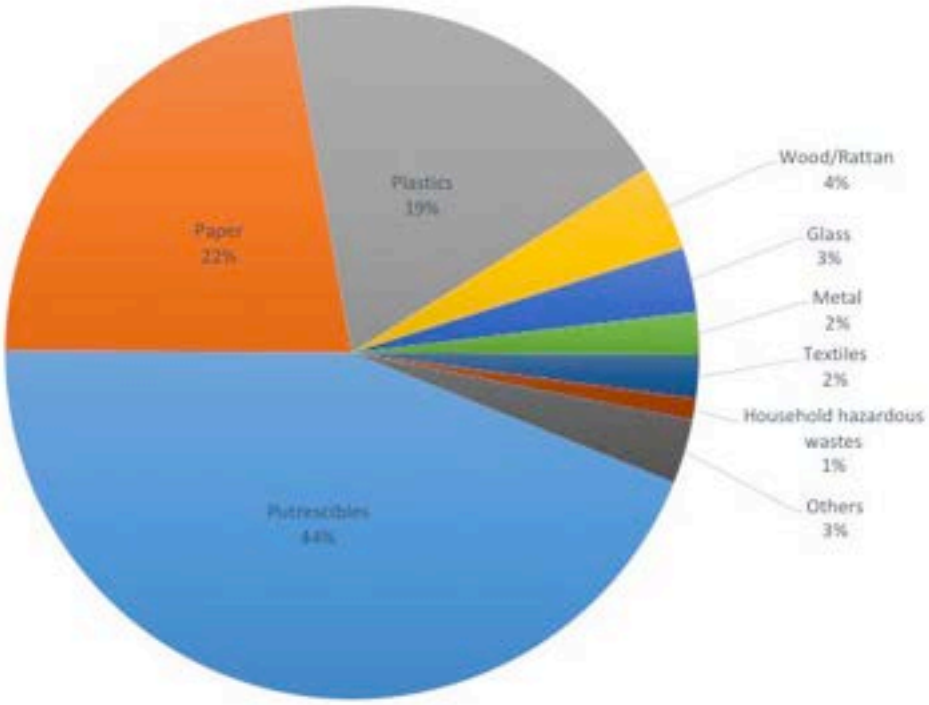

Figure 2.3 Composition of MSW in Hong Kong (Source: *Hong Kong Blueprint for Sustainable Use of Resources 2013–2022*, 2013)

2.2.2 The development of waste reduction and recycling in Hong Kong

In the past few decades, the Hong Kong government, environmentalists, NGOs and some industries have made tremendous efforts in developing policies and measures on waste disposal and recycling. As early as 1933, the local government implemented an offences ordinance to provide a control on littering. Incinerators and landfills were used to deal with solid waste. In 1989, the local government set

out a 10-year Waste Disposal Plan to develop new facilities and strategies. During the 1990s, three strategic landfill sites were deployed one after another, in the North East New Territories (NENT), South East New Territories (SENT) and West New Territories (WENT). Concurrently, all the retiring landfills and incinerators were phased out by government. Until 1998, recycling facilities were provided in the ground floor of buildings or in designated common areas in neighbourhoods to encourage household and community participation in recycling. Nowadays, landfill and recycling are the two major methods of tackling solid waste, as Hong Kong phased out the remaining incinerators in 1998. However, according to the EPD (2013), as MSW continues to expand, the landfills will reach their capacities by 2019. Thus, the local government must tackle the waste problem by more effective and rapid means such as landfill extensions, establishing large-scale infrastructure.

Figure 2.4 Waste management hierarchy (Source: *Hong Kong Blueprint for Sustainable Use of Resources 2013–2022*, 2013)

A waste hierarchy framework was first introduced in Europe in 1975 as part of a European waste policy. According to the framework, the most effective waste management solution is the avoidance and minimisation of waste at source. The

next priority is to reuse, recycle and then recover the waste to useful resources. Similar to the internationally accepted waste management hierarchy deployed in most developed countries, the local government in Hong Kong has adopted a sustainable waste management strategy and hierarchy for a ‘use less, waste less’ lifestyle (Figure 2.4).

According to the *Hong Kong Blueprint for Sustainable Use of Resources*, local government deploys multiple strategies to prevent and reduce waste, in a comprehensive system including policies and legislation, infrastructure and social mobilisation (EPD, 2013). Although local government provides an ideal blueprint to deal with the waste problem, practical barriers make it difficult to conduct these strategies effectively. For instance, integrated waste management facilities (IWMF) with advanced incineration and waste-to-energy technology have a forecasted treatment capacity of 3,000 tonnes a day. However, it would take nearly 20 years to complete the whole process of site selection, environmental evaluation, announcement, judicial proceedings and finally establishment of such facilities.

According to the Environmental Protection Department (EPD, 2012), 5,870 tonnes of MSW (i.e., domestic, commercial and industrial waste) were disposed of each day in 1986, and this figure had climbed to 8,996 tonnes by 2011. The per capita MSW disposal rate is 1.27 kg each day (Table 2.1). The recovery rate for domestic waste is highly inefficient – only 40%, compared to 70% for commercial and industrial waste (EPD, 2010). This striking difference in efficiency stems from the greater complexity and diversity of waste from domestic activities, which makes it much harder to sort. Therefore, it is imperative to encourage household and community participation in reducing and separating domestic waste at source.

Table 2.1 Per capita disposal rates and waste disposed at landfills in 1986–2011 (*Solid waste data: EPD, 2012; Population data: Census and Statistics Department, 2011*.)

	Average daily quantity (tonnes/day)		***Population***	***Per capita (kg/person/day)***	
	Domestic waste	MSW		Domestic waste	MSW
1986	4,420	5,870	5,495,488	0.80	1.07
1991	5,560	7,390	5,674,114	0.98	1.30
1996	6,260	8,140	6,412,937	0.98	1.27
2001	7,551	9,300	6,708,389	1.12	1.39
2006	6,634	9,279	6,864,346	0.97	1.35
2011	5,973	8,996	7,071,576	0.84	1.27

In recent years, the local government and various NGOs in Hong Kong have actively promoted the 'reduce, reuse and recycle' effort regarding domestic waste. The programmes implemented include providing buildings with three-coloured bins or collection stations, offering encouragement through campaigns and promotions and conducting public education efforts. Since 1998, three-colour waste separation bins for collecting waste paper, aluminium cans and plastic bottles have been placed on the ground floors or designated public areas of many housing estates (EPD, 2010). The first trial efforts at encouraging people to separate recyclables from waste were conducted in a small area. Then, in 2005, the Programme on Source Separation of Domestic Waste (SSW) was implemented on a territory-wide basis. By the end of 2010, this programme had been adopted in 1,637 housing estates (private housing, public housing and government quarters), and covered 80% of Hong Kong's population.

These scattered campaigns and policy measures have had little effect on the prevailing recycling practices. Studies show that Hong Kong's domestic waste

recovery rate has increased from 14% in 2004 to approximately 40% in 2010 (EPD, 2005, 2010). However, the separation activities are mainly conducted by collection crews and scavengers rather than by residents.

2.2.3 Public facilities for waste disposal and recycling in Hong Kong

To encourage public participation in recycling in Hong Kong, many researchers have made tremendous efforts on policy and management issues. However, public design encompassing cultural factors, user behaviour and community participation is seldom discussed. Some studies illustrate that economic incentive such as pay-as-you-throw is the only one way to solve the waste problem, however, in some cities, not only the ratio of recyclables and disposal has no significant change but also illegal disposal issues occur (Callan & Thomas, 2006; Fullerton & Kinnaman, 2000). Strategies and designs that lack consideration of local cultures and physical contexts may lead to overwhelming annoyance. A recent news story reported that in some public spaces, the openings of rubbish bins were reduced by 51% by local authorities with the aim of encouraging people to waste less, but the result was unsatisfactory – the openings of most rubbish bins were blocked by large items of rubbish (Figure 2.5).

According to EPD (2008), there are 28,500 waste separation bins installed in public spaces, nearly two-thirds of which are in housing estates. Some of these facilities are made of poor-quality, nondurable materials with low functional efficiency and poor appearance. However, replacing the bins would not only require significant financial capital, but would also result in waste, particularly in relation to those bins that have not been used by residents. Although some of the older generation of three-coloured recycling bins are worn out and no longer suitable for their current situations, most of them are still in use. In the housing estates, cleaning workers are

hired by cleaning service companies to collect waste and recyclables, and it is impractical to rely on them to separate the recyclables from the waste stream because each cleaner must deal with the garbage from hundreds of households.

Figure 2.5 The openings of most rubbish bins were blocked up by large items of rubbish after the design was modified (Source: *Headline Daily*, 2016)

There are guidelines for the placement of recycling facilities in the public spaces of domestic or composite buildings based on the requirements of the Fire Services, Housing, Food and Environmental Hygiene and Home Affairs Departments (EPD, 2005). However, these guidelines have little consideration for convenience and accessibility from the users' perspective. Moreover, because housing estates are managed by property management companies or housing departments, the estates still have many options for placing the bins based on the guidelines. To encourage and assist housing estates to participate in recycling practices, waste separation bins

are provided for free. However, due to the limited quota of bins assigned to each building, property management companies must apply for government subsidies if they want to install more recycling facilities on each floor (EPD, 2005). The process is expensive and time-consuming, and many property management companies are thus reluctant to increase the number of facilities in their housing estates even when the public space on each floor is sufficiently large.

The implementation and maintenance of public facilities is quite different from their original design purpose. For example, refuse chutes have long been provided for residents to dispose of their waste through inlets on each floor (Chan & Lee, 2006). All of the waste drops into a central waste-collection area on the ground floor and cleaners only need to transfer the collection bins from this central waste-collection area. However, to minimise health risks and nuisance, the refuse chutes in some buildings have been closed and replaced by bins, and cleaners manually transport the refuse from the bins into the refuse chutes.

2.3 Policy and design of recycling practice and facilities in other densely populated cities in Asia

In recent decades, some densely populated areas in Asia, such as Japan, Korea, Taiwan, Hong Kong and Singapore, have deployed different strategies and types of facilities for the source separation of domestic waste. In Hong Kong, landfilling and recycling are the two existing methods of dealing with massive waste, because all of its incinerators were phased out before 1998 (EPD, 2013). Compared with other Asia areas, Hong Kong is a unique city that relies on landfills for waste disposal (Figure 2.6). Some reference to surveys of other Asian areas would be helpful in the search for methods for increasing the household recycling rate in Hong Kong.

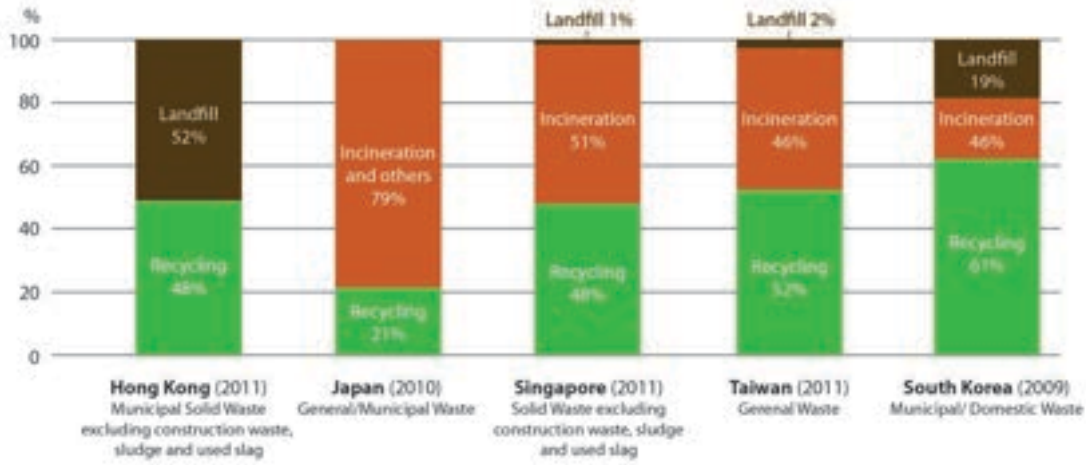

Figure 2.6 Comparison of waste management structure with other Asia areas (Source: *Hong Kong Blueprint for Sustainable Use of Resources 2013-2022,* 2013)

To change undesired behaviour, local authorities in some areas have adopted various interventions on waste disposal. Minimising the use of refuse bins while increasing the availability of recycling facilities is a significant method to encourage pro-environmental behaviour (SITA, 2012; Steg & Vlek, 2009). One typical example is refuse collection in Taiwan, which has a high degree of institutionalisation with rigid socio-temporal structures. In the early decades, the waste problem became a serious issue. Garbage was dumped into rubbish bins (i.e., collection points) on the streets at any time, without any classification or even piled up roughly when bins were stuffed, waiting to be collected by garbage-collection crews at night. Since 1997, the government's policy of 'Keep Trash off the Ground' has involved the removal of almost all rubbish bins from the streets (Chang et al., 2008). Citizens are only allowed to throw their waste into garbage- collection trucks when these trucks arrive at designated times and areas. In the evenings, people stand in rows and wait for the garbage-collection and food-waste-collection trucks to arrive. It is common for people to chase after the truck when they are late, because those who miss the truck have to take their rubbish back home and wait for the next

collection day. This strategy also provides an alternative method for those for whom the collection time is not convenient; that is, citizens can appoint specific staff to take their waste for disposal at the designated times (Chao, 2008). Along with the implementation of a volume-based fee system, the result of waste disposal rates has been satisfactory; the volume of waste dropped from 1.14 kg per capita per day in 1997 to around 0.45 kg per capita per day in 2011 (EPD, 2013; Lu et al., 2006). The streets where garbage-collection trucks pass can serve as community space by enhancing opportunities for the residents to come together and supervise one another (Lee, Kim & Lee, 2010). Reducing the convenience of refuse disposal is an effective way to deal with environmental problem in terms of waste management, yet the imposition of collective temporal rhythms onto personal schedules and legitimising the routine of a social practice may lead to frustration and annoyance. This practice is very inconvenient for some residents because they may sometimes arrive home late and miss the collection time.

As in Hong Kong, the recycling of domestic waste in Singapore was implemented on a voluntary basis. There are two methods of refuse collection in Singapore, direct collection from individual households and indirect collection from bulk containers that store rubbish from the refuse-chutes of high-rise buildings (Foo, 1997). Indirect collection is prevalent because 81% of the population lives in government-subsidised flats in buildings with refuse-chutes (Neo, 2010). The residents dispose of their garbage through the indoor inlet of the refuse-chute or an outdoor inlet on each floor. The level of public participation in recycling within government-subsidised flats is low because of the convenience of waste disposal and the lack of economic incentives. Karung guni men (i.e., junk-buyers) purchase recyclables from households door-to-door and then sell them at a higher price to the recycling companies. They play an intermediary role between the households and the

recycling companies. However, not many residents sell their recyclables because of the irregular collection times and the limited types of recyclables (Neo, 2010). In some modern housing estates, there are two refuse-chutes, one for waste collection and the other for recyclable collection, including paper, cans, glass and plastic. Recycling is just as easy and convenient as refuse disposal; thus some residents are willing to participate in it. These recycling facilities can increase recycling rates; however, they should be considered at the early stage of construction. The Singaporean experience shows that the installation of an alternative chute for the collection of recyclables not only increases the rate of participation in recycling but also enables the cleaners to save time and energy. However, this system requires long-term maintenance and self-discipline on the part of the users. It is necessary to ensure that recyclables are not mixed with putrescibles; the facilities have to be closed if any potential health risks arise. Long-term education, clear indications and public information are necessary to assist people in the proper use of the facilities.

In some areas of South Korea, recycling activities are similar to those in Japan. Different types of materials are collected on a designated date and improper or illegal disposal is rejected or can even lead to punishment (Lee & Paik, 2011). For example, Monday is for waste collection, Tuesday is for paper collection, Wednesday is for plastic collection and so forth. Residents have to store different types of material, including food waste, at home and then dispose of them according to the schedule of refuse collection. In some neighbourhoods, dryers and processors are provided to handle food waste in situ; in addition, the food waste collection machine can weigh the food waste automatically and charge the disposal fee as people deposit their food waste into it. Local authorities can decrease the convenience of arbitrary refuse disposal by adopting mandatory measures such as restricted collection times and ‘pay as you throw’ pricing. As the degrees of

convenience of refuse collection and recyclable collection are approximately the same, people generally separate materials before disposal. However, due to the limited dwelling space in Hong Kong, residents may not be willing to store different types of materials, especially food waste, inside their houses for a few days.

2.4 Summary

Following the identification of the development of policy and design for waste recycling in Chapter 1, this chapter first reviewed the particular terms of reference to formulate the research scope. ‘Waste’ is identified as socially and culturally formed in a given society. It is simplistic to address unsustainable behaviour in a ‘throwaway society’ without examining the social and cultural context (Evans, 2012; Strasser, 1999). This understanding of the term ‘waste’ can allow governments, researchers, designers and communities to rethink the real meaning of waste and to reconsider how to treat or recycle it.

The development of waste reduction and recycling was then reviewed in terms of policies, management strategies and recycling facilities in Hong Kong, emphasising that it is necessary to consider not only policy and management, but also public design encompassing cultural factors, user behaviour and community participation. Overwhelming annoyance may result if management, strategies and designs lack consideration of the local culture and physical context. This historical review is of great importance before research is conducted on designing for sustainable behaviour in Hong Kong.

This chapter also reviewed the policy and design of recycling practice and facilities in other high-density spaces in Asia, focusing on Singapore, Taiwan and Korea because of their similar living situations and context. Reference to these areas

provides insights into how the efficiency of recycling in Hong Kong could be increased.

CHAPTER 3 Influencing sustainable behaviour through design

Design interventions can influence user behaviour. However, people's experiences and responses cannot be ignored because they ensure the effectiveness of design interventions. To understand this statement, the factors that influence behaviour and approaches to influencing behaviour must be identified. This chapter examines the factors that influence human behaviour from different perspectives. The significance of context is identified and approaches to influencing behaviour are reviewed. By examining different models and strategies for interventions, the challenges of influencing sustainable behaviour through design are identified. This chapter also reviews practice-led research by following Lockton's (2013) suggestion as well as community-based research, which are useful for identifying opportunities and structuring the study.

3.1 What influences behaviour

It is not easy for researchers to draw definitive conclusions about what factors influence behaviour because understanding behaviour requires a holistic review of various disciplines including psychology, sociology, anthropology and physiology. Nevertheless, an attempt can be made to find some practical implications from different perspectives to help designers understand which design considerations are important.

Behavioural interventions have been studied and discussed for a few decades. However, most studies come from social and environmental psychology and other related fields. Interventions are not yet common in design research except for human–computer interaction (HCI) design. In studies from other disciplines, both

external and internal factors have been considered for a complete understanding of human behaviour (Jackson, 2005; Lewin, 1935; Simon, 1990). In Lewin's equation (Lewin, 1935), behaviour (*B*) is a function of personal factors (*P*) and an individual's environment (*E*):

$$B = f(P, E)$$

According to this equation, human behaviour results from internal influences such as norms and attitudes and the environmental setting, which includes social factors and physical factors. In line with Lewin's equation, Simon (1990) proposes a 'behaviour scissors' metaphor in which two blades of the 'scissors', namely 'context' and 'cognition', must be dealt with holistically; focusing exclusively on one blade will not achieve a comprehensive understanding of user behaviour. However, Lockton (2013) notes that it is not able to separate these two factors thoroughly into two blades because cognition is dependent on context. Nevertheless, Simon's metaphor illustrates the significance of contextual factors on sustainable behaviour. Winter and Koger (2004) also indicate that people often overestimate the extent to which behaviour is caused by personal factors while underestimating the extent to which it is influenced by the contextual environment. In terms of waste management, unsustainable behaviour is generally attributed to the wrong attitude and social norms rather than to the contextual factors that make it easy to dispose of waste or difficult to recycle it.

3.1.1 Environment (context) and behaviour

The term 'behaviour' has been widely used by sociologists, anthropologists, psychologists and design professionals for many years. The relationship between human behaviour and environment has been discussed in several disciplines such as anthropology, ecology, psychology and sociology. Design researchers and

designers have increasingly emphasised the importance of understanding environment. Bell (et al., 1996) and Kopec (2012) have explored the environmental factors responsible for the evolution of human behaviour and activities. Environment's role has been seen as a powerful determinant in lifestyle, values and behaviour (Altman & Chemers, 1980). From an alternative perspective, environmental psychologist Altman (1975) proposes a model of environment-behaviour issues that encompasses social setting, user groups and behavioural phenomena. This view states that environmental factors and behaviour operate in a functional interdependent system, such that changes in the physical environment can result in alterations in behaviour and vice versa. The environment-behaviour phenomena suggest that the relations between behaviour and environment should be considered as a network of related issues. Moore (1979) emphasises that the systematic study of the relationship between environment and human behaviour is of great importance in design progress because it represents how people interact with their physical environments and determines whether designs can meet human needs.

3.1.2 Approaches to influencing behaviour through design

Verbeek (2005) suggests that design is a mediator that can actively facilitate the relationship between people and their environment, rather than a neutral intermediary. Although it is not possible to completely separate cognition and context, Simon's (1990) scissors nevertheless offer a simple outline and help to structure a literature review. Contextual approaches aim to change the context in which people behave, for example, by making it easier or more difficult to behave in a certain way. Cognition approaches aim to change people's thinking, attitudes and motivations so that they behave or do not behave in the desired way. Lockton (2013) has examined approaches to influencing sustainable behaviour through

design and provided a brief review of the major methodologies, which not only include contextual approaches to behaviour from psychological and design perspectives, such as behaviourism, architecture and urbanism, affordances and constraints, ecological psychology, Gestalt psychology, the social context and *Poka-yoke*, but also cognitive approaches to behaviour, such as heuristics decision-making, information flows, persuasive technology, gamification, product semantics and the theory of planned behaviour (TPB). Further details on these approaches and insights for design can be found in Lockton (2011, 2012 & 2013). The main approaches are summarised below.

Contextual approaches

- Applying stimuli such as positive or negative reinforcement to provoke the desired behaviour;
- designing physical environments and patterns in a particular context;
- identifying and formalising the behaviour of a certain group of users, which might have already provided a desired path for other people to follow;
- manipulating perceived affordance by users;
- using social proof as a stimulus to show individuals how other people behave;
- making the desired behaviour easier to do, and the undesired behaviour more difficult;
- designing systems or situations for people to 'role-play' (Goffman, 1959), by encouraging them to 'act' consistently with their role; and
- reducing or eliminating undesired behaviour through design.

Cognitive approaches

- Identifying both peripheral and central route persuasion;
- using elements from games for design to increase engagement;
- making use of emotion by recognising people's responses and needs, e.g., *kansei* engineering (Nagamachi & Lokman, 2011);
- making pleasurable design rather than simply meeting functional and basis requirements;
- using product semantics to enable people to understand the intended meaning;
- using a product or service that helps to mobilise other individuals;
- applying different kinds of feedback to correct 'errors' automatically; and
- providing 'feedforward' to users, e.g., a simulation, possibility or preview of the outcomes of an action.

3.2 Interventions

The effectiveness of interventions is generally identified when we discuss how to influence human behaviour. Various strategies for applying different interventions for behaviour change have been explored (Jackson, 2005; Lilley et al., 2005; Lockton, 2013; Tromp, et al., 2001; Wever et al., 2008). Some potentially useful models and strategies that help formulate this study are introduced below.

3.2.1 Lilley's model

Referring to sustainable practices, Lilley (2009) indicates that product intervention, together with educational and technological interventions, constitute the intervention strategies influencing user sustainable behaviour. By slightly modifying an earlier model (Lilley et al., 2005), Lilley (2009) proposes three strategies of design intervention to change user behaviour (Figure 3.1):

- Eco-feedback – helping users to recognise the effects of their behaviour by providing signs, such as audio, visual and tactile information.
- Behaviour steering – encouraging users to act in designated ways by means of ‘scripts’ (for definitions of ‘scripts’ ‘affordances’ and ‘constraints’, see also Crilly et al., 2004; Norman, 1998).
- Persuasive technology – circumventing users’ decisions by addressing certain limitations, even without their consent.

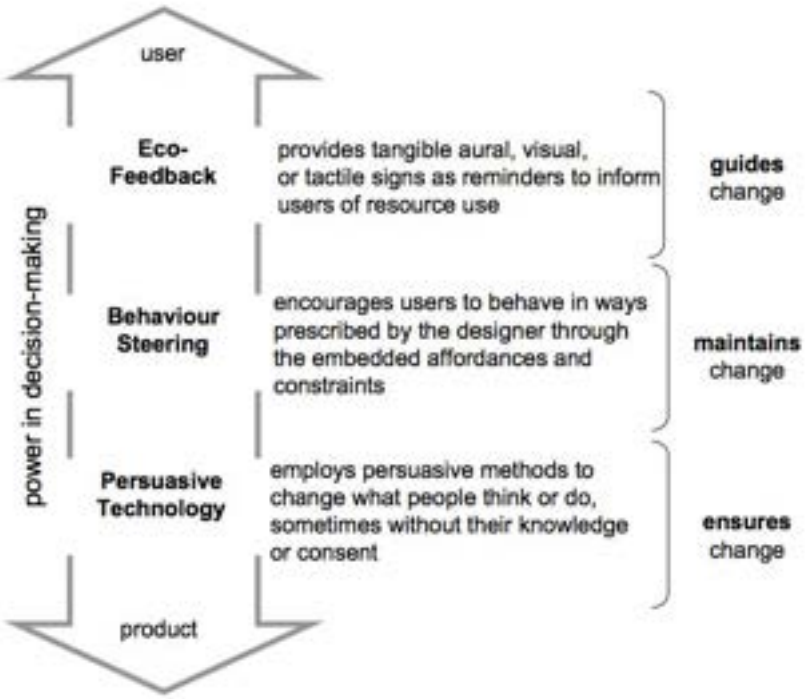

Figure 3.1 Lilley’s (2009) model of sustainable behaviour interventions

Similarly, Wever et al. (2008) use the terms ‘eco-feedback’, ‘scripting’ and ‘forced functionality’ to categorise design interventions. The terms ‘eco-feedback’ and ‘scripting’ are in line with the ‘eco-feedback’ and ‘behaviour steering’ of Lilley et al. (2005). ‘Forced functionality’ not only involves ‘intelligent product and systems decreasing the potential for unsustainable behaviour by circumventing users’ design-making’ (Lilley et al., 2005), but also incorporates Norman’s (1998)

‘constraints’ that create strong obstacles to prevent undesired behaviour from occurring.

It is clear that several approaches can be applied to product design to influence more sustainable behaviour. Lilley et al. (2005) claim that product-led interventions neither rely on user compliance nor require users to totally change their way of life; instead, they aim to affect users’ practice and form positive behaviour in a circular and spiral-turning way.

3.2.2 Steg and Vlek’s strategies

In the exploration by Geller et al. (1982), strategies for behaviour change are divided into two groups – antecedent strategies and consequence strategies. Antecedent strategies aim to change behaviour by raising social awareness, informing people of alternative choices, or promoting positive activities through information, education, economic incentives, promotion and sustainable design. In contrast, consequence strategies such as feedback, rewards and penalties aim to change the results of behaviour. In line with Geller’s suggestion, Steg and Vlek (2009) propose two types of intervention strategy to encourage pro-environmental behaviour – informational strategies and structural strategies. Informational strategies aim to alter people’s cognitions, perceptions, knowledge, values and norms and structural strategies aim to alter the circumstances in which behaviour is formed.

Informational strategies, aim to influence people’s motivations, attitudes and norms rather than changing their behaviour. Generally, such strategies result in minimal behaviour change, but they can raise social awareness and increase knowledge, which will eventually affect behaviour. Informational strategies provide an

important precondition for the implementation of structural strategies. When applying informational strategies, it is important to consider that listening to people and gaining their commitment, for example by encouraging public participation, is useful for the design and implementation of long-term interventions (Steg & Vlek, 2009). Participation approaches can help understand people's needs, attract their attention, built support and enhance public involvement without exceeding the public's tolerance limits (Gardner & Stern, 2002).

Structural strategies aim to change contextual factors such as physical infrastructure, the availability of facilities, the quality of design and services, financial regimes and laws and regulations rather than personal factors. Steg and Vlek (2009) point out that these strategies may indirectly influence people's motivations and attitudes. Rewards and penalties are more effective in changing human behaviour, however, these strategies cannot ensure long-term effects after they are stopped. To ensure the effectiveness of structural strategies, specific contextual factors should be examined carefully. Interventions tailored to people's motivations and the situation of target groups are needed.

The effectiveness of interventions related to informational strategies has been evaluated by many researchers, but the effectiveness of structural strategies is seldom discussed (Abrahamse et al., 2005; Xiao & Siu, 2016). As a gap exists between perceived effects and actual effectiveness and acceptance, interventions must be evaluated via solid experiments (Steg & Vlek, 2009). Although evaluation studies via experiments are costly and time-consuming, they not only reveal to what extent an intervention might be adapted but also provide insight into how to refine these interventions. Moreover, Steg and Vlek (2009) point out that effects evaluations should not only focus on environmental behaviour but also need to

examine quality of life, which plays an important role in motivating sustainable behaviour. Siu and Xiao (2016) explore quality of life from residents' points of view and identify quality of life factors that affect sustainable behaviour.

3.2.3 Lockton's model

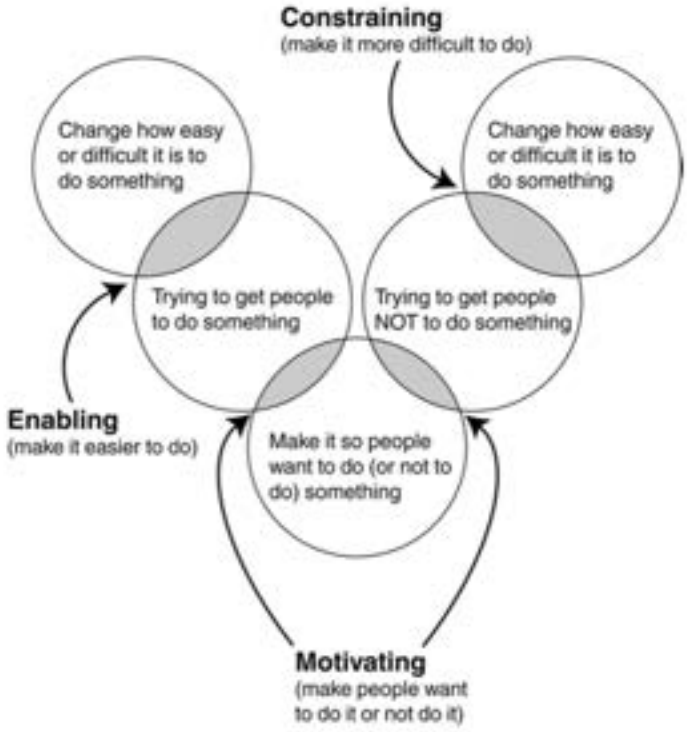

Figure 3.2 Lockton's (2013) model of approaches to influencing user behaviour

Lockton, Harrison and Stanton (2010) developed the Design with Intent Toolkit (DwI) for changing user behaviour by means of design. It provides potential methods for designers early in the design process. Along with these practical approaches, Lockton (2013) offers a simple but fundamental way of categorising these approaches. All approaches to influencing user behaviour are either 'trying to get people to do something or trying to get people not to do something; and the ways to do that are either about changing how easy or difficult it is to do it, or

making it so people want to do (or not to do) it' (Lockton, 2013, p. 125). 'Enabling', 'motivating' and 'constraining' approaches can be useful ways to link these categories (Figure 3.2).

- Enabling approaches (making it easier to do it) enable sustainable behaviour by making it easier or possible for people.
- Motivating approaches (making people want to do it or not do it) motivate people to change their undesired behaviour by means of educating, incentivising or changing their attitudes.
- Constraining approaches (making it more difficult to do it) constrain people to behave in a desired way by making alternatives difficult or impossible; see also Norman's (1998) *forcing function* and Shingo's (1986) *Poka-yoke*.

In general, it is not difficult to apply these approaches, but a designer should consider when to apply which strategy and how people might react (Lockton, 2013).

3.2.4 The model proposed by Tromp et al.

Although the number of studies on how design can change human behaviour is growing, how users might experience or react to this influence is seldom discussed. However, the user's experience and response to the influence of design is of great importance, determining the effectiveness of design interventions.

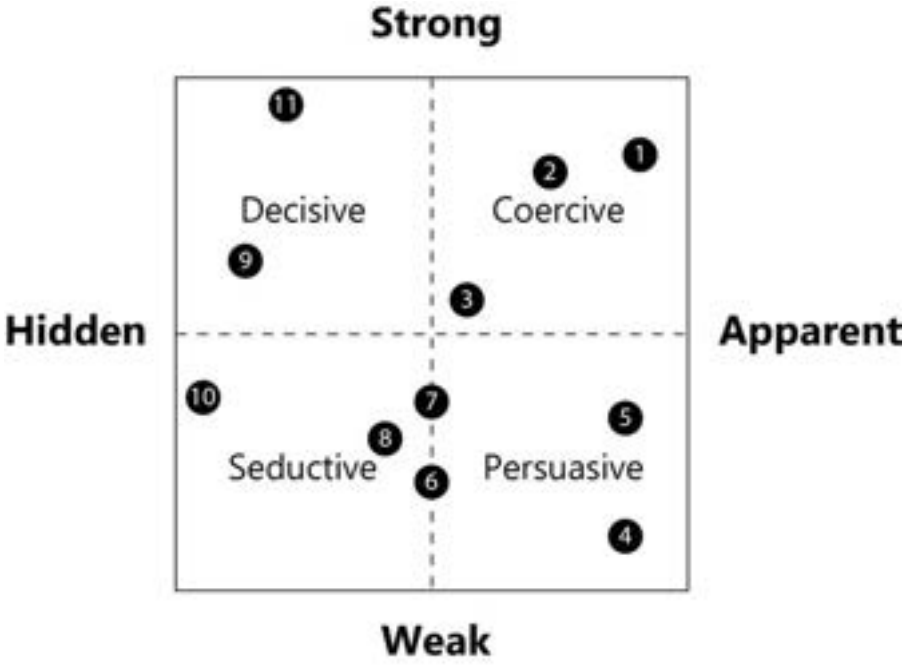

Figure 3.3 Four types of influence on the basis of force (weak–strong) and salience (hidden–apparent) (Tromp et al., 2011)

Tromp et al. (2011) propose a model of influence on the basis of two dimensions, salience and force. Their matrix is then divided into four categories of influence: coercive, persuasive, seductive and decisive (Figure 3.3). Coercive intervention is both strong and apparent. People who are coerced by an intervention will probably experience the intervention as forceful. Persuasive intervention is weak and apparent in its influence (e.g., a campaign to promote food saving). Decisive intervention is both strong and hidden in its influence. People experience the design as externally regulated rather than recognising it as a deliberate intervention by the designer. Seductive intervention is both weak and hidden in its influence.

