Transforming household practices for enabling urban transitions to circular plastic economies: A practice perspective

Olamide Shittu

BSc, MSc

Supervisors:

Associate Professor Christian (Andi) Nygaard and Doctor Aisling Bailey

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TO THE LIGHT – ALL IN ONE AND ONE IN ALL.

I dedicate this thesis to the loving memory of Dr Vivienne Waller who transitioned in the first year of my PhD. Despite going through some personal challenges, Viv selflessly accepted to supervise my doctoral research and strongly supported my research vision. She introduced me to theories of practice that I later applied in my PhD. Aside from her soulful music, Viv's legacy will continue to live on through her novel academic work, this PhD thesis, and other impactful projects she spearheaded.

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CANDIDATE DECLARATION

I, Olamide Shittu, declare that this thesis titled, "Transforming Household Practices for enabling Urban Transitions to Circular Plastic Economies: A Practice Perspective" and the work presented in it are my own. I confirm the following:

1. This thesis contains no material which has been accepted for the award to the candidate of any other degree or diploma, except where due reference is made in the text of the examinable outcome;
2. To the best of the candidate's knowledge, this thesis contains no material previously published or written by another person except where due reference is made in the text of the examinable outcome, and with permission received to republish the work in the thesis; and,
3. This thesis includes one joint publication, and the relative contributions of respective authors are disclosed in signed authorship declaration forms included in Appendix C.

Signed by the PhD Candidate

Olamide Shittu

04-11-2022

ABSTRACT

This study is driven by the environmental challenges facing cities relating to the use of plastic. Cities are the largest source of unsustainable plastic production and consumption yet possess socio-economic and technological capabilities to achieve environmental sustainability. This has prompted the development of scholarly discourse and sustainability policy initiatives on the transitions of cities to greater circularity in material use such as plastic. The focus of extant plastic-related sustainability research is on analysing socio-economic trends and growth at a societal scale or understanding the social behaviour of individuals.

Consequently, plastic-related policy interventions typically focus on influencing market forces and individuals' (rational) choices without necessarily embedding these in the day-to-day activities of households, thereby limiting their efficacy. Practice theory captures the essential aspects of materiality and socio-environmental transformation. In this regard, market trends and individual social attributes are considered outcomes of the complex interaction of daily practices (with elements including materiality, competences, and meanings), rather than formative in their own right. This study takes household practices – the bundle of daily activities of households – as its unit of analysis for developing alternative theoretical, empirical and policy insights for sustainable plastic consumption, and indeed a transition to a prospective circular plastic economy (CPE).

The overarching research question addressed in this thesis is: *how can plastic-related household practices be transformed for enabling the transition of cities to circular plastic economies?* The study combined exploratory and descriptive research designs in answering the research question. The study adopted a mixed-methods approach to collect data in Lagos, Nigeria and Victoria, Australia.[1] Key-informant interviews were conducted with 6 sustainability experts in Victoria (3) and Lagos (3) to guide subsequent data collection and provide policy perspectives on household plastic consumption and circular (plastic) economies. Household participants were selected from low-income households in Surulere, Lagos to expose the dimensions of plastic materiality, and explore new contextual insights into plastic-related sustainability practices. In-depth interviews were conducted among 12 low-income household case studies and supplemented with home tours and directed photography. Two short surveys were administered to 18 household participants (including the 12 interviewed household participants). Inductive and deductive techniques were employed to code and analyse the collected data with hermeneutic and statistical software programs.

This is a PhD by Publication. The thesis, thus, consists of an envelope that includes a chapter presenting a literature overview of fields relevant to the study, a methodology chapter examining the research paradigm and methods, and two chapters discussing the implications of the thesis for research, policy, and practice. The envelope 'sits around' 5 papers. Jointly the envelope and papers argue that the transition of cities to the CPE consists of transforming plastic-related compound sustainability practices into plastic-related integrative sustainability practices which are then bound in a teleoaffective formation that is the CPE. Paper one (chapter 4) develops a conceptualisation of a CPE from a practice perspective. The paper posits that a CPE is a teleoaffective formation or conglomeration of practices aimed at regenerating plastic and anchored by general understandings of sustainability. Paper two (chapter 5) adopts a

[1] This is a COVID-19 thesis. For the majority of the candidature period the candidate was locked down in Lagos, Nigeria. The impact of COVID-19 on the research is further explained in chapter 3.

systematic literature review to examine emerging sustainability concerns of urban household consumption. Key findings in the paper include the influence of income level on the adoption of a sustainable lifestyle and the need to explore solutions to sustainability challenges in households through a practice perspective.

Paper three (chapter 6) explores how plastic aids the manifestation of practices in low-income urban households through its materiality dimensions. The paper reveals that plastic facilitates the reproduction of household practices through the interaction between the 'corporal', 'spatiotemporal' and 'functional' dimensions of its materiality. Paper four (chapter 7) explores the transformation of plastic-related practices in urban households. The paper conceptualises plastic-related sustainability practices to include 'contractive', 'protractive' and 'regenerative' practices. A key finding here is that the daily activities of low-income households result in some sustainability outcomes, such as the maintenance and reuse of plastic, although such activities are not necessarily motivated by environmental considerations. The paper concludes that plastic consumption in urban households can be transformed by consolidating sustainability activities into 'integrative' sustainability practices. Paper five (chapter 8) draws insights from the thesis for urban environmental governance and circular transitions. The paper concludes that circular practices can be embedded into households by addressing grassroots environmental justice issues and leveraging communities of practice.

Overall, this thesis provides evidence on emerging concerns in urban household consumption; a circular plastic economy framework; a plastic materiality framework; a sustainability practice framework and insights into grassroots environmental governance to facilitate the transition of cities to circular economies. This doctoral study makes an original and significant contribution to knowledge by applying practice theory to zoom into plastic consumption and explore the sustainable transformation of household practices and zoom out on the transition of cities to circular plastic economies.

The contributions highlighted in this thesis, therefore, raise implications for broader circular economy transitions in cities. These include developing a more nuanced analysis of sustainability considerations in research and policy and advancing resourcefulness through innovation by combination in design and practice.

Keywords: practice theory; plastics; materiality; circular economy; cities; environmental justice; household; behaviour; activities; sustainability; transitions; communities; practice; consumption; Lagos; Melbourne

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LIST OF PAPERS

Title	Aim	Authors	Publication status
Practice theory analysis of the circular plastic economy: Conceptual and policy implications	The paper aims to provide a practice-based conceptual framework for the configuration of a circular plastic economy.	Olamide Shittu (100%)	Manuscript under preparation
Emerging sustainability concerns and policy implications of urban household consumption: A systematic literature review	The study adopts a systematic approach to reviewing scholarly studies published from 2015 until June 2019 to answer the following questions: a) What are the emerging concerns of research on sustainable household consumption in cities over the past five years? b) What theoretical frameworks inform the understanding of sustainable household consumption in cities in the last five years? c) What strategies have been identified for achieving sustainability transitions in urban household consumption in the last five years?	Olamide Shittu (100%)	Published February 2020 Journal of Cleaner Production (Q1)
'Almost everything in the house now is plastic': Foregrounding plastic materiality in household routines and practices	The overarching question of the paper is: how does plastic facilitate the reproduction of practices in households? The specific questions are: a) What are the physical aspects (corporality) of plastic that promote its functionality or expression of meanings? b) How does plastic engender the spatiotemporal arrangement of practices? c) What household routines and practices are materialised through plastic items?	Olamide Shittu (100%)	Published August 2021 Sociological Research Online (Q1)
Sustainability practices and materiality: Transforming plastic consumption in urban households	The study applies a practice theory approach to the issue of transforming consumption and embedding sustainability activities in low-income households.	Olamide Shittu (80%) Christian Nygaard (15%) Aisling Bailey (5%)	Manuscript submitted September 2021 Resources, Conservation and Recycling (Q1)
Grassroots strategies for environmental governance and circular cities: Lessons from Lagos and Melbourne	The paper draws on doctoral research findings to examine grassroots strategies for circular transitions.	Olamide Shittu (100%)	Manuscript submitted October 2021 Edited book on Research Agenda on Sustainable Cities and Communities (Edward Elgar Publishing)

CHAPTER ONE

Introduction

1.1 Research background

Unsustainable plastic consumption and disposal in cities are highly problematic for the environment. For instance, suffocation, entanglement, and ingestion of plastic and microplastic debris are primary threats to marine life, with secondary effects on human health via oceanic food chains (Eagle, Hamann & Low 2016). Likewise, significant greenhouse gases are released during the extraction, transportation, production, landfilling and incineration of plastic. As a product of fossil fuels, it has been estimated that by 2050, plastic may contribute about 2.75 billion metric tons of carbon dioxide equivalent (Centre for International Environmental Law 2019). Therefore, climate scientists and international organisations have reiterated the importance of sustainably transforming plastic consumption to reduce global carbon footprints, especially in cities. Cities have not only been the centre of increased population and consumption, but they have also experienced aggravated environmental hazards (Elmqvist et al. 2019). Moreover, the import ban on plastic waste in China in 2018 disrupted solid waste management systems in emerging and established cities (Blue Environment 2019).

The preceding highlighted the need to rethink global plastic use and disposal (Petit-Boix & Leipold 2018), and the transition of cities to circular plastic economies (CPEs). A circular economy design for plastics aims to restore and regenerate the socio-economic value of plastic materials. That is when plastic materials are in a ‘closed loop’ system where their production and consumption flow in a circular model of maintenance, reuse, repair, and recycling rather than the current linear model which results in environmental leakage (Van Eygen, Laner & Fellner 2018). In the context of this study, achieving a CPE requires a shift in production and consumption systems including waste infrastructure in cities (Greene 2018; Watson & Shove 2022). Therefore, given their socio-geographical compositions, cities are regarded as important settings to galvanise transitions to CPEs (Keivani 2010).

Although such a socio-technical transition is widely accepted in sustainability literature, its research and implementation have been the focus of much academic debate. Markard, Raven and Truffer (2012, p. 956) define a socio-technical transition as "a set of processes that lead to a fundamental shift in socio-technical systems… [including] technological, material, organisational, institutional, political, economic, and socio-cultural." As further discussed in chapter 2, theories of transitions such as multi-level perspective (MLP), strategic niche management (SNM) and transition management (TM) have different conceptualisations for actualising circular economies. For instance, while SNM mainly focuses on technological developments in the niche as a catalyst for regime change, MLP posits that broader systemic factors (e.g., niche innovations, regime destabilisation or landscape pressure) could disrupt the existing processes in the regime thus creating new socio-technical systems (Loorbach and van Raak 2007; Markard & Truffer 2008).

However, a general criticism of theories of transitions is the undervaluation of material agency and relations in facilitating sustainability transitions. For instance, Labanca et al. (2020) suggest that technological development influences the evolution of social practices and standards. This is a consequence of an overemphasis within some transition theories on the role of socio-cognitive actors "who do the instantiating upon which structural properties depend for their existence" (Archer 1995, p. 100). Although transition theories attempt to integrate structure and agency as middle-range analytical frameworks, other middle-range perspectives such as practice theory argue for a shift of focus from attitudes, behaviours, or choices to the sociomaterial arrangements that shape social reality (Strengers & Maller 2014). Here, sociomaterial arrangements refer to the "relationships between human [activities] and material arrangements [that is, set-ups or configurations], and how these relationships emerge in a practice" (Nyström 2016, p. 3). Practice theory also enables a focus on the role of materiality in shaping patterns of consumption and disposal which often is missing in transitions and behaviour change literature. This study, therefore, employs practice theory to explore household plastic consumption thereby contributing to a recent call for an alternative perspective to the existing theory and policy focus on individuals and institutional arrangements (Shove 2010).

In practice, city administrators have attempted to advance sustainability transitions by implementing policies that shape market forces and influence individual behaviours (Davies & Doyle 2015). However, studies have shown that these efforts have not necessarily led to sustainable practices among city dwellers or sufficiently galvanized sustainable systemic change such as in waste infrastructure (Marres 2011). For instance, low-income households still face socio-economic difficulties in translating sustainability education into sustainable choices to change actual practices (Lavelle, Rau & Fahy 2015).

Furthermore, studies in emerging cities such as Lagos reveal that government regulations to improve waste management have failed to tackle high levels of environmental pollution in cities (Akanle & Shittu 2018; Ihua-Maduenyi 2018). Lagos and other cities in Nigeria are constantly challenged with issues of marine pollution, flooding and environmental degradation. Likewise, studies in Australia show that the existing waste management infrastructure in the country is incapable of processing all types of plastic while recovering less than half of plastic waste (Commonwealth of Australia 2018; Madden & Florin 2019). Figure 1.1 shows the warehouse of a recycling company in Australia with unrecycled plastic materials which pose a fire hazard and the risk of infernos in communities (Kerr 2018). In addition to environmental damages, figure 1.1 shows the loss of material and economic value that could have been retained in the economy through a circular economic system.

Figure 1.1 *Recycling warehouse in Australia with unrecycled plastics*

Source: https://www.theage.com.au/politics/victoria/massive-warehouses-filled-with-recyclable-materials-that-no-one-wants-20190808-p52f2o.html

Moreover, Newton and Meyer (2013) reveal that although many households in Melbourne claim to support environmental sustainability, they still find it difficult in terms of making choices to change actual practices. Achieving sustainable plastic consumption becomes even more imperative within the context of Victoria's goal to be a circular economy by 2030 (Sustainability Victoria 2021). Thus, circular transitions, waste management restructuration and the social context of households' plastic consumption cannot be fully understood without exploring the nature and composition of household practices.

By adopting practice theory, this thesis argues that achieving a systemic transition to CPE is predicated on understanding and transforming plastic-related household practices in cities. As further discussed in chapter 4, practices are the teleoaffective orientation of meanings, skills, and material elements to achieve normative ends (Strengers & Maller 2014). Teleoaffectivity refers to the normativised ordering of tasks and goals connected with their normative emotional attributes (Schatzki 2002). Practice theory scholars argue that practices constitute wider socio-technical arrangements through varying degrees of complexities (Strengers & Maller 2014).

In a CPE transition, households cannot be considered mechanically as simply responding to adjustments in technical or political-economy domains but constitute part of a societal configuration that will separately and recursively determine CPE transitions. Throughout, the thesis focuses on household practices as the unit of analysis. This is not to ignore the substantial effort and research that goes and has gone into sustainability transitions in technical or political-economy domains but analytically allows the researcher to focus explicitly on households in systemic transitions.

Furthermore, practice theory views sustainability transitions as the complete dissolution of unsustainable sociomaterial practice formations which are then replaced by the emergence of new and sustainable practice complexes (Shove 2010). The dissolution or emergence of practices is facilitated by the breakage or introduction of links among constituting elements (Shove, Pantzar & Watson 2012). In this regard, the unique socio-economic and spatial arrangements of cities enable this thesis to explore the interconnectivity of household practices with broader institutional agglomeration and how to achieve sustainability coordination at multiple scales of complexity. This is further discussed in chapters 4 and 7 by theoretically conceptualising and empirically analysing circular transitions in cities respectively. This introductory chapter further explains the research purpose, aim and questions, the research approach, the significance and impact of the study, and the structure of the thesis.

1.2 Research purpose, aim and questions

This research is motivated by the need to find alternative explanations and solutions to cities' plastic crisis and the challenges to transitioning to the CPE – a system that eliminates or reduces the negative impact of plastic on the environment. The increasing global consumption of plastic has resulted in a rising level of non-degradable plastic infiltration into natural environments (such as oceans and other blue infrastructure, green space in and outside cities), food chains (such as fish stocks and microplastic consumption by humans), urban environments (such as sewage systems and water management) and landfill sites or waste incineration. Plastic, thus, have an increasingly negative effect on human and animal health, and the environment (Li, Tse & Fok 2016). Yet, the needed socio-economic, environmental, and technological solutions are

either non-existent in some cities or inadequate in others. Moreover, plastic use has been problematised in government policies and public discourses given the difficulty in eradicating the negative effects of plastic on the environment (Hawkins 2010).

However, plastic has become entrenched in the design and infrastructure of modern cities. The flexible, cheap, and durable qualities of plastic make it invaluable in sectors such as transportation, arts and crafts, packaging, electronics, construction, energy generation and healthcare. Moreover, these physical characteristics make plastic a valuable material in performing daily activities, thereby, enabling it to shape sociomaterial and spatiotemporal arrangements in households. These high-level applications and embeddedness suggest that the complete eradication of plastic in cities may prove difficult, if not impossible, especially given the urgency of achieving sustainable development goals. This prompts the need to ensure the circularity and sustainable use of plastic across the supply chain, consumption, and disposal systems.

Against this backdrop, this study explores plastic-related household practices and their implication for the transition of cities to CPEs. In a circular model, plastic materials and plastic-related infrastructure are (re)designed to maximise production and consumption efficiency and minimise or eradicate negative socio-environmental externalities (Ellen MacArthur Foundation, n.d.). This research is, therefore, placed at the centre of institutional policies and theoretical explanations on the one hand and day-to-day activities and conceptual understandings on the other hand. This is achieved by focusing on the fundamental elements that constitute practices, which in turn create social and institutional constellations. This research, thereby, also seeks to advance theoretical understanding and policy analysis of circular economy beyond frameworks of behavioural change and market forces. The main aim of this research is to explore plastic-related household practices and their transformation for enabling the transition of cities to CPEs. The overall question this study aims to answer is:

How can plastic-related household practices be transformed for enabling the transition of cities to circular plastic economies?

It is important to note here that this thesis considers the systemic manifestation of CPEs to be distinct for individual cities, hence the use of the term 'transition of cities to CPEs' in the overall research question (section 2.1 further discusses this). This is not to say, however, that such a transition cannot be conceptualised, and general principles developed to guide each city in implementing a bespoke CPE strategy as done in this thesis. This thesis answers this question by conceptually and empirically examining plastic-related household practices and how they could be configured in a circular economy. Exploring the overall research question advances broad interdisciplinary discourses in consumption studies, practice theory, sustainability transitions and circular economy. The intersection of these four key areas of research, therefore, guides this study to raise subsequent questions that provide new insights into plastic-related household practices and their interconnectedness with broader sustainability discourses.

First, an aspect of the overall research question relates to the preoccupation with the sustainable purchase, use and disposal of goods in urban households in consumption and sustainability transitions studies. Recently, though, scholars have been concerned with the urgency of achieving sustainable development goals in cities and the sustainability challenges such pose for urban households (Wu, Lei & Li 2019; Wang C. et al. 2019). This study recognises the importance of synthesising knowledge from recent studies on sustainable household consumption in cities to provide the critical basis upon which the research aim is developed.

The first sub-question therefore, follows: *what are the emerging themes in the research, theory, and sustainability transition of urban household consumption?* The study answers this question by conducting a systematic literature review of recent literature on urban household consumption to analyse the emergent topics addressed by empirical studies from 2015 when the Sustainable Development Goals (SDGs) were adopted. This is written as a paper and presented in chapter 5. The paper identifies the theoretical frames that have been adopted by researchers to understand sustainable household consumption in cities and the recommended strategies for achieving sustainability transitions. Answering this research question enables this study to contribute to knowledge by providing a much-needed synthesis of theories, empirical data, and policies in urban household consumption for researchers and policymakers.

Importantly, the systematic literature review also identifies knowledge gaps and provides the scholarship foundation upon which the other research questions build.

Second, aspects of the overall research question point to discourses on the reproduction of the day-to-day through sociomaterial arrangements and practices. These discourses extend beyond the scope of this study and intersect several social fields of enquiry such as sociology, geography, and political science. Even within practice theory, there are multiple accounts of how practices are reproduced and the role of materiality in everyday life (Warde 2005; Southerton 2013; Schatzki 2010). Given the focus on plastic in this study, the second sub-question asks: *how does plastic facilitate the reproduction of practices in urban households?* The paper presented in chapter 6 addresses this sub-question. While practice theory scholars typically study practices as a unit (Kuijer 2014), this study adopts a different approach by placing plastic as a material element at the centre of analysis. The paper presents a conceptual framework of the three aspects of plastic materiality that shape household practices which include physical features, spatiotemporal qualities and meaning mediation. Interview and visual data from the study were analysed for the paper. Utilising data from case studies of low-income households in Lagos provides some significant contributions to knowledge by identifying new contextual insights into household practices beyond dominant Western case studies.

Third, another aspect of the overall research question draws upon interdisciplinary discourses within sustainability transitions, circular economy, and practice theory. There are ongoing debates within these scholarly fields about the configuration of a sustainable city; the perspectives to analyse the pathways to such sustainable formations and the strategies for environmental governance in such systems (Kaplan, Sanchez & Hoffman 2017; Oliveira et al. 2021; Skjerven & Reitan 2017). By focusing on plastic consumption in urban households, this study further draws out two sub-questions. As the third sub-question, this study asks: *how can plastic consumption be transformed, and sustainability practices be embedded in urban households?* In chapter 7, the study conceptualises plastic-related sustainability practices in urban households and their integration into sustainability practice complexes. The chapter reveals that sustainability in plastic consumption cannot be classified into binary and absolute

categories of sustainable or unsustainable. Instead, sustainability cuts across protractive, contractive, and regenerative practices that refer to the lifecycle extension, supply reduction and transformation of plastic respectively. These sustainability practices manifest in varying degrees in the daily use of plastic in urban households. Chapter 7 contends that the transition of cities to CPEs is not complete without embedding the three sustainability practices in households.

The fourth sub-question asks: *how can environmental governance be enhanced at the grassroots to accelerate the transition of cities to circular economies?* Examining environmental governance and systemic realignment is crucial to transforming household practices and facilitating circular transitions. Therefore, chapter 8 discusses lessons drawn from the findings on addressing environmental justice issues confronting low-income households and leveraging communities of practice (Wenger-Trayner & Wenger-Trayner 2015) to facilitate circular transitions. Chapter 8 includes a paper written as an invited book chapter and represents the first part of the discussion of the findings of this thesis. Chapter 9 covers the second part of the discussion by examining the implications of a practice perspective for systemic realignment. Chapter 10 concludes the thesis and discusses the study's limitations and future research directions.

1.3 Research approach

This study adopts pragmatism and mixed methods as methodological tools to answer the research questions. Pragmatism as a research paradigm enables the researcher to employ multiple theoretical explanations and practical considerations in the design of research methodologies (Feilzer 2010). This study collected and analysed mixed-methods data (i.e., interviews, home tours, digital photography, short survey) from low-income households in Lagos as case studies and supplemented this with expert interviews in Melbourne, Australia and Lagos, Nigeria. More details about the paradigmatic and methodological justifications for the research are provided in chapter 3. As later discussed in this thesis, the selection of low-

income households as case studies is informed by the additional transition challenges posed by the adoption of sustainable lifestyles (Lavelle, Rau & Fahy 2015; Shittu 2020).

Low-income households experience socio-economic, environmental and health vulnerabilities, and as a result, deeply depend on existing unsustainable consumption systems. This implies that they may be unable to afford the high cost of sustainable lifestyles. Also, compared with middle- and higher-income households, choosing a sustainable lifestyle may require low-income households to exercise a higher level of social conscience while such a change may cause a higher level of disruption in their daily arrangements. The inability of low-income households to consume sustainably may impede the transition to circular economies and further raise environmental justice issues in emerging and established cities. In this regard, any city that intends to truly transition to a circular economy must aim to provide affordable and alternative solutions to the current costly sustainable lifestyle choices (Sole & Wagner 2018).

By centralising plastic as a material element in households, the study was confronted with the risk of overlooking the broad interconnectivity of household practices and the influence of other elements including existing infrastructure in equally shaping household practice performances. Take cooking as a household practice, for instance. A household performance of cooking typically involves the complex interaction of multiple materials (e.g., pots, food items, cutleries), meanings (e.g., sustenance, pleasure) and skills (e.g., culinary, hygienic, and aesthetic skills). Consequently, practice scholars are compelled to focus on such complex interactions in empirical studies. However, given the main aim of this study, it is important to centralise plastic in the methodological and analytical frameworks to engage with the practical elements of plastic-related practices. This in turn provides a basis for identifying the role of plastic in influencing, connecting, and shaping household practices, and designing transformative strategies.

Furthermore, two strategies are employed to minimise the research risk. First, the study adopted the ‘zoom in and out’ approach (Nicolini 2009) which helps not only capture the specific roles plastic plays in manifesting household practices but also analyses the reciprocal influence of other elements or practices on plastic. It is important to state that given the focus of the thesis

on transforming plastic consumption in households, the thesis focuses more on zooming into plastic-related household practices. However, the thesis also zooms out to establish the background and contexts of the topic in multiple chapters across the thesis.

For instance, chapter 4 applies this approach to conceptualise CPE as a teleoaffective formation (which is the conglomeration of practices aimed at achieving a set of goals and anchored by general understandings) and examine its composition both at the societal and household scale (Welch 2017). Here, the teleoaffective formation concept is applied to formulate a prospective CPE composed of societal domains (e.g., social, technical and political-economy domains) and connected by general understandings of sustainability such as sustainable lifestyles and sustainable socio-economic development (see chapter 4). Second, this study is a PhD by publication. While individual papers address specific research questions (using the 'zoom in and out' approach), the across-paper analysis that forms the thesis discussion and conclusion focuses on the interconnectivity of plastic-related sustainability practices with broader sustainability issues of circular transitions. The overarching PhD question, therefore, returns to the issue of connectivity.

1.4 Significance and impact of the study

The study contributes significantly to theory and policy development. Originality and significance in research represent producing new and valuable contributions to knowledge and practice (Baptista et al. 2015). Significant contributions can be accomplished by applying an existing theory in a new context and the impact of the findings on policy and future studies (Petre & Rugg 2010). This thesis delves into an area that is hitherto less researched in sustainability transition literature – understanding the role household practices play in sustainable urban transitions. This is achieved by extending the application of practice theory to study plastic consumption in low-income households in an emerging city (Lagos, Nigeria). While most studies on practice view it as a unit of analysis, this thesis also centralises the role of (plastic) materiality in manifesting household practices. Because household activities are mostly carried out reflexively (Wilk 2009), their material elements (including plastics) are also relegated to the background of social life. Unless they break down (disrupting practice), household objects remain mostly anonymous to the carrier in the performance of household

practices. Therefore, this thesis foregrounds plastic materials to unveil the active role these seemingly passive materials play in shaping the performance and dynamics of practices, thus, introducing new concepts and dimensions to the practice literature.

In chapters 4 and 7, the thesis draws on Schatzki's (2002) and Warde's (2013) concepts of compound and integrative practices. Both authors consider the difference between compound and integrative practices to be their extent of formalisation and cohesiveness (e.g., eating and driving). The thesis draws on the distinction in formalisation and cohesiveness to extend the use of these concepts into household activities for which common parlance is not readily available. For instance, cooking or driving (integrative practices) readily bring to mind a set of activities and their goals and commonly understood meanings. Sustainability practices do, however, not similarly bring to mind a set of individual or multiple activities that, societally, are associated with a common goal or widely understood meaning. By extending both concepts to such activities, the study views existing plastic-related sustainability practices to be compound in the sense that there are no current widely adopted processes around sustainable plastic use in cities (e.g., sorting and recycling). Therefore, the study conceptualises the transformation of compound sustainability practices into integrative sustainability practices as potential intervention points in plastic use for enabling the transition of cities to CPEs.

The binding of several integrative sustainability practices in a teleoaffective formation in turn constitutes a systemic shift to the CPE. As discussed in chapter 7, the transformation of compound sustainability practices involves providing adequate material arrangements and creating formal processes, guidelines and rules that consolidate sustainability activities into integrative practices. This process is often driven by the permeation of general understandings of sustainability into the different social domains, thereby informing the meanings attached to practice performance. In practice this means the conscious creation of cohesiveness among the elements of a practice, for instance by limiting plastic to those that are recyclable, ensuring explicit guidelines on their sustainable use and promoting sustainability-related meanings among practitioners. Thereafter, the integrative sustainability practices must then be bound together into practice complexes that create the CPE teleoaffective formation. Chapter 4 provides a detailed discussion of teleoaffective formations and structures. Throughout, the thesis draws on Welch's (2017) conceptualisation of teleoaffective formations. In other words, each domain (that is, households, political-economy and technical domains) would be

composed of sustainability practice complexes that achieve part of broader CPE goals and is seamlessly integrated into other practice complexes in other domains.

Furthermore, conceptualising protractive, contractive, and regenerative practices in chapter 7 advances knowledge on integrating plastic-related household activities into sustainability practice complexes that connect the household domain with wider production, consumption, and waste management systems. In chapter 8, this study integrates the insights from the findings to highlight transferable benefits for grassroots involvement in circular transitions in emerging and established cities. Thus, this study contributes conceptually to practice theory, circular economy, and sustainability transitions literature. Moreover, the dissemination of the research findings through publications, seminars and conferences highly benefits all stakeholders in a sustainable city – individuals, governments, corporate organisations, and international bodies. This study, therefore, addresses the gap between theoretical understanding and policy interventions that have an impact on the daily activities of households and broader sustainability efforts.

Also, this study formulates action-based strategies across the chapters that integrate household activities into broader socio-technical practices. Chapter 8 synthesises these strategies into insights that could assist policymakers and community development organisations to address environmental justice issues and cater for socio-economic dynamics in households during circular transitions. This study calls attention to policy initiatives that directly target plastic-related household practices, unlike the blanket approaches that have hitherto informed government strategies yet are less effective in achieving sustainable consumption (Strengers & Maller 2014). Specifically, extant policies that strive for climate change action in both public and private sectors would be more effective in planning and execution if there was a clearer understanding of the composition of households' practices and how they impact environmental sustainability. Therefore, the research provides policymakers with alternative toolkits to combat unsustainable plastic consumption by focusing on household practices rather than individual actions and choices.

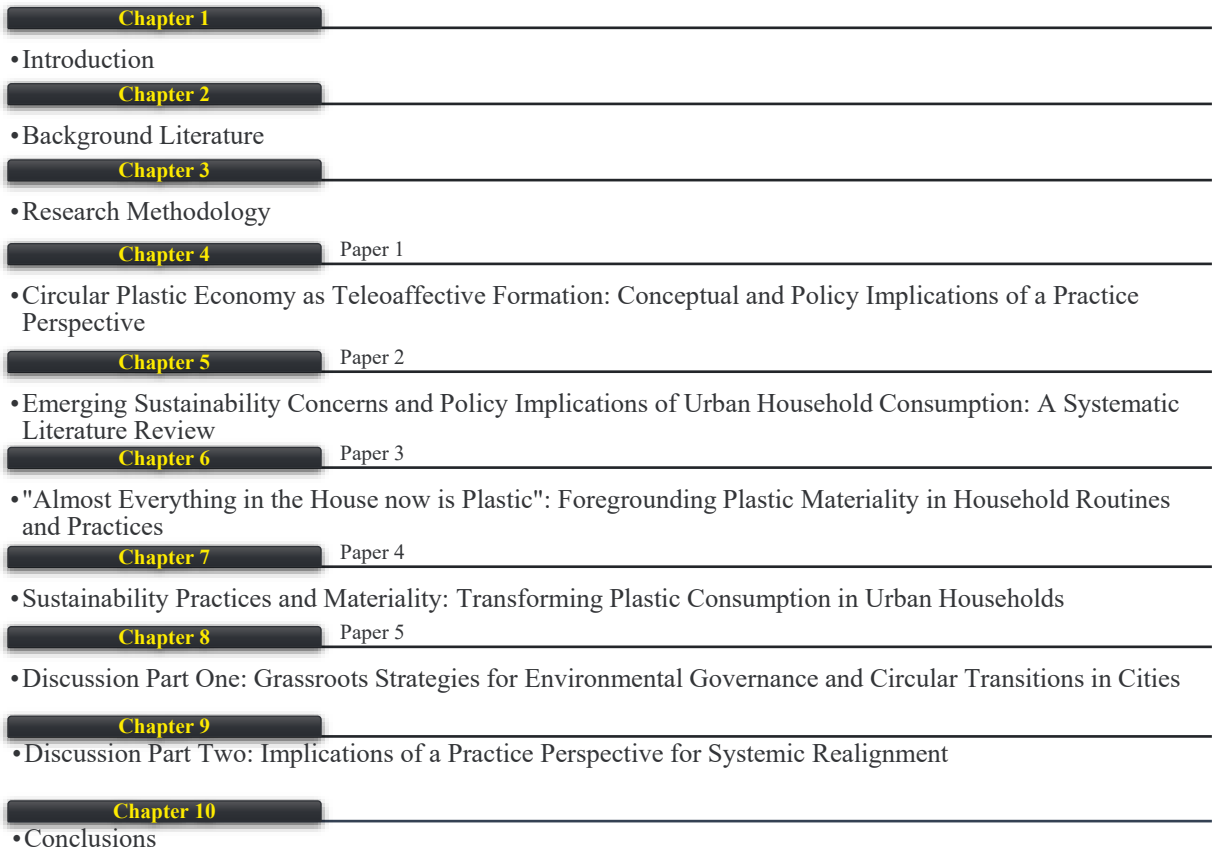
Lastly, this research provides insights into how to make plastic use sustainable and circular which could provide a significant impact on reducing illegal plastic disposal, pollution, and flooding in emerging and established cities. The study's research design is transferrable to

related areas of sustainable household consumption and therefore has the potential for policy development more broadly, for instance, energy consumption in urban areas.

1.5 Structure of the thesis

This research explores sustainable plastic consumption in urban households and the policy implications for transitioning to CPEs through a practice perspective. This is a PhD by Publication and as such, it involves the publication and compilation of papers that address the thematic focus of the research. Figure 1.2 diagrammatically presents the structure of this thesis.

Figure 1.2 *Structure of thesis with papers*



Following this introduction, chapter 2 reviews the extant literature on conceptual and theoretical approaches to sustainability transitions, as well as theories of practice, circular economies in cities, plastic consumption, and waste management that relate to, and within

which, a practice perspective on transforming plastic-related household practices for enabling the transition of cities to circular economies. The literature review of theories of transition discusses several transition perspectives (e.g., SNM, MLP and TM) including their central ideas, application to circular economy research, analytical limitations and the research gaps addressed in this thesis.

Chapter 3 presents the research methodology including the research paradigm, design and methods adopted in the study. A mixed-methods approach was utilised to collect the data that are analysed and presented across the five papers included in this thesis.

Chapter 4, the first paper of the thesis, conceptualises a CPE from a practice perspective. The paper adopts a 'zoom in and out' approach to analysing a CPE as a teleoaffective formation which is the conglomeration of practices aimed at achieving a set of goals and anchored by general understandings (Welch 2017). This paper forms the conceptual and theoretical basis upon which other papers in the thesis establish the empirical findings from the study.

This is followed by chapter 5 which answers the first research question and is the second paper in the thesis. The paper has been published and presents a systematic literature review of emerging themes from the literature on sustainable urban household consumption. Specifically, the paper examined the sustainability concerns on urban household consumption that emerged from recent studies; the recent theoretical frameworks employed in understanding urban household consumption, and the strategies recommended by recent studies for sustainably transforming urban household consumption.

Chapter 6, the third paper (also published), answers the second research question on how plastic facilitates the reproduction of practices in urban households. The analyses in this paper were informed by part of the mixed-methods data (i.e., household interviews, home tours and directed photography) collected from case studies of low-income households in Lagos. The findings illustrated household practices manifested through plastic use, the spatiotemporal qualities of plastic and how households express meanings through plastic's physical aspects.

The next chapter (7) presents the fourth paper and answers the third research question. This paper developed an analytical framework that developed plastic-related practices in urban

households including protractive, contractive, and regenerative practices. The paper further explored how compound practices can be sustainably transformed into integrative practices in urban households (Schatzki 2002; Warde 2013).

Chapter 8 presents the fourth paper and forms part of the envelope for the thesis. The paper was submitted for consideration in a book covering research agendas on sustainable cities and communities. The paper draws insights from data analysis and findings identified in the study for grassroots strategies to achieve circular transitions in cities. The insights pertain to addressing environmental justice issues in urban households and facilitating circular practices through communities of practice (Wenger-Trayner & Wenger-Trayner 2015). The penultimate chapter (9) represents the other part of the thesis envelope by critically examining the theoretical and empirical implications of the study for broader circular economy transitions in cities.

Chapter 10 then concludes the thesis and provides insights for future research in the fields of sustainability transitions, consumption studies and circular economy. In all, the thesis comprises five papers that form a thematic thread in answering the research questions and developing analytical frameworks that significantly contribute to the theory and practice of circular transitions.

CHAPTER TWO

Background Literature

2.1 Introduction

This chapter presents a literature overview of fields including sustainability transition theories, practice theory and circular economy. This chapter reviews how some theoretical frameworks typically found in the sustainability and urban transitions literature conceptualise transition processes. Throughout the review of these frameworks, the focus is on their application to circular economy research and knowledge gaps, their relevance to this study, and how the thesis speaks to identified knowledge gaps. The chapter provides an overview of practice theory, specifically discussing the composition of practices and application to sustainability transitions. Concerning theories of sustainability transitions, the chapter focuses on the literature on strategic niche management, multi-level perspective, transition management and transformative capacity. This is followed by a discussion of the circular economy in cities and the importance of geographical context in circular transitions with a focus on plastic.

2.2 Practice theory

Although not a unified body of theory, practice theory neither focuses on structures nor individual actions, but on the range of activities that order and give meaning to social living and in this way can be considered a middle-range perspective (Kuijer 2014). A popular definition of a practice is provided by Reckwitz (2002, p. 249) thus:

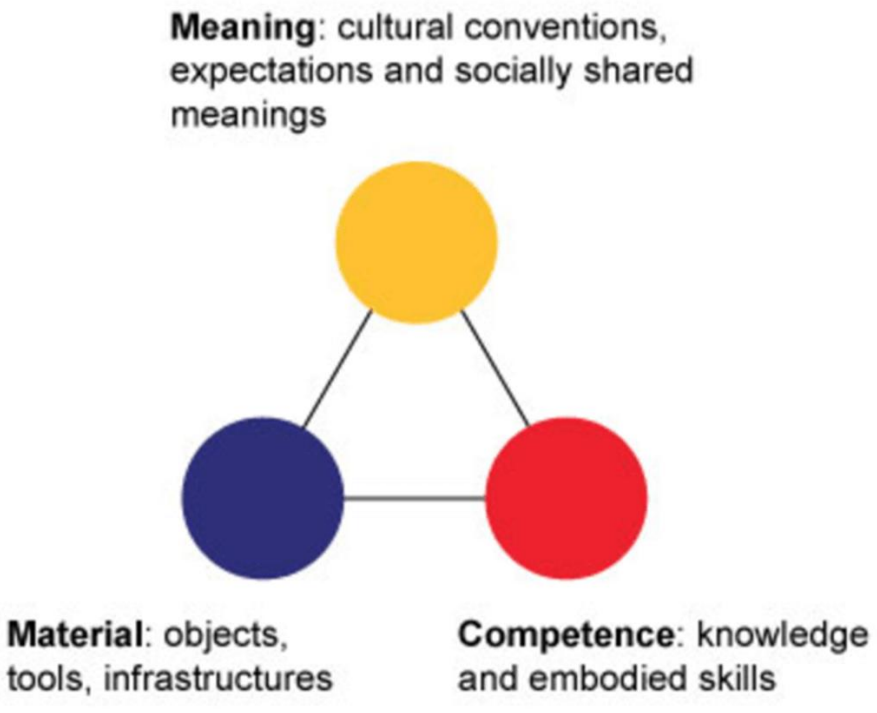
> a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge.

Shove (2009; 2010; 2009; 2019) has also written several seminal works on practice theory. As shown in figure 2.1, Shove, Pantzar and Watson (2012) describe a practice as composed of basic elements namely material, meaning and competence. Material varies from small objects like household plastic items to large technologies and infrastructure such as the electricity grid

of a city. The human body is also categorised as a material element of a practice. Meanings encompass affective values, expectations, rules, and socio-cultural conventions that attach subjective significance to practices. Competence refers to the knowledge and embodied ability to proficiently perform a practice. To illustrate, the performance of drinking as a practice could involve a cup, liquid, and the human body as materials; the meanings of sustenance, pleasure, social bonding, and healthy living; and knowledge and embodied skills such as ensuring the right quality, quantity, time, context, and the practicalities of transferring water into the mouth.

As implied by the preceding description, practice theory attempts to decentralise humans in social theorisation by regarding humans as practitioners rather than actors. In this regard, Shove et al. (2007) note that practices recruit individuals as carriers through their family, profession, social group, and cultural background. Moreover, each instance of household consumption involves the contextual performance of a practice or set of practices that integrate or compete for carriers or practitioners. Therefore, it is important to understand the practices that an individual, or a group, engages in to answer the why, how, and when of social phenomena.

Figure 2.1 *Elements of practices*



Source: Shove, Pantzar and Watson (2012)

Furthermore, practices are believed to manifest in two interacting forms—practices-as-entity and practices-as-performance (Schatzki 1996; Shove et al. 2007; Warde 2005). The former is a broader understanding of practice as a form that is existing and enduring in space and time with provisions of guidelines as to how they should be enacted in performance (Shove et al. 2007). On the other hand, practices-as-performance is the enactment of practice through the unique process of combining the above-mentioned elements in a socio-spatial and temporal context (Warde 2005). Therefore, studying plastic consumption through a practice perspective requires focusing on elements that constitute daily practices on the one hand and institutional complexes on the other.

Jaeger-Erben and Offenberger applied the practices-as-entity and practices-as-performance framework, or the 'iceberg metaphor' in their words, by describing the visible aspect of daily consumption as the top of the iceberg while they examine changes in household consumption patterns in the context of life events. From a practice perspective, consumption may be an instance of the performance of a practice (Shove, Pantzar & Watson 2012) but is intricately "embedded in socio-cultural and socio-technical settings" (Jaeger-Erben & Offenberger 2014, p. 166).

A study of households (Jaeger-Erben & Offenberger 2014) reveals that changes in everyday consumption usually accompany the adoption of new practices in households, which in turn, often precede a life event. Life events activate tangible and intangible social fields with certain spatial, cultural, and historical evolution and comprise practices-as-entity (Jaeger-Erben & Offenberger 2014). Furthermore, the adoption of new practices also results in changes to the justification for and meaning of consumption especially as it becomes embedded in the web of other existing practices within the household. This, therefore, emphasises the importance of context as a practice may manifest in diverse ways within different spatiotemporal and socio-material arrangements. This thesis adopts a similar approach by exploring how plastic-related practices are configured in urban households and how they could be transformed for enabling the systemic transition to circular economies.

While some scholars have addressed practice theory's application to sustainability transitions (Shove & Walker 2010; Shove 2010; Watson 2012), there is still a need for more development in the area. According to Öztekin and Gaziulusoy (2020), practice theory analyses change and transition in three scales: reorganising the internal processes of a practice, substituting unsustainable practices with sustainable ones and "interlocking alternative bundles of practices" (p. 206). The last scale of analysis involves transforming "user motivations, reasons, needs and wants" that engenders the fundamental network of practice bundles which could then "generate fundamental shifts in wholes of practices and everyday lifestyles, and extensively contribute to sustainability transitions" (Öztekin & Gaziulusoy 2020).

However, the authors criticise practice theory's tendency to mostly analyse systemic complexities and divergences retrospectively with less effort to actively lead the transformation agenda through a "more direct and practice-oriented impact for change" (Öztekin and Gaziulusoy 2020). Likewise, Köhler et al.'s (2019) discussion on the sustainability transition agenda charged practice theory scholars to extend practice analyses to include considerations of social differences such as class.

Meanwhile, the role of materials and materiality in the emergence, evolution, and dissolution of practices and concerning space and time is well documented in practice literature. For instance, Shove, Pantzar and Watson (2012) recognise materials (such as stuff and things) as one of the elements that constitute practices alongside meanings and competences. The unique ways materials are combined in each contextual enactment of a practice partly produce the accumulated changes that occur to such practices over time (Shove 2010). However, materials are not mere tools to be manipulated in the fulfilment of tasks or goals but active agents in conveying functionality, emotions, and affections in practice performance. As Maran and Stockhammer (2012, p. 1) put it,

> . . . the way humans and objects communicate during social practices is very powerful: . . . it persuades us to change either the surroundings or ourselves and it forces us to believe that objects have a will of their own.

Practice theory scholars have recently integrated non-human agency into the understanding of practices and the role materiality plays in their performance (Everts, Lahr & Watson 2011), for instance, drawing on the notion of materials as co-agents in the reproduction of social phenomena in Actor-Network-Theory. Focusing on the conceptualisation of materiality in practice theory, Schatzki (2010, p. 129) views practices as separate from, but coexisting with, what he calls "material arrangements' – the interconnection of 'humans, artefacts, organisms, and things of nature". Material arrangements relate to practices through mutual "causality, prefiguration, constitution, and intelligibility", thus possessing some agency in practice performance (Schatzki 2010, p. 139). Although other scholars differ by maintaining that materials are essential components of practices alongside meanings or images and competences or know-hows, they still acknowledge the capacity of non-human objects to actively influence human dispositions or express "meanings about their needs" (Hawkins 2019; Shove et al. 2007; Strengers, Nicholls & Maller 2016, p. 774).

Aside from objects being the means of expressing meanings, emotions, and skills in the day-to-day iteration of practices, they also function as the physical embodiment of the spatiotemporal evolution of practices as entities (Schatzki 1996). This means that an understanding of the geographical and temporal manifestation of artefacts could unveil the doorway to narrating the stability or dynamics of practices as links that are connected or broken among the constituent elements (Shove et al. 2007). Therefore, the analysis of household practices in Lagos may reveal additional spatiotemporal dimensions of materiality, given the unique socio-cultural configurations of practices in less-developed nations. According to Miller (2008), another way materiality connects to temporality is through the interaction of things with practitioners and the memories created by the day-to-day application of those things in practice performances. Shove, Trentmann and Wilk (2009) express a similar view of materials as markers of past events, objects that stabilise time, and instruments to navigate future occurrences.

However, Schatzki (2009) prefers to interpret temporality not as connected with the human total life course, but with human daily activities. Borrowing the term 'existential temporality' from Heidegger (1962), Schatzki (2009) argues that the three dimensions of temporality (past,

present, and future) are inherent characteristics of the performance of practices. In this sense, the three dimensions manifest instantaneously in practice performance and disappear in the same way when activity ceases. Schatzki (2009) sees temporality not as a separate phenomenon but as a unified phenomenon with spatiality he refers to as timespace. He understands the 'spatiality' aspect of the concept to be 'the world around (an actor) in its pertinence to and involvement in human activity'. The concept of timespace differs from the conception of spacetime as an objective reality common in the literature.

Whether spacetime is regarded as a teleological phenomenon or an objective reality, materiality anchors settings and moments. When practices are viewed in a teleological timespace, materials constitute the places and paths that create the settings for a carrier's daily activities (Schatzki 2009). Similarly, the dimensions of temporality are achieved in the arrangement of materials when a carrier approaches, performs and departs from such activity (Schatzki 2009). Meanwhile, the performance of practices in objective spacetime is also expressed through and by the unique combination of objects in a defined spatial context and specified moment. Stemming from this, households who share similar material arrangements and hence practices may also share similar features of teleological and objective spacetime.

There is a substantial body of literature that studies the management of plastic waste in cities (Akanle & Shittu 2018; Lam et al. 2018). However, few scholars analyse the materiality of plastic concerning wider political, socio-economic, and environmental practices. The consensus in this growing body of literature is that the current view of plastic as an environmental challenge in public and political discourses may be a hindrance to achieving sustainable development in cities. Hawkins (2010) argues that while plastic objects are imbued with several material qualities, they perform and influence humans in various ways depending on the sociomaterial arrangements at play (e.g., from everyday routines to environmental campaigns).

Similarly, Evans et al. (2020, p. 7) contend that plastics "can only be understood in terms of the wider networks and relations of which they are part". The services that plastic packaging provides, such as "freshness, convenience, safety, accountability and affordability" may not be

easily replaced by other materials given plastic's embeddedness in the current socio-economic system (Evans et al. 2020, p. 7). As such, they suggest that more attention should be paid to plastic packaging regulations and changing extant norms to facilitate the sustainable reconfiguration of consumer practices. However, such practice reconfiguration can only be possible with a grounded understanding of how plastic materiality is implicated in day-to-day routines and practices as presented in this study.