Although Tromp et al. (2009) divide influence into four categories, this approach cannot guarantee that the result that a user experiences will be as expected. Individuals might assign the same intervention to different categories according to their personal factors. For example, a design may be expected to exert a coercive

influence, but a user might experience the intervention as persuasive. The influence an intervention exerts on different individuals can be considered case by case. Moreover, a user might experience the same intervention differently over time. For example, some people who experience the intervention as decisive might change their attitudes to it shortly afterwards. Only when users eventually experience and respond to the design can interventions be categorised as coercive, persuasive, decisive, or seductive. Although there are only four categories of influence, Tromp et al. (2009) further indicate that user experience is richer than these four categories alone. Even when users experience the intervention as coercive as expected, the experience can be different among individuals. For example, one might consider the intervention as ‘meaningless’ and ‘strictly controlled’ when others recognise it as ‘reasonable’ and ‘acceptable’.

Although designers are not able to guarantee the result of a particular intervention, the strategies can still, to some extent, have a greater or lesser influence on the user experience. Intervention strategies can increase or decrease the extent of influence exerted. Eleven design strategies are proposed:

1. Make a perceivable barrier for unwanted behaviour (e.g., punishment, pain);
2. Disclose unacceptable behaviour (e.g., shame);
3. Make the behaviour a necessary activity;
4. Provide information or arguments about the consequences of specific behaviour;
5. Provide suggestions or guide actions, if necessary;
6. Provide alternative motivations for the same behaviour, such as games and gamification;
7. Elicit emotions to induce a desired action or prevent unwanted action;

8. Induce desired behaviour by making use of physiological processes;
9. Activate human tendencies by triggering a perceived stimulus (similar to Norman's (1998) concept of 'affordance');
10. Provide optimal conditions for desired behaviour, without interfering with psychological processes excessively; and
11. Trigger the expected behaviour as the only possible behaviour.

According to Tromp et al. (2009), designers can exert influence either by discouraging problematic or negative behaviour or by encouraging other sustainable behaviour. In general, most existing interventions that are relevant to socially responsible behaviour are designed on a basis of collective concerns of responsibility rather than individual concerns.

Coercive influence can be regarded as effective intervention for certain types of social issue. Coercion might be a temporary solution to deal with a specific situation. As the behaviour is externally regulated, user experiences this intervention as strictly controlled or regulated. In general, coercive interventions concerning matters of life and death are acceptable and reasonable. However, creating obstructions for other social issues can be unacceptable and debatable. Likewise, improper persuasive, decisive or seductive influences can also lead to unpleasant user experiences.

3.2.5 Insights from existing models and strategies

Scott (2004), Lilley et al. (2005) and DeVries (2006) emphasised that changing human behaviour is challenging because users tend to accommodate sustainable practices slowly. In the broadest terms change encompasses user behaviour, needs and acceptance and social effects (Norman, 1998; Siu, 2003).

To some extent, intervention can influence human behaviour. It is essential for design interventions to steer human behaviour towards sustainable practices without diminishing people's willingness and ability to interact with objects. However, trying to alter human behaviour in an inappropriate way may be unacceptable and lead to annoyance and frustration. When people feel uncomfortable and experience interventions as intrusive, their acceptance and willingness decrease. Only when appropriate interventions are adopted can long-term sustainable behaviour result. Choosing a proper intervention requires further consideration of the user experience and response. Users' experiences and responses to a design intervention cannot be ignored because they ensure the effectiveness of the intervention.

As there are different levels of intervention, users may have different responses, such as reluctant (passive), understandable (neutral) or spontaneous (active). If people are reluctant to adopt sustainable practices through behaviour steering or eco-feedback interventions, persuasive (or coercive) intervention should be undertaken to ensure changing practices. However, if people's attitudes remain negative and they are reluctant to change their behaviour in response to all types of intervention, designers should reconsider their design to in terms of how to increase users' acceptance and meet their needs.

As both design and users have dynamic natures, there is not an absolute level of intervention for a specific experience or performance. Besides, because users are slow to accommodate sustainable practices, a reluctant (passive) performance may later become spontaneous (active). Thus, a long period of observation should be conducted to ascertain whether the intervention is suitable or not.

3.3 Practice-led research

The DwI toolkit of Lockton, Harrison and Stanton (2010) mentioned above provides an excellent reference for strategies that can be applied to influence behaviour via design. However, it gives little guidance on when to apply which strategies and how people might react. As the effectiveness of design interventions differs from case to case, interventions should be applied and evaluated in place.

As both social context and human behaviour are complex and dynamic, designers should change their focus to practices instead of designs. Nowadays, some researchers propose 'practice-led' (and practice-based) approaches, which focus on how users behave in practice, as an effective way for designers to determine proper strategies in the design process according to the dynamic social context. Although individuals can learn from each other, one individual's action (i.e., practice) will be different from another's due to private consciousness and attitudes. The variety of human behaviour demonstrates that it is impossible to insist on a static way to deal with a constantly changing situation. As users' practices and social norms are non-static in space and time, mobility should be considered in terms of sustainability in the design process. In other words, a design that was suitable for society and met people's requirements in the past may not fit society today. Likewise, practices that people used to be opposed to may be totally accepted in the current situation, and vice versa.

'Practice-led' may be regarded as an alternative way for designers to adapt to social change, encouraging users to participate in the design process and co-create design with designers. Indeed, users' participation is imperative because those who are directly affected by a decision should have the greatest right to make the decision. Designers can determine appropriate interventions to alter improper behaviour

through users' (practitioners') activities. Through a practice-led approach, designers should understand the complex and dynamic social practices between users, objects and society, rather than focusing on individual products.

3.4 Community-based research

More recently, partnership approaches to research and practice have been applied in many different academic disciplines. The term 'Community-based research', which is also known as community-wide research, community-centred research and community-involved research, has been increasingly applied in the fields of public health, nursing and education. Community-based research is a collaborative approach to research in a community that equitably involves community members, organisation representatives, and researchers in all aspects of the research process (Israel, Schulz, Parker & Becker, 1998). A number of literature on social sciences has also identified related approaches to research that actively involves participants in all aspects of research process, such as 'participatory research', 'participatory action research (PAR)', 'action research', 'cooperative inquiry', 'Community-based participatory research (CBPR)', 'participatory evaluation' and 'empowerment evaluation' (deKoning & Martin, 1996; Hassenforder, Smajgl & Ward, 2015; Plaut, Landis & Trevor, 1992; Scariot, Heemann & Padovani, 2012; Stringer, 1999). 'Community-based co-design', combining action research, industrial design, education and other social measures, has currently adopted in design area in order to understand users' requirements and reduce bias from designers (Blake, Tucker, Glaser and Freudenthal, 2011; Ellery, Ellery, Motloch & Hunt, 2015).

In spite of differences among these approaches, each will benefit involved communities either through direct intervention or by using the findings to achieve

action for change (Israel et al., 1998). Israel et al. (2003) also provide nine principles of CBPR research:

1. Recognises the community as a unit with shared identity;
2. Builds on strengths and resources within the community;
3. Encourages social involvement and collaborative partnerships in all phases of the process;
4. Integrates knowledge and action for mutual benefit of all partners;
5. Facilitates a co-learning and empowering process;
6. Involves a cyclical and iterative development process;
7. Addresses health from both positive and ecological perspectives;
8. Disseminates findings and knowledge gained to all partners; and
9. Involves a long-term process and commitment to sustainability.

CBPR basically emphases on various engaged partners, and on striving for equity, partnership formation and maintenance, reciprocity and co-learning. Since CBPR is one of the approaches including both research and action, some reference to methods and case examples from CBPR would be helpful in the search for knowledge in social and behavioural change in household recycling.

3.5 Summary

This chapter has reviewed the factors influencing human behaviour from different perspectives, the approaches to influencing sustainable behaviour, the models and strategies for design interventions, the practice-led research and community-based research.

In studies from other disciplines, both external and internal factors have been treated as a contributing to a complete understanding of human behaviour. Not only personal factors such as norms and attitudes but also environmental settings,

including social and physical factors, affect actual behaviour. However, people often overestimate the extent to which behavioural change is caused by personal factors and underestimate the extent to which it is caused by contextual factors. As cognition occurs in a context, it is important for designers and researchers to investigate the context systematically.

Interventions can influence user behaviour. Different types of intervention can be applied to behaviour change. When designing interventions, a designer should keep in mind the balance between product interventions and user performance because inappropriate or problematic interventions may be unacceptable and lead to annoyance and frustration (Lilley, 2009; Lockton et al., 2009). People's acceptance of and reaction to an intervention determine its effects. In this regard, people's experiences and responses cannot be ignored because they ensure the effectiveness of design interventions. Given the specific and dynamic nature of the environmental context, interventions tailored to people's motivations and the situation of target groups are necessary. Moreover, when evaluating the effects of behaviour change, it is worth examining quality of life and other factors, because it plays an important role in motivating sustainable behaviour.

Finally, this chapter has reviewed practice-led research by following Lockton's (2013) suggestion. To examine people's responses to interventions, practice-led research should be adopted for particular contexts, circumstances and target users. This chapter has further reviewed community-based research as well as other related labels on collaborative research. These theoretical review provide a basis for further study and identifies the research gap in the area of influencing sustainable behaviour through design. A wide ranges of research methods and cases

from CBPR would be helpful in the search for knowledge in social and behavioural change in household recycling.

CHAPTER 4 Research methodology

This chapter describes the research methodology, that is, the epistemology, theoretical perspectives and methods used in this study. Based on Crotty's (1998) framework of epistemological stances and relevant perspectives, Constructionists and Interpretivists dominate this study. To investigate the in-depth understanding of people's everyday recycling practices within the particular social context and to improve recycling practices and the design of recycling, case studies and action research were used as the main research strategies. The research methods applied here have been outlined, and include interviews, questionnaires, observations, workshops and prototypes. Both quantitative and qualitative methods were deployed, and the scientific method of data collection has ensured the validity and reliability of the outcome.

4.1 Epistemology and theoretical perspectives

In Crotty's (1998) discourse on the characteristics of research, epistemology, theoretical perspectives, methodology and methods were described as the four elements of research design. Holden and Lynch (2004) pointed out that research should be philosophically led rather than methodologically led. In this chapter, epistemology, theoretical perspectives, methodology and methods are discussed in sequence. As Lockton (2013) suggested, epistemology affects the theoretical perspective, which in turn affects the methodology and ultimately the choice of methods.

In this study, the elements of all three epistemological stances suggested by Crotty (1998) were involved:

- The constructionist stance dominated in the participatory development process through PAR. Knowledge was built by reflecting upon iterative design practices;
- The objectivist stance was used to objectively explain the empirical facts of the phenomenon and to identify rational ways to problem-solve; and
- The subjective stance was used peripherally in attempting to create tools based on the research. However, this study has mainly focused on the iterative development process, rather than on the artefacts (or tools) themselves.

Theoretical perspectives inform methodology, which informs the methods selected. Because it is associated with the philosophical position of the three epistemological stances stated above, interpretivism was widely used in this study to understand its processes and meanings through social construction. Positivism was adopted for its association with objective stances, and was used to objectively explain the phenomena based on the natural sciences. Finally, postmodernism was used for its association with subjective stances, to critique the legitimacy of the other perspectives.

4.2 Methodology

In this section, the research methodologies associated with epistemology and theoretical perspectives are presented.

4.2.1 Case studies as a research strategy

In consideration of the objectives and practical limitations of this study, the exploratory case study was predominantly used. This does not mean that descriptive

and explanatory research was ignored. As Andranovich and Riposa (1993) and Yin (1993) indicated, descriptive and explanatory research is of great importance. This study has presented some descriptions of the user's everyday practices and has collected data bearing on casual relationships.

Case studies have some advantages in social research, especially for investigating human behaviour. As de Certeau (1984) emphasised, everyday practices provide us with a realistic perspective to recognise the unforeseen possibilities behind appearances. The case study has been defined as 'an empirical investigation of a particular contemporary phenomenon' (Robson, 1993) conducted in 'any variety of real-life field settings' (Yin, 1993) directed towards multiple variables.

Whereas other sociologists and philosophers have focused on great events and institutions, Lefebvre (1991) drew attention to the 'micro-scale' events undertaken by the 'ordinary' or 'common people' or the 'grassroots class'. In general, this involved the entire course of people's lives, including their activities, practices, strategies and perceptions in space and time (Simonsen, 1997). Because everyday life is a collection of things and activities, it can be 'repetitive', 'ordinary', 'common' and 'banal' (Eley, 1995). Corresponding to social theory perspectives of phenomenology, reconsidering the 'social construction of reality' (Berger & Luckmann, 1967), some researchers have thus taken account of individual practices, repetitive rhythms and experiences in terms of spatio-temporality to show how people live and interact with their surroundings and their beliefs, needs and responses to everyday life.

Despite the advantages of case studies, they have some limitations. Yin (1994) posited that the equivocal evidence and biased opinions from case studies could

influence the direction of the findings. Benis (2009) pointed out that researchers might not be able to generalise beyond the person or small group being studied. The participants may lack representativeness. However, Yin (1994) and Hamel, Dufour and Fortin (1993) suggested that establishing parameters and objective settings are much more significant in case studies than large sample sizes.

4.2.2 Action research methodology

In terms of household recycling, most studies have relied heavily on quantitative surveys of reported behaviour and attitudes to identify the barriers to and opportunities for public participation in recycling (Chung & Poon, 1999; Hage, Söderholm & Berglund, 2009; Yau, 2010). However, some researchers have argued that self-reporting produces over-estimates of pro-environmental behaviour (Chung & Leung, 2007; Farrelly & Tucker, 2014). Findings obtained from large-scale surveys may reduce complex situations to simplistic answers (Neuman, 2000). Some advocates have stated that to achieve an in-depth understanding of people's behaviour and to improve recycling designs, more diverse methodologies that include qualitative methods, such as field observations, interviews and focus groups should be adopted (Barr, Ford & Gilg, 2003; Fahy & Davies, 2007; Martin, William & Clark, 2006). Farrelly and Tucker (2014) suggested that action research could enable researchers to find solutions to practical problems in collaboration with stakeholders through the cyclical process of reflective learning. Although action research has been widely used in the field of health science, qualitative research methodologies designed to examine actual recycling practices and to improve public designs through action research have been few (Fahy & Davies, 2007).

Action research, which is also known as community-based study, co-operative enquiry, action science and action learning, is an approach commonly used to

improve conditions and practices (Lingard, Albert & Levinson, 2008; Whitehead, Taket & Smith, 2003). It is essentially a 'step-by-step process' that occurs over 'varying periods of time and a variety of mechanisms' (Cohen & Manion, 1994). Its on-going nature enables researchers to review, evaluate, adjust, modify and improve practices based on immediate feedback (Bell, 1987; Stringer, 1999). Figure 4.1 shows the circles of action research (O'Leary, 2014). In action research, the researcher formulates speculative, tentative or general principles at an early stage; hypotheses may then be generated which may 'lead to the desired improvements in practice' (Brown & McIntyre, 1981). Actions are taken and data are collected, the early hypotheses or principles are revised and more appropriate action can then be carried out, with further principles or hypotheses being generated. Consequently, both action and reflection are of great importance in PAR (Jansen, Baur, de Wit, Wilbrink & Abma, 2015). Because of the longitudinal nature of action research, researchers are able to determine a baseline for recycling practice and to gauge any behaviour changes during the research period (Farrelly & Tucker, 2014).

In contrast to case studies, which focus on reporting events, action research requires researchers to undertake actions and interventions during the research process (Davison, 1998). In this study, the researcher (the author) not only acted as the facilitator, coordinating all matters, but also provided suggestions and support throughout the practical aspects of the research process.

In this study, the iterative development process was central to the study, and more important than the artefacts or tools because it attempted to gauge behavioural changes and obtain experience throughout the process.

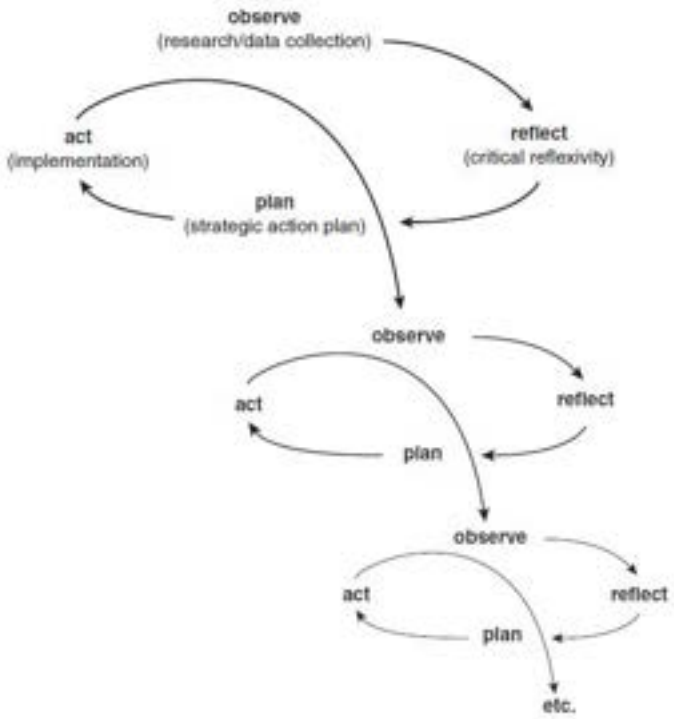

Figure 4.1 O'Leary's cycles of research

4.3 Research Design

Research design is the strategy that 'guides the process of collecting, analysing and interpreting data' (Manheim & Rich, 1986, p.88). Because each research method has its strengths and limitations, using only one qualitative method has been viewed as unreliable even if a quantitative approach such as a questionnaire is also used (Bell, 1987; Cook & Campbell, 1979). The selection of a research method in this study was thus based on its nature and purpose and the practical limitations such as time, staffing, funds and the availability and accessibility of information (Cook & Campbell, 1979).

4.3.1 Research Framework

This study's research questions focus on how people deal with waste, the factors influencing their sustainable behaviour together with their context and barriers, and

the methods of solving problems with waste. This chapter aims to specify the elements of who, what, why and how pertaining to the research questions. Figure 4.2 shows the research process. To answer the research questions, this study has been divided into four main phases: general review, overview understanding, targeted case studies and action research.

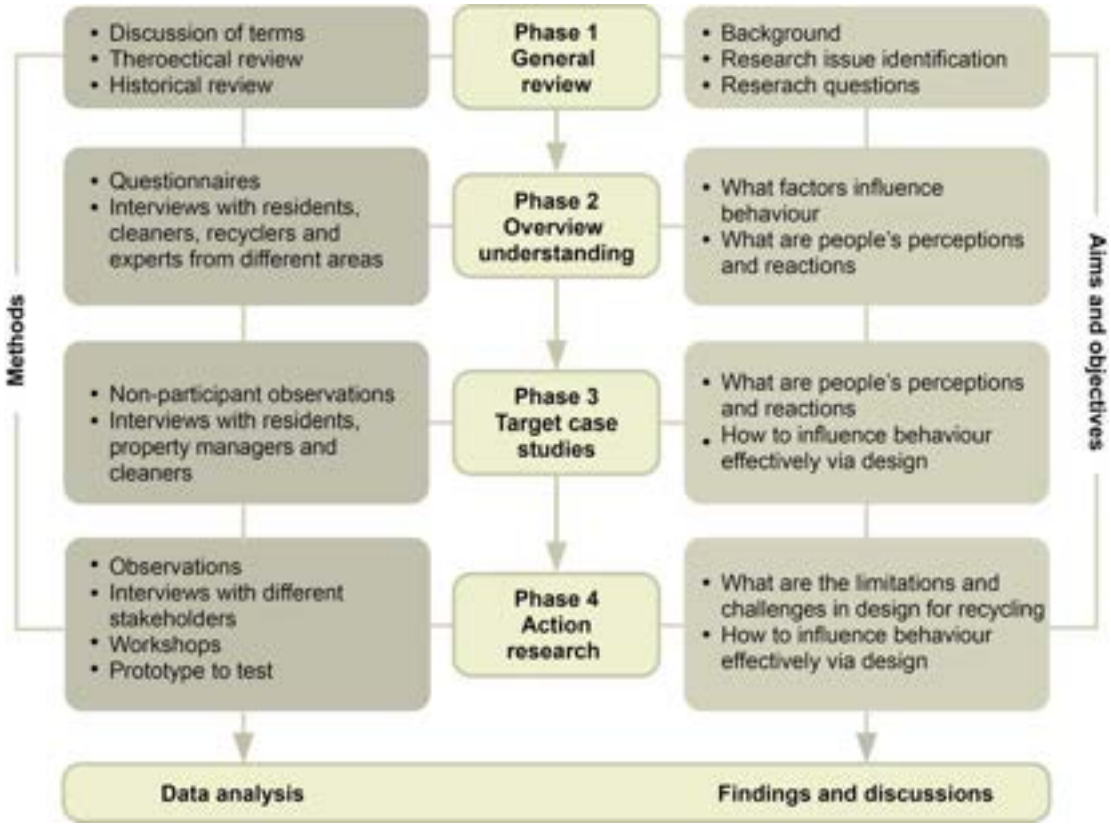

Figure 4.2 Research process

The general review formed the foundation for the study by identifying the research background and narrowing the research scope. After reviewing the literature, research models were developed, which provided theories for the later study. In the overview-understanding phase, surveys including questionnaires and interviews were used to provide a general impression of household recycling. Before conducting action research, targeted case studies were conducted within several selected sites. Both quantitative and qualitative methods were used with the aim of

gaining an in-depth understanding of people's behaviour and living contexts. In the final stage, which was the most time-consuming phase of the study, action research was conducted. Collaborative workshops, prototypes, observations and interviews were used to understand the current situation and how to improve conditions and practices.

4.3.2 Phase one: Literature and document review

This study began with a literature review of the research terms, a review of historical developments and a review of theoretical perspectives, which were all presented in chapters 2 and 3. This provided the foundation for this study given that an in-depth understanding of the topic was necessary before further research could be conducted. The review first addressed the definitions of the research terms from sociological and anthropological perspectives. The aim was to achieve a full understanding of the research topics from their theoretical perspectives and to narrow the research scope. The development of waste recycling, recycling practices and public designs in Hong Kong were then examined. Concurrently, the situations in other densely populated Asian cities were compared. The historical review provided an overview of waste recycling practices in terms of policy, management, strategy and public design. It also provided some insight into how to encourage community and household participation in recycling. Theories related to influencing sustainable behaviour were reviewed, focusing on approaches to influencing sustainable behaviour through design. Both contextual and cognitive approaches to behavioural change were investigated. The theoretical discussion addressed the significance of the contextual factors concerning user behaviour and how to interpret recycling behaviour within specific contexts.

The theoretical and historical review is the foundation of the research. From the literature review, the research scope and hypotheses were formulated. The comprehensive review helped to limit the problems with the study and to evaluate promising research methods.

4.3.3 Phase two: Survey

The literature review explicitly addressed the research topic. However, before in-depth studies at several selected sites could be conducted, it was necessary to gather general information on people's attitudes towards recycling practices. Thus, in Phase two, a survey was conducted to help measure the attitudes and orientations of the larger population (Babbie, 2011). Questionnaires were distributed to random participants over three months to identify what factors influenced sustainable recycling behaviour. The sample included people from different groups in terms of demographic structures and living conditions. People's attitudes and a general interpretation of recycling practices were obtained. To collect data on waste recycling policies, plans and management, semi-structured interviews were also conducted with various parties such as the EPD, representatives of NGOs, professional bodies and local communities. The conversations were recorded and transcribed.

The data generated in Phase two were useful for the interviews and observations taking place in the next phase. Based on the data collected from this phase, an overall understanding of current household recycling practices was gained.

4.3.4 Phase three: Case studies

In consideration of this study's objectives and its practical limitations, case studies were the dominant feature of Phase three. This phase concluded with a detailed

description of how the household recycling survey discussed in Phase two was identified. Both qualitative and quantitative methods were used in this phase, including observations, questionnaires and interviews. Yin (1993) indicated that case studies could also include quantitative analysis of archival data and documents, interviews and qualitative field observations.

According to its Census and Statistic Department, in 2011 there were 2,381,125 quarters and 18 council districts in Hong Kong. Due to the limitations of time, funding and the nature of this study, it was impractical and unnecessary to reach all of these housing estates. In this phase, twelve sites from five council districts were chosen as the core areas for field research. Other sites in different districts with diverse users and practices were also selected as supplementary sites to 'enhance the argument and reinforce the evidence' of this study (Yin, 1993). The communities were diverse and stratified in terms of demographic structure and spatial characteristics and included both public and private housing estates and different building types. The sites were full of human activities and diverse living environments, which provided opportunities to investigate what the challenges of household and community participation in recycling were and how different individuals disposed of recycle waste with attention to the particular living environment, social and cultural factors.

Reasons for selecting the sites for the case studies

In Hong Kong, there are three main types of housing, namely public rental housing (PRH), home ownership (HOS) housing and private housing. According to the Hong Kong Housing Authority (2015), 29.1% of the population live in PRH, 16.5% live in HOS housing and 53.8% live in private housing. The local authorities provide PRH for low-income citizens who cannot afford the rent for a private

accommodation. There are a high proportion of low-income households and elderly people in PRH. HOS housing is sold to low and middle-income families on the basis of HOS schemes to help them improve their living conditions. To enable residents to continue their lifestyle and have familiar environment, the HOS housings provided by local authorities have similar appearance to existing public housing estates. Private housings, as opposed to public housing estate built by Hong Kong Housing Authority or the Hong Kong Housing Society, are developed by private developers according to the market-oriented economy. In this study, the author differentiates between two housing sources, namely public housing and private housing, by combining PHR and HOS housing.

In consideration of the variety of neighbourhoods, 12 case studies were carried out in Hong Kong over 10 months. Six public housing estates and six private housing estates were selected. These included new private housing and ‘old slab’-style public rental housing that had been used for nearly 60 years. Thus, the social classes of the residents were diverse and stratified, ranging from lower working class to upper middle class individuals. The distinct demographic structure and spatial characteristics of the different living environments provided a viable laboratory in which to examine recycling activities.

4.3.5 Phase four: Participatory action research (PAR)

To address how the design of public recycling facilities and built environments could be improved to influence pro-environmental behaviour, action research was carried out, directed towards ‘greater understanding and improvement of practice over a period of time’ (Bell, 1987, Brown & McIntyre, 1981).

In Phase four, the study was further divided into a series of research projects. As seen in Figure 4.3, a pilot study, main user study, design exploration and an evaluation were carried out in conjunction with the literature review of action research on public design and household recycling in high-rise buildings.

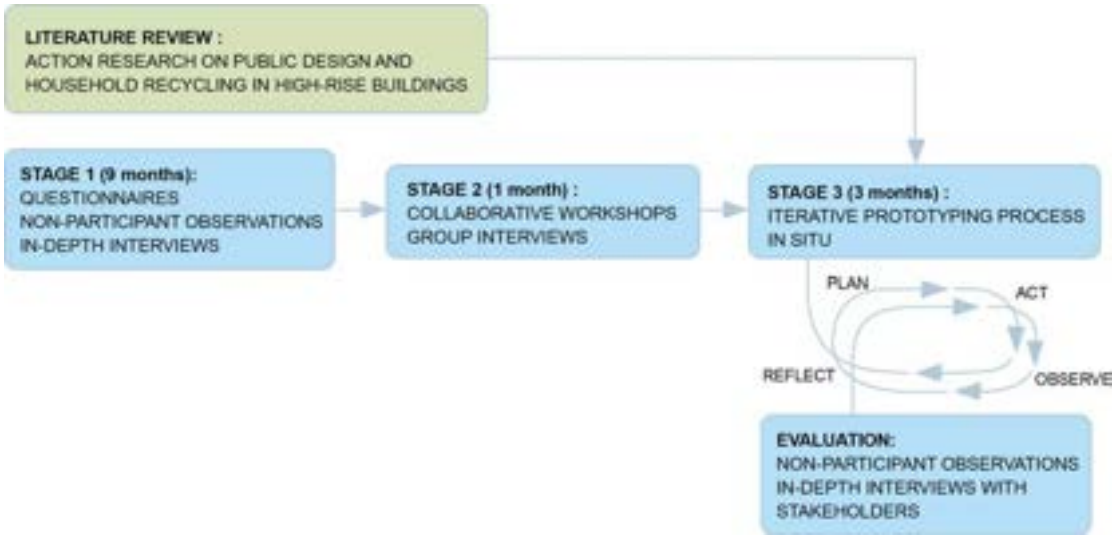

Figure 4.3 Research stages

In the initial stage, research methods involving non-participant observations, questionnaires and interviews were adopted to identify the problems and current behavioural phenomena. In Stage 2, drawing on the findings from Stage 1, the main user study was conducted to explore people's habits, needs and preferences in household recycling. The researchers worked collaboratively with the participants from five housing estates. Close interaction with the end-users allowed designers to obtain valuable information from them while encouraging their participation in the design process (Kujala, 2003). Collaborative workshops enabled the participants to share their opinions openly and to develop ideas by using scaled-down models provided by the researchers. After the workshops, group discussions were carried out with the participants to gain in-depth understanding of their opinions.

Tangible tools and ‘best practice’ models have been effective in participatory development (Tremblay & de Oliveira Jayme, 2015). As suggested by Blake et al. (2011), generative tools – the drawing/building materials, can be adopted in a focus session to make a visual representation of a situation. In Stage 3, design exploration and evaluation were conducted iteratively to reveal how prototypes actually work in everyday life. Based on the data generated from Stage 2, full-scale prototypes were developed and provided in situ to identify whether they could meet the users’ preferences and facilitate public participation in recycling. Critical reflection and evaluation was necessary during this stage.

Reasons for selecting the sites for PAR

In January 2015, in collaboration with the Caritas Mok Cheung Sui Kun Community Centre and the Caritas Ngau Tau Kok Community Centre, PAR was carried out in five housing estates in Central & Western District and Kwun Tong District (i.e., Sai Wan Estate, Ngau Tau Kok Estate, Choi Ying Estate, Choi Fok Estate and Choi Tak Estate). The Sai Wan Estate was selected as the core site for in-depth study because its spatial characteristics were quite distinct from the other four housing estates.

Sai Wan Estate is a public housing estate comprising 640 flats in five linear blocks of 10 to 14 storeys. The buildings of this estate, which is the one of the oldest existing public housing estates built by Hong Kong Housing Authority, have been in use for nearly 60 years. They were built in the ‘old slab’ style according to old-fashioned standards for resettlement estates. ‘Old slab’ style residential blocks involve one or more elongated rectangular buildings with a long corridor linking the housing units. In Sai Wan Estate, five buildings are joined to a large shared

platform by long public corridors. Elevators are provided in each building, but the elevators located on the ground floor can only carry people to the shared platform and not to their own buildings. Therefore, people have to transfer to another elevator after reaching the shared platform and then walk through the long corridors.

4.4 Research methods

Qualitative research aims to gain an in-depth understanding of human behaviour and social context. Densombe (1998) pointed out that the qualitative method is actually an umbrella concept covering several forms of inquiry to enable researchers to understand and explain the meaning of social phenomenon with as little disruption to real-life settings as possible. This method provides a means of investigating the why and how of the decisions being made, not merely where, when and what decisions are made (Denzin & Lincoln, 2000). Conversely, quantitative research is used to transform numerical data into knowledge that provides support for the assumptions of a study.

As Yin (1993) stated, 'Qualitative research is characterised as being 'soft' social science, interested in 'mushy' processes and dealing with inadequate evidence. Quantitative research is considered hard-nosed, data-driven, outcome-oriented and truly scientific' (p. 57). The combination of research methods in this study has allowed for more accuracy. Qualitative research is used to gain a better understanding of conclusions arrived at through quantitative research. Similarly, quantitative research is used to provide precise and evaluable expressions of qualitative ideas. There are three approaches that combine qualitative methods and quantitative methods:

- Two phases approach: Quantitative and qualitative methods are used separately without any connection.

- Dominant-less dominant approach: One method is selected as the dominant component while the other is merely a component alongside the core component.
- Mixed methods approach: Both of the methods are used, combined or transformed.

Morse and Niehaus (2009) pointed out that ‘mixed methods is the latest approach to social science research’, referring to ‘the use of two or more research methods in a single study when one or more of the methods is not complete in itself’ (p. 9). The approach has ‘a qualitative or quantitative core component and supplementary component which consists of qualitative or quantitative research strategies’ (p. 20). The core component achieves the dominant position in the mixed method approach. The supplementary component not only plays alongside the core component but also joins together with it until the point of interface in the main project is reached (Morse & Niehaus, 2009). Mixed methods can be either qualitatively driven or quantitatively driven.

After considering the objectives of the research questions and the nature of the theoretically driven, mixed methods approach, both qualitative and quantitative methods were used in this study. In this respect, the qualitatively driven approach was adopted as the core component, supplemented by the quantitative component. The qualitative and quantitative components of this study were carried out simultaneously and sequentially, and were integrated at the points where they interfaced.

4.4.1 Field observations

A gap can be found between attitudes and actual recycling behaviour (Chung & Leung, 2007). In this study, observations were carried out to explore recycling

behaviour. Marshall and Rossman (2011) defined observation as ‘the systematic description of events, behaviour and artefacts in the social setting chosen for study’ (p. 79). Observations enable researchers to describe a situation in its natural setting using the five senses. They added that observation is a qualitative methodology that aims to gain in-depth data on human behaviour without influencing or interacting with the participants. In Introduction to Social Research, Babbie (2011) indicates the importance of recording observations in an unobtrusive manner because people may behave differently if they notice the observer marking down what they say or do. The less face-to-face contact involved, the more likely the respondents are to admit to socially undesirable behaviour (Norman et al., 1979; Sanoff, 1992).

The observations were conducted without influence of or interaction with subjects in time and space. Observations were conducted on weekdays, weekends and holidays. Single days were divided into different periods such as early morning, rush hours and evening, to make the results easier to compare. Regarding the spatial dimension, the research area included lobbies, corridors, lifts, ground floors, communities, streets and recycling centres in correspondence with users’ routes in their day-to-day activities, which enabled the observers to obtain general information from the living environment. Cameras were chosen as a recording tool instead of video cameras, because video recording may have disturbed people in the semi-open housing estates. Notes were made as soon as possible to record what the observer ‘knew’ and ‘thought’. During observations, both the residents and the environment were treated as an indivisibly interactive compound (Rutledge, 1985). Observations were employed in different phases, during which thousands of residents were observed in selected sites.

Advantages and limitations of field observations as a research method

Field observations address contemporaneous situations and human behaviour in all of their complexity (Beins, 2009). They produce contextual data relating to the natural setting, and strive to observe what people actually do, instead of what they think they do.

There are some limitations associated with this method. It has been criticised in the sense that researchers who serve as instruments for data collection are constrained by their own knowledge and interests, and that may influence their analysis and interpretation. Notes and reflections are supportive, however, they cannot ensure that subjectivity and bias are eliminated. Besides, it is not easy to identify why people act as they do because various factors affect human behaviour in the natural world (Beins, 2009). In terms of technical limitations, videos are considered to be effective tools for data collection. They can provide a more comprehensive and permanent record of a given situation, and improve the credibility of the research. However, videos may disturb people in their living environment. In this research, cameras were chosen as a recording tool instead of video cameras, raising ethical issues related to privacy. It can be argued that involving people without their consent or knowledge is unethical (Kimmel, 1988). To protect the privacy and to maintain the dignity of the participants, most of the people being photographed were informed that they could appear in the photographs and their knowledge or consent was obtained. In actual practice, it was difficult to obtain informed consent from all of the people who were observed. Further, some residents were not willing to be captured on camera. To treat participants with respect, notes were made to supplement the data.

4.4.2 Interviews

Face-to-face interviews are a means of gaining more comprehensive and 'qualitative descriptions of the real-life world of the participants with respect to the interpretations and meanings they give things (Kvale, 1996, p.124). In qualitative research, semi-structured interviews are often conducted with individuals or groups and last about 30 minutes to an hour or more. To capture data effectively and systematically within the limited interview time, participants are kept focused on the core question and the associated questions based on the interview guides. In contrast, unstructured interviews, which are characterised as 'conversations' more than interviews, allow respondents to express their views and attitudes freely without any pre-planned sets of questions (Gray, 2009). In long-term fieldwork, informal, conversational, unstructured interviews are generally used with local participants together with observations to gather in-depth information. In this study, both semi-structured and unstructured interviews were used in different phases with different participants. To be precise, semi-structured interviews were mainly adopted in phases two and four due to their 'open-ended' characteristics, allowing for a great deal of potential information to be uncovered from the conversation. Unstructured interviews were mainly used in phases three and four. Most of the questions were generated contemporaneously during the observations.

Advantages and limitations of interviews as a research method

An interview can easily collect a significant amount of qualitative data. It offers a better understanding of a situation and supplements the data collected through observation.

In terms of technical issues, audio recording was chosen to record the interviews. All of the participants were notified in advance that their conversation would be

recorded, and most allowed the recording. Nonetheless, some participants had concerns and were reluctant to be recorded. Others were uncomfortable and said they could not express their views freely when they noticed that the conversation was being recorded. In that case notes were made recording their answers concurrent with or following the interview.

Another limitation was the qualification criteria for the interviewers. In the author's experience, in Hong Kong using interviewers who are native speakers is relatively important because many participants, especially the older people, only speak Cantonese. Barrier-free communication between an interviewer and a participant encourages the latter to more freely explain his or her views.

Interview Samples

In this study, interviews were conducted at different stages of the overall research. Residents from 24 residential estates in six Hong Kong districts were randomly selected at different periods of time. The sample of participants was by no mean representative; however, it was diverse enough to ensure there were some differences among the participants in terms of age, gender and other demographic factors. In addition to the residents, other stakeholders such as private recyclers, scavengers, cleaners and property management officers were recruited for interviews to gain insight into their current recycling activities. Semi-structured interviews were also conducted with various parties from, for example, government offices (e.g., EPD and HKHA officers), NGOs (e.g., Friends of the Earth) and local communities to collect data and comments on recycling management and practices.

For the resident participants, the interviews included questions like, 'Are you satisfied with the existing recycling facilities', 'What's your attitude toward

recycling behaviour in your residential area', 'How do you feel about the private recycling sectors and people's behaviour', 'Are you satisfied with the neighbours' and 'Are you satisfied with the neighbourhood and physical settings'. For the intermediaries, the interviews included questions like, 'When did you start to run the business', 'What are you satisfied with' and 'What are you dissatisfied with'. For the others, in addition to the questions propounded to the participant residents above, the interviews also included questions like, 'Do you have any experience and difficulties in household recycling related to implementation and management', 'Do you have any problems in your current programme on source separation of domestic waste', 'Do you have any suggestion to improve the sustainable behaviour' and 'How do you think about the private recycling networks'. The conversations were all recorded and transcribed.

4.4.3 Workshops

As part of PAR, the collaborative workshop is a context-specific method that allows the researcher to actively facilitate a participants' problem solving rather than simply describing or understanding the phenomenon (Robson, 1993). Collaborative workshops also enable participants to be open and to develop ideas through the use of scaled-down models.

To enable the participants to express their ideas and explain why they have constructed their recycling networks in the ways they did, group interviews were carried out after the workshops.

Advantages and limitations of workshops as a research method

This method engages the researcher as a collaborator with the participant in the process of identifying a problematic situation within the participant's living

environment. Van der Panne, van Beers and Kleinknecht (2003) pointed out that failing to consider the end users' perspectives could lead to problems when trying to match a designers' desires with the users' needs. Indeed, the participation of end users is imperative, because those who are directly affected by a decision should have the greatest input into how it is made. User involvement in design projects may be a constructive way to avoid such problems (Kuijer & De Jong, 2011). A number of studies have demonstrated the benefits of user involvement in the design process. For example, Damodaran (1996) reported that such involvement could improve the quality of designs by taking on board specific user requirements. By involving different stakeholders in the workshops, barriers could be addressed and potential ideas could be developed after negotiation. Moreover, as a form of action research, workshops conducted in the early phases of a design process could speed up the research process and better accommodate the end users' preferences.

The use of workshops as a research method, however, has some limitations. The ideas generated in 'artificial' settings might not be applicable to 'real-world' settings (Lockton, 2013). Nonetheless, from a reflective perspective, problems, opportunities and ideas explored during workshops could provide insight for the subsequent development process. In the case of this study, the ideas and outcomes developed in the workshops were put into action and evaluated in a later phase. Previous research has also shown that workshop participants may be reluctant to give their opinions or lack the confidence to express their ideas precisely (Wilson et al., 1997). This could lead to potential difficulties in finding participants who are motivated to contribute to the workshops, difficulties in accessing users and the failure to deliver on the participants' expected purpose. In this study, with the support of two local community centres, the participants generally understood in advance what the purposes of the research and the design process were. They stated

that they were willing to participate because they wanted to contribute to sustainability in the community.

Samples for workshops

Meyer (2000) states that when conducting PAR, it is important to ensure that participants are willing to play an active role in the research process. With the assistance of Caritas Community Centre, 30 participants who live in or work in these five housing estates were invited to participate in the workshops. Each of the participants understands that his or her responses can contribute to community sustainability and thus was willing to participate in this research. According to Fahy and Davies (2007), three vital characteristics should be considered in action research: participatory character, democratic impulse and its contribution to change. To enable people from different positions to voice their views on public design for recycling, various stakeholders were involved in this study. Among the 30 participants, 26 were local residents, 2 were recyclers, 1 was a member of the property management staff and 1 was a cleaner. Of the 26 local residents, 54% were female. The ages of the residents ranged from 25 to 80 years old: 23% were 25–44, 46% were 45–64 and 31% were 65 or above. In terms of educational attainment, 23% had a tertiary degree, while 27% had only a primary or lower degree.

4.4.4 Prototype to test

Prototyping to test is the iterative process using low-resolution tools to help probe different aspects of design solutions. It is an implementation process that turns abstract ideas, theories and plans into actual, concrete and experiential action plans. In the field of design research, prototypes are widely used to test the performance and gain knowledge (Blake et al., 2011; Coughlan, Suri & Canales, 2007). Its purpose is not simply to create a mock-up or a scale model based on previous

findings but to learn how people react and understand their existing experiences. In this process, prototypes act as communications media, which are used to quickly capture concepts and feedback (Erickson, 1995). Coughlan et al. (2007) defined prototypes as 'learning tools' to explore, evolve and communicate ideas in a design process. Through prototyping the users' perceptions and needs are identified and unforeseen challenges or unintended consequences can be explored. By implementing an iterative prototyping plan, many possibilities regarding physical form, human behaviour, its context and how people perceive things can be explored. The context and testing scenario are important aspects for what is being tested. In this regard, as opposed to lab experiments, prototypes must be tested in situ to obtain real and meaningful feedback. Coughlan et al. (2007) concluded with three prototyping objectives: (1) building to think, (2) learning faster by failing early, and (3) encouraging behavioural change.

In prototyping to test, the value of the participatory design is shared among researchers. As Holtzblatt and Jones (1993) suggested, prototyping in participatory design is significant because it can make ideas explicit and engage stakeholders directly. To increase user acceptance, designers should therefore encourage user-participation in developing designs (Sanoff, 2000). Community participation in public design is important because those who are the most affected by a decision should have the greatest voice in it (Rouse, 2002). It has been recognised that when a community participates in the development process its citizens gain the ability to express their own views in addressing the specific conditions and problems in their area.

In this study, multiple stakeholders were involved early in the design process and they freely expressed their views on public recycling design. Scaled-down models

and full-scale prototypes were evolved or refined in the participatory design process. During the collaborative workshops, participants generated a number of ideas on how to improve public participation in recycling by placing and arranging the scaled-down models and cards. Following the workshops, full-scale prototypes were developed and provided in situ in line with the participants' suggestions in an attempt to find solutions to practical problems.

As mentioned above, Sai Wan Estate was selected as the core site for the in-depth study because its spatial characteristics were quite distinct from the other four housing estates. After installing the prototypes in situ, observations and interviews were conducted in the buildings on weekdays and weekends for three months. Notes and cameras recorded the data immediately. To make the results easier to compare, single days were divided into several periods (i.e., early morning, rush hours, afternoon and evening). The findings were identified and evaluated during two cyclical processes.

Advantages and limitations of prototype to test as a research method

According to the experience of action research discussed above, I must admit that it is not easy to conduct such kind of empirical study. It is because it is difficult to get the consents and support of the property management companies and households (residents) to participate in the studies and provide information. In terms of limitation of time, staffing and funds, the sampling size of multiple cases cannot cover a large proportion of people. Besides, the findings and discussion of the study may not be widely applied to different situation with various contexts. Future research would have been more convincing if proposed theories can be examined through more empirical studies in similar areas. Long-term empirical

studies in other cities should be conducted to provide a comprehensive understanding on sustainable practice.

4.4.5 Questionnaires

Quantitative research is characterised as a systematic and scientific means of investigating social phenomena through a statistical and mathematical process (Given, 2008). Bell (1987) stated that ‘questionnaires are a good way of collecting certain types of information quickly and relatively cheaply as long as subjects are sufficiently literate and as long as the researcher is sufficiently disciplined to abandon questions that are superfluous to the main task’ (p.58). Quantitative methods are used frequently to gather major information on the participants’ beliefs, attitudes, values and behaviour (Sommer & Sommer, 1997). Before conducting large-scale questionnaire research, a pilot study in a small group is necessary because it can ‘test how long it takes recipients to complete them, to check that all questions and instructions are clear and to enable you to remove any items which do not yield usable data’ (Bell, 1987, p. 65). In this study, the questionnaire was adopted to supplement the data collected from the qualitative research to learn about the time schedules and general attitudes of the participants toward waste and recycling.

Advantages and limitations of questionnaires as a research method

Questionnaires can easily collect a significant amount of data and researchers can analyse the data in a scientific way. In some cases, researchers are able to compare the data from different groups of respondents. However, it is not easy to address how accurately or truthfully self-reported behaviour and attitudes are. Some of the questions may be incomplete or exaggerated. Thus, researchers must treat self-reported information carefully.

Samples for questionnaires

Questionnaires were distributed to the habitants among 24 residential estates in six districts of Hong Kong. Of the 1,250 questionnaires distributed, 549 copies were returned (response rate =43.92%) and 505 were utilised in this study. Of the 505 respondents, the percentage of female (53.27%) is slightly more than men (46.73%). In terms of age distribution, 39.41% of the respondents were 45-64 years old, followed by the 25~44 year old category (34.85%). In terms of monthly household income, 30.30% were between 10,000~19,999, 24.75% were between 20,000~29,999, and 15.84% were between 30,000~39,999. 42.97% had a tertiary degree, 14.46% had primary or lower degree. 51.88% of participants lived in public housings while 48.12% lived in private housings.

4.4.6 Data collection and analysis

Qualitative data collection and analysis

(a) Data collection

In this study, qualitative data were generated from multiple sources such as documentation, observation, interviews and physical artefacts. The convergence of various data sources contributes to research by providing a holistic understanding of the phenomenon being studied (Yin, 1994). Potential data sources are then interpreted and used by researchers.

Data from various sources can enhance data reliability. However, researchers may find themselves ‘lost’ in the overwhelming amount of data being generated (Baxter & Jack, 2008). Organisation and management of data is required for later retrieval (Stake, 1995). All raw data including notes, transcripts, photographs and audio files

must be organised and stored effectively. In this study, the collected raw data were converted into similar formats. For example, the data collected from interviews were transcribed and then reproduced in a document. The layout of document was divided into two columns, which allowed for the researcher's notes and comments to be recorded in addition to the participants' words. The date and time were recorded to ensure each type of datum was stored in chronological order, which was necessary especially during the iterative process. All of the photographs were categorised by time and space.

(b) Data analysis

Data collection and analysis occur concurrently in qualitative studies (Baxter & Jack, 2008). The data generated from different phases must be merged for analyses to reach a holistic understanding of the entire situation. Baxter and Jack (2008) warned that researchers must avoid treating each source of data and its findings separately. Additionally, during the analysis phase, it is important for researchers to return to their core propositions because this leads to a focused analysis without jumping outside the scope of the research (Yin, 1994). Further, new thoughts can emerge during the analytical process. When this happens, alternative explanations and new insights should be recorded to further develop the research process.

Quantitative data collection and analysis

In this study, the questionnaire was divided into three sections to measure various independent variables that could be associated with sustainable recycling behaviour. Section A aimed to discern the respondents' behaviour related to household recycling. Section B focused on their views and their satisfaction with the recycling services, the neighbourhood and the local facilities. All of the items in this section were measured on a 5-point Likert scale, ranging from 'very poor'

to ‘very satisfactory’. The final section collected demographical data on the respondents. The questions were designed to elicit the respondents’ self-reported recycling behaviour, and the author took the self-reported information seriously. Several questions were used to clarify their recycling activities, because answers to only one question may be incomplete or exaggerated. The survey questions were as follows: (1) Do you participate in recycling? If yes, how often? (2) Do you use the public recycling facilities? If yes, how often? (3) Do you sell recyclables to private recycling sectors? If yes, how often?

(b) Data analysis

Data obtained from the survey were analysed by correlations and multiple regression analyses by using SPSS. This study estimated models to identify environmental, attitudinal and socio-demographic factors that influence sustainable recycling behaviour. First, the correlations between all pairs of both independent and dependent variables were measured by pearson correlation analysis. To avoid any highly correlative variables in the same model, a precondition of this analysis was that any independent variables with a high correlation would be excluded in the model. The independent variables that were correlated to any dependent variables were then adopted by using multiple regression analyses.

4.5 Validity and reliability

In the social sciences, triangulation is used to validate naturalistic research associated with constructionist epistemology (Golafshani, 2003). The idea behind triangulation is that it leads to a more confident and reliable construction of reality by engaging multiple research methods. Cohen and Manion (1994) pointed out that triangulation helps the researcher fully explain the complexity of human behaviour from different points of view. It enables the researcher to overcome the weakness

or problems generated from a single source. Among the four basic types of triangulation identified by Denzin and Lincoln (2000), data and methodological triangulation were selected for this study. Data triangulation involves time, space and persons whereas methodological triangulation involves using more than one method. Data triangulation attempts to map out a phenomenon with different time and spatial dimensions to render the results easier to compare. Methodological triangulation requires the author to crosscheck data regarding the same phenomenon using multiple methods. This was applied throughout the research process, including the survey, observations, workshops and especially in the selected case studies. In this study, data and methodological triangulation were used in two ways: (1) using different methods to examine the same situation. For example, the researcher conducted non-participant observations and interviews with residents in residential housings; and (2) using the same method in different situations. For example, observations were conducted in the same space with the same group at different times, and vice versa.

4.6 Summary

This chapter discussed epistemology, theoretical perspectives, methodology and methods and provided a comprehensive description of how and why they have been applied in this study. The framework of this study, in relation to the research aims and methods, was outlined. Constructive action research methodology dominated.

The first phase consisted of a literature review of the research terms, historical developments and theoretical foundations, which were presented in chapters 2 and 3. The literature suggested that recycling behaviour is socially and culturally formed in a society, and that contextual factors are significant elements that affect human behaviour. In the second phase, a survey was conducted to provide a general

impression of people's attitudes and to identify what contextual factors could influence sustainable behaviour. This phase also provided supplementary data for selecting the case studies later on. In the third phase, targeted case studies, triangulation was used to collect data from twelve selected sites, with the aim of gaining an in-depth understanding of people's behaviour and context. The final phase described the iterative development process of designing and evaluating a prototype through a 'step by step' spiral approach, not only to explore opportunities but to identify barriers and to have the experience of using PAR in actual practice.

CHAPTER 5 Contextual factors affecting sustainable behaviour

In dealing with recycling issues, researchers and environmentalists have focused mainly on policy and management initiatives. Various studies of waste management have been conducted in recent decades (Chan & Lee, 2006; Fahy & Davies, 2007). Some researchers emphasise that a lack of economic incentives and moral motivation has led many citizens to practise free-riding on the contributions to recycling made by others (Chung & Poon, 1996; Hage et al., 2009; Yau, 2010). However, the impacts of contextual factors such as social culture and living environments on recycling activities and human behaviour are seldom discussed, especially in the communities with dense population.

This chapter analyses the factors affecting recycling behaviour from the inhabitants' perspectives. Personal factors, such as norms and attitudes, and contextual factors, such as social culture and physical settings, are examined.

This particular focus of this chapter is on the contextual factors. In this regard, sustainable recycling behaviour is determined not only by physical aspects such as the quality of the built environment and recycling networks, but also on the social aspects such as human ties within a community (Steg & Vlek, 2009; Stern, 1999; van Diepen & Voogd, 2001). In this chapter, the context is divided into three aspects: physical context, social context and socio-cultural context. This provides a framework of contextual information related to personal behaviour in which the field operates as a holistic system encompassing relevant variables such as customs, the neighbourhood, neighbours, the community, facilities and lifestyles. By describing each aspect associated with recycling behaviour, this chapter analyses

how sustainable behaviour in carrying out daily activities is facilitated or constrained.

Based on an analysis of the socio-cultural context, the culture of convenience, a prominent cultural factor affecting sustainable behaviour, is further examined to gain a clear understanding of what convenience means and to identify how to approach convenience in terms of public design and management. By illustrating institutionalised rhythms and the challenges to achieving convenience in recycling, several recommendations on how to approach 'convenient recycling' are proposed. This study provides insight for future design work and references for researchers on how to encourage household and community participation in recycling by making it convenient.

5.1 Factors affecting recycling behaviour

A survey addressing the factors that affect sustainable recycling behaviour was conducted in Hong Kong in 2014 and 2015. Six hundred twenty-five residents from various housing estates were randomly recruited from three housing sources (PRH, HOS housing and private housing). Figure 5.1 shows the results from the inhabitants' points of view. According to the self-report questionnaires, 17% of respondents mentioned they recycled frequently while over one third claimed that they did not recycle. Half of the respondents claimed that they recycled occasionally. When asked the reasons why most of the people did not participate in recycling, 76% claimed inconvenience was one of the major reasons for disposal behaviour. Time- and energy consuming were important issues that most of respondents concerned. Further details on the findings of 'convenience' can be found in Section 5.5. For a large number of residents who seldom or never participated in recycling, they were not willing to spend time on recycling because

they thought it as a burden. Inadequate or poor design and public awareness were other important reasons that led to low rate of participation in recycling. 48% claimed that the recycling bins were neither enough nor effective in their neighbourhood. 41% mentioned the tiny indoor space made it difficult for them to storage recyclables at home. Besides, 26% claimed that it may cause some sanitary issues if they stored rubbish and recyclables at home for a long time. Monetary incentive is an important factor that can promote behaviour change, yet, only 23.5% of respondents claimed that people did not willing to participate in recycling due to the lack of economic incentives. Social environments also had some impacts on human behaviour, for example, people may be influenced by other's behaviour (Lo & Siu 2010). 12% of respondents found it useless if they noticed their neighbours did not participate in recycling. Even there were some education and guiding concerning waste separation, 11% of respondents were unaware of how to separate materials. They did not actually know what materials could be recycled. Personal norms and attitudes were often widely discussed by many researchers (Hage et al., 2009). In this research, only a small number of respondents mentioned it was government's responsibility to deal with waste issues instead of themselves.

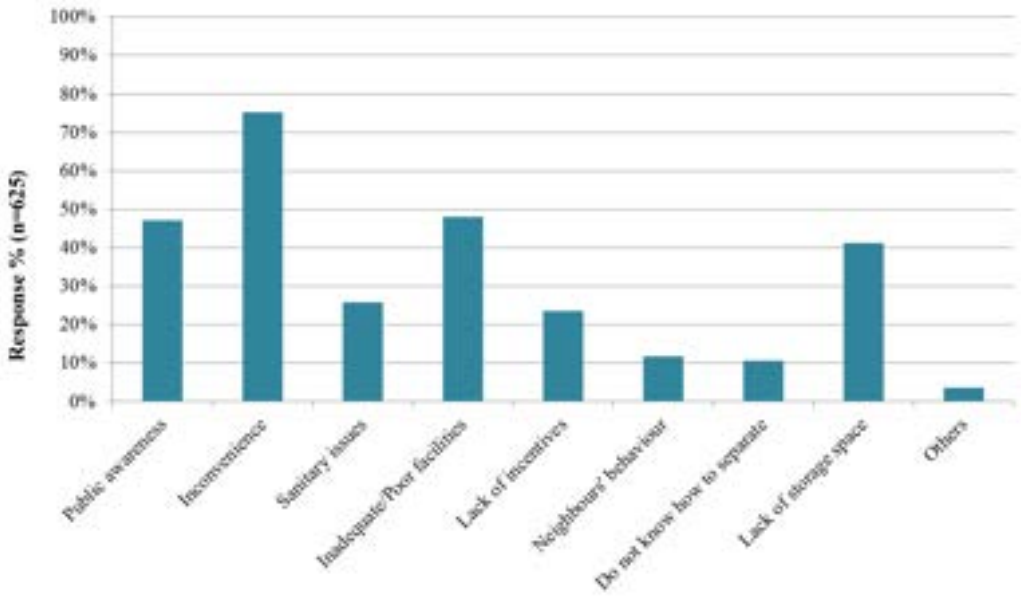

Figure 5.1 Factors that affect sustainable behaviour

5.2 Context and human behaviour

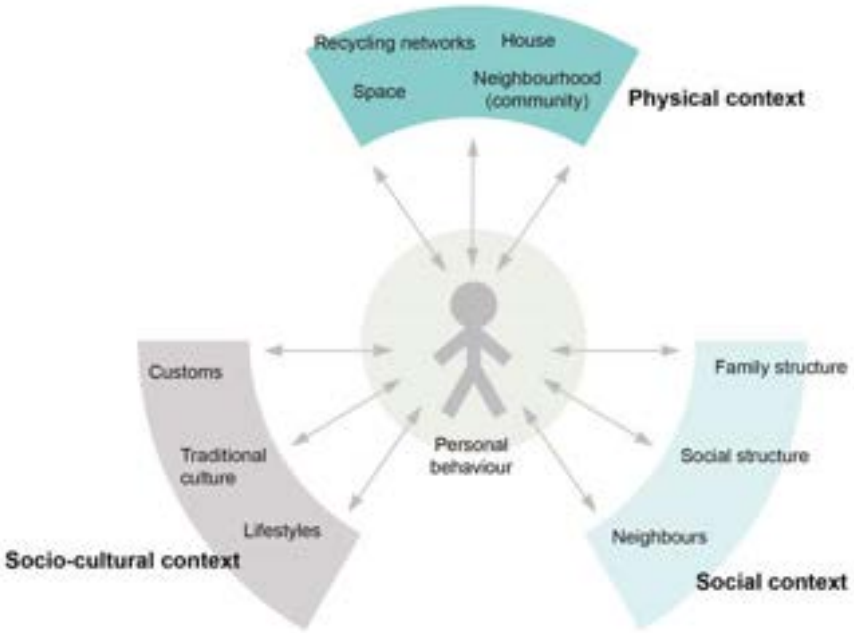

Figure 5.2 Contextual information in personal behaviour

In Lewin's early equation (Lewin, 1935), *E*(environment) includes social factors and physical factors. Martin et al. (2006) indicate that ignoring the social, cultural and structural aspects of people's lifestyles may lead to failure of understanding people's behaviour in recycling issues. Previous finding discussed in Section 5.1 also shows that cultural aspect - 'convenient lifestyles' is a prominent reason for unsustainable behaviour. Based on the findings from the literature review and survey, human behaviour in a local context was divided into three aspects: physical context, social context and socio-cultural context. The results show that these three aspects influence recycling behaviour holistically, forming the contexts and behaviour shown in Figure 5.2. As can be seen, there is a variety of contextual information regarding personal behaviour in which the field operates as a holistic system rather than as unrelated issues. The physical context includes built environments such as the neighbourhood (community), housing types, space, and recycling networks. The social context includes social and family structures and neighbours. The socio-cultural context includes the local culture with its customs, traditional culture and lifestyles. Each one of the variables in the framework such as customs, neighbourhood, neighbours, recycling networks and lifestyles indicate that they can affect human behaviour. For example, in the physical context, variety can result in distinctive cultural behaviour and practices, with people in the same environment behaving differently due to disparate cultural factors. In the following sections, Hong Kong is used as a case study for a more in-depth discussion, during which some of the key variables associated with recycling behaviour are presented. The result of the survey pertaining to what contextual factors affect human behaviour will be further discussed in Section 5.3.

5.2.1 Physical context

Neighbourhood (community)

Gifford (2011) indicated that neighbourhoods containing high-rise buildings are experienced as venues with low social involvement and a low sense of community. Some research investigating this has found a relationship between having a sense of community and various types of neighbourhood participation (Farrell, Aubry & Coulombe, 2004). Chavis and Wandersman (1990) examined the role of the neighbourhood in facilitating local action.

In the past few decades, Hong Kong society has undergone a tremendous change in terms of living conditions. Due to the high density of its population, many people have moved into high-rise buildings (Figure 5.3). Under the current living conditions, many people who live in high-rise buildings have become alienated from their community (Lee & Yip, 2006), and some people feel isolated even though they are living with others. Consequently, the way individuals behave seems to have nothing to do with the amenities surrounding them. Most of these inhabitants have a weak sense of belonging or attachment to where they live and as a result they have little interest in participating in recycling activities.

Recycling networks

There are several methods of waste recycling in Hong Kong, including recycling activities organised by the local authorities, NGOs and private recycling enterprises. In this section, two mainstream methods are focused on, covering a large number of population- public recycling facilities and private recycling sectors.

(a) Public facilities

Local authorities provide some recommendations for three-coloured recycling bins in public spaces in terms of locations for housing estates to install bins. According to the guidelines (EPD, 2005), self-closing lids should be designed to prevent

people from casually throwing burning objects such as cigarette butts into the bins, and to prevent fires from spreading if the waste is ignited (EPD, 2005). However, such self-closing lids discourage many residents from throwing in recyclables at all. Many people are unwilling to touch the lids, especially if the recyclables they carry are not hard enough to use as tools for opening the lids. According to the policy framework for MSW, recycling facilities are not approved in many buildings, or cannot be installed on every storey. The choices of where to locate the facilities depend on the available spaces and structures of the buildings. In some buildings with limited public space, recycling facilities can only be placed in the ground-level lobby. Hence, hundreds of residents in the whole building have to share one set of recycling bins. In buildings with large refuse storage rooms or refuse-chute rooms, these rooms are the most preferred locations to install recycling facilities. However, the closed environments of these rooms tend to trap odours, which makes it difficult for people to stay in the rooms long enough to separate their recyclables.

Figure 5.3 Current recycling facilities provided by local authorities.

The colours are used to help users understand the differentiation, such as blue for paper, yellow for metal and brown for plastics. Likewise, labels with small text and graphics are posted on each bin. However, due to the weak connection between the

colour and its symbolic meaning, a few residents find it difficult to recognise the three bins. Cleaners sometimes place plastic bags inside the bins to make collecting the recyclables easier, but the bags often cover the labels, further confusing the users (Figure 5.3).

(b) Private recycling sectors

In some old areas where a great many public housing projects are located, in addition to the recycling facilities provided by the government, active recycling networks have been formed by scavengers, elderly people, cleaners and private recyclers (Figure 5.4-5.5). This phenomenon is rather rare in the rich areas, especially in those neighbourhoods where the latest modern private housing is found. Consequently, the private recycling centres in public housing neighbourhoods have been more active than those in the private housing locales. For many private recyclers and enterprises, the recycling locations have been fixed in the neighbourhoods for a long time, which makes them easy for people to find. Some scavengers and elderly people even go from one recycling centre to another to collect recyclables from the community. The traditional physical settings make it possible and convenient for these people to sell the recyclables. For example, some scavengers, elderly people and cleaners collect recyclables and second-hand objects from households in the neighbourhood and then sell them to second-hand stores or recycling companies. This kind of cottage industry is common because these individuals rely on recycling to make a living. Although most of these people are profit-driven, this type of circulation can be regarded as a spontaneous and small-scale sustainable recycling practice.

Figure 5.4 Some scavengers simply set up a board to announce what kind of recyclables they collect.

In Sham Shui Po, an old district in Hong Kong where the median monthly household income lags far behind many other districts in Hong Kong, the private recycling networks are more active than in other districts. Many private recycling centres that collect recyclables and second-hand objects are located in this district. In public spaces near the subway, some hawkers sell second-hand objects (Figure 5.6). Many people regard the examination of these random collections as an enjoyable activity, and they are delighted to buy some of the objects they see. In this regard, both the hawkers and customers participate in recycling practices in an unconscious but positive way.

Figure 5.5 Private recycling sectors

Figure 5.6 Hawkers sell second-hand items in Sham Shui Po.

Building types and space

The high-rise living situation and constructed communities in Hong Kong differ greatly from the neighbourhoods comprised of single-storey or low-rise buildings, making it challenging to practice waste separation in both public and private spaces.

As mentioned in Chapter 4, there are three main types of housing in Hong Kong: PRH, HOS and private housing, with various types of accommodations and stratified living environments. Local authorities provide PRH to low-income citizens who cannot afford to rent private accommodations. HOS housing is sold to low- and middle-income families based on HOS schemes to help them improve their living conditions. Private housing is developed by private developers according to the market-oriented economy.

PRH in Hong Kong dates back five decades, and was initially provided to house victims affected by the big fire in Shek Kip Mei squatter area in 1953 (Smart, 2006). The poor living environments of squatter huts, which were blighted by hygiene and security problems, urged local governments to deal with the severe situation (Lee & Yip, 2006). Some public housing estates are still being built or repaired to provide

better accommodation for residents. In general, most public housing is standardised in terms of design and layout. There are several types of PRH, including the earliest ‘old slab’ with a long corridor on each floor, the second-generation ‘twin tower blocks’ and ‘I blocks’ built in the 1970s, the third-generation ‘trident blocks’ with more than 30 storeys built in the 1980s, and the latest-generation ‘harmony blocks’ and ‘concord blocks’ that have been in wide use since the 1990s (Wang & Lin, 2013; Yeung & Wong, 2003). In some large-scale public housing estates, the neighbourhood is a self-contained community that shares various facilities and social services such as wet markets, recycling facilities, shops, parks and community service centres. However, in some of the old public housing, the communal space is so limited that it is difficult to install any public facilities.

In terms of public space, some high-rise buildings have refuse storage/material recovery rooms or refuse chutes in the common areas. Other buildings, such as walk-ups, are too narrow to accommodate collection bins. Such complexity and variety of living conditions makes it difficult to apply collection facilities in a systematic, effective way. For example, in some PRH estates, hundreds of households have to share just one set of waste-separation bins located on the ground floor (Figure 5.7). Research has shown that many high-rise buildings only provide one set of recycling bins on the ground floor. The habitants have to bring their recyclables downstairs if they want to participate in recycling. In the old-style public housing estates, the residents must walk down a long corridor and then take the elevator to the ground floor to the recycling bins.