This thesis contributes to practice theory analysis in two ways. First, rather than a retrospective analysis, part of the aims of the thesis is to conceptualise the prospective and emerging transition of cities to circular economies. In this thesis, this transition is conceptualised as the transformation of compound practices into integrative sustainability practices, and the binding of integrative sustainability practices in teleoaffective formations. Chapter 4 examines how a CPE could be understood from a practice perspective as a teleoaffective formation. While teleoaffective formation is composed of practice complexes at a broader level, it also manifests at a micro level in the form of teleoaffectivities (Welch 2017). As further elaborated in chapter four, teleoaffectivities enjoin the normativised ordering of goals and associated affectivities with practice elements such as competences, meanings, and materials. Chapter 7 further examines how household practices can be sustainably transformed and be connected to the larger systemic changes that will herald the circular economy.

Second, this thesis utilises a case study approach to focus on the underexplored context of low-income households in an emerging city to contribute new insights and concepts to knowledge. In this regard, chapter 6 explores the dimensions of plastic materiality in anchoring daily practices in low-income practices. Furthermore, chapters 8 and 9 synthesise the findings across the preceding chapters and draw out lessons and insights for addressing environmental justice issues in cities, leveraging communities of practice (Wenger-Trayner & Wenger-Trayner 2015) to establish circular practices, conducting nuance analyses of practices, and facilitating innovation by combination toward circular transitions.

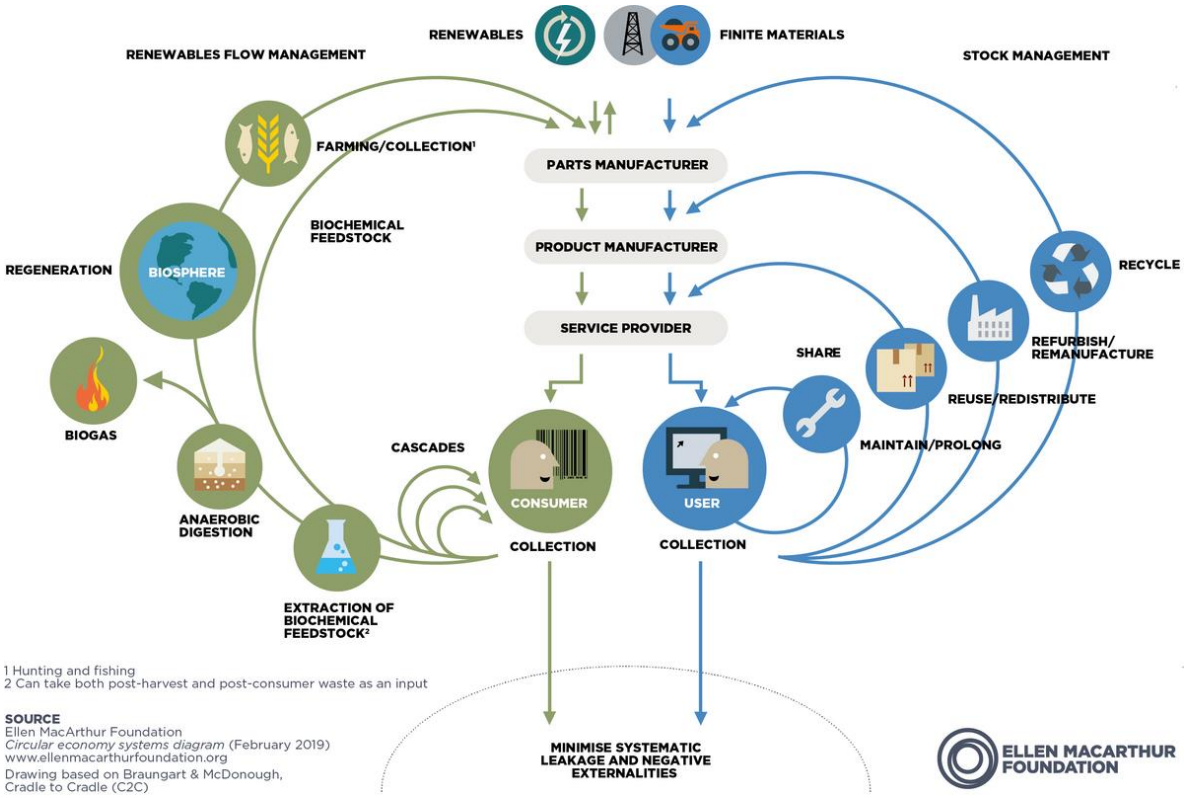
2.3 Circular economies in cities and geographical context in transition

> A circular economy is a systemic approach to economic development designed to benefit businesses, society, and the environment. In contrast to the 'take-make-dispose' linear economy, a circular economy is restorative and regenerative by design and aims to decouple growth from the consumption of finite resources. It is based on three principles i.e., to design out the waste and pollution, keeping the products and materials in use and to regenerate natural systems.
> - Dhawan and Beckmann (2018, p. 8)

As explained in the above definition and expressed in figure 2.2, a circular economy is a system that aims to decouple economic growth from the increasing use of finite natural and material resources and aggravated environmental pressure. However, Bauwens (2021) identified some challenges in associating the concept of economic growth with a circular economy. The author largely considered circular business models to be costly to businesses and result in reduced profit margins. Instead, Bauwens (2021, p. 2) argues for a post-growth circular economy that focuses on "abolishing the political economy of the growth imperative and putting material loops at the service of the wellbeing of both humans and non-humans."

Following the focus of this thesis on plastic, a circular economy for materials implies maximising the imbued value of materials during their lifecycle and recovering the residual value at the end of life. The lifecycle of plastic materials can be extended through several activities including maintaining, reusing, sharing, repurposing, and recycling. Chapter 7 of this thesis explores how household activities can be transformed and integrated into circular practices.

Figure 2.2 *Circular economy systems*



Beyond activities that extend the lifecycle of materials such as plastic, a circular economy also aims to lessen the amount of plastic in circulation by encouraging the reduction of plastic use and substituting plastic with more environmentally friendly materials such as reusable glass for containers. However, as revealed in this thesis (see chapters 6 and 7), these efforts are often not successful in low-income households for several reasons including the unique functions offered by plastic materials and the environmental justice issues low-income households experience.

Scholars have raised some concerns about circular economy transitions (Rizos, Tuokko & Behrens 2017). As with many other socio-economic concepts, the circular economy concept has been interpreted and applied differently among scholars, businesses, and policymakers. This reduces opportunities for collaboration on the transition agenda and the ability to measure circular economy impacts. Also, circular economy discourses have been said to oversimplify "the myriad challenges related to transforming linear structures and business models that have been in place for many decades" (Rizos, Tuokko & Behrens 2017, p. 7).

Moreover, Hobson (2021) takes the current CE discourse to be overly descriptive and conceiving of people as 'user-consumers' rather than active stakeholders with the realisation of the enormous task of a CE transition. Along the same vein, Gregson et al (2015) consider CE policy and practice to be heavily imbued with political and moral framings of how resource recovery is defined and implemented, especially in the European Union (EU). The authors argue that this limits the applicability of the CE ideology, particularly within existing global recycling networks.

These critiques further highlight the role of humans and subjective meanings in realising change. From a practice perspective, humans and meanings are but part of the elements of a practice which include others such as materials (the human body is an example of this) and competences. The three practice elements of materials, meanings and competences must be considered to create stability or change in social processes, which in this case is a circular economy.

Furthermore, this thesis reflects on these CE discourse criticisms by acknowledging the complexity of existing practice configurations and in chapter 4, delves deeper into conceptualising the nexus of practice complexes that composes a circular economy. A guiding principle of this thesis is the need to adequately understand the sociomaterial and spatiotemporal context of practices before implementing circular economy policies given the entrenchment of the former in existing social structures. Moreover, this thesis contributes to the call for more consideration of consumers as 'doers' rather than ordinary 'users' of products and services (Mylan, Holmes & Paddock 2016) by conceptualising consumption as an outcome of the bundle of activities performed by practitioners. This further supports the importance of households (as consumers) in sustainability transitions as the domain manifesting the joint impact of technical and political domains through practice performance.

Along with other points, the preceding reinforces the importance of geographical context in circular economy transitions as done in this study through the focus on case studies of low-income households in Lagos. First, circular economies are bespoke solutions to a particular

geographical context, that is, the processes in a circular economy are designed to rely significantly on the production and consumption capacities of local systems. For instance, Christensen (2021) noted that facilitating the circular economy requires local modes of governance by leveraging local assets, managing utilities and waste companies, implementing rules and economic policies and galvanising collaboration among relevant stakeholders.

Stemming from the above, the circular economy represents a push away from the socio-environmental justice issues that accompany a globalised economy where waste from advanced cities is exported to emerging cities to the detriment of the latter's environment (Okafor-Yarwood & Adewumi 2020; Little & Lucier 2017). In this regard, the circular economy not only reduces the environmental damage of materials but also maximises the value of materials within a local system. Therefore, it is important for policy, research, and industry to gain an adequate understanding of the systemic configuration of a city before implementing circular economy policies. Also, while research, policy and industry may transfer learnings and best practices from other cities, such must be adapted to suit the socio-material, economic and cultural context of the intended city.

Second, within a local system, circular economy configurations will manifest differently for various income categories. The income category is emphasised here because it represents the capacity of households to acquire valued goods and services and influences their social groups. For instance, low-income communities experience a different social reality and hold different values than middle- or high-income communities (Murphy 2015). A community's social reality is shaped by several complex factors including its access to adequate socioeconomic and spatiotemporal resources; the beliefs, meanings, and goals it values, and its level of embodied knowledge and skills. In other words, practices shape the social reality of communities through material, meaning and competence elements. Following this, the transition to circular economies will shape and reconfigure community or household practices differently. Hence, the need to understand the contextual configurations of household or community income categories.

2.4 Theories of sustainability transitions

The challenge of the 21st century and beyond is that of sustainability transitions. The current socio-economic system prioritises maximising resource extraction and consumption with little regard for the resulting environmental consequences. The environmental implications including climate change, environmental injustice, environmental pollution, health challenges, loss of biodiversity and other ecological challenges necessitate global transitions to sustainable systems. According to Markard, Raven and Truffer (2012, p. 956) "sustainability transitions are long-term, multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption". The focus of this thesis is explicitly on households in the transition processes. However, transition theories remain of particular relevance for connecting household perspectives, such as practice theory, with systemic transformation or transitions. In the following four subsections, four approaches to understanding sustainability transitions, that intersect with household practices for enabling urban transitions are discussed. These are strategic niche management (SNM), multi-level perspective (MLP), transition management (TM) and transformative capacity (Markard, Raven & Truffer 2012).

Generally, sustainability transition theories attribute a shift in socio-technical systems to the complex and multidirectional interactions between niche, regime, and landscape societal levels. Niches are protective spaces where novel socio-technological innovations, such as circular economy products, incentives, and planning interventions (including nature-based solutions), can be developed, shielded, nurtured, and empowered before being introduced into, or exposed to, the existing socio-technical regime (Smith & Raven 2012). Regimes are a complex set of institutional routines, rules, technologies, and practices that reinforce existing socio-economic and socio-technical systems (Geels 2010). Lastly, landscapes are exogenic socio-political, economic, and cultural forces that exert influence on the regime to "open windows of opportunities for niches to break through and contribute to fundamental changes, or shifts, in socio-technical regimes" (Markard, Raven & Truffer 2012, p. 958). Chapter 8 of this thesis discussed the role of communities of practice (Wenger-Trayner & Wenger-Trayner

2015) in protecting circular practices as a niche and facilitating regime transformation into circular economies.

2.4.1 Strategic niche management

SNM advocates for real-world experiments with emerging technologies and socio-technical arrangements to introduce, nurture and expand niches for societal transitions (Loorbach & van Raak 2007). According to Schot and Geels (2008, p. 537), SNM emphasises the "co-evolution of technology, user practices, and regulatory structures" in niche development as a precursor to extensive socio-technical transitions. The authors reviewed the theoretical and empirical discourse in SNM over 10 years particularly focusing on niche development. A successful socio-technical transition occurs when a technological niche transforms into a market niche and finally, a shift in regime takes place (Schot & Geels 2008). The authors' analysis reveals that vision articulation, social networks and diverse learning processes are three important factors in developing a technological niche. Moreover, each of the three factors needs to be broad enough to be shared among several actors, include multiple stakeholders, and facilitate theoretical reconceptualisation respectively. On the other hand, the three transition processes must be sufficiently deep to provide specific guidelines, galvanise contextual actions and focus on empirical analysis respectively.

Scholars have applied SNM to empirically study the sustainability transition to circular economies. Chembessi, Beaurain and Cloutier (2021) in a recent study explore how a circular economy can be scaled up through SNM. Through a qualitative approach, the study applies an SNM analytical framework to explore public policies for implementing a circular economy in Quebec. Public strategies adopted in Quebec to promote circular economy principles include integrated residual material management policies (e.g., polluter-pays principle and extended producer responsibility principle; socio-technical strategies (e.g., galvanising local circular economy networks and provision of funding programmes) and coordinated national strategy (e.g., public consultation on circular economy and active commitment of government ministries) (Chembessi, Beaurain & Cloutier 2021).

A critique of SNM's approach to sustainability transitions argues that simultaneously incorporating such broad or social and specific or technological processes may create unresolved conflicts, network tensions and incompatibilities during such transitions (Schot & Geels 2008). Other approaches such as TM have proposed that such conflicts could be resolved through a reiterative design of visions before and during experiments and starting with a focus on social processes before technology, during experiments (Schot & Geels 2008).

Similarly, to address some of SNM's limitations as an analytical tool for circular economy transitions, Barrie, Zawdie and João (2017, p. 6) suggest the integration of the triple helix system (referring to a "hybridisation of university, government and industry") and innovation intermediaries into the SNM framework. The authors argue that merging a protected space with knowledge and innovation spaces would create a consensus space of policy, academia and industry which would, therefore, create the right circumstances for transitioning to circular economies (Barrie, Zawdie & João 2017). Meanwhile, innovation intermediaries would facilitate optimal knowledge transfers between knowledge space enablers (policymakers), knowledge creators (academia) and knowledge users (industry).

However, these suggested theoretical integrations further ignore one important aspect of social processes for circular economy transitions – household consumers. Households are central to the successful implementation of circular economy models such as service-as-product, sharing economy and repair services. Therefore, niche actors need to consider how their innovations or new technical processes would impact practices and socio-material arrangements within households. Niche innovations and emerging sustainability practices may be similar in that they both take place within localised segments of society. For instance, as discussed in chapter 8, sustainability practices can develop within communities of practice that aim to recruit more carriers or individuals thereby generating momentum in scaling up (Wenger-Trayner & Wenger-Trayner 2015). However, niche innovations are often developed within a hierarchical conceptualisation of systemic transformation.

2.4.2 Multi-level perspective

Perhaps the most dominant theory in sustainability transition studies is MLP. According to this analytical framework, a socio-technical transition is a shift from one regime to another resulting from the intricate and multi-layered interactions between niches, regimes, and landscapes (Geels, 2011). Geels and Schot (2007) describe how the multi-layered interactions between the three levels often emerge: technological advances, social learning and power affiliations trigger an impetus within niches; cultural, economic, and socio-political developments occur at the landscape level to force transformations in the regime, and these changes enable innovations to disrupt and replace existing regime processes. Geels and Schot (2007) further identify four transition pathways that arise from such multi-layered interactions using the timing and nature of the interaction as criteria:

1) *Transformation path*: This occurs when landscape developments pressurise and destabilise regime processes, but niche innovations are not fully developed to replace existing regime processes. While this does not displace the extant regime architecture, it enables regime actors to remodel the existing regime towards new goals and aspirations. However, the effectiveness and pace of this transition pathway depend on the extent of landscape pressure on the regime, the emergence of new socio-technical processes to sustain new goals and the willingness of regime actors to act.
2) *De-alignment and re-alignment path*: This transition pathway results from the effect of an 'avalanche change' in the landscape that overwhelms the regime thereby de-aligning regime processes. In this case, regime actors are discouraged from taking actions to stabilise the regime given the increasing economic cost of such actions. Meanwhile, due to the breakdown of regime processes, several niche innovations compete for domination, but one eventually emerges as the new regime. The niche innovations in this regard are less stable and have low internal momentum.
3) *Technological substitution path*: Unlike the preceding transition pathway, niche innovations in this pathway are well-stabilised and fully developed to replace the extant regime. However, regime actors are less receptive to these niche innovations and would rather accept incremental innovations resulting from the evolution of the existing

regime. For a transition to occur, landscape changes would, therefore, disrupt regime processes for niche innovations to be established as the new regime.

4) *Reconfiguration path*: This pathway is similar to the transformation path but involves the reconstruction of the underlying systemic architecture as regime and niche innovations interact to create new socio-technical processes. The niche innovations are radical and would emerge from, or become relevant to, multiple socio-technical domains thereby creating competition among regime actors. The additional pressure of landscape changes facilitates the successful transition to a new regime.

From a multi-level perspective, the transition to circular economies fits within the reconfiguration pathway. Ongoing local and global sustainability discourses including the leadership of international organisations on achieving SDGs provide landscape pressure on regimes (e.g., industries and cities) to disrupt existing production and consumption processes (Jackson, Lederwasch & Giurco 2014). Also, niche circular innovations such as product-as-service are symbiotic with existing regime innovations such as recycling. This, therefore, creates continuous interactions between regime actors (e.g., established businesses) and niche actors (e.g., small-scale circular businesses and start-ups) which results in new consumption and production processes, including new, or reconfigured supply and value chains. Chapters 7 and 8 explored how current unsustainable household and grassroots practices can be transformed to accelerate the transition of cities to circular economies.

Geels (2011) identifies and addresses some major criticisms of the MLP for sustainability transitions. These criticisms include a low consideration of agency in MLP's analysis; the difficulty in operationalising MLP concepts and an overemphasis on bottom-up transition approaches. One of these criticisms concerns the disparity between the ontologies of theories of practice (flat world) and MLP (hierarchical levels) (Geels 2011). For instance, Shove and Walker (2010) argue that while there are wider social or 'landscape' issues (e.g., gender inequality and poverty) that influence people's daily lives and their iterative performance of practices, all social elements exist on the same plane rather than being hierarchal. In response, Geels (2011, p. 37) noted that the niche-regime-landscape levels in MLP refer more to "different degrees of structural of local practices, which relate to differences in scale and the

number of actors… and different degrees of stability" than the hierarchy of the levels. In this sense, MLP concepts could be explained through a practice theory lens and vice versa.

However, Geels (2011) further identified some shortcomings of theories of practice in explaining sustainability transitions. That is theories of practice lack well-developed theoretical accounts of sustainability transitions beyond specific empirical cases. To contribute to this knowledge gap, this PhD thesis (chapters 4, 7 and 8) theoretically conceptualises the transitions of cities to circular economies from a practice perspective (chapter 4); conceptualises the sustainable transformation of urban household practices (chapter 7) and discusses transferable insights from the empirical findings for improving grassroots participation in circular transitions (chapter 8).

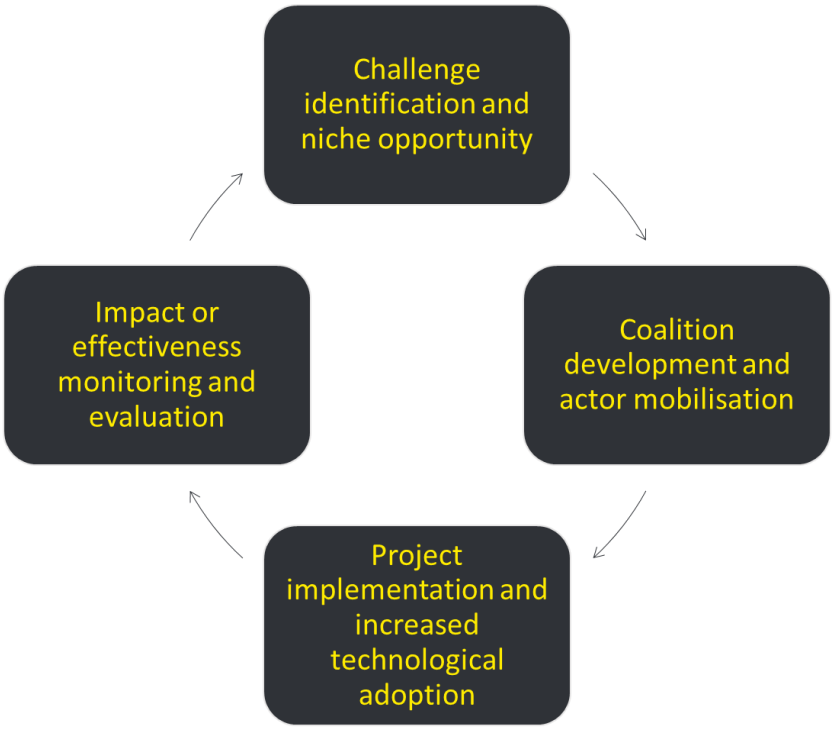
2.4.3 Transition management

Transition management (TM) is a sustainability transition framework that integrates technological transitions with socio-political transformations. TM scholars conceptualise societal domains as complex adaptive systems that could be managed towards sustainability transitions through "a reflexive and evolutionary governance process" (Markard, Raven & Truffer 2012, p. 958). As a governance approach, transition management involves the collaborative participation of sustainability stakeholders including policymakers, businesses, research institutions, non-governmental organisations, and citizens. The governance of sustainability transitions in TM adopts bottom-up and top-down strategies to facilitate networking, interactions, and social learning among transition actors (Loorbach & van Raak 2007; Rotmans, Loorbach & Kemp 2007). TM approaches transition interventions by focusing on the whole system rather than a layer or level of social formation. The sustainability governance of a complex and adaptive system requires continuous interaction among stakeholders across the societal levels. TM conceptualises transitions as covering a prolonged timeframe and encompassing multiple domains, actor networks and levels.

Peterson et al. (2022) developed a framework from Rotmans and Loorbach (2009) and Geels and Schot (2007) that depicts the cycle of transitions in TM (see figure 2.3). They apply this

framework to conceptualise how to transition to a circular phosphorus system. According to the authors, the stages identified in figure 2.3 interact with transition levels (niche, regime, and landscape) and dimensions (e.g., science and technology, policy, and infrastructure) to achieve circularity in the current linear phosphorus system.

Figure 2.3 *Stages within the transition management cycle*



Source: Peterson et al. 2022

In another study, Hofmann and Jaeger-Erben (2020) applied TM to understand the configuration of circular business models (CBMs) in organisations. The authors develop three propositions about the circumstances that promote CBM innovations in organisations. First, the experimental space for CBM innovations should be independent but also intra-organisational. That is, while CBM innovations grow in niche settings that are protected from the influences of existing organisations, they are also linked with regime systems "to test, negotiate, reflect, and evaluate new game rules for circularity" (Hofmann & Jaeger-Erben 2020, p. 2784). Second, applying TM to CBM innovations in organisations entails managing contradictions that arise from reconfiguring linear systems. For instance, CBM innovation management requires finding a balance between *zooming out* to understand holistic interactions

in complex circular systems and business networks and *zooming in* to identify and address internal factors that inhibit implementing CBMs in business operations by deploying available resources. Other management paradoxes include effectively regulating heterogeneity among members of the CBM exploration team and interlinking CBM experiments and strategies through a "normative reference frame of ecological performativity" (Hofmann & Jaeger-Erben 2020, p. 2785). The third proposition states that facilitating 'viable long-term CBMs' involves the creation of a nexus that effectively stabilises the CBM innovation paradoxes.

This thesis diverts from TM in that the former explores the implications of applying a theoretical perspective (practice theory) to plastic consumption and circular transitions while the latter is a holistic transition tool adopted mainly to implement sustainability initiatives in geographical space. However, TM shares some of the methodological approaches adopted in this study, for instance, zooming in and out. In this regard, this study conceptualised a CPE as a teleoaffective formation (Welch 2017). In chapter 4, this study zooms out on the components of a CPE as a system including general understandings, practice complexes and (non-) discursive formations. The chapter then zooms into the household domain to examine how plastic-related practices would be organised around day-to-day living.

2.4.4 Transformative capacity

According to Ziervogel, Cowen and Ziniades (2016), transformative capacity is another socio-technical transition framework that draws heavily from resilience theory, organisational change, climate change adaptation, social-ecological systems, and developmental psychology. Transformative capacity denotes the capacity of actors to transform sociotechnical systems and individual lifestyles consciously. Societal transformation extends beyond having a resilient or reactionary adaptive system to intentionally designing regenerative systemic changes that provide a balance of human activities with natural capacities (Ziervogel, Cowen & Ziniades 2016). Ziervogel, Cowen and Ziniades (2016) further conceptualise that facilitating transformative capacity involves being aware of and reconnecting with natural and human life support systems, developing a full-fledged sense of agency, and achieving social cohesion.

Ziervogel, Cowen and Ziniades (2016) note that the concept of transformation takes on different definitions at the societal, organisational, and individual scales. At the societal scale, transformation is achieving "living systems that are complex, adaptive, dynamic, emergent, interdependent, and never in equilibrium" (Ziervogel, Cowen & Ziniades 2016, p. 3). This contrasts with a socio-technical system that adopts a linear understanding of social processes with the provision for little or no deliberate choices to make sustainable changes. The authors argue that the complete transformation of societies occurs over centuries, cloaked in several periodic transition approaches.

For an organisation, Edwards (2010, p. 30) sees transformation as a "discontinuous change that involves subjective and objective aspects of the whole multilevel organisational system and which results in a radical multidimensional reconfiguration of culture, systems and structures." However, since organisations are composed of people, their transformation is inherently tied with individual transformation, which is defined as "the fundamental realignment of personal attitudes, consciousness, motivation, beliefs and spirituality" (Edwards 2010, p. 31). This understanding differs from practice theory in that the latter conceives individuals to be carriers of practices and as such, transformation takes place within the practices that an individual carries, but which manifests in day-to-day social realities.

Horlings et al. (2020) applied the transformative capacity framework to explore how place-shaping practices can engender sustainable development. The authors argue that the lack of place-based considerations in sustainability agendas and strategies results in unequal global development, environmental and social injustice, and the degeneration of ecosystems among others (Horlings et al. 2020). However, Horlings et al. (2020, p. 353) note that:

> a place-based approach… acknowledges the activities, energies and imaginations of the people and communities and how these can have impact on the environment and economy in a more sustainable way.

Transformative capacity represents not only empowering people and institutions, but also recognising the importance of contexts, spaces, and places in the implementation of such frameworks. Horlings et al. (2020) conceptualise the transformative capacity of place-shaping practices to involve three reciprocal dimensions of re-appreciation, re-grounding, and re-

positioning, corresponding with socio-cultural, ecological, and political-economic processes respectively. Re-appreciation refers to the process of improving the values and meanings people attach to a place as something to be protected and honoured. Re-grounding is about integrating place-based practices into innovative and strategic processes that reflect the traditions and viewpoints of inhabitants. Lastly, re-positioning is an approach that recognises the importance of sustainable alternatives and niche innovative practices in transforming existing political and economic institutions and the relations that impact place-based processes (Horlings et al. 2020).

Furthermore, Zwiers, Jaeger-Erben and Hofmann (2020) examine the knowledge dimensions of a circular economy. The authors build on the work of a ProClim group (1997) to conceptualise circular literacy as composed of system knowledge, target knowledge and transformation knowledge. Zwiers, Jaeger-Erben and Hofmann (2020) argue that it is important for circular economy scholars and stakeholders to invoke these three dimensions to boost the transformative capacity of a circular economy. System knowledge involves an "understanding of complexity" and "complex interactions between nature, society and technologies" (p. 125). Target knowledge is an understanding of the desired futures and their associated values which includes transitioning to circular economies and achieving sustainable development goals. Meanwhile, transformation knowledge refers to the adoption of two aspects: 1) epistemologies of complexities to integrate multiple perspectives into circular transition research and policymaking, and 2) reflexivity and innovation which is the ability of transition actors to examine their actions and address the resulting negative effects (Zwiers, Jaeger-Erben & Hofmann 2020).

In a way, this thesis is also about exploring the transformative capacity of the circular economy but through the frame of materiality, low-income households, and practice theory. Similar to the work of Horlings et al. (2020), in chapters 6 and 7 the capacity of plastic materials to condition low-income household practices is conceptualised, thereby emphasising object-shaping and place-shaping practices in achieving circular economies. Furthermore, the knowledge dimensions of Zwiers, Jaeger-Erben and Hofmann's (2020) circular literacy are embedded in this study by conceptualising the circular economy as a teleoaffective formation

(Welch 2017) with a zooming-in-and-out approach (chapter 4), integrating sustainability practices with circular transitions (chapter 7) and adopting a pragmatic approach that enables multiple paradigms, methodologies, and analytical frameworks (chapter 3).

2.5 Conclusion

This chapter has provided an overview of the literature on transitions theory, practice theory and circular economy, focusing specifically on their conceptualisation of sustainability transitions. This review highlighted the knowledge gaps in the fields that this study addresses by exploring the transformation of plastic-related practices for enabling circular transitions. These include focusing on households as an important dimension of circular economy transitions; advancing practice theory's understanding of sustainability transitions by conceptualising CPE transitions and the sustainable transformation of urban household practices; applying the zoom-in-and-out approach to understand daily practice performance and systemic configurations and focusing on underexplored contexts in transition studies for contributions to knowledge and practice.

Key insights from this review relate to the importance of technological processes, systemic forces, innovations, and actors in sustainability transitions. However, it is also evident that aspects such as the role of households in transitions, and the transformation of household practices as an integral component of societal transformations, are under-theorised or conceptualised in several of the sustainability transitions theories. Instead, when focusing on households as the unit of analysis/observation, practice theory provides a conceptual framework that can analyse components (e.g., material) of daily practices and how they could be sustainably transformed. The application of practice theory to plastic-related household practices and the analysis in this thesis is further detailed in the methodology (chapter 3).

CHAPTER THREE

Research Methodology

3.1 Introduction

The main question addressed in this thesis is: *how can plastic-related practices be transformed for enabling the transition of cities to circular plastic economies?* This research contributes to what is recognised as the 'practice turn' in social research (Cetina, Schatzki & Von Savigny 2005). A particular strength of practice theory is its potential to explain social stability and change at varying degrees of social complexities. Furthermore, practice theory enables a focus beyond anthropocentric perspectives on the intricacies of materials and their role in (re-)organising the social world. More importantly, practice theory's emphasis on analysing underlying bundles of activities and their interconnections makes it to be particularly useful in zooming in on plastic consumption in households and zooming out on a CPE system.

By adopting a practice approach to answering the research question, this chapter postulates ontological and epistemological assumptions about the social world that vary from the traditional perspectives in the social sciences (Schatzki 2016). The chapter further discusses the rationale for adopting pragmatism as a research paradigm and its implications for gathering data on plastic-related household practices. Other sections of the chapter discuss the research design, methodology, methods, research plan and quality control mechanisms.

3.2 Ontology and epistemology in practice theory

In addition to the discussion of materiality in chapter 2, this study's view of the ontology of materials is similar to that of new materialism. Given the dominant approaches that overemphasise "language, discourse, culture, and values" in explaining social phenomena, Coole et al. (2010) explained that new materialism is a call to reconsider materiality and material processes in social theorisation. Similar to new materialism and as findings in chapter 6 show, this thesis considers materials to be more than ordinary matter that is acted upon and

shaped by humans. Instead, materials are active agents in forming and shaping the social world and practices. However, while new materiality considers materials to possess agency, the role of materials in practices is still contested in practice theory. This thesis, therefore, contributes to the discourse in chapter 6 by revealing the corporeal, spatiotemporal, and meaning mediation aspects of plastic materiality (Shittu 2021a)

Furthermore, practice theory scholars generally conceptualise the ontology or nature of practices to be flat (Schatzki 2016). That is, the entire web of connections among practices in the various social domains exists on a single level. This implies that in each social domain, practice elements constantly combine in new and multiple ways in everyday life. This dynamic combination could reinforce existing, form new or break up old sociomaterial arrangements in each practice performance (Shove 2019). This ontology is unlike other social theories such as the multi-level perspective where social formations are conceptualised as existing on hierarchical levels.

However, Denegri-Knott, Nixon, and Abraham (2018) note that practice theory's flat ontology raises questions about how concepts of power and unequal relationships are imbued into practices – a notion critics have noted is not prominent in the various accounts of theories of practice. To address this, Denegri-Knott, Nixon, and Abraham (2018) delve into how normality and politics are imbued into household and community practices and how such could drive sustainability transitions. Their analysis of a sustainable community in England reveals "how power-knowledge governs the various ways in which different elements, such as people, knowledge, discourses, rules, material artefacts, and competencies, come together in practices" (p. 555). Although such discourse extends beyond the scope of this study, chapters 6, 7 and 8 analyse how a lack of access to space, socio-economic resources, sustainability information and other environmental justice issues influence household practices and circular transitions. These chapters further exemplify the applicability of practice theory in analysing how households ascribe meanings to practice performance and the prevalence of some types of knowledge (sustainable or otherwise) in household practices.

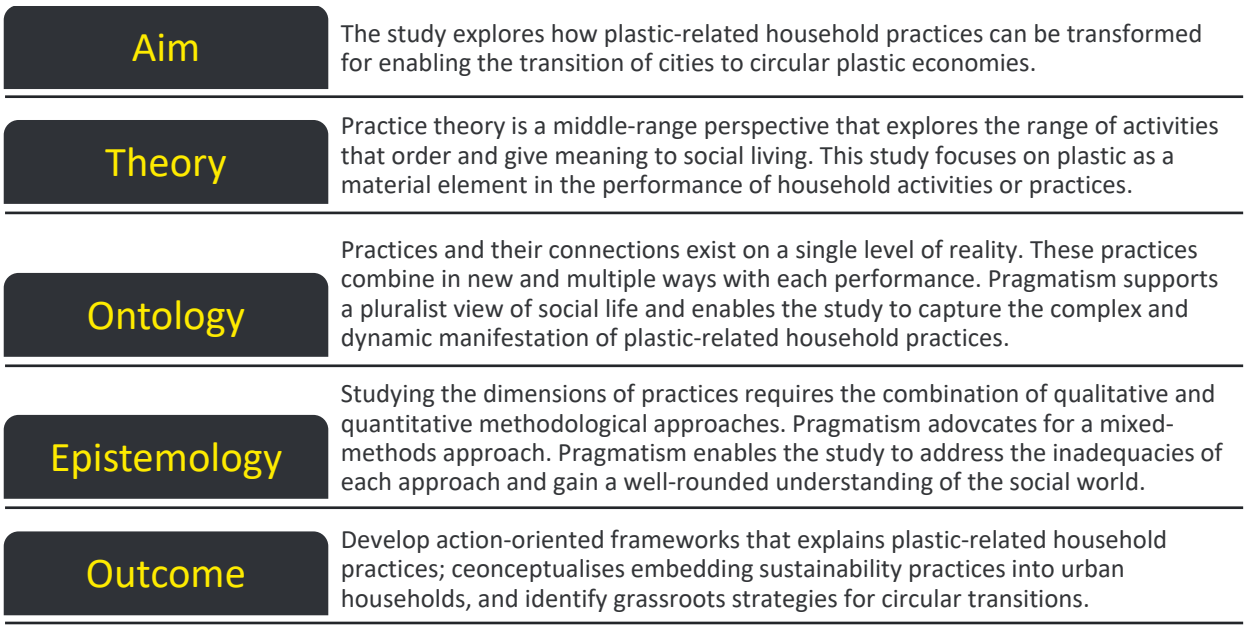
On the other hand, the methods of knowing or epistemic assumptions of practices are not well defined. This ambiguity derives from two empirical issues. First, a proper understanding of household practices and their spatial-temporal manifestations requires an element of objectivity or non-participant observation to reduce research bias. Nonetheless, scholars have argued that absolute objectivity may not be achievable or desirable in social research (Khatwani & Panhwar 2019). Second, while it is desirable to understand practices within the social and temporal contexts in which they occur, there are limited methods of covertly observing the everyday performance of practices. As a result, past studies tend to rely on the subjective description of interview participants (Strengers 2010; Butler, Parkhill & Pidgeon 2014).

However, interviews are largely subjective and depend on the respondents' ability to recount past experiences adequately and correctly. This has, therefore, prompted previous studies on household practices to adopt a mixed-methods approach including ethnographies, home tours and diaries to obtain a more complete account of practices (Hargreaves 2011). The ontological and epistemological nature of practices informed the adoption of pragmatism as a research paradigm as explained in the next section.

3.3 Research paradigm

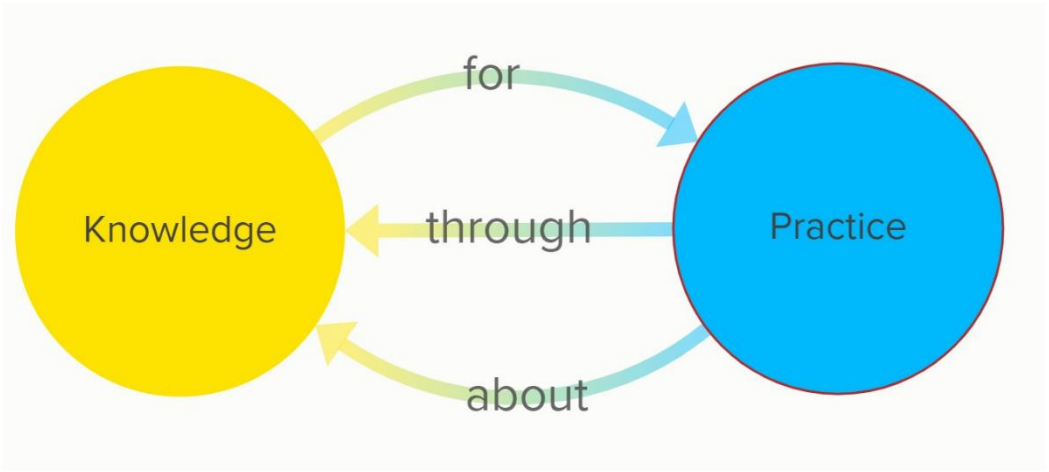
According to Morgan (2007, p. 50), paradigms are "worldviews or all-encompassing ways of experiencing and thinking about the world, including beliefs about morals, values and aesthetics". This study adopts a pragmatist paradigm to empirically capture the complex and dynamic manifestation of plastic-related practices in households. Figure 3.2 summarises the application of the pragmatic paradigm in this thesis.

Figure 3.1 *Application of pragmatic paradigm in the study of plastic-related household practices*



Pragmatism, prominent in the works of social philosophers John Dewey and Herbert Mead, is a paradigm that enables the researcher to search "for the feasible, workable solutions to complex human problems" (Parvaiz, Mufti & Wahab 2016, p. 68). Goldkuhl (2008) theorises pragmatism as involving three forms: knowledge for action, knowledge through action and knowledge about action. Figure 3.2 presents an adaptation of Goldkuhl's (2008) framework as applied to this thesis with an emphasis on practices rather than actions. It should also be noted that the knowledge referred to here is scientific knowledge created through the performance of research practices. Therefore, knowledge for practice is the development of scientific knowledge for practical application, knowledge about practice is the description of a social phenomenon by focusing on practices, and knowledge through practice refers to the generation of scientific knowledge by performing, experiencing, and reflecting on such practices. While this study is mostly driven by the first form (knowledge about practice), the other two dimensions are also reflected in the methodology. Essentially, facilitating problem-solving in societies through practice-oriented research as the central philosophy of pragmatism (Parvaiz, Mufti & Wahab 2016; Powell 2001) aligns with the aim of this study which is to explore how to transform plastic-related household practices for enabling the transition of cities to CPEs.

Figure 3.2 *The forms of connection between knowledge and action in pragmatism*



Adapted from Goldkuhl (2008)

Furthermore, adopting pragmatism enables the study to address important operational issues within the research context. First, empirical research within the social sciences is always faced with the positivism versus constructivism paradigm debate (Creswell & Plano Clark 2007). Positivism emphasises the existence of an objective reality that should be studied with quantitative methods while constructivism argues for the existence of multiple realities which are studied using qualitative methods informed by the researcher's subjective bias (Hwang 1996). In the context of this study, although it could be argued that practices are realities that exist outside of the researcher's construction, it is, at the same time, difficult to objectively describe them and their interactions.

Moreover, the performance of a practice is distinctive spatiotemporally. That is, households uniquely combine the constituting elements of practice (i.e., material, competence and meaning) in each consumption to achieve a normative end. This implies that no two performances of a practice, for instance involving a plastic material, will be entirely the same in their process or manifestation. While this poses a difficulty in studying practices, it also presents the opportunity to account for spatial-temporal changes in the evolution of practices, especially within households.

To capture the dynamic nature of practices, pragmatism affords a study to combine multiple perspectives and explanations in answering a research question (Morgan 2014). Ontologically, pragmatism holds a pluralist view of social life, as reality could be influenced by the historical, social, and economic context of the phenomenon (Lohse 2017). Epistemologically, a pragmatic approach views knowledge as being obtained from social experiences or actions and is evaluated based on its application in practice (Lohse 2017). Therefore, pragmatism supports multiple methods of data collection including interviews, case studies and surveys among others (Feilzer 2010). As explained in section 3.2, a mixed-methods approach is also adopted to balance the inadequacies of each method in studying household practices. As Onwuegbuzie and Johnson (2006, p. 54) noted, while quantitative and qualitative methods may appear conflicting, pragmatism aids the researcher to view them as "different perspectives that are complementary and enable one to more fully to *[sic]* see his or her world".

Second, studying circular transitions has inexorably imbued the research process with a sustainability value-laden approach. In this regard, the data is explained and interpreted regarding transforming plastic-related household practices for enabling the transition to CPEs in cities. A pragmatic approach to studying plastic-related household practices also enables the researcher to adopt multiple stances methodologically (Morgan 2014). Nonetheless, it is important to present an unbiased description of practices to ensure that the research and policy implications from the findings are empirically justified and reflect social reality. The multiple methods of data collection employed in this study help to provide a balanced analysis of the research objectives. Therefore, the research adopts both inductive and deductive reasoning as methodological approaches for data collection. Also, pragmatism enables the study to adopt a practical approach in investigating potential solutions to unsustainable plastic consumption in low-income urban households. The next section further discusses the research methodology as well as the mixed-method approach adopted in the study.

3.4 Research design

A research design describes the systematic procedure and details the strategy developed to achieve the research aims (Morse 2016). A detailed research plan justifies the decisions made

during the research process and enables the accurate analysis of the research findings (Jang 1980). This study combines exploratory and descriptive research designs in answering the research questions. The descriptive research design involves detailing the nature and attributes of a social phenomenon. This approach is employed in the systematic literature review and analysis of household practices. Exploratory research design, however, is the main approach adopted in this study.

In this sense, the philosophical basis of exploratory research differs from confirmatory research in social sciences even though they adopt similar methods. Confirmatory studies aim at obtaining absolute truths about the social world through deductive techniques, hypothesis testing and rigorous reliability measurements (Reiter 2017). However, Popper (2002) argues that even with confirmatory studies, social science research cannot obtain definite proofs of social theories but at best gather collaborative data to support the theory. Exploratory research, according to Reiter (2017, p. 135), therefore acknowledges:

> …that all research is provisional; that reality is partly a social construction; that researchers are part of the reality they analyse; and that the words and categories we use to explain reality arise from our own minds and not from reality.

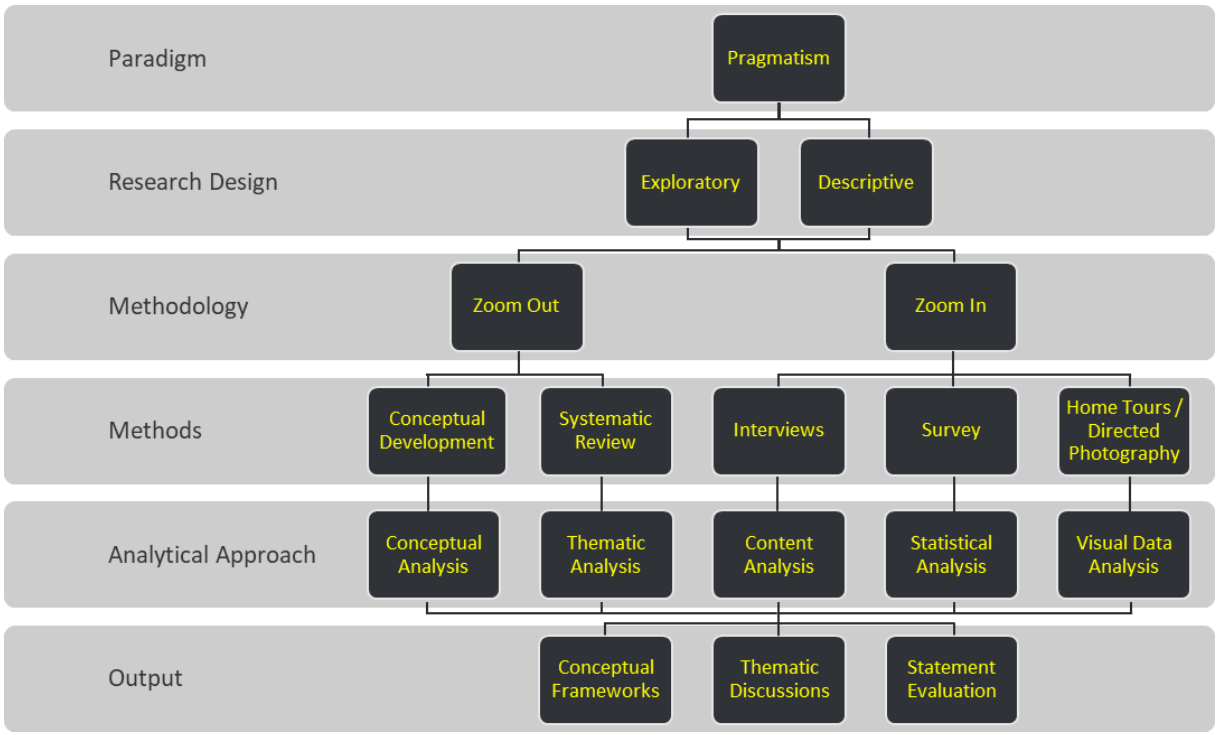
Stemming from the above, an exploratory research design shapes the study of practices as done in this thesis in two ways.

First, practices are intricately tied with and constantly shaped by their comprising elements of materials (including the human body), competences and meanings. For instance, the meanings ascribed to plastic-related household practice vary significantly or otherwise with each practitioner and context (see chapter 6). Therefore, an exploratory research design aids this study to actualise its significant contribution to knowledge with the contextual understanding of plastic-related practices in low-income households in an emerging city and the transferable insights on circular transitions for other cities.

Second, undertaking research is a practice in itself with the researcher combining research skills, materials, and techniques to answer research questions. This means that the researcher's mental processes and subjective worldview could influence the application of research methods

or reporting of research findings. Employing an exploratory research design in this study enables the reflection and acknowledgement of these idiosyncrasies while applying measurements to reduce researcher bias in the study. One such measurement is the use of a mixed-methods approach to collect data for the study as outlined in figure 3.3.