Figure 5.7 Public spaces in PRH

In terms of private space, most flats in Hong Kong are very small, especially in the PRH estates. In contrast to other cities that have enough dwelling space, the limited space in Hong Kong makes it difficult for residents to store a large amount of recyclables. It is also impractical to set up different types of bins or bags for different recyclables. The limited household space and especially the tiny kitchens, make it particularly difficult to store recyclables by category. In general, residents tend to put all types of recyclables in one bag or container and then separate them when they go to the recycling bins (Figure 5.8).

Figure 5.8 The limited household space makes it difficult to store a large quantity of recycables.

5.2.2 Social context

Family structure: family roles and home manager

In terms of family structure, the average household size in Hong Kong has experienced a continuous drop, from 3.7 in 1985 to 2.9 in 2011. According to the population census, the fertility rate decreased by 37% between 1981 and 2011 (CSD, 2012). The responsibilities of women as housewives are therefore quite different from what they were in traditional society. For example, in previous decades many families had more than one child, and housewives had to stay at home to take care of the children and household chores. Some housewives took part-time jobs, but they also had to manage the household chores after getting home from work. In the 1970s, however, as the economy grew and the fertility rate continuously decreased, many women found more opportunity to enter the full-time labour force. Due to the long hours and high-pressure involved in such work, these women had less time than before to take care of their families (Lo & Siu, 2010). Over time, the responsibilities of each family member have shifted. For example, many men now offer some help to their wives with specific domestic tasks. However, the general sense concerning family roles and gendered responsibilities has been maintained. In most families, the wife is still regarded as the home manager, with primary responsibility for the domestic tasks.

Although recycling practices are targeted at every individual, the member of the family who has primary responsibility for handling the everyday household tasks is the person most related to waste recycling. Bernardes (1987) emphasises that the whole family is a social group that clearly addresses social behaviour/responsibility in terms of its roles. The roles of ‘wife’, ’husband’ or ‘child’ involve corresponding responsibilities, which are confirmed and reinforced through everyday practices

(Gregory, 1999; Graham, 1985). The term housewife implies the entire gender-specific responsibility of ‘wife’ – not only the female reproductive role (in childbirth and parenting) or the caring role (for husband and children). The housewife role includes responsibility for household chores, which are commonly seen as the wife’s ‘job’.

Social structure: the increasing number of domestic helpers

Society in Hong Kong has undergone a tremendous change in the past few decades, with major shifts in living conditions, family structures and levels of financial income or education. The role of labour has changed as the effects of global restructuring. Since the 1980s, as financial problems in the Philippines have grown worse, many Filipinas have left their homes and searched for jobs in other places across Asia. Meanwhile, with the increasing number of double-income families in Hong Kong, numerous middle- to upper-class people have found themselves in great need of domestic workers who could substitute for them in caring for their children and households. Thus, a large number of Filipinas have been approved to come to Hong Kong and work as ‘helpers’, which allows educated local women to participate in full-time work. By 2010, according to the CSD (2012), over 280,000 Hong Kong households had hired foreign domestic helpers. This emergence of foreign domestic helpers has changed the role of many housewives in Hong Kong. With the help of domestic workers, women have been increasingly released from boring household chores, and enabled to pursue new lifestyle options and gain a higher social status. In many families, women are no longer regarded as ‘housewives’ because they have passed on the household chores to their domestic helpers.

In general, the duties of household management include cooking, cleaning, ironing and child care. The kinds of duties that should be taken by a domestic helper depend on the requirements of the employer. Even if most domestic workers are less educated and work long hours for low pay, they are still mature and responsible people. As suggested above, a domestic helper will participate in recycling practices if her employer requires it. From time to time, the helper brings the recyclables to the collection bins, wherever the bins are located, because she realises that this is part of the job, like cleaning and cooking. Hence, in families with domestic helpers, the employer plays an important role in recycling activities, even if a helper is hired to deal with the household chores. In some families whose members are well educated and environmentally aware, recycling activities are conducted effectively, either by the family members or the domestic helper. With instructions from the employer such as ‘put these newspaper and clothes into the recycling bins’, the domestic helper has a clear understanding of her responsibilities. Recycling is thus considered one of the domestic tasks to be done, and it soon becomes a habit.

Although the domestic helper works as a substitute for the housewife, she has little decision-making power in family issues. All lifestyle options (e.g., habits, behaviour and taste) are determined by the home manager, who arranges or allocates domestic tasks. In others words, the home manager plays a vital role in source separation regardless of whether a domestic helper is hired.

Neighbours

Although the neighbourhood is perceived as being a large physical space where social interaction occurs, only a few people are active neighbours. Most people seldom have contact with their neighbours (Forrest et al., 2002) and are likely to

close their iron gate and alienate themselves from the community. As Lee and Yip (2006) emphasised, interaction between neighbours is minimal and the relationships are ‘loose’. Even if they live side by side in the same neighbourhood, people seldom see or get to know each other. Individuals’ daily lives are manipulated by their schedules and the routines of everyday life that are highly stylised. Large numbers of people go back and forth between work and home, following schedules that are set by social conventions. They share the corridors, elevators and other public facilities in their community, but they seldom talk with those around them. This situation increases the challenge of spreading propaganda related to recycling activities. People are less interested in recycling when they see that their neighbours are not participating in the process and there is no information to counter it.

5.2.3 Socio-cultural context

Culture of convenience

Hong Kong is a highly dense, fast-paced city with a modern lifestyle. Compared to other developed cities, convenience is a prominent characteristic of Hong Kong’s scheduled society. In the past few decades, Hong Kong society has undergone tremendous changes in its living conditions, family structure, financial income and educational levels. In terms of the family structure, in the past many women stayed in the home as housewives. Today, many women have the opportunity to enter the full-time labour force. Due to the long hours and high-pressure working conditions, they have less time than before to deal with domestic tasks (Lam et al., 2012; Lo & Siu, 2010). Convenience is thus a desirable attribute, especially for home managers.

‘Convenience’ means ‘the state of being able to proceed with something without difficulty’ (Oxford English Dictionary online, 2014). The ongoing discussion of convenience and human behaviour indicates that convenience is a multidimensional construct. Yale and Venkatesh (1986) explore six categories of convenience: time use, handiness, appropriateness, portability, accessibility and avoidance of unpleasantness. Brown (1989) argues that some of these categories are ambiguous and difficult to measure, and thus proposes more general dimensions of convenience: time, place, acquisition, use and execution. However, after exploring the construct of convenience, Brown and McEnally (1992) suggest that the categories can be further modified and reduced to two dimensions – time and energy – from which they provide the following definition of convenience:

> Convenience is a reduction in the amount of consumer time and/or energy required to acquire, use and dispose of a product or service relative to the time and energy required by other offerings in the product/service class (p. 49).

Similarly, Gofton (1995) suggests that convenience refers to people’s capacity to acquire or gain access to resources and to ‘time availability’. ‘Time availability’ refers not only to timesaving but also to the efficient use of time (Brown & McEnally, 1992). Some researchers suggest that money is interchangeable with time and energy (Linder, 1970, Southerton, 2003). It is also necessary to evaluate cost when considering convenience. The aforementioned research defines convenience and its construct based on the perspectives of consumption and marketing to provide hints as to the methods by which marketing can satisfy consumers. The convenience of acquisition is one of the most obvious factors that lead to symptomatic excess waste, but the means by which the disposal phase of

convenience affects recycling activities remains unclear. Disposal characteristics affect people's perceptions and behaviour, which determine whether they sort their recyclables.

In line with 'time availability', the terms 'rushed' and 'harried' have been widely discussed by some sociologists and economists (Hewiit, 1993; Linder, 1970; Southerton, 2003). The pace of daily life in Hong Kong is commonly perceived to be very fast amidst an overall shortage of time. The city is constantly busy, especially during rush hours, as crowds of people board and exit trains, buses, footbridges and elevators. The schedules for mealtimes, working rotas and sleeping act as the institutionalised rhythms that structure people's everyday lives. The 'routinisation' of everyday life is one of the key challenges for changing human behaviour (Jackson, 2005).

The terms 'rushed' and 'harried' are directly related to having limited time, yet some research has shown that people perversely choose to 'rush' despite having enough time to relax (Cross, 1993; Linder, 1970). 'Time budget' is Southerton's (2003) explanation of this particular phenomenon. As Darier (1998) notes, 'speeding up', 'being busy' and being 'rushed' and 'harried' all represent a 'full' and 'valued' life. In this way, people legitimise unsustainable behaviour because of their need to budget their time. In many cases, citizens are generally not even willing to bring their recyclables to recycling bins, even if they regularly pass the recycling facilities.

Socio-economics

Unlike many other places that have implemented chargeable policies such as 'pay-as-you-throw', Hong Kong still provides household waste management for free.

Among the local residents, waste disposal behaviour has long been an ingrained habit. Most people lack awareness of environmental issues, and do not recognise the meaning of recycling (Tam & Tam, 2006; Yau, 2010). Further, only a limited number of people are personally concerned with environmental sustainability and take the initiative to participate in recycling. Many people still rely on the efforts of others, maintaining a 'free-ride' mentality (Yau, 2010). Due to cultural factors, the ways in which people respond to policies or measures are complex and diverse. For example, people who are well educated or environmentally aware may think seriously about their social responsibility. Conversely, those who are living in poor conditions (e.g., in terms of living environment, economic status or access to education) are commonly absorbed in the struggles of everyday life and have little awareness of social responsibility. However, they are more likely to be active recyclers because they can benefit financially from selling their recyclables.

Traditional culture and habits

As mentioned above, in many families without domestic helpers, housewives predominantly deal with household chores. In the past, most housewives took on part-time jobs or stayed at home to take care of their families. Today, however, most housewives are involved in full-time, high-pressure jobs. Their long hours make it difficult for them to spend too much time on domestic tasks. Most females are less enthusiastic about recycling than males because they recognise the burden associated with waste separation

Traditional Chinese food habits dictate a preference for fresh food rather than food from cans and jars (Martin et al., 2006). In Hong Kong, people are prone to go to the wet market instead of the supermarket. Food waste from the wet market has a high proportion of water and putrescible material that may cause hygiene problems

if not handled properly. To save time and to avoid hygiene problems people tend to pack food waste, packaging and other rubbish into plastic bags and get rid of it as soon as possible.

5.3 Contextual factors affecting recycling behaviour

Pursuant to the findings from the literature review and the observations described in Section 5.3, a decision was made to statistically analyse the contextual factors associated with recycling behaviour to support the arguments. The following sections examine survey data to determine what contextual factors, mentioned above, affect recycling behaviour.

Variables

Table 5.1 Hypothesised indicators of Contextual factors for sustainable recycling behaviour.

	N	***M***	***SD***
Employment	499	2.86	1.292
Educational attainment	505	2.29	.703
Dwelling density	505	1.73	.676
Housing type	505	.48	.500
Monthly household income	503	3.23	1.245
Availability of recycling facilities nearby	505	.58	.494
Availability of private recycling sectors nearby	505	.46	.499
Satisfaction with the location of recycling facilities	505	2.92	1.117
Perceptions of the usability of public recycling facilities	505	2.82	.998
Perceptions of the private recycling sectors	505	2.92	1.218
Satisfaction with residents' participation	504	2.22	1.145
Perceptions of accommodation	505	2.86	.931
Satisfaction with neighbourhood/community space	502	2.84	.963

In this study, the predictor variables included both objective and subjective indicators of contextual factors. Previous studies have indicated that people's satisfaction with physical conditions directly and or indirectly influences their behaviour (Fullerton & Kinnaman, 1996; Hage et al., 2009; Lee et al., 1995; Marans, 2015). The convenience of access to public and private recycling facilities or services is a major determinant of residential satisfaction, which can result in the residents' willingness to participate in recycling (Vrbka & Combs, 1993). In addition, people's sense of relatedness to the neighbourhood can affect their level of involvement in community activities (Forrest et al., 2002; Nigbur et al., 2010). Socio-demographic variables were included in the survey, because it has been well documented that the socio-economic and demographic status of the residents can be an important factor that affects recycling behaviour (Belton et al., 1994; Martin et al., 2006). Based on the previous studies, the following selected attributes of contextual factors associated with recycling behaviour were tested. Different factors including physical settings, social setting, and respondents' sense of surroundings that related to contextual factors were examined (Table 5.1). Since culture factors are hard to measure in a quantitative way, the author attempts to identify these issues based on qualitative data by following sociological and anthropological research methods, which will be discussed in Section 5.4.

Sustainable recycling behaviour was the dependent variable, and the study examined this variable's relationship with the hypothesised indicators listed above. As the author wished to shed light on the effects that various contextual indicators have on sustainable recycling behaviour, two variables were used to measure household participation in recycling, namely UPRF and UPRS.

5.3.1 Results

Correlations

Table 5.2 shows that the physical setting, social context and their sense of surroundings were directly correlated to the recycling behaviour. People who were satisfied with the location and design of recycling facilities or with the private recycling sectors reported higher participation in UPRF and UPRS. The respondents' attitudes towards participation and their satisfaction with the neighbourhood significantly correlated with UPRF, but not with UPRS. Monthly household income showed a positive relation to UPRF, but a negative correlation to UPRS. Other socio-economic variables such as educational attainment, dwelling density and housing type did not show any significant correlations with UPRF, but had a negative correlation with UPRS. The availability of nearby recycling facilities and the perceived quality of public facilities did not show any relation to UPRS. Also, no significant correlations appeared between the availability of private recycling sectors and UPRF. The findings showed that the availability of nearby private recycling sectors was significantly correlated with housing types. Private recycling sectors were more accessible in public housing estates than in private housing areas.

Table 5.2 Correlations between variables

Variables	***UPRF***	***UPRS***
1. Employment	.092*	-.036
2. Educational attainment	.023	-.088*
3. Dwelling density	.061	-.294**
4. Housing type	.066	-.451**
5. Monthly household income	.127**	-.655*
6. Availability of recycling facilities nearby	.559**	-.025
7. Availability of private recycling sectors nearby	.006	.570**
8. Satisfaction with the location of recycling facilities	.599**	-.037
9. Perceptions of the usability of public recycling facilities	.339**	.000
10. Perceptions of the private recycling sectors	.009	.540**
11. Satisfaction with residents' participation	.526**	.024
12. Perceptions of accommodation	.351**	-.109*

13. Satisfaction with neighbourhood	.537*	-.507

*p< .05; **p< .01

Multiple regression analyses

Predictor variables that were significantly correlated with the dependent variable were used in the multiple regression analyses. Dwelling density was not entered into the multiple regression analyses, because it was highly correlated with housing type and could cause a problem with multicollinearity. As indicated by Wang and Lin (2013), 81.1% of PRH units have a relatively small unit size (< 40.0 square metres), but over 80% of private housing units have 40.0 square metres or more.

Table 5.3 Multiple Regression Analyses Model 1: UPRF

Variables	***Model 1*** ***R= .770, R^2= .593, Adjusted R^2= .586, DW=2.281***
Availability of recycling facilities nearby	.308***
Satisfaction with the location of recycling facilities	.239***
Satisfaction with residents' participation	.235***
Satisfaction with neighbourhood/community space	.168***
Perceptions of accommodation	.125***
Perceptions of the usability of public recycling facilities	.044
Employment	.036
Monthly household income	.017

*p< .05; **p< .01; ***p< .001 Note: β= standardized betas.

The results of the multiple regression analyses of independent variables in relation to UPRF are presented in Table 5.3. The R^2 indicated that 59.3% of the total variance in the dependent variable was explained by the independent variables. The residents' satisfaction with their surroundings had a significant influence on recycling behaviour. The findings suggested that the availability of nearby

recycling facilities, satisfaction with the location of recycling facilities, satisfaction with other residents' participation, and satisfaction with the neighbourhood and with accommodation were the most significant predictors of UPRF ($p < .05$). In this survey, only 48 respondents (9.5%) mentioned that recycling facilities were installed on each storey of their building. The vast majority (90.5%) of the respondents said that the common locations were lobbies, entrances of buildings and open spaces outside the buildings. In other words, in many high-rise buildings, hundreds of household units had to share a single recycling facility. As has been shown previously, people's enthusiasm for recycling tends to decrease when they have to bring their recyclables to the ground floor (SITA, 2010). The findings also showed that in the housing estates where recycling facilities were installed on each storey, the rate of use for the public recycling facilities significantly increased. Among these 48 respondents, the mean satisfaction rating with the location of public recycling facilities was 4.58 (1 = very poor, 5 = very satisfactory), and the rate of use for the recycling facilities was 81.25%.

Although socio-demographic variables such as employment and monthly household income were correlated with recycling behaviour, these variables were not able to predict UPRF significantly. This result is consistent with that of previous research. As discussed earlier, the situation in Hong Kong is quite different from that in many Western cities, where affluent and well-educated people are the most active recyclers (Chung & Poon, 1994; Martin et al., 2006). In this study, the respondents with higher educational attainment and greater monthly household income did not show higher participation in UPRF. In addition, perceptions of the usability of public facilities were not shown to be significant predicators for UPRF. In other words, people recycled (or not), regardless of the design of the recycling facilities.

Table 5.4 Multiple Regression Analyses Model 2: UPRS

Variables	***Model 2*** ***R= .753, R^2= .567, Adjusted R^2= .562, DW=2.120***
Monthly household income	-.466***
Availability of private recycling sectors nearby	.299***
Housing type	-.095*
Perceptions of the private recycling sectors	.105*
Perceptions of accommodation	.033
Educational attainment	.052

*p< .05; **p< .01; ***p< .001 Note: β= standardized betas.

shows the results of the multiple regression analyses of independent variables for UPRS. The R^2 indicated that 56.7% of the total variance in the dependent variable was explained by the independent variables. Monthly household income and availability of nearby private recycling sectors were the most significant predictors of UPRF (p < .05), followed by housing type and perceptions of the private recycling sectors. Perceptions of accommodation and educational attainment did not predict UPRS significantly, although these variables were correlated with UPRS. Monthly household income was a strong predictor of UPRS, as this variable explained 46.6% of the variance. Respondents who had lower monthly household incomes reported that they participated in UPRS more frequently. Some of the old areas covered by this survey had massive public housing estates in which the government-provided recycling facilities were supplemented by the activities of scavengers, elderly people and private recyclers, who formed active recycling networks. These phenomena, however, were rather rare in richer areas, especially in those neighbourhoods with the latest modern private housing. Consequently, the private recycling sectors were more active in the neighbourhoods of public housing than in areas of private housing. Respondents who lived in public housing were

prone to sell their recyclables, not only because of the economic incentive, but also due to the accessibility of private recycling sectors.

5.3.2 The quality of environments and recycling behaviour

The quality of local environments was important for encouraging recycling behaviour. The results from the interviews showed that both physical and social context significantly influenced sustainable behaviour, as shown in the following quotations from the participants.

a) Accessibility of recycling networks

In alignment with the results from the questionnaires, the interviewees raised several points about the issue of accessibility. The accessibility and convenience of recycling networks were of great concern. In general, most of the recycling facilities were installed in the building entrance.

> Respondent: I don't know how many people participate in recycling practices in my neighbourhood. However, I will continue insofar as I can. I feel I'm not alone in that when I notice that there are some recyclables in the bins, even only a few … I'm still satisfied with the public recycling facilities because they are quite accessible.

b) Sense of community and satisfaction with neighbours

Unlike the sense of neighbourhood that was found in resettlement blocks in the past, most residents of the existing public housing estates regard their living environment as a physical space with low social involvement (Forrest et al., 2002; Mitchell, 1971). People's satisfaction with the neighbourhood and with accommodation

could significantly influence recycling behaviour. The results of our study revealed that the percentage of respondents who were very satisfied with their neighbourhood was relatively low. Most of the respondents had a weak sense of their surroundings and low satisfaction with their neighbourhood. Respondents who felt this way had little interest for participation in recycling.

c) Socio-economic factors

Some respondents mentioned that economic incentives had encouraged them to participate in recycling. They mentioned that they used private recycling networks to benefit financially by selling the recyclables. One respondent indicated that many of her neighbours recycled by using public facilities, because a reward scheme was applied in her neighbourhood.

> Respondent: Some of my neighbours use the public facilities frequently. In general, the management staffs of our housing estates collect recyclables and then sell them to recycling enterprises. The residents are given some subsidies for community activities such as barbeques and trips as a reward.

In their interviews, the participating private recycling enterprise operators and scavengers said that they were mainly motivated by socio-economic factors. Their attitudes towards recycling behaviour were quite simple. The four intermediaries interviewed all mentioned that they collected recyclables every day because they had to make a living.

> Intermediary: We have run this business for more than ten years. Frankly speaking, our business is on a small scale and I have to work

hard to feed my family. Many neighbours know us well. They sell some waste paper to me frequently.

Intermediary: I collect waste paper and plastic bottles every day. As it is not allowed to get recyclables from the recycling bins, I have to collect these materials from shops, streets and rubbish bins. Also, some warm-hearted residents frequently give me their waste paper, such as newspaper.

5.4 Convenience and Recycling

Because ‘inconvenience’ was identified in Section 5.1 as having the most significant effect on recycling behaviour, this section considers convenience from the perspective of consumers, and elucidates how to improve recycling design and management to encourage household and community participation in terms of convenience.

Following the definition of convenience discussed above, the categories of convenience can be reduced to time and energy (Brown & McEnally, 1992). To obtain people’s perspectives towards the convenience of refuse and recycling facilities, time and energy were taken into consideration as well. Figure 5.9 shows the degree of convenience and the time/energy requirements of different recycling methods from the perspective of the participants. The methods of refuse and recyclable collection highlighted in Figure 5.9 are the methods commonly used in Hong Kong. On the basis of the data collected through the interviews, it was noted that many participants considered the existing refuse collection system to be very convenient and considered the recycling facilities to be less convenient.

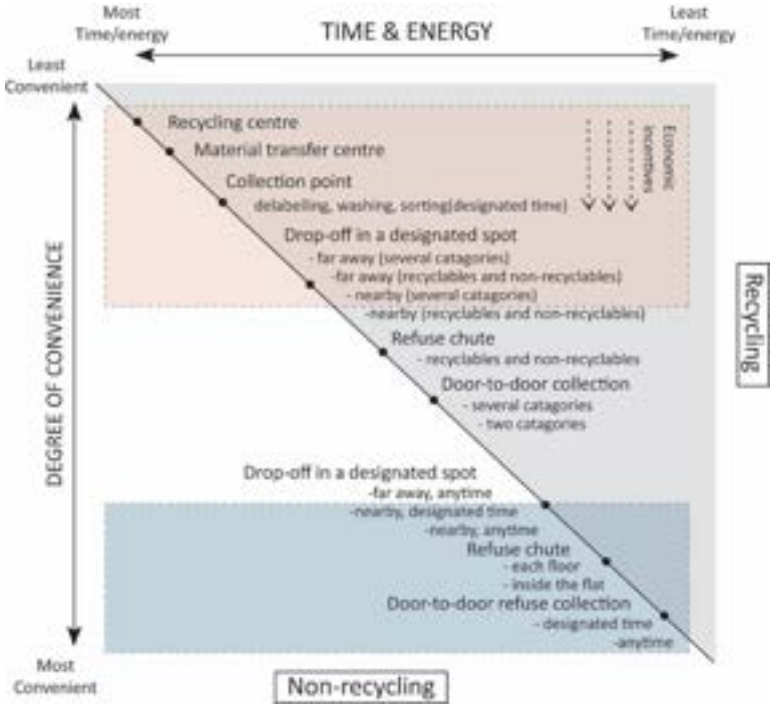

Figure 5.9 The degree of convenience and time/energy requirements of different means of recycling

According to the EPD (2010), the recycling network, including the recycling facilities, collection points, material transfer centres, recycle centres and second-hand exchanges, is accessible to households and communities. In practice, many separation facilities are provided in the entrances of buildings, which is a convenient and visible location from the point of view of property management. However, some of the participants emphasised that the recycling facilities were neither sufficient nor convenient. In effect, this belief was not only a result of the inadequate and inefficient recycling facilities, but also because the subjects found that dumping their waste without sorting was easier and saved them time and energy. In contrast to the refuse collection methods in the other areas of Asia mentioned above, the gap between recycling and not recycling in terms of convenience is rather obvious. In these cases, people will not be charged or

punished if they do not separate materials; thus many citizens are more likely to choose the quicker and more convenient way to deal with their waste.

According to general understanding, door-to-door recycling collection was regarded as the most convenient way for many of the participants, especially for those who lived in public housing estates. However, according to the interviews with cleaners, door-to-door collection imposed a heavier workload for them because they had to spend more time and energy handling the recyclables and non-recyclables from hundreds of flats. In terms of categories, for some participants, binary recycling was considered a relatively convenient and time-saving method if they had to separate materials.

In addition, the researcher found that economic incentives could shift the degree of convenience in line with the discourse above. Many participants emphasised that recycling was time- and energy-consuming and that they did not have time to separate recyclables. They typically were not willing to spend time on housework because they regarded it as a burden. Nevertheless, with regard to volume-based fees and deposit-refunds, some of them indicated that separation was not so inconvenient, because they did not need to spend too much time, energy or space on collection and because they were rewarded for doing so. In these cases, the residents actively collected the recyclables due to the positive feedback from their recycling efforts, proving that time and space are not as limited as so many claim.

5.4.1 Institutionalised rhythms: allocation of time

The term ‘rhythm’ is closely related to everyday life (Lefebvre, 2004). Rhythms are everywhere, repeated, crossing and re-crossing. Where there is interaction between body, space, and time, there is rhythm. Lefebvre (2004) points out the rhythm is the

inhabitant who moves in space and that the natural space involves body movement. Each individual has his or her own personal rhythm, just as a society has its social rhythm. The standardised social time and technological efficiency may be far away from a person's inner experience. Lefebvre draws attention to 'micro-scale' events taken by 'ordinary people', 'common people' or the 'grassroots class'. In general, it involves the whole process of people's lives, including their activities, practices, strategies and perception in space and time (Simonsen, 1997).

Figure 5.10 After the removal of rubbish bins, some residents still disposed of their waste in the public space if they missed the designated collection time

In some old public housing estates, the residents placed bags of waste in the corridor in front of their door to wait for door-to-door collection by the cleaners twice a day – a very convenient method. In the evening, the common collection time was around 8:00 pm. If the residents missed the collection time, most of them did not put their waste in the corridor due to hygiene concerns. Instead, they walked through the corridor and dropped their bag into the large rubbish bins. Many people arrived home late in the evening. Their 'subjective' collection time was different from the 'objective' time. Recently, in some housing estates, property managers have removed the rubbish bins on each storey for more effective waste collection. However, the traditional disposal behaviour has been formed over a long period and removal of the rubbish bins has led to significant irritation. As a result, some

residents were found to dispose of their waste in the same place even though the bins had been removed (Figure 5.10). Over the course of our in-depth study within six families, the researchers noted that the traditions of waste disposal behaviour were well-formed, long-ingrained habits. The daily schedule that embodies the stability of the temporal structure of everyday life is difficult to change (Jackson, 2005). In many double-income families without domestic helpers, women still assume the key role with regard to the domestic household chores. Women's daily routines contain not only full time and high-pressure work but also a high proportion of the domestic chores. They have a clear understanding of the workload of source separation; thus the women studied showed less interest in source separation than other family members. For example, Mrs Poon, a saleswoman married to a builder, began her description of an ordinary weekday:

7:55 Wake up and remind son of time
8:35 Leave home and go to work
18:00 Get off work and go to wet market
19:30 Arrive home and prepare for dinner
20:30 Have dinner and watch the soap opera (20:30-21:30) with family
21:30 Do some cleaning – wash the dishes, throw away the rubbish, sweep the floor, etc.
22:30 Take a bath and get ready to sleep

> Resident (Mrs Poon): I'm very busy, you know, every day when I go home … it is very late. I have to prepare for the dinner for my family. After finishing dinner, it is over 9 o'clock. I don't have adequate time on household chores. I just need to walk within 30

> second to the rubbish bin near the elevator to dispose of waste. So why not choose such a convenient and easy way?

In the interviews, the participants often used the Cantonese term ‘ma fan’ (i.e., inconvenient, troublesome) to express their view towards recycling.

> Resident: Many local people like us are afraid of ‘ma fan’ things. It is so ‘ma fan’ to separate recyclables. Disposal is so convenient … why should we spend time on source separation?

5.4.2 The challenges of achieving convenience of recycling

A dilemma: safety or convenience?

Jackson (2005) points out that the identification of barriers within a specific context is the first step in the encouragement of pro-environmental behaviour. In practice, policies and legislation have some effect on the design of public facilities. The demands of standardisation make it difficult for recycling facilities to accommodate the living situations in densely populated high-rise buildings. After the *Shek Kip Mei* squatter-camp fire destroyed thousands of houses in 1953, fire legislation was fortified (Smart, 2006). Security related to fire legislation takes priority over convenience and accessibility, especially in high-density housing estates. For example, recycling facilities must be installed in refuse storage rooms or corners to avoid hindering people’s movement. According to the policy framework provided by the EPD, public spaces such as refuse storage rooms, lift lobbies and entrances are preferred over corridors for the implementation of recycling facilities. In some cases, the installation of a recycling facility cannot be approved on every floor. In general, the recycling facilities are installed in one of the so-called ‘preferred’

locations, namely, the entrance of the building on the podium (Figure 5.11). The locations of these facilities are neither visible nor preferred by the residents. The appearance of these recycling facilities meets government expectations rather than the residents' perceptions.

Figure 5.11 The locations of recycling facilities

Moreover, to prevent people from throwing cigarette butts into the recycling bins and to prevent fires from spreading if the recyclables are ignited (EPD, 2005), each of the recycling bins is designed with a self-closing lid that hinders improper disposal behaviour, but the lid also discourages people from throwing their recyclables into the bins. Given the aforementioned hygiene concerns, most people are not willing to touch the recycling facilities, even if the lids are clean, and some bin designs cause recyclables to become stuck in the opening because the lids are difficult to open.

Both governments and individuals have a strong sense of public health. The proper recycling of food waste, which accounts for a large proportion of domestic waste, can reduce the stress on landfills, but the recycling or storage of food waste in housing estates can be a real challenge. People are not willing to store many recyclables, especially putrescibles (e.g., food waste), because they want to keep their houses clean. Waste is deemed a threat and in both public and private spheres people are urged to dispose of it as quickly as possible. Waste removal practices

are conducted in a fast and invisible manner to support the ideal of an absolutely pure and clean society. In practice, cleaners collect the waste from buildings once or twice a day, which increases the convenience of refuse disposal without sorting.

Limited space?

According to the field study, there are some physical limitations in the implementation and management process. Regarding recycling practices, the residents and property management officers studied mainly focused on:

a) Limited public space
b) Limited private space

As previously mentioned most of these facilities have a low-priority status and therefore have little effect on people's sustainable behaviour. Research has shown that many high-rise buildings have only one set of recycling bins located on the ground floor. The residents must bring their recyclables downstairs if they want to participate in recycling. In the old-style public housing estates, the residents must walk down a long corridor and then take the elevator to the ground floor to the recycling bins. The resulting level of participation in recycling is obviously unsatisfactory, as people seldom bring their recyclables to the separation bins or collection points. When they find that other residents in the neighbourhood dispose of their materials without any classification, their enthusiasm further decreases.

(a) Limited public space

As mentioned above, there are a variety of building and housing estate types with stratified living environments and accommodations. Some high-rise buildings have relatively large communal spaces such as refuse storage rooms, whereas some

walk-up buildings are too narrow to allow for the installation of any public facilities. The following options for collection systems illustrate the variety of living conditions and waste separation systems in Hong Kong.

Waste separation facilities are available on each floor or provided in various common-area locations (e.g., refuse storage rooms, material recovery rooms, cleaner rooms, water-meter rooms, lobbies or staircases), subject to the approval of housing and fire services authorities.

- A refuse-chute/waste collection bin is provided, with a central waste-collection area on the first floor or basement and waste separation facilities on the ground floor.
- A refuse-chute/waste collection bin is provided, with facilities for waste separation located in the neighbourhood.
- No chutes are provided. Rubbish bins are placed on each floor, with waste separation facilities on the ground floor.
- No chutes or separation facilities are provided. Rubbish bins are placed on each floor.
- No chutes, separation facilities or rubbish bins are provided. Waste is packaged and placed directly outside doorways in the corridors every day to wait for door-to-door collection.
- No chutes, separation facilities or rubbish bins are provided. A collection station is located in a nearby public area.

Such complexity and variety of living conditions makes the systematic or effective implementation of collection facilities difficult. In many other buildings, recycling facilities are unavailable due to the particular living situation (EPD, 2010). Given that rubbish bins are provided everywhere, many residents choose convenience

over sustainability and throw away their recyclables and waste without separating them. Some of the residents reported that inadequate facilities discouraged them from disposing of recyclables and that increasing the availability of such facilities would make it more convenient for residents to participate in recycling.

(b) Limited private space

In Hong Kong, most flats are very small, high-efficiency dwellings, especially in the public housing estates. The limited space in people's homes makes the storage of a large quantity of recyclables difficult and inconvenient.

Due to the limited interior space, it is impractical to set out different types of bins or bags for different recyclables. However, space is still available, if people learn how to make the most of it. Even in a flat of no more than a few hundred square feet, one resident was still able to find effective ways to store certain types of recyclables (Figure 5.12).

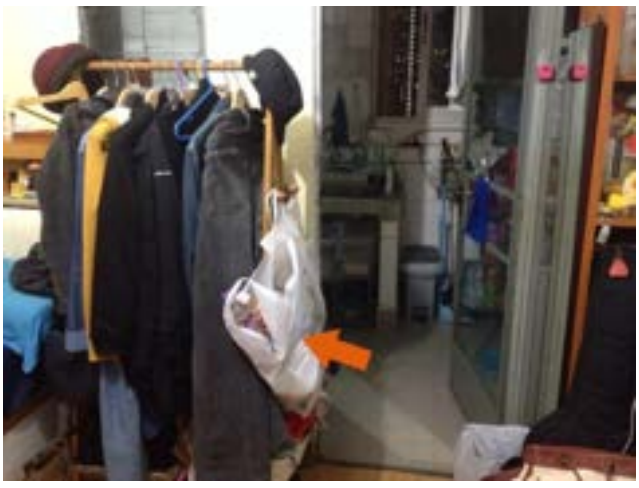

Figure 5.12 Recycling practice within a limited private space

Respondent: My 200 feet house is quite suitable for me. Normally, I put all types of recyclables into a bag, including cans, bottles and paper, and then throw them into corresponding recycling bins every several days. Frankly speaking, I don't think that recycling facilities are inconvenient because I pass them every day.