Figure 3.3 *Outline of the research process*

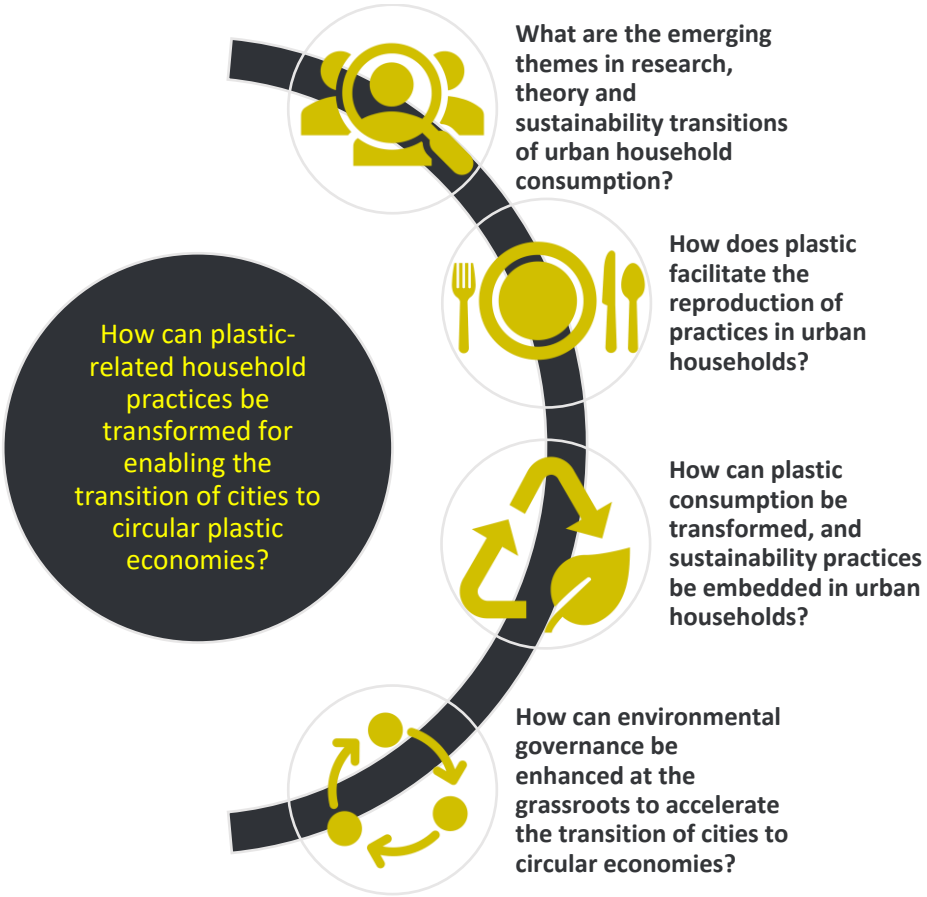


3.5 Approach to data analysis

Figure 3.4 describes the overall and specific research questions addressed in this study. This study adopts practice theory's 'zoom in and out' methodological approach to connect plastic-related household practices to larger socio-cultural arrangements (Nicolini 2009; Shittu 2020). Nicolini (2009) argues that zooming in and out of practice performance and complexes respectively enables practice theory to overcome the reductionist critique of interactionism by foregrounding and backgrounding different aspects of practice complexes. This approach strengthens the exploratory nature of this research and enables the thesis to capture the

complexity of a circular plastic economy through a systemic view of practices. The 'zoom in and out' approach is applied during the data collection process and analysis across the chapters.

Figure 3.4 *Description of overall and specific research questions*



Chapter 4 employs both aspects of the approach by first zooming out and conceptualising a CPE through a practice perspective and then zooming in on the household domain to examine the nature of plastic-related practices. To answer research question one, chapter 5 zooms out on household consumption by systematically reviewing the sustainability issues identified in the consumption studies literature, the theoretical approaches adopted, and the policy suggestions for achieving sustainable consumption. Chapter 6, in turn, answers the third research question by zooming in on the materiality of plastic in facilitating plastic-related practices in low-income urban households. The interest here is to explore the central role plastic plays as a material element in manifesting household practices. Specifically, chapter 6

examines how the physical features, spatiotemporal qualities and functionalities of plastic materials interact with other elements in the daily performance of household practices.

Chapter 7 combines both aspects of the approach to answer the third research question by linking plastic-related household practices to the wider discourse on sustainable consumption. The chapter achieves this by zooming in on household activities that yield sustainable outcomes while also zooming out to analyse plastic-related sustainability practices and how they can be embedded in low-income urban households. Lastly, chapters 8 and 9 zoom out to synthesise the lessons identified in the thesis for facilitating grassroots strategies and systemic realignment for enabling the transition of cities to circular economies.

3.6 Research methods and modes of data collection

A mixed-methods approach combines multiple techniques of data collection to improve on the inadequacies of a single method (Tashakkori and Teddlie 2010). This is particularly useful for studies, such as this, that collect different types of data to answer a series of related research questions. Utilising a mixed-methods approach ensures that this study captures the various aspects of plastic-related household practices while reducing interview subjectivity and researcher bias. This is achieved by combining methods such as in-depth interviews, home tours, digital photography, and short surveys. Moreover, while interviews provide the benefits of research flexibility and deeper exploration of research questions, they may not provide a holistic understanding of household practices due to the potentially unreliable nature of interviews in describing household practices. A mixed-methods approach ensures that a contextual but unbiased account of practices is presented to inform practical and sustainable research and policy strategies.

The study employed a systematic literature review method to synthesise findings from previous studies on emerging sustainability concerns in urban households (see section 3.6.1 for more details). The study also employed a case study approach to collect data on plastic-related practices in cities. As further explained in section 3.6.2, case studies were selected among low-income households in Surulere, a suburb in Lagos to gain new contextual understandings of an

emerging city as a significant contribution to knowledge. The data collection relied mostly on qualitative methods including in-depth interviews, home tours and directed photography. A short survey complemented the quantitative methods and provided additional data on plastic-related practices in low-income households in Lagos2. The collected data are analysed with hermeneutic and statistical software programs.

This study obtained ethics approval from the human research ethics committee of Swinburne University of Technology (SHR Project 20201222-3365) and rigorously observed all ethical requirements related to the study. The consent information statements, the consent forms and the research script were used in recruiting participants. The informed consent form was provided to all participants before conducting interviews face-to-face while the research script was used to explain the research to participants for interviews conducted over the telephone or Zoom. A copy of the consent and information form is provided in Appendix x.

This thesis is written as a PhD by publication. There is thus some repetition of the methods presented in the following sections (3.6.1 – 3.6.2) and the methods discussions in each paper (chapters 5-8). However, sections 3.6.1 – 3.6.2 allow additional methods discussions and descriptions that, for reasons of brevity/word limits in peer-reviewed published work, were omitted in the published work.

2 The household interview and survey were initially intended to provide a comparative analysis of Melbourne, Australia and Lagos, Nigeria and enable an additional layer of the zoom in and out approach. For COVID-19 related reasons, the researcher was unable to collect household interview and survey data in Melbourne.

3.6.1 Systematic literature review: Emerging sustainability concerns and policy implications of urban household consumption

3.6.1.1 Review approach

Understanding household-level sustainable consumption challenges is crucial in designing micro policies that account for the socio-economic contexts of specific households rather than generalised macro policies that may not trickle down to household units (Dubois et al. 2019; Wu, Lei & Li 2019). Also, synthesising these sustainability challenges would help to transform macro policies by addressing the common themes identified across urban households (Wang C. et al. 2019). To this end, this thesis (chapter 5) integrates sustainability research and policy by synthesising research findings and policy strategies in the literature since the adoption of the SDGs in 2015.

The paper presented in chapter 5 adopts a systematic literature review to analyse studies that investigate sustainable household consumption in cities over the past five years. A systematic literature review is a tool that permits the application of a methodical and transparent approach aggregating findings on sustainable household consumption from previous studies (Bradbury-Jones et al. 2019; Evans et al. 2017). It also reduces the level of bias and gives more focus to aggregating the implications of findings for policy and research (Campbell Collaboration 2019). To answer the thesis' first research question, the paper examines sustainability concerns in urban household consumption over the past five years; the theoretical frameworks utilised and, the policy recommendations proposed for sustainable transitions in household consumption. This process ensured that the final articles selected for the analysis are directly relevant to answering the research questions. However, it is acknowledged that the limitations of the literature reviewed and the interpretation of the findings are factors that reduce the generalisability of the study's conclusions.

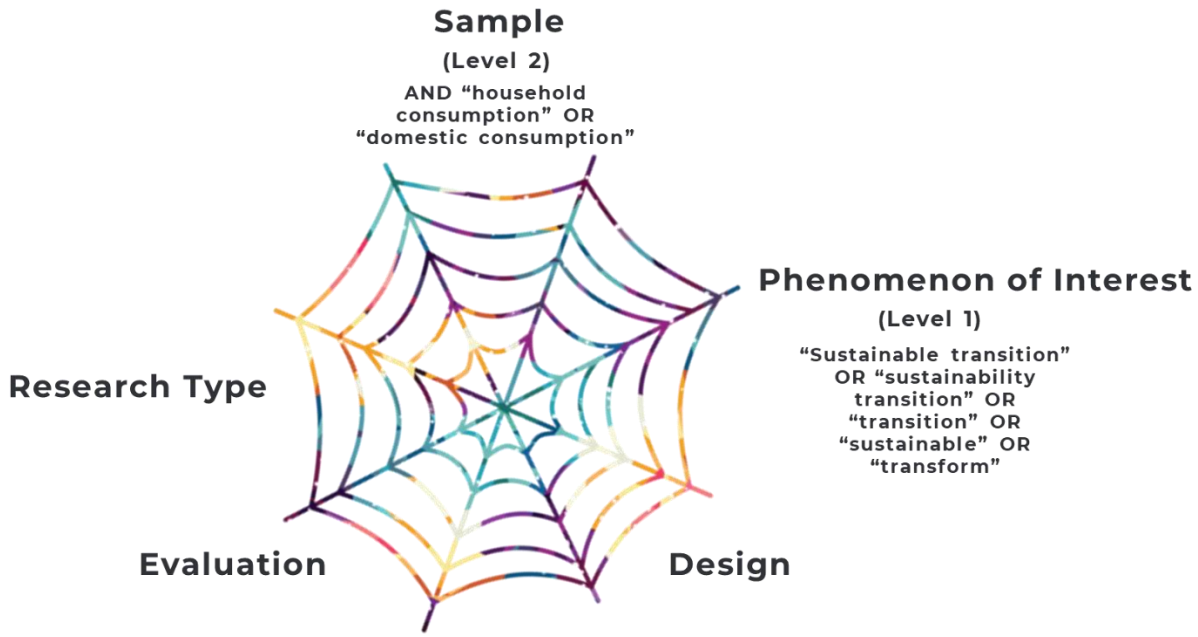
The literature search strategy adopts the SPIDER tool (Cooke, Smith & Booth 2012). The SPIDER tool (Sample, Phenomenon of Interest, Design, Evaluation, Research type) is shown

to yield better results over the PICO tool (Population, Intervention, Comparison, Outcome) for studies that adopt qualitative and mixed methods techniques (Cooke, Smith & Booth 2012; Ellis et al. 2016; Gough, Oliver & Thomas 2017). This is done to identify the breadth of methodological approaches and themes given the multidisciplinary nature of the field. As shown in figure 3.5, the keyword search only employs the "SPI" aspect (Sample, Phenomenon of Interest) of the tool. This is in recognition of the importance of being open in the research objectives in terms of "DER" (Design, Evaluation, Research type) which relates to analysing the methods, findings and policy implications of the included studies. Specifically, the initial search only takes into consideration empirical studies that focus on households (Sample) and sustainable consumption (Phenomenon of Interest) while aspects such as research design, data evaluation and research type are examined at the analysis stage.

The literature search focuses on empirical studies conducted in a five-year period (2015 – June 2019) on emerging sustainability challenges since the adoption of the SDGs. Given the multidisciplinary nature of sustainable consumption research, the study sourced relevant literature from three popular databases – Scopus, Web of Science and EBSCO Host. Keywords guiding the search within the titles, abstracts and keywords of journal articles are: "Sustainable transition" OR "sustainability transition" OR "transition" OR "sustainable" OR "transform" AND "household consumption" OR "domestic consumption". The utilisation of singular search terms allows for both singular and plural forms to be identified (for instance, "transition" and "transitions").

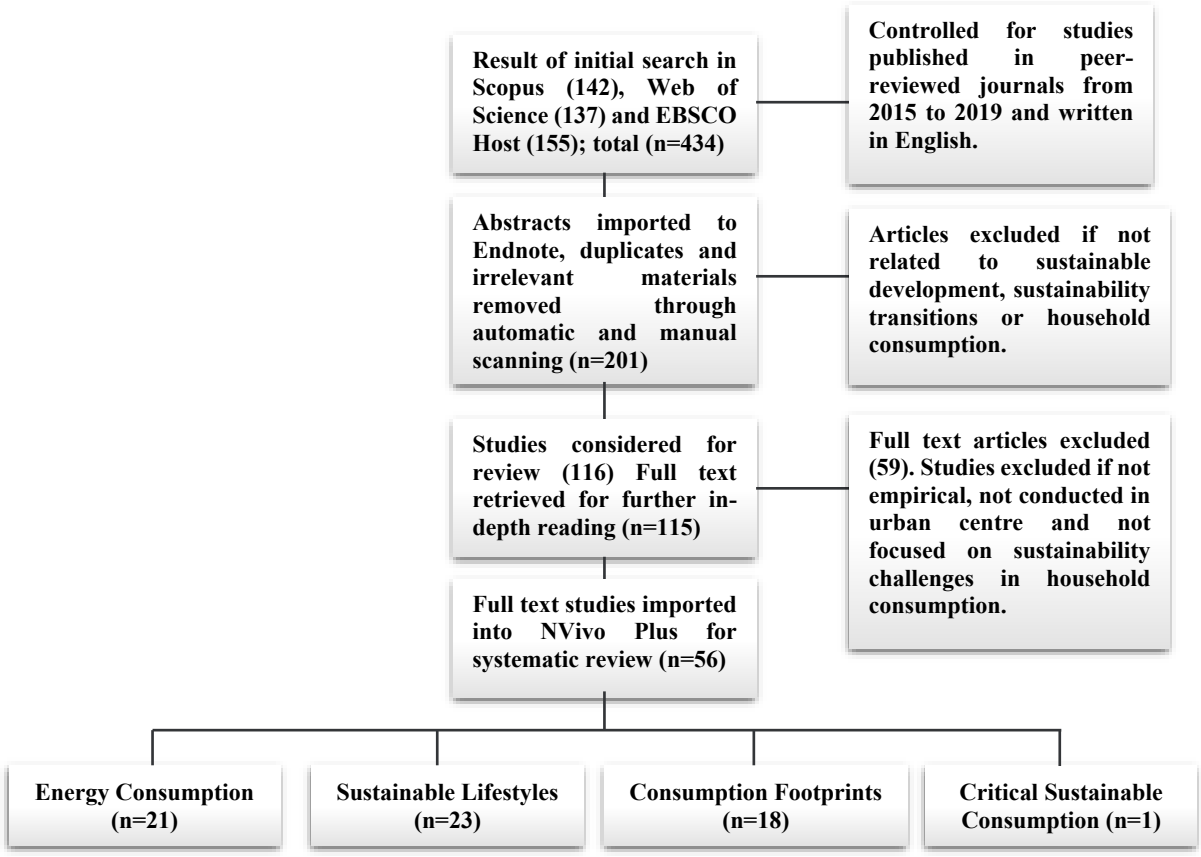
Although studies in sustainable consumption are not limited to these three databases, they host top peer-reviewed journals with high-impact factors in the field of sustainability transitions. The selection of only peer-reviewed journal articles is informed by an interest in empirical studies that have gone through a rigorous research process to establish findings and conclusions. Selecting credible studies is necessary to examine patterns from research findings informed by the household consumption challenges observed in the real world to answer the research questions. The selection of peer-reviewed journal articles that are published in English is due to their use of an international academic language which enhances their visibility and reach.

Figure 3.5 *SPIDER tool for systematic literature review with key search terms*



The initial keyword search yielded 434 peer-reviewed journal articles (Scopus – 142 articles; Web of Science – 137 articles; EBSCO Host – 155 articles) written in English and published between 2015 and June 2019. Further selection within Endnote applying the automatic duplicate removal facility and further assessment of the relevance of article abstracts generates a total of 201 articles for further evaluation. A relevant article in this context comprises a study that conducts an empirical investigation into the consumption patterns of households in cities concerning sustainability transitions. Further eligibility criteria include a focus on sustainability and transition challenges, data collected on household consumption, empirical studies conducted in cities, and full-text availability. The application of these criteria generates 56 peer-reviewed journal articles for in-depth review. Figure 3.6 details the selection process.

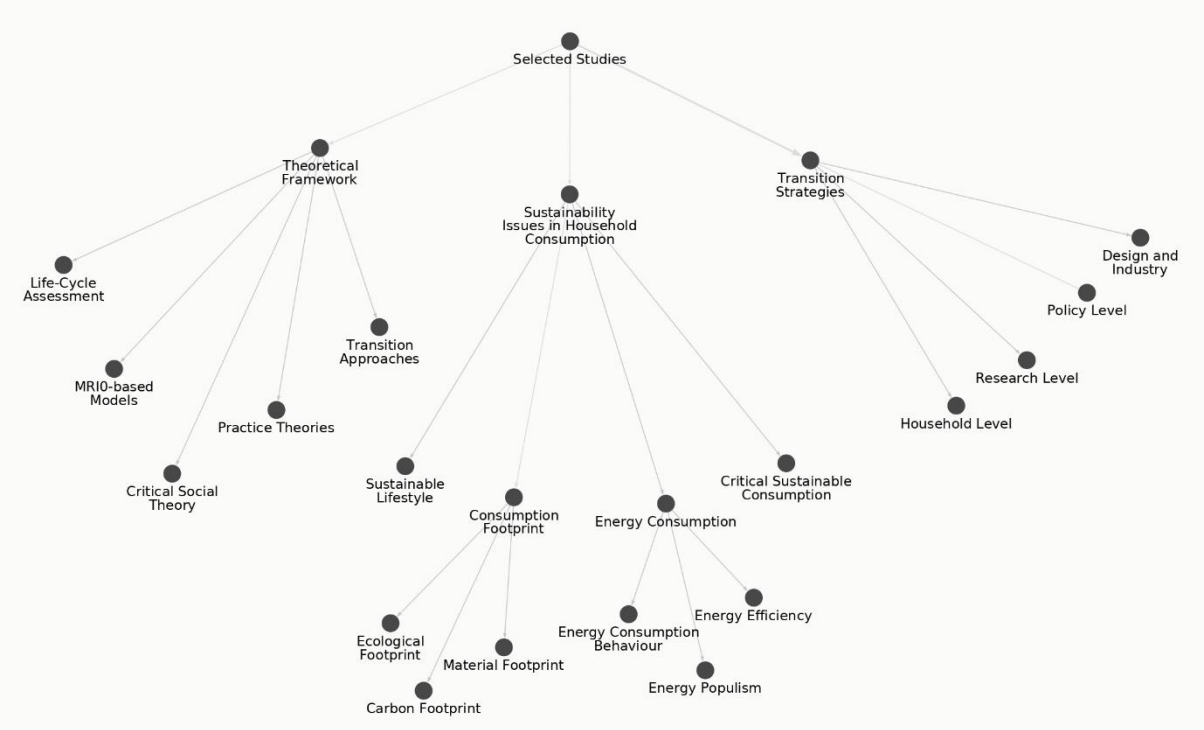
Figure 3.6 *Systematic literature review process*



3.6.1.2 Analytical approach

Full-text analysis utilising NVivo Plus offers the opportunity to develop a matrix of the study characteristics, as well as the opportunity to explore the texts thematically and develop common threads across the articles reviewed. The systematic review of the selected studies starts with the recording of their characteristics such as the journal name, country of study, method of data collection and household type. Notwithstanding the common focus of these studies on emerging sustainability concerns in urban household consumption, their objectives and findings reveal a categorisation into themes and subject areas. Figure 3.7 details the themes and sub-themes identified during the analysis. It is important to note that these categorisations are not mutually exclusive but interconnected, that is, some studies address multiple thematic areas.

Figure 3.7 *Themes and sub-themes identified in the systematic literature review*



Source: Author's analysis

Regarding the emerging sustainability concerns in urban households, the thematic areas identified are consumption, sustainable lifestyles, consumption footprints and critical sustainable consumption. 'Energy consumption' includes all studies that set out to understand the emerging nature of urban household energy consumption and assess whether these outcomes meet global or local sustainability standards (n=21). 'Sustainable lifestyles' consists of studies that are interested in exploring the consumption choices of urban households and their influence on sustainable living (n=23). 'Consumption footprints' comprises studies that aim to measure the impact of urban household consumption on the environment and its implication for sustainability transitions (n=18). 'Critical sustainable consumption' includes a study that addresses the class power relations embedded in sustainable consumption narratives (n=1) as its approach to understanding household consumption does not fit into other categories.

3.6.2 Case study: Plastic-related household practices in low-income households in Surulere, Lagos

Plastic-related practices are best understood in the context of households given that this is where consumption mainly takes place (Yates 2018). This study, therefore, adopts a case study approach to collect empirical data on plastic-related household practices. Adopting a case study approach enables the study to explore unique and important contexts that contribute new insights to circular transitions in cities. Furthermore, a case study approach enables the development of theoretical conceptualisations that add new knowledge dimensions to practice theory.

The data collection started with three key informant/expert interviews in Melbourne. Interviews were conducted with senior officials at Sustainability Victoria, the Victorian Waste Transport Association, and the Council of Hobsons Bay. These interviews were primarily collected to guide the design of the questionnaire for the household survey. After the design of the survey instruments, modification approval was obtained from the ethics committee. The research then proceeded with the collection of qualitative and quantitative data in Lagos, Nigeria. Three expert interviews were further conducted among senior officials of the Lagos Waste Management Authority (LAWMA), the Recycling Association of Nigeria (RAN) and the Food and Beverage Recycling Alliance (FBRA).

The expert interview participants were those who are directly involved and experienced in designing and implementing sustainability projects in Lagos and Melbourne. Interviews focused on gathering data on participants' understanding and knowledge about the link between plastic-related household practices and environmental sustainability including policy initiatives that could promote sustainable plastic consumption in households. The expert interviews aided the study to examine extant and possible policy initiatives on transforming plastic-related household practices in cities. The expert interviews in Melbourne and Lagos did not explicitly answer any research question but constituted a methodological part by guiding the PhD candidate's interview protocol development, as well as data collection and analysis.

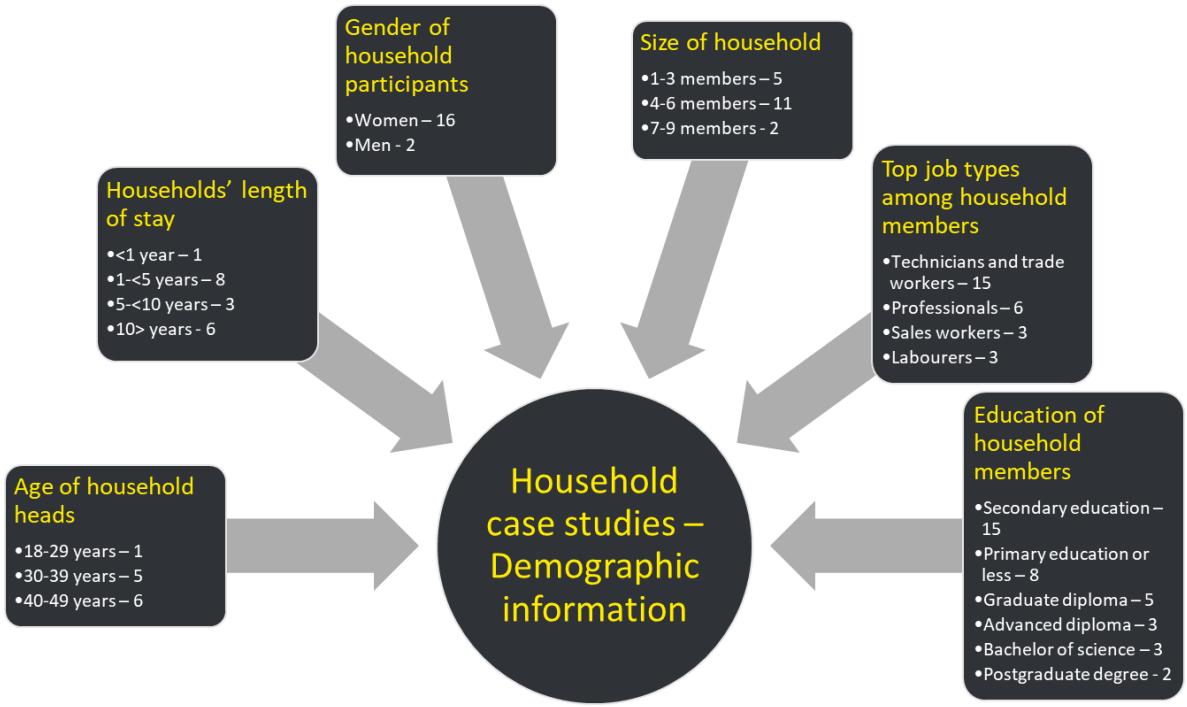
While expert interviews in Melbourne facilitated the design of household surveys, expert interviews in Lagos provided an understanding of the context of waste management policies and activities in Lagos.

The household data collection process of this study started before the onset of the COVID-19 pandemic in Lagos, Nigeria. Initially designed as a comparative study, the researcher intended to conduct 10 interviews and administer 100 surveys among low-income households in Lagos and Melbourne each. However, COVID-19-related issues prevented the researcher from collecting household data in Melbourne and administering more household surveys in Lagos. The decision to change the data collection process, for instance stopping the face-to-face household survey and interview in Lagos, was taken to prevent the exposure of the researcher and research assistants to the additional risk. The risk was assessed in conjunction with the supervisors and in line with Swinburne University of Technology guidance on modes of working during the pandemic, principally to maintaining 'social distance', health and safety advice during the data collection, and working from home. In Australia, this guidance began to change as vaccination levels increased through 2021. In Lagos, vaccination levels remained low throughout 2021. Consequently, the researcher was unable to collect household data in Melbourne due to other COVID-19-related issues including the researcher having to isolate in Lagos, the blockage of international borders, the shutdown of services by a housing service organisation that offered to assist with recruiting low-income households and the vulnerability nature of low-income households.

Given the above, this study purposely selected low-income households (with an average weekly income of 150 USD per household) in Surulere, Lagos for empirical data collection. While all 18 households were surveyed, 12 of those households were further selected as case studies. The case-study approach employed in-depth interviews, home tours and directed photography to further contextualise each household within its material and socio-cultural environment. As further discussed in section 3.6.2.3, the data collection process is guided by the strength of the information power to ensure that the data is adequate to answer the research questions.

Figure 3.8 presents the demographic information from the surveyed households (including those further selected as case studies). Study participants were mostly women (16/18), although most of the households (11/18) were headed by men aged 30 to 49 years. The cultural context within which the study took place views women (or wives) as the custodians of the home, hence, the gender imbalance (Raimi et al. 2019). Also, the majority of the households (14/18) had stayed more than five years at their location indicating a sense of familiarity with their neighbourhood and the existing waste management system. Eleven households (11/18) had between four to six members with most adult household members working as traders (15), professionals (6), sales workers (3) and labourers (3). Most household members (15) had secondary education as their highest educational qualification followed by those with primary education or less. Nonetheless, some household members possessed a graduate diploma (5), bachelor's degree (3), advanced diploma (3) and postgraduate degree (2). This suggests that most household members have a fair ability to comprehend sustainability concepts and guidelines.

Figure 3.8 *Demographic information of selected households in Surulere, Lagos*



Before detailing the process of data collection, the following two sections provide an additional contextual description of the household case studies' socio-cultural context and plastic and waste management context.

3.6.2.1 Low-income households in Surulere, Lagos

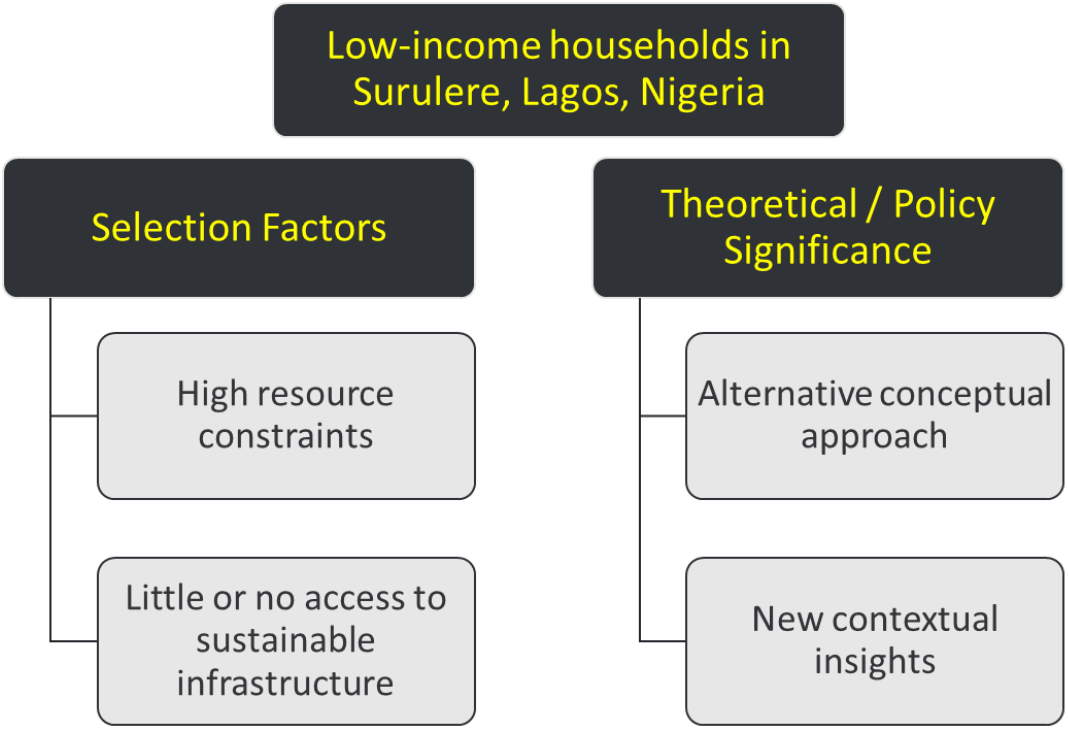
This study selected low-income households in Surulere, a suburb in Lagos, Nigeria as case studies. In this study, low-income households are those with an average weekly income of 150 USD or 60,000 Naira per household. Surulere is a suburb that fits the study's objective given the low-income profile of the households in the area and the environmental challenges posed by the incursion of plastics into the waterways (Okoye & Ojeh 2015). To gain access to the community, contact was established with a resident who introduced the researcher to potential participants. The community contact aided the initial recruitment of households, but snowball sampling was employed at a later point in the data collection stage. Each study participant was duly compensated for the time they dedicated to the research.

The selection of low-income households as case studies is informed by the following considerations (figure 3.9). First, low-income households experience high resource constraints (Adamkiewicz et al. 2011) and are therefore necessitated to utilise cheap and easily accessible materials such as plastic in performing their daily activities. Also, previous studies have shown that sustainable lifestyles are expensive and may require a substantial reconstitution of existing sociomaterial arrangements (Shittu, 2020). Thus, low-income households may not be able to afford extant sustainable material alternatives, or such may create disruptions in their domestic organisation. In the absence of spatiotemporal assets, low-income households are compelled to develop innovative, cheap, and effective ways of performing their daily routines and practices.

This provides a background for this study to explore how plastic assists low-income households to sustain their livelihoods and a context within which plastic-related practices can be observed and analysed. This study, therefore, expands the current literature on materiality by examining the role of plastic in navigating socio-economic and spatiotemporal constraints in low-income household practices (see chapter 6). Second, low-income communities tend to have little or no

access to proper waste disposal and recycling infrastructure (Evans and Kantrowitz, 2002). This may not only lead to an increased dependency on plastic but also its unsustainable use in low-income households. Chapter 8 discusses the environmental justice issues that affect low-income households because of inadequate access to sustainability infrastructure.

Figure 3.9 *Selection factors and significance of case studies*



3.6.2.2 A brief background on plastic use and waste management in Lagos, Nigeria

Nigeria, like many other less-developed countries, faces several challenges in managingplastic waste in the country such as drainage blockages, landfill issues, ocean contamination and environmental degradation (Adebiyi-Abiola et al. 2019). According to Babayemi et al. (2018), plastic imported in its primary form and as product packaging constituted about 30% of total plastic imports (1996–2014) in Nigeria. Plastic bottles, shopping bags, combs, dustbins, refuse sacks, and furniture are some of the household items producedwith imported plastic (Babayemi et al. 2018). Other household objects with plastic components include refrigerators, air conditioners, laundry washing machines, and motorvehicles (Babayemi et al. 2018).

Plastic shopping bags and plastic packaging, the mostprominent waste items produced in the country, usually end up in landfills (Duru, Ikpeama & Ibekwe 2019). Although governments at all levels have attempted to enact laws to control plasticconsumption and disposal, plastic waste still plagues the environments of major citiesincluding low-income suburbs (Adebiyi-Abiola et al. 2019; Nwafor and Walker 2020).

As the centres of production and consumption, major cities experience rapid population growth and as a result, serve as the hotspots of plastic waste generation in Nigeria (Kofoworola 2007). Lagos, the country's economic hub, generates an estimated 12,000 tonnes of waste per day, with plastic contributing approximately 15% (Adebiyi-Abiola et al. 2019). Selecting low-income households in Lagos as a study location presents an opportunity to gain new contextual insights into household plastic-related sustainability practices as discussed in section 3.6.2.1. The complication of plastic-related environmental problems with other socio-economic challenges further necessitates the sustainable transformation of plastic use in the city. However, like many other cities, major urban solutions tend to focus on providing waste disposal and recycling infrastructure (Simatele, Dlamini & Kubanza 2017).

The Lagos Waste Management Authority (LAWMA) charged with environmental law regulation and enforcement has also taken up the collection, transportation, and disposal of waste in the city (Kofoworola 2007). Recently, the city administration has improved the public-private partnership on plastic waste management while encouraging social enterprises in the recovery and recycling of plastic materials (Adebiyi-Abiola et al. 2019). Despite this, the plastics recycling sector is dominated by informal and small-scale businesses faced with economic, health, and social challenges (Akanle and Shittu 2018).

The setting for the study is an example of Hawkins' (2010) analysis of how plastic has been problematised in urban administration and policymaking. This problematisation encourages policymakers to focus on managing the volume and environmental consequences of plastic materials through collection and disposal. As a result, there is little focus on how plastic materiality engenders the reproduction of the practices that create the resulting waste management challenges. Despite this, the continued use of plastic materials in households

signifies their importance in facilitating domestic routines. In the proceeding sections, this study aims to unfold the dimensions of plastic materiality in low-income households in Surulere – a suburb of Lagos, Nigeria.

3.6.2.3 Case studies qualitative data collection

This study mainly utilised the empirical data collected from the case studies of low-income households in Surulere, Lagos. While the study collected some survey data, the primary data collection method is qualitative. As an exploratory study, the collection of qualitative data is based on the strength of the information power the sample holds during the research (Malterud, Siersma & Guassora 2015). According to Malterud, Siersma and Guassora (2015, p. 1759), "information power indicates that the more information the sample holds, relevant for the actual study, the lower number of participants is needed".

The information power is utilised to overcome a major challenge in qualitative studies to arbitrarily attribute the point of saturation to sample size thresholds, especially in studies that are not based on grounded theory. The information power is determined by considerations of the study's aims, sample specificity, use of established theory, quality of dialogue and analysis strategy (Malterud, Siersma & Guassora 2015). Critically, the satisfactoriness and quality of the sample size should be continuously evaluated during the research process to "demonstrate whether (the) actual sample held adequate information power to develop new knowledge, referring to the aim of the study at hand" (Malterud, Siersma & Guassora 2015, p. 1759).

Stemming from the aforementioned, this research evaluated the data's information power in the following ways: how plastic-related household practices can be transformed towards transitioning to a CPE. First, the case study participants were selected specifically among low-income households in Lagos, an emerging city. Low-income households' use of cheap materials provides an opportunity to contextually understand the role of plastic in influencing household practices. Second, the study is predicated on practice theory's proposition of the impact of sociomaterials on the ordering of social life. The interview questions were semi-

structured to facilitate in-depth discussions with the participants and probe unscripted lines of inquiry to drill into additional information.

The household interview guide presented in Appendix B details discussion topics rather than specific questions. Third, the data were thematically analysed using NVivo, a qualitative software program. The themes that emerged from the analysis are classified according to multiple categories such as plastic materiality (e.g., corporality, spatiotemporal features, and functionality), plastic-related practices (e.g., hygiene-related, comfortability and storage practices) and sustainability practices (e.g., protractive, contractive, and regenerative practice) and further discussed in section 3.6.2.5. An evaluation of the information power was conducted after each interview. Moreover, a preliminary analysis of the theoretical insights was conducted after four interviews. This analysis provided a basis for the conceptualisation of plastic materiality as discussed in chapter 6.

Twelve out of the eighteen households surveyed in Lagos were selected as case studies by utilising in-depth interviews, home tours and directed photography. According to Strauss and Corbin (1998), at least ten interviews or case studies are needed for theory structuration. The in-depth interviews focused on the plastic-related domestic activities that households perform; the functions and meanings that plastic promotes during domestic practice performance and the socio-economic and environmental factors that could promote sustainable plastic use within the household. Face-to-face interviews were conducted for the first two selected households. However, in response to the onset of COVID-19, in-depth phone interviews were utilised in the other ten households. These interviews were semi-structured and lasted for up to two hours per household.

Home tours were conducted for the first two selected households and provided visual data on the spatial arrangement of plastic items. Maller and Strengers (2016) contend that a home tour "not only prompts participants' memories but allows the material dimensions and skilful performance of practices to become more prominent". Participants recounted how materials are utilised in their daily activities and showed the researcher the locus of plastic-related practices within the household. At the onset of COVID-19, phone interview participants were

directed to send pictures of plastic items at the locus of practice in their households. Photo direction is centred on the types of plastic materials in the household as well as their use and storage spaces. All photographs were de-identified and did not include people's images. Household participants were required to give consent to the capture and usage of household plastic pictures for the study.

The home tours and directed photography enable the study to capture the state of plastic materials as they are employed in the performance of domestic practices. The aspects captured in the home tours and directed photography include the spaces of use and storage of plastic; the physical features of the plastic materials and the participants' memories of their daily routines involving plastic. Visual data provide the researcher with a means to scrutinise the various aspects of practice performance (Martens, 2012) – in this case, the materiality of plastic in low-income household routines. Household participants took photographs of plastic materials such as bowls, spoons, baths, containers, bottles, and bags in multiple household spaces including the kitchen, living room, bathroom, and compound.

3.6.2.4 Quantitative data collection

This study collected quantitative data through a seven-rating compass survey and a ten-statement short survey. The study intended to administer 100 household surveys in Lagos and Melbourne each. However, COVID-19-related issues prevented the collection of data in Melbourne and stopped face-to-face surveying in Lagos. As a result, eighteen households were purposely selected for the quantitative data collection which includes the twelve households that were involved in interviews. The study started with face-to-face data collection but resorted to survey administration over the phone at the onset of COVID-19. Rather than serve as a measure of statistical significance, the two administered surveys were aimed at obtaining a broader and more robust understanding of the prevalence and dynamics of plastic-related household practices. The surveys took up to 30 minutes per respondent.

The seven-rating compass survey was adapted from Place Standard (https://www.placestandard.scot/#/home) and designed to examine sustainability

considerations in households' use of plastic. The survey questions sought answers to the indispensability of plastic within households; the usage frequency of plastic in communities and households; the environmental consideration of plastic use in households and the experiences of households in sustainable plastic use. Study participants were asked to carefully consider each of the questions and rate their households on a scale of 1 to 7, where 1 and 7 represent 'least' and 'most' respectively. The responses were then plotted on a compass diagram as discussed in chapter 7.

Meanwhile, the second survey included ten sustainability statements that are suggested as practical strategies that households may embed into their daily activities. These statements were informed by key-informant interviews previously conducted with sustainability experts in Victoria, Australia and Lagos, Nigeria. The first four statements are strategies that could improve the sustainable use of plastic items within the household and the last six statements include strategies that could promote the avoidance or reduction of plastic use within households. Study participants were instructed to evaluate the practicality of each of the statements with the contextual consideration of their extant household practices. The percentage responses of each statement were then tabulated and further analysed in chapter 7.

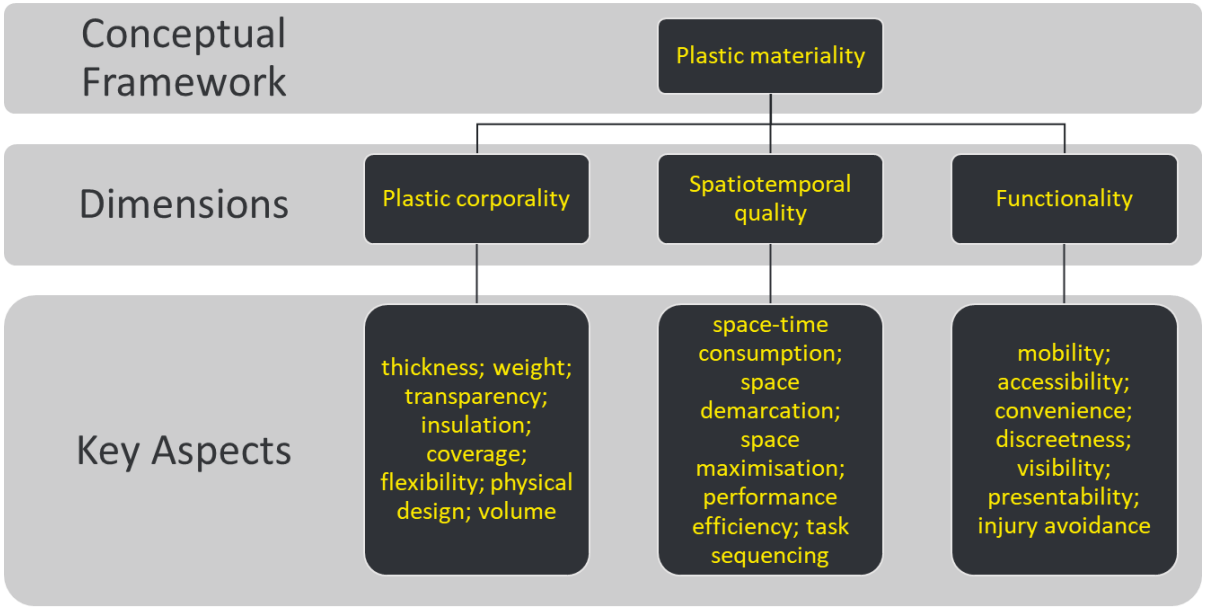
3.6.2.5 Analytical approach

Voice and pictorial data were coded and analysed with NVivo Plus. The software program provided the tools that were employed in analysing the discursive elements and emotional expressions in the interviews, and the material and spatial features in the pictures. Audio analysis was employed to retain the unique discursive elements of the interviews since they were mostly conducted in the participants' languages, such as Yoruba and Pidgin English. Language-embedded emotions are important to understand the way plastic materials enable affective expressions in household routines. When reporting the research findings, participants were assigned pseudonyms and their personally identifiable information was de-identified However, to ensure clarity for analysis purposes, participants were informed through the consent form of the potential to reference their suburb location or position in an organisation.

To answer the second research question and identify the dimensions of plastic materiality in household practices presented in chapter 6, both inductive and deductive coding techniques were adopted to generate themes from the interview data. Examples include 'plastic-related practices', 'reasons for use', 'space of use/storage', and 'time of use', among others. The deductive process informed themes that were generated from the research questions, while the inductive approach identified themes from the data analysis. The themes were then refined and reorganised through an iterative process of multiple items coding, while notes and memos were developed to identify anecdotal or theoretically intriguing scenarios. The final themes identified from the interviews informed the conceptual framework on plastic materiality as discussed in chapter 6.

Figure 3.10 presents the analytical framework for conceptualising plastic materiality in low-income households. The dimensions and key aspects are drawn from the analysis of household interviews. Corporality in this context simply refers to the physical state of an object or being composed of matter. The spatiotemporal quality denotes the existence of an object in spacetime and its involvement in a practice's manipulation of the same. Meanwhile, functionality refers to the purpose, meanings, and affective states that are expressed through an object by practitioners during practice performance. As depicted in figure 3.10, plastic as an active material combines these three dimensions in several ways in practice performance to manifest household practices. For example, in performing a storage practice, a transparent plastic item with a cover (corporality) can be employed to store food items, thus demarcating space away from pests and prolonging the food item's life cycle (spatiotemporal quality) to express meanings of convenience and sustenance (functionality).

Figure 3.10 *Analytical framework for conceptualising plastic materiality in low-income households*



Answering the second research question as presented in chapter 7 also involved utilising deductive and inductive analysis techniques during the coding process to create themes identifying the plastic-related sustainability activities in low-income households. The research aims and literature review guided the deductive analysis and the formulation of themes such as 'protractive', 'contractive' and 'regenerative' practices. Meanwhile, the inductive analysis involves the multi-layered coding of field data and informs themes such as 'maintenance', 'repair' and 'repurpose'. The final themes inform the conceptual framework of household sustainability practices discussed in chapter 7.

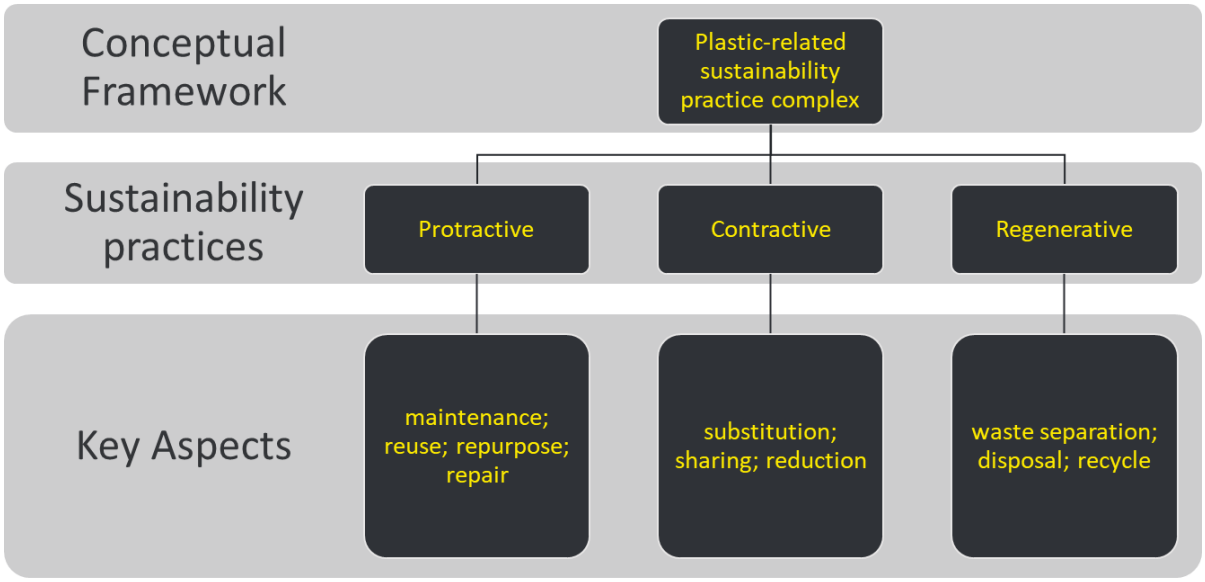
Figure 3.11 illustrates the analytical framework conceptualising plastic-related sustainability practices in urban households. The framework design was informed by the synthesis of data analysis and sustainability and practice theory literature. The three plastic-related sustainability practices identified are contractive, protractive, and regenerative.

1) Contractive sustainability practice results in the reduction in the amount of plastic in circulation and include activities that are performed to reduce, share and/or substitute plastic items.

2) Protractive sustainability practice aims to prolong the life cycle of plastic materials and include activities such as maintenance, reuse, repurposing and repair.

3) Regenerative sustainability practice facilitates the transformation of plastic items into new plastic products and includes waste separation, disposal, and recycling activities.

Figure 3.11 *Analytical framework for conceptualising plastic-related sustainability practices in urban households*



3.7 Research plan

Table 3.1 presents an overview of the chapters in the thesis along with their purpose, analytical technique, and research outputs. As a PhD by publication, the research outputs include five papers with two published (chapters 5 and 6), one under review as a book chapter (chapter 8) and one submitted to an academic journal (chapter 7). The fifth paper is structured as a journal article and included in the thesis (chapter 4). The chapters and papers are consolidated in the thesis to answer the overall research question.