5.4.3 How to approach 'convenient recycling'?

The foregoing discussion has shown that unsustainable behaviour is not easy to change because people grow accustomed to their personal rhythms. People also have relatively high expectations for convenience from design and management. It is thus imperative to approach recycling from the perspective of being 'convenient recycling'. Based on the literature review of behavioural change in Chapter 3, and the findings mentioned above, several recommendations are summarised below:

- Maximising the convenience of recycling is the direct way to approach 'convenient recycling'. Increasing the number of recycling facilities is necessary. Additionally, it is important to ensure that recycling facilities are convenient and accessible for people to identify and approach. Flexible time for recycling is also required due to different personal rhythms. People should be able to bring their recyclables (except for food waste) to separation bins at any time. Providing a refuse-chute for collection of recyclables together with a clear indication of its use is an alternative way to increase recycling convenience if these facilities are available in buildings.
- Decreasing the convenience of unclassified refuse disposal is an indirect way to approach 'convenient recycling'. Deploying a volume-base system and instituting mandatory measures such as 'pay-as-you-throw' are effective ways to dispose of waste that have been applied in many cities. For example, a

rubbish machine that can weigh the waste automatically and charge a disposal fee can encourage people to separate recyclables before disposing of them. Decreasing the number of rubbish bins, as is found in other Asian counties such as Taiwan, can be used as a reference for household recycling. However, at the same time, effective recycling networks, supervision and other regulations must be ensured. In effect, these kinds of interventions are not easy because they try to influence human behaviour in a powerful way. People may have different attitudes and behave differently from the original purpose intended. In some cases, improper interventions may be rejected or even lead to irritation. Only when the balance of intervention and users' acceptance is carefully configured can we ensure the sustainability of public participation.

- Because economic incentives can shift the perception of convenience, increasing economic incentives is another indirect way to approach 'convenient recycling'. Some programmes, such as 'deposit-refund' could be implemented to facilitate recycling. Some premium or commodity amounting to positive feedback for active recycling could be provided, especially in public housing estates. Further, some financial support for property management officers and NGOs could be provided so that they could educate or help the public participate in recycling. Monetary incentives can initiate recycling behaviour, however, they are unable to ensure long-term and durable behavioural change.
- Safety and a high standard of hygiene must be ensured in the design of 'convenient recycling'. If recycling facilities are conveniently provided, it is important to ensure that they are in locations without potential risks, especially when fire occurs. The facilities should not block people from passing by. Besides, the cleanliness and maintenance of recycling facilities are of great concern, otherwise people are not willing to approach these facilities. Given the aforementioned hygiene concerns, recyclables should be collected by cleaners

on time.

These recommendations represent a potential approach to the design and management of recycling that encourages public participation in accordance with specific living contexts. To verify the feasibility of these recommendations, some of them will be evaluated through action research, which will be discussed in Chapter 7.

5.5 Summary

This study contributes to the current literature on waste policies and management in high-density spaces, which are focused on contextual factors. Martin et al. (2006) suggested that ignoring the social, cultural and structural aspects of people's lifestyles could lead to a failure to understand the issues of public participation in sustainable activities. According to the discussion above, a holistic understanding of the living context is useful in the design and management of household recycling. In this study, a framework of contextual information pertaining to personal behaviour, encompassing relevant variables such as customs, neighbourhood, neighbours, community, facilities and lifestyles has been proposed with the aim of obtaining a systematic, comprehensive understanding of the contextual factors involved. This study has investigated the quality of living environments, from the dwelling to the neighbourhood and the surrounding community, and how they affect people's level of satisfaction and ultimately influence their behaviour.

Based on the findings and analysis from previous studies, a prominent socio-cultural factor- 'culture of convenience' has been examined to identify the way to approach convenience in terms of design and management. In effect, policy makers and experts, rather than the inhabitants formulate most of the current strategies and

management policies. In general, they assume that they share a common understanding of convenience with users. They simply assume that the recycling networks, including the facilities and recycling centres, are convenient and accessible for the residents. However, the residents may not consider them to be convenient. Due to lack of consideration from the inhabitants' perspective, many existing built environments cannot meet people's needs. In this study, the opinions of different people including residents, cleaners and private recyclers have been expressed.

This study has also examined the challenges and barriers to achieving recycling convenience in Hong Kong. The limited amount of space, hygiene problems and safety issues make it difficult to approach 'convenient recycling' in high-density housing estates. In considering how to enhance the convenience and accessibility of recycling facilities in high-density spaces, these important issues should be evaluated accordingly.

This study has identified the significance of contextual factors for household recycling and has discovered several design opportunities to improve recycling practices. However, more practical work is needed to evaluate the feasibility of implementing these opportunities. Chapter 6 will discuss the relationship between people, disposal and the community based on the contextual factors influencing sustainable behaviour set forth in this chapter.

CHAPTER 6 Re-establishing relationships among human beings, disposal and community

In Chapter 5, the qualities of community (neighbourhood) and facilities are identified as significant factors that affect human behaviour. Based on empirical findings and the theoretical review discussed in previous chapters, this chapter investigates H–D–C relationships within the context of densely populated high-rise buildings and provides an analysis of why individuals dispose of waste arbitrarily in everyday life. This chapter also identifies applying interventions in the H-D relationship and developing collaboration in the H-C relationship as two main approaches to change unsustainable behaviour.

6.1 H–D–C relationships in densely populated high-rise buildings

Figure 6.1 Relationships among human beings, disposal and community.

Marx's discourse on 'alienation from work' concerns workers who are coerced into selling their own labour power to capitalists and are then alienated from other human activities for the sake of survival. The purpose of labour in capitalism is not to find expression for human capabilities but to earn money. In *The System of Objects*, Baudrillard (1996) points out that the 'deep motives' or contradictions in the process of consumption are symptoms of contemporary alienation, and are similar to the alienation of labour power in the process of production. In line with

Marx's notion of alienation, two forms of alienation between human beings can be identified: disposal and community (Figure 6.1).

6.1.1 Alienated from disposal

People in consumer societies are alienated from the disposal of unneeded products and waste. In some cases, people know how to use waste if they have a close relationship with production. For instance, in rural areas, people collect food waste to feed their domestic animals and grow vegetables. They have a clear understanding of why and how to deal with food waste. However, due to increasing urbanisation, farmland has sharply contracted and people in the city are no longer engaged in farming. Society establishes a distance between people and waste, with distinctions drawn between public and private and between clean and dirty. To remain clean and pure, humans establish their distance from waste by developing massive infrastructures for disposal. For instance, new public infrastructures such as incinerators are used to eliminate waste. Such infrastructures involve 'techniques of invisibility, a technological and aesthetic commitment to disappearance' (Hawkins, 2006, p. 56).

Municipal waste is managed with the goal of making it 'disappear'. The practices of waste removal are conducted in such a way that is hidden from view. Waste is deemed a threat to both the public and private spheres and is viewed as something that should be removed as quickly as possible. In many housing estates, cleaners collect waste from the buildings one or twice a day (Figure 6.2). After people have disposed of their waste in a bin, they have no real idea of what happens to it subsequently. Due to such alienation, individuals consider waste as merely a burden to be removed as quickly as possible.

Figure 6.2 Cleaners collect waste from housing estates once or twice a day.

> Resident: In our building, cleaners collect waste “door-to-door” in the hallways. We just need to put the waste into a bag mixed with recyclables and then place it in the corridor outside. If I miss the collection time, I will bring the waste to the rubbish bin rather than leaving it outside in the corridor for the whole night … it may cause odour or hygiene problems.
>
> Respondent: The recycling facilities are relatively insufficient compared to the rubbish bins. It is very inconvenient for me to bring the recyclables to the ground floor.

In practice, the provision of most of the existing recycling facilities was given a low priority. Compared to the inconvenience of recycling, the methods of waste disposal are much more convenient. Normally, waste is collected by the cleaners twice a day, in the morning and night. Given that rubbish bins are provided everywhere, many residents choose convenience over sustainability and throw away their recyclables and waste without separating them. As a result, many residents consider the recycling bins as little more than decoration. When they were

asked how many kinds of recyclables could be collected in their neighbourhood, some of them said that no facilities were available in their building although they had in fact already been in place for a few years.

> Resident: I often see that cleaners put the recyclables into the rubbish bag and throw them together! Why should we do separation? It is a waste of time!

> Cleaner: I am very busy … I have to deal with all the rubbish in the building. It is my duty. I must ensure cleanliness, otherwise I will be punished.

For some people, such as scavengers and private recyclers, there is a lack of awareness of environmental issues and social responsibility; however, they have a close relation to waste and realise how to recycle it because they relied on waste to make a living.

> Respondent: There are three private recycling sectors on the opposite side of the street. They have been located there for a few years. I always bring some recyclables and sell them to the intermediaries, because it is very convenient … and I can earn some money. I notice that many residents in my neighbourhood sell their recyclables to private recycling sectors regularly.

6.1.2 Alienated from community (neighbourhood)

As discussed in Section 5.3, people in a consumer society are alienated from their communities. Society has undergone a tremendous change in terms of living conditions. High population density has meant that many people have had to move

into high-rise buildings. Unlike the sense of neighbourhood that was found in resettlement blocks in the past, most residents of existing public housing estates regard their living environment as a physical space with low social involvement (Forrest et al., 2002; Mitchell, 1971). Even if they live side by side in the same neighbourhood, they seldom see or get to know each other (Figure 6.3). Their daily routines are manipulated by their social schedules and are highly stylised. Large numbers of people go back and forth between work and home, following schedules set by social conventions. They share the corridors, elevators and other public facilities in their community, but they seldom talk with others around them. Even people who live with others have feelings of isolation in the community. Consequently, the way they behave seems to have nothing to do with their surroundings. Due to a weak sense of belonging and attachment, people are not keen to oversee each other.

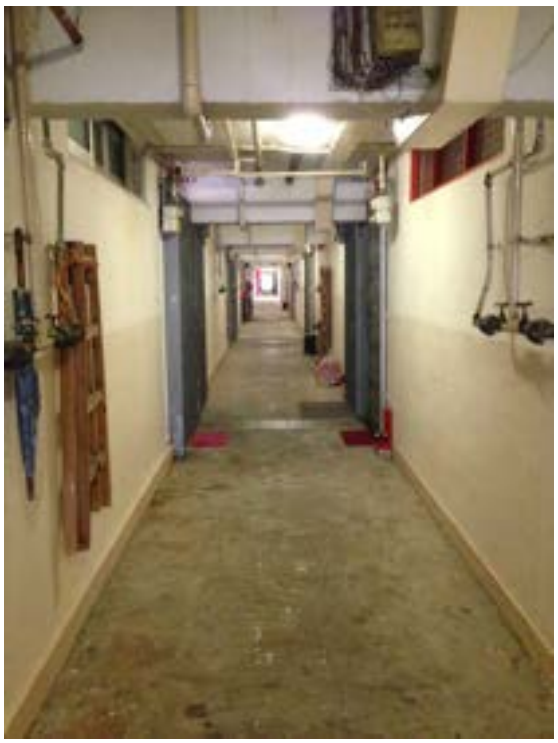

Figure 6.3 Even if people live side by side in the same neighbourhood, they seldom see or get to know each other.

In the survey, most respondents indicated indifferent or negative attitudes towards their neighbours and their neighbourhoods.

> Respondent: It seems I have no neighbours ... even though they live nearby ...You know, most of the neighbours close the iron gate. It is quite different from the past when I lived in resettlement blocks ... we cooked together, ate together, played together and shared what we had.

> Respondent: I'm not familiar with the neighbours, and I even have no idea of their behaviour. You know, I work day and night every day, and have no time to recycle ... Maybe other people recycle ... I don't know ...

> Respondent: Actually, I feel alone when I notice that most of my neighbours don't recycle. The low rate of participation decreases my enthusiasm.

However, some respondents reported satisfactory relations with their neighbours. Their descriptions indicated a sense of community and emotional connection. These respondents had lived in their neighbourhoods for a long time and had grown familiar with their neighbours.

> Respondent: My neighbours are very nice. They give some waste paper to me because they know I regularly collect some recyclables for private recycling.

6.2 Re-establishing H–D–C relationships

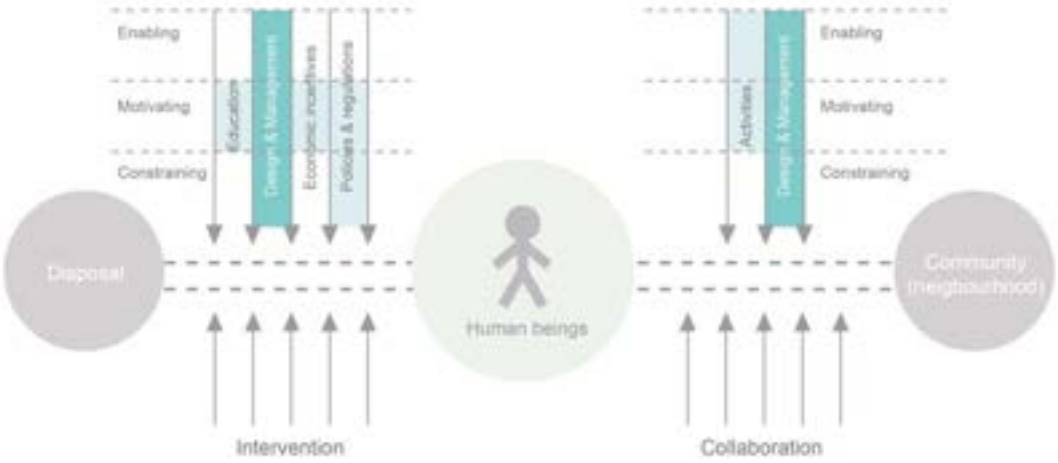

Figure 6.4 Re-establishing the H–D–C relationships.

Figure 6.4 shows how to re-establish the H–D–C relationships. Two main ways are identified: intervening in the H–D relationship and developing collaborations in the H–C relationship. The figure illustrates different ways of re-establishing H–D–C relationships from various disciplines, and the levels of intervention in addition to suggesting design opportunities.

In terms of applying interventions on the H–D relationship, education, design and management, economic incentives, policies and regulations have been proposed as significant methods for encouraging pro-environmental behaviour. Lockton (2013) proposes three fundamental approaches to influencing human behaviour – making it easier to do something (enabling), making people want to do something or not do it (motivating) and making it difficult or impossible for people to do something (constraining). Following Lockton's framework, different methods of influencing behaviour can be categorised according to three levels of intervention. Economic incentives and education (including information) are considered as motivating

approaches; design and management are applicable to the three levels; policies and regulations including discipline and punishment usually have a motivating or constraining approach. In many modern cities, these methods are often applied simultaneously. For example, in Taipei, local authorities deploy a ‘keep trash off the ground’ policy and also remove almost all rubbish bins to prevent people from disposing of rubbish easily. Improper or illegal disposal is discouraged and can even lead to punishment. In this case, design, management, policies and regulations had a constraining approach. All attempts to re-establish the H–D relationship directly can be described as passive methods, from ‘I urge you to’ enabling approaches and ‘I ask you to’ motivating approaches, to ‘I order you to’ constraining approaches. As the development process is passive in nature, people have different attitudes and behaviour in response: reluctant (negative), accepting (neutral) and spontaneous (positive).

To develop collaboration in the H–C relationship, activities conducted by NGOs and local communities often use an enabling and motivating approach. In general, activities usually aim to develop collaboration on H–C. However, design and management in collaboration with different stakeholders is seldom discussed. Only when people have a close connection with the community do they care about their surroundings and become keen to participate in community recycling activities. Attempts at re-establishing the H–C relationship can be described as active or ‘from passive to active’ strategies. The fundamental idea is to move from ‘I help you to do’ and ‘you need me to do’, to ‘we do together’, with the purpose of enhancing social interaction and cultivating sustainable behaviour by forming collaborations with different stakeholders.

As discussed in Chapter 3, intervention can influence human behaviour. However, inappropriate or problematic interventions may be regarded as counter-intuitive and are often short-lived (Lilley, 2009; Lockton et al., 2010). It is not easy to alter unsustainable behaviour without studying people's needs, acceptances and responses along with the social effects of the interventions in the context of their particular situation (Norman, 1998; Siu, 2005). This chapter focuses on how design and management can be applied and how people react during the reestablishment of H–D–C relationships.

6.3 Towards sustainable community: A case in Amoy Gardens

Amoy Gardens is a classic high-density middle-class private housing estate located in Ngau Tau Kok district of Hong Kong. To establish a sustainable community and improve the living environment, a pilot programme of household recycling was initiated by the district councillor, Mr Yip. In addition to the separation of domestic waste at source launched on a territory-wide basis by local authorities in 2005, some small-scale initiatives were conducted in four blocks, comprising 1,024 flats. After conducting the community-level initiatives for nearly a decade, some residents of Amoy Gardens gradually formed a close relation with disposal behaviour and community.

6.3.1 Background to Amoy Gardens

Amoy Gardens is typical of the most common style of high-rise private housing estate in Hong Kong built in the 1980s and 1990s. It comprises 19 blocks, ranging from 30 to 40 storeys high, above a three-storey shopping mall. Over 5,000 flats house a total of 17,000 residents. The residential living spaces are densely packed around a central core of elevators, staircases and public services, and the semi-enclosed spaces between flats are very narrow. Such narrow spaces – sometimes as

narrow as 1.5m – are designed to meet the minimum requirements for natural lighting and ventilation. Given their narrowness, depth and height, these spaces are often dark and stuffy.

In 2003, an epidemic of severe acute respiratory syndrome (SARS) occurred in Hong Kong. Due to the high-rise, high-density built environment, an intense outbreak occurred in Amoy Gardens, spread via public facilities and infrastructure such as floor drains. Over 300 residents were infected and moved out for isolation. The SARS outbreak affected not only the habitants of Amoy Gardens, but the entire territory (Wong, 2010). It was a dark time in Hong Kong, but it did trigger some positive changes. During this time, the government announced emergency measures such as the cleansing and disinfection of public spaces in buildings. Since then, the enhancement and management of public spaces and facilities in terms of environmental issues has become increasingly important in households and communities. Residents are highly concerned about hygiene-related issues and are more willing to participate in community activities, especially pro-environmental practices.

After the SARS outbreak, a series of new initiatives was launched in an attempt to improve the living environment. Most of the design and measures are tailored to sustainable communities specifically within the context of high-density living.

6.3.2 Re-establishing H–D–C relationships via design and management

To re-establish H–D–C relationships, public and private spaces for household recycling are taken into consideration. In the following paragraphs, the design and management of both private and public spaces are identified from observations and interview data.

Design for private space

Following a pay-as-you-throw scheme, residents were asked to buy rubbish bags on a voluntary basis. According to the interview with Kwun Tong district councillor Mr Yip, who was also the chairman of the Amoy Gardens Owners Committee, over 60% of the residents bought the rubbish bags when the scheme was introduced.

> Mr Yip: I stood at the lobby to encourage residents to buy the rubbish bags for five days. Most of the residents were willing to buy the bags. We could not urge all the people to do it … of course, some residents bought the bags only to "answer chairman's call".

Mr Yip indicated that the pay-as-you-throw scheme could encourage people to separate recyclables before disposal. The scheme resulted in a fast reduction in waste. However, fiscal policies or monetary incentives could not be relied upon to guarantee long-term recycling habits due to many contextual factors. In practice, less than 30% of the residents continued to buy these bags after a few weeks. Some respondents mentioned it was unnecessary to purchase rubbish bags:

> Resident: I have so many plastic bags … When I buy some take-away food, they give me a plastic bag; when I buy food from the wet market, they give me a plastic bag ... I have several plastic bags every day, and they are also free. It seems ridiculous if I buy a new rubbish bag and put a bag into a bag.

> Mr Yip: After the outbreak of SARS, residents have a strong sense of hygiene issues. They are not willing to store rubbish, especially

> putrescibles (e.g., food waste), for a long time. In general, they dispose of it every day to keep their houses clean.

Although only a few residents continued to follow the pay-as-you-throw scheme, there was a gradual decline in waste generation and growth of recyclables.

Design for public space

As most flats are very small, it is impractical to encourage residents to use different types of bins or bags to store recyclables. Moreover, items bought at the wet market contain a high proportion of water, which may cause hygiene problems if the waste is stored at home for a long time. The kitchens are too narrow to allow for the installation of large food processors. Hence, public facilities play an important role in residents' ability to deal immediately with rubbish and recyclables.

> Resident: Our flat is so small. It is impossible to store a large amount of recyclables at home, and the rubbish, especially the food waste, may be infested with rats and roaches. I must deal with the rubbish every day.

In the four selected blocks of Amoy Gardens, public design for recycling is significantly different from other buildings. Compared to many other buildings, in which provision of recycling bins has low priority, recycling facilities in the four blocks are more visible and accessible. In addition to the traditional three-coloured separation bins distributed by local governments, various categories of bin are provided for different types of recyclable (Figure 6.5).

> Mr Yip: Recycling facilities were the problem. We need enough recycling bins. I cannot encourage residents to deposit their

recyclables without ensuring the availability of public facilities. Convenience and accessibility of public design for recycling plays an important role in household and community participation in recycling. Actually, the number of recycling bins provided by local authorities is limited; we have to provide more to meet residents' satisfaction. Hence, I bought some bins, and even modified the design in accordance with the specific living situation.

Resident: I notice that many neighbours participate in recycling every day. I'm quite satisfied with the public design in our building because it is very convenient for us to recycle. Actually, we cannot miss such a large group of recycling bins because they are installed next to the lift which we pass by every day.

Figure 6.5 Various categories of bin are provided to collect different types of recyclable.

To help people to deal with food waste, a food waste recycling project was started in four blocks in 2013. Several buckets were provided on the rooftop to collect food waste. The collection time was between 8:00 pm and 10:00 pm every evening. Workers then put then put the collected waste into the food processor. Although food waste was recycled in situ, the hygiene issues should not be ignored. To ensure

long-term sustainable practices, barriers associated with the particular high-rise, high–density living environments should be identified. Unlike the open spaces on the ground floor, the public spaces between the housing estates had some constraints and limitations on the design of recycling facilities.

> Mr Yip: Many processors decompose food waste in situ. It is convenient, but not suitable for our neighbourhood. It generates a disgusting odour during the decomposition process … residents who live nearby must complain about it. In this regard, we chose processors that only dry, smash and compress food waste. The treated food waste is then sent out for decomposition, and returned as organic soil.

Ever since the food waste recycling programme was launched, more and more residents who live within the four blocks have actively participated in it. Moreover, some residents who live in other blocks showed enthusiasm for it and were willing to bring their food waste here. Not only local residents including kids, adults and older people but also domestic helpers participated in it. In addition to the buckets and food processor, a wash basin was installed nearby, with a bottle of hand washing liquid on top of it.

> Resident: You know, almost all of the participants take elevators to the rooftop; some participants even transfer elevators twice. We try our best to ensure cleanliness and health during the whole process. I installed a wash basin here because they need to wash their hands after dealing with the food waste.

Residents use their own containers such as buckets and plastic bags to carry the food waste (Figure 6.6). They wash their hands after dealing with the waste (Figure

6.7). Most of them reported that they were quite satisfied with the current facilities and participated in recycling every day.

> Resident: Food waste is a big problem. I have got used to recycling food waste every day since food waste processors were installed in our community. It is convenient and clean. Besides, the collection time is quite flexible, which enables most of us to participate in it.

Figure 6.6 Residents use their own containers to transport their food waste to the collection point.

Figure 6.7 A woman washing her hands after dealing with food waste.

However, some respondents said they did not bring any food waste to the food waste collection point because they lived far away. The respondents raised an

important point about the issue. Although the public design was available to everyone in the neighbourhood, it was not ‘equitable’ and ‘accessible to all’.

> Resident: It takes me more than ten minutes to reach the collection point … It is inconvenient for me to take one elevator to the platform and transfer to another to the rooftop while taking a bag full of food waste.

A garden recycling programme was initiated concurrently. The open space of the rooftop was used for a small self-contained recycling system. Residents deposit their food waste in the processor and got some organic soil made from the food waste. Each household has its own container to grow plants (Figure 6.8). Nearly one hundred households participate in this scheme. Although this is not a high percentage, it provides a viable laboratory for constructing sustainable community. The rooftop was bustling with activity when the scheme was introduced and served as a communal space that enhanced the opportunities for social interaction and encouraged the residents to participate in recycling. The built environment can influence people’s sense of community and social involvement.

> Mr Yip: We don’t have enough facilities to digest a large quantity of food waste. So I don’t inform all of the residents and encourage each of them to participate in it. Actually, more and more residents tell me that they want to participate after noticing it.

Each container had a number plate sticking into the soil, which stood for the household number. It is easy for participants to recognise their own and their neighbours’ plants.

Resident: Look at this, this is my plant, it is sprouting now! I check it every day. That is my neighbours' plant, it grows faster than mine. I often help them water it because they are busy.

Activities such as planting courses and competitions are conducted from time to time, helping participants to develop their skills and get to know each other (Figure 6.9).

Figure 6.8 Each household had its own container to grow plants.

Figure 6.9 Planting courses are conducted from time to time (*source: photo provided by Mr Yip*).

Figure 6.10 Participants shared their tools and skills during the whole process.

The garden is the public place that most of the residents pass through every day. Participants in the scheme said they often came to the garden in the evening after dinner or when they were passing by. When they were asked about their attitudes to their neighbourhood, they showed a glow of satisfaction at having such a good place that enhanced their opportunities to participate in community activities. In the garden recycling, they collaborated with each other. They shared their tools and skills during the whole process (Figure 6.10). A young couple came to see their vegetable and took a bottle of liquid from the shelf:

> Resident: Thanks to Mrs Chen' home-made pesticide, after spraying our vegetables, they are seldom riddled with worms.

Mrs Chen looked at her pesticide with satisfaction. She explained that they always discussed how to care for the plants well.

> Resident (Mrs Chen): This is a mixed pesticide made with ginger and other vegetables. It is organic … doesn't contain any toxic substance! I learned it from the planting course. The teacher taught

me how to make it. It is very useful! I put it on the shelf now so everyone can use it.

Figure 6.11 Some participants came to the harvest with their family (*source: photo provided by Mr Yip*).

The public space on the rooftop is divided into several areas according to different types of vegetable. Some participants brought their family to the garden during the harvest (Figure 6.11).

> Resident: It is quite exciting to see my food waste turn into food again! It is amazing, you know … in our concrete jungle! It provides an opportunity to communicate with my family.

6.3.3 Opportunities and limitations

The pilot programme for household recycling in Amoy Gardens is an attempt at an individual-driven grassroots initiative. The success of community-run recycling programmes suggests that re-establishing H-D-C relationships is important to encourage household and community participation in recycling. In addition to traditional interventions such as economic incentives, design and management, such programmes also form an active built environment to re-establish the

relationship between people and community. It promotes an atmosphere of social interaction and facilitates sustainable behaviour. However, there is a critical flaw in such attempts. The individual-driven nature indicates that they are highly reliant on support from the organiser, which may lead to failure if the organiser moves away or stops the programme. Establishing a community-driven approach with support from different stakeholders is important for securing long-term success.

6.3.4 Implications for sustainable design in high-density spaces

Satisfaction with neighbourhood (or community) space is significantly associated with recycling behaviour. As Steg and Vlek (2009) suggest, the physical environment is important for community satisfaction, and a high-quality environment results in sustainable behaviour. To form active sustainable communities, both policy makers and city planners should make community spaces more satisfactory for the residents. The improvement of built environments is necessary to promote an atmosphere of social interaction and to cultivate sustainable behaviour. To increase residential satisfaction, high-quality recycling facilities are necessary. In addition, community activities such as garden recycling programmes or environmental competitions can be launched to activate the community space. Cho and Lee (2011) indicate that public participation in community activities can cultivate a sense of community and result in a more sustainable lifestyle.

6.4 Summary

Following the identification of research issue in Chapter 1, and considering the contextual factors discussed in Chapter 5, this chapter has attempted to investigate why individuals dispose of waste arbitrarily from a fundamental and philosophical perspective, and to provide a better understanding of the problem. It has also

identified applying interventions in the H-D relationship and developing collaboration in the H-C relationship as two main approaches to change unsustainable behaviour. This chapter serves as a link between the study in previous chapters and the study to follow. Chapter 7 will further discuss and evaluate design intervention and collaboration for behaviour change via an action research methodology.

In summary:

- People dispose of waste arbitrarily in everyday life due to two forms of alienation. People in a consumer society are alienated from disposal behaviour, and those who live in densely populated high-rise buildings are alienated from the community. H–D–C relationships influence how people deal with waste.

- Re-establishing H–D–C relationships can influence human behaviour. Two main approaches are identified: applying interventions in the H–D relationship (passive) and developing collaboration in the H–C relationship (active).

- In general, most current strategies can be categorised as different levels of intervention (i.e., enabling, motivating or constraining), including information, education, economic incentives, design, management, regulations and punishment, with the aim of changing unsustainable behaviour directly. As the development process is passive in nature, people may have different attitudes and behaviour in response: reluctant (negative), accepting (neutral) and spontaneous (positive).

- To re-establish the link between humans and community, developing collaboration is a modest strategy that changes unsustainable behaviour indirectly. In general, most activities are conducted by NGOs and local communities, rather than by residents themselves. The aim is to enhance social interaction and cultivate sustainable behaviour by forming collaborations with different stakeholders.

- The living environments of high-rise buildings are perceived as large physical spaces populated by residents with low levels of social involvement in community activities, which constrains public participation in the recycling process. Consequently, community activities and design and management promoting collaboration could be launched in neighbourhoods to promote an atmosphere of social interaction and cultivate sustainability-oriented behaviour. Long-term positive and devoted management is essential to encourage public participation in the recycling process.

CHAPTER 7 Design intervention and collaboration for behaviour change

In Chapter 5, contextual factors such as physical environments, public design and the social culture are addressed as important factors influencing sustainable behaviour. Chapter 6 identifies intervention and collaboration as two main approaches to change unsustainable behaviour. It also addresses that collaboration can be launched in neighbourhoods to promote an atmosphere of social interaction and cultivate sustainability-oriented behaviour. Based on the empirical study discussed above in Chapter 5 and 6, this chapter discusses how to apply design intervention and collaboration for behaviour change via an action research methodology, including a spiral 'plan-act-observe-reflect' approach (Robson, 1993), and also explores appropriate design interventions for household recycling. By identifying target users among four behaviour models, this chapter further discusses the applicability of design intervention and collaboration in changing behaviour.

In this study, in collaboration with two Caritas community centres, PAR including questionnaires, interviews, non-participant observations, collaborative workshops and an on-site iterative prototyping process was carried out. Stakeholders including local residents, private recyclers, scavengers, property management officers and cleaners in five public rental housing estates were recruited to voice their views on public design for recycling. This chapter also discusses the experience of applying PAR to improve design for household recycling in high-rise living environments.

7.1 Initial considerations

Reflect

The results and discussion of the case studies described in Chapters 5 and 6 identify the significance of contextual factors in public participation in recycling and suggest that contextual factors might facilitate or constrain recycling behaviour. Improving the design of built environments as well as recycling facilities can increase people's willingness to participate in recycling. It is thus necessary to apply appropriate design interventions and develop collaboration in the community. However, most current design for recycling mainly focuses on the perspectives of policymakers, designers and other experts rather than those of the end users. User's perspectives on how to improve design for recycling were not addressed. In effect, people have their own perceptions and recommendations for the design. As mentioned in Section 3.4, people's acceptance and response determine the effects of intervention. From the case studies, it is obvious that people have various responses to the design and behave differently. To help understand how people behave based on design and management, a fundamental categorisation is illustrated in Figure 7.1.

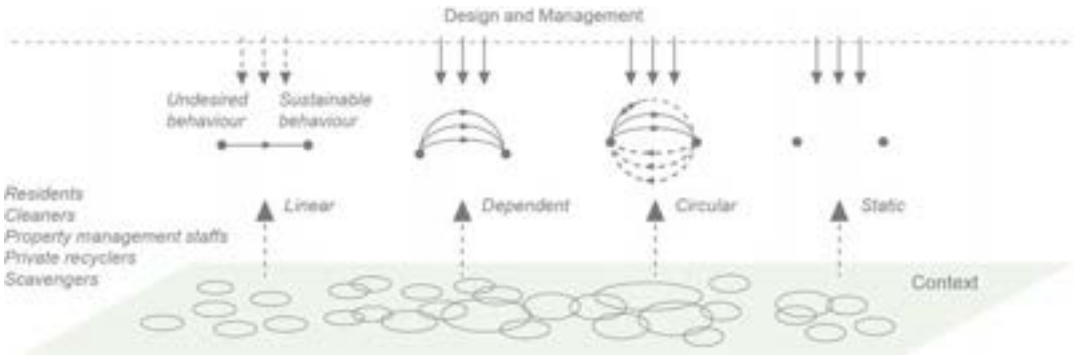

Figure 7.1 Models of behaviour influenced by design

As shown in Figure 7.1, an individual's behaviour is formed within a particular context. The design and management for recycling results in different types of behaviour change. In terms of the end users, not only residents but also cleaners, property management staff, scavengers and private recyclers should be taken into

consideration because their behaviour may affect the effectiveness of the design. To simplify the various processes of behaviour change, they are divided into four main groups with simple icons: linear, dependent, circular and static.