Table 3.1 *Thesis chapters, scope and purpose, analytical technique, and research output*

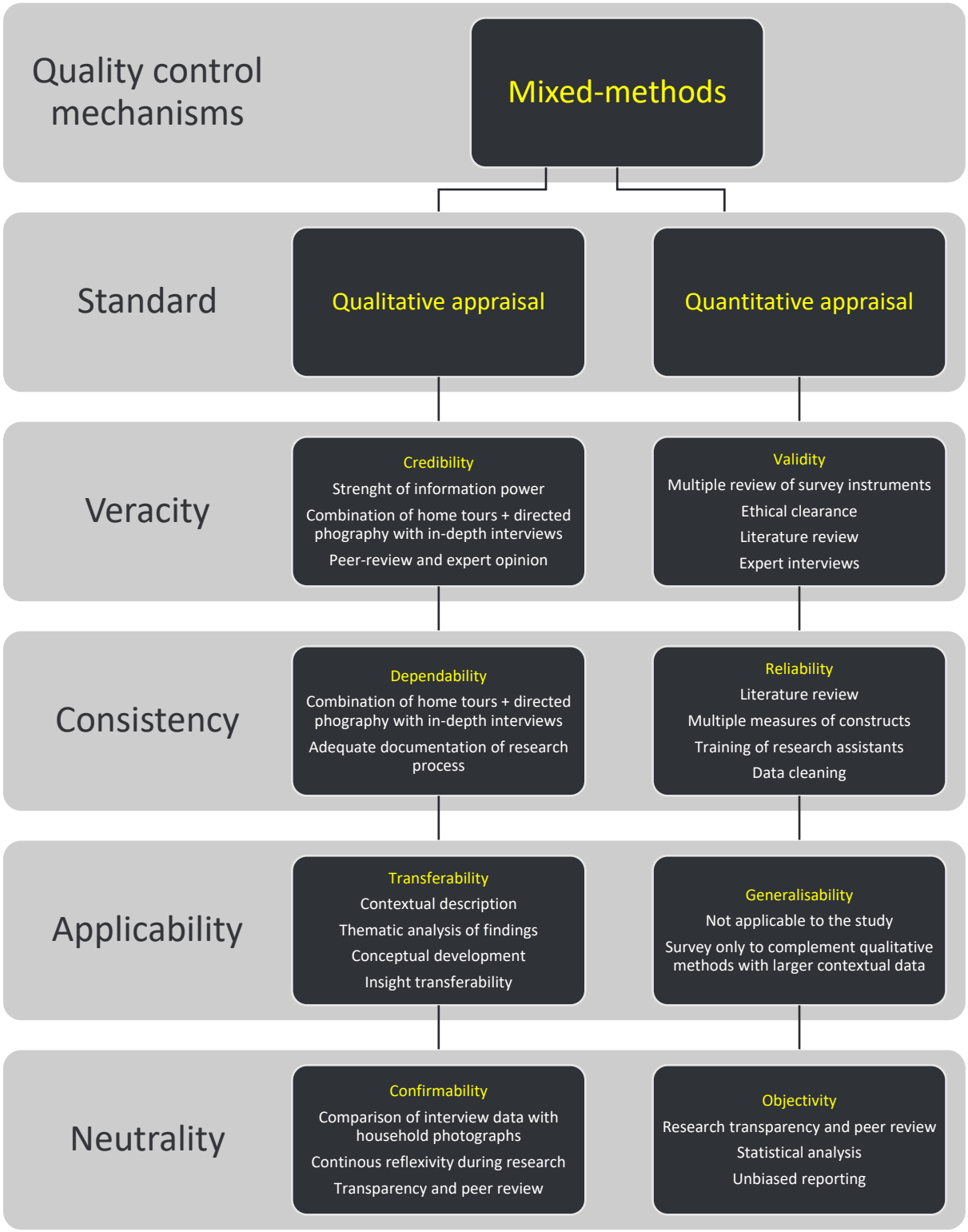
Chapters	Scope and purpose	Analytical technique	Research outputs
1	Introduction and Research problem: unsustainable plastic-related practices and inadequate theoretical perspectives. Study significance and structure.	Narrative and synthesis / Literature review	Thesis chapter
2	A critical review of background literature: theories of sustainability practices, theories of practice and circular economies in cities.	Narrative and synthesis / Literature review	Thesis chapter
3	Discussion of ontological and epistemic considerations; research paradigm, design, methodology and methods. Research plan and quality mechanisms.	Narrative and synthesis / Literature review	Thesis chapter
4	Conceptualising CPE from a practice perspective; zooming out on CPE as a teleoaffective formation; zooming in on plastic-related practices in households, and policy implications of circular transitions.	Narrative and conceptual synthesis / Literature review	Paper (draft for submission)
5	Systematic literature review of emerging sustainability concerns, theoretical frameworks for understanding sustainable household consumption and strategies for achieving sustainability transitions in cities.	Systematic literature review / Narrative and conceptual synthesis	Published paper
6	Exploration of plastic materiality and household practices through the case studies of low-income households in Surulere, Lagos	Thematic analysis / Conceptual analysis / Narrative / Literature review	Published paper
7	Discussion of transforming plastic-related household practices and conceptualisation of embedding sustainability practices in urban households through the case studies of low-income households in Surulere, Lagos	Thematic analysis / Conceptual analysis / Narrative	Paper submitted
8	Discussion and synthesis of insights and lessons from research findings for addressing environmental justice issues and facilitating grassroots strategies for circular transitions	Narrative and synthesis / Literature review	Book chapter (under review)
9	Discussing key concepts and new contributions to knowledge and reflecting on how cities can transition to circular economies through a practice perspective	Reflective and critical analysis	Thesis chapter

3.8 Quality control mechanisms

Figure 3.12 outlines the quality control mechanisms for the mixed-methods approach employed in this study. Although qualitative and quantitative methods have different quality control criteria, Curry and Nunez-Smith (2017, p. 5) posit that it is important for mixed-methods research to align them "across common standards to focus on the essential elements of quality in scientific investigations." According to Curry and Nunez-Smith (2017), veracity, consistency, applicability, and neutrality are key strategies to achieve research quality with a mixed-methods approach.

Veracity refers to "the degree to which the results accurately and precisely represent the phenomenon under study" (Curry and Nunez-Smith 2017, p. 6). This corresponds with credibility and concept validity in qualitative and quantitative approaches respectively. This study ensured veracity by measuring the strength of 'information power' during sampling (see section 3.6.2.3); triangulating multiple methods; reviewing previous studies for verification and seeking expert opinions on research instruments, among others. Meanwhile, consistency denotes the dependability of qualitative methods and the reliability of quantitative methods (Curry and Nunez-Smith 2017). For instance, this study achieved consistency across the research process by combining multiple methods; training data collectors to establish inter-rater reliability, and sufficiently detailing the research process.

Figure 3.12 *Outline of quality control mechanisms for a mixed-methods approach*



Curry and Nunez-Smith (2017) defined applicability as the degree to which the findings of a study can be applied to other contexts or populations, akin to external validity in qualitative and quantitative approaches. This study ensured the transferability of the qualitative findings by adequately describing the setting for the study, developing concepts and themes from the findings, identifying insights and lessons for other contexts, and critically reflecting on when and when not findings can be extrapolated.

Importantly, the quantitative data collected in this study was not intended as a large-scale and generalisable approach but to complement the qualitative data by gaining a more robust knowledge of the study's aim as well as validity considerations (both concept and external validity). Lastly, neutrality refers to the avoidance of researcher bias in the collection, analysis and reporting of data. To achieve this, this study utilised continuous reflexivity in the qualitative aspect and statistical analysis tools for survey data. Furthermore, papers in this thesis are published, submitted, or prepared to be submitted as articles in Q1 journals or book chapters in edited books by world-leading publishers.

CHAPTER FOUR

Circular Plastic Economy as Teleoaffective Formation: Conceptual and Policy Implications of a Practice Perspective

This chapter presents the theoretical and conceptual framework upon which the thesis is built. The overall aim of this thesis is to explore how household practices can be transformed for enabling the transition of cities to circular plastic economies. Chapter 3 provides a broad explanation and justification for the choice of practice theory. As noted in section 2.4, the application of practice theory to sustainability transitions is still evolving. Hence, this chapter more specifically expounds on the transition to CPEs from a practice theory perspective. In doing so, it further explains and justifies a practice theory approach, but also provides an extension, and thus scholarly contribution, to practice theory itself. By zooming out and in on social aggregates, this chapter addresses two important aspects of the research question – understanding circular plastic economies and plastic-related household practices from a practice theory perspective.

This chapter is a theoretical explanation of household practices related to plastic consumption and the understanding of the CPE from a practice perspective. This chapter is also part of the study's methodology by presenting the conceptual frameworks that connect the theory, aims and methods of the research visually, thus facilitating analysis. The theoretical and analytical underpinnings of CPE are embedded in the scholastic and policy discussions on the need for cities to transition from a linear to a circular economy. Although focusing on plastic within the circular economy framework could be considered simplistic, such an analytical approach is important to dissect the complex lifecycle of each material resource and design policies that make them sustainable. Therefore, this chapter will help to position the study within the circular economy discourse by exploring the micro and macro practice formations related to plastic use and their implications for sustainability transitions.

By adopting the 'zooming out and in' methodology, this chapter conceptualises CPE as a teleoaffective formation, defined as the conglomeration of practices aimed at achieving a set

of goals and anchored by general understandings (Welch 2017). As these concepts are further clarified in the chapter, they are applied to explain how plastic interconnects integrative practices bound by the general understanding of sustainability discourse across the social sphere (Schatzki 2002). The need to make plastic use sustainable and circular is additionally enhanced by the discursive and non-discursive formations of resource reuse, repurposing, remanufacture and recycling. On the other hand, zooming into the household domain in CPE shows how plastic contributes to the performance of household practices and how they in turn enhance the spatial-temporal mobility of plastic circularity. The influence of practice complexes outside the household domain on household plastic use is also expanded upon.

The chapter then closes with a theoretical explanation of how cities could transition from the current linear model of plastic use to CPE. The implications of such transitions for research and policy are then discussed. In keeping with the PhD by Publication format, this chapter is presented in the form of a paper. The paper has been submitted as a chapter in an edited book on ‘Sustainable Urban Transitions: Research, Policy, and Practice’ to be published in Springer Nature.

Abstract

Unsustainable plastic consumption and disposal are problematic for the environment through its marine life-threatening prevalence and for people in the form of microplastic digestion, inter alia. Changing the nature of how plastic is used and circulated through our economic systems is thus central to transitioning to a circular plastic economy (CPE). The extant analyses of such a transition in socio-technical systems have either focused on waste infrastructure, recycling technology or behavioural change. However, studies have shown that these approaches may reinforce linear models of production and consumption and are inadequate in galvanising a shift to CPE.

In this paper, we explore an alternative conceptual analysis of CPE through the practice perspective. Specifically, we argue that CPE could be examined as a teleoaffective formation or the constellation of practice complexes that are oriented towards making plastic production and consumption sustainable. By zooming out on CPE, we propose a framework that integrates daily practices with general understandings of sustainability and discourses across the socio-technical and political economy domains. To illustrate how CPE would manifest on a smaller scale, we then zoom into the household domain by analysing the plastic-related sociomaterial arrangements in the daily performance of domestic practices and routines. To achieve CPE, there is a need to transition the existing compound or disintegrated set of sustainability practices into an integrative or well-defined and formalised web of sustainability practices that ensure the circularity of plastic materials. Lastly, we assess the policy and design implications of the sustainability transitions to CPE.

Keywords: plastic consumption; circular economy; household practice; practice theory; cities

4.1 Introduction

Climate change, ocean plastic pollution and overexploitation of natural resources have alerted urban policymakers and scholars to the environmental impact of unsustainable plastic production, use and disposal (Martin 2019; Rochman et al. 2013; Akanle & Shittu 2018). The volume and intensity of consumption activities and socio-material processes in cities result in the high leakage of materials (including plastics) out of disposal mechanisms and into the environment (Godfrey 2019; Shittu 2020). It is widely recognised that solutions are required that can transition current plastic-related resource consumption in cities to low-impact models, specifically the circular plastic economy (CPE) (Vanapalli et al. 2019). A CPE is a system where plastic consumption is minimised, the lifecycle of plastic materials is maximised, and plastic waste is eliminated. Extant low-impact models in cities include reforms along the linear value chain with better waste management and recycling and an emphasis on attitude-behaviour-choice (ABC) approaches (Shove 2010), but with less focus on reduction and reuse which are integral aspects of the CPE (Sauvé, Bernard & Sloan 2016).

Moreover, reformed linear models often face contamination, North-South dumping and low product demand issues (Brooks, Wang & Jambeck 2018), and ABC models often encounter a disconnect between household attitudes and their practices (Lavelle, Rau & Fahy 2015; Newton and Meyer 2013). A key insight from the literature is, therefore, that existing implementation frameworks are inadequate to deliver CPE transitions in cities, particularly concerning the day-to-day activities of households and firms (Millar, McLaughlin and Börger 2019; Shittu 2020). However, the circular plastic economy (CPE) concept in cities is also not without some analytical challenges in theory and practice.

First, the framework to understand the CPE as a societywide system is currently inadequate. As implied in the name, the CPE can be widely regarded as an economic strategy. The circular economy literature is at a consensus that there is a need to transform business processes such as product design, manufacturing, energy use, resource consumption and waste management through technological innovations including alternatives to problematic materials like plastic (Merli, Preziosi & Acompora 2018). While technological innovations provide an avenue to

transform production systems towards circularity with businesses at the forefront (Pieroni, McAloone & Pigosso 2019), they are not enough for circular economy transitions, which require restructuring activities across all domains including households.

Second, there is a tendency for extant CPE frameworks to be overly focused on the physical aspect of plastic thereby ignoring other aspects of its materiality such as mediating affective attributes (Shittu 2021). The ubiquitous and tenacious nature of plastic in production and consumption activities in cities proves that the material might not be easily eliminated or replaced by alternatives (de Sousa 2021). Consequently, there is a need to provide a holistic conceptualisation of plastic that delves into the intricacies of the material's embeddedness in day-to-day activities, especially in the social (or household) domain.

Third, the transition of cities to CPEs is, to a large extent, currently conceptualised in terms of implementing circular models such as reduce, reuse, repair, remanufacture and recycle (Bocken et al. 2019). However, as several studies have shown, embedding circular solutions into day-to-day activities presents more complications in practice (Guldmann & Huulgaard 2020; Winans, Kendall & Deng 2017). Besides, as later discussed in this chapter, expanding existing circular models is only an aspect of the transition of cities to CPEs. In addition to developing and implementing alternative and novel circular solutions, it is also important for existing linear models and processes that cannot be replaced to be transformed.

This chapter adopts practice theory to address some of the above-outlined CPE analytical issues for theory and practice. We aim to provide a practice-based conceptual framework for how the CPE ecology might be configured. We conceive of the CPE through a practice perspective using the 'zooming in and out' method (Nicolini 2009). Although this significantly simplifies the complexity that a circular economy would exhibit, it nevertheless allows us to focus on the specifics of daily routines while at the same time engaging with how each routine relate to, condition and impact other routines. Also, utilising Welch's (2017) concept of teleoaffective formation, we propose a conceptualisation of the CPE to be the constellations of general understandings, practice complexes and normative orders that achieve both circularity and

sustainability. According to Welch and Warde (2016, pp. 1-2), general understandings could be understood as:

> … ideational elements… [that are] common to multiple practices, condition the manner in which practices are carried out and are expressed in their performance… General understandings are formulated in *both* doings and sayings… [and] include such things as concepts, values, and categories. Specific candidates might include: collective concepts, such as nation, state, economy or organisation; membership categories, such as ethnicity or gender; fundamental, culturally structuring concepts, such as animal\human or private\public; and diffuse but culturally significant understandings, such as notions of convenience, cosmopolitanism or authenticity.

Furthermore, a shift from behaviours, technological approaches and market mechanisms to practices provides a means of analytically disaggregating plastic consumption to focus on routinized activities of households and firms. Two practice theory concepts that underlie the CPE analysis presented in this chapter are 'integrative practices' and 'compound practices' (Schatzki 2002; Warde 2013). Integrative practices are bundles of multiple routines with defined skills and performance processes that jointly deliver a specific outcome. For instance, the morning routines that result in someone getting to work involve formalised practices such as official wear and driving. Conversely, compound practices may also result in a specific outcome but do not involve a formally defined set of know-hows or explicit socially agreed meanings (Warde 2013). To illustrate, the existing bundles of activities around sustainable plastic use are still largely uncoordinated in many cities. That is, individual sustainability activities (or routines) such as maintenance or reuse do not constitute a specific circular plastic economy practice with a defined set of know-hows or socially agreed meaning – some households reuse plastics due to thrift, others due to environmental consideration.

This, however, raises the question of how the routinized activities of households and firms assemble to form a constellation of practices that individually and jointly constitute the CPE ecology. We contend that the challenge of achieving the CPE as a teleoaffective formation is one of transforming compound sustainability practices into integrative sustainability practices as potential intervention points for delivering plastic-related sustainable and circular economy outcomes (Schatzki 2002; Warde 2013; Welch 2017). Achieving such CPE ecology, after transforming compound sustainability practices to become integrative, is the next transition

challenge. Chapter 7 further discusses insights from the study's findings on transforming plastic-related sustainability practices while chapter 8 examines the grassroots strategies that can be implemented to achieve broader CPE transitions.

The remainder of the chapter is structured as follows. Section 4.2 discusses the key conceptual terms and foundations of a practice-based perspective. Section 4.3 zooms out and analyses the CPE as a teleoaffective formation (Welch 2017). Section 4.4 focuses on day-to-day plastic-related household routines. We here zoom in on the actualisation of the CPE as a set of practices performed in the daily lives of the practice carriers (that is, people) to achieve circularity and sustainability. Section 4.5 discusses the implications of conceptualising CPE from a practice perspective for policy and practice. Section 4.6 concludes the chapter.

4.2 Practice theory, sustainability transitions and circular economy

Scholars have employed the practice theory to explain diverse social phenomena ranging from daily activities to global consumption patterns. This endeavour is partly motivated by the need to provide alternative theoretical explanations of social configurations and changes different from traditional theories of social formations such as institutionalism and interactionism (Shove 2010). Both theories have been collectively critiqued for their over-emphasis on an aspect of the social world while ignoring practices (Shove 2010). Practices are the unit of analysis and serve as the building blocks of social domains and interact to create social phenomena (Strengers & Maller 2014).

Ontologically, practice configurations exist as a flat constellation interweaving multiple elements together in a dynamic and organised order (Schatzki, 2016). In other words, the bundles of activities that constitute our everyday life are set up as in a web of practices with varying degrees of complexity. In the societal system, practices exist as spatial-temporal entities that arose from an enduring process of aggregating daily activities (Schatzki 1996). These activities are achieved by combining practice elements including materials, competences, and meanings. Thus, a practice can be defined as a bundle of activities that are affectively orientated towards achieving some set of goals. The normativised ordering of goals

of a practice and the associated affectivities constitute what Schatzki refers to as 'teleoaffectivity' (Welch 2017). Moreover, practices possess 'teleoaffective structures' or "a range of normativized and hierarchically ordered ends, projects, and tasks, to varying degrees allied with normativized emotions" (Schatzki 2002, p. 80).

Meanwhile, sustainability transitions have been a preoccupation of scholars in the practice theory domain (Shove & Walker 2010; Borch, Vitterso & Sto 2015). Perhaps the most empirically studied phenomenon in practice theory literature is unsustainable consumption which manifests in modern-day societal patterns and its effect on climate change (Yates & Evans 2016; Zang & Lahr 2018; Sole & Wagner 2018). Theoretically, practice theory scholars such as Shove (2019), Hargreaves (2011) and Borch, Vitterso and Sto (2015) have continued to interrogate how the historical construction and reconstruction of practices can lead to social change, particularly sustainability transitions. Of note here is also Gäbler's (2015) conception of sustainability as a practice composed of routinised activities which enable socio-ecological processes. Sustainability transitions to circular economies, in this sense, would be the reconfiguration of unsustainable practices and the normativisation of sustainable practices (see Figure 4.2). Understanding CPEs from a practice theory lens presents a new paradigm that provides a nexus between the systemic and agency, to address not only the materiality of plastic but also the consumer practices that drive and are associated with this.

The CPE is in response to a renewed call for the transition from a linear economy to a cyclical mode of production and consumption locally and globally (Sauvé, Bernard & Sloan 2016). Shifting to the CPE appears as a promising alternative model that could ensure that waste and pollution are marginalised from the system by the continual loop of plastic materials through socio-technical and ecological processes (Korhonen, Honkasalo & Seppala 2018). The predominant literature on circular economy has focused on the systemic analysis of such transitions in cities, countries and on a global scale. Such analysis explores the socio-technical elements that are required to achieve a circular economy through frameworks such as the multi-level perspective with little consideration for the elements that connect those structures to the day-to-day activities thereby reinforcing and regenerating the system.

4.3 Zooming out beyond technological analysis: Conceptualising CPE as a teleoaffective formation

Welch's reconceptualisation of teleoaffective structure guides the CPE framework presented in this section. Welch (2017) argues that Schatzki's concept of teleoaffective structure does not "capture cultural configurations that cross multiple practices" (p. 5). Although Schatzki's concept of a 'teleoaffective regime' represents the bundle of teleoaffectivities that exist across multiple practices, Welch (2017) contends that it creates issues for the application of practice theory in consumption studies. Of particular concern is the difficulty in separating 'teleoaffective regime' from 'general understandings', two concepts Schatzki identified as embedded in practices, but which also exist outside of and regulate practices. Therefore, Welch (2017) proposes 'teleoaffective formation', a related concept employed in consumption studies to understand practice complexes in multiple social domains. According to Welch (2017:7), teleoaffective formation is:

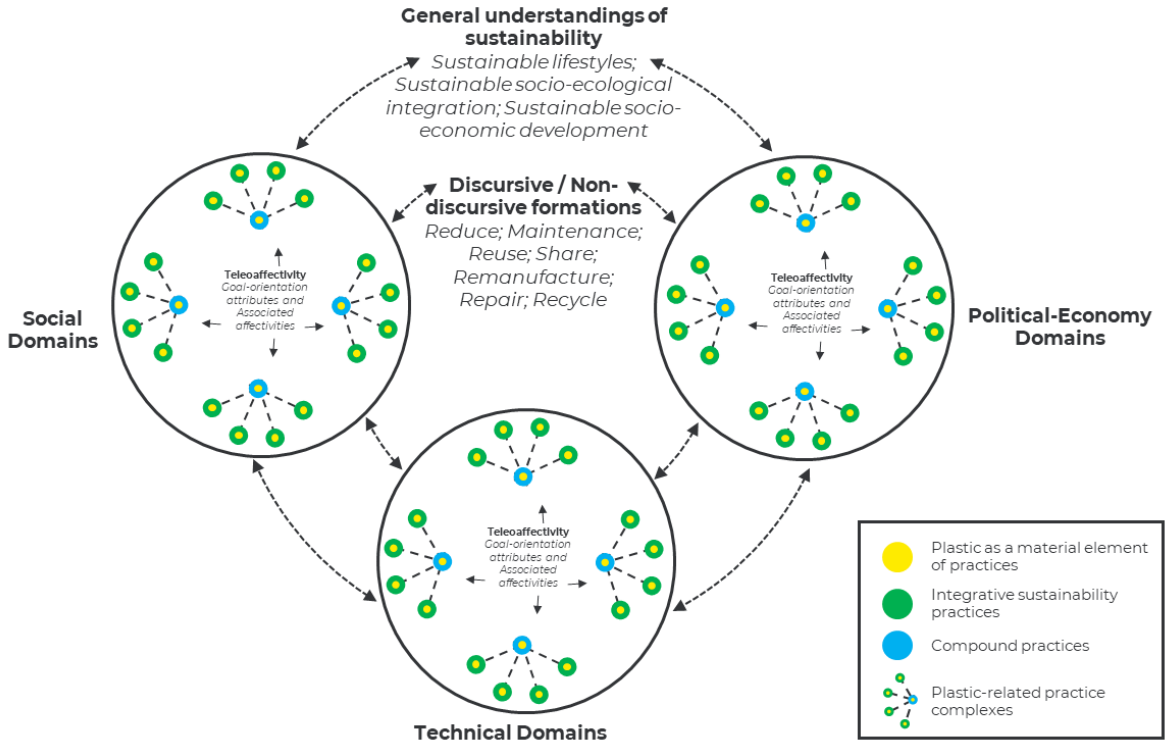
> …a configuration across multiple practices, conditioned by a relational nexus of general understandings, that enjoins those practices to common ends and normatively orders the orientations and affective engagements of those practices.

The above definition serves as a basis to understand the circular (plastic) economy. We define a circular economy as a configuration composed of sustainability practice complexes across all social domains aimed at eradicating waste, optimising resource use and prolonging material lifecycle.

Taking Welch's (2017) definition of teleoaffective formation, the CPE is thus the arrangement of multiple sustainability practices that are oriented towards making plastic production and consumption sustainable. For any practice to be part of the CPE, plastic as a material (in any form) must compose part of the elements that make up its performance. In the societal system, the general understandings that condition the CPE include the notion of ecological sustainability, sustainability transitions and ongoing public discourse about the environmental pollution resulting from indiscriminate plastic disposal. In figure 4.1, a conceptual

representation of the circular (plastic) economy, these general understandings are categorised as sustainable lifestyles, sustainable socio-economic development, and sustainable socio-ecological integration. As depicted in figure 4.1, these general understandings integrate domains to form the CPE and are found across the circular economy spectrum. It should be noted that the general understandings of sustainability would take different forms from expert to lay understandings across each domain.

Figure 4.1 *Circular plastic economy framework from a practice perspective*



Furthermore, the general understanding of sustainable plastic use intersects other discursive and non-discursive formations, for instance around the well-known three 'Rs' of reduce, reuse and recycle. However, the CPE underscores the importance of sharing, maintaining, reducing, reusing, remanufacturing, and repairing plastic materials above recycling and disposal (Ellen MacArthur Foundation, n.d.). It should be noted that the CPE is not only meant to eliminate plastic waste, but it is also a system championed to protect the environment, minimise resource use, deliver more employment opportunities, promote sustainable manufacturing, design, and

consumption, and grow the economy in general (European Academies Science Advisory Council [EASAC] 2016).

As Welch (2017) argues, teleoaffective formations are configurations that exist across multiple scales of analysis. Depending on the framework adopted, teleoaffective formations can be analysed based on the practice complexes existing in different domains (household practices are further explored below). Thus, basic social institutions such as the economy, governance and households involve constellations of practice complexes that grant them their form and connect them with other institutions. As shown in figure 4.1, constellations of practice complexes can be categorised into those in the social domains, political economy domains and technical domains. The social domains involve practice complexes existing in households, businesses, religious groups, and other social groups. The political economy domain is the aggregation of social formations that deliberately make policy and economic strategies that directly or indirectly influence other domains (this is separated from the social domain due to its significance in sustainability transitions). While the technical domain includes practice complexes involved in design and science and technology innovation.

It is important to provide a distinction here between Welch's 'teleoaffective formation' (2017), Schatzki's 'integrative practices' (2002) and Warde's 'compound practices' (2013). Schatzki (1996) defines integrative practices as "the more complex practices found in and constitutive of particular domains of social life" such as cooking and farming practices (p. 98). Welch (2017) notes that the difference between teleoaffective formation and integrative practice could only be determined at an empirical level. For Warde (2013), an integrative practice is formalised with an explicit, or measured, way of acquiring the specified know-how and its performance carries coordinated and shared norms. However, compound practices such as eating, are those that are disorganised, but connect several integrative practices with different spatial-temporal evolution together (Warde 2013).

This chapter attempts to extend these conceptualisations to understanding the current and potential state of plastic-related sustainability practices. Acknowledging that these conceptualisations may seem to divert from their original use by Schatzki and Warde, they

nevertheless provide us with the framework to understand CPE from a practice perspective. It is important to clarify here that with regards to plastic-related sustainability practices, the focus is not on the 'practices involved around plastic' like cooking or eating but on the specific activities that directly act on plastic as a material to make it sustainable e.g., maintaining and repairing plastic to prolong its lifecycle. For instance, unlike Warde's (2013) example of eating as a compound practice, there is currently no apparent common parlance in everyday life known as 'sustainability practice'. The concept is mainly employed in the thesis as a theoretical contribution to practice theory and sustainability transitions literature. The 'compound' and 'integrative' concepts provide the PhD candidate with frameworks of how practice theory could explain the transformation of plastic consumption in urban households. This is in terms of transforming plastic-related sustainability practices from their current 'compound' or unorganised nature to a prospective 'integrative' or organised state.

To understand the CPE and avoid conceptual ambiguities, the three concepts offer distinct explanations in this chapter. In figure 4.1, teleoaffective formations exist in the overarching societal system (not to be confused with the social domain) of the CPE and those bounding constellations of practice complexes. They are composed of general understandings that link complex practices and discourses together to achieve some set of goals. As explained by Welch (2017), promoting sustainable consumption is a teleoaffective formation integrating business practices, policy practices, consumer culture and civil society organisations. The CPE could also be a spatially bound teleoaffective formation such as local, city, regional, national, or international geographical boundaries. As depicted in figure 4.1, integrative practices are those complexes that are relatively structured, have standard conventions and can be learnt in an organised way. As Schatzki (2002) notes, these practices are found in specific domains and enjoin simpler practices together. Cooking, bathing, decorating, recycling, parenting, and homemaking are some integrative practices that can be found in the household domain.

In figure 4.1, compound practices are those that are disorganised in structure but generally recognised as binding multiple integrative practices together to achieve a project (Warde 2013). Plastic-related sustainability practices, defined as practices that directly ensure the sustainable use of plastic materials, can be categorised as compound in their current form. Aside from

recycling, the other aspects of plastic-related sustainability practices such as reuse and reduction still lack a set of systematic processes including, how, when, where or what to reuse and reduce. There is also no generally accepted standard or formalised means to learn what sustainable plastic use is.

Given the current level of unsustainable plastic consumption and lack of adequate regulation on plastic use (Blue Environment 2019), plastic-related sustainability practices are compound practices that "may be considered as failed, or not yet worked up, integrative practices" (Warde 2013, p. 26). However, in the CPE, plastic-related sustainability practices would manifest as integrative practices within domains or teleoaffective formations at societal system scales that have clearly defined goals, are organised with supportive sociomaterial arrangements, and are connected by general understandings of sustainability (Welch 2017). Transforming the current 'compound' plastic-related sustainability practices to 'integrative' plastic-related sustainability practices is one of the tasks of stakeholders involved in sustainability transitions to the CPE (Schatzki 2002; Warde 2013).

Therefore, the transition of cities to the CPE would require an understanding of how practices constitute the socio-technical domains and the role of plastic material in interlinking practices to achieve projects or goals. The next section employs this approach by zooming in on the role plastic plays in forming and changing the practices around plastic consumption in households.

4.4 Zooming in beyond physical features: Examining the complexity of plastic-related practices in households

Analysing the role of plastic in the performance of household practices requires centralising plastic materials from other practice elements as depicted in figure 4.1. The form the CPE takes in a domain (such as households) would be somewhat similar to the framework in figure 4.1, albeit at a smaller scale. A major influence in the way that plastic-related household practices are formed and performed (as with other domains) is the teleoaffectivities that enjoin the practices together in achieving household projects. Teleoaffectivities can be understood as the manifestation of general understandings and (non-)discursive formations articulated in the

performance of practices (Welch 2017). Figure 4.1 shows that simple practices are (re)combined to form more complex practices that interact to create household teleoaffective formation.

Furthermore, plastic-related practices composing the CPE are connected to discursive and non-discursive formations such as sharing, maintaining, reusing, repurposing, and recycling around general understandings of sustainability as shown in figure 4.1. This means that plastic-related sustainability practices in the CPE would be integrative practices with established guidelines and conventions on sustainable plastic use (Schatzki 2002).

In Shove, Pantzar and Watson's (2012) categorisation of practice elements, plastic represents a material element that embodies and conveys the meanings (or affective aspects) and competences (or skills) of the carrier through practice performance. By combining with other material and non-material elements, plastic serves as a means through which carriers express affective engagements oriented towards achieving a set of goals. For instance, Shittu (2021) found that plastic assists low-income urban households to convey meanings such as mobility, convenience, and accessibility in their daily performance.

Furthermore, the mobility of plastic within and outside of the household spatiotemporal boundary can also be influenced by the meanings embedded in its physical form. These embedded meanings reflect the value placed on plastic as a material addressing multiple conceived needs. However, some plastic materials, such as single-use and disposable plastics, carry less post-consumption value or meaning in their physical form and thus are highly likely to move out of the household domain. While they may be transitory, these types of plastic may not have an enduring or predominant role in the material arrangements of the CPE, especially at the household level thereby requiring their elimination or recycling.

In addition to mediating meanings, the current indispensability of plastic to household practices is derived from its potential to physically manifest in different forms and provide high spatiotemporal mobility. Presently, plastic materials could be employed in performing household practices such as cooking (plastic kitchenware), eating (plastic tableware), bathing

(bathroom beauty products), refrigerating (plastic packs), cleaning (washing machines), decorating (plastic arts), gardening (plastic flower vases) household entertainment (plastic appliances), shopping (plastic bags), parenting (plastic toys) and so on.

Another point to consider is that a household's plastic use in the CPE is also influenced by the complex interaction of household practices, the general level of know-how in performing those practices and the socio-economic and cultural background within which the household is located. For instance, households with young people working long hours and possessing little sustainability education would more likely eat out often and purchase packaged foods but may not be able to appropriately recycle plastic materials.

This implies that the (non)performance of practices not directly related to plastic by a household would influence their (non)performance of practices related to plastic use. For example, households living near supplies of fresh food available in city centres or supermarkets might find it easier to frequently purchase fresh foods to reduce plastic use. But a household's purchase of fresh instead of pre-packaged foods could be influenced by the importance attached to the emotional expression and goals of sustainable lifestyles. Whereas other households may value the convenience offered by pre-packaged foods above the known environmental costs, particularly within the context of time pressures and low economic resources. The preceding examples show that due to limited spatial-temporal and (non)material resources, households' performances of practice instead of another depends on the importance carriers attach to the practice's teleoaffectivity.

Concerning the role of socioeconomic status in influencing the importance placed upon sustainable practices, Australian data suggests that environmental concern is most evident amongst those within the highest personal income quintile (Australian Bureau of Statistics [ABS] 2012). On the other hand, Shittu (2020, 2022) reveal that low-income households experience several environmental justice issues that prevent them from adopting plastic-related sustainability practices. First, unlike higher-income households that may afford existing sustainability solutions, which often are costly, low-income households lack access to adequate socio-economic resources and socio-material arrangements that enable the adoption of

sustainability practices. Second, low-income households are often excluded from policy initiatives and social groups promoting sustainability education and upskilling, which consequently inhibit them from adopting sustainable lifestyles.

Moreover, income class considered more broadly, as well as gender expectations, appear to play a role in avoiding pre-packaged foods. For instance, middle-class motherhood in the United Kingdom appears to be associated with expectations of providing home-cooked, fresh, and healthy food, in sharp contrast with take-away and junk food viewed with disgust by this group (Parsons 2016). Similarly, age may play an interesting role in convenience food. To illustrate, age appears to play a more significant role than gender, education level or socio-economic status among Danish youth, the majority of whom consume convenience food regularly (Halkier 2017).

Lastly and as the above exemplifies, teleoaffective formations (Welch 2017) and broader socioeconomic practices outside the household domain, such as business practices and policies, influence plastic consumption in the CPE. Specifically, the sociomaterial practices that a business adopts will to an extent shape the performance of household practices such as shopping. These business practices include the decisions on the offering of plastic bags to consumers, providing reusable bags, serving as deposit points for plastic recyclables, supporting organic and fresh food supply, and engaging in green marketing activities among others.

Moreover, there is a need to holistically transform supply chain processes in transitioning cities to CPEs. For instance, many fresh products that are presented to the consumer in a market style (i.e., not individually wrapped/packaged) often arrive at the retail stage wrapped up in a lot of single-use plastics that then are removed before final sale. Consumers may choose agricultural produce that is pre-packaged or packed at the point of sale while others may decide to avoid plastic packaging altogether. In this sense, ‘sustainable’ shopping practices of consumers may ultimately not have a significant difference in terms of their plastic footprint as relates to ‘unsustainable’ shopping practices.

The next section focuses on the policy implications of the transitions to the CPE.

4.5 Transitioning to a circular plastic economy: Implications for policy and practice

Transitioning to the CPE requires an understanding of the interconnections among existing elements, practices, teleoaffectivities, nexuses and large practice formations. This necessitates the holistic consideration of teleoaffective formations (Welch 2017) and the trajectory of material and non-material arrangements within the system. Uncoordinated or little changes in practices or the constituted elements, such as in isolated local initiatives, may not have the significant effect required to create a shift from a linear to a circular economy.

Given the heightened intricacies of the globalised world economy, any isolated effort by an individual, business or city administrator to implement the CPE policies may be overwhelmed by the entrenched and unsustainable practice complexes that perpetuate the current linear economy. In this regard, a transition to the CPE involves the purposeful and active involvement of all stakeholders who could influence practices at varying societal scales. From a practice perspective and deriving from the above discussions, the CPE can be achieved from two aspects: transforming existing plastic-related practices to become sustainable and engendering integrative plastic-related sustainability practices.

The first aspect refers to the redesign and reconfiguration of elements of existing plastic-related practices (that is, material, meaning and competence) circularly and sustainably. As a material element in the performance of a myriad of practices across social, political-economy, and technical domains, plastic use may not be circular or sustainable if the performance of those related practices continues to be linear and unsustainable. This also implies that focusing on an aspect of the ‘R’s of sustainability may not deliver the circular economy objectives.

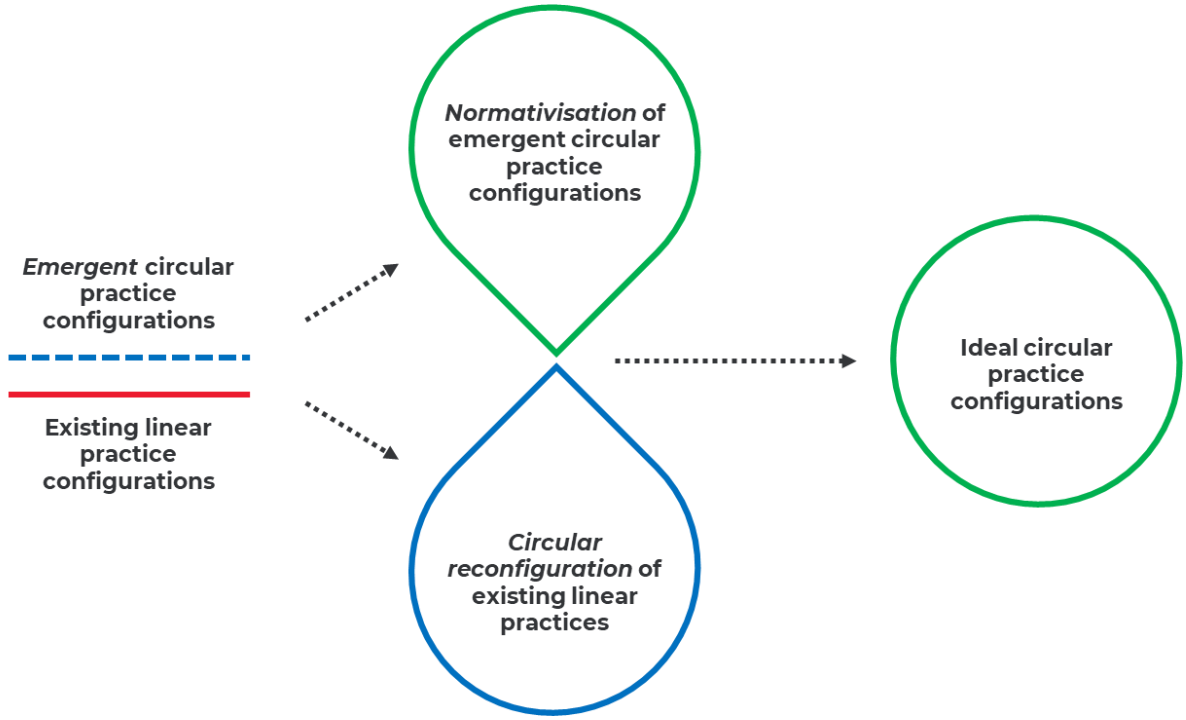
Therefore, there is also a need to rethink and redesign production, consumption, packaging, and agricultural processes among others. A major means that this could be done would be the implementation of initiatives that promote service models and producer responsibility for plastic-related goods. Government bodies could facilitate such transition by collaborating with

non-governmental organisations, research organisations, businesses, and community associations on scaling up the CPE initiatives. For large manufacturing organisations, other sustainable alternatives to plastic could also be identified through research and development.

Perhaps the most important aspect of shifting to the CPE is establishing plastic-related sustainability practices. As argued in this chapter, plastic-related sustainability practices are those integrated practices that are particularly performed to make plastic use sustainable and circular without leaking into the environment. Therefore, sustainability stakeholders must collaborate to establish infrastructures, rules, processes, skills, emotional affectivities, and other elements that promote and advance the sharing, maintaining, reduction, reuse, repurposing, remanufacturing, repairing, and recycling of plastic materials across all social domains. Aside from this, more attention should be paid to the existing socio-economic and environmental inequalities and injustices arising from the conflicts and contradictions of existing teleoaffective formations that may prevent the transition to the CPE.

Transitioning from the linear plastic economy to the CPE would be as depicted in Figure 4.2. The three panels in Figure 4.2 are connected by arrows symbolising the transition process. Panel A illustrates emergent circular practices and existing linear practices. Panel B illustrates the normativisation of emergent circular practice configurations and the circular reconfiguration of existing linear practices. Panel C illustrates the final stage of circular transitions. In the context of this chapter, the arrows connecting the panels (the transition process) in practice represent changes in general understandings, (non-)discursive formations and teleoaffectivities.

Figure 4.2 *Transitioning from linear to circular plastic economy from a practice perspective*



The framework suggests that the linear trajectory of current practice complexes would require reconfigurations to fit into the CPE. Reconfiguration might mean different things. For instance, some practices and their constituting elements could disappear or lose carriers. Other practices or practice elements would be rearranged to either form new practices that combine in new ways or recruit new carriers to conform to the CPE. On the other hand, there would be a few extant practice configurations, most likely on a small scale, that are reflective of the CPE such as some innovative small business practices. These emerging circular practice configurations need to be normativised, performed continuously and expanded across all institutional domains to entrench them into the system. The final transition state would encompass practice complexes that emerge or are created and performed to achieve a waste minimization strategy to achieve prolonged product lifecycles and sustainable socio-ecological integrations.

4.6 Conclusion

In this chapter, we presented a theoretical framework for transitioning cities to the CPE based on a practice theory perspective. This is accomplished through a zoom-in-and-out approach

which explores the socio-material arrangements composing the CPE at different societal scales. While the application of practice theory to sustainability transitions is still evolving, this chapter more specifically expounds on the transition to CPEs from a practice theory perspective. In doing so, it provides an extension, and thus scholarly contribution, to practice theory itself.

First, we employ the concept of teleoaffective formation to analyse the CPE as the complex interconnection of social, political-economic, and technological domains (Welch 2017). This shows that the CPE is to be understood as a system extending beyond technological innovations to include the nexus of practice complexities enjoined by the general understandings of sustainable lifestyles, sustainable socio-economic integration, and sustainable socio-economic development. In turn, general understandings condition discursive and non-discursive formations guiding circular practices.

In the CPE, it is expected that sustainability can become the general understanding that guides all plastic-related practices. Propagating this general understanding then becomes one of education, capabilities, and resources. General understandings are, however, but one component of the CPE. A transition strategy is also about developing infrastructure, design and related processes in a manner that enables households (or practitioners) to gradually adopt sustainability practices within a framework that nevertheless delivers the CPE. Capability-enhancing infrastructure, design and processes provide a top-down opportunity of transforming practices and can also enable a shift or realignment in meanings and preferences over time. These meanings are then articulated in emerging plastic-related sustainability practices.

The conceptual framework presented in this chapter provides a key contribution to the circular economy literature. Specifically, applying a practice-based perspective illustrates how the daily activities in an institutional domain (for instance, household consumption) are embedded within the socio-technical and practice complexes of the CPE. Also, the conceptual framework presents a transition pathway from linear practice configurations to circular practice configurations in cities. Conceptualising the transition to the CPE will benefit urban

policymakers, organisations and scholars when adopting either top-down or bottom-up approaches to implementing circular economy strategies.

CHAPTER FIVE

Emerging Sustainability Concerns and Policy Implications of Urban Household Consumption: A Systematic Literature Review

This chapter has been published as an academic paper in the Journal of Cleaner Production (Shittu 2020). The published paper is here reproduced in its entirety, but without the formatting evident in the published version. This paper analyses the emerging themes in the research, theory, and sustainability transitions of urban household consumption, or research question one from section 1.2.

Through a systematic literature review of the sustainable consumption literature, the paper analyses a final selection of 56 articles to examine emerging concerns, theoretical frameworks, and strategies for sustainable household consumption in cities since the adoption of the Sustainable Development Goals (SDGs).

The paper contributes to knowledge and policy by addressing the following research questions: (a) *what are the emerging concerns of research on sustainable household consumption in cities over the past five years?* (b) *what theoretical frameworks inform the understanding of sustainable household consumption in cities in the last five years?* (c) *what strategies have been identified for achieving sustainability transitions in urban household consumption in the last five years?* This systematic literature review provides a general overview of the obstacles to achieving sustainable consumption in urban households from 2015 to 2019 since the adoption of the Sustainable Development Goals (SDGs). More significantly, this paper identifies some of the gaps in knowledge that will be addressed within this study's aim of exploring the transformation of urban household consumption to promote circular transitions. Likewise, few studies have adopted a mixed-methods approach and therefore its methodological benefit to understanding urban household consumption is another important gap this study intends to fill (see the published paper below).

Abstract

The 2015 Paris Agreement marked a significant shift in public and scholarly discourse on climate change by laying more emphasis on stakeholder involvement and local-level policies in achieving sustainability transitions. Sustainable Development Goal 12 further emphasises the importance of households in achieving sustainable consumption before 2030, especially in cities. However, since its adoption in 2015, no study has sought to synthesise the scholarship conducted around the emerging urban household consumption challenges that could inhibit the achievement of Goal 12. Through a systematic selection and in-depth review of relevant literature over the last five years, this paper assesses these sustainability challenges and critically examines the policy implications for achieving sustainable consumption. The review notes that in recent years, researchers have explored a range of issues including energy consumption, sustainable lifestyles, consumption footprints and class relations in urban household consumption through models and social perspectives. The urban household challenges identified include, inter alia: intensifying household consumption; rising commodification of household activities; continued reliance on unsustainable energy sources; low levels of sustainability education; high costs of sustainable lifestyles; and class differences in sustainable consumption patterns. In addressing these problems, the literature suggests strategies such as greening urban infrastructure, involving households in intervention programmes and promoting sustainability education, among others. Furthermore, to achieve Goal 12, future research and policy initiatives should consider the impact of materiality in household consumption, explore the interlinkages of household consumption with wider socio-cultural institutions and be more practice-oriented.

Keywords: sustainable development goals; urban centre; household consumption; systematic literature review; sustainable development; sustainability transitions

5.1 Introduction

The grand challenges of the 21st century are sustainability challenges (Davidson et al. 2015; Martin, Mullan & Horton 2016; Vitale, 2012). Recently, local, and national resources undergo undue stress with resultant socio-economic and environmental consequences such as high carbon emissions, deforestation, plastic pollution, urban population growth, and food and water insecurity, among others (United Nations 2013). The aggravated environmental challenges that accompany population growth and increased commodification of human activities in cities necessitate achieving sustainable consumption in urban households (Elmqvist et al. 2019). According to the Organisation for Economic Co-operation and Development (OECD 1997), sustainable consumption means "the use of goods and services that respond to basic needs and bring a better quality of life while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardise the needs of future generations." This, therefore, highlights the importance of examining the impact of household consumption patterns on the environment, especially in areas with large human settlements such as cities to achieve sustainable consumption (Caeiro, Ramos & Huisingh 2012).

The focus on households in sustainable consumption studies is not a recent development. Despite the multidisciplinary nature of consumption studies, scholars within the field acknowledge the importance of households as the major source of the purchase, use and disposal of goods and services in achieving sustainable consumption (Takase, Kondo & Washizu 2005; Welford, Young & Ytterhus 1998; Yates 2018). To this end, scholars have emphasised the importance of improving resource consumption and household services concerning the environment for both current and future generations (Caeiro, Ramos & Huisingh 2012; Wang Q. et al. 2019; Welford, Young & Ytterhus 1998). The recognition of households' impact on sustainable consumption has motivated decades of studies on consumer behaviours and sustainable lifestyles (Fischer et al. 2017; Hartmann & Siegrist 2017; Tukker et al. 2010). A major concern of scholars in the past decade has been to adequately understand how these findings can effectively inform policies that in turn drive sustainable consumption and lifestyles (Tukker et al. 2010). Therefore, the 2015 Paris Agreement can be said to represent a culmination of decades of attempts to integrate research findings and policies on a global

scale. Since then, despite its shortcomings, the Paris Agreement serves as an improved model for research and policy alike, prompting different research questions, methods, and policy implications (Wake 2019). Hence, this paper aims to extract and synthesise these changes from empirical studies that are published since the 2015 Paris Agreement and focused on impacting urban household consumption to achieve sustainable development.

The 2015 Paris Agreement is chosen as a reference point because it represents a significant global shift in public discourse about climate change and the environmental policies of cities and other stakeholders with a renewed scholarly interest in sustainability studies (Sharma & Payal 2019; Wake 2019). In policy circles, the connection between household consumption, environment and sustainable development was first acknowledged by the Brundtland Commission's Our Common Future report of 1987 (World Commission on Environment and Development 1987). The Brundtland Commission's report was followed by a series of international conferences, including the 1992 United Nations Conference on Environment and Development (UNCED), culminating in the Millennium Development Goals (MDGs) (Robert, Parris & Leiserowitz 2005).

However, the composition and implementation of the MDGs have been critiqued for being unambitious, lacking adequate consultation and emphasising international and national intervention while ignoring local dynamics and needs (Fehling, Nelson & Venkatapuram 2013; Pogge 2004). These challenges were addressed in the 2015 Paris Agreement through the adoption of the Sustainable Development Goals (SDGs). The SDGs emphasise the importance of multiple stakeholder involvement and the design of local-level strategies in achieving sustainable development and thus, signal new understandings of the sustainable consumption challenges facing households and related policy implications, especially in cities.

Goal 11 of the SDGs emphasises the importance of achieving sustainable development in cities by building resilient, inclusive, and safe cities. Keivani (2010) reiterates the importance of cities in achieving the SDGs as the drivers of economic growth and sustainable development. Cities are not just centres of large human settlements but also have the highest concentrations of the world's production and consumption activities (Elmqvist et al. 2019; McGranahan &

Satterthwaite 2003). As a result, cities are responsible for about 80% of global carbon dioxide emissions including the greenhouse gasses that further impact climate change (Keivani 2010). This has led to the recent increase in environmental hazards such as hurricanes, air pollution and floods in major cities of North America, China, England, and the Caribbean (Keivani 2010; Spangler et al. 2019). Tackling the challenges facing cities such as waste management, carbon emissions and environmental degradation could be the drive for the achievement of the SDGs (Kawakubo et al. 2018; Parnell 2016; Rodriguez, Ürge-Vorsatz & Barau 2018). However, in the quest to improve urban governance and reform industrial production, it is important not to lose sight of the impact of household consumption in achieving the SDGs, particularly Goal 12, which deals with responsible consumption and production.

In this regard, "Workshop on education for sustainable development" (2016) contends that to achieve Goal 12 in cities, there is a need for a synergy of research and policy in identifying emerging sustainable challenges at local and household levels, and to design and implement innovative policy intervention programmes to address them. Understanding household-level consumption challenges is crucial in designing micro policies that account for the socio-economic contexts of specific households rather than generalised macro policies that may not trickle down to household units (Dubois et al. 2019; Wu, Lei & Li 2019). Also, synthesising household-level consumption challenges would help to transform macro policies by addressing the common themes identified across urban households (Wang Q. et al. 2019). To this end, this paper attempts to integrate sustainability research and policy by synthesising research findings and policy strategies in the literature since the adoption of the SDGs in 2015.

While focusing on Goal 12, the paper aims to synthesise the findings around contemporary challenges and strategies for achieving the SDGs. Specifically, the paper adopts a systematic approach to reviewing scholarly studies published from 2015 until June 2019 to answer the following research questions:

a) *What are the emerging concerns of research on sustainable household consumption in cities over the past five years?*

b) *What theoretical frameworks inform the understanding of sustainable household consumption in cities in the last five years?*

c) *What strategies have been identified for achieving sustainability transitions in urban household consumption in the last five years?*

This paper attempts to answer these questions through a systematic literature review by identifying, selecting, and critically appraising previous research to ensure transparency, focus and integration in discussing research findings (Sambunjak, Cumpston & Watts 2017; Gough, Oliver & Thomas 2017; Pittway 2008). Scholars have employed systematic literature reviews within the field of sustainable consumption to study mindfulness (Fischer et al. 2017), business focus (Roy & Singh 2017), product innovation (de Medeiros, Ribeiro & Cortimiglia 2014), technology design (Murugesan, Hoda & Salcic 2015), water supplies (Majuru et al. 2016) and food waste (Schanes, Dobernig & Gözet 2018). However, no study has attempted to analyse the sustainability challenges and strategies identified in urban household consumption since the adoption of the SDGs in 2015 – a gap this paper intends to fill.

Therefore, the contributions provided by this paper include an examination of the emerging sustainability concerns within urban household consumption in the last five years that must be critically addressed to achieve the SDGs (Goal 12) and the identification and discussion of research and policy strategies to address these challenges and make urban household consumption sustainable. The remainder of this paper is organised as follows. Section 5.2 details the research methodology adopted. Section 5.3 provides a descriptive analysis of the included studies. Section 5.4 provides a systematic synthesis of the research evidence. Section 5.5 discusses the implications for policy and research. Section 5.6 concludes.

5.2 Research methodology

This paper adopts a systematic literature review to analyse studies that investigate sustainable household consumption in cities over the past five years. A systematic literature review is a tool that permits the application of a methodical and transparent approach aggregating findings on sustainable household consumption from previous studies (Bradbury-Jones et al. 2019;

Evans et al. 2017). It also reduces the level of bias and gives more focus to aggregating the implications of findings for policy and research (Campbell Collaboration 2019). The paper examines sustainability concerns in urban household consumption over the past five years, the theoretical frameworks utilised, and the policy recommendations proposed for sustainable transitions in household consumption. This process ensured that the final articles selected for the analysis are directly relevant to answering the research questions. However, it is acknowledged that the limitations of the literature reviewed and the interpretation of the findings are factors that reduce the generalisability of the study's conclusions.

5.2.1 Data sources

The literature search strategy adopts the SPIDER tool (Cooke, Smith & Booth 2012). The SPIDER tool (Sample, Phenomenon of Interest, Design, Evaluation, Research type) is shown to yield better results over the PICO tool (Population, Intervention, Comparison, Outcome) for studies that adopt qualitative and mixed methods techniques (Cooke, Smith & Booth 2012; Ellis et al. 2016; Gough, Oliver & Thomas 2017). This is done to identify the breadth of methodological approaches and themes given the multidisciplinary nature of the field.

The keywords search only employs the "SPI" aspect (Sample, Phenomenon of Interest) of the tool in recognition of the importance of being open in the research objectives in terms of "DER" (Design, Evaluation, Research type) which relates to analysing the methods, findings and policy implications of the included studies. This means that the initial search only takes into consideration empirical studies that focus on households (Sample) and sustainable consumption (Phenomenon of Interest) while aspects such as research design, data evaluation and research type are examined at the analysis stage.

The literature search focuses on empirical studies conducted in the last five years (2015 – June 2019) on emerging sustainability challenges since the adoption of the SDGs. Given the multidisciplinary nature of sustainable consumption research, the study sourced relevant literature from three popular databases – Scopus, Web of Science and Ebsco Host. Keywords guiding the search within the titles, abstracts and keywords of journal articles are: "Sustainable

transition" OR "sustainability transition" OR "transition" OR "sustainable" OR "transform" AND "household consumption" OR "domestic consumption". The utilisation of singular search terms allows for both singular and plural forms to be identified (for instance, "transition" and "transitions").

Although studies in sustainable consumption are not limited to these three databases, they host top peer-reviewed journals with high-impact factors in the field of sustainability transitions. The selection of only peer-reviewed journal articles is informed by an interest in empirical studies that have gone through a rigorous research process to establish findings and conclusions. Selecting credible studies is necessary to examine patterns from research findings informed by the household consumption challenges observed in the real world to answer the research questions. The selection of peer-reviewed journal articles that are published in English is due to their use of an international academic language which enhances their visibility and reach.

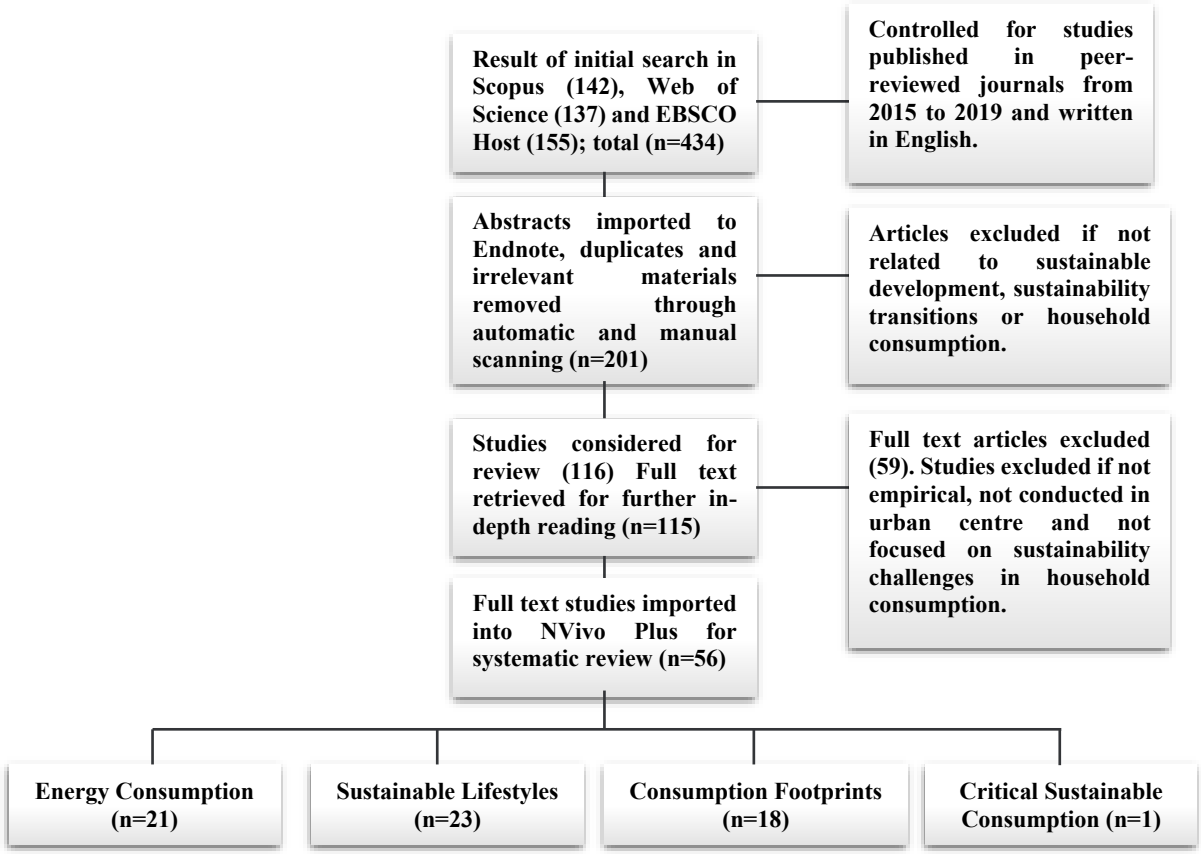
5.2.2 Selection of research materials

The initial keyword search yielded 434 peer-reviewed journal articles written in English and published between 2015 and June 2019. Further selection within Endnote applying the automatic duplicate removal facility and further assessment of the relevance of article abstracts generates a total of 201 articles for further evaluation. A relevant article in this context comprises a study that conducts an empirical investigation into the consumption patterns of households in cities regarding sustainability transitions. Further eligibility criteria include a focus on sustainability and transition challenges, data collected on household consumption, empirical studies conducted in cities, and full-text availability. The application of these criteria generates 56 peer-reviewed journal articles for in-depth review. Figure 5.1 summarises the selection process.

5.2.3 Strategy for review of included studies

Full-text analysis utilising NVivo Plus offers the opportunity to develop a matrix of the study characteristics, as well as the opportunity to explore the texts thematically and develop common threads across the articles reviewed. The systematic review of the studies starts with the recording of their characteristics such as the journal name, country of study, method of data collection and household type. Notwithstanding the common focus of these studies on emerging sustainability concerns in urban household consumption, their objectives and findings reveal a categorisation into themes and subject areas. The thematic areas identified are energy consumption, sustainable lifestyles, consumption footprints and critical sustainable consumption as shown in figure 5.1. It is important to note that these categorisations are not mutually exclusive but interconnected and thus, some studies address concerns in multiple thematic areas.

Figure 5.1 *Systematic literature review process*



'Energy consumption' includes all studies that set out to understand the emerging nature of urban household energy consumption and assess whether these outcomes meet global or local sustainability standards (n = 21). 'Sustainable lifestyles' consists of studies that are interested in exploring the consumption choices of urban households and their influence on sustainable living (n = 23). 'Consumption footprints' comprises studies that aim to measure the impact of urban household consumption on the environment and its implication for sustainability transitions (n = 18). 'Critical sustainable consumption' includes a study that addresses the class power relations embedded in sustainable consumption narratives (n = 1) as its approach to understanding household consumption does not fit into other categories.

5.3 Descriptive analysis of included studies

A review of the included studies shows they are mainly published in environment and sustainability, general management, and multidisciplinary journals. However, the majority (n = 16) of the studies are published in the Journal of Cleaner Production which is an indication of the interdisciplinary scope of the journal. There is a steady increase in the number of articles published per year from nine studies in 2015, 10 publications in 2016, 13 articles in 2017 to 17 studies published in 2018. Some seven studies were published in the first half of 2019. Some of the studies (n = 6) cut across multiple subject areas and are allocated to more than one category (see Mach, Weinzettel & Scasny 2018; Salo et al. 2016; Shim, Kim & Na 2018). Tables 5.1 – 5.3 present the categorisations of the household types, countries of study and methodologies concerning the thematic areas.

Data analysis shows that 57% of the included studies across the thematic areas are conducted mainly in developed countries (n = 32) such as the United Kingdom, Spain, and Finland while 39% focus on developing countries (n = 22). Only 4% of the studies (n = 2) adopt a comparative lens in exploring sustainability challenges within households across both developing and developed countries (Khalid et al. 2019; Spencer, Lilley & Porter 2015). Khalid et al. (2019) explore the adaptation of household practices to dynamic cultural contexts and electricity provision systems in Pakistan and Denmark while Spencer, Lilley and Porter (2015) investigate how culture influences household laundry activities across the United Kingdom, Brazil, and India.

Table 5.1 *Categorisation of household types across the thematic areas*

Household type	Energy consumption	Sustainable lifestyles	Consumption footprints	Critical sustainable consumption
High-income households	Castillo (2017); Hewitt et al. (2016); Ho (2015)		Cai, Liu and Zhang (2019)	
Middle-income households	Khalid et al. (2019); (2015)	Spencer, Lilley and Porter (2015)		
Low-income households	Bohlmann and Inglesi-Lotz (2018); Thondhlana and Kua (2016)	Thondhlana and Kua (2016)		
Comparative household studies		Claudelin et al. (2018); Lavelle, Rau and Fahy (2015)	Baabou et al. (2017); Duarte, Mainar-Causapé and Sánchez-Chóliz (2017); Dutta and Gupta (2018); Lopez et al. (2016); Lopez et al. (2017); Zhang et al. (2017)	Anantharaman (2018)
Count	7	4	7	1

Note: Some of the studies cut across multiple subject areas and are allocated to more than one column category

Many of the included studies (n = 39) are general in scope with no focus on any specific household type. However, some studies that explore issues of energy consumption in households restrict the scope of their studies to high-income (Castillo 2017; Hewitt et al. 2016; Ho 2015), middle-income (Khalid et al. 2019; Spencer, Lilley & Porter 2015) and low-income households (Bohlmann & Inglesi-Lotz 2018; Thondhlana & Kua 2016). Combining multiple household types, Claudelin et al. (2018) and Lavelle, Rau and Fahy (2015) conduct a comparative analysis of high-income and low-income households to understand how a change in household behaviour could improve sustainable lifestyles. The same approach is used by studies that examine consumption footprints and inequality in households (Baabou et al. 2017; Dutta & Gupta 2018; Lopez et al. 2016).

The quantitative method of data collection is the most used technique across three thematic areas. This is the preferred means of data collection for articles that investigate household

lifestyles (Qual. = 7; Quant. = 16) and household consumption footprints (Qual. = 2; Quant. = 15; Mixed = 1). However, studies enquiring into energy consumption in households are balanced, with little preference for a particular data collection technique evident (Qual. = 9; Quant. = 10; Mixed = 2).

Table 5.2 *Categorisation of the countries of study across the thematic areas*

Country	Energy consumption	Sustainable lifestyles	Consumption footprints	Critical sustainable consumption
Developed economies	Berry et al. (2017); Gianniou et al. (2018); Hagbert and Femenias (2016); Herrmann, Brumby and Oreszczyn (2018); Hewitt et al. (2016); Ho (2015); Matos et al. (2017); Pothitou, Hanna and Chalvatzis (2017); Smale, van Vliet and Spaargaren (2017); Yates and Evans (2016)	Allen et al. (2019); Claudelin et al. (2018); Davies and Doyle (2015); Hirano, Ihara and Yoshida (2016); Jalas and Juntunen (2015); Lavelle, Rau and Fahy (2015); Longo, Shankar and Nuttall (2019); Mach, Weinzettel and Scasny (2018); Paddock (2017); Salo et al. (2016); Shim, Kim and Na (2018); Skrinjaric, Recher and Budak (2017); Yates (2018); Yates and Evans (2016)	Baabou et al. (2017); Beylot et al. (2018); Brizga, Feng and Hubacek (2017); Buhl et al. (2018); Duarte, Mainar-Causapé and Sánchez-Chóliz (2017); Lopez et al. (2016); Lopez et al. (2017); Mach, Weinzettel and Scasny (2018); Pothitou, Hanna and Chalvatzis (2017); Salo, Mattinen-Yuryev and Nissinen (2019); Salo et al. (2016); Shim, Kim & Na (2018); Tobarra et al. (2018)	
Developing economies	Al-Marri, Al-Habaibeh and Watkins (2018); Bohlmann et al. (2018); Castillo et al. (2017); Hancevic, Cont and Navajas (2016); Liao et al. (2019); Mohamed et al. (2015); Sole and Wagner (2018); Thondhlana and Kua (2016); Zandi et al. (2017)	Hui, Dong and Jia (2018); Maneesh and Shaharban (2015); Padma et al. (2018); Rakic and Rakic (2015); Thondhlana and Kua (2016); Workicho et al. (2016); Zhang and Lahr (2018); Zhang, Lahr and Bi (2016)	Cai, Liu and Zhang (2019); Ding et al. (2019); Dutta and Gupta (2018); Wang, Liu and Yin (2015); Zhang et al. (2017)	Anantharaman (2018)
Comparative studies across countries	Khalid et al. (2019); Spencer, Lilley and Porter (2015)	Spencer, Lilley and Porter (2015)		
Count	21	23	18	1

Note: Some of the studies cut across multiple subject areas and are allocated to more than one column category

Table 5.3 *Categorisation of the methodologies across the thematic areas*

Methodology	Energy consumption	Sustainable lifestyles	Consumption footprints	Critical sustainable consumption
Qualitative studies	Berry et al. (2017); Hagbert and Femenias (2016); Herrmann, Brumby and Oreszczyn (2018); Ho (2015); Khalid et al. (2019); Matos et al. (2017); Sole and Wagner (2018); Spencer, Lilley and Porter (2015); Thondhlana and Kua (2016)	Davies and Doyle (2015); Longo, Shankar and Nuttall (2019); Paddock (2017); Salo et al. (2016); Shim, Kim & Na (2018); Spencer, Lilley and Porter (2015); Thondhlana and Kua (2016)	Baabou et al. (2017); Beylot et al. (2018); Brizga, Feng and Hubacek (2017); Buhl et al. (2018); Cai, Liu and Zhang (2019); Ding et al. (2019); Duarte, Mainar-Causapé and Sánchez-Chóliz (2017); Dutta and Gupta (2018); Lopez et al. (2016); Lopez et al. (2017); Mach, Weinzettel and Scasny (2018); Pothitou, Hanna and Chalvatzis (2017); Tobarra et al. (2018); Wang, Liu and Yin (2015); Zhang et al. (2017)	Anantharaman (2018)
Quantitative studies	Castillo et al. (2017); Bohlmann and Inglesi-Lotz (2018); Gianniou et al. (2018); Hancevic, Cont and Navajas (2016); Hewitt et al. (2016); Liao et al. (2019); Matos et al. (2017); Mohamed et al. (2015); Yates and Evans (2016); Zandi et al. (2017)	Allen et al. (2019); Claudelin et al. (2018); Hirano, Ihara and Yoshida (2016); Hui, Dong and Jia (2018); Jalas and Juntunen (2015); Lavelle, Rau & Fahy (2015); Mach, Weinzettel and Scasny (2018); Maneesh and Shaharban (2015); Padma et al. (2018); Rakic and Rakic (2015); Skrinjaric, Recher and Budak (2017); Workicho et al. (2016); Yates (2018); Yates and Evans (2016); Zhang and Lahr (2018); Zhang, Lahr and Bi (2016)	Salo et al. (2016); Shim, Kim & Na (2018)	
Mixed methods	Al-Marri, Al-Habaibeh and Watkins (2018); Smale, van Vliet and Spaargaren (2017)		Salo, Mattinen-Yuryev and Nissinen (2019)	
Count	21	23	18	1

Note: Some of the studies cut across multiple subject areas and are allocated to more than one column category

Further analysis reveals that many studies that adopt a quantitative technique gather secondary descriptive data from existing sources such as a national database (Allen et al. 2019; Hirano, Ihara & Yoshida 2016) and primary data through survey administration (Al-Marri, Al-Habaibeh & Watkins 2018; Hewitt et al. 2016). Conversely, qualitative methods of data collection adopted in the literature include in-depth interviews (Anantharaman 2018; Hagbert & Femenías 2016), observations (Matos et al. 2017), focus group discussions (Davies & Doyle 2015) and household tours (Spencer, Lilley & Porter 2015). Only a few articles combine both quantitative and qualitative means of data collection in their studies (Al-Marri, Al-Habaibeh & Watkins 2018; Salo, Mattinen-Yuryev & Nissinen 2019; Smale, van Vliet & Spaargaren 2017).

5.4 Evidence synthesis

Table 5.4 shows a summary of the findings of the literature review synthesis. This section further presents a discussion of the results across all four subject areas highlighted above. The analysis identifies the common themes across the four subject areas and synthesises the findings addressing the research questions.

5.4.1 What are the emerging concerns of research on sustainable household consumption in cities over the past five years?

5.4.1.1 Consumption pattern of urban households

Results show an increasing trend in the rate and intensity of urban household consumption over the last five years (Baabou et al. 2017; Duarte, Mainar-Causapé & Sánchez-Chóliz 2017; Hirano, Ihara & Yoshida 2016). This has also led to an increase in the overall level of carbon emissions from urban households. For instance, Hirano, Ihara and Yoshida (2016) show that given the current consumption pattern in some selected households in Japan, there is a greater increase in indirect, rather than direct CO_2 emissions. In Finland, the overall increase in household energy consumption is attributed to the high intensity and commodification of household consumption activities (Jalas & Juntunen 2015).

However, the analysis of urban household expenditure reveals that types of residential buildings, electricity and transportation are the major consumption elements contributing to the increase in CO_2 emissions (Baabou et al. 2017; Mach, Weinzettel & Scasny 2018). Ding et al. (2019) show that the Global Warming Potential (GWP) of household transportation is further increased with a corresponding rise in automobile possession in China. Other household expenditures such as food consumption, services, clothing, and electronics are also important elements in the material and ecological footprints of households (Baabou et al. 2017). These findings illustrate that there is a relationship between household income level, resource use and the total consumption footprints of urban households (Buhl et al. 2018; Duarte, Mainar-Causapé & Sánchez-Chóliz 2017).

5.4.1.2 Household's level of income

The major concern at the level of urban household income is the corresponding influence it has on the intensification of household consumption activities. Studies show that high-income households engage in more consumption activities which then impact their carbon and material footprints (Buhl et al. 2018; Dutta & Gupta 2018; Zhang et al. 2017). Another impact of a high household income is the increase in the choices and variation of household consumption composition with the potential of owning more energy-demanding appliances (Duarte, Mainar-Causapé & Sánchez-Chóliz 2017; Zhang et al. 2017). However, Rakic and Rakic (2015) show that having a high income is more important than being young or educated in translating positive attitudes into sustainable behaviours. They argue that the awareness of the materials, skills and meanings that are needed to consume sustainably does not necessarily translate to socially responsible behaviour without corresponding high income and product availability (Rakic & Rakic 2015).

In terms of material and waste footprints, there is no concluding evidence to show that high-income households contribute more than low-income households (Buhl et al. 2018; Cai, Liu & Zhang 2019; Lopez et al. 2017). As Buhl et al. (2018) put it, "smaller shares on household expenditure do not necessarily lead to lower material footprints, as resource intensities can be very different between categories of consumption". Nonetheless, Anantharaman (2018) argues

that household income influences the interpretation of similar activities. For instance, middle-class individuals in India distinguish their bicycling activities as being for sustainability purposes as opposed to that of lower-class individuals who engage in it due to necessity (Anantharaman 2018).

5.4.1.3 Sustainability knowledge in household

Studies show that urban households' knowledge and understanding of sustainability issues and processes are still largely inadequate (Al-Marri, Al-Habaibeh & Watkins 2018; Herrmann, Brumby & Oreszczyn 2018). Herrmann, Brumby and Oreszczyn (2018) find that the selected households mostly rely on their memory to explain their energy use with a low level of understanding of energy data and interpreting technological visualisations to explain their home electricity consumption. Furthermore, Al-Marri, Al-Habaibeh and Watkins (2018) note that the lack of awareness about environmental risks is a contributing factor to the high level of energy consumption trends in Qatar.

On the other hand, literature analysis shows that acquiring knowledge about sustainable lifestyles does not necessarily lead to engaging in pro-environmental behaviour because of conflicting expectations and associated high costs. Longo, Shankar and Nuttall (2019), for example, find that the acquisition of more information and knowledge about sustainability leads to a "self-inflicted sustainable consumption paradox" in people's "attempts to lead a sustainable consumption lifestyle" where people become emotionally conflicted about their achievement.

Likewise, Sole and Wagner (2018) show that even when households are informed about the impact of their consumption activities and educated about different sustainable ways of saving energy, they still rely mainly on unsustainable sources of energy such as solid biomass and petroleum fuels. The use of solid biomass for cooking by low-income households such as in developing countries is detrimental to public health, the environment, and the economy (Hafner, Tagliapietra & de Strasser 2018). The reason for the persistent unsustainable household activities could be attributed to the high costs that come with routinely engaging in pro-environmental behaviours (Lavelle, Rau & Fahy 2015) and a household's inability to make sustainable choices in the short term. Therefore, the difficulties individuals face in making sustainable choices and using their acquired knowledge to lead a sustainable lifestyle are not

due to a lack of will but the result of interconnected socio-cultural practices and material factors such as income and product availability (Paddock 2017; Rakic & Rakic 2015).

5.4.1.4 Management of urban resources

Some studies that explore urban household energy consumption conclude that inefficient energy use within households is mainly or partly due to the poor regulation and control of energy supply in cities (Mohamed et al. 2015; Sole & Wagner 2018). For instance, Al-Marri, Al-Habaibeh and Watkins (2018) note that the free nature of the electricity supply and the lack of economic penalty for excessive energy use in Qatar influence the high level of energy consumption trends in the country. Allen et al. (2019) also see a high level of urban carbon footprints as the result of continued reliance on national and regional infrastructure such as coal and gas to generate electricity. Lastly, high resource requirements in cities are related to the large per capita ecological footprints of residents in cities such as Barcelona, Roma, and Marseille (Baabou et al. 2017) which could lead to more challenges in the management of urban resources to meet increasing household consumption.

5.4.1.5 Household use of technology

Some of the studies find that technology affects household consumption negatively (Allen et al. 2019; Castillo 2017; Pothitou, Hanna & Chalvatzis 2017), while others see it as enhancing sustainable household consumption (Berry et al. 2017; Salo et al. 2016). On the one hand, Castillo (2017) notices that an increase in the household use of appliances over time in Mexico leads to an increase in the intensity of practices around household energy consumption. Likewise, Pothitou, Hanna and Chalvatzis (2017) study the impact of ICT entertainment appliances on household energy consumption in the United Kingdom and show that the advent of portable and smart technological appliances doubled household energy demand due to people's ability to engage in diverse activities at different locations in the household almost at the same time. Lastly, Allen et al. (2019) reveal that despite the adoption of effective innovations in households in the United Kingdom, Finland and Germany, their resource consumption and material footprints are far above the 8000 kg per individual limit required to achieve sustainability.

Table 5.4 *Categorisation of the methodologies across the thematic areas*

Thematic areas	Emerging sustainability challenges	Type of data collected	Suggested transition strategies
Energy Consumption **(Liao et al. 2019; Gianniou et al. 2018; Sole and Wagner 2018)**	Increasing carbon emissions High intensity of consumption activities High level of electricity consumption Energy-inefficient buildings Low awareness level of energy consumption's impact on the environment Poor management of urban resources Increasing energy demand due to increasing household appliances	Energy expenditure Emissions due to energy-use Energy prices Energy behaviour and perceptions Practices around energy consumption	Address inequality in energy accessibility Energy generation from renewable energy sources Implement integrated product policies (IPP) Adopting energy-saving technologies Action research and intervention studies
Sustainable Lifestyles **(Allen et al. 2019; Salo et al. 2016; Yates and Evans 2016)**	Increase in income and consumption potential The high cost of adopting a sustainable lifestyle Conflicting social and psychological expectations of a sustainable lifestyle	Household expenditure Household behaviour and practices Emissions due to household consumption	Integrate product and space design Emotional attachment to the household practice process Stakeholder engagement and sustainability education Household active involvement in implementation programmes Economic incentives and price regulation Greening product value chain and green marketing Focus on practices rather than behaviours Segmentation of households in research and policy
Consumption Footprints **(Baabou et al. 2017; Ding et al. 2019; Zhang et al. 2017)**	Increasing commodification of consumption activities Increasing variations in consumption composition The inability of households to interpret and understand footprint data Continued reliance on unsustainable infrastructure The rising level of automobile possession	Demand and supply of consumption footprints Emissions due to household consumption Life cycle inventory data Purchase, possession, lifespan, and service life data	Decarbonise energy consumption and promote the use of renewable energy Targeting households with high emission intensities through policies Promote efficiency in the production process Improvement in national/regional infrastructure
Critical Sustainable Consumption **(Anantharaman, 2017)**	Socio-cultural and class impact on sustainable lifestyles and consumption	Perceptions and actions of social groups	Encourage interactions across social classes through sustainability programmes Explore justice and power dynamics in sustainability consumption research

Note: The references in the first column represent selected examples of the thematic areas except for Critical Sustainable Consumption which has only one article

Conversely, Salo et al. (2016) illustrate that interactive processes and feedback systems of household energy consumption are effective ways of making household consumption choices sustainable. Similarly, Berry et al. (2017) find in an intervention study that despite some challenges, most households can interact with energy-saving technologies and feedback displays to reduce their energy consumption level. In terms of household footprints, Cai, Liu and Zhang (2019) find that technological innovations and increased household expenditure on entertainment reduced the per capita waste footprints of Chinese urban households.

5.4.2 What theoretical frameworks inform the understanding of sustainable household consumption in cities in the last five years?

5.4.2.1 Type of data collected

Studies on energy consumption collect qualitative and quantitative data through both primary and secondary sources on household energy expenditure (Castillo et al. 2017), emissions due to energy use (Gianniou et al. 2018), energy prices (Hancevic, Cont & Navajas 2016), household energy behaviour and perceptions (Mohamed et al. 2015), and energy-related activities (Ho 2015). For studies exploring sustainable lifestyles in urban households, data used to answer their research questions are mostly obtained from three sources: household expenditure (Claudelin et al. 2018; Maneesh & Shaharban 2015; Padma et al. 2018); household behaviour and practices (Davies & Doyle 2015; Lavelle, Rau & Fahy 2015; Yates & Evans 2016); and emissions due to household consumption (Hirano, Ihara & Yoshida 2016). Generally, the studies included in the consumption footprints category collect data on the demand and supply of ecological footprints (Baabou et al. 2017); emissions attributable to household energy consumption (Brizga, Feng & Hubacek 2017; Lopez et al. 2016); life cycle inventory data (Ding et al. 2019); and other consumer data such as purchase, possession, lifespan, and service life data (Beylot et al. 2018; Tobarra et al. 2018).

Anantharaman (2018) explores household consumption from a critical perspective. According to Anantharaman (2018), a critical perspective of viewing sustainable consumption would engage in an in-depth probe of issues such as the exploitation of immigrant labours in the

production of ‘sustainable’ organic foods and why societies view such exploitation as ‘ethical’. Anantharaman (2018) collects empirical data on the views and perceptions of individuals involved in sustainable consumption activities at community and organisational levels in Bangalore, India. Across all thematic categories, the data collected to study urban household consumption varies from one study to another. The data type also largely depends on the theoretical lens adopted and the research questions the study aims to answer. All included studies offer insight into past and potential future changes in household consumption.

Almost half of the studies exploring sustainable consumption in urban households adopt a theoretical approach in their research (n = 27), while others prefer to investigate sustainable household consumption through a grounded approach (Hewitt et al. 2016; Smale, van Vliet & Spaargaren 2017; Sole & Wagner 2018). For clarification, studies categorised as using a grounded approach are those with no theoretical framework and do not aim to formulate a theory from the findings. A large percentage of the studies that use theoretical frameworks employ models (n = 18) while only nine studies use social theory in their research. Models, in this context, are frameworks that give a factual interpretation of household consumption through quantitative, graphical, verbal, or visual representations. On the other hand, social theories provide general explanations of household consumption with variations in interpretations of reality. This finding shows that there is a need for more studies that use social perspectives to explain household consumption in cities concerning achieving the SDGs. Social theories could offer useful explanations and understanding of complex phenomena such as urban household consumption beyond the capture of a model. The type of data collected by the included studies and their corresponding theoretical frameworks are outlined below.

5.4.2.2 Model-based studies

Salo et al. (2016) make use of an action model to study unsustainable consumption patterns and design strategies that could assist households in transitioning towards sustainable consumption in Finland. Similarly, Allen et al. (2019) apply an ‘agent-based model’ in a study on the impact of scientific innovations on household lifestyles (living, food, mobility, and energy) in 10,000 households in the European Union. In another study on sustainable lifestyles,

Lavelle, Rau and Fahy (2015) draw on the ABC (attitude, behaviour, and structural conditions) model developed by Guagnano, Stern and Dietz (1995) to disaggregate pro-environmental behaviour in the Republic of Ireland and Northern Ireland.

As examples of studies that adopt a Multi-Regional Input-Output (MRIO) model, Zhang and Lahr (2018) calculate "household indirect energy use for a particular time point" using a Structural Decomposition Analysis (SDA) framework while Mach, Weinzettel and Scasny (2018) develop a hybrid input-output model to determine how emissions from Czech households impact the environment. Data analysis shows that most of the studies (n = 7) that report on the consumption footprints of households are based on an MRIO model (Baabou et al. 2017; Tobarra et al. 2018; Zhang et al. 2017).

Other models adopted include using a Social Accounting Matrix (SAM) to calculate the direct and indirect emissions from household consumption in different Spanish regions (Duarte, Mainar-Causapé & Sánchez-Chóliz 2017) and analysing the unplanned aspects of household energy consumption with the values-beliefs-norms (VBN) framework in the United States (Hewitt et al. 2016). Furthermore, while Ding et al. (2019) use the process life cycle assessment (PCLA) to estimate the amount of greenhouse gas (GHG) emissions from Chinese households, Wang, Liu and Yin (2015) adopt the economic input-output life-cycle assessment model in combination with the structural decomposition model to explore the factors that influence indirect carbon emissions from household consumption in China.

5.4.2.3 Social theories

Most of the studies with a social theoretical perspective employ practice theories (Ho, 2015; Khalid et al. 2019; Yates and Evans, 2016). Smale, van Vliet and Spaargaren (2017) explore how newly introduced smart grid technologies shape household energy consumption and the implications for domestic practices such as leisure and cooking in The Netherlands. Likewise, Khalid et al. (2019) study how households adapt energy-related practices like laundering to the system change in electricity provision in Pakistan and Denmark.

Other social theories include understanding practices around fuel use in South Africa through the social construction of technology (SCOT) perspective (Sole & Wagner 2018); understanding the dilemma people face in acting upon knowledge and information on sustainable living through the Consumer Culture Theory (CCT) (Longo, Shankar & Nuttall 2019); and, exploring the issue of social justice and class inequality in household sustainable consumption in India through the lens of critical social theory (Anantharaman 2018).

5.4.3 What strategies have been identified for achieving sustainability transitions in urban household consumption in the last five years?

5.4.3.1 Urban administration and local-level intervention

One of the strategies suggested by the included studies to achieve sustainable consumption in urban households is the need for infrastructural development (Al-Marri, Al-Habaibeh & Watkins 2018; Sole & Wagner 2018; Zandi et al. 2017). Decarbonising energy consumption and promoting the adoption of renewable energy are the main strategies identified to improve energy generation and supply and to achieve the Paris climate agreement (Bohlmann & Inglesi-Lotz 2018; Wang, Liu & Yin 2015; Zhang et al. 2017).

However, the most common strategy highlighted among the included studies is the focus on carrying out policy initiatives and intervention programmes at local and household levels instead of nationally driven programmes. For instance, a nationally driven programme may not be easily adaptable to the specific needs and social realities of local communities. Therefore, Allen et al. (2019) argue that countries would not be able to achieve the SDGs without the involvement of local-level administrations in adopting and continuing environmental policies. Duarte, Mainar-Causapé and Sánchez-Chóliz (2017) also note the importance of regional governments in designing and evaluating environmental policies for mobility education and industrial development. Thondhlana and Kua (2016) recommend that local or municipal governments could implement long-term household-driven intervention programmes that promote sustainable energy use.

Studies have shown that households are capable of sustainable energy consumption through the application of interventions that target household behavioural change (Berry et al. 2017; Thondhlana & Kua 2016). However, it is not clear if such behavioural change is influenced by an individual's intrinsic motivations or solely due to external drivers. To reduce household contributions to climate change, Mach, Weinzettel and Scasny (2018) propose that policies could target the set of households with very high emission intensities in heating, electricity, and transportation.

Zhang et al. (2017) share a similar sentiment by suggesting the implementation of different policy initiatives across household income levels, promoting efficiency in the production process and categorising goods based on their emissions level. Considering the potential of achieving sustainable lifestyles within households, Claudelin et al. (2018) demonstrate that through some short-term savings and behavioural changes in households, a gradual shift to the adoption and investment in renewable energy could be achieved while a long-term change could result in transitions across all societal institutions.

Most of the studies agree that the effective implementation of such local-level intervention programmes requires adequate stakeholder engagement, sustainability education and the participation of households in implementing sustainable consumption policies (Claudelin et al. 2018; Zhang & Lahr 2018). Rakic and Rakic (2015) argue that collaborative consumption and involvement of households in community activities could encourage households to view themselves as co-producers of goods and services, thus improving efforts towards achieving sustainable living. Salo et al. (2016) also highlight the importance of one-on-one contact with households to create awareness and assist in the interpretation and understanding of their consumption patterns.

Other studies also emphasise the role of civil societies and non-governmental organisations (NGOs) in influencing household consumption choices through campaigns, workshops, and community events (Anantharaman 2018; Davies & Doyle 2015; Longo, Shankar & Nuttall 2019). For instance, Anantharaman (2018) demonstrates that an NGO was able to bring about a transformational relationship through the interaction of middle-class environmental

advocates and lower-class resource recoverers in sustainable consumption advocacy in India. As a result of this, more recognition was afforded to the rights and contributions of the resource recoverers (Anantharaman 2018).

5.4.3.2 Economic and technological initiatives

One of the economic strategies identified in the literature to achieve sustainable consumption in urban households is the implementation of integrated product policies (IPP) (Ho 2015; Yates & Evans 2016). This could be done by targeting the interrelationships between the production and consumption of goods and services (Yates & Evans 2016) and implementing economic-related initiatives such as price regulation; providing economic incentives for sustainable behaviour; and promoting green products and services, among others (Mach, Weinzettel & Scasny 2018; Thondhlana & Kua 2016). Spencer, Lilley and Porter (2015) further outline seven guidelines that could assist designers to impact household sustainable behaviour. These include understanding the flow of households; integrating product and space design; and making the user have an emotional attachment to the household practice process (Spencer, Lilley & Porter 2015).

In line with this, there is a need for greening the production processes of goods and services. Longo, Shankar and Nuttall (2019) suggest that greening the value-chain of goods and services could lead to a positive change in the lifestyle of individuals and the reduction of feelings of guilt experienced by those who could not live sustainably due to market-related challenges. Also, Liao et al. (2019) propose that households' reliance on water resources through energy consumption could be reduced by policies that promote the adoption of water-saving technologies and reduce water intensities in the upstream sector through drip irrigation. Studies show that technology innovation, design and development are important in reducing consumption footprints and promoting energy conservation and monitoring in urban households (Berry et al. 2017; Cai, Liu & Zhang 2019; Liao et al. 2019).

5.4.3.3 Research focus and theoretical approach

In terms of future research trajectories, Ho (2015) suggests that research questions could be framed in terms of transitions from current practices to more sustainable outcomes. He also proposes complementing quantitative methods such as household energy use modelling with qualitative methods (Ho, 2015). Ho also believes researchers should search for household consumption challenges beyond the obvious to include issues such as "environmentally-problematic unmetered consumption" (2015). For Sole and Wagner (2018), exploring multiple household practices through qualitative research methods would open up context-specific issues and multi-layered factors that need explanation, especially in developing countries.

Furthermore, Yates and Evans (2016) and Paddock (2017) imply that understanding household consumption should go beyond considering behavioural instances or outcomes to include the study of the interlinkages among practices, how they are embedded in larger social institutional arrangements, and how they shape household choices and lifestyles. Lastly, Anantharaman (2018) calls for sustainability consumption researchers to embrace critical social theory as a way of questioning the current system of capitalist oppression in household consumption and thus create alternative insights into how to approach the sustainability challenge through discussion of power, justice, and societal oppression.

5.5 Discussion of findings

5.5.1 Policy implications

The main aim of this paper is to examine emerging sustainability challenges in urban household consumption over the last five years and related policy implications. A systematic literature review on the subject is particularly important for researchers, policymakers, and sustainability actors to understand the studied challenges and the lessons that can be derived from them in the wake of implementing the SDGs and sustainability transitions in cities.

The major conclusion drawn from the findings presented above is that significant sustainability challenges relating to consumption still face urban households across both developed and developing countries. There is also a need for local and household-level perspectives in designing policy actions hoping to address sustainable consumption challenges. These sustainability challenges, as examined in this study, are multifaceted and extend beyond the four walls of households to include socio-economic, political, environmental, and technological factors (Castillo 2017; Hancevic, Cont & Navajas 2016; Herrmann, Brumby & Oreszczyn 2018). Data analysis shows that at the current rate, meeting the SDGs set in motion in 2015 may be unachievable for national and metropolitan governments across the world by 2030 without the right intervention policies in urban household consumption (Allen et al. 2019).

However, a review of the included studies shows that households can consume sustainably with the right mix of structural, practical, and socio-cultural elements (Hirano, Ihara & Yoshida 2016; Thondhlana & Kua 2016). This implies that there is significant potential for facilitating sustainable household consumption through implementing policies highlighted in this review. Regrettably, the ongoing negative impact of household consumption on the environment is proof of the largely ineffective implementation of sustainability policies at the household level by local administrations. As shown in the analysis, existing literature on the subject since 2015 has proposed introducing economic incentives (Lopez et al. 2017), adopting renewable energy (Allen et al. 2019), changing household behaviour (Brizga, Feng & Hubacek 2017), improving national infrastructure (Mohamed et al. 2015), enhancing stakeholder engagement (Longo, Shankar & Nuttall 2019) and promoting sustainability education (Al-Marri, Al-Habaibeh & Watkins 2018), among others.

This paper contends that hitherto, policy implementation has focused on changing market forces and appealing to individual rational choices to achieve sustainable development with little success. Given the urgency of climate change and sustainability transitions of cities, the study calls for a broadening of policy focus to impact practices that are involved in producing household consumption outcomes instead of behaviours (Strengers & Maller 2014). Practices are the underlying units that make up social structures and are composed of material elements,

competencies or skills and meanings that interact to inform actual consumption (Shove, Pantzar & Watson 2012; Warde 2005). Scholars have increasingly adopted practice theory to study household consumption issues such as waste and energy-related practices (Schanes, Dobernig & Gözet 2018; Smale, van Vliet & Spaargaren 2017).

For instance, Paddock (2017) shows that understanding food consumption through a practice lens reveals the routine activities that interact to bring stability or change in household consumption. These interdependent practices would otherwise be overlooked when focusing on individual attitudes, beliefs, and choices in implementing social change. As argued by Strengers and Maller (2014) and Browne (2015), a modification of policy focus from direct behaviour change or technological improvement to impacting household practices could provide efficient methods for achieving sustainable consumption in cities. Recognising that policymakers could face the challenge of adapting existing behavioural research outcomes to practice-oriented policy initiatives, the study recommends a broadening of theoretical orientations from understanding behaviours or people to understanding practices (see Strengers and Maller [2014] for more discussion on integrating policy and practice).

5.5.2 Implications of findings for research

As mentioned above, it is established in the literature that research outcomes and policy implications have some degree of influence on the design and implementation of policy intervention programmes (Nutley et al. 2019; Weiss 1979). Scholars have adopted consumer culture theory (Longo, Shankar & Nuttall 2019), critical social theory (Anantharaman 2018), practice theories (Davies & Doyle, 2015), life cycle assessment (Wang, Liu & Yin 2015) and MRIO-based models (Brizga, Feng & Hubacek 2017) in studying sustainable household consumption in cities over the last five years. Although this reflects the multidisciplinary nature of the field, there is still a need for more social research to have a contextual understanding of urban household consumption.

Given that research outcomes are shaped by the theoretical framework studies they are based on, the study recommends the adoption of theories of practice in exploring sustainability issues in urban household consumption. Furthermore, it is argued that to ensure sustainable transitions and achieve the SDGs, empirical investigations on urban household consumption should not only have knowledge contribution as their end goal but should also embed the design of innovative policy strategies into their objectives.

The analysis shows that there are more studies on energy-related consumption than materials. Thus, future studies could examine practices around material consumption in households. For instance, plastic consumption is a major sustainability concern in developed and developing countries (International Finance Corporation 2017; Akanle & Shittu 2018; Omolawal & Shittu 2016). Therefore, exploring the practices around household plastic consumption in cities would help to understand the constituting elements in practices around domestic plastic use, and also show how these elements are interwoven with, and influence other household practices. Exploring and mapping out the complexities of household practices and their interrelationships could assist in designing specific policy initiatives that could impact household consumption across different domains.

Lastly, as analysis shows only a few studies adopted mixed-method and comparative approaches in collecting data, future studies could consider collecting household consumption data with both qualitative and quantitative methods to strengthen and enhance data analysis. Conducting comparative studies across income and geographical levels, for example, could be instructive in understanding the influence of socio-cultural factors on household consumption and designing relevant policy interventions for each household category. In addition, future studies could adopt a 'zooming in and out' method in studying emerging sustainability concerns in urban household consumption (Nicolini 2009). This implies that future research should not only consider understanding the intricacies and composition of household consumption but also explore how household consumption is connected to larger socio-cultural institutions.

5.6 Conclusion

This paper aims to contribute to sustainability transitions research and policy by synthesising emerging sustainability challenges in urban household consumption since the introduction of the SDGs (Goal 12); understanding the theoretical frameworks adopted to study these concerns and analysing the policy initiatives that have been proposed to achieve sustainability transitions. Given the SDGs' emphasis on local-level actions, discussing these objectives is important to show how the topical sustainability concerns in urban household consumption identified since 2015 can be addressed and to identify the lessons to be derived for future studies and policy initiatives. As argued above, understanding sustainable consumption challenges from a household perspective is important in achieving the SDGs and having a real impact on the consumption choices of urban households.