A (linear): In this group of individuals, behaviour can be changed towards sustainable behaviour easily by means of basic design and management. As mentioned in Section 5.4, some people have already adopted recycling behaviour due to their norms and personal factors. For example, people who have pro-environmental awareness about their social responsibility may behave sustainably even without any design interventions. Those who depend on recycling to make a living may also behave sustainably even if they have little awareness of social responsibility. In general, people behave actively in this process. This is an example of spontaneous (active) behaviour with or without interventions.

B (dependent): Individuals in this group are more likely to change their unsustainable behaviour towards sustainable behaviour. However, this process may rely heavily on external design and management. Among this group, some individuals' behaviour is easy to change and others' is more difficult. Nevertheless, people may approach sustainability even if they have different attitudes. For example, residents may have to participate in recycling when their behaviour is supervised by others. Improving the quality of recycling facilities as well as built environments can facilitate residents' behaviour change. It is possible for this group to form long-term sustainable behaviour with certain design interventions.

C (circular): Both dependent type and circular type groups are dynamic in nature. There is some opportunity to change undesired behaviour towards more sustainable practices. However, people's willingness to perform sustainable behaviour may

decline under certain circumstances. People may show enthusiasm and behave in an active or neutral way at the beginning but show reluctance and react in a passive way later. This type of model has a tendency to be fluid, and it is a challenge to ensure long-term sustainable behaviour because it may turn out to be a 'loop' and eventually return to the starting point. For example, trying to alter human behaviour in an inappropriate way may easily lead to such a loop. When people feel disappointed, uncomfortable or unpleasant, their acceptance and willingness decrease. For this type of group, design tailored to people's motivations and situation is necessary. To understand actual current practices and offer appropriate design, it is thus important to enable this group of people to express their views and suggestions on design and management.

D (static): Different from the other four types of behaviour change, this group is static and stable. For example, some adults and elderly people have lived in their own way and formed their habits over the course of several decades. It is obviously difficult to encourage these people to behave sustainably merely via design and management. This type often fails to make any change because these people are generally not interested in adopting any sustainable behaviour. In general, individual concerns take priority over collective concerns; hence, there may be little motivation to alter behaviour. In some cases, people may simply ignore the design intervention or respond in an undesired way. It is important for designers to bear in mind that irrational and inappropriate interventions may generate social issues.

Plan

Based on previous study, the author applied a stakeholder map matrix to show the level of influence/power and interest of different stakeholders at the early stage of the PAR. This step enabled the researcher to easily identify which stakeholders

were expected to be the blockers, and which stakeholders had the potential to support. As shown in Figure 7.2, stakeholders were classified by power and interest. Communities centres were identified as one of the key players that the researcher should work closely with. Local authorities and property management sectors had relative high power on this issue but not enough high interest on it. Gaining supports from these powerful stakeholders helped the researcher to gain more resources. Residents were the largest group with four different natures due to the diverse and stratified demographic structure in terms of ages, educational attainment and position. The researchers should pay more attention to this group. Cleaners had some influence on this issue since they were an important part of the implementation and management of household recycling. Private recyclers, scavengers and some NGOs had interest but low power on it. For the low power, high interested people, they should be kept informed adequately since they could provide helpful information. For the low power, low interested people, the researcher should monitor them but do not conduct excessive communication.

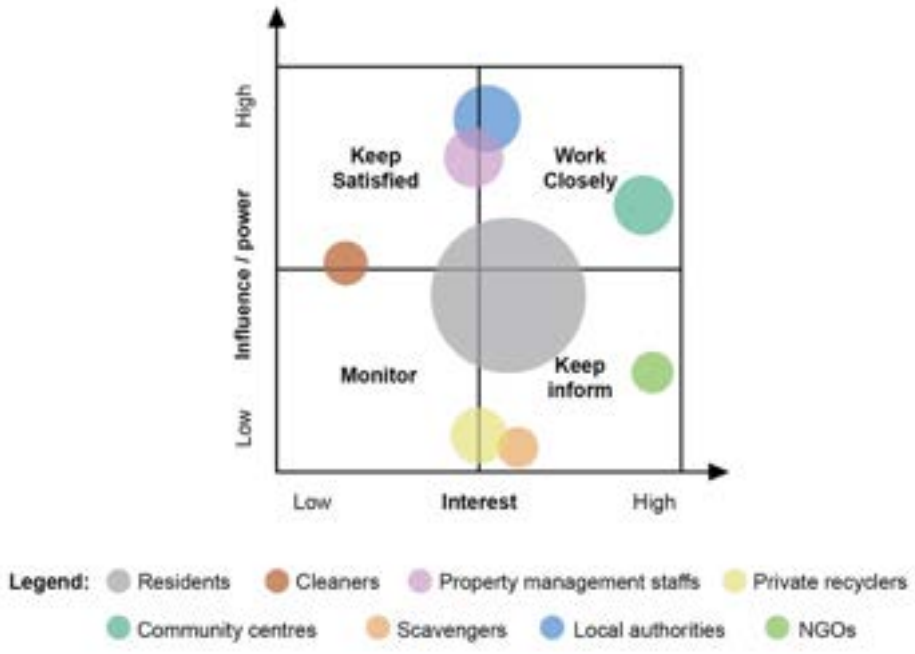

Figure 7.2 Stakeholder map matrix

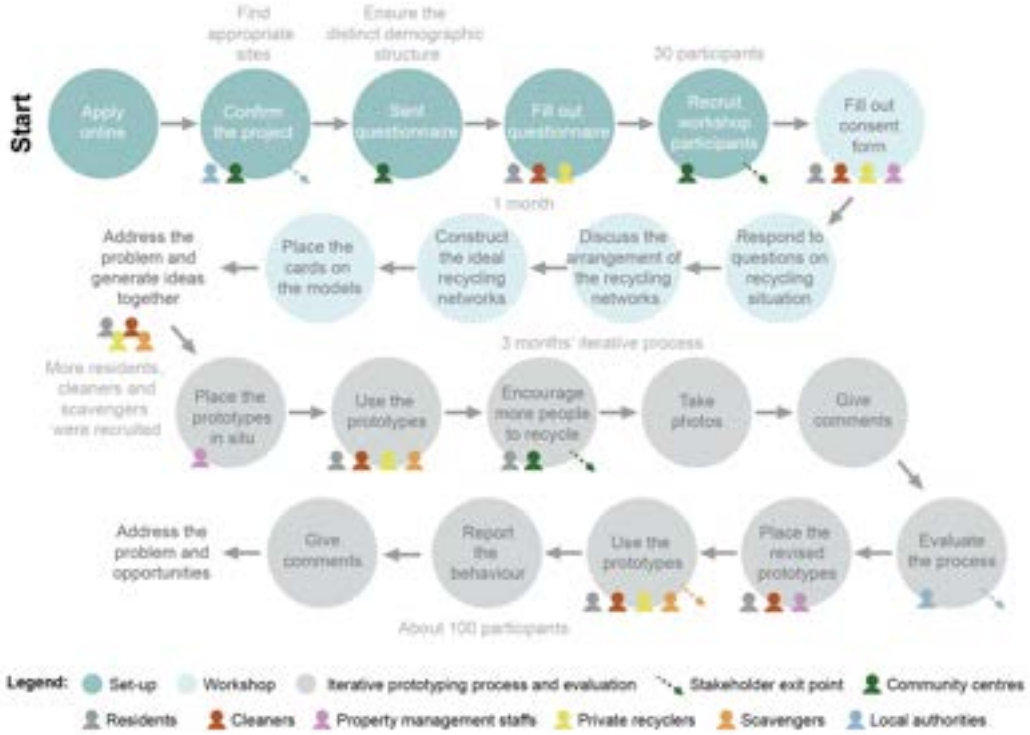

Figure 7.3 Journey map

When planning how to identify appropriate design interventions for sustainable behaviour, the most obvious solution is to involve different stakeholders in the design process. Figure 7.3 is journey map of this study. It sketches the journey, touch point and stakeholders' engagement in different process.

Before recruiting people to participate in the workshops, it was necessary to select appropriate sites for action research. The reliability and feasibility of the selected sites should be taken into consideration. As mentioned in Section 4.3.4, there were two main housing types, public housing and private housing. It is possible to conduct observations and interviews in both types of housing location. However, conducting action research in private housing was very difficult due to complex

management issues. In practice, many incorporated owners refused to participate in this research because they had concerns.

As local community centres have close contact with public housing estates, an alternative way to conduct action research within some housing estates was by seeking the assistance of local community centres. For this study, several typical public housing estates were chosen as the core sites due to the practical limitations of conducting action research in private housing. These sites still provided a viable laboratory for the examination of recycling activities. For example, in some communities, in addition to public recycling facilities, private recycling sectors such as recycling centres and scavengers were rather obvious. In other communities, only public recycling facilities were available for people to use.

When recruiting participants for workshops, the researcher should ensure the distinct demographic structure in terms of age, gender, educational attainment and position (see Section 4.4.3). To enable the participants to articulate their suggestions in the workshops, they were randomly divided into five groups and separate workshops were conducted with these five groups. To ensure that each group had a range of participant characteristics, the participants were required to complete a questionnaire before the workshops.

7.2 Understanding and evaluating design: collaborative workshops

Act

Each workshop took about 60 minutes and consisted of two sections. To ensure authenticity, the researcher introduced the purpose of our project at the beginning and promised that the data collected were only for research purposes, which should

have encouraged the participants to give the actual answers rather than the ‘right’ answers. The participants were also required to fill out a written consent form before the workshops started.

In the first section, each participant was provided with an A4 page of stickers depicting various types of recyclables – for example, cans, used clothes, books, plastic bottles, toys and electrical and electronic equipment waste. Two pieces of white paper were also provided: one represented current recycling practices, while the other represented the future situation. The participants were asked to select the materials they recycled (or expected to recycle) in their daily activities and correspondingly affixed them to these two pieces of paper (Figure 7.4).

Figure 7.4 Collaborative workshops: Section 1

In the second section, the researcher provided a series of scaled-down models (on a 1:100 scale) representing the infrastructure and recycling facilities, including the housing estate, recycling organisations, recycling bins, second-hand stores, private collectors/recyclers and recycling vehicles. A set of cards representing various recyclables was provided to each participant. The recyclables included waste paper, metal, plastic, glass, used clothes, rechargeable batteries, food waste, electrical

equipment and fluorescent lamps. As noted by Sanoff (2000), a high degree of participation results in a high degree of personal satisfaction. During the action research process, the role of researchers is of great importance. In this stage, we acted as facilitators to coordinate the research process and ensure that participants had equal opportunities in the decision making. There were three steps in this section: (1) discussing the arrangement of the recycling networks; (2) cooperatively constructing the ideal recycling networks; and (3) placing the cards on the models according to the participants' preferences (Figure 7.5–7.7).

In summary, the aim of the collaborative workshops was to reveal people's habits, needs and preferences for sustainable practices, to address issues that concern different stakeholders, and to uncover insights on how to improve design for sustainable behaviour.

Observe

To enable the participants to express their ideas and explain why they constructed the recycling networks in the ways they did, group interviews were carried out at the end of the workshops.

Some residents pointed out that the recycling bins were inconvenient. Although the design had changed over the years, the usability and accessibility of contemporary recycling facilities still left many participants dissatisfied.

> Participant: Only a small number of recycling bins are provided in our housing estate. The openings of the bins are not large enough for people to put in large material … especially paper and plastic.

> Moreover, the self-closing lids are not convenient; we have to touch the lids – you know, many people are unwilling to touch the lids.

During the workshops, the researcher noted that the participants had high expectations of convenience. However, most mentioned that they were still willing to separate recyclables into several categories. They were concerned about time and space rather than categories in terms of convenience.

> Researcher: I notice that most of you chose multiple categories of recycling bins rather than two categories (i.e., recyclables and non-recyclables). It may take you more time to deal with different types of recyclables. Why didn't you choose the easier way? For example, just separate recyclables from general waste and then put them all in the same recycling bin?
>
> Participant: It still requires labour for further separation. We are already used to the waste separation. There is no need to decrease the number of categories. People are still willing to separate recyclables in detail if they are used to it. Other people who do not recycle in daily life will not recycle even if there are only two categories.

Colours were used for differentiation: blue for paper, yellow for metal and brown for plastics. Likewise, labels with small text and graphics were posted on each bin. However, because of the weak connection between the colours and their symbolic meaning, some residents found it difficult to identify the three bins. Some respondents also mentioned that cleaners sometimes placed plastic bags inside the bins to make collecting the recyclables easier, but the bags often covered the labels, confusing them.

In terms of the provision of recycling facilities, there were different attitudes among different stakeholders depending on their positions. Although the residents complained about the lack of recycling facilities, both the cleaner and property management staff insisted that as few facilities should be provided as possible. Normally, cleaners collect waste from the rubbish bins on each floor once or twice a day. Spending time handling recyclables in addition to general waste from each floor would increase the workload for cleaners. Thus, the cleaner indicated that having fewer recycling bins would make it easier to collect recyclables from the housing estates.

> Cleaner: Some of the recycling bins are located in public areas, such as the corner of the stairs, where there are no lifts. I have to drag the plastic bags full of recyclables up and down the stairs. It is terrible. Moreover, I have to clean these facilities if they are dirty.

Private recyclers and scavengers were active in recycling practices because they had to earn a living. Some residents mentioned they collected recyclables and then sold them to subsidise their household income. Compared to the other estates, the participants from Sai Wan Estate were more active in selling recyclables because there was a private recycling enterprise nearby. However, they were only willing to collect certain types of recyclables such as cans and paper because of the rewards for them, and they showed little interest in low-profit material. They also mentioned that scavengers took clothes out of the used clothes recycling box.

> Property management staff: I noticed that some scavengers took recyclables, such as newspaper, from recycling bins and sold them to private recycling enterprises. Some residents disposed of their rubbish next to the bins because they didn’t want to touch the public bin. A great deal of unexpected behaviour took place appeared when

no one else was nearby. It was difficult to prevent people from doing that. If these facilities were placed in a public space where people could supervise one another – for example, the lobby – it would be much easier for us to manage household recycling.

The participants also discussed the provision of public facilities for collecting items that can still be used. Some participants suggested that more public space or facilities should be provided to enable residents to share materials.

Participant: From time to time, I give items that I don't need to the scavengers and the second-hand recycling centre. These items are not rubbish; they can be used. I think other people may need them. So I wonder if there are any facilities in our community that enable us to share these materials.

Figure 7.5 Collaborative workshop: Section 2

Figure 7.6 Collaborative workshop: Participants construct their ideal recycling network.

Figure 7.7 Collaborative workshop: Participants construct their ideal recycling network.

Figure 7.8 Collaborative workshop: Participants discuss the arrangement of their recycling network.

Figure 7.9 Collaborative workshop: Participants place cards on the models according to their preferences.

Reflect

The collaborative workshops enabled different stakeholders to discuss and develop ideas together. Table 7.1 shows the problems addressed and the ideas generated by the participants. The project findings illustrate several major concerns of the participants.

- Many participants were concerned about the accessibility and equity of public recycling facilities. Some residents found them inconvenient to use because there were no recycling bins provided in their own buildings. It is impractical to require residents who live in other buildings to take elevators to the platform and transfer to another lobby to deal with their recyclables.

Table 7.1 Ideas generated in the workshops

Stakeholders	***Behaviour***	***Problem***	***Ideas***
S1 (Residents)	Separate	• Forget to separate recyclables • It takes time to clean some recyclables	• Provide some containers or bags for indoor separation
	Store	• Limited indoor space for storing	
	Dispose	• Inconvenient recycling facilities • Small size of the openings • Limited number of recycling bins • Difficult to identify the bins • The recycling bins are dirty and always full of recyclables • No facilities to collect food waste • Some cleaners put the recyclables together with rubbish • No facilities are available to share second-hand materials	• Increase the number of recycling bins • Enhance the accessibility and equity of public recycling facilities • Enlarge the openings • Provide effective and clear guidance for collecting recyclables • Ensure the cleaners maintain the cleanliness of the bins and collect recyclables • Give the recyclables to neighbours or scavengers who collect recyclables • Sell them to private recyclers • Provide some facilities/places to collect food waste

			• Provide some facilities/places to share second-hand materials
S2 (Cleaner)	Collect	• Not enough time to collect recyclables frequently • Improper location of recycling bins makes it difficult to deliver them • Improper separation	• Do not provide too many recycling bins • Do not install the recycling bins in places where no lifts can access
	Store	• Limited space for storage • Hygiene issues	• Do not store recyclables in the refuse room for too long
	Dispose	• No effective way to deliver the recyclables	
S3 (Property management staff)	Implement	• There are many restrictions on installation of recycling bins	• Install recycling bins in refuse storage rooms or corners to avoid hindering people's movement
	Supervise	• Some scavengers pick up recyclables from recyclable bins • Some improper disposal behaviour occurs when nobody witnesses it	• Do not provide too many recycling bins • Provide recycling bins in places where people can supervise one another easily
S4 (Recyclers)	Collect	• Low profit of some recyclables, e.g., plastic	• Make it easy to collect recyclables

- Different stakeholders had different attitudes towards public facilities according to their positions. It is thus important to balance these attitudes appropriately.
- Some residents had difficulty identifying the different categories of recycling bins quickly, as they were a similar colour. They confused what kinds of materials could be recycled because the existing illustrations did not provide effective and clear guidance for collecting recyclables.
- Some participants were willing to sell or leave their recyclables to nearby private recyclers. The location of private recycling enterprises and second-hand shops directly influenced the use of private recycling networks.

- Many people were unwilling to touch public recycling bins because of hygiene-related issues. These issues are often neglected in the design and implementation processes. The cleanliness and maintenance of recycling facilities could not be ensured in actual practice.
- Some residents, especially the elderly and the disabled, had difficulty going downstairs while carrying bags of recyclables.

Although the participants mentioned they were willing to make comments on environmental sustainability, they had no confidence that their suggestions would be put into action. Nearly half of the participants had negative attitudes towards environmental issues. In some cases, the participants felt that there could be no follow-up actions based on their comments and that it was difficult to enter a new phase in collaboration with other partners such as local authorities and property management. However, the participants still advocated that their personal experiences and suggestions in this process be taken into consideration in actual practice.

In the collaborative workshops, the participants were encouraged to freely discuss household recycling. However, in some groups, the participants were initially hesitant, as they were unaccustomed to voicing their opinions. In contrast, some participants actively participated in the process and functioned as supervisors. As a result, these groups required more time than the others for all of the participants to explicitly express their views.

The groups did suggest some recommendations for improving the design and management of recycling, but the sample size was quite small. Moreover, as people's attitudes are often not correlated with their actual behaviour, it is necessary to conduct an iterative prototyping process *in situ* to evaluate the results. In the next

iteration process, the problems and ideas generated in the workshop were addressed with some improvements. More stakeholders were involved, including residents and cleaners.

7.3 Understanding and evaluating design: the iterative process

7.3.1 Stage 1

Plan

The outcome from workshops was considered to provide a valuable opportunity for future development. When planning how to improve design by considering people's perceptions and reactions, the best approach is an iterative process. Tangible tools and 'best practice' models have been shown to be effective (Section 4.3.5). In this stage, full-scale prototypes were provided *in situ* to identify actual behaviour and unforeseen possibilities. The recommendations and ideas listed in Section 7.2 were taken into consideration. Designs for both public space and private living space were tested and evaluated. Considering the small number of participants in previous workshops, comments from more residents, cleaners and scavengers were needed during the iterative process. To allow respondents to express their views and attitudes freely, unstructured interviews in the style of conversations were used.

When designing public facilities or public space, safety problems and hygiene issues should be borne in mind. Given the aforementioned concerns and the feasibility of action research, some of the ideas generated in the workshops were not suitable for testing in this research. For example, food waste recycling was not possible due to the property management's concerns. The research therefore focused on traditional recyclables that could be collected by cleaners.

Considering the limited indoor space, it was impractical to install different types of container for storing recyclables at home, so environmentally friendly bags were provided to participants to remind and assist them to store recyclables at home. Twenty respondents were given a diary to record their recycling practices, emotions and opinions during the process.

Act

As mentioned above, the living environment in Sai Wan Estate was quite particular (Figure 7.10). According to the results from the workshops, places through which many residents passed every day were the most preferred locations for installing recycling facilities. Four public spaces were taken into consideration (i.e., one area in front of the elevators, two areas near the elevators and one near the corridor). However, in practice, more issues should be carefully examined. In the recycling activities implemented by local authorities and property management, security related to fire legislation and barrier-free facilities took precedence over other considerations such as convenience and practicality. For example, recycling facilities could not be installed on the Braille tiles (i.e., tactile guiding paths) or too near them, lest visually impaired persons encounter difficulties because they were accustomed to the original layout (Figure 7.11). In addition, the area in front of the elevators was deemed unsuitable because it might be inconvenient for disabled people. Therefore, it was necessary to balance these important factors without decreasing the convenience and practicality of recycling activities. After further discussion with the property management officer, one area near the elevators was considered to be an appropriate place to install full-scale prototypes.

Figure 7.10 Housing in the Sai Wan Estate.

Figure 7.11 Many existing circumstances limit the location of recycling facilities.

As shown in Figure 7.12, full-scale prototypes were provided in the area near the elevators. Based on the ideas and suggestions from previous research, the researcher redesigned the three categories of recycling bins (blue for paper, yellow for metal and brown for plastics). As mentioned by the participants, some residents found it difficult to recognise the three bins because the existing illustrations did not provide effective and clear guidance. Therefore, the labels and used transparent materials were redesigned.

On previous recycling bins, the lids were supposed to lock to prevent scavengers from getting recyclables easily. Self-closing lids were also used to prevent people from casually throwing burning objects such as cigarette butts into the bins and to prevent fires from spreading if the waste ignited (EPD, 2005). However, such self-closing lids discouraged many residents from throwing in recyclables. As mentioned by the participants, many people were unwilling to touch the lids, especially if the recyclables they carried were not firm enough to use to open the lids. In the project, we redesigned the openings by following some mainstream designs from other cities and enlarged the openings to make it easier for people to dispose of recyclables. However, scavengers still found ways to extract recyclables from the bins even though they were locked. Moreover, although the scavengers were active recyclers, they were not welcomed by local authorities. With these matters in mind, rather than lock the lids, the researcher made them easier to open so that people could more easily dispose of large recyclables.

According to the findings of the previous main user study, the participants desired more public space or facilities to enable them to share their materials. Because of the limitations of public space, it was not possible to provide a large area or tables

for sharing. I provided a cabinet near the recycling bins to collect items that could still be used.

Figure 7.12 Full-scale prototypes were provided *in situ* to facilitate public participation in recycling and identify whether the prototypes met users' preferences.

After installing the prototypes *in situ*, observations and interviews were conducted in the buildings on weekdays and weekends for four weeks. To make the results easier to compare, single days were further divided into several periods (i.e., early morning, rush hours, afternoon and evening).

Observe

In this stage, the researcher identified some opportunities and weaknesses through observations and interviews. In practice, many residents noticed the new recycling facilities when they passed by. Some residents were curious and approached the facilities to better see the design. Participants who had attended the workshops previously were excited when they noticed that their recommendations had been

put into practice. A participant introduced this recycling activity to his neighbours when they were waiting for the elevator (Figure 7.11).

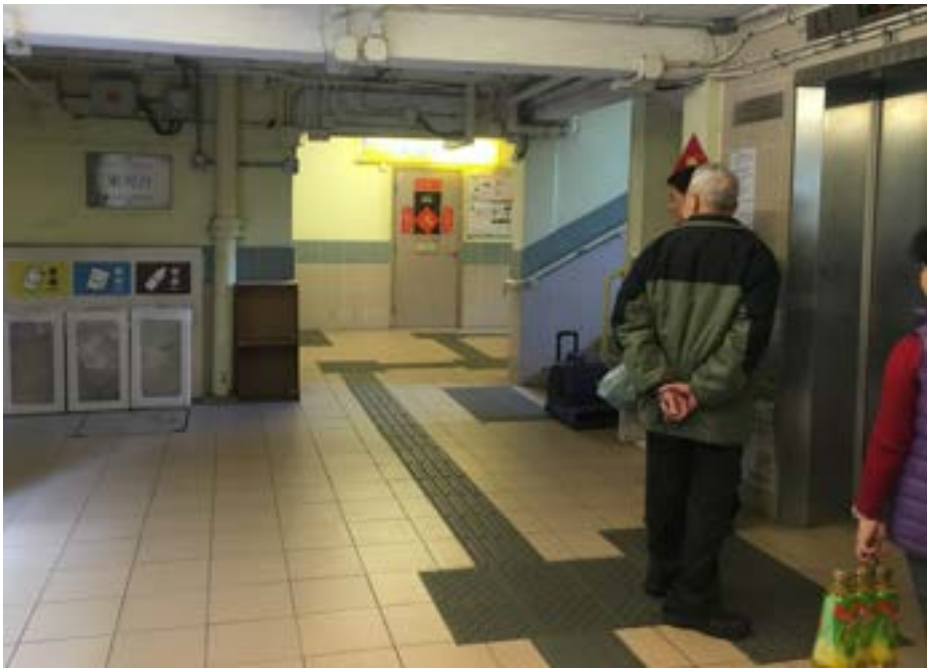

Figure 7.13 A participant introduced this recycling activity to his neighbours when they were waiting for the elevator

> Respondent: Well … it is so cool. I felt that there would be no follow-up actions after the workshops … and the guidance is very clear. I will definitely support this activity.

Among the 64 respondents interviewed in stage 1, 65.6% had a positive attitude to the design in terms of usability. Flexible ways for people to dispose of recyclables were necessary. Most of the users tried to use this design according to their own ideas. There were some large items inside the recycling bins, which was in accordance with the researcher's expectation. For example, users would consciously open the lids rather than putting materials next to the bins or on top of the lids if they had to dispose of large recyclables.

> Respondent: This design makes it easy to differentiate the categories of recyclables. But I feel the openings are not large enough sometimes, especially the bin for metals ... you know, many biscuit tins are very large. So I open it directly when I dispose of large recyclables. By the way, can I open it? Is it right?

In terms of accessibility, 59.4% of the respondents indicated that the design was inconvenient for them, especially those who lived in another building. Some residents complained that there were no recycling facilities in their building. They stated that most of the residents who lived in other buildings were not willing to participate in recycling because of the inconvenient design.

> Respondent: I highly recommend you to install a set of recycling bins in the podium of our building. No recycling facilities are available there! Our neighbours have to walk through the long corridors and then transfer to another elevator if they want to recycle … Do you think we have time?

Because of the limited space in people's homes, residents tended to store all kinds of recyclables in a single plastic bag and then separate them in front of the recycling bins (Figure 7.14). It was thus necessary to ensure that the design and management of the recycling bins were clean and user-friendly.

Figure 7.14 Residents tended to store all kinds of recyclables in a single plastic bag and then separate them in front of the recycling bins.

Figure 7.15 Residents tossed rubbish such as used tissue and peels into or near the bins. The lid of the rubbish bin was often closed by the cleaners.

Figure 7.16 Many residents put recyclables next to the rubbish bins on their own floors.

Some residents tossed rubbish such as used tissue and peels into or near the bins (Figure 7.15). There was actually a rubbish bin located nearby; however, the cleaners often closed the lid. Many residents were not willing to open it because of the hygiene issue. In practice, inappropriately decreasing the convenience of refuse disposal may lead to improper behaviour. In other words, trying to intervene with users in an inappropriate way may even be counterintuitive, creating annoyance and frustration (Lilley, 2009; Lockton, Harrison & Stanton, 2008).

Many residents put their recyclables next to the rubbish bins on their own floors (Figure 7.16). They mentioned that people who collected these items would be

appreciative because they could earn money by selling them. In practice, these recyclables were taken away on the same day.

Figure 7.17 All of the sharing items were collected by the cleaners as rubbish. A cleaner stated that she would be punished if she did not collect the rubbish every day.

Interviews with residents and cleaners revealed some disagreements and different concerns about household recycling. For example, residents left items such as stationery and newspaper inside the cabinet. However, all of these were collected by the cleaners as rubbish (Figure 7.17). Cleaners stated that they would be punished if they did not collect the rubbish when they were on duty and that they were under a great deal of pressure with the sharing items. Compared to the bins of paper and metal, the bin for plastics was often full. While the volume of plastic was larger than those of the other recyclables, neither scavengers nor cleaners were willing to collect them because of low economic incentives. Table 7.2 compares several major differences generated in stage 1.

Table 7.2 Interviews with residents and cleaners during stage 1

Week 1
Resident 1: I asked the cleaner why she did not collect the recyclables even though they were full and she told me that nobody asked her to collect them. I felt so angry! Did she mean it was the residents' responsibility to deal with the recyclables? So I went to the property management office and complained about this issue.
Cleaner 1: I don't know… Our managers didn't tell me to collect them from these new facilities. I will only do what I have to do.
Week 2
Resident 2: I put some used stationery on the cabinet once because I think other people may need it. But I don't think many residents realise that the cabinet is for sharing materials. Moreover, I think it would be more helpful if there was someone to supervise it.
Cleaner 1: You mean the materials on the cabinet? I think they are rubbish! I would be punished if I do not collect the rubbish every day, so I threw them away.
Week 3
Resident 3: The cleaners are very bad! I notice some cleaners put all the recyclables into large rubbish bags together with other rubbish! Why should we spend a lot of time to wash and separate recyclables? It makes me so disappointed!
Cleaner 2: All of these are rubbish, I have to clean them away. Some residents cursed me when they noticed I put them [recyclables and rubbish] together but I

have no choice. Only a few trucks come here to collect recyclables, perhaps every few days, perhaps every few weeks…I am not sure. It may cause a lot of hygiene problems if we store too many recyclables in the refuse room, especially the plastic bottles. They may attract rats and roaches.

Week 4

Resident 1: After I complained about the collection issue to the property management department, the cleaners started to collect them. However, I still found that the cleaners did not empty them frequently. The recycling bins were always full, especially the bin for plastics. Should I have to push them every day?

Resident 4: Actually, the cleaners, elderly people and scavengers often pick up recyclables from the recycling bins and sell them to private recyclers. They can earn money by selling them!

Cleaner 3: Yes, some cleaners and scavengers collect and sell them [i.e., recyclables] but only some valuable materials such as paper and metals. The plastic bottles are very cheap – only 40 cents [HK dollars] per kilogram – of course no one is willing to sell them. Moreover, the private recyclers often give short weight. Anyway, I never do that. I am very busy, and the reward is so small. You can't depend on us to deal with all the recyclables.

The design for indoor separation was quite different from the original concept generated in the collaborative workshops (Figure 7.18). Of the twenty participants who were given a diary as well as environmentally friendly bags, only four of them mentioned that the environmentally friendly bags could help them to separate recyclables at home. The respondents who frequently participated in recycling mentioned that the bags or containers for indoor space were unnecessary because

they already had containers in which to store recyclables (Figure 7.19). The respondents who did not recycle seldom paid attention to this level of design intervention. In general, the bags designed for indoor separation did not have effective influences on household recycling.

Figure 7.18 Participants' diaries on household recycling

Figure 7.19 Participants stored recyclables in different containers (Source: *photos provided by participants*)

Reflect

Stage 1 helped to encourage public participation in recycling and enabled different stakeholders to voice their needs and preferences. Some interviewees who never or seldom recycled mentioned they began to participate in recycling.

During the process, the author also conducted an interview with the EPD to understand the practical difficulties of household recycling from the government's perspective, and to evaluate the effectiveness of this stage. It was pointed out that property management companies contacted the recycling companies by themselves. Thus property management companies play an important role in the implementation and management of household recycling. Although local governments provide some information and regulations as a reference, the extent to which recycling can be achieved mainly depends on its implementation by property management companies. Scavengers and cleaners are not encouraged to pick up recyclables from bins and then sell them, but it is not necessary to stop these activities as they are active recycling in the whole process. Moreover, this *ha lan* money (a Cantonese term that means earning money by selling cheap things) from selling recyclables can supplement family incomes.

In the next iteration, design interventions need to be revised taking into account the several issues raised in this stage. Recommendations for improving the design for recycling included:

- Improve the public design so it can reduce some inappropriate behaviour such as tossing used tissue and peels anywhere.
- Increase accessibility and equity, perhaps with more sets of recycling bins for other buildings.

- Remove the facility for sharing materials.
- Rethink the target behaviour groups among the four behaviour models.
- Suggestions on household recycling should highlight applicable situations.
- To evaluate the result of PAR and people's behaviour change, more people should be involved.

7.3.2 Stage 2

Plan

Based on previous action and reflection, this stage improved the design by considering the recommendations generated in stage 1. In this stage, the author attempted to recruit more respondents to give their opinions in the following eight weeks. Observations and unstructured interviews were conducted at different times on both weekdays and weekends to identify further barriers and experiences of PAR in context. Given the four types of behaviour change identified in Section 7.1, the plan was to gauge behaviour change during the research period. Semi-structured interviews were conducted at the end of this stage to gain an in-depth understanding of the residents' attitudes and changes in their behaviour. Respondents were required to answer several questions such as 'Are you satisfied with these recycling facilities?', 'Did you participate in recycling before?', 'Have you ever used these facilities during this period', 'Will you continue to recycle?' and 'Do you have any suggestions about recycling activities?' This plan was also a trial of whether design interventions and collaboration could influence sustainable behaviour.

Act

According to the findings and evaluations in stage 1, the researcher further revised the prototypes. Because of the limitations of public space, the cabinet for sharing items was replaced with a rubbish bin. The rubbish bin was designed with non-transparent material and with a small circular opening in the lid (Figure 7.20). After installing the bin to collect small-sized rubbish, it witnessed a decreasing number of cases of improper behaviour. Residents seldom tossed rubbish into the recycling bins or anywhere else. As expected, most of the rubbish inside the rubbish bin was small waste, such as tissue and peels, rather than bags of household waste. Residents still used the traditional large rubbish bins to deal with their household waste.

Figure 7.20 The revised design in stage 2

Based on the suggestions from residents, another set of prototypes should be provided in another building. However, the researcher found that two sets of recycling bins had already been provided nearby, although few residents used them because they were located in a low-traffic corner (Figure 7.21). Moreover, cleaners

claimed that it was inconvenient for them because they had to use stairs only when collecting recyclables.