Based on the findings in this study which shows that fewer studies on urban household consumption are conducted in developing compared to developed countries, considerable attention must be focused on the emerging needs and challenges facing megacities in both developed and developing countries through research and policymaking to achieve the SDGs on a world scale. As a consequence of a globalised world, efforts to achieve sustainable development in some parts of the world while ignoring others could seriously undermine global outcomes, without adequately addressing the inadequacies in the socio-technical and economic systems of the ignored cities – one of the reasons for critiquing the Millennium Development Goals. This suggests that researchers and international organisations should engage in more comparative studies of sustainability issues in urban households across developing and developed cities. Although such an approach requires more resources, adopting a comparative analysis will help to identify the socio-cultural and institutional dynamics that influence practices related to urban household consumption and how the sustainability policies could be implemented within each city's context.

Furthermore, although urban households have the potential to consume sustainably, their consumption patterns are a long way from meeting Goal 12 with the increasing intensification of household consumption activities. Despite the continuous 'pro-environmental behavioural change' campaign by governments, international organisations, and civil societies, findings

reveal that sustainability education is still very low among urban households. This study also reveals that such sustainability campaigns may not only create psychological conflicts within people but may also be difficult to translate to actual practices due to other socio-economic factors such as income level.

In contrast, rising income levels have led to an increase in household use of appliances which then increases household carbon footprints. This implies that urban household consumption should not be studied in isolation but through a multiple-domain perspective to understand how households are influenced by or influence other socio-technical arrangements through their consumption choices. Such systems thinking is necessary to achieve the recent clamour for the creation of a circular economy in developing and developed countries.

As a result, the included studies recommend sustainable transition strategies across design and industry (energy-saving technologies), policy (improved national infrastructure), household (household behaviour change) and research domains (sustainable behaviour segmentation). This study's findings indicate that the continued unsustainable consumption in urban households calls for an expansion in the focus of policy and research from individuals and structures to the inclusion of practices which inform and constitute them respectively. Therefore, future research could adopt theories of practice, focus on material elements, and employ comparative, mixed-methods, and 'zoom in and out' approaches to the understanding of sustainable household consumption in cities. The outcomes of these studies could then inform policy initiatives that aim to impact household practices to achieve sustainability transitions.

CHAPTER SIX

"Almost Everything in the House now is Plastic": Foregrounding Plastic Materiality in Household Routines and Practices

This chapter reproduces an adapted version of an academic paper published in Sociological Research Online (Shittu 2021a). The published paper is here reproduced in its entirety, but without the formatting evident in the published version. In addition to the published paper, more research findings that answer the second research question (see section 1.2) are presented while photographs of plastic materials from low-income households in Surulere, Lagos are presented in 6.4 along with their corresponding themes.

The published paper explores how plastic facilitates the reproduction of practices in urban households. To explore how cities can transition to circular plastic economies, it is important to empirically understand the current sociomaterial configuration of plastic-related practices in households. Case studies were selected from low-income households in Lagos to examine the physical aspects of plastic that are invoked in practice performance; how plastic facilitates the spatiotemporal arrangements of practices and which household practices are materialised through plastic items.

This chapter presents an empirical investigation of plastic-related practices in low-income households in Lagos, Nigeria. The chapter interrogates the materiality of plastic in manifesting and organising household routines by interacting with other practice elements. Understanding the role plastic plays in the sociomaterial arrangements of day-to-day activities holds significant importance for social theory, research, policymaking, and product design. For instance, for a successful transition to CPE, it is important to examine the different spatiotemporal forms plastic takes in all societal domains including households. Also, while there is a lot of theorising in the practice literature about the material composition of practices, this study extends the theoretical and empirical knowledge of materiality in engendering practice dynamics. Moreover, the focus on Lagos as a case study of a less-developed city presents different contextual insights into the use of plastic materials in daily living.

The methodology involved selecting twelve low-income households in Surulere, a Lagos suburb, as case studies with an exploratory research design. By adopting a mixed-methods approach involving face-to-face and phone interviews, home tours and directed photography, the study overcame the challenges presented by the COVID-19 pandemic. Using NVivo for data analysis, themes relating to plastic-related practices, meanings, and spatiotemporal qualities were generated through inductive and deductive techniques. Plastic-related practices identified in low-income households include hygiene-related practices, comfortability or entertainment practices, storage practices, food-related practices, and child-rearing practices.

The identified corporeal features of plastic in household practice performance include thickness, weight, transparency, insulation, aesthetic design, and volume. By embodying the above practices through its unique physical properties, plastic engenders affective and socio-psychological meanings of safety, convenience, sanitation, privacy, and accessibility among others. The spatiotemporal qualities of plastic in materialising household practices include mobility, space-time consumption (the way plastic use up space and enables activity sequencing), space demarcation, space maximisation, performance efficiency and task sequencing.

Given low-income households' limited access to socio-economic and spatiotemporal resources, plastic materials perform an active role in configuring, shaping, disrupting, and organising sociomaterial and spatiotemporal arrangements in practice performance. This chapter establishes that materiality is not only relational as discussed in practice literature but also corporeal or intrinsic. The chapter concludes by stating the importance of considering the dynamics of plastic use in households in policymaking and design, especially for enabling the transition to the CPE.

This chapter has been published in an academic journal (see below for the published paper). The paper was published in Sociological Research Online because it encapsulates the objectives of the journal in publishing empirical studies that deal with current sociological issues of popular and material culture, environment, and theory development among others. The paper bridges the knowledge gap on materiality and material agency in Practice theory literature thereby serving as an anchor for future empirical studies. The paper presented below includes additional pictorial data that are not in the published version.

Abstract

The impact of materials in disrupting routines and practices has recently become significant in scholarship and policymaking. This has motivated alternative social theories such as practice theory to look beyond the traditional human behavioural approaches to how objects exert their materiality in achieving daily activities. While there is a substantial theoretical body of work on materiality in practice theory, this study focuses on plastic and asks how plastic facilitates the reproduction of practices in households. To foreground plastic materiality, this study makes use of the data collected in the case studies of low-income households in a suburb of Lagos, Nigeria through a mixed-methods approach, including interviews, household tours, and directed photography. The data analysis combines inductive and deductive approaches to facilitate an iterative process of identifying and refining themes related to the research aim. As a ubiquitous material, plastic facilitates the performance of household practices related to hygiene, comfortability, storage, food, and child-rearing, among others. By interacting with other practice elements, plastic actively materialises household routines through its corporality or physical features, functionality, and spatiotemporal quality. The implication of these dimensions in enabling or disrupting household routines is further discussed. The findings present important lessons for advancing the corporal and relational dimensions of materiality in social theory and implementing sustainability policies.

Keywords: household, materiality, plastic, practice theory, routine

6.1 Introduction

The practice theory literature has established that the characteristics of materials can actively shape the way otherwise reflexive practices are carried out (Hawkins 2010; Shove 2014). To appropriately respond to resource constraints and environmental challenges, it is thus not only recycling or disposal characteristics that matter but, critically, also how materials (such as plastic) shape household practices and use. According to practice theory proponents, practices form the basic unit of social life and recruit individuals, who then embody the affective and know-how elements as carriers (Shove et al. 2007). Put simply, practices are bundles of doings and sayings that involve materials, meanings, and skills to achieve some valued goals (Strengers & Maller 2014). While some aspects of practice performance require discursive endeavours, it also involves less thought-out habits and routines. Routines, a diminutive of the word 'route' (Ehn & Löfgren 2009), create safety and security for practitioners by simplifying tasks or uncertainties and efficiently using time and energy (Wilk 2009).

In all societal domains, perhaps the most routinised activities are to be found in the household (Nicholls & Strengers 2015). For the average person, the household provides what Giddens (1984) calls 'ontological security' by serving as a space for mental relaxation, body rejuvenation, social preparation, and emotional expression. These meanings are the teleological aims of most domestic practices and are accompanied by affective experiences. Because household activities are mostly carried out reflexively (Wilk 2009), their material elements are also relegated to the background of social life. Unless they break down (disrupting practice), household objects remain mostly anonymous to the carrier in the performance of household practices.

However, recent efforts in practice theory have made attempts to unveil the active role these seemingly passive materials play in shaping the performance and dynamics of practices (Jørgensen, Madsen & Læssøe 2017; Shove 2014; Svabo 2009). Plastic is an example of a material that may appear inactive in domestic routines and practices. For instance, Hawkins (2009, 2010, 2019) explores the role of plastic materiality in politics and ethics. Beyond being a passive object in practice performance, plastic "presents its materiality as something to be

experienced and negotiated" (Hawkins 2010, p. 127). Therefore, the materiality of plastic is enacted in the reiterative process of practice performance and negotiated through the reconfiguration of material and discursive arrangements (Hawkins 2009). In this article, materiality is conceptualised to encompass the corporality (physical features), the functional aspects (meaning mediation), and the spatiotemporal qualities of an object in the context of practice performance.

The overarching issue of this article is, therefore, *how does plastic facilitate the reproduction of practices in households?* The specific questions are as follows: what are the physical aspects (corporality) of plastic that promote its functionality or expression of meanings? How does plastic engender the spatiotemporal arrangement of practices? And what household routines and practices are materialised through plastic items? This article makes use of data collected from low-income households in a less-developed city's suburb to expose the dimensions of plastic materiality in households. The article makes three contributions to practice theory and research.

First, while the socio-economic challenges confronting low-income households may limit their access to valued spatiotemporal resources, the way they navigate such constraints is not well documented. Hence, this study bridges this gap by analysing how a ubiquitous material like plastic enhances household spacetime utilisation through daily routines. Second, previous studies show that the spatiotemporal nature of practices is largely influenced by the contexts within which they are enacted (Southerton 2009). Therefore, given the diverse socio-cultural realities and institutional arrangements of less-developed cities, this study provides new context and insights into the spatiotemporal flow of materials in household practices. Following Khalid and Sunikka-Blank (2017), this study expands the conceptualisation and understanding of practices beyond the dominant Western case studies. Third, this study adds to the need for a practical understanding of domestic plastic use in policymaking and urban administration (Shittu, 2020). Finally, this study fulfils Nicolini's (2009) recommendation for empirical studies to zoom into practices at the level of performance.

The following sections start with a review of topical literature on the concepts of materiality, spatiality, temporality, and plastic in theories of practice. After presenting the study's methodology, the article then provides a brief background on plastic management in the study location. This is followed by the analysis of the dimensions of plastic materiality in households, the discussion of findings and the concluding remarks.

6.2 Materiality, spatiality, temporality, and plastic in theories of practice

The role of materials and materiality in the emergence, evolution, and dissolution of practices and concerning space and time is well documented in practice literature. For instance, Shove, Pantzar and Watson (2012) recognise materials (such as stuff and things) as one of the elements that constitute practices alongside meanings and competences. The unique ways materials are combined in each contextual enactment of a practice partly produce the accumulated changes that occur to such practices over time (Shove 2010). However, materials are not mere tools to be manipulated in the fulfilment of tasks or goals but active agents in conveying functionality, emotions, and affections in practice performance. As Maran and Stockhammer (2012, p. 1) put it,

> . . . the way humans and objects communicate during social practices is very powerful: . . . it persuades us to change either the surroundings or ourselves and it forces us to believe that objects have a will of their own.

Practice theory scholars have recently integrated non-human agency into the understanding of practices and the role materiality plays in their performance (Everts, Lahr & Watson 2011), for instance, drawing on the notion of materials as co-agents in the reproduction of social phenomena in Actor-Network-Theory. Focusing on the conceptualisation of materiality in practice theory, Schatzki (2010, p. 129) views practices as separate from, but coexisting with, what he calls "material arrangements' – the interconnection of 'humans, artefacts, organisms, and things of nature". Material arrangements relate to practices through mutual "causality, prefiguration, constitution, and intelligibility", thus possessing some agency in practice performance (Schatzki 2010, p. 139). Although other scholars differ by maintaining that materials are essential components of practices alongside meanings or images and competences or know-hows, they still acknowledge the capacity of non-human objects to actively influence

human dispositions or express “meanings about their needs” (Hawkins 2019; Shove et al. 2007; Strengers, Nicholls & Maller 2016, p. 774).

Aside from objects being the means of expressing meanings, emotions, and skills in the day-to-day iteration of practices, they also function as the physical embodiment of the spatiotemporal evolution of practices as entities (Schatzki 1996). This means that an understanding of the geographical and temporal manifestation of artefacts could unveil the doorway to narrating the stability or dynamics of practices as links that are connected or broken among the constituent elements (Shove et al. 2007). Therefore, the analysis of household practices in Lagos may reveal additional spatiotemporal dimensions of materiality, given the unique socio-cultural configurations of practices in less-developed nations. According to Miller (2008), another way materiality connects to temporality is through the interaction of things with practitioners and the memories created by the day-to-day application of those things in practice performances. Shove, Trentmann and Wilk (2009) express a similar view of materials as markers of past events, objects that stabilise time, and instruments to navigate future occurrences.

However, Schatzki (2009) prefers to interpret temporality not as connected with the human total life course, but with human daily activities. Borrowing the term ‘existential temporality’ from Heidegger (1962), Schatzki (2009) argues that the three dimensions of temporality (past, present, and future) are inherent characteristics of the performance of practices. In this sense, the three dimensions manifest instantaneously in practice performance and disappear in the same way when activity ceases. Schatzki (2009) sees temporality not as a separate phenomenon but as a unified phenomenon with spatiality he refers to as timespace. He understands the ‘spatiality’ aspect of the concept to be ‘the world around (an actor) in its pertinence to and involvement in human activity’. The concept of timespace differs from the conception of spacetime as an objective reality common in the literature.

Whether spacetime is regarded as a teleological phenomenon or an objective reality, materiality anchors settings and moments. When practices are viewed in a teleological timespace, materials constitute the places and paths that create the settings for a carrier’s daily activities

(Schatzki 2009). Similarly, the dimensions of temporality are achieved in the arrangement of materials when a carrier approaches, performs and departs from such activity (Schatzki 2009). Meanwhile, the performance of practices in objective spacetime is also expressed through and by the unique combination of objects in a defined spatial context and specified moment. Stemming from this, households who share similar material arrangements and hence practices may also share similar features of teleological and objective spacetime.

There is a substantial body of literature that studies the management of plastic waste in cities (Akanle & Shittu 2018; Lam et al. 2018). However, few scholars analyse the materiality of plastic concerning wider political, socio-economic, and environmental practices. The consensus in this growing body of literature is that the current view of plastic as an environmental challenge in public and political discourses may be a hindrance to achieving sustainable development in cities. Hawkins (2010) argues that while plastic objects are imbued with several material qualities, they perform and influence humans in various ways depending on the sociomaterial arrangements at play (e.g., from everyday routines to environmental campaigns).

Similarly, Evans et al. (2020, p. 7) contend that plastics "can only be understood in terms of the wider networks and relations of which they are part". The services that plastic packaging provides, such as "freshness, convenience, safety, accountability and affordability" may not be easily replaced by other materials given plastic's embeddedness in the current socio-economic system (Evans et al. 2020, p. 7). As such, they suggest that more attention should be paid to plastic packaging regulations and changing extant norms to facilitate the sustainable reconfiguration of consumer practices. However, such practice reconfiguration can only be possible with a grounded understanding of how plastic materiality is implicated in day-to-day routines and practices as presented in this study.

6.3 Research methodology

This study aims to investigate how the materiality of plastic manifests in household practices. An exploratory case study approach was adopted to focus on plastic-related practices within

their real-life context and uncover the dimensions of plastic materiality in households (Yin 1994). In all, 12 low-income household cases were studied in Surulere, Lagos (Nigeria). According to Strauss and Corbin (1998), at least 10 interviews or case studies are needed for theory structuration. The participating households each earned less than US$150 per week and were recruited through a snowballing approach (Parker, Scott & Geddes 2019). The majority (five) of the households were led by men aged 20–49 years. However, most of the interviewees were women (10/12). The cultural context within which the study took place views women (or wives) as the custodians of the home, hence, the gender imbalance. The typical household size was four to six members. Initial participants were recruited with the help of research assistants and snowballing (onwards referral) was used to grow the sample size. The study obtained ethics approval from the human research ethics committee of Swinburne University of Technology (SHR Project 20201222-3365).

The study employs a mixed-methods approach to reveal the different aspects of plastic materiality in household routines (Browne 2016). The initial research design involved collecting data through face-to-face interviews and home tours in two households. Maller and Strengers (2016) contend that a home tour "not only prompts participants' memories but allows the material dimensions and skilful performance of practices to become more prominent". Participants recounted how materials are utilised in their daily activities and showed the researcher the locus of plastic-related practices within the household. However, in response to the onset of COVID-19, in-depth phone interviews and conversations with directed photography were utilised in 10 households. Photo direction is centred on the types of plastic materials in the household as well as their use and storage spaces. Visual data provide the researcher with a means to scrutinise the various aspects of practice performance (Martens 2012) – in this case, the materiality of plastic in low-income household routines.

Table 6.1 *Dimensions of plastic materiality in five central household practices.*

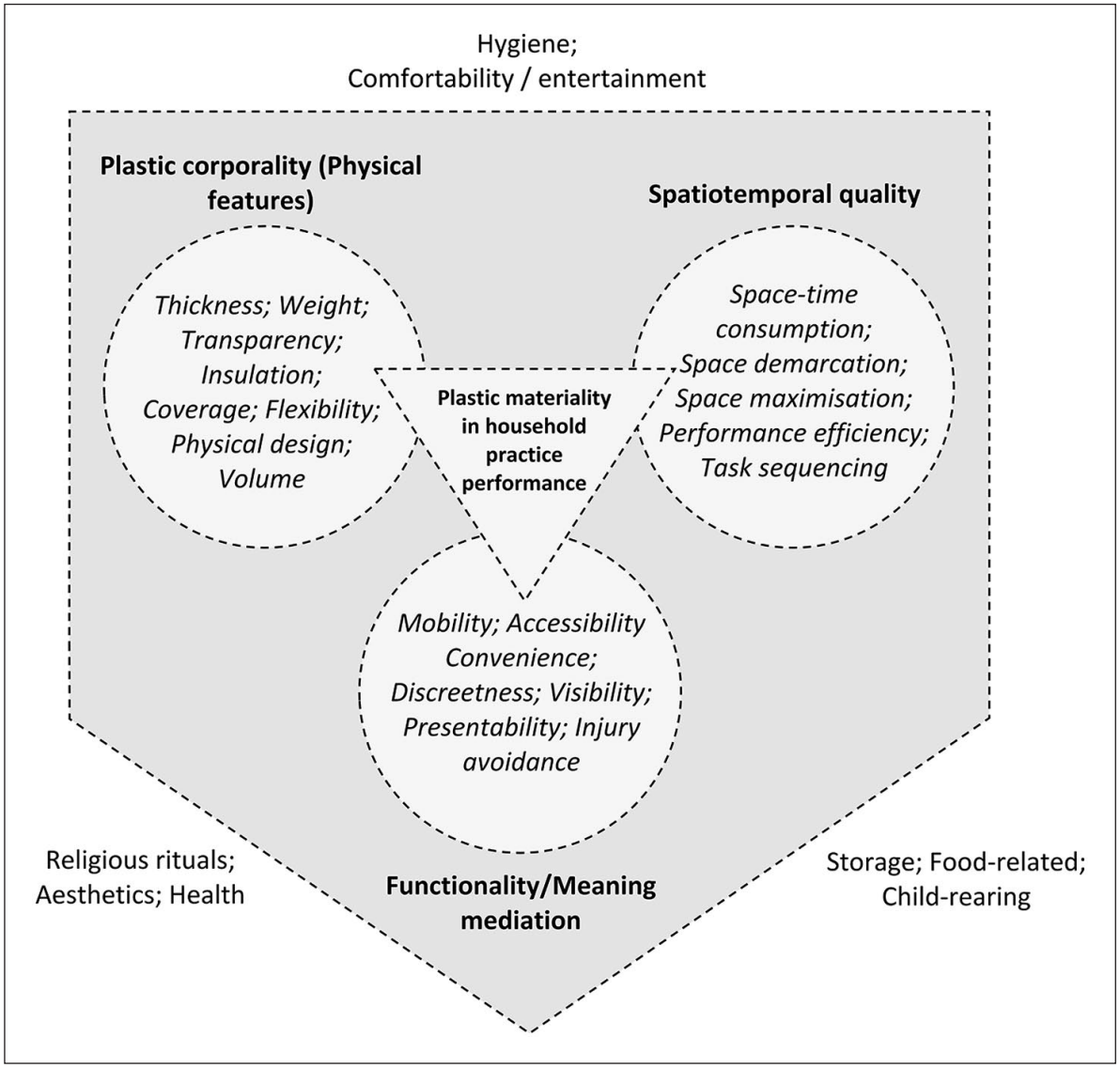
Practices	Fundamental tasks to do with plastic/on plastic	Examples of plastic	Key aspects of plastic's materiality	The function of plastic	Plastic's site of social action	Plastic's essential time or period of social action	Instances of quotes said about plastic
Hygiene-related practices	To keep the body, other objects, or the environment sanitary	Buckets, bowls, dustpans, toothbrushes, personal effects container	Mobility, lightweight, convenience, retainment, transference	Plastic as a container	Bathroom, kitchen sink, room, and compound surfaces	Day: morning, evening Week: weekend	"We use plastic [buckets] to bathe… My children also have plastic potty to defecate."
Comfortability and entertainment practices	To enable cooling, relaxation, and amusement	Technological components, hand fans, chairs	Insulator, flexibility, lightweight, artistic design, weight support	Plastic as an enhancement	Living room, in hand, bedroom, outdoors	Day: evening Week: weekend	"We have remote controls made of plastic for our television… we also have plastic hand fan that we use when there is no light."
Storage practices	To safeguard, preserve and arrange items	Buckets, bowls, barrels, bottles, bags	Accessibility, coverage, transparency, thickness, hollowness, retainment, non-infiltration, mobility, space maximisation, privacy	Plastic as a protective material	Refrigerators, cupboards, under the bedstead, compound, storage, bedroom, and kitchen shelves	Day: any time after item retrieval Week: Any day after item retrieval	"I have a big, covered plastic [bowl] where I store the likes of spaghetti and all that… If I put it in a carton, it will consume more space, so I put it inside a covered plastic and [then] inside a cabinet. With that, I am able to save some space."
Food-related practices	To satisfy hunger, nourishment, taste, and social ritual/festive events	Bags, spoons, plates, bowls, coolers, bottles, strainers, trays, sachets	Convenience, mobility, lightweight, insulator, discreetness, efficiency, privacy, non-infiltration, accessibility, thickness, coverage, transparency, presentability, flammable	Plastic as a facilitator	Kitchen counter, cupboard, refrigerator, in-hand, living room, bedroom, compound, market	Day: anytime Week: any day	"For my kitchen, I use plastic for cooking. I mean when I want to wash say my rice, plastic tends to be handier than using [stainless steel]."
Child-rearing practices	To promote the nourishment, healthiness, cleanliness, entertainment, and education of a child	Baths, bottles, spoons, plates, playthings, baskets, flasks, diapers, tables, chairs, buckets	Mobility, flexible, lightweight, convenience, non-infiltration, insulator, weight support	Plastic as a safety-related material and information carrier	Living room, bedroom, outdoors	Day: morning, evening Week: weekend	"When I go out and I see a toy that I like and feel it will be educative, I buy it. Like the Lego block… it makes my boy retentive and sometimes he put colours together."

Voice data were coded and analysed with NVivo Plus. Audio analysis was employed to retain the unique discursive elements of the interviews since they were mostly conducted in the participants' languages, such as Yoruba and Pidgin English. Language-embedded emotions are important to understand the way plastic materials enable affective expressions in household

routines. To identify the dimensions of plastic materiality in household practices, both inductive and deductive coding techniques were adopted to generate themes from the interview data, such as ‘plastic-related practices’, ‘reasons for use’, ‘space of use/storage’, and ‘time of use’, among others. The deductive process informed themes that were generated from the research questions, while the inductive approach identified themes from the data analysis. The themes were then refined and reorganised through an iterative process of multiple items coding, while notes and memos were developed to identify anecdotal or theoretically intriguing scenarios. The final themes identified from the interviews guided the analysis and writing of the research findings as summarised in table 6.1.

Figure 6.1 presents the conceptual framework for plastic materiality comprising the corporal, functional, and spatiotemporal dimensions in low-income households. The dimensions of figure 6.1 are drawn from the analysis of household interviews. Corporality in this context simply refers to the physical state of an object or being composed of matter. The spatiotemporal quality denotes the existence of an object in spacetime and its involvement in a practice’s manipulation of the same. Meanwhile, functionality refers to the purpose, meanings, and affective states that are expressed through an object by practitioners during practice performance. As depicted in figure 6.1, plastic as an active material (centre triangle) combines these three dimensions (inner circles) in several ways in practice performance to manifest hygiene, storage, aesthetics, and other practices and routines (outer pentagon). To illustrate, in performing a storage practice, a transparent plastic item with a cover (corporality) can be employed to store food items, thus demarcating space away from pests and prolonging the food item’s life cycle (spatiotemporal quality) to express meanings of convenience and sustenance (functionality).

Figure 6.1 *The dimensions of plastic materiality in household practice performance*



6.4 A brief background on plastic use and waste management in Lagos, Nigeria

Nigeria, like many other less-developed countries, faces several challenges in managing plastic waste in the country (Adebiyi-Abiola et al. 2019). According to Babayemi et al. (2018), plastic imported in its primary form and as product packaging constituted about 30% of total plastic imports (1996–2014) in Nigeria. Plastic bottles, shopping bags, combs, dustbins, refuse sacks, and furniture are some of the household items produced with imported plastic (Babayemi et al.

2018). Other household objects with plastic components include refrigerators, air conditioners, laundry washing machines, and motor vehicles (Babayemi et al. 2018). Plastic shopping bags and plastic packaging, the most prominent waste items produced in the country, usually end up in landfills (Duru, Ikpeama & Ibekwe 2019). Although governments at all levels have attempted to enact laws to control plastic consumption and disposal, plastic waste still plagues the environments of major cities including low-income suburbs (Adebiyi-Abiola et al. 2019; Nwafor & Walker 2020).

As the centres of production and consumption, major cities experience rapid population growth and as a result, serve as the hotspots of plastic waste generation in Nigeria (Kofoworola 2007). Lagos, the country's economic hub, generates an estimated 12,000 tonnes of waste per day, with plastic contributing approximately 15% (Adebiyi-Abiola et al. 2019). The Lagos Waste Management Authority (LAWMA) charged with environmental law regulation and enforcement has also taken up the collection, transportation, and disposal of waste in the city (Kofoworola 2007). Recently, the city administration has improved the public-private partnership on plastic waste management while encouraging social enterprises in the recovery and recycling of plastic materials (Adebiyi-Abiola et al. 2019). Despite this, the plastics recycling sector is dominated by informal and small-scale businesses faced with economic, health, and social challenges (Akanle & Shittu 2018).

The setting for the study shows how plastic has been problematised in urban administration and policymaking (Hawkins 2010). This problematisation encourages policymakers to focus on managing the volume and environmental consequences of plastic materials through collection and disposal. As a result, there is little focus on how plastic materiality engenders the reproduction of the practices that create the resulting waste management challenges. Despite this, the continued use of plastic materials in households signifies their importance in facilitating domestic routines. In the proceeding sections, this study aims to unfold the dimensions of plastic materiality in low-income households in Surulere – a suburb of Lagos, Nigeria.

6.5 Unpacking plastic materiality in manifesting household routines and practices

> I want you to understand that we can't do without this plastic stuff . . . Seventy per cent of what is at home is made of plastic and if anyone breaks, things don't look as they should be at home. Like the shoe rack, when one of the old broke I felt somehow. It will not make things look fine...

The preceding quote from an interview participant expresses the ubiquitous nature of plastic materials in low-income household practices. This pervasiveness comes from the utilisation of plastic in design, manufacture, technical processes, and other consumer goods. The malleability of plastic materials makes it easy to embody practical functions in the performance of household practices. Hence, this section discusses the materiality of plastic in manifesting household routines. Table 6.1 details the dimensions of plastic materiality described and identified in the interviews. These dimensions relate to hygiene, comfortability, storage, food, and child-rearing.

Low-income households, especially in a less-developed economy, experience significant environmental injustice (Adamkiewicz et al. 2011) and considerably lack adequate access to essential socio-economic resources, including household income, household water systems, and other household amenities (Addo 2016). As a result, the material arrangements in these households facilitate the stable, cheap, and efficient reproduction of daily routines. Consequently, the routine application of plastic materials in achieving ordered tasks is enabled through embodied experiences, meanings, knowledge, skills, and general understandings. The bundling of these repetitive activities accompanied by their affective outcomes create the plastic-related practices identified in low-income households. It should be noted that the following categories are not absolute or mutually exclusive but involve interwoven elements or practices as shown in table 6.1.

6.5.1 Corporality and functionality/meaning mediation dimensions of plastic materiality in household routine reproduction and practice performance

Given the ubiquity of plastic materials, it is no surprise that plastic is present in the performance of household practices (table 6.1). While the affordability of plastic may be important for households with limited financial resources (such as in this study), its wide-ranging application is shown to be more valued in low-income households than its low cost. A participant whose household earns less than US$50 per week expresses this sentiment:

> ...most of what we use is plastic and I don't think about the financial aspect because when I need iron, I buy iron and when I need plastic I go for plastic. There are things that iron can do that plastic cannot do...

Beyond economic considerations, this section shows how the functionality of plastic in the performance of household practices is connected to the material's physical features and its wider social significance.

The functionality of plastic is embedded in its physical features and expressed with meanings and know-how in practice performance as shown in figure 6.1 and table 6.1. The findings in this research indicate that the utility of plastic material is derived from its corporal dimension including height, plasticity, width, weight, aesthetic design, rigidity, thickness, clearness, curvature, or a combination of any of these (figure 6.1). For instance, some households use transparent, lightweight, and covered plastic materials in storing salt, cooking oil, spices, and other food ingredients to enable easy identification and retrieval when needed in cooking, eating, or drinking (table 6.1). A participant with three children explains this thus: "in the kitchen, I prefer transparent plastic because I use it to store spices so even if I am not around my children can identify it". In a related study, Hawkins, Potter and Race (2015) note that plastic bottles enable the mobility of water in outdoor settings and consumers' concerns with health and water quality. Similarly, the materiality of the plastic bottle connects industrial packaging with hydration, bodily exercises, and outdoor exercises (Hawkins 2019).

In table 6.1, plastic's thickness, volume, and curvature are important physical features in liquid storage. These characteristics are especially important for low-income households when

fetching and transporting water with the body, for example, due to drawing water with hands, lifting containers with arms, and balancing vessels on the head. For practice performers, employing plastic to collect and store water involves mentally examining the capacity of the body and the plastic's density, among others:

> We don't use plastic that can break to fetch water especially because we carry it up and down. The one we use to store water, food and spices don't normally break anyhow like that . . . How I make sure a plastic [item] does not break is that I don't put more water than I can carry because there are some days where you won't use all your strength, so it falls and breaks.

Relatedly, plastic items also perform an implicit function of safety and injury avoidance in household practices such as transporting, entertainment, storage, cooking, and child-rearing (table 6.1). While some households prevent kitchen accidents by utilising plastic bowls in the cooking process as a thermal insulator, others use plastic in refrigeration as an electrical insulator to avoid electrical shocks. From the case studies, a household only buys lightweight plastic items for children's use to avoid harm. This functionality is further explained by a mother of one thus:

> ...anyone can use [plastic]. Those children can easily use it. It will not break, and it will not injure them, unlike your stainless or ceramic plate that can easily injure a child when it falls. But if a plastic plate falls, it can easily be picked up without hurting the baby or the child... For me, that is [the reason I use plastic items].

The prevention of bodily harm further exemplifies the multifunctionality of plastic and its interaction with meanings, competences, and other materials in practice performance. The study demonstrates that plastic enables the longevity and safety of other materials, such as consumables, clothing, and valued household items. As summarised in table 6.1, the use of plastic for item preservation expresses the psychosocial meanings of sustenance, maintenance, privacy, healthy living, and efficient resource utilisation. Also, as a material that embodies functions and meanings, plastic use requires the appropriate knowledge, skill, and social understanding from the practice carrier for its successful application in practice performance. For instance, a certain level of understanding and skill is needed for household members to repurpose a worn-out or broken plastic item in other household practices. Nevertheless, the expectations of children to use new or fully functioning toys may compel households to dispose of broken plastic toys.

Depending on their unique physical characteristics, the foregoing indicates that in the interaction with other elements in practice performance, plastic materials can physically change over time. Such degradation, in turn, affects the capacity of plastic to convey functional and socio-psychological meanings in practice performance. The loss of a plastic material's quality to evoke affectivity and thus achieve a task in the performance of practice may lead to its transfer to other suitable household practices. In this respect, Jørgensen et al. (2017) note that the decay of material not only links it to the past through memories but also engenders thoughts about possible future uses. As explained by a participant below, when the valued attribute of a plastic material's physical feature is lost, it is 'downgraded' as a vessel for other less important household practices or goes to waste:

> When the children's toys break, there is no means of restoring them, so I have to dispose of them. But for the bowls, cups, and basins in the kitchen, when they break, I find another means of still using the plastic. Perhaps I might use it for just storage, or I might use it to put a sponge or maybe as a bailer.

The lifespan of plastic is determined by its corporality, level of attachment to other materials, and changes in its functions. In this regard, the study identifies three general categories of household plastic. The first category includes plastic items expressly designed for use in a specific task or practice (whether single or multiple uses). The inability to continue fulfilling this purpose means the end of its lifecycle in the household. Repairing or repurposing these plastic materials may be impossible given their attributes. Examples of this category include plastic water sachets, sporks, spoons, plates, toothbrushes, food sieves, pants, and toys. The second category includes plastic materials designed to be structurally embedded with other artefacts as a component. Their use within the household is dependent on function and durability, usually a technical or aesthetic object. Clothing materials, washing machines, fans, irons, blenders, televisions, remote controls, refrigerators, water closets, electric lamps, and electrical sockets were examples given in this category. The third category of plastic items includes those not designed with any specific task or practice in mind. Their use may involve multiple tasks across multiple household practices. They are also easy to repair or repurpose which elongates their lifespan. Most items in the participating households belong to this category and they include plastic bowls, buckets, bags, tanks, and coolers.

6.5.2 Spatiotemporal qualities of plastic materiality in household practices

figure 6.1 shows the spatiotemporal qualities of plastic in household routine reproduction. The involvement of plastic in reproducing routines engenders the mobility of the material from different sites and periods of social action within and outside the household. Table 6.1 provides details on additional sites of social action of plastic-related household practices. The extent to which plastic is mobile in practice performance is influenced by and influences the usage category it belongs to. Category 3 plastic items (above) appear to be the most mobile given their multifunctionality. Category 2 plastic items appear the least mobile due to their specific spaces and times. Regardless, this study shows that household plastic items have relatively defined spaces of use and storage as a material element in practice performance. A participant living in a one-bedroom apartment comments on assigning functions and spaces to the household plastic materials thus:

> The plastic used in eating is different from that used in washing plates and everything is in different sizes. You don't put bathing buckets in the kitchen but bowls the same way you don't put cooking bowls in the bathroom... We also use buckets to wash, and they have their own space in the house.

It can be inferred from the preceding quote that the socio-cultural expectations around hygiene limit the mobility and interaction of plastic materials utilised in different household spaces. Khalid and Sunikka-Blank (2017) also identify the influence of socio-cultural expectations and norms on household practices as manifested in the spatiotemporal ordering of household materials. Several interviewees reiterate how plastic materials associated with hygiene and body cleanliness practices (e.g., defecation, bathing, and washing) are meant to be applied and stored away from those employed in food-related practices. This, therefore, promotes the confinement of those materials to their assigned spaces of use which in most cases also serve as their space of storage.

However, this spatial arrangement and separation of plastic materials may vary significantly depending on the size, proximity, or privacy of the sites of social action, and the frequency of material usage. Households occupying self-contained one-room apartments with a small

kitchen and bathroom space were able to store cooking, eating, laundry, bathing, and body adornment items in the same space. By contrast, a household living in a lodging house with shared kitchen and bathroom spaces stored plastic items utilised for cooking and bathing in the living room or locked cupboards to prevent others from utilising them. Although the shared kitchen space is demarcated with an implicit recognition of individual privacy, storing items openly risks others utilising them. As one interviewee highlighted, this discreet use of other households' items is further facilitated by the lightweight feature of plastic materials, which produces little or no sound when moved. This attribute also sets plastic apart from other cooking objects with the capacity to produce reverberating sounds such as stainless-steel items. The consideration of usage, frequency, and space in low-income storage practices is well-captured by this participant in a lodging house:

> ...the big coolers that I don't use every time... they are stored far from the surfaces... because I don't have enough space [but]... the ones that I tend to use [regularly], they are very close by for easy access.

A plastic material enters the household space in different ways, including direct or indirect purchase, sharing, gifts, and recovery. They sometimes also leave the household domain by the same means or, more likely, through different forms of waste disposal. Within the household, a plastic item's spatial mobility is governed by its use (or non-use), cleaning (or lack of cleaning), and storage (or non-storage). Furthermore, the iterative but varied enactment of these processes creates the unique ways plastic materials interact with other practice elements to achieve the ordered tasks in household activities.

The spatial mobility of plastic material is not only intrinsic in its features, but importantly relational to other material and non-material elements in practice performance. The same is true for the temporal mobility of plastic items. Although a plastic material exists in time as an object, its real value in household practices comes from its participation in the temporal arrangements of tasks and activities. The moment plastic material is invoked in the sequential ordering of tasks is as important in practice performance as other contextual considerations like materiality, spatiality, meanings, and skills. When preparing food, for instance, a plastic bag may only be utilised to transport food items after purchase to the kitchen, while a plastic plate may only be employed to serve after having performed other cooking tasks.

It is important to note that although household practices may involve multiple materials and an array of knowledge and skillsets, each performance may involve diverse and unique combinations of these elements in achieving the affective goal(s). The use of plastic as a material element may in some cases dominate the routine performance of some activities, while in others it may be a less invoked pattern of manifesting practices. Moreover, each performance of practice could involve the use of a different set of plastic materials. This is influenced by other material items, the patterns of other associated practices and broader spatiotemporal arrangements or changes.

Finally, the findings here show that aside from the time of day, the type and frequency of plastic use may vary across the week. Participants engage in practices that require heavy plastic use, such as handwashing, house cleaning, shopping, and home cooking mostly on weekends. This is because most households spend more time at home and prepare for the new week at weekends. Household practices during the week involved fewer plastic items as they occur mostly in the morning to prepare for life outside the house, or in the evening to recuperate from nonhome activities. The variations in the frequency of plastic use between weekdays and weekends may become relatively blurred under particular circumstances as narrated thus by this mother of two:

> At the beginning of this [coronavirus] pandemic, there have not been schools, so my children make use of their toys almost every day... But before now when they had to go to school and I had to go to work, I only use most plastic in the evening and on weekends.

6.6 Plastic-related household practices

6.6.1 Hygiene-related practices

Plastic contributes to the materialisation of hygiene-related practices through the interaction of its corporal, functional and spatiotemporal dimensions. A participant in a household of three describes the multiple functions of plastic as a container thus:

> We cannot do without plastic in the morning. You go to the bathroom where you have your bathe with plastic… you make use of your [plastic] laundry basket where you store your clothes... you make use of your [plastic bucket] and [plastic] drum where you store water… you

> also make use of hand wash because we have to wash our hands regularly and we have a little [plastic] bottle for that.

From the findings, plastic items including buckets, bowls, toothbrushes, and sponge cases facilitate bodily hygiene in households including bathing and flushing. Plastic buckets also enable cleansing routines in households with showers due to the irregular supply of water and electricity. For some households, plastic potties provide healthy, safe, and convenient alternatives to water closets in shared restrooms for children and women. In most households, plastic facilitates the performance of other hygiene-related practices such as laundry and housecleaning at weekends. During the weekdays, plastic enables household members to perform body cleansing routines as they prepare to leave the household domain to perform other socio-economic activities. In their analysis of daily routines, Ehn and Löfgren (2009) underscore the importance of morning routines (or mindless activities) in preparing the mind and body of the practitioner for the day's demanding tasks (or the mindful ones).

Another aspect of hygiene-related practices facilitated by plastic materials involves cleaning household materials. Plastic materials and other household appliances with plastic components enable and are the object of the sanitation of household items. Some of the items that are often sanitised include clothing materials, cooking utensils, household appliances with plastic components and other items used for eating and drinking. The plastic items employed in the cleaning process include water buckets, sponge cases, plastic soap bottles, washing machines with plastic components, baths, bowls, kegs, laundry baskets, and irons with plastic components (for pressing laundries). These hygiene-related plastic materials are usually invoked in the kitchen, the bathroom and mostly in outdoor spaces for those in lodging houses. While plastic items such as cooking utensils are cleaned every day due to their multiple daily uses, others such as clothing items are manually washed mostly at weekends when household members can have time away from work to prepare for the following week.

Lastly, plastic items aid the sanitisation of indoor and outdoor spaces. The plastic materials involved in these activities include plastic buckets, plastic mopping sticks, plastic dustpans, plastic waste bags and plastic dustbins. The use of plastic items in cleaning indoor spaces such as living rooms and bedrooms mostly occurs in the morning while the cleaning of kitchen

spaces happens after every use. For those in lodging houses, personal plastic items are employed in cleaning shared spaces such as bathrooms, kitchens, and other outdoor spaces. Cleaning activities are rotated among the tenants mostly weekly.

6.6.2 Comfortability and entertainment practices

Plastic acts as an enhancement in the performance of household practices that result in temperature reduction, easiness, and amusement. The technological amenities identified from the study that provide household members with recreational functions, contents or programmes include electric fans, toys, games, television sets, radio sets, smartphones, and their paraphernalia. Most of these household items depend on electricity supply from energy providers before they can be used. The irregularity of power supply in these low-income households leads to the creation of alternative ways of performing comfortability and entertainment practices. For instance, plastic materials such as hand fans, chairs and cups or bottles enable some households to relax outdoors (especially at night), take drinks and fan their bodies to provide cooling. Entertainment practices are mostly performed during the evening time when household members retire to rest and at weekends for recuperation from the week's socio-economic activities.

6.6.3 Storage practices

Storage practices are one of the bundles of plastic-related routines identified in the study. The materiality of plastic in practices results in the short- or long-term storage of items for safeguarding, preservation and/or organization purposes. The findings demonstrate that plastic safeguards numerous household objects including cleansing agents, medicine, waste, baby affects, other plastic items and water. Plastic assists households with children to store hygiene-related items such as clothes to prevent stains as explained by this father of three: *"Before in the house, we normally keep our clothes in little [iron] box[es]. But we have stopped using it… we now put our children's clothes in plastic containers so that they will not get dirty"*. Plastic materials have generally replaced iron vessels for storage purposes because the former does

not rust. Besides, plastic drums enable households living in areas with poor access to an adequate water supply to store water temporarily as explained by this participant:

> For instance, when there is no water supply in the house, we have a plastic drum… we used iron drum before… now we use plastic [drum to] store water. When we do not have electricity for some days, we use the stored water. We cannot do without using plastic because it is very convenient to use.

Another reason why plastic materials have generally replaced iron containers in storage practices relates to their lightweight and flexible physical features. These physical features enable the former to provide better mobility and safety than the latter in storage practices. These meanings are especially important for low-income households given their inability to afford large physical spaces and the need to share common spaces with others. A household participant living in a one-bedroom apartment describes the importance of using plastic containers for item storage thus:

> Plastic [material] is easy to lift and does not cause body injuries unlike old steel buckets – we don't use those again. When we take a plastic [material] and we are done using it, we place them inside each other. We pick the one we need, use it in the kitchen or bathroom and then return them after use. It is easy to move around.

As shown in the preceding quote, a significant way in which plastic assists households to maximise physical space is through being stacked up whether on the ground, on other household objects such as tables, in cupboards, on walls or on shelves. In this instance, the two main factors that influence the proximity of plastic materials to their respective sites of social action are their frequency of use and the availability of physical storage spaces. Regarding space availability and as highlighted in paper three, plastic items in households with shared spaces may only be stored in the living room or doorway. However, large plastic items such as water drums or baths used in manual washing may be stored outdoors for houses within large compounds. Plastic materials that are invoked in regular day-to-day activities such as cooking are usually stored close to the practice locus. For household practices that are performed periodically or less often, the associated plastic materials may be stored far away from the locus of plastic. As with other practices highlighted in this study, plastic materials function as a physical nexus between food-related practices and storage practices in low-income households. This linkage is further discussed in the following section.

6.6.4 Food-related practices

The study shows that plastic materials play a prominent role in the keeping and preservation of food items in low-income households including grains, vegetables, cooking oils, spices, seasonings, and powders. These plastic materials may include bags, bottles, and bowls whether as carriers or packaging. The first role performed by plastic materials involves the storage and mobility of food items from the point-of-sale such as restaurants, stores, or open markets into the household. In this regard, plastic materials create a spatial shield around purchased goods thus providing protection to these items and enhancing privacy. When inside the household space, plastic materials further serve as a temporary vessel for food items before they are used in the cooking process. Enclosed plastic containers not only offer holding spaces for the stored items but also prevent pest attacks and other contaminants.

Plastic items further enhance the cooking process in households by holding cooking items and functioning as thermal insulator. For one of the households, plastic materials serve as a flammable object to kindle the burning of firewood in outdoor traditional cooking. This could be related to the household's lack of understanding of the health effects of traditional cooking or access to alternative cooking methods given their low socioeconomic status. After food preparation, plastic items also help to prolong the life of the food by operating as electrical and thermal insulators through refrigerating or heating.

Findings further indicate that low-income households depend heavily on plastic materials in eating and drinking activities. As indicated in section 6.6.3, large basins, coolers, and other plastic items are used to cook, store, or serve food items during social or festive events such as naming ceremonies or birthday celebrations. Furthermore, plastic bowls serve as a hand wash basin before and after eating as part of the food ingestion routine. Similarly, plastic cups facilitate the taking of hot tea as part of a household's morning routine during the week given the material's thermal insulation feature. This prevents a thermal burn to the body when sipping, holding, or moving the teacup from the table to the mouth. In another household, plastic trays enhance food presentation when serving and its mobility from the kitchen to the

dining room. This way, plastic mediates the expression of hospitality, especially when serving older members of the household or visitors as expressed by this mother of two: *"I have separate [plastic] plates for children visitors… like [my son's] friends… I keep those plates aside for them and we don't use them to eat…".* Hosting the friends of one's children may constitute child-rearing practices which are further examined in the following section.

6.6.5 Child-rearing practices

The study shows that the dimensions of plastic materiality manifest in household routines that revolve around the teleoaffective qualities of raising a child. According to Löfgren (2014), material objects are embedded and cooccur with affects which prompt some emotions or memories when applied in practice performance. For instance, the feeding of a child in a household may go beyond satisfying the baby's hunger to include an expression of motherhood, fatherhood or caregiving depending on the circumstances. Paper three further shows how these meanings interact with corporality and spatiotemporal quality to enhance the performance of child-rearing practices. A mother of two sums up the safety, mobility, and information transition functions of plastic materials in child-rearing practices, thus:

> My children have a quite number of toys made of plastic… they have Legos, a pusher, and a bicycle. I have a baby girl of about 3 months, and she cannot use steel to eat because it might injure her gum, so I have to make use of the plastic spoon for her. The same thing for my boy too… I had to make use of the plastic cup for him to drink water because if it is ceramic, he might drop it and get injured.

As identified from the study, the plastic materials used in child-rearing practices can be grouped into serving two functions relating to their contact with the bodies of children in the household. First, plastic items that do not directly have contact with the bodies of children such as water buckets and flasks are mainly used to provide functions such as mobility, insulator, non-infiltration, and flexibility. Second, plastic items that directly interact with the bodies of children such as spoons, playthings, potties, and chairs can offer convenience, weight support, flexibility, lightweight qualities and prevent bodily harm. Some other important but less prevalent plastic-related practices identified in the study are highlighted in the next section.

6.6.6 Other plastic-related practices

The study further reveals two less widespread but significant plastic-related practices in low-income households which are fulfilling religious beliefs and beautifying the household. First, plastic facilitates the performance of religious practices in low-income households. Plastic kettles enable household members practising the Islamic religion to hold water when performing an ablution – a ritual washing of the body before praying. Plastic kettles not only function as water containers but their lightweight feature provides mobility and convenience to the practitioners when engaging with the material during the ritual performance.

Second, plastic also facilitates the beautification of household spaces. The plastic materials involved in aesthetics-related practices are those designed with attractive physical and ornamental attributes. The items are usually hung on walls or placed in strategic areas of the household space most especially the living rooms. Lastly, plastic items act as containers for health and medicinal products to facilitate mobility and convenience in health-related practices. Aside from the pharmaceutical plastic bottles that are obtained directly from hospitals or chemists, some households also use bottles to contain traditionally concocted medicines.

6.7 Discussion of findings

According to Ehn and Löfgren (2009), routines are small paths created in daily living that reduce conscious decision-making by practitioners. As illustrated in figure 6.1, the dimensions of plastic materiality interact to facilitate the contextual and efficient routinisation of household activities by blending into the background of daily living. The study shows that it is precisely through their materiality that plastic items interact with other practice elements, including bodies, meanings, embodied skills, and other objects (see figure 6.1). These features also separate plastic materials in households from other materials in their ability to convey meanings of mobility, convenience, and safety in household practice performance. These findings lend credence to what Giddens (1984) refers to as ontological security or "the deep-seated trust people have that their world is secure and predictable" (Phipps & Ozanne 2017, p. 361). The

way plastic presents its materiality as something convenient, safe, and easy to manipulate produces a sense of trust and confidence in performing daily routines without disruption.

As Wilk (2009) notes, routines and habits are mainly disrupted through physical, spatial, or temporal changes in material arrangements. This is reflected in the study through the displacement of or damage to plastic items. The inability of a plastic item to anchor the manifestation of a task may result in the temporary disruption of the activity. However, depending on the degree of damage, the defective plastic item is either repaired, repurposed, or disposed of. Defective plastic materials are mostly replaced with new or repurposed plastic items that are physically able to anchor the teleoaffective qualities of the practice. Phipps and Ozanne (2017) theorised how widespread social disruptions could result in the breakdown and reconstitution of practical understanding anchored in material arrangements. In this respect, the findings here show that COVID-19 and the consequent stay-at-home policies intensified the reproduction frequency of household routines and therefore plastic use. An area for further study is to investigate how material arrangements are impacted by social disruptions and the incursion of work-related practices into the household space.

Finally, this study shows that in addition to the political and economic dimensions of waste disposal, plastic exerts its materiality on household practices that are critical to understanding the demand, use, and reuse of plastic. Plastic anchors household routines and practices related to hygiene, comfortability, storage, food, and child-rearing. The analysis highlights the continuous interaction of meanings, skills, and materials in routinising household activities. In doing this, it zooms into practices at the level of performance (Nicolini 2009). Future studies could zoom out of the household domain to explore the role of materiality in large-scale teleoaffective formations (Welch 2017), general understandings, and practice constellations. For instance, the conceptual understanding of a circular plastic economy at the household and societal level, or the influence of general understandings of sustainability on household plastic-related practices could be explored.

6.8 Concluding remarks

This study investigates how plastic materials manifest domestic practices in the context of low-income households, to contribute new insights into theory and practice. Shove (2009) argues that household practices and routines consume and compete for space and time around practitioners. In addition, for low-income households with limited access to spatiotemporal resources, practices consume or contest spacetime through material arrangements. The analysis in this article reveals that a dimension of plastic materiality is its spatiotemporal quality which is invoked when practices manipulate spacetime. Practices, manifested in materials, actively configure, shape, and organise spatiotemporal landscapes in performance and vice versa. In doing so, material arrangements mediate the meanings of mobility, efficiency, and comfortability for practitioners.

Furthermore, the findings of this study suggest that the material, meanings, and skills elements of practices have correspondences with materials such as corporality, functionality, and spatiotemporal qualities. These findings raise implications for the ongoing discourse relating to the anthropocentric view of practice embodiment and the agency of materials or more-than-human bodies in practice performance (Strengers, Nicholls & Maller 2016). Shove (2014) notes that material qualities are an attribute of practice and do not reside in an item. Meanwhile, the findings of this study imply that it is important to review the coexistence of both corporal and relational dimensions in materiality for further theoretical development. For instance, the physical and (some) spatiotemporal qualities of an object may be said to exist outside of a practice and are only invoked in practice performance to mediate functions and meanings, thus both corporal and relational.

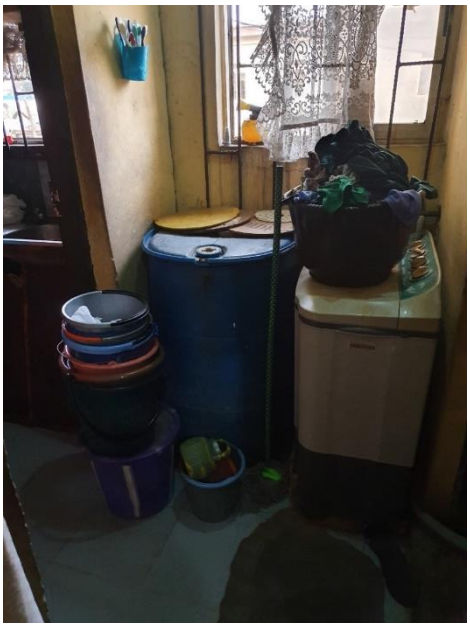
As suggested in this study, although the lightweight nature of plastic may only be useful in practice performance when interacting with other practice elements, that physical feature is intrinsic in the material and may not be found in other objects such as glass or iron. Furthermore, the malleability of plastic's physicalness makes it capable of anchoring several meanings and interacting with other materials, hence, its prominent usage in many household routines and practices. Therefore, this study is an indication that there is a need for the further

development of a theoretically informed understanding of materiality and material agency in practice theory literature.

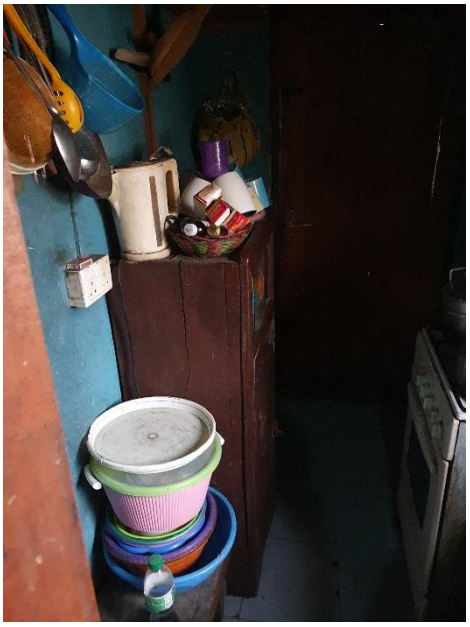
Finally, while plastic has been problematised due to its impact on the environment, this study shows that some policy strategies such as an outright plastic ban may not be effective in changing household practices (Evans et al. 2020). As revealed in the findings, plastic materials have become entrenched in household routines and habits and are instrumental in expressing valued emotional and teleological meanings. Sustainability stakeholders should pay more attention to facilitating the circularity of plastic to reduce its incursion into the environment.

A well-implemented circular plastic economy could engender the reconstitution of existing practices by phasing out unsustainable aspects while promoting new sustainable practices. The adoption of new sustainable practices could reduce the consumption of harmful plastic, promote the reuse of essential plastic items, and cater for the proper recycling of plastic alongside other sustainability strategies. Product design could also consider the design of plastic items that meet strict environmental standards and the identified functional and spatiotemporal aspects of household practice performance. It is recommended that future studies investigate how such strategies could be implemented in local, national, and global contexts.

6.9 Selected photographs of plastic materials with themes in low-income households in Surulere, Lagos

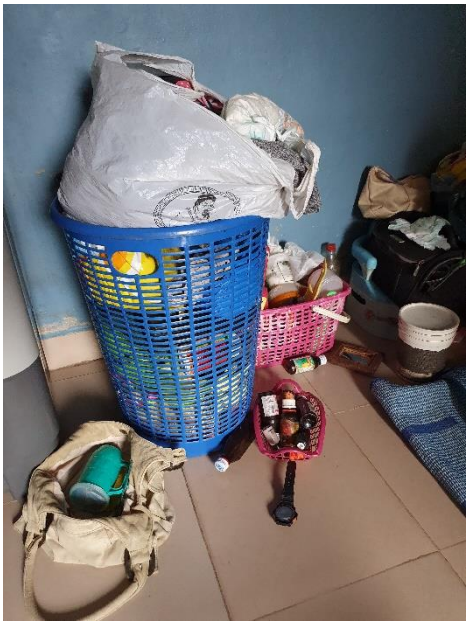


Durable materials for reuse; covering for content protection; technological component
Hygiene, storage, and religious practices; mostly weekend and morning performances;
Embedded and multiple functionalities; ground and wall storage for easy retrieval;
Lightweight for mobility and safety; heavyweight for stationary materials



Durable materials for reuse; covering for content protection; technological component
Food-related and storage practices; mostly morning and night performances;
Staking and wall storage for space maximisation and easy retrieval; repurposing;
Embedded and multiple functionalities; lightweight for mobility and safety

Durable materials for reuse; high ground storage for occasional use;
Food-related and storage practices; mostly weekend and morning performances;
Embedded and multiple functionalities; thick for thermal insulation and item durability;
Shape-facilitated functionalities; mostly outdoor and ceremonial use



Durable materials for reuse; mostly weekend and morning performances;
Hygiene, health, child-rearing, and storage practices; covering for content protection;
Ground and wall storage for space maximisation and easy retrieval; repurposing;
Embedded and multiple functionalities; lightweight for mobility and safety

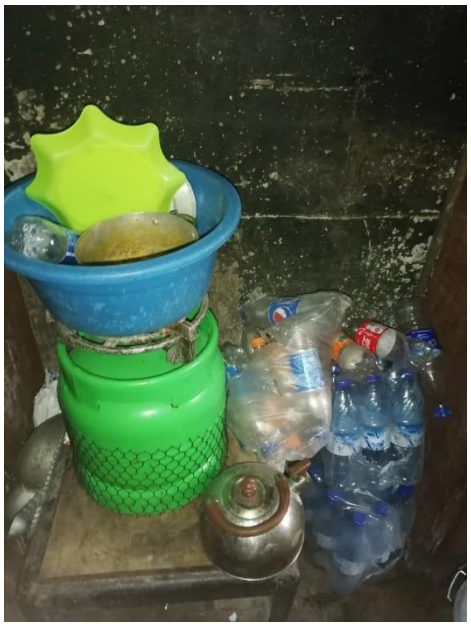
Durable materials for reuse and single-use for convenience; technological component
Laundry and child-rearing practices; mostly weekend and morning performances;
Ground and vertical storage for easy use and retrieval; embedded and specific functionalities;
Heavyweight for stationary materials

Durable materials for reuse; mostly daily performances; technological component
Hygiene and storage practices; shape-facilitated functionality;
Ground storage for easy retrieval; repurposing; lightweight for mobility and safety
Embedded and multiple functionalities

Single-use for convenience; durable materials for reuse;
Food-related and storage practices; mostly daily performances;
Embedded and specific functionalities; thick for thermal insulation and item durability;
Stacking for space maximisation

Durable materials for reuse; mostly daily performances;
Food-related and storage practices; covering for content protection;
Stacking for space maximisation and privacy delineation; repurposing;
Embedded and multiple functionalities; lightweight for mobility and safety

Durable materials for reuse; Stacking for space maximisation; Food-related and storage practices; mostly daily performances; Embedded and multiple functionalities; repurposing for lifecycle extension; Lightweight for mobility and safety; Delineating privacy in public space



Sorting single-use plastic for recycling; Durable materials for reuse; Food-related and storage practices; lack of space for sorted plastic Ground storage for space maximisation and easy retrieval; repurposing; Single-use plastic for convenience; lightweight for mobility and safety

Durable materials for reuse; ground storage for easy access; Hygiene and storage practices; mostly daily performances; Embedded and multiple functionalities; covering for content protection; Shape-facilitated functionalities; lightweight for mobility and safety

Durable materials for reuse; repurposing for lifecycle extension; Hygiene and storage practices; covering for content protection; Stacking for space maximisation and easy retrieval; repurposing; Embedded and multiple functionalities;

Durable materials for reuse; mostly daily performances;
Hygiene, food-related and storage practices; maintenance for lifecycle extension;
Embedded and multiple functionalities; repurposing materials for outdoor use;
Shape-facilitated functionalities; lightweight for mobility and safety

Durable materials for reuse; mostly weekend and morning performances;
Hygiene and storage practices; covering for content protection;
Heavyweight for stationary materials; shape-facilitate functionalities
Embedded and specific functionalities

Durable materials for reuse; mostly daily use;
Child-rearing and entertainment practices;
Embedded and specific functionalities; lightweight for mobility and safety;
Shape-facilitated functionalities

CHAPTER SEVEN

Sustainability Practices and Materiality: Transforming Plastic Consumption in Urban Households

This chapter reproduces an academic paper submitted to Resources, Conservation and Recycling (Shittu, Nygaard & Bailey 2021). The paper analyses the emerging themes in the research, theory, and sustainability transitions of urban household consumption, or research question one from section 1.2. The paper presents a practice theory approach to addressing the environmental consequences of unsustainable plastic use and disposal by embedding sustainability activities in urban households. Cities are actively implementing policies such as circular economies to solve waste management issues. This paper addresses an important aspect of this which is the adoption of sustainability practices in households by collecting data from low-income households in Lagos, Nigeria. The collected data present new contexts and insights into the daily activities performed in households that could serve as catalysts for sustainable plastic use. The paper bridges the knowledge gap on waste management, sustainable plastic use, practice theory and circular economy thereby serving as an anchor for future empirical studies. The submitted paper is presented below.

This chapter follows from formulating a circular plastic economy conceptual framework in chapter 4; identifying emerging sustainability concerns in urban households in chapter 5 and examining how plastic materialises household practices in chapter 6. Therefore, the paper presented addresses the third research question (see section 1.2): how can plastic consumption be transformed, and sustainability practices be embedded in urban households? By answering this question through empirical findings, paper four presents a framework for integrating sustainability practices in households into broader circular economy systems.

Abstract

Transforming plastic production and consumption is imperative to addressing sustainability and environmental concerns. Urban policies, business initiatives and product designs are providing countermeasures to the unsustainable use of plastic and its incursion into the environment. However, many of these urban solutions are reactionary rather than anticipatory and address behaviours or market trends which are outcomes of underlying sociomaterial arrangements and practices. Instead, this study adopts practice theory to explore plastic-related sustainability activities in urban households. By selecting low-income households in Lagos city as case studies, the study utilises a mixed-methods approach including interviews and short surveys. This paper conceptualises plastic-related sustainability in households as a practice complex that includes protractive, contractive, and regenerative practices. Although some plastic-related protractive activities such as maintenance and reuse are identified in low-income households, their performances are motivated by socio-economic factors other than environmental considerations. Meanwhile, the meanings attributed to plastic use and constraints of sociomaterial arrangements limit the performance of plastic-related contractive and regenerative activities in low-income households. These findings imply that plastic-related sustainability practices are currently compound in nature, that is, they are disjointed, insubstantial and informal (Welch 2013). Transforming plastic-related sustainability practices from compound to integrative with solidified, simple, and formal processes could be achieved by addressing environmental justice issues and leveraging communities of practice (Schatzki 2002; Welch 2013; Wenger-Trayner & Wenger-Trayner 2015). The paper further identifies other research and policy implications of the findings including the transitions of cities to circular economies.

Keywords: plastic; cities; sustainability; practice theory; household

7.1 Introduction

Transforming plastic production and consumption is imperative to addressing sustainability and environmental concerns (Shittu 2020; Heidbreder et al. 2019). Policy regulation and experimentation are taking place across the globe to promote sustainable plastic consumption (Pantsar et al. 2016; European Commission 2018; Nielsen, Holmberg & Stripple 2019). A range of market-based initiatives (e.g., carbon trading, or taxes), regulatory (standards, extended producer responsibilities, packaging signage) and subsidies/fiscal incentives have been applied to support the emergence and competitiveness of sustainable products and technologies, and direct household consumption patterns (Fankhauser & Pearce 2014).

Also, several studies utilising the theory of planned behaviour show that behavioural approaches, situational factors, and the provision of facilitating infrastructure are critical to tackling how we use plastic (Ajzen 1991; Tonglet, Phillips & Read 2004; Cerasi et al. 2021). However, notwithstanding awareness of the climate and environmental impacts of plastic consumption, and the increasing range of measures to incentivise behavioural change, the use of plastic remains ubiquitous, and growing (UN GRID-Arendal 2018). A recent review of the social-scientific literature on perceptions relating to plastic consumption and disposal concluded that "although problem awareness is high, the perceived advantages of plastic, consumer habits, and situational factors make it difficult for people to act accordingly" (Heidbreder et al. 2019, p. 1088).

Achieving sustainable consumption, therefore, also requires addressing the transformative constraints imposed by materials, habits and/or contextual factors. These constraints may or may not be intrinsic to the material itself, for instance, some forms of convenience are non-intrinsic to plastic (Lam & Chen 2006) while others, such as transparency, can be intrinsic (Shittu 2021a; Nørgaard Olesen & Giacalone, 2018). Both habits and convenience are sometimes found to outperform deliberate intentions (Heidbreder et al. 2019; Lally & Gardner 2013). Habits can be thought of as "automatic behavioural responses to environmental cues [that] develop through repetition of behaviour in consistent contexts" (Lally & Gardner 2013, p. S137). From a sustainability transitions perspective, automated behaviour and environmental

context imply that individual plastic consumption can only partly be understood by examining individual decision-making. That is, the individual decision around plastic use cannot necessarily be understood in isolation from the activity (context) within which it is used. For instance, plastic consumption is not the object of an activity that consumes plastic. Instead, plastic consumption is a process or outcome in the performance of a bundle of daily activities (practices). The frequent performance of these practices shapes the use and disposal of plastic and the formation of habits (Shittu 2021a).

This study, therefore, applies a practice theory approach to the issue of transforming plastic consumption and embedding sustainability activities in low-income households. Practice theory focuses on the performance of practices, as opposed to behaviours around particular tasks (Strengers & Maller 2014), and thus provides an alternative approach to conceptualising plastic consumption and contextual determinants of sustainable transitions. The aim of this paper is twofold. First, drawing on data collection in Lagos, Nigeria, this paper identifies a range of elements in the performance of daily activities that carry within them sustainability-related outcomes (without necessarily being the object of the activity). Second, this paper provides a conceptualisation of these elements around three categories of plastic-related sustainability practices – protractive, contractive, and regenerative; and where these are jointly performed, they constitute a conceptualisation of a sustainable household practice complex. The integration of these sustainability practices into urban households represents a miniature model of the sustainability transitions of cities.

The following sections are organised as follows. Section 7.2 presents the study location, data collection and analysis, demographic analysis, and conceptual framework. Section 7.3 examines environmental sustainability considerations in plastic consumption, the extension of the plastic lifecycle in urban households and the practical strategies for sustainable household plastic consumption. Section 7.4 interrogates the implications of the findings for the sustainability transformation of urban household plastic consumption. Section 7.5 presents the concluding remarks.

7.2 Methodology

7.2.1 Study location

This study explores the embeddedness and integration of plastic-related sustainability activities in urban households' daily routines. This study selected low-income households in Surulere, a suburb in Lagos, Nigeria as case studies. The selection of low-income households as case studies is informed by two major reasons. First, low-income households experience high resource constraints (Adamkiewicz et al. 2011) and are therefore necessitated to utilise cheap and easily accessible materials such as plastic in performing their daily activities. Low-income communities also tend to have little or no access to proper waste disposal and recycling infrastructure (Evans & Kantrowitz 2002). This may not only lead to an increased dependency on plastic but also its unsustainable use in low-income households. Second, previous studies have shown that sustainable lifestyles are expensive and may require a substantial reconstitution of existing sociomaterial arrangements (Shittu 2020). Thus, low-income households may not be able to afford extant sustainable material alternatives, or such may create disruptions in their domestic organisation. Nevertheless, some sustainability activities may currently be embedded in household practices. Moreover, extant unsustainable domestic practices can potentially be progressively transformed alongside other large systemic transitions.

Selecting Lagos as a study location presents an opportunity to gain new contextual insights into household plastic-related sustainability practices. As a developing city and the economic centre of Nigeria, Lagos disposes of about 12,000 tonnes of solid waste daily with significant plastic waste management challenges such as drainage blockages, ocean contamination and environmental degradation (Adebiyi-Abiola et al. 2019). The complication of these plastic-related environmental problems with other socio-economic challenges further necessitates the sustainable transformation of plastic use in the city. However, like many other cities, major urban solutions tend to focus on providing waste disposal and recycling infrastructure (Simatele, Dlamini & Kubanza 2017). As argued in this paper, promoting regenerative sustainability practices at the expense of protractive and contractive sustainability practices

may create more sustainability challenges for cities such as an increased energy footprint. Therefore, this study aims to examine how the three sustainability practices can be integrated into urban households as a microcosm of cities.

7.2.2 Data collection and analysis

The data for this study was collected among low-income households in Surulere, a suburb of Lagos, Nigeria. This study collected data through a seven-rating compass survey, in-depth interviews, home tours and a ten-statement short survey. Eighteen households were purposely selected for the study although only twelve out of those were involved in interviews, home tours and directed photography. Research assistants aided the initial recruitment of households, but snowball sampling was employed at a later point in the data collection stage. The study started with face-to-face data collection but resorted to phone interviews and survey administration at the onset of COVID-19. Each study participant was duly compensated for their time dedicated to the research. Ethics approval for the study was obtained from the human research ethics committee of the University and adhered to during the research.

Rather than serve as a measure of statistical significance, the two administered surveys were aimed at capturing information from the selected low-income households beyond the in-depth interviews. The seven-rating compass survey was adapted from Place Standard (https://www.placestandard.scot/#/home) and designed to examine sustainability considerations in households' use of plastic (see figure 7.2). The survey questions sought answers to the indispensability of plastic within households; the usage frequency of plastic in communities and households; the environmental consideration of plastic use in households and the experiences of households in sustainable plastic use. Study participants were asked to carefully consider each of the questions and rate their households on a scale of 1 to 7, where 1 and 7 represent 'least' and 'most' respectively. The responses were then plotted on a compass diagram as shown in figure 7.2.

Meanwhile, the second survey included ten sustainability statements that are suggested as practical strategies that households may embed into their daily activities (see table 7.1). These

statements were informed by key-informant interviews previously conducted with sustainability experts in Victoria, Australia and Lagos, Nigeria. The first four statements are strategies that could improve the sustainable use of plastic items within the household and the last six statements include strategies that could promote the avoidance or reduction of plastic use within households. Study participants were instructed to evaluate the practicality of each of the statements with the contextual consideration of their extant household practices. The percentage responses of each statement were then tabulated as shown in table 7.1.

Furthermore, twelve households were selected for in-depth interviews, home tours and directed photography. The interviews focused on the plastic-related domestic activities that households perform; the functions and meanings that plastic promotes during domestic practice performance and the socio-economic and environmental factors that could promote sustainable plastic use within the household. Home tours were conducted for the first two selected households and provided visual data on the spatial arrangement of plastic items. At the onset of COVID-19, phone interview participants were directed to send pictures of plastic items at the locus of practice in their households.

The voice and pictorial data were analysed with NVivo Plus. The software program provided the tools that were employed in analysing the discursive elements and emotional expressions in the interviews and the material and spatial features in the pictures. Deductive and inductive analysis techniques were employed during the coding process to create themes identifying the plastic-related sustainability activities in low-income households. The research aims and literature review guided the deductive analysis and the formulation of themes such as ‘protractive’, ‘contractive’ and ‘regenerative’ practices. Meanwhile, the inductive analysis involves the multilayered coding of field data and informs themes such as ‘maintenance’, ‘repair’ and ‘repurpose’. The final themes inform the conceptual analysis discussed in section 7.3 and presented in figure 7.1.

7.2.3 Demographic analysis

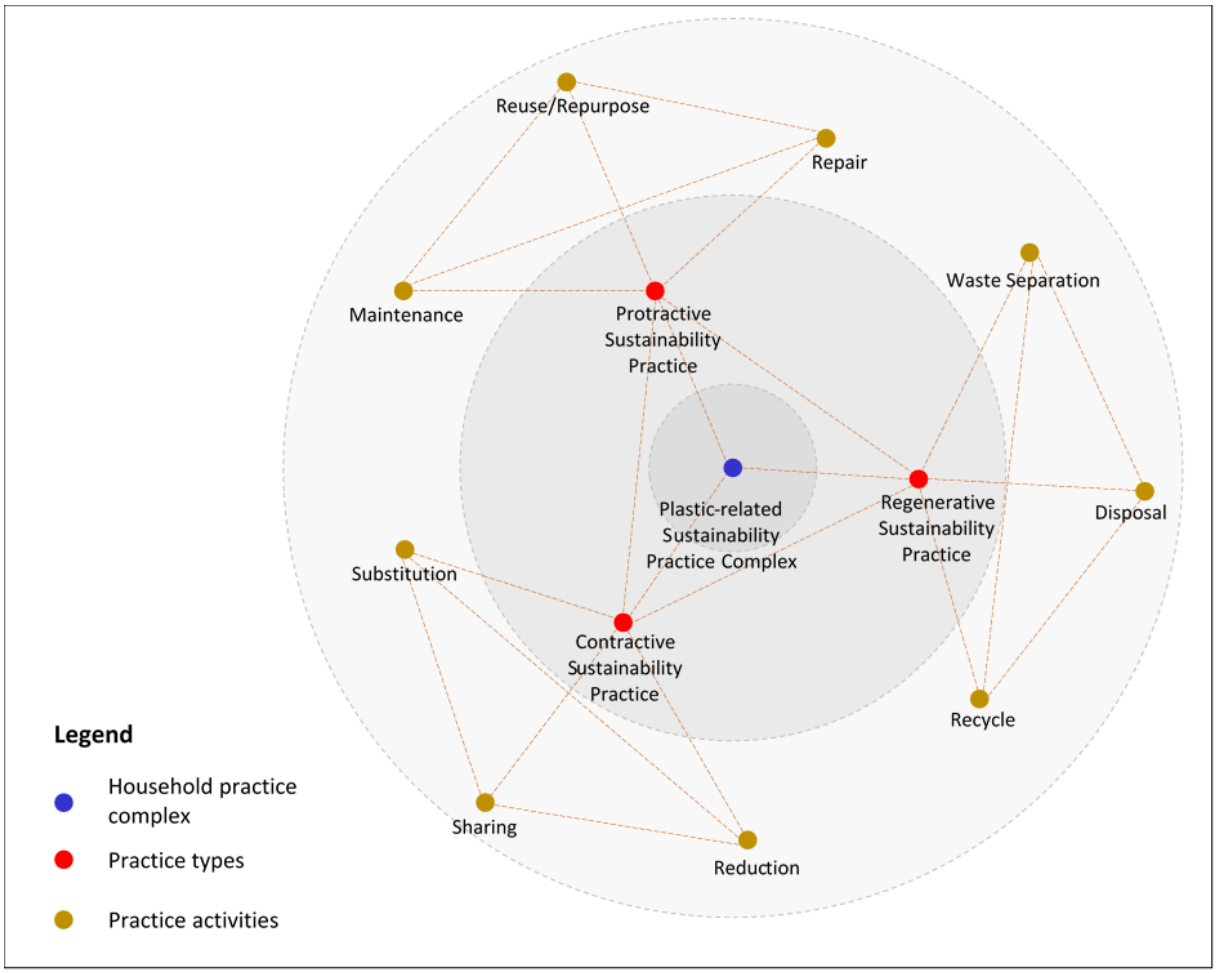
To examine the embeddedness of plastic-related sustainability activities in urban households, this study purposely selected 18 low-income households (with an average weekly income of 150 USD per household) in Surulere, Lagos. Study participants were mostly women (16/18), although most of the households (11/18) were headed by men aged 30 to 49 years. The difference between participants and household heads may reflect the cultural perception of women as the custodian of the home (Raimi et al. 2019). Also, the majority of the households (14/18) had stayed more than five years at their location indicating a sense of familiarity with their neighbourhood and the existing waste management system. Eleven households (11/18) had between four to six members with most adult household members working as traders (15), professionals (6), sales workers (3) and labourers (3). Most household members (15) had secondary education as their highest educational qualification followed by those with primary education or less. Nonetheless, some household members possessed a graduate diploma (5), bachelor's degree (3), advanced diploma (3) and postgraduate degree (2). This suggests that most household members have a fair ability to comprehend sustainability concepts and guidelines.

7.2.4 Conceptual framework

Figure 7.1 illustrates the conceptual framework guiding the analysis of this study. The framework design was informed by the synthesis of data analysis and sustainability and practice theory literature. Figure 7.1 consists of three space rings (activity, practice, and domain) with each representing different levels of abstraction. The conceptual framework describes the connection of plastic-related practice activities (the outer activity-space ring) with practice types (middle practice-space ring) which then weaves into a practice complex (the centre domain-space ring). The three plastic-related sustainability practices identified are contractive, protractive, and regenerative. First, contractive sustainability practice results in a reduction in the amount of plastic in circulation and includes activities that are performed to reduce, share and/or substitute plastic items. Second, protractive sustainability practice aims to prolong the lifecycle of plastic materials and include activities such as maintenance, reuse,

repurposing and repair. Lastly, regenerative sustainability practice facilitates the transformation of plastic items into new plastic products and includes waste separation, disposal, and recycling activities. It should be noted that the web of household sustainability practices is expected to be interwoven with other societal practice complexes including those related to production, community organisation, policy, waste management and technological development among others.

Figure 7.1 *Map of plastic-related sustainability practices in households*



Note: The dashed lines connecting the nodes in figure 7.1 depict a disjointed and insubstantial relationship which creates compound sustainability practices as further discussed in section 7.4)

7.3 Findings

7.3.1 Plastic consumption and environmental sustainability considerations in low-income households

Figure 7.2 presents the result of a seven-rating compass survey on the considerations of sustainability regarding plastic consumption in low-income households in Lagos. With an average rate of 6.6, the majority of households considered plastic to be highly indispensable to their daily activities. Cooking, eating, bathing, storing, and cleaning are some of the practices that are performed with plastic items. Respondents note that the use of plastic materials in domestic activities provides the emotional and social meanings of mobility, privacy, comfortability, convenience, security, sustenance, and accessibility, among others. As shown in figure 7.2, survey respondents further observed that the use of plastic materials has increased over time in their communities (6.2 average rate) and households (6.3 average rate). This increase was mostly attributed to the prevalent industrial use of plastic, especially in product packaging and the gradual substitution of essential metal or wooden household items with plastic given the latter's wider material functionality (Shittu 2021a).

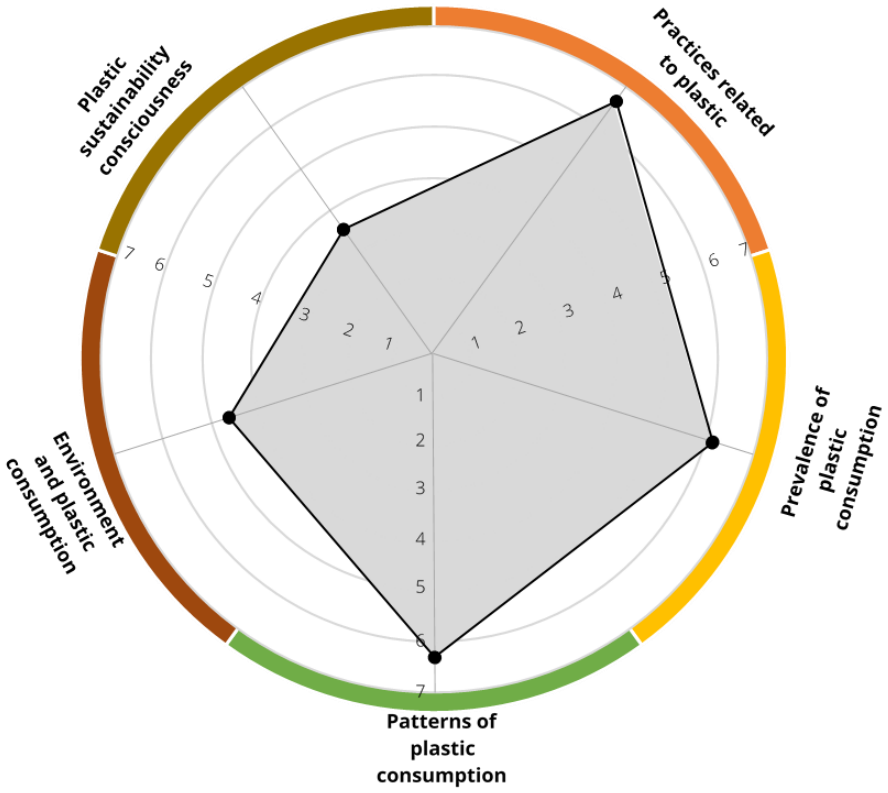
Given its high consumption in households, a significant factor in literature for sustainable plastic consumption is the prevention of plastic from leaking into the environment (Akanle & Shittu 2018; Gallo et al. 2018). However, as figure 7.2 indicates, environmental considerations are not the top priority for many low-income households when performing plastic-related practices that can be recognised as contributing to sustainability whether intentionally or not (4.7 average rate). Those who considered themselves environmentally considerate highlighted their disposal of plastic materials in the government-provided waste bins. Nevertheless, almost all the solid waste collected in Lagos households ends up in dumpsites, waterways, and drainages with relatively little being recycled by informal businesses and social enterprises (Akanle & Shittu, 2018). Meanwhile, the majority of the survey respondents did not consider their households to be very experienced in terms of sustainable plastic use (3.6 average rate). Instead, the analysis of findings shows that while the established domestic practices do not have environmental sustainability at their core, their performances usually result in some plastic-related sustainability outcomes. Most case-study participants mentioned that these

sustainability outcomes are primarily influenced by different factors including functionality, convenience, sustenance, and financial considerations. An interviewee narrated her motivation, thus:

> "…on average, I would say that I don't tend to consider the environment whenever I want to dispose [of plastic]. Basically, the [reason why I practice sustainable plastic use] is for my financial status. I will have to manage whatever I have because I know if it gets spoilt, I will have to buy another."

As section 7.3.2 shows, some activities embedded in low-income households' practices are channelled towards extending the lifecycle of plastic items, hence, simultaneously constituting protractive sustainability practices. However, the data analysis did not present significant findings regarding the activities of contractive and regenerative sustainability practices in low-income households. Section 7.3.3 explores some of the challenges and opportunities of embedding contractive and regenerative sustainability practices in low-income households.

Figure 7.2 *Compass diagram of sustainability considerations in household plastic consumption*



7.3.2 Extending plastic lifecycle in urban low-income households

Protractive sustainability practices include activities that are performed to maintain, reuse, repurpose and/or repair existing plastic materials within the household. This study shows that low-income households do not purposely perform sustainability activities that extend the life of plastic materials for environmental considerations. However, the sustainability goal of protracting plastic lifecycle is somewhat achieved when the main household routines are carried out. Generally, domestic routines are expected to provide order, comfort, sustenance, and security for household members (Giddens 1984). Therefore, practitioners are induced to utilise household material arrangements (including plastic items) in ways that create fewer disruptions in their practice performances. This continuous and coordinated use of household materials produces a level of emotional, social, and historical attachment among practitioners (Lamond & Everett 2019). For instance, an interviewee recounted her grandmother's comments whenever a valued household item is damaged, thus:

> I remember when my [grandma used to say] 'you see this thing? [Do] you see how [well] we used it? Now you people have come to [damage] it.' So, you use it in a way to remember [and recount that you] have used it for [this number of] years…

In addition, the findings reveal that the maintenance and reuse of plastic items in low-income households require the mental, but mostly subconscious assessment of their physical capacities when invoked in domestic activities. This is because plastic items may become strained or damaged when in contact with other materials, especially in energy-related practices such as cooking and refrigerating. For this reason, households mostly make use of thick plastic bowls to hold hot food items when cooking. As explained by this interview participant, purchasing quality plastic items when concerned with maintenance and reuse appears to be the logical decision:

> Who will buy something [just to damage] it? Nobody. You will want your stuff to [be durable]. When you buy a strong item, you won't need to replace it [soon afterwards].

Furthermore, moving materials from one locus to another around the household could result in accidental breakage or damage. Therefore, maintaining and reusing household plastic items

involves their careful handling when invoked in household routines. The thorough but careful cleaning of each item after use is also essential in the maintenance and reuse of plastic. This is to ensure that the item is rid of all unwanted microorganisms. In this sense, the cleanliness of a plastic item is strongly tied to its functionality in the routinisation of household activities. This association, however, is reciprocal. That is, while the cleaning of plastic items ensures that they can be utilised in the next practice performance, such items need to have been perceived as effective by practitioners in the previous practice performance. An interviewee's comment on reuse highlights this reciprocity, thus: *"Except the one that breaks, we reuse plastic items well. If you see that you like that stuff, you wash and reuse it"*. Another interviewee described what happens when a plastic item is detected to be unsuitable for household use as follows:

> …like all these bowl[s] I'm talking about, if I see that the quality is not that good [and] that [they] will break easily, I will take it outside so when it [breaks], it won't make any difference to me.

Meanwhile, the opposite is the case for a participant who recently moved into a rooming house:

> I [used to] keep the [barrel] outside but when I [saw] the way they use [other people's] things here, I [had] to take it [away]… because [with] the way they [were] using it, it will get [damaged quickly] … I had to take it to where it will be safer…

The preceding quotes imply that households store valued plastic items in private spaces because their long exposure to public spaces may prompt their use by others and accelerate their breakage. When households are less interested in prolonging the lifecycle of a plastic item but reluctant to dispose of such, they leave it in open spaces for others to use. This suggests that there is a significant relationship between the functionality of plastic items, their place of storage and thus, their maintenance or reuse. Therefore, caring for plastic items involves their proper storage after use as further explained by this mother of two:

> Let me give you an example of my first child, because most of the things I [used] as plastic like the bath [when he was young are] what I still use for the second one… because immediately I clean them off, I pack them inside nylon… I push them straight under the bed or I put them in the store… So that is what I'm still using presently.

In some instances, when a valued plastic item gets partially broken (especially multiple-use items like baths), households may engage the services of informal mobile plastic repairers who weld other plastic pieces with broken plastic items using a soldering iron or other hot metals.

However, some of the interviewees observed that the rate of plastic repairs has reduced in recent times given the reduction of mobile plastic repairers. They suggested that the reasons for the disappearance of mobile plastic repairers are a mix of an improved maintenance culture, increasing do-it-yourself household repair practices and national economic downturns. Meanwhile, for single-use plastic items, households find ways to repurpose them for other domestic activities after consuming their contents. They, however, are not as valued or durable as multiple-use plastic items. The most common single-use plastic items repurposed in low-income households include water or soft drink bottles, shopping bags and food packages. These items are utilised in performing household practices such as storage, refrigeration, cooking, eating, and washing. An interviewee gave an instance of his household, thus:

> If we go to some fast food [restaurants] and buy some ice cream… once we are done eating the ice cream, we clean and keep the plastic [package]. Whenever we cook and have leftovers, we can use [the plastic package] to store [the excess food]. Or if we want to pack something like salt or detergents, we secure [the item] in a [plastic bag] before storing it in the [plastic container]. You have to reuse or [repurpose] whatever you have.

7.3.3 Evaluating practical strategies for sustainable household plastic consumption

Table 7.1 presents the result of a short survey conducted among the selected households. As the previous section shows, the conventional daily practices that low-income households perform regularly result in some sustainability outcomes, although secondary. This survey, therefore, further assesses the possibility of introducing some other doings of plastic-related sustainability practices in low-income households. The survey was designed as an exercise for the case study participants to evaluate the practicality of the suggested strategies if embedded into their household activities. The ten statements in table 7.1 were informed by a review of sustainability literature and previous expert interviews. The statements are categorised into strategies that facilitate plastic-related household sustainability practices and strategies that promote the avoidance or reduction of plastic use.

7.3.3.1 Strategies that facilitate plastic-related household sustainability practices

As table 7.1 reveals, only a few of the respondents (33.4%) noted that it would be impractical for their households to incorporate sorting plastic recyclables into small containers located at

each domestic site of social action. It is suggested that this added material element may reduce contamination and improve the recyclability of household plastic waste. However, the lack of physical space was the main concern for low-income households who find this strategy impractical. Many people live in rooming houses where they share spaces such as kitchen, bathroom, and compound with other tenants. While such shared spaces may be demarcated, there are limits to how they can be used. A participant described her situation this way:

> [Temporarily sorting plastic recyclables] will be difficult because there is no space for you to keep [the plastic items]. The landlord will complain… For me, it will be easy if I am living in my apartment, it won't inconvenience my neighbour but in a one-room apartment, [there is] no [way] you will do that.

Table 7.1 *Strategies for sustainable household consumption*

S/N	Statement	Practical	Not Practical
	Strategies that facilitate plastic-related household sustainability practices		
1.	Have small containers to temporarily sort recyclables in the kitchen and other parts of the house	66.6%	33.4%
2.	Learn about which plastic can be reused and recycled	88.9%	11.1%
3.	Reuse plastic materials in different household activities e.g., storage, gardening etc.	94.4%	5.6%
4.	Set guidelines for each household activity on the right way and time to use and dispose of plastic materials around the household	83.3%	16.7%
	Strategies that promote the avoidance or reduction of plastic use		
5.	Avoid purchasing products or services with single-use plastic	0%	100%
6.	Use better alternatives to plastic e.g., metal, and biodegradable materials	38.9%	61.1%
7.	Change the household shopping activities e.g., buying fresh foods, shopping more often, patronising businesses that accept and reuse their plastic materials	38.9%	61.1%
8.	Change the household consumption activities e.g., home cooking, drinking tap water, having personal water bottles and coffee cups etc.	22.2%	77.8%
9.	Take personal responsibilities e.g., educating others about reducing, reusing, and recycling, joining community organisations etc.	66.7%	33.3%
10.	Participate as a household in plastic-free movements/months	0%	100%

Those who responded positively (66.6%) in table 7.1 highlighted that while it may be possible for households to sort plastic waste, it is equally important that the right infrastructure should be provided to facilitate plastic waste collection and recycling. Although Lagos largely practices a single-bin system, there is a gradual improvement in its recycling system with the latest initiative being the introduction of a "Pakam" mobile application used to request the pickup of recyclables (Alonge 2020). The use of mobile applications may be more difficult for low-income households if they lack access to modern technology and the internet. Moreover, case study participants noted the importance of providing rewards to households for sorting plastic waste. A participant provided a detailed justification, thus:

> It is easy to separate plastic from other waste [if] they are collected [by recyclers]. [For instance], you can see that cartons are no more [wasted] like before. [In the past], when you use [a] carton, you will throw it away but now [you will hardly] see cartons [in the environment] to pick because people are keeping [them] now. Even [shop owners] now keep [cartons] in their shops until buyers come for them. So, you won't see cartons around again because it brings in money for the owners. That is what [needs to be done about] plastic and you will see that no one will [continue] throwing them away because everybody needs money.

The majority of the study participants (88.9%) also indicated their willingness to further learn about the reuse and recycling of plastic items (see table 7.1). As explained in the preceding quote, the possibility of receiving rewards for recycling is one of the motivations for learning about recycling among the study participants. A participant buttressed this point, thus: *"It is easy because it will be like a source of income if somebody know[s] how to recycle something… and [when] you take it [seriously], you will go about teaching others."* As table 7.1 shows, almost all study participants (94.4%) specified that the sustainability activity of reusing plastic in their household activities is practical. This is because, as discussed in section 7.3.2, reusing and repurposing plastic items are already embedded in daily household activities. Similarly, the majority of study participants (83.3%) mentioned that setting guidelines on proper plastic use within the household is practical. Some study participants noted that the elderly members of the household usually provide oral instructions (especially to the young household members) that guide the domestic use of plastic. Therefore, improving on such guidelines may not be difficult for the case study of households.

7.3.3.2 Strategies that promote the avoidance or reduction of plastic use

The statements under this category are suggested as approaches that households can adopt to reduce or completely avoid the use of plastic in domestic practices. The study could not establish any substantial sustainability task relating to plastic use reduction or avoidance among the selected low-income households. In this case, the strategies listed in Table 7.1 provide an evaluation of the opportunities and challenges around plastic use reduction and avoidance.

As previously established in figure 7.2, statement 5 in table 7.1 reveals that all study participants (100%) indicated that it is impractical for them to avoid using plastic items in their daily activities. The findings show that a major component of low-income household materials is single-use plastics such as plastic bags and water packages. For instance, the inadequate provision of clean water facilities in low-income households necessitates the purchase of packaged drinking water as explained by this participant:

> Since sachet water [and bottled water packages are] made of plastic, there is no how you can avoid the two things that are useful for you. You [must] drop one for [the other], you can't drop the two. If I say I want to avoid bottled water, I will have to go for sachet water. Because around here, [although] we have tap water [in the community], we think that it is not good enough for us to drink so we make use of sachet water. So, we can't leave the two.

From table 7.1, more than half of the study participants (66.1%) signified that using alternative materials for household plastic items would not be practical for them. This is mainly because plastic provides several domestic functionalities given its malleability that may not be found in other materials such as metal. This study shows that many households replaced metal and wooden household items such as iron buckets and wooden cooking utensils with plastic items to provide more convenience and safety during practice performance. Moreover, some study participants remarked that the high cost of those alternative materials relative to plastic items is a major reason for their impracticality.

Furthermore, table 7.1 reveals that the majority of the study participants (61.1%) found it impractical to change their household shopping activities. This study demonstrates that many low-income households consider decisions regarding the use of plastic in shopping activities

mostly beyond their immediate control. For instance, several study participants noted that even when they shop for fresh foods, the sellers usually insist on packing the goods into separate single-use plastic bags to avoid contamination, provide a sense of privacy and distribute the weight of the goods for ease of carriage. Similarly, most of the selected low-income households (77.8%) suggested that changing their consumption activities to reduce or avoid plastic items would be impractical (see table 7.1). However, some aspects of low-income households' current practices may present opportunities for the reduction or avoidance of plastic. These activities include the purchase of fresh foods in open markets rather than packaged foods in supermarkets and home cooking instead of eating out as noted by this interviewee:

> Yes, it will be easy because we don't buy food outside. I cook everything we eat. And my kids have the plastic bottles [that] they take to school [and] we don't change [them] except [when they break].

Also, statement 9 in table 7.1 indicates that many study participants (66.7%) are willing to assume more personal responsibilities regarding public sustainability education, community participation and volunteer service. Concerning those who find the strategy impractical, while some study participants mentioned that they can only perform such activities if they receive some form of reward, others believed such responsibilities belong to the government:

> [Plastic bottles], [Styrofoam packs] and sachet packs are mostly what you will see in the canals. If [the government] can enlighten people on how to [dispose of] the [plastic packages] and make small [recycling] bins available in every corner [of the community], you will see [that] people will cooperate…

Lastly, all study participants (100%) considered participating in plastic-free movements (statement 10 in table 7.1) to be impractical. Plastic-free months are global movements championed by non-governmental organisations to motivate individuals and households to reduce or avoid single-use plastic items for a month in a calendar year through social media campaigns, participation in community projects and the provision of free educational resources. However, as this study shows, the study participants consider the use of plastic in their daily activities to be unavoidable given its integration within domestic sociomaterial arrangements. An interviewee interjected thus:

> No, it will not be possible because we make use of it every day. How will we do without it in one particular day, [much less] a month [or] a year? It's not possible.

7.4 Discussion of findings: Sustainable transformation of urban household plastic consumption

This study explores the nature and extent of plastic-related sustainability practices in urban households by taking low-income households in Lagos as case studies. The findings reveal that low-income households consider plastic materials indispensable in the performance of domestic practices such as cooking, storing, and cleaning. However, it is also clear from the findings that these household practices do not necessarily, or at all, have sustainable plastic consumption as their goal. Instead, their regular performance delivers plastic-related sustainability outcomes for a variety of reasons. For instance, the activities of protractive sustainability practices identified in this study such as repair and maintenance are often driven by budget (cost) considerations, sentimental value, or practical considerations (such as the time required to find a new item). Nevertheless, these undertakings help to prolong the lifecycle of household plastic items and in this way have beneficial implications from a resource consumption or sustainability perspective.

The sustainability activities or outcomes identified from the studied households, however, do not currently constitute a coherent plastic-related sustainability practice. As figure 7.1 illustrates, plastic-related household sustainability practices consist of protractive, contractive, and regenerative sustainability practices. However, the study could not identify substantial tasks of contractive and regenerative practices given some sociomaterial, infrastructural and regulatory challenges confronting low-income households (see section 7.3.3.2). In this sense, plastic-related household sustainability practices can be conceptualised as compound practices (depicted in figure 7.1 as the dashed lines connecting the nodes in the three practice-space rings).