Figure 7.21 Two sets of recycling bins had already been provided nearby

Figure 7.22 A new set of prototypes was provided in South Terrace

Following participants' suggestions, a new set of prototypes was provided near the elevator in an area that many residents of South Terrace passed every day (Figure 7.22).

At the end of this stage, eighty-five residents, five cleaners, three property management staff and four scavengers were selected randomly to report their behaviour change and give their comments.

Observe

For the first two days after installing the new prototypes, the result of recycling was satisfactory. A few residents put their recyclables into the bins. However, on the third day, three residents suggested that the bins should be moved to another place because a typhoon was approaching Hong Kong. They were concerned that as it would rain a lot for a few days the bins should be moved to another place nearby to prevent the recyclables from getting wet in bad weather.

Hence, the place for installing the prototypes needed to be changed again. In terms of public space in this area, several spots were taken into consideration. After further discussion with the residents and the property management office, prototypes were moved to another place according to their suggestions (Figure 7.23). They had three main concerns: 1. ensuring the convenience of recycling facilities; 2. preventing recyclables from getting wet in bad weather; and 3. ensuring the accessibility of fire hydrants.

Figure 7.23 Prototypes were moved to another place according to the participants' suggestion

Residents who were interviewed in previous studies, some of whom had been non-recyclers at the beginning of this study, were more active in the process and were

willing to provide support when they noticed their suggestions had been implemented. Workshop participants continually encouraged their neighbours to recycle and supervised recycling activities, developing further collaboration with increasing numbers of residents. Several participants who were members of the mutual-aid committee spontaneously took photos and notes and reported to the researcher frequently.

After setting up the prototypes in another area, the amount of recyclables increased quickly on that day. Many residents mentioned that it had become much more convenient for them to deal with these recyclables. Two days later, the bins for collecting waste paper and plastics were almost full (Figure 7.24). However, the cleaners did not collect them immediately. On the following day, residents put the recyclables directly on top of the bins because the bins were full already (Figure 7.25). The transparent appearance not only made it easy for users to differentiate the categories of recyclables but also enabled them to observe the recycling situation.

> Respondent: I asked the cleaner last time … she told me that she did not think it was her responsibility to collect them [the recyclables] because nobody asked them to do that. I think the property management office may solve this problem.

Figure 7.24 The bins for collecting waste paper and plastics were almost full two days after they were moved

Figure 7.25 Residents put the recyclables on top of the bins because the bins were full already

Some residents reported this situation to the property management office spontaneously. On the next day, one of the residents took a photo and reported that the recyclables had already been collected by the cleaners (Figure 7.26). However, the resident noticed that some cleaners still treated these recyclables as rubbish.

> Respondent: Frankly speaking, I never recycled before. It was my first time to participate in recycling. I washed all of the plastic bottles before disposal. You know, the plastic bottles are very difficult to wash – especially the bottle of shampoo! I washed them

again and again. Imagine how angry I was when I noticed the cleaner threw them away!

Figure 7.26 The recyclables had already been collected by the cleaners (*source: photo provided by a resident*)

As there was no effective way to solve this problem temporarily, some residents then asked the elderly people and scavengers to collect them before final disposal. During the research period, scavengers often collected recyclables from the recycling bins. Some residents still left recyclables next to the bins, to make it easier for scavengers to collect them. At the same time, with the help of community centre and property management company, the researcher continued to negotiate with related local authorities regarding the issues.

Table 7.3 Comments from different respondents in line with the four behaviour models

Behaviour model	***No. of respondents***	***Comments***
Linear	twelve residents; two cleaners; four scavengers	'recycling is very important', 'I do what I can', 'I've got used to doing that', 'the design makes it easy to differentiate the categories of recyclables', 'some elderly people and scavengers collect them and then sell them to subsidise their household income'

 *Dependent*	twenty-four residents; three property management staff	'the facilities are clean and easy to use', 'the facilities are accessible and convenient', 'some follow-up actions after the workshops', 'the facilities are installed as I suggested', 'some of my neighbours are active recyclers'
 *Circular*	twenty-two residents	'I noticed a cleaner dispose of recyclables as rubbish and throw them away', 'the bins are always full'
Static	twenty-seven residents; three cleaners	'little interest', '*ma fan*', 'the cleaners put all the recyclables and rubbish together', 'busy', 'nobody asked me to do that', 'lack of storage space', 'sanitary problem', 'waste of time', 'lack of effective implementation and management', 'no effective way to transfer recyclables afterwards', 'the reward of selling recyclables is low'

Error! Reference source not found. clusters the major issues raised by different respondents according to the four behaviour models identified in Section 7.1. Among the ninety-seven interviewees, thirty-six residents, two cleaners, four scavengers and three property management staffs mentioned this project was able to facilitate them to participate in household recycling. Twenty-two residents mentioned this project enhanced their motivation and changed their undesired behaviour at the beginning, however, their willingness to form sustainable behaviour declined due to poor implementation and management. Since people felt disappointed and unpleasant, they showed reluctant and reacted in a passive way afterwards. For the rest of the interviewees, they mentioned they had little interest in adopting any sustainable behaviour and simply ignored it. Moreover, some of them responded in another undesired way if inappropriate interventions were made.

Reflect

Stage 2 helped to develop further collaboration with increasing numbers of different stakeholders. This stage not only explored opportunities, but also revealed the

barriers and experiences of using PAR in practice. Given the experiences of action research during this period, it was impossible to satisfy all people's expectations and encourage everyone to behave sustainably merely by design interventions and collaboration. Finding the target behaviour groups and understanding their concerns can encourage more people to participate in household recycling. The point of this stage is not to make an excuse for the difficulties of public participation in household recycling or to ignore comments from certain groups. Rather, this stage identifies the target users among the four behaviour models to enhance the effectiveness of design for public participation in recycling. Concurrently, by exploring the comments from groups such as the static group, it is possible to gain some insights from the failure to involve them in recycling.

As shown in Table 7.3, for the linear group and the dependent group, the design improvement was able to facilitate participation in recycling. For the circular group, design interventions and collaboration enhanced their motivation and changed their behaviour initially. However, poor implementation and waste management led to failure; design interventions and collaboration alone were not enough to change undesired behaviour. It was thus important to ensure appropriate long-term design implementation and management. For the static group, design interventions and collaboration were not particularly effective. People in this group may simply ignore the intervention or respond in an undesired way. Other motivating or constraining strategies such as policies, regulations and economic incentives may help, but it should be borne in mind that irrational and inappropriate interventions may generate social issues. Researchers should pay special attention to this group.

In this stage, it was able to see further opportunities and weaknesses from the observations and interviews.

- There was still some disagreement between the residents and cleaners. On the one hand, the residents complained that the recycling bins were always full – especially the bin for plastics – because the cleaners did not empty them every day. The cleaners stated that they were too busy dealing with large amounts of household waste and were thus unable to collect the recyclables frequently. To balance these issues, large-sized recycling bins for plastics would be useful in future research.
- There was no effective and convenient way for cleaners to transfer the recyclables to recycling stations after collecting them from the bins, which decreased cleaners' motivation to collect the recyclables. Consequently, some participants lost their enthusiasm for recycling when they noticed there was no effective implementation. Not only design but also subsequent treatments may influence people's behaviour.
- Persuading and educating the older generation to participate in recycling was ineffective because this generation's waste disposal behaviour had become long-ingrained habits. However, it was possible to persuade the younger generation to behave sustainably.
- Although some people changed their undesired behaviour during the research period, this does not ensure long-term sustainable behaviour afterwards, especially in terms of implementation and management issues. In this regard, continuous studies are necessary in future.

7.4 Reflections on the process

Given the aforementioned concerns of action research, several questions need to be borne in mind: did the research enhance people's awareness to participate in the process? Did the research balance different attitudes from different stakeholders

appropriately? Will the research bring any changes to the community? What aspects of the research work and do not work and how these could be adjusted or developed?

During the collaborative workshops, the participants were encouraged to freely discuss household recycling. However, in some groups, the participants were initially hesitant, as they were unaccustomed to voicing their opinions. In contrast, some participants actively participated in the process and functioned as supervisors. As a result, these groups required more time than the others for all of the participants to explicitly express their views.

During the iterative prototyping process *in situ*, participants who had attended the workshops previously were excited when they noticed their recommendations had been put into practice. Some interviewees who never or seldom recycled began to participate in recycling. They began to recognise their competency in the community and played an active role in the process. Residents who were members of the mutual-aid committee spontaneously encouraged their neighbours to participate in this project and also supervised recycling activities. They collected the comments from other residents and then gave some suggestions to researchers frequently. Moreover, they informed property management company and discussed how to improve the situation. As mentioned above, the property management companies play an important role in the implementation and management of household recycling. Compared to the other housing estates that were not willing to participate in the project, both property management company and housing authority in Sai Wan Estate were urged to improve the situation. They listened residents' suggestions carefully and treated them seriously. However, it took some time for them to implement because they had to negotiate with different departments. For the residents, since no effective way to collect the recyclables

temporary and they urged for change, they began to seek another way to deal with this problem at the same time (e.g. informing the elderly people and scavengers to collect recyclables). This study helped to enhance people's competency in sustainable community development and strengthen their sense of community. Mr. Lee, a workshop participant expressed his feeling of the project:

> Actually, I seldom participated in housing recycling and community activities before. It is the first time for me to become one of the participants. I felt so excited when I noticed our recommendations had been put into practice. Here I can do something for the community, and for the environment.

However, the author must admit that there are some weaknesses in this PAR project. It is not easy to conduct this project in housing estates because it is difficult to obtain the consent and support of the property management companies and households (residents) to participate in the studies and provide information. So the author had to choose several public housings that were willing to. Moreover, parts of the concepts generated from the process were not able to be tested in the research. For example, food waste recycling was unavailable due to property management's own concerns. Many paths have not been travelled due to the constraints of practicality.

Residents were the most active stakeholders in this study. They helped to improve the project and push it forward. Although some people have changed undesired behaviour during the research period, it cannot ensure long-term sustainable behaviour after the research. In effect, poor implementation and management may decrease people's willingness and lead to failure. In this study, both property management company and housing authority provided a lot of supports, and social workers also helped to coordinate different stakeholders. However, it was still

difficult for cleaners to implement. They need governments to provide effective way for transferring the recyclables in time.

Besides, though the researcher tried to balance different attitudes from different stakeholders appropriately, I found that it was impossible to meet all people's satisfaction. Compared to the residents, cleaners were more passive in participating in the project. They were initially reluctant to tell the truth. The researcher had to spend more time to listen to their views. Due to a lack of communication, there were some conflicts between residents and cleaners during the research period. After being negotiated by the researcher and social workers, some residents began to understand the situation and find alternative solutions. Moreover, although some people may simply ignore the project or response in another way, the author need to continuously pay attention to their opinions because any irrational and inappropriate interventions may generate social issues.

7.5 The experiences of the action research process

Data collected from collaborative workshops and on-site prototyping processes tend to provide more information than traditional surveys. This *in situ* PAR not only explored opportunities in household recycling but also revealed some barriers in actual practice. However, it is not easy to conduct PAR in community activities, especially those relating to household participation in recycling. The location for collaborative workshops determined the characteristics of the participants. For example, older people and disabled people had difficulty attending the workshops. Therefore, the laboratory might not be an appropriate place for the workshops. To ensure that participants include different groups of people, a nearby location for the workshops was necessary. Secondly, the spatial characteristics of the residential housing estates are quite different across institutions and companies. In many

modern cities with high-rise buildings, residential housing estates are managed by property companies and have security guards. It is impossible to conduct an investigation in a residential building without obtaining approval from various stakeholders, including the housing department and the property management company. In practice, many housing estates had concerns and were reluctant to participate in the project. In addition, conducting observations inside the buildings may have caused annoyance because of the intrusion into the residents' living area, which includes the public space. Furthermore, the demographic structure of the residential housing estates was diverse and stratified in terms of age, household income and educational attainment, which made it difficult to motivate residents to participate in recycling practices.

With reference to the case study, the key experiences of PAR in household recycling were as follows.

- Seeking the assistance of community centres that work with and for the residents is necessary. Social workers have close contact with many local residents in the buildings, which makes it easy for researchers to reach residents without intruding on their private living spaces.
- Support from different stakeholders, including the local government, property management, private recyclers and cleaners is pivotal for improving public facility design.
- The outcome of PAR is important, as it allows different stakeholders to voice their needs and preferences during the process. The step-by-step and on-going nature of the process ensures that researchers can review, plan, evaluate, adjust and implement the design based on immediate feedback to fit people's needs and concerns.

- To promote participatory and democratic design for recycling, it is necessary to involve users in a project's early stages. Studies have shown that early user involvement facilitates the exploration of problems, opportunities and ideas before the final design (Steen et al., 2007).
- PAR in household recycling involves a hierarchy that includes implementation, management and policy (Siu & Wong, 2013). Greater user satisfaction and public participation can be achieved if participants witness follow-up actions based on their comments.
- The iterative prototyping process is effective for decision making. Once it is set in motion, barriers to and opportunities for change at all levels can be explored. The iterative prototyping process also helps to achieve greater involvement and to find solutions to practical problems.
- The roles of project members must be identified before the project. Both participants and researchers play active and important roles in the design process (Siu & Kwok, 2004). The researchers act not only as facilitators to coordinate all matters but also provide professional suggestions and support during the process.
- An action approach helps the achievement of greater understanding and the evaluation of behaviour changes through cyclical processes over a period of time (Farrelly & Tucker, 2014). Given the constant changes in social and cultural environments, people may have different reactions and needs as time goes on. Therefore, the findings and results of long-term studies must be carefully evaluated.

7.6 Summary

As most studies have relied heavily on quantitative surveys of reported behaviour and attitudes to identify the barriers to and opportunities for public participation in

recycling, this study contributes to finding solutions to challenges by a cyclical processes of reflective learning *in situ*.

To improve public design for behaviour change, it is not enough to enhance the usability and accessibility of public facilities by merely relying on designers. Efforts to facilitate active involvement in recycling must also consider different stakeholders and encourage them to voice their views in the early design stage. In practice, different stakeholders, including residents, cleaners, scavengers and property management staff, had different attitudes towards public facilities because of their positions. To explore appropriate design interventions and collaboration, PAR is a good way since it can respect and reveal people's actual needs and preferences. Efforts to provide high-quality recycling facilities based on users' requirements can induce residents to develop sustainable behaviour. However, long-term and continuous actions at different levels of the hierarchy, including implementation, management and policy, are necessary. Moreover, if participants witness follow-up actions based on their comments, a higher degree of public participation can be achieved.

This study has also identified four behaviour models and has discovered the target groups where design interventions and collaboration can be applied. Design interventions and collaboration can influence human behaviour. However, this is by no means an effective way to change all people's behaviour. In practice, it is impossible to satisfy all people and encourage everyone to behave sustainably merely through design interventions and collaboration. According to the findings of this study, design interventions and collaboration have effects on the linear, dependent and circular groups, yet have little or no effects on the static group. Nevertheless, designers should pay attention to the static group because irrational

and inappropriate interventions may generate social issues. It is thus necessary to identify different behaviour groups and understand their concerns to encourage more people to participate in recycling.

CHAPTER 8 Conclusion

This thesis has reviewed the literature on waste, public design for household recycling and design for influencing behaviour, provided a comprehensive understanding of contextual factors related to recycling behaviour, investigated H-D-C relationships and discussed how designs can be improved to influence sustainable behaviour. In this concluding chapter, the research questions proposed in Chapter 1 are answered, the outcomes are restated, and the contributions to knowledge in design practice and design research are summarised. This chapter also discusses the limitations of the study and makes suggestions for further study.

8.1 Answering the research questions

This study explored how to effectively alter people's behaviour through design and management. Four research questions formulated in Chapter 1 were answered. This study not only answered each question but also described the process of searching for these answers.

8.1.1 Q1: What factors affect sustainable recycling behaviour?

The literature review identified that not only personal factors such as norms and attitudes but also the environmental setting, including social and physical factors, affect actual behaviour. Although economic incentives and moral motivations have been widely discussed in various studies of public participation in recycling, the influence of contextual factors such as social culture and living environments on recycling activities and human behaviour have seldom been discussed, especially in the context of densely populated communities.

In this regard, personal factors such as norms and attitudes, and contextual factors such as social culture and the physical setting were examined, concentrating especially on contextual factors. According to the self-report questionnaires, inconvenience was identified as one of the major reasons for disposal behaviour. Inadequate or poor design and public awareness were further important reasons for low rates of participation in recycling. A monetary incentive was an important factor that could promote behaviour change. Neighbours' behaviour might also influence others' behaviour.

Following the discussion of factors that influence behaviour in Chapter 3, a framework of contextual information was proposed to provide a holistic understanding of contextual factors. In this framework, context related to personal behaviour was divided into three aspects: physical, social and socio-cultural. The physical context includes built environments such as the neighbourhood (community), housing types, space, and recycling networks. The social context includes social and family structures and neighbours. The socio-cultural context includes the local culture with its customs, traditional culture and lifestyles. Each one of the variables in the framework such as customs, neighbourhood, neighbours, recycling networks and lifestyles was indicated as a factor that affected human behaviour.

To investigate what contextual factors significantly affect recycling behaviour, a survey was conducted in two districts with high population densities. Correlations and multiple regression analyses were conducted to interpret the data collected through the questionnaires. The findings indicated that the availability of nearby recycling facilities, satisfaction with the location of recycling facilities, satisfaction with other residents' participation, and satisfaction with the neighbourhood and

with accommodation were the most significant predictors of UPRF. The findings also showed that monthly household income and availability of nearby private recycling sectors were the most significant predicators of UPRS.

As cultural factors are hard to measure in a quantitative way, the study identified these issues based on qualitative data by using sociological and anthropological research methods via interviews and observations. The culture of convenience was addressed as a prominent cultural factor affecting human behaviour. Many people find it '*ma fan*' to separate recyclables. It was shown that unsustainable behaviour is not easy to change because people grow accustomed to their personal rhythms. People had relatively high expectations for convenience from design and management.

8.1.2 Q2: What are people's perceptions and reactions towards existing design and management of waste recycling in Hong Kong?

The findings from questionnaires and interviews showed that many residents believed that the existing design for household recycling was inconvenient. Some residents claimed that the recycling facilities provided in public space were neither adequate nor effective. Many participants emphasised that recycling was time- and energy-consuming and that they did not have time to separate recyclables. In effect, this belief was not only a result of the inadequate and inefficient recycling facilities, but also because the subjects found that dumping their waste without sorting it was easier and saved them time and energy. Normally, waste was collected by the cleaners twice a day, in the morning and at night. Rubbish bins were provided everywhere. It was noted that many interviewees considered the existing refuse collection system to be very convenient and considered the recycling facilities to be very inconvenient. In contrast to the refuse collection methods in other areas of

Asia such as Japan and Korea, the gap between recycling and not recycling in terms of convenience in Hong Kong was rather obvious. Consequently, many citizens were more likely to choose a fast and convenient way to deal with their waste. As a result, many residents considered the recycling bins as little more than decoration.

8.1.3 Q3: What are the limitations and challenges in public design for recycling, with particular attention to high-rise, high-density living environments?

To search for the answer, this study deployed both quantitative and qualitative methods to explore the limitations and challenges in public design for recycling.

According to the field study, there were many socio-cultural challenges to achieving convenience in recycling. In practice, security related to fire legislation took priority over convenience and accessibility of recycling facilities. Recycling facilities should be installed in refuse storage rooms or corners to avoid hindering people's movement. Moreover, both governments and individuals had a strong sense of public health. People were not willing to store many recyclables, especially putrescibles (e.g., food waste), because they wanted to keep their houses clean. Waste removal practices were conducted in a fast and invisible manner. Cleaners were required to collect the waste from buildings once or twice a day, which increased the convenience of refuse disposal without sorting.

There were also some physical limitations and barriers in public design for recycling in high-rise, high-density living environments. There were a variety of building and housing estate types with stratified living environments and accommodations. Some high-rise buildings had relatively large communal spaces such as refuse storage rooms, whereas some walk-up buildings were too narrow to

allow for the installation of any public facilities. Such complexity and variety of living conditions makes the systematic or effective implementation of collection facilities difficult. Besides, most flats in Hong Kong are very small, especially in the PRH estates. In contrast to other cities with more dwelling space, the limited interior space in Hong Kong makes it difficult for residents to store a large amount of recyclables. It is also impractical to set up different types of bins or bags for different recyclables at home. The limited household space and especially the tiny kitchens, makes it particularly difficult to store recyclables by category.

Moreover, the implementation and management was quite different from the original purpose. In general, housing estates are managed by property management companies or housing departments, and the estates thus have many options to place the bins based on the guidelines. Waste separation bins are provided for free distribution. The property management companies can apply for government subsidies if they want to install more facilities in the buildings. However, most property management companies are reluctant to apply for more recycling bins.

In addition, although recycling bins were provided in the public space, there was no effective and convenient way for cleaners to transfer the recyclables to recycling stations after collecting them from the bins, which decreased cleaners' motivation to collect the recyclables and subsequently decreased residents' willingness to participate in recycling.

8.1.4 Q4: How can human behaviour be effectively influenced through design?

Chapter 6 investigated why individuals behave in an undesired way from a fundamental and philosophical perspective. It was addressed that H-D-C

relationships influence how people deal with waste. Applying intervention in the H-D relationship (passive) and developing collaboration in the H-C relationship (active) were identified as two main approaches to influence human behaviour. In terms of design and management for changing human behaviour, there were three fundamental approaches – making it easier to do something (enabling), making people want to do something or not do it (motivating) and making it difficult or impossible for people to do something (Lockton, 2013).

According to the findings in Section 5.3, the physical environment is important for community satisfaction and a high-quality environment results in sustainable behaviour. A case in Amoy Gardens showed that the improvement of built environments was necessary to promote an atmosphere of social interaction and to cultivate sustainable behaviour. Community activities such as garden recycling programmes, and design and management promoting collaboration could be launched in neighbourhoods to encourage public participation in recycling.

Because inappropriate interventions might be unacceptable and lead to annoyance and frustration, it is necessary to study people's needs, acceptances and responses along with the social effects of the interventions in the context of their particular situation. Moreover, there is a gap between self-reported attitudes and actual behaviour. To explore design barriers and opportunities, and evaluate the feasibility of design interventions and collaboration, action research was conducted *in situ* (see Chapter 7). Different stakeholders such as local residents, scavengers, property management officers and cleaners were recruited to voice their views on design for recycling. The step-by-step and on-going nature of the process can ensure that researchers or designers plan, evaluate, adjust and implement the design based on immediate feedback to fit people's needs and concerns.

Moreover, this study also identified that it was impossible to satisfy all people and encourage everyone to behave sustainably merely by design interventions and collaboration. Figure 8.1 highlights the opportunities for design and management for recycling among the four behaviour groups in this study. It was shown that design and management might affect the linear, dependent and circular groups, yet have little or no effect on the static group (Figure 8.1). Nevertheless, researchers or designers should pay attention to static groups because irrational and inappropriate interventions might generate social issues.

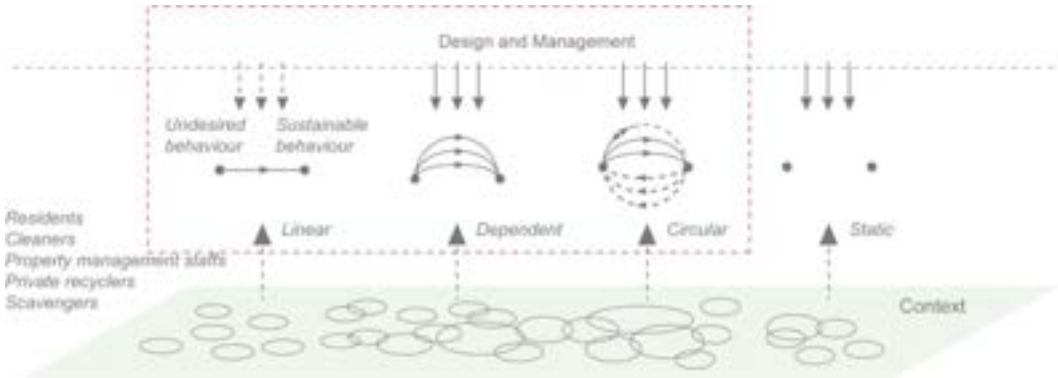

Figure 8.1 The opportunities of design and management among the four behaviour groups in this study

8.2 Conclusions

The aim of this study was to explore how to improve design for sustainable recycling behaviour in high-density spaces. This involved exploring not only opportunities and difficulties for household recycling through design, the strategies or approaches to change unsustainable behaviour, but also the applicability of design approaches in changing behaviour. This research did not conclusively demonstrate the effectiveness of design approaches identified for behaviour change.

Nevertheless, it did reflect on perceptions of different stakeholders who may play a role in design, implementation and management of household recycling.

In terms of research methodology, as interpretivism was widely used in this study to understand processes and meanings through social construction, a constructive, interpretive, practice-led action research was considered to be the most appropriate methodology to develop and evaluate design strategies through a cyclical process of reflective learning *in situ*. This study was divided into four main phases by applying different research methods. In the overview understanding phase after the literature review, surveys including questionnaires and interviews were used to obtain a general impression of household recycling. Before conducting action research, targeted case studies were conducted at several selected sites. Both quantitative and qualitative methods were used with the aim of gaining an in-depth understanding of people's behaviour and living contexts. In the final stage, which was the most time-consuming phase of the study, action research was conducted.

Given the aforementioned concerns of PAR, both action and reflection are of great importance in PAR (Jansen, Baur, de Wit, Wilbrink & Abma, 2015). Extensive analysis and reflections on the process were discussed in Chapter 7. In Section 7.4, critical reflections into what aspects of PAR work and do not work were discussed, which could help researcher understand the situations and what aspects could be adjusted or developed. This study does not intent to suggest that PAR is the best approach to conducting household recycling. Instead, it aims to identify the opportunities, challenges, barriers and lessons learned from experiences based on this approach during the process. It also offers a way to reduce the gap between theory and practice.

This study has especially focused on the process, rather than on the designs (or tools) themselves. Collaborative workshops help to balance this situation and enable stakeholders to develop ideas together. Conducting an iterative prototyping process enables researchers to review, plan, evaluate, adjust and implement the design step by step, providing an in-depth understanding of various concerns that are often neglected or misunderstood by designers and governments. It can also result in equal opportunities for different stakeholders to improve and maintain public design for sustainability. Moreover, constraints and challenges to public design can be examined *in situ* during the iterative prototyping process.

This research has investigated that the factors that affect recycling behaviour. Given that personal factors have been widely discussed by many researchers, this study mainly focused on contextual factors. To obtain a comprehensive understanding of the contextual factors involved, a framework of contextual information pertaining to personal behaviour, encompassing relevant variables such as customs, neighbourhood, neighbours, community, facilities and lifestyles was proposed. The finding indicated that the residents' satisfaction with recycling networks and the perceived quality of environments were positively associated with sustainable recycling behaviour. It was suggested that not only the physical settings but also the social environments and the residents' satisfaction should be taken into consideration in sustainable studies.

This research has also investigated H-D-C relationships within the context of densely populated high-rise buildings. The findings indicated that applying interventions in the H-D relationship (passive) and developing collaboration in the H-C relationship (active) were two main approaches to change unsustainable behaviour. Design intervention was further divided into three levels – enabling,

motivating and constraining – in line with Lockton's (2013) framework. Most current strategies, such as information, education, economic incentives, design and punishment were categorised according to three levels of intervention. All attempts to re-establish the H–D relationship directly can be described as passive methods, from 'I urge you to' enabling approaches and 'I ask you to' motivating approaches, to 'I order you to' constraining approaches. Collaboration was regarded as a modest strategy that changed undesired behaviour indirectly. It also addressed that collaboration could be launched in neighbourhoods to promote an atmosphere of social interaction and cultivate sustainability behaviour.

Since there was a gap between self-reported attitudes and actual behaviour, it was thus necessary to discuss and evaluate the feasibility of applying design intervention and developing collaboration for behaviour change on the cyclical processes of reflective learning. Due to the limitations described below, the data was collected from several housing estates. The sample of participants was by no mean representative; however, it was diverse enough to ensure there were some differences among the participants in terms of age, gender and other demographic factors. By involving different stakeholders at different research stages, it was found that different stakeholders had some disagreements and different concerns about household recycling, which would affect the result directly or indirectly. It was thus necessary to understand their situation and apply appropriate interventions.

During the PAR research, though the author tried to balance different attitudes from different stakeholders appropriately, it was clear that it was impossible to meet all people's expectations and encourage everyone to behave sustainably merely through design interventions and collaboration. This study has identified four

behaviour models and has discovered the targets groups where design intervention and collaboration can be applied. Although some people have changed undesired behaviour during the research period, it cannot ensure long-term sustainable behaviour after the project. Poor implementation and management may decrease people's willingness and lead to failure. Moreover, although some people may simply ignore the project or response in another way, the researcher still need to pay attention to their opinions because any irrational and inappropriate interventions may generate social issues.

8.3 Contributions to knowledge

The study contributes to both design practice and design research in influencing sustainable behaviour. Design frameworks and theories constructed in this study facilitates designers, researchers as well as policy makers to gain more insights and reflective learning on design for sustainability.

8.3.1 Contribution to knowledge in design practice

The design theories and practice constructed in this study come to an in-depth understanding of design for sustainable behaviour in high-density space. This study indicates PAR is significant in design practice for public design issues. Through the action and reflection, it helps designers, researchers and policy makers to understand the situation and what aspects could be adjusted. Although PAR in public space may not be easy for researchers and designers to implement, especially in terms of iterative prototyping processes in residential areas, its results are nevertheless promising. The experiences in this study also provide references for greater mobilisation and behaviour change in other public design issues. The contributions to knowledge in design practice can be summarised as follows:

- This study is among the first to apply PAR in design for behaviour change related to recycling issues in high-density space.
    - The importance of PAR *in situ* and the experiences of using PAR in design practice were identified.
    - The limitations and barriers to household recycling in high-rise buildings were analysed.
- This study has advanced understanding in design practice:
    - Different stakeholders' perceptions and reactions towards design and management of household recycling were analysed. It suggests that PAR helps to understand different stakeholders' concerns and apply appropriate interventions.

8.3.2 Contribution to knowledge in design research

A contribution to knowledge in design research has been made via case studies and a spiral 'plan-act-observe-reflect' action research. The significance of contextual factors was identified, which were seldom discussed in studies of design and management for recycling, especially in densely populated high-rise buildings. This study also suggests that people's responses and reaction to the influence determine the effects of intervention. Although action research is widely used in the field of health science, qualitative research methodologies designed to examine actual recycling practice and to improve public design through action research are few. As pointed out by Keremane and McKay (2011), most of the the participatory methods are generated from traditional survey methods such as interviews and quantitative methods and lack the ability to effectively involve different stakeholders in the research processes. The research methods adopted in this study have empowered different stakeholders to express their opinions and to enhance people's

competency in the community. The contributions to knowledge in design research can be summarised as follows:

- The methodology in this study provides an original contribution to literature on both action research and design for behaviour change.
  - Exploration and reflections on action research on household recycling in actual practice were addressed.
  - Design opportunities for household recycling in high-rise living situations and constructed communities were identified and evaluated.
- The empirical facts of the phenomenon have been explored through research process:
  - The H-D-C relationships were identified.
  - Challenges of influencing sustainable behaviour through design were identified.
  - A framework of contextual information was formulated. The context was divided into three aspects and the effects of each aspect were analysed.
- This study has provided recommendations, directions and approaches for further work in design research:
  - Two main approaches to influence sustainable behaviour via design were identified.
  - The processes of behaviour change were divided into four main groups with a behaviour model. The target behaviour groups were identified.

8.4 Limitations of the study

This study has answered the research questions and described the process of searching for these answers. However, there are some limitations of the overall process. This study identified interventions and collaboration as two major ways to influence human behaviour via design. However, the interventions tested in this study cannot cover all possibilities. Inevitably, many paths have not been travelled due to the constraints of time, finances and practicality. Many approaches, such as gamification and *Poka-yoke*, were not tried. Are there any other design interventions which could change human behaviour more effectively? As explored in Sections 6.3.4 and 7.2, various recommendations and ideas were generated, but some of them were not feasible due to the constraints of the study.

The limitations of each research method adopted in this thesis were discussed in Section 4.4. Admittedly, it is not easy to conduct PAR in housing estates because it is difficult to obtain the consent and support of the property management companies and households (residents) to participate in the studies and provide information. The sample size for multiple cases cannot cover a large proportion of people. In addition, the findings and discussion of the study may not be widely applicable to different contexts. This study does not provide a universal set of design guidelines for the design and management of household recycling at the global level. Nevertheless, it provides useful insights into the research process of how to improve design for public participation in household recycling in similar living conditions and social contexts.

8.5 Further study

In consideration of the constantly changing conditions and the complexity of local contexts, continuous studies on design for household recycling in high-rise buildings are particularly necessary.

This study identifies how to influence recycling behaviour without diminishing people's willingness and raising any annoyance through design from both research and practice perspectives. This was an initial trial of PAR in household recycling. Design interventions and collaboration have great potential to influence behaviour. More practical work on different types of intervention and collaboration must be conducted.

Future research should consider the proposed theories through more empirical studies in similar areas. In-depth and continuous studies conducted in more communities in different local contexts and with different users are required to test and evaluate the effectiveness of design interventions and collaboration. Studies of the specific challenges in recycling practices such as different physical environments and social and cultural settings are also needed. Long-term empirical studies in other cities should be conducted to provide a comprehensive understanding of sustainable practice.

Appendix

The English Translation of Questionnaire of Household recycling

This questionnaire aims to find out your opinion and behaviour with regard to household recycling. Your views on waste recycling issues are known and improvement on waste management and public design can be made. There is no right answer for the questions. No individual answers will be disclosed or published.

Section A

1. Have you ever participated in domestic waste recycling?

☐ Frequently (go to question 2)

☐ Occasionally (go to question 2)

☐ Seldom (go to question 2)

☐ No, never (go to question 3)

2. How often do you participate in domestic waste recycling?

☐ More than three times a week

☐ Once or twice a week

☐ Once or twice a month

☐ More than a month

3. Which statement best describes your situation in domestic waste collection?

☐ I carry the waste to rubbish bins/refuse chute/waste collection point on my storey, without any separation.

☐ I carry the waste to rubbish bins/refuse chute/waste collection point on the ground floor, without any separation.

☐ I put a bag of waste next to my main door for waste collection, without any separation.

☐ I separate the recyclables from household waste and carry them to recycling

bins/rubbish bins/refuse chute/waste collection point accordingly

☐ Other, please specify _____

4. When do you dispose of domestic waste?

☐ When I pass by rubbish bins ☐ After dinner

☐ Any time ☐ Other, please specify _____

5. Do you know what kinds of recyclables could be collected in your neighbourhood?

☐ Yes ☐ No

6. Do you know what kinds of recyclables could be put into the brown recycling bins?

☐ Plastic bottles ☐ Metal ☐ Paper ☐ Plastics

7. Do you use the public recycling facilities?

☐ Yes (go to question 8) ☐ No (go to question 9)

8. How often do you use the public recycling facilities?

☐ More than three times a week

☐ Once or twice a week

☐ Once or twice a month

☐ More than a month

9. Where are the recycling bins installed in your neighbourhood?

☐ Each storey

☐ On the ground floor inside the building

☐ Beside the entrance to the lift lobby

☐ On the entrance of the building

☐ Open space in the community

☐ Other, please specify _____

10. The private recycling sector is available in your neighbourhood.

☐ Yes ☐ No

11. Do you sell recyclables to private recyclers?

☐ Yes ☐ No

Section B

12. The distribution of public design for recycling is very satisfaction.

☐ Strongly agree ☐ Agree ☐ Fair ☐ Disagree ☐ Strongly disagree

13. What are the reasons for not recycling?

☐ Lack of public awareness

☐ Inconvenience

☐ Sanitary issues

☐ Inadequate/poor facilities

☐ Lack of incentives

☐ Lack of support from neighbours

☐ Do not know how to separate

☐ Lack of storage space

☐ Others, please specify _____

14. Where do you prefer to install recycling bins?

☐ Each storey

☐ On the ground floor inside the building

☐ Beside the entrance to the lift lobby

☐ On the entrance of the building

☐ Open space in the community

☐ Other, please specify _____

15. What kind of recycling method do you prefer?

☐ Separate the discarded into two categories (recyclables and non-recyclables) and put them to designated bins/collection point accordingly

☐ Separate recyclables into several categories and put them to designated bins/collection point accordingly

☐ Other, please specify _____

16. How do you feel about the relationship between you and your neighbours?

| _____ | _____ | _____ | _____ | _____ |

Very unfamiliar Very familiar

17. How do you feel about the living environments?

| _____ | _____ | _____ | _____ | _____ |

Very poor Very good

18. How do you feel public design for recycling in terms of usability?

| _____ | _____ | _____ | _____ | _____ |

Very poor Very good

19. Are you satisfied with other residents' participation?

| _____ | _____ | _____ | _____ | _____ |

Very unsatisfactory Very satisfactory

20. How do you feel about the private recyclers nearby?

| _____ | _____ | _____ | _____ | _____ |

Very inconvenient Very convenient

21. Are you satisfied with your neighbourhood/community space?

| _____ | _____ | _____ | _____ | _____ |

Very unsatisfactory Very satisfactory

22. Would you be willing to participate in recycling if recycling containers were provided in each storey?

☐ Yes ☐ No ☐ No opinion

Section C

23. Gender: ☐ Female ☐ Male

24. Age: ☐ 14 or below ☐ 15~24 ☐ 25~44 ☐ 45~64 ☐ Above 65

25. Education attainment:

☐ Primary or lower ☐ Secondary ☐ Tertiary or higher

26. Monthly household income:

☐ <10,000 ☐ 10,000~19,999 ☐ 20,000~29,999 ☐ 30,000~39,999 ☐ ≥40,000

27. Which type of accommodation are you living in?

☐ Public rental housings

☐ Home Ownership housings

☐ Private housings

☐ Others, please specify _____

End of questionnaire. Thank you.

References

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, J. A. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology, 25*(3), 273-291.

Altman, I. (1975). *The environment and social behaviour: Privacy, personal space, territory, crowding.* Monterey, California: Brooks/Cole Press.

Altman, I., & Chemers, M. (1980). *Culture and environment.* Monterey, California: Brooks/Cole Press.

Andranovich, G. D., & Riposa, G. (1993). *Doing urban research.* Newbury park, London, New Delhi: Sage.

Babbie, E. R. (2011). *Introduction to social research* (5th edition). Belmont, Calif.: Cengage learning Press.

Barr, S., Ford, N. J., & Gilg, A. W. (2003). Attitudes towards recycling household waste in Exeter, Devon: quantitative and qualitative approaches. *Local Environment: The International Journal of Justice and Sustainability, 8*(4), 407-421.

Baudrillard, J. (1996). *The system of objects*. London: Sage.

Baudrillard, J. (1998). *The consumer society: Myths and structures*. London: Sage.

Baxter, P., & Jack. S. (2008) Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report, 13*(4), 544-559.

Beins, B. C. (2009). *Research methods: A tool for life* (2nd edition). Boston: Pearson Education.

Bekin, C., Carrigan, M., & Szmigin, I. (2007). Caring for the community: An exploratory comparison of waste reduction behaviour by Brithis and Brazilian consumer. *International Journal of Sociology and Social Policy*, 27(5), 221-233.

Bell, J. (1987). *Doing your research project: A guide for first-time researchers in education and social science.* Milton Keynes, England: Open University Press.

Bell, P. A., Greene, T. C., Fisher, J. D., & Baum, A. (1996). *Environmental Psychology* (4th edition). Fort Worth: Harcourt Brace College Publishers.

Belton, V., Crowe, D. V., Matthews R., & Scott, S. (1994). A survey of public attitudes to recycling in Glasgow. *Waste Management & Research, 12*(4), 351-367.

Benwell, B., & Stokoe, E. (2006). *Discourse and identity*. Edinburgh: Edinburgh University Press.

Berger, P. L., & Luckmann, T. (1967). *The social construction of reality: Everything that passes for knowledge in society*. London: Allen Lane.

Bernardes, J. (1987). "Doing things with words": Sociology and "family policy" debates. *The Sociology Review, 35*(4), 679-702.

Blake, E. H., Tucker, W., Glaser, M., & Freudenthal, A. (2011). Deaf telephony: Community-based co-design. In Y. Rogers, H. Sharp, & J. Preece (Eds.), *Interaction design: Beyond human-computer interaction, 3rd ed.,* (pp.1-48). New York: Wiley.

Bondi, L. (1999). Gender, class and gentrification: Enriching the debate. *Environment and Planning D: Society and Space, 17*(3), 261-282.

Brown, L.G. (1989). The strategic and tactical implications of convenience in consumer product marketing. *Journal of Consumer Marketing, 6*(3), 13-19.

Brown, L. G., & McEnally, M. R. (1992). Convenience: Definition, structure, and application. *Journal of Marketing Management, 2*(2), 47-56.

Brown, S., & McIntyre, D. (1981). An action-research approach to innovation in centralized educational systems. *European Journal of Science Education, 3*(3), 243-258.

Bourdieu, P. (1984). *Distinction: A social critique of the judgement of taste*. Cambridge, MA: Harvard University Press.

Callan, S. J., & Thomas, J. M. (2006). Analyzing demand for disposal and recycling services: A systems approach. *Eastern Economic Journal, 32*(2), 221-240.

Campbell, C. (1997). When the meaning is not a message: A critique of the consumption as communication thesis. In M. Nava, A. Blake, I. MacRury, & B. Richards (Eds.), *Buy this book: Studies in advertising and consumption* (pp. 340-351). London: Rouledge.

Carlson, D. L., & Lynch, J. L. (2013). Housework: Cause and consequence of gender ideology? *Social Science Research*, 42(6), 1505-1518.

Castells, M. (1997). *The power of identity*. Oxford: Blackwell.

Chan, E. H. W., & Lee, G. K. L. (2006). A review of refuse collection systems in high-rise housings in Hong Kong. *Facilities, 24* (9/10), 376–390.

Chang, Y. M., Liu, C. C., Hung, C. Y., Hu, A., & Chen, S. S. Change in MSW characteristics under recent management strategies in Taiwan. *Waste Management, 28*(12), 2443-2455.

Chao, Y. L. (2008). Time series analysis of the effects of refuse collection on recycling: Taiwan's "Keep Trash Off the Ground" measure. *Waste Management, 28*(5), 859-869.

Chavis, D., & Wandersman, A. (1990). Sense of community in the urban environment: A catalyst for participation and community development. *American Journal of Community Psychology, 18*(1), 55-81.

Cho, S. H., & Lee, T. K. (2011). A study on building sustainable communities in high-rise and high-density apartments – Focused on living program. *Building and Environment, 46*(7), 1428-1435.

Chung, S. S., & Leung, M. M. Y. (2007). The value-action gap in waste recycling: The case of undergraduates in Hong Kong. *Environmental Management, 40*(4), 603-612.

Chung, S.S., & Poon, C. S. (1994). Recycling behaviour and attitude: the case of the Hong Kong people and commercial and household wastes. *International Journal of Sustainable Development & World Ecology, 1*(2), 130-145.

Chung, S. S., & Poon, C. S. (1996). The attitudinal differences in source separation and waste reduction between the general public and the housewives in Hong Kong. *Journal of Environmental Management, 48*(3), 215-227.

Chung, S. S., & Poon, C. S. (1999). The attitudes of Guangzhou citizens on waste reduction and environmental issues. *Resources, Conservation and Recycling, 25*(1), 35-59.

Cohen, L., & Manion, L. (1994). *Research methods in education* (4th edition). London, New York: Routledge.

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues for field settings*. Chicago: Rand McNally.

Cooper, T. (2005) Slow consumption: Reflections on product life spans and the "throwaway society". *Journal of Industrial Ecology*, 9(1), 51-67.

Coughlan, P., Suri, J. F., & Canales, K. (2007). Prototypes as (design) tools for behavioural and organisational change: A design-based approach to help organisations change work behaviours. *The Journal of Applied Behavioural Science, 43*(1), 1-13.

Crilly, N., Moultrie, J., & Clarkson, P. J. (2004). Seeing things: Consumer response to the visual domain in product design. *Design Studies, 25*(6), 547-577.

Cross, G. (1993). *Time and money: The making of consumer culture*. London: Routledge.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process.* Thousand Oaks, CA: Sage Publications.

CSD, Census and Statistics Department. (2012). *Hong Kong 2011 population census: Summary results.* Hong Kong: Census and Statistics Department.

Cunningham, M. (2008). Influences of gender ideology and housework allocation on women's employment over the life course. *Social Science Research, 37*(1), 254-267.

Damodaran, L. (1996). User involvement in the systems design process – a practical guide for users. *Behaviour & Information Technology, 15*(6), 363-377.

Darier, E. (1998). Time to be lazy: work, the environment and modern subjectivities. *Time & Society, 7*(2), 193-208.

Davison, R. M. (1998). *An action research perspective of group support systems: How to improve meetings in Hong Kong. Hong* Kong: City University of Hong Kong.

de Certeau, M. (1984). *The practice of everyday life*. Berkeley, CA: University of California Press.

deKoning K., & Martin, M. (1996). *Participatory research in health: Issues and experiences*. London: Zed Books.

Denscombe, M. (1998). *Good research guide: For small-scale research projects*. Philadelphia, PA: Open University Press.

Denzin, N. K., & Lincoln, Y. S. (2000). *Handbook of qualitative research* (2nd edition). Thousand Oaks, CA: Sage Publications.

DeVries, M. J. (2006). Ethics and the complexity of technology: a design approach, *Philosophia Reformata, 71*(2), 118-131.

Douglas, M. (2002). *Purity and danger: An analysis of the concepts of pollution and taboo.* London: Routledge.

Eley, G. (1995). *The history of everyday life: Reconstructing historical experiences and ways of life* (W.Templer,Trans.). Princeton, NewJersey: Princetpm University Press.

Ellery, P. J., Ellery, J., Motloch, J., & Hunt, M. (2015). The Lutiisi Academy Primary School: Using community-centered design as a catalyst for change. *International Public Health Journal, 7*(1), 103-115.

EPD, Environmental Protection Department. (2005). *A policy framework for the management of municipal solid waste (2005-2014)*. Hong Kong: EPD.

EPD, Environmental Protection Department. (2008). *Three-coloured waste separation bins.* Hong Kong: EPD.

EPD, Environmental Protection Department. (2010). *Programme on source separation of domestic waste: Annual Update 2010.* Hong Kong: EPD.

EPD, Environmental Protection Department. (2012). *Monitoring of solid waste in Hong Kong: Waste statistics for 2011*. Hong Kong: EPD.

EPD, Environmental Protection Department. (2013). Hong Kong blueprint for sustainable use of resources 2013-2022. Hong Kong: EPD.

Erikson, T. (1995). Notes on design practice: Stories and prototypes as catalysts for communication. In J. Carroll (Ed.), *Envisioning technology: The scenario as a framework for the system development lifecycle* (pp. 37-58). New York: John Wiley.

Evans, D. (2012). Beyond the throwaway society: Ordinary domestic practice and a sociological approach household food waste. *Sociology, 46*(1), 41-56.

Fahy, F., & Davies, A. (2007). Home improvements: Household waste minimisation and action research. *Resources, Conservation and Recycling, 52*(1), 13-27.

Farrell, S. J., Aubry, T., & Coulombe, D. (2004). Neighbourhoods and neighbours: Do they contribute to personal well-being? *Journal of Community Psychology, 32*(1), 9-25.

Farrelly, T., & Tucker, C. (2014). Action research and residential waste minimisation in Palmerston North, New Zealand. *Resources, Conservation and Recycling, 91*(1), 11-26.

Featherstone, M. (1991). *Consumer culture and postmodernism*. London: Sage.

Foo, T. S. (1997). Recycling of domestic waste: Early experiences in Singapore. *Habitat International, 21*(3), 277-289.

Forlizzi, J. (2008). The product ecology: Understanding social product use and supporting design culture. *International Journal of Design, 2*(1), 11-20.

Forrest, R., Grange, A. L., & Yip, N. M. (2002). Neighbourhood in a high rise, high density city: Some observations on contemporary Hong Kong. *The Sociology Review, 50*(2), 215-240.

Fullerton, D., & Kinnaman, T. C. (2000). Garbage and recycling with endogenous local policy. *Journal of Urban Economics, 48*(3), 419-442.

Galbraith, J. K. (1998). *The Affluent Society*. Boston: Houghton Mifflin.

Gardner, G. T., & Stern, P. C. (2002). *Environmental problems and human behaviour* (2nd edition). Boston, MA: Pearson custom Publishing.

Geller, E. S., Winett, R. A., & Everett, P. B. (1982). *Preserving the environment: New strategies for behaviour change*. Elmsford, NY: Pergamon.

Giddens, A. (1971). *Capitalism and modern social theory: An analysis of the writings of Marx, Durkheim and Max Weber.* UK: Cambridge University Press.

Gifford, R. (2011). The consequences of living in high-rise buildings. *Architectural Science Review, 50*(1), 2-17.

Given, L. M. (2008). *The Sage encyclopedia of qualitative research methods.* Los Angeles, Calif: Sage Publications.

Goffman, E. (1959). *The presentation of self in everyday life.* UK: Penguin Books, Harmondsworth.

Gofton, L. (1995). Convenience and the moral status of consumer practices. In Marshall, D. (Ed.), *Food choice and the consumer* (pp. 152-181). London: Blackie Academic & Professional.

Gregory, S. (1999). Gender roles and food in families. In L. McKie, S. Bowlby, & S. Gregory (Eds.), *Gender, power and the household* (pp. 60-75). New York: St. Martin's Press.

Gray, D. E. (2009) *Doing research in real world* (2nd edition). London: Sage.

Greham, H. (1985). Providers, negotiators and mediators: women as hidden carers. In E. Lewin & V. Oleson (Eds.), *Women, health and healing: Towards a new perspective* (pp.25-52). London: Tavistock.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report, 8*(4), 597-607.

Hage, O., Söderholm, P., & Berglund, C. (2009). Norms and economic motivation in household recycling: Empirical evidence from Sweden. *Resources, Conservation and Recycling, 53*(3), 155-165.

Hassenforder, E., Smajgl, A., & Ward, J. (2015). Towards understanding participatory processes: Framework, application and result. *Journal of Environmental Management, 157,* 84-95.

Hamel, J., Dufour, S., & Fortin, D. (1993). *Case study methods*. Newbury Park, CA: Sage.

Hawkins, G. (2006). *The ethics of waste: How we relate to rubbish*. Lanhma, MD: Rowman and Littlefield.

Heidegger, M. (1982). *The question concerning technology, and other essays.* (W. Lovitt, Trans.). New York: Harper & Row.

Hewitt, P. (1993). *About time: The revolution in work and family life.* London: Rivers Oram Press.

Holden, M. T., & Lynch, P. (2004). Choosing the appropriate methodology: Understanding research philosophy. *The Marketing Review, 4*(4), 397-409.

Holtzblatt, K., & Jones, S. (1993). Contextual inquiry: A participatory technique for systems design. In D. Schuler & A. Namioka (Eds.), *Participatory design: Principles and practices* (pp. 177-210). Hillsdale, NJ: Lawrence Erlbaum.

Israel, B. A., Schulz, A. J., Parker, E. A., & Becker, A. B. (1998). Review of community-based research: Assessing partnership approaches to improve public health. *Annual Review of Public Health, 19,* 173-202.

Israel, B. A., Eng, E., Schulz, A. J., & Parker, E. A. (2003). Introduction to methods for CBPR for health. In M. Minkler & N. Wallerstein (Eds.), *Methods for community-based participatory research for health* (pp. 1-37). San Francisco, California: Jossey-Bass.

Jackson, T. (2005). Motivating sustainable consumption: A review of evidence on consumer behaviour and behaviour change. University of Surrey.

Jansen, E., Baur, V., de Wit, M., Wilbrink, N., & Abma, T. (2015). Co-designing collaboration: Using a partnership framework for shared policymaking in geriatric networks. *Action Research, 13*(1), 65-83.

Keremane, G. B., & McKay, J. M. (2011). Using PhotoStory to capture irrigators' emotions about water policy and sustainable development objectives: A case study in rural Australia. *Action Research, 9*(4), 405-425.

Kimmel, A. J. (1988). Ethics and values in applied social research. Newbury Park, Calif.: Sage Publications.

Kopec, D. A. (2012). *Environmental Psychology for Design* (2nd edition). New York: Fairchild books.

Kuijer, L., & De Jong, A. M. (2011, May 29-31). Practice theory and human-centered design: a sustainable bathing example. Paper presented at Nordic Design Research Conference, Helsinki, Finland. Retrieved from http://studiolab.ide.tudelft.nl/studiolab/kuijer/files/2011/12/Kuijer-and-De-Jong_Practice-theory-and-HCD_a-sustainable-bathing-example_2011.pdf

Kujala, S. (2003). User involvement: A review of the benefits and challenges. *Behaviour & Information Technology, 22*(1), 1-16.

Kvale, S. (1996). *Interviews: An introduction to qualitative research interviewing*. Thousand Oaks, Calif.: Sage Publications.

Lam, W.W.T., Fielding, R., McDowell, I., Johnston, J., Chan, S., Leung, G.M. & Lam, T.H. (2012). Perspectives on family health, happiness and harmony (3H) among Hong Kong Chinese people: a qualitative study. *Health Education Research, 27*(5), 767-779.

Lastovicka, J. L., & Fernandez, K. V. (2005). Three paths to disposition: The movement of meaningful possessions to strangers. *Journal of Consumer Research, 31*(4), 813-823.

Lee, J., & Yip, N. M. (2006). Public housing and family life in East Asia: Housing history and social change in Hong Kong, 1953-1990. *Journal of Family History, 31*(1), 66-82.

Lee, Y. J., De Young., & Marans, R. W. (1995). Factors influencing individual recycling behaviour in office settings: A study of office workers in Taiwan. *Environment and Behavior, 27*(3), 380-403.

Lee, Y., Kim, K., & Lee, S. (2010). Study on building plan for enhancing the social health of public apartments. *Building and Environment, 45*(7), 1551-1564.

Lee, S., & Paik, H. S. (2011). Korean household waste management and recycling behaviour. *Building and Environment, 45*(7), 1159-1166.

Lefebvre, H. (1991). *Critique of everyday life: Volume I.* (J. Moore, Trans.). London, New York: Verso.

Lefebvre, H. (2004), *Rhythmanalysis: Space, Time and Everyday Life*. (S. Elden, & G. Moore, Trans.). London: Continuum.

Lewin, K. (1935). *A Dynamic Theory of Personality: Selected papers.* London: McGraw-Hill Book Company, Inc.

Lilley, D., Lofthouse, V., Bhamra, T. (2005). *Towards Instinctive Sustainable Product Use.* Paper presented at the Second International Conference: Sustainability Creating the Culture, Aberdeen Exhibition & Conference Centre, Aberdeen. Retrieved from https://dspace.lboro.ac.uk/2134/1013.

Lilley, D. (2009). Design for sustainable behaviour: Strategies and perceptions. *Design Studies, 30*(6), 704-720.

Linder, S.B. (1970). *The harried leisure class.* Columbia University, Columbia.

Lingard, L., Albert, M., & Levinson, W. (2008). Grounded theory, mixed methods, and action research. *British Medical Journal, 337* (7667), 459-461.

Lo, C. H., & Siu, K. W. M. (2010). Lifestyles and recycling: Living environments, social changes and facilities in a densely populated city. *The International Journal of Interdisciplinary Social Sciences, 5*(2), 439–450.

Lockton, D., Harrison, D., & Stanton, N. (2008). Making the user more efficient: Design for sustainable behaviour. *International Journal of Sustainable Engineering, 1*(1), 3-8.

Lockton, D., Harrison, D., & Stanton, N. A. (2010). The design with intent method: A design tool for influencing user behaviour. *Applied Ergonomics, 41*(3), 382-392.

Lockton, D. (2011). Architecture, urbanism, design and behaviour: a brief review. Design with Intent blog. Retrieved July 1st, 2016, from http://architectures.danlockton.co.uk/2011/09/12/architecture-urbanism-design-and-behaviour-a-brief-review/

Lockton, D. (2012). *Simon's scissors and ecological psychology in design for behaviour change. Social Science Research Network.* Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2125405.

Lockton, D. (2013). *Design with Intent: A design pattern toolkit for environmental & social behaviour change.* London: School of Engineering & Design Brunel University.

Lu, L. T., Hsiao, T. Y., Shang, N. C., & Ma, H. W. (2005). MSW management for waste minimization in Taiwan: The last two decades. *Waste Management, 26*(6), 661-667.

Manheim, J. B., & Rich, R. C. (1986). *Empirical political analysis: Research methods in political science*. White Plains, New York: Longman.

Marans, R. W. (2015). Quality of urban life & environmental sustainability studies: Future linkage opportunities. *Habitat International, 45*(1), 47-52.

Marshall, C., & Rossman, G. B. (2011). *Designing qualitative research* (5th edition). Thousand Oaks, CA: Sage.

Martin, M., Williams, I. D., & Clark, M. (2006). Social, cultural and structural influences on household waste recycling: A case study. *Resources, Conservation and Recycling, 48*(4), 357-395.

Massey, D. (1994). *Space, place and gender.* Oxford: Polity Press.

McCracken, G. (1988). *Culture and consumption: New approaches to the symbolic character of goods and activities.* Bloomington: Indiana University Press.

Meyer, J. (2000). Using qualitative methods in health related action research. *BMJ Clinical Research, 320*(7228), 178-181.

Mitchell, R. E. (1971). Some social implications of high density housing. *American Sociological Review, 36*(1), 18-29.

Moore, G. T. (1979). Environment-behaviour studies. In J. C. Snyder & A. J. Catanese (Eds.), *Introduction to architecture* (pp. 46-71). New York: McGraw-Hill.

Morse, J., & Niehaus, L. (2009). *Mixed method design: Principles and procedures*. Walnut Creef, Calif.: Left Coast Press.

Nagamachi, M., & Lokman, A. M. (2011). *Innovations of kansei engineering*. Boca Raton, Fla: CRC Press.

Neo, H. (2010). The potential of large-scale urban waste recycling: A case study of the National Recycling Programme in Singapore. *Society & Natural Resources: An international Journal, 23*(9), 872-887.

Neuman, W. L. (2000). Social research methods: Qualitative and quantitative approaches. Boston: Allyn and Bacon.

Nigbur, D., Lyons, E., & Uzzell, D. (2010). Attitudes, norms, identity and environmental behaviour: Using an expanded theory of planned behaviour to predict participation in a kerbside recycling programme. *Journal of Social Psychology, 49*(2), 259-284.

Norman, D. A. (1998). *The Design of Everyday Things*. Cambridge, MA: The MIT Press.

Norman, M.B., Seymour, S, & Edward, B. (1979). *Improving interview method and questionnaire design*. San Francisco: Jossey-Bass.

O'Brien, M. (2008) A crisis of waste? Understanding the rubbish society. New

York: Routledge.

O'Leary, Z. (2014). *The essential guide to doing research* (2nd edition). LA: Sage.

Oxford English Dictionary online. (2014). Retrieved from http://www.oed.com

Packard, V. (1960). *The waste makers*. London: Longman.

Pajo, J. (2008). *Recycling culture: Environmental beliefs and economic practices in post-1990 Germany*. University of California, Irvine.

Plaut, T., Landis, S., & Trevor, J. (1992). Enhancing participatory research with the community oriented primary care model: A case study in community mobilization. *The American Sociologist, 23*(4), 56-70.

Robson, C. (1993). *Real world research: A resource for social scientists and practitioner researchers.* Oxford: Blackwell.

Rose, N. (1997). Assembling the modern self. In R. Porter (Ed.), *Rewriting the self: Histories from the middle ages to the present* (pp. 224-248). London: Rouledge.

Rouse, J. (2002). Community participation in household energy programmes: A case-study from India. *Energy for Sustainable Development, 6*(2), 28-36.

Rutledge, A. J. (1985). *A visual approach to park design*. New York: John Wiley and Sons Ltd.

Sanoff, H. (1992). *Integrating programming, evaluation and participation in design: A theory Z approach.* Aldershot, UK: Ashgate.

Sanoff, H. (2000). *Community participation methods in design and planning.* New York: Wiley.

Scanlan, J. (2005). *On garbage*. London: Reaktion Books.

Scariot, C. A., Heemann, A., & Padovani, S. (2012). Understanding the collaborative-participatory design. *IEA 2012: 18th World congress on Ergonomics – Designing a sustainable future, 41*(1), 2701-2705.

Scott, F. (2004). Behaviour Change: Believing You Can Make A Difference!

BTCV, Global Action Plan and The Environment Council Workshop, London.

Sennett, R. (1977). *The fall of public man: On the social psychology of capitalism.* New York: Vintage Books.

Shingo, S. (1986). *Zero quality control: Source inspection and the Poka-yoke system.* Portland, OR: Productivity Press.

Simon, H. A. (1990). Invariants of human behaviour. *Annual Review of Psychology, 41*(1), 1-19.

Simonsen, K. (1997). Modernity, community or a diversity of ways of life: A discussion of urban everyday life. In O. Kalltrop, I. Elander, O. Ericsson & M. Franzen (Eds.), *Cities in Transformation-transformation in cities: Social and symbolic change of urban space* (pp. 162-183). Aldershot: Avebury.

SITA. (2010). *Looking up: International recycling experience for multi-occupancy households.* London: SITA UK.

Siu, K. W. M. (2003). Users' creative responses and designers' roles. *Design Issues, 19*(2), 64-73.

Siu, K. W. M., & Kwok, Y. C. J. (2004). Collective and democratic creativity: Participatory research and design. *The Korean Journal of Thinking and Problem Solving, 14*(1), 11-27.

Siu, K. W. M. (2005). Pleasurable products: Public space furniture with user fitness. *Journal of Engineering Design, 16*(6), 545-555.

Siu, K. W. M., & Wong, M. M. Y. (2013). Promotion of a healthy public living environment: participatory design of public toilets with visually impaired persons. *Public Health, 127*(7), 629-636.

Siu, K. W. M., & Xiao, J. X. (2015). Quality of Life and Recycling Behaviour in High-Rise Buildings: A Case in Hong Kong. *Applied Research in Quality of Life*. DOI 10.1007/s11482-015-9426-7.

Smart, A. (2006), *The Shek Kip Mei myth: Squatter, fires and colonial rule in Hong Kong, 1950-1963*. Hong Kong: Hong Kong University Press.

Smith, D. (1987). *The everyday world as problematic: A feminist sociology*. Boston: Northeastern University Press.

Sommer, B., & Sommer, R. (1997). *A practical guide to behavioral research: Tools and techniques* (4th edition). New York: Oxford University Press.

Southerton, D. (2003). Squeezing time: allocating practices, coordinating networks and scheduling society. *Time & Society, 12*(1), 5-25.

Strasser, S. (1999). *Waste and want: A social history of trash*. New York: Metropolitan Books.

Stake, R. E. (1995). *The art of case study research.* Thousand Oaks, CA: Sage.

Steen, M., Kuijt-Evers, L., & Klok, J. (2007, July 5-7). Early user involvement in research and design projects - A review of methods and practices. Paper presented at the 23rd European Group for Organizational Studies Colloqium, Vienna, Austria. Retrieved March 23, 2016, from http://www.marcsteen.nl/docs/EGOS2007%20Early%20user%20involvem ent.pdf

Stern, P. C. (1999). Information, incentives, and proenvironmental consumer behaviour. *Journal of Consumer Policy, 22*(4): 461–478.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309-317.

Stringer, E. T. (1999). *Action research* (2nd edition). Thousand Oaks, CA: Sage.

Szmigin, I. (2006). The aestheticization of consumption: an exploration of 'brand.new' and 'Shopping'. *Marketing Theory, 6*(1), 107-118.

Tam, W. Y., & Tam, C. M. (2006). Evaluations of existing waste recycling

methods: A Hong Kong study. *Building and Environment, 41*(12), 1649-1660.

Tammamagi, H. (1999). *The waste crisis: Landfills, incinerators, and the search for a sustainable future.* Oxford: Oxford University Press.

Thompson, M. (1979). *Rubbish theory: The creation and destruction of value*. Oxford, UK: Oxford University Press.

Timlett, R. E., & Williams, I. D. (2008). Public participation and recycling performance in England: A comparison of tools for behaviour change. *Resource, conservation and recycling, 52*(4), 622-634.

Tremblay, C., & de Oliveira Jayme, B. (2015). Community knowledge co-creation through participatory video. *Action Research, 13*(3), 298-314.

Tromp, N., Hekkert, P., & Verbeek, P-P. (2011). Design for socially responsible behaviour: A classification of influence based on intended user experience. *Design Issues, 27*(3), 3-19.

Vaiou, D., & Lykogianni, R. (2006). Women, neighbourhoods and everyday life. *Urban Studies*, 43(4), 731-743.

van der Panne, G, van Beers, C., & Kleinknecht A. (2003). Success and failure of innovation: Aliterature review. *International Journal of Innovation Management, 7*(3), 309-338.

van Diepen, A., & Voodg, H. (2001). Sustainability and planning: Does urban form matter? *International Journal of Sustainable Development*, *4*(1), 59–74.

van Loon, J. (2002). *Risk and technological culture: Towards a sociology of virulence.* New York: Routledge.

Verbeek, P-P. (2005). *What things do: Philosophical reflections on technology, agency, and design.* University Park, Pa.: Pennsylvania State University Press.

Vrbka, S. J., & Combs, E. R. (1993). Predictors of neighbourhood and community satisfactions in rural communities. *Housing and Society, 20*(1), 41-49.

Wang, D.G., & Lin, T. (2013). Built environments, social environments, and activity-travel behaviour: A case study of Hong Kong. *Journal of Transport Geography, 31*, 286-295.

Wever, R., Van Kuijk, J., & Boks, C. (2008). User-centred design for sustainable behaviour. *International Journal of Sustainable Engineering, 1*(1), 9-20.

Whitehead, D., Taket, A., & Smith, P. (2003). Action research in health promotion. *Health Education Journal, 62*(1), 5-22.

Williams, R. (1976). *Keywords: A vocabulary of culture and society.* New York: Oxford University Press.

Wilson, S., Bekker, M., Johnson, P., & Johnson, H. (1997). Helping and hindering user involvement – A tale of everyday design. *The ACM SIGCHI Conference on human factors in computing systems.* Proceedings of CHI 1997 (pp. 178-185). New York, USA.

Winter, D. D. N., & Koger, S. M. (2004). *The Psychology of Environmental Problems* (2nd edition). Mahwah, N. J.: Lawrence Erlbaum.

Wong, K. S. (2010). Designing for high-density living: High rise, high amenity and high design. In E. Ng (Ed.), *Design high-density cities: For social an environmental sustainability* (pp. 321-329). London: Earthscan.

Xiao, J. X., & Siu, K. W. M. (2016). Public design and household participation in recycling for sustai nability: A Case Study in Hong Kong. *The International Journal of Environmental Sustainability, 12*(1), 27-40.

Yale, L., & Venkatesh, A. (1986). Toward the construct of convenience in consumer research. *Advances in Consumer Research, 13*(1), 403-408.

Yau, Y. (2010). Domestic waste recycling, collective action and economic incentive: The case in Hong Kong. *Waste Management, 30*(12), 2440-2447.

Yeung, Y. M., & Wong, K. Y. (2003). *Fifty years of public housing in Hong Kong: A golden jubilee review and appraisal.* Hong Kong: Chinese University Press.

Yin, R. K. (1993). Applications of case study research. Newbury Park, London, New Delhi: Sage.

Yin, R. K. (1994). *Case study research: Design and methods* (2nd edition). Thousand Oaks, London, New Delhi: Sage.