The practice literature defines a compound practice to be a set of routines and activities that, although achieving certain outcomes, do not have unified skillsets and meanings (Warde 2013; Schatzki 2002). As discussed by our interviewees, they maintain or repair household plastic items for various reasons that, at heart, are unrelated to sustainability (although, as stressed

above, they also deliver sustainability-related outcomes). The implication of this, then, is that the outcomes of compound sustainability practices are ad hoc and subject to variability (Warde 2013). Conversely, integrative practices possess a formalised assemblage of know-how, a stable sociomaterial arrangement and a clear process of performance that deliver well-defined goals (Warde 2013; Schatzki 2002). Therefore, from a practice perspective, the transition of cities to sustainable futures is one of transforming the extant plastic-related sustainability practices from compound to integrative practices (the connecting lines in figure 7.1 will change from dashed to solid lines). As further discussed in chapter 8, such transformation into integrative practices involve creating, strengthening and/or breaking the links between and among practices and their constituting elements. For low-income households, for instance, transforming practices could mean providing material infrastructure or developing their sustainability competencies to aid their performance of sustainability practices.

Within the household domain, the sustainable transformation of plastic consumption presents two important challenges. First is the consolidation of the activities of plastic-related sustainability practices into a set of integrative practices with clear guidelines and environmentally informed meanings (Schatzki 2002). As conceptualised in figure 7.1, the nodes in the outer activity-space rings connect to the nodes in the middle practice-space ring and each other by dashed lines. This is to indicate that plastic-related activities may be embedded into regular domestic practice performance and deliver some sustainability outcomes, but they must be strongly connected to form the components of integrative sustainability practices. For instance, protractive sustainability practice involves the combination of preserving household plastic items, then reusing or repurposing them during practice performance and when broken, repairing them for continuous use.

Also, the connection between the activities could be strengthened by facilitating the environmentally informed meanings, embodied skills and sociomaterial arrangements that enable the embeddedness of integrative sustainability practices in households. For instance, establishing regenerative sustainability practices in households may entail the knowledge of which type of plastic is recyclable, the skill of properly sorting plastic waste from others and the provision of material arrangements for disposing of plastic recyclables. However, while

some activities may have already been established in extant domestic practices, others may create more complications when attempting to integrate into existing sociomaterial arrangements of households. For instance, this study identifies that the valued functionalities of plastic in low-income households include convenience, accessibility, and privacy. These extant plastic-related meanings may be counteractive to the establishment of contractive sustainability activities such as substitution, reduction and sharing respectively as table 7.1 shows (see section 7.3.3.2).

Once day-to-day activities strongly align around a specific sustainability practice (that is, becomes integrative), the second sustainability challenge arises concerning integrating the three sustainability practices into a practice complex within the household domain. The current disjointed relationship between protractive, contractive, and regenerative sustainability practices is depicted in the practice-space ring of figure 7.1 with dashed lines. The integration of these sustainability practices will create a complex web of plastic-related sustainability practices in the household domain (domain-space ring of figure 7.1). The main concern here is that the successful embeddedness of one of the sustainability practices may reduce the performance intensity of others, thus weakening the domain-space connection. For instance, the effective, continuous, and wide-range performance of regenerative sustainability practices in households may undermine the sustainability practices that aim to reduce the amount (contractive) or prolong the lifecycle (protractive) of plastic items in households.

While it may be argued that an optimal recycling system may overcome the need to protract or contract plastic items in households, sustainability scholars have maintained that recycling alone may not address cities' aim of achieving a circular economy. Major sustainability challenges of plastic use include the inability to recycle some types of plastic; the incursion of microplastic into water streams from households and the high amount of energy consumption involved in plastic production, transportation, and recycling. However, contractive, and protractive activities such as avoiding, reducing, reusing, and repairing could provide important alternative solutions to sustainable plastic use challenges. Within a set of integrative practices, shared knowledge of, for example, the Zero Waste Hierarchy situating contractive and

protractive practices as higher priorities than regenerative practices, may help to achieve a balance of these practices for optimal sustainability outcomes.

The sustainable transformation of plastic use extends beyond the household domain to the society-wide web of practice complexes. Indeed, achieving a circular economy in cities involves the coordinated efforts of stakeholders in transforming existing regulatory, production and consumption processes and embedding new sustainability activities into socio-economic institutions. This could be the subject of future sustainability transitions and practice theory research.

7.5 Concluding remarks

This paper explores the transformation of urban household plastic consumption and interrogates the embeddedness of sustainability practices in low-income households. The findings and conceptual framework of this study raise some important implications for policy and research. First, there is an interesting parallel between the need to sustain items within a household due to limited financial resources, and the need for sustainability more generally due to limited environmental resources. As seen in this study's findings, those protractive practices within households responding to financial limitations contribute to environmentally sustainable outcomes. Acknowledgement and investigation of this dynamic in future research and efforts seeking to enhance sustainability outcomes, could in this way also contribute to social justice outcomes among populations within developing nations. Moreover, the sustainability solutions accompanying the transitions of cities to circular economies may be ineffective if they do not consider the existing socio-economic realities of low-income households. Given this study's findings, urban sustainability solutions that will be inclusive of low-income households should be simple, affordable, and efficient.

Second, the findings of this study reveal that plastic-related sustainability practices are currently compound – that is, the elements and activities are insubstantial, disjointed, and informal (Warde 2002). Therefore, urban administrators are tasked with transforming these compound sustainability practices into integrative sustainability practices by embedding all

sustainability activities into households' daily life and introducing clear and formal processes for performing sustainability activities (Schatzki 2002). Communities of practice (Wenger-Trayner & Wenger-Trayner 2015) could be an avenue to promote the adoption of sustainability activities such as sharing, reducing, and repairing among urban households. Lastly, private organisations are important collaborators in innovating, designing, and implanting urban sustainability solutions. For instance, small businesses and social enterprises could serve as catalysts for applying circular solutions to plastic consumption and disposal. Future studies could, therefore, further explore the co-designing of plastic-related circular solutions between businesses, communities, and households.

CHAPTER EIGHT

Discussion Part One: Grassroots Strategies for Environmental Governance and Circular Transitions in Cities

This chapter reproduces an academic paper that has been submitted for publication as a chapter in an edited book (Shittu 2021b). The paper draws out lessons and insights from the thesis on addressing environmental justice issues in urban households' sustainability practices and leveraging communities of practice (Wenger-Trayner & Wenger-Trayner 2015) to mainstream circular practices. This paper provides further grassroots strategies to accelerate the transition of cities to circular economies such as promoting sustainability values and facilitating circular innovations that are inexpensive and user-friendly.

This chapter (and the paper presented therein) achieves two objectives. First, it answers the last research question (see section 1.2): how can environmental governance be enhanced at the grassroots to accelerate the transition of cities to circular economies? Second, it functions as part of the envelope of the thesis by synthesising the findings across the chapters and discussing their implications for identifying grassroots environmental governance strategies to galvanise circular transition in cities. Chapter 9 presents the final part of the thesis envelope by discussing the implications of a practice perspective for systemic realignment.

Abstract

The dominant linear socio-material way of life is resulting in global environmental damage and foreshadows a catastrophic urban future. Transitioning our way of life to circular economy principles provides a strategy for closing material loops and creating alternative solutions to unsustainable consumption. The circular economy literature abounds with scholarly discourses on technological innovations and business initiatives, and country-level strategies for transforming businesses to circular socio-material models are emerging. However, less attention is accorded to grassroots strategies and practices. Given the extensive and perhaps radical changes that implementing circular policies will bring to household and community socio-material practices, it is imperative that cities also actively promote people's involvement in environmental governance and enable the emergence of circular practices. This chapter, therefore, draws lessons from recently completed doctoral research on practice theory, plastic consumption, and transitions to circular plastic economies. Lessons identified in this chapter are based on case studies in Lagos (Nigeria) and Melbourne (Australia) and provide insights on addressing environmental justice issues in urban household sustainability practices; leveraging communities of practice to facilitate circular practices and urban strategies for grassroots environmental governance. Looking forward, the chapter highlights policy and research recommendations for the sustainability transition of cities to circular economies.

Keywords: grassroots strategy, circular economy, cities, sustainability transitions, practice theory

8.1 Introduction

There is a growing recognition among urbanist scholars that a solution to reducing environmental impact and maximising resource use is a transition of cities to circular economies (Ghisellini, Cialani & Ulgiati 2016; Khan et al. 2020). Advancing such sustainability transitions involves galvanising and synergising sustainability initiatives across all social domains including households and communities (Frantzeskaki & Rok 2018). Beyond implementing laws that regulate resource consumption and disposal, mobilising the grassroots for circular transitions also entails facilitating mutually beneficial environmental governance strategies (Gernert, Bilali & Strassner 2018). Haque (2017, p. 1) defines environmental governance as "the rules, practices, policies and institutions that shape how humans interact with the environment." Specifically, while households are expected to actively participate in designing and implementing circular policies, urban administrators should also resolve the socio-economic and infrastructural challenges that inhibit the adoption of sustainable lifestyles (Rakic & Rakic 2015; Paddock 2017).

This chapter, therefore, draws on recent doctoral research findings published in Shittu (2020), Shittu (2021a) and Shittu, Nygaard and Bailey (2021) to examine grassroots strategies for circular transitions. First, the chapter provides insights on addressing environmental justice issues arising from inequitably distributed sustainable infrastructure and unequal access to elements of sustainability practices in low-income urban households. Second, the chapter discusses leveraging communities of practice (Wenger-Trayner & Wenger-Trayner 2015) as transition intermediaries to scale up and establish sustainability practices. Before turning to lessons for urban strategies to promote environmental governance, the next section briefly synthesises the methodology and knowledge basis from Shittu (2020), Shittu (2021a) and Shittu, Nygaard and Bailey (2021). The final section provides recommendations for policy and research and concludes the chapter.

8.2 Methodology and knowledge basis for addressing environmental justice and leveraging communities of practice

Shittu (2020), Shittu (2021a) and Shittu, Nygaard and Bailey (2021) provide alternative theoretical and policy frameworks for circular economy and sustainable consumption based on low-income household practices in Lagos, Nigeria. Taken as a unit of analysis, practices are bundles of doings and sayings that people perform to achieve certain goals (Strengers & Maller 2014). A study of low-income urban households in an emerging city enabled a focus on contextual circumstances and thus contributes new insights to consumption studies, circular economy, and practice theory beyond dominant Western case studies. The study of household practices was augmented with interviews with sustainability experts in Melbourne, Australia and Lagos, Nigeria for additional empirical understanding and connection with policy debate and practice. Data in Shittu (2020), Shittu (2021a) and Shittu, Nygaard and Bailey (2021) were collected through mixed methods including interviews, short surveys, home tours and directed photography were analysed using inductive and deductive approaches.

Shittu (2020) investigated emerging themes in the research, theory, and sustainability transitions of urban household consumption through a systematic literature review. Findings revealed that urban households face the following consumption challenges: household activities are increasingly commodified thereby creating more demand for materials such as plastic; sustainability education is deficient among urban households; the cost of adopting sustainable lifestyles is increasing for urban households and there are significant class differences in the consumption patterns of urban households (Shittu, 2020).

Shittu (2021a) explores how plastic facilitates the reproduction of practices in urban households. Specifically, the study investigated how low-income urban households invoke plastic materiality when performing their daily activities. Findings showed that low-income urban households utilise plastic in performing practices related to storage, food, hygiene, comfortability, and child-rearing (Shittu 2021a). Plastic manifests these practices by combining the three aspects of its materiality – corporality or physical features, functionality or meaning mediation and spatiotemporal qualities (Shittu 2021a). These findings highlight the

indispensability of plastic to low-income households and provide evidence on why the isolated ban on certain materials may be ineffective in enabling the transition toward a circular economy (Shittu 2021a).

Shittu, Nygaard and Bailey (2021) examine how to transform plastic consumption and embed sustainability practices in urban households. Plastic-related sustainability practices are categorised into three practice types: contractive, protractive, and regenerative sustainability practices (Shittu, Nygaard & Bailey 2021). Contractive sustainability practices are performed to reduce the number of materials in circulation (e.g., sharing and reducing); protractive sustainability practices entail prolonging the lifecycle of materials (e.g., reuse and repair) while regenerative sustainability practices are performed to transform materials into new products (e.g., waste separation and recycling) (Shittu, Nygaard & Bailey 2021). Findings reveal that although some sustainability activities such as maintenance can be identified in households, they are not coherent enough to form a sustainability practice (Shittu, Nygaard & Bailey 2021). Moreover, the study shows that low-income households perform these sustainability activities mostly for financial and functional reasons with little or no consideration for the environment. While the meanings attached to plastic use prevent the performance of contractive sustainability practices, the constraints of sociomaterial arrangements also limit the performance of regenerative practices in low-income urban households (Shittu, Nygaard & Bailey 2021).

In the following sections, the insights discussed above form the basis for lessons for environmental justice in urban households' sustainability practices, and communities of practice (Wenger-Trayner & Wenger-Trayner 2015) for leveraging circular transitions in cities.

8.3 Environmental justice issues in urban households' sustainability practices

Urbanist scholars have a long history of addressing environmental justice issues in cities (Gelobter 1994; Myers 2008; Rigolon, Browning & Jennings 2018). To prevent the environmental justice issues generated by the extant linear economy, including global and class inequality, the transitions of cities to circular economies should not only be sustainable but also

just. According to Walker and Burningham (2011, p. 216), "environmental justice has become increasingly used as a frame for evaluating relations between people and environment, as well as a political focus for grassroots activism, and, at times, a policy principle." In this regard, environmental justice has been employed to address several socio-environmental issues including poverty, gender inequality, race, hazards, and infrastructure provision (Walker & Burningham 2011). Empirically, addressing environmental justice often requires engaging with multiple and interconnected forms of inequality. For instance, black communities (also low-income) in cities in the United States experience inadequate infrastructural provision and serve as the location of waste facilities that may negatively impact their environmental health (Gelobter 1994; Pineda-Pinto et al. 2021).

As indicated above, environmental justice scholars have been mostly preoccupied with urban sociomaterial and spatial arrangements that are 'external' to households such as the distribution and access to green spaces, community centres, schools, and healthcare centres (Wolch, Byrne & Newell 2014). However, to achieve material circularities in cities, it is equally important to examine how environmental justice issues influence the performance of sustainability practices within households. That is, while environmental justice issues are not regarded as explicit in the components of a sustainability practice or the general understandings of sustainability, it is nevertheless important to address them when transforming plastic-related household practices and during the transition to CPEs. In this regard, the empirical findings from Nigeria and Melbourne highlight three environmental justice issues that may hinder the performance of plastic-related sustainability practices in urban households. These include a lack of access to sustainability information, inadequate financial capabilities, and low access to spatial resources.

Given the emerging nature of sustainability concepts, procedures and goals, there is still a significant gap between theoretical understandings and the practical information available to urban households. However, where sustainability information is available, urban households often face the difficult task of interpreting and applying the guidelines in their daily tasks. For instance, the attempt to identify which household plastic item is reusable, recyclable, compostable or disposable is in itself often a daunting exercise. This becomes more pronounced

for urban households with low education or income who may be unaware of or lack access to such sustainability information. The findings from the case studies in Lagos illustrate that majority of the low-income households are inexperienced with the sustainable use of plastic and have low consideration for the environment when utilising plastic in their daily activities (Shittu, Nygaard & Bailey 2021). Some households that claimed to be sustainability-conscious in terms of plastic use believe that such equates to the disposal of plastic in the city's general waste bins (Shittu, Nygaard & Bailey 2021). The disposed plastic items are most times transported to the dumpsites in the city (Akanle & Shittu 2018). Also, the few households that indicated their knowledge of recycling are only aware of the rudimentary process of exchanging plastic items for rewards but lack information about the extended recycling operations in the city (Shittu, Nygaard & Bailey 2021).

In Melbourne, interviews with policy experts reveal that sustainability information from the government is usually directed at community groups mostly composed of high-income and sustainability-inclined members, thereby contributing to the reproduction of inequalities. A common assumption in Melbourne policy circles that affect the access of low-income households to sustainability information is that they are preoccupied with other issues (usually financial) than sustainable plastic use. Nonetheless, case studies in Lagos indicate that even when household plastic use is motivated by financial rather than environmental factors, their day-to-day practices usually produce several sustainable outcomes as part of other practice performances, including the maintenance, reuse, and repair of plastic items (Shittu, Nygaard & Bailey 2021). This finding suggests that the conscious and effective exposure of households to sustainability information could improve their performance of sustainability practices. When households acquire adequate sustainability knowledge, they may consciously and skilfully navigate the available sociomaterial processes to achieve sustainability goals with their daily activities.

The Lagos case studies and expert interviews in Melbourne also demonstrate that poverty is another environmental justice concern that limits the performance of sustainability practices in households (Shittu, Nygaard & Bailey 2021). The implications of poverty on residents' choice of neighbourhood and access to communal sustainability infrastructure are well documented in

environmental justice literature (Gelobter 1994; Figueroa 2004). Yet, little attention is accorded to how inadequate financial capabilities may also affect urban households' ability to adopt sustainable lifestyles. A circular economic system relies not only on practices that protract or regenerate materials but also on contractive practices such as substituting unsustainable materials and adopting a product-as-service model. However, green products and services are currently obtained at a premium and are therefore largely unaffordable for low-income households. The need to address the affordability of sustainable lifestyles for enabling the transition to circular cities is even more significant given that many urban households may fall into extreme poverty by 2030 (World Bank 2020).

Lastly, unequal access to space is another environmental justice issue that affects the household performance of sustainability practices such as maintenance, waste separation and recycling. As an illustration, most household case study participants in Lagos occupy single rooms in lodging houses where they share bathrooms, kitchens, and compound spaces with other tenants (Shittu 2020). For the household participants, an important element in the maintenance of plastic is their proper storage to prevent damage or unauthorised use by others. Nonetheless, the limited space available within households require householders to exploit horizontal (e.g., under the bed) and vertical space (e.g., stacking plastic containers) within rooms when storing valuable plastic items (Shittu 2020). Over time, this may create a claustrophobic and disorganised household sociomaterial arrangement with a high risk for physical and mental stress.

Meanwhile, study findings reveal that sorting out plastic waste at the sites of social action within the household could aid plastic recycling. However, households that occupy multi-unit and rooming houses often lack control over their shared and immediate outer spaces (e.g., kitchen and compound). This creates a problem for some households in Lagos that attempt to separate their plastic waste (Shittu, Nygaard & Bailey 2021). As a result of the limited storage space, they may decide to place the recyclables in the compound pending collection, but the homeowners usually complain of defacing the environment with plastic waste. For multi-unit dwellers in Melbourne, disposal of plastic waste in the recycling bins is often counteracted by co-tenants who contaminate the recyclables with general waste.

The preceding analysis also alludes to how unequal power relations are embedded into sociomaterial arrangements and practice complexes. From a practice perspective, unequal distribution of and access to sustainability resources are consequences of the conflicts, competitions and interferences that arise from the interaction of multiple practices. Nicolini and Monteiro's (2017) dialectical approach to studying practices focuses on how different configurations of practices empower some social groups and disempower others. Therefore, addressing environmental justice issues for enabling the transition of cities to circular economies involves resolving how existing practice configurations disenfranchise some social groups (for instance, low-income households) from adopting sustainable lifestyles (Shittu & Nygaard 2021).

8.4 Communities of practice as leverage for facilitating circular practices

Two ontological positions of practice theory guide the analysis in this section. First, for the most part, individuals do not choose which practice to adopt. Instead, practices often recruit individuals who then embody the accompanying knowledge and skills and reify the normative ends through daily performances (Hargreaves 2011). In this regard, individuals are not mindless automatons, but practitioners who encounter, carry and defect from multiple practices by applying their bodies and minds to navigate the contextual performance of practices (Reckwitz 2002). The organisation of practices in a physical or virtual space mutually shapes the sociomaterial arrangements (including bodies) surrounding the practitioner. Second, practices are inherently social, that is, they are created, shared, and shaped by multiple practitioners. Each iteration of a practice (including those performed in isolation such as bathing) adds to or detracts from (slightly or significantly) the elements and processes that compose such practice. Hence, the historical or geographical differences in globally shared practices.

A major way that practices recruit individuals and evolve is through communities of practice. According to Wenger-Trayner and Wenger-Trayner (2015, p. 1), "communities of practice are groups of people who share a concern or a passion for something they do and learn how to do

it better as they interact regularly". Also, communities of practice could be considered a social system which is defined by Rogers (2003, p. 14) as "a set of interrelated units that are engaged in a joint problem solving to accomplish a common goal". However, a community of practice differs from other social groups in that the people involved share a committed interest in a field and skills that develop from continuous practice (Wenger-Trayner & Wenger-Trayner 2015). They also interact to develop and refine the guidelines, processes and tools that assist in solving shared problems. This constant engagement with each other results in networks of learning and a collection of shared experiences. These features imply that communities of practice could involve the physical or virtual collection of people (Wenger-Trayner & Wenger-Trayner 2015). The multifaceted attribute of the concept makes it a useful theoretical tool for scholars in the fields of organisational studies, political economy, knowledge management, sociology, and internet studies.

In Lagos, SustyVibes, Food and Beverage Recycling Alliance (FBRA) and Recyclers Association of Nigeria (RAN) are examples of communities of practice promoting circular practices among local businesses and households (Shittu & Nygaard 2021). SustyVibes operates an online community of young people who share deep interests in environmental sustainability and participate in community outreach programmes and other environmental volunteer activities. FBRA and RAN are associations of producers and recyclers respectively that aim to promote Extended Producer Responsibility (EPR), influence sustainability policymaking and share resources to facilitate members' sustainability activities.

Communities of practice (Wenger-Trayner & Wenger-Trayner 2015) are central to grassroots involvement in enabling the transition of cities to circular economies for at least three reasons: (1) consolidate or scale-up circular practices; (2) establish or sustain circular practice complexes and (3) guide the transformation of circular practices. First, circular practices are still at the periphery of the existing linear economy. From a transition perspective, circular innovations and business strategies are currently at the niche stage and are yet to be widely adopted. Replacing the existing linear production and consumption systems would require consolidating and scaling up circular practices to the regime domain. In this regard, communities of practice could coordinate and synergise efforts to spread awareness of their

practice and recruit new members into the group. Also, communities of practice could provide members with helpful resources in navigating the sociomaterial constraints imposed on their performance of circular practices (Wenger-Trayner & Wenger-Trayner 2015).

These functions are essential in launching and experimenting with new circular innovations while also facilitating their uptake among urban households. According to Rogers (2003), communication channels and social systems (which are two features of communities of practice) are important elements in the diffusion of innovations. In this regard, communities of practice could be regarded as grassroots or eco-innovation intermediaries that "circulate or aggregate lessons and transfer knowledge across local experiments, potentially contributing to the upscaling of experiments beyond niches and challenging the status quo" (Kanda et al. 2020, p. 449).

Second, following the S-curve transitions model, the adoption of circular practices may be slow at the start but grow exponentially after accumulating a critical mass before reaching a saturation stage when circular practices become established in cities (Harris & Matusitz 2016). To become the new regime, circular practice complexes must be established and sustained through consistent and continuous performances at the grassroots. Communities of practice could facilitate this through documentation, assets reuse and support offer (Wenger-Trayner & Wenger-Trayner 2015).

Communities of practice are also characterised by a shared repertoire that involves "easily accessible tools, routines, knowledge repositories and other instrumental aids to engagement" (Murillo 2008, para. 18). Furthermore, communities of practice engage in collaborative problem-solving and intensive participant interaction to create and maintain identities (Rosenbaum & Shachaf 2010). The identities generated from the shared repertoire and mutual engagements of members of a community of practice could further solidify circular practices while differentiating them from other practices (Wenger-Trayner & Wenger-Trayner 2015). At this stage, communities of practice could function as a regime-based transition intermediary whose role is to extend the lifecycle of circular practices by utilising political instruments and advanced socio-technical innovations (Kivimaa et al. 2019).

Lastly, practices evolve: a practice may disappear due to the breakage in the links that connect its constitutive elements; another practice may emerge given the novel combinations of multiple elements and a practice may transform into new forms as constitutive elements are replaced or combined in different ways during iterations. In a complex system of interwoven circular practice nexuses, these practice evolutions may take different directions and result in varied outcomes. However, communities of practice could be highly instrumental in guiding such systemic evolution at the grassroots (Wenger-Trayner & Wenger-Trayner 2015). As a regime, circular systems will be impacted by developments in the landscape and niche domains including technological improvements, changing meanings, improved skills and guidelines, and innovative circular business strategies. Therefore, discussing developments, mapping knowledge, identifying gaps, and integrating solutions are some of the features of communities of practice that could accelerate the effective transformation of circular practices (Wenger-Trayner & Wenger-Trayner 2015).

8.5 Urban grassroots strategies for environmental governance and circular transitions

Facilitating the transition of cities to circular economies necessitates the involvement of the grassroots in the design and implementation of environmental governance strategies. However, findings from the doctoral study suggest that this entails addressing two major issues affecting grassroots participation in urban environmental governance. First, as discussed in section 8.3, there are significant environmental justice issues that affect embedding sustainability practices in urban households. For instance, the systemic exclusion of low-income households from sustainability information, public participation, and sustainability infrastructure. This, therefore, calls for identifying and resolving the environmental constraints that prevent different household categories to adopt and perform sustainability practices. Also, providing accurate sustainability information that is clear and relevant to households' environmental realities could improve their performance of sustainability practices. Furthermore, promoting environmental governance at the grassroots entails the involvement of communities of practice

(Wenger-Trayner & Wenger-Trayner 2015), multicultural and income groups in public consultations and co-design of sustainability solutions.

Second, although many urban households perform some sustainability activities such as maintenance and reuse as part of their daily practices, they were not necessarily motivated by environmental sustainability concerns (Shittu, Nygaard & Bailey 2021). Instead, such sustainability activities were influenced by other factors such as financial considerations, functionality, and convenience among others. Moreover, the sustainability activities could not form integrative practices due to being disjointed and lacking concrete guidelines. According to Warde (2013), integrative practices are bundles of activities with skills that can be formally acquired, clear material processes that can be executed and well-defined goals. Integrative sustainability practices suggest a level of affective attachment among practitioners beyond analytical considerations. Sustainability values could provide meanings and affective attachments that anchor the reiterative household performance of circular practices.

The preceding suggests that a grassroots strategy for urban environmental governance would be the generation and promotion of environmental sustainability values in households. This could be achieved through community programmes, volunteer activities, support visits and embedding sustainability programmes into the school curriculum. Shared learning processes in communities of practice (Wenger-Trayner & Wenger-Trayner 2015), peer pressure and the transfer of social capital through social interactions are other factors that may promote the adoption of sustainability values. Also, facilitating circular solutions that are low-cost and easy to perform could improve households' interest in acquiring more knowledge and skills in the circular economy. Lastly, there is a need to provide clear guidelines, processes, skills, and rules that integrate circular activities into practice complexes at the regime level.

8.6 Conclusion and recommendations

The current consensus in the circular economy literature is that the transition of cities requires keeping materials within closed loops and out of the environment. Policies, business innovations and technological inventions are geared towards providing downstream circular solutions in energy recovery, recycling, market creation, waste to energy, waste evacuation and

upcycling. There are also other upstream circular solutions geared at researching alternative materials that are degradable and non-toxic to the environment. However, in terms of grassroots environmental governance, findings from the doctoral study suggest a strategy that combines both upstream and downstream solutions.

Therefore, it is recommended for policymakers and scholars to research and implement the optimal integration of both sustainability solutions to achieve the transition of cities to circular economies. Potential subject matters include leveraging communities of practice (Wenger-Trayner & Wenger-Trayner 2015) to promote minimisation, sharing and waste separation among households; creating a blueprint for new and existing local businesses to implement circular business models and co-dependence of materials in performing household practices and creating waste. To expand on the last point, multiple materials are invoked and interact in different ways during practice performance. When not combined, materials may substitute each other. For instance, findings show that low-income households substituted iron and glass objects for plastic given the latter's functions of mobility, safety, and convenience in some household practices (Shittu 2020). Understanding the evolution of such practices means tracking the entry, combination and exit of different materials. Therefore, research must investigate the various sociomaterial combinations that can facilitate circular practices. Also, policymakers should focus more on designing policies that optimise such sociomaterial combinations in a circular economic system.

CHAPTER NINE

Discussion Part Two: Implications of a Practice Perspective for Systemic Realignment

9.1 Introduction

This thesis explores a household practice perspective on urban transitions to circular plastic economies. The focus on circular plastic economies in this study sits within broader national and global environmental and health challenges created as consequences of unsustainable resource consumption, including plastic consumption, in the current linear economic system.

By employing practice theory, this thesis interrogates plastic-related practices in urban households and draws insights into grassroots strategies for circular transitions in cities. The practice perspective is adopted to provide an alternative theoretical understanding of plastic materiality, sustainability practices, sustainability transitions and circular economy. This thesis contributes to knowledge of circular economies and practice theory by conceptualising circular plastic economy as a teleoaffective formation (Welch 2017; see chapter 4). The paper presented in chapter 4 describes circular plastic economies as composed of a constellation of complex plastic-related practices that are anchored by a general understanding and discourse of sustainability. This exposition presents a framework that incorporates social, political, economic, and technological domains into a circular system that aims to achieve the sustainable use of plastic. This chapter further builds on chapter 4 to draw insights for research and policy in examining sustainability practices. This chapter also extends the zooming in and out approach adopted in chapter 4 to draw out insights from the thesis for wider systemic transitions.

Chapter 5 presents a systematic literature review of the emerging sustainability concerns in urban households. The chapter is published as Shittu (2020). One of the premises of this thesis is built on the systematic literature review finding that household sustainability knowledge and attitudes do not necessarily result in sustainable lifestyles. Literature shows that households are

unable to consume sustainably, not necessarily because they lack sustainability knowledge, but due to the complex interconnection of socio-cultural practices (Sole & Wagner 2018; Paddock 2017). Shittu (2020) further demonstrates that policies targeting individual characteristics have largely not resulted in sustainable consumption, hence, the need to understand and intervene in the underlying practices of everyday life.

Moreover, even though the literature could not identify any substantial difference in the unsustainable environmental impact of material consumption between low-income and high-income households (Buhl et al. 2018; Cai, Liu & Zhang 2019), the transition to sustainable consumption may be more challenging for the former given the additional socio-economic and environmental difficulties low-income households face in adopting sustainability lifestyles (Shittu 2020). This chapter examines the implications of such socio-economic disadvantages for understanding sustainability practices. Shittu (2020) further establishes that scholars in consumption studies are increasingly adopting theories of practice to understand household consumption. However, as discussed in the paper, most studies are focused on non-material aspects such as energy-related practices. The thesis, therefore, addresses this knowledge gap by extending practice theory to explore household plastic consumption.

Chapters 6 – 8 present the empirical evidence to support the theoretical analysis propounded in this thesis. Chapter 6 is published as Shittu (2021a). Chapter 6/Shittu (2021a) empirically analyses how plastic materiality facilitates the performance of household practices through plastic's corporeal, spatiotemporal, and functional dimensions. This study is an important empirical investigation of the way materiality manifests in household routines using practice theory. The paper builds on seminal works (Shove 2010; Schatzki 2010; Hawkins 2019) to advance the understanding of materiality in practice theory. The findings discussed in chapter 6 reveal that plastics (and by extension, materials) are more than tools that practitioners utilise to perform practices, instead, plastics are actively influencing practitioners and practices through their inherent physical features, spatiotemporal attributes, and functionalities (Shittu 2021a).

Beyond dominant Western case studies, data from case studies of low-income households in an emerging city presents new contexts and insights into how a ubiquitous material like plastic could materialize and routinise household practices. Shittu (2021a) categorically identifies the dimensions of plastic agency and their implication for theory, research, and policy. As conceptualised in the paper, plastic actively contributes to practice performance through its corporality, functionality or meaning mediation and spatiotemporal quality or competence. The paper responds to Nicolini's (2009) call for practice research to zoom in on material arrangements in social domains. Moreover, the paper follows Strengers, Nicholls and Maller's (2016) analysis of materials as actants in household practice performance. Shittu (2021a) also makes a conceptual contribution by extending Shove, Trentmann and Wilk's (2009) conceptualisation of practice elements by arguing that materials anchor meanings and skills through their unique corporal features. However, the paper raises the possibility that material agency can be simultaneously corporal and relational. Lastly, the paper looks at the implications of the findings for policymaking and sustainability transitions.

Chapter 7 further examines the embeddedness of plastic-related sustainability practices such as contractive, protractive, and regenerative practices in urban low-income households and their integration into the sustainability transitions of cities. The chapter was submitted to a journal as Shittu, Nygaard and Bailey (2021). The paper significantly contributes to the waste management literature in several ways. First, Shittu, Nygaard and Bailey (2021) conceptualise plastic-related sustainability to include protractive, contractive, and regenerative practices. The paper posits that achieving sustainable plastic use, and by extension circular plastic economy, requires the integration of practices that extend the lifecycle of plastic, reduce the amount of plastic in circulation and transform plastic waste into new products. Second, while low-income households perform some protractive sustainability activities such as maintenance and reuse, they are mostly influenced by socioeconomic factors rather than environmental considerations. Also, the sociomaterial arrangements of low-income households inhibit their performances of contractive and regenerative activities including sharing and recycling. Therefore, implementing circular plastic economies also involves addressing environmental justice and waste infrastructural issues in cities as further discussed in chapter 8. Lastly, Shittu, Nygaard

and Bailey (2021) discuss the major implications of the findings for the sustainable transformation of plastic consumption in urban households.

Chapter 8 (Shittu 2021b) focuses on household-level insights and lessons from Shittu (2021a) and Shittu, Nygaard and Bailey (2021), as well as the methodological discussion in chapter 3, for grassroots environmental governance strategies for urban transitions to circular economies. These include addressing environmental justice issues in urban households and leveraging communities of practice (Wenger-Trayner & Wenger-Trayner 2015). Addressing environmental justice issues includes improving access to sustainability information, public participation in sustainability consultations and the provision of sustainability infrastructure. Communities of practice can promote circular transitions by scaling up circular practices, sustaining circular practice complexes and directing the transformation of circular practices (Shittu, Nygaard & Bailey 2021). In this chapter, the attention turns to a discussion of the thesis findings and insights for research, policy, and practice.

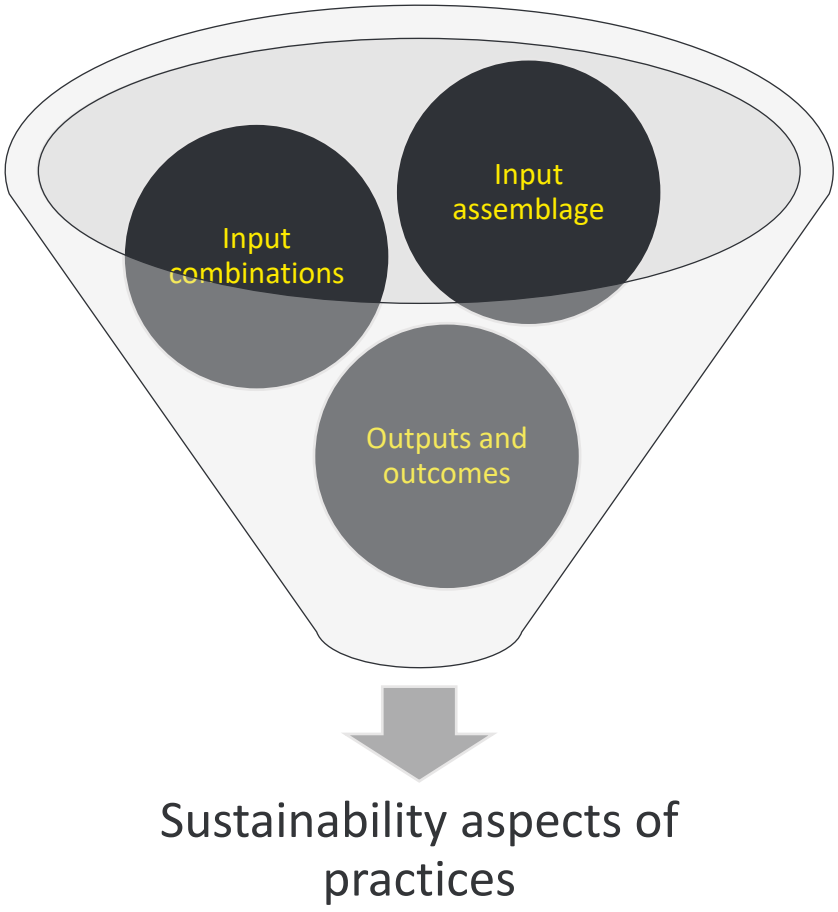
9.2 Examining sustainability considerations for a nuanced analysis of practices in research and policy

An important implication of the findings presented in chapters 5-7 and as presented above is that researchers and policymakers need to engage in a more nuanced analysis of sustainable urban household consumption. This thesis thus shows that practices cannot be adjudged on binary scales of 'sustainable' and 'unsustainable'. Instead, practices can be thought of to exist in three different variations and stages of materialisation. Here I call these input assemblage, input combinations, and outputs and outcomes (see figure 9.1). This analogy could apply to the performance of practices in any societal domain including households, businesses, and politics.

First, to perform a practice, practitioners may obtain or assemble input elements sustainably. This could be the use of sustainable materials, the sustainable procurement of materials, the acquisition of sustainability skills and/or the setting of sustainability aspirations. Nonetheless, not all sustainability practices necessarily require sustainable inputs. For instance, the performance of recycling as a sustainability practice may involve the use of 'unsustainable' or

'less environmentally friendly' materials such as plastics. In such cases, such practices lay more emphasis on transformation processes and sustainable outcomes. It is important to note here that the input of a practice performance is often the outcome or by-product of another ongoing or previously completed (set of) practice(s).

Figure 9.1 *Sustainability considerations in stages of materialisation*



For households, gathering the practice elements for cooking, for instance, could be preceded by the performance of shopping practices, the embodiment of cooking skills through professional or informal training practices and the adoption of meanings of sustenance and cultural culinary art through socialisation. Likewise, the acquisition of input materials for a business could involve several complex practices such as design, extraction, business-to-business purchase, transportation, communication, and negotiation.

The implication of the preceding for research and practice is that a sustainability practice may become ineffective in the long run if the inputs are constantly supplied from close-knitted practices. An instance relates to some of the challenges of the current recycling systems in cities. Recycling systems in cities suffer not just from the lack of markets for recycling products but also because of the improper sorting of household and industrial waste (Ibrahim 2020; Yoada, Chirawurah & Adongo 2014). This results in massive contamination of potential recyclables which then puts significant pressure on the recycling system and most often, the plastic waste ends up polluting the environment. As discussed in chapter 7, sorting is one of the sustainability activities that need to be embedded in household practices to transfer clean input to the recycling system but low-income households face difficulties due to their lack of access to adequate storage spaces. Beyond that, the performance of other plastic-related sustainability practices such as protractive and contractive practices in households and industries will reduce not only the pressure on the recycling system but also the energy footprint of material regeneration processes. Thus, researchers, policymakers and other sustainability stakeholders must consider the extent to which a practice is integrated with others when designing intervention programmes.

Second, the process of combining the input elements may also reveal some sustainability aspects of a practice. Here, the materials are sustainably and skilfully commingled following sustainability principles to achieve a desired goal such as reducing the negative environmental impact of practices. For both households and businesses, this could be in terms of using the right quantity of materials, avoiding material damage, maximising material functionalities, proper channelling of unwanted materials and other activities that prevent environmental leakage and improve resource efficiency.

For instance, Shittu (2021a) and Shittu, Nygaard and Bailey (2021) find that low-income households take caution in handling plastic materials when performing daily practices to extend their lifecycles. Specific examples from low-income households include avoiding using a plastic spoon to stir food when cooking and filling a plastic bucket with the water quantity that corresponds with its capacity. Thus, from a practice perspective, the sustainable combination

of materials during the performance of a practice is heavily reliant on the level of embodied sustainability competences and the solidification of sustainability meanings and values. This analogy is closely related to what chapters 4 and 7 refer to as the transformation of compound sustainability practices to integrative practices (Schatzki 2002; Warde 2013).

Furthermore, the detailed sustainability evaluation of input combinations of practices is important for several practical reasons. As the systematic literature review (Shittu 2020) and Buhl et al. (2018) show, the resource intensification of consumption and consequently, the material and waste footprints of households, are less about the income of households and more about the input combinations and performance processes of individual household practices. Moreover, chapter 5 highlights that even with sustainable technologies that are designed to reduce the energy footprint of households, the lack of adequate knowledge and skills in using these technologies while performing energy-related practices inhibit their effectiveness (Herrmann, Brumby & Oreszczyn 2018; Shittu 2020). Therefore, sustainability design, policies and strategies must ensure that the recent burgeoning sustainable materials and technologies are accompanied by the embodied knowledge of environmental risks and the adoption of sustainability values in business and household practices.

However, another issue here as identified across this thesis regards the capacity of households to acquire sustainable materials as inputs and sustainably combine them. Several chapters in this thesis (chapters 5, 6, 7 and 8) discuss the inability of low-income households to afford the current high cost of adopting sustainable lifestyles and their unequal access to sustainability infrastructure and information to sustainably process inputs during practice performance (Shittu 2020; Shittu 2021a; Shittu, Nygaard & Bailey 2021; Shittu 2021b). As a result, policies must lay a stronger emphasis on addressing environmental justice issues and enhancing the capacities of households and businesses to perform sustainability practices.

The third facet of sustainability considerations in practices concerns their performance outcomes. An interesting insight that can be drawn from this thesis is that sustainability outcomes are not necessarily produced by the acquisition and combination of sustainable inputs but could also result from unsustainable processes. However, sustainability outcomes arising

from unsustainable processes may appear to be fleeting or have less impact on wider sociomaterial practice constellations. This, therefore, suggests the importance of sustainably transforming socio-economic processes to create lasting outcomes. Furthermore, an evaluation of a sustainability outcome in research and policy should examine its multiple forms and scale of impact. The form of sustainable outcomes could be in terms of novel or upcycled materials and technologies, new or enhanced skills or procedures, and new or refined principles, values, and rules. Regarding the scale of impact, sustainability outcomes may vary by space (e.g., household space versus community or organisation versus industry) or period (e.g., short-term versus long-term).

The preceding description of the sustainability facets of practices further brings to the fore the need for a proper conceptualisation of sustainability practices in research and policy. As revealed in this thesis, while households may perform some practices that result in sustainable outcomes such as the extension of the material lifecycle, those practices are not in themselves sustainable. A suggested conceptualisation is that a sustainability practice results in sustainable outcomes and entails a sustainable process which is sometimes guided by sustainability principles such as the transformation of materials into new products or the utilisation of services that reduce material use. Therefore, as applied across this thesis (chapters 4-8), researchers and policymakers must develop frameworks that both zoom into practices to examine the intricate performance processes and zoom out to address the impact of interconnection among practices.

9.3 Achieving sustainability and circularity calls for innovation by combination and resourcefulness in socio-technical systems

Although the selected low-income households in this study lack sufficient access to socio-economic resources, they nevertheless combine low-cost materials with other practice elements in mundane but innovative ways to perform household practices. Examples of this include repurposing used or old materials from one part of the household to another to maximise value utilisation; transferring personal items to significant others to prolong sentimental values and sharing items with neighbours to reduce the financial burden and improve communality (see

chapter 6). This is not to argue that these practices are sustainable or just, but to highlight the importance of socio-technical resourcefulness in addressing the challenges of rising consumption, income gap, disposability, wastage, and environmental degradation (see chapter 5).

Transitioning cities to circular economies must, therefore, go beyond business-as-usual to re-imagine new, radical, and disruptive practice configurations in socio-technical systems including markets, product and service design, technological innovations, infrastructure provision, and community services and policy landscapes. While it is important to pursue domain-specific circular strategies and action plans, it is imperative for the barriers between and among domains (e.g., industries, business scales, knowledge domains) to dissolve with trans-local, multidisciplinary, and multi-stakeholder circular solutions. In this case, the transition challenge can be summarised thus: optimising socio-technical and socio-economic resourcefulness by innovatively combining existing approaches in new, sustainable, and circular ways.

Innovation by combination addresses two central issues of circular transitions: diverting existing materials away from the environment and creating new products and services that embed circular principles. Several examples of innovation by combination already exist although currently at a marginal and premium rate. According to Heleven (2010), innovation by combination strategies include (Figure 9.2): 1) designing products with multiple functionalities such as in fashion, construction, transportation, mobile technology and household items; 2) introducing new products to the market by using established brands such as in-home design and fast-moving consumer goods; 3) conscious design of packaging with additional functions such as in-home appliances and food packaging; 4) enabling user-led temporary combinations such as in spatial design; 5) subsuming multiple products into each other as a nested design such as in transport technology, mobile technology and household appliances; 6) innovative combinations of products and services such as in mobile technology and product-as-service; 7) integrating multiple products and services into one product or service (e.g., old and new materials, all-in-one or co-branding) such as in hybrid energy systems; 8) oxymoronic design of products and services such as in virtual reality, home office

and biotechnology, and 9) adjectival innovations in industries (e.g., wildlife tourism, agritourism and backpack tourism.

Figure 9.2 *Innovation by combination strategies*

Source: Heleven (2010), author's design

It should be noted here that while innovations are important in aiding socio-technical transitions, they must be developed in the context of socio-material practices. The current approach to introducing new materials or innovations (e.g., technologies, products etc.) into society assumes that embedding materiality with sustainability elements is enough to reconfigure existing practice complexities. As established in this study, although materials shape practices through their corporal, spatiotemporal and functional dimensions (see chapter 6), they are in turn shaped by other practice elements such as competence and meanings. A sustainable material that is not accompanied by sustainable skills and meanings may become ineffective within the context of a practice.

Moreover, no practice exists in isolation and practitioners often give preferences to the practice that provides the highest value in a particular context. In such cases, a sustainability practice (i.e., involving sustainability innovations) may become less effective if the attached values do not outweigh those of an unsustainable alternative or are impeded by other socio-economic factors. For instance, findings from chapter 7 reveal that although some low-income households are keen on sorting their plastic waste, they are inhibited by the lack of storage space and control over their immediate environment. This finding also speaks to the planning strategies that aim to increase residential density patterns and multi-unit dwellings in cities, such as Melbourne (Chhetri et al. 2013; Motazedian). Such planning strategies may consequently reduce personal and shared spaces in residential areas and impact household sustainability practices, even for high-income households. Urban planning approaches for developing a compact city alongside transitioning to circular economies must not just focus on infrastructure that aids the flow of people but also the flow of materials and their implications for urban household practices.

The preceding point alludes to one of the recurring recommendations in this thesis – the importance of creating an enabling environment for the integration of sustainable innovation in household practices. As discussed in chapter 8, this involves providing easy access to sustainable infrastructure, promoting the adoption of sustainability values, and facilitating sustainability skills empowerment among households and businesses. In essence, the successful transition of cities is predicated on cooperation among sustainability stakeholders and a combination of approaches across all spheres of the socio-technical system to produce novel processes and practices. As discussed in sections 1.2 and 2.4, circular economies are solutions that require different implementation strategies for each city by relying on local resources and networks. This requires promoting mutually beneficial and sustainable partnerships in design, governance, markets, and communities (Shittu 2021b).

9.4 Conclusion

This chapter discusses the implications of a practice perspective for systemic realignment. Awareness already exists of the dangers of the current linear economic system to the environment and the need to transition to more sustainable economic models such as the circular economy within cities. To this end, researchers, policymakers, businesses, and other sustainability stakeholders need to be sensitive to evaluating the connectivity of a practice to others, the influence of skills and values in performing a practice and the creation of lasting sustainability outcomes.

Furthermore, this thesis establishes that sustainability meanings and values are anchored in materials. Therefore, a systemic realignment to a circular economic system calls for new and innovative combinations of materials and technologies that aid circular practices and business models. Some of these innovations by combination have been identified to include brand extension, user-led temporary combinations and a combination of products and services. More importantly, examining sustainability considerations and promoting innovation by combination are two major tools for addressing environmental justice issues and accelerating multi-stakeholder collaboration toward circular transitions.

CHAPTER TEN

Conclusions

10.1 Thesis conclusion

This research sits within the broader efforts to tackle the impacts of climate change and environmental degradation by transitioning cities to circular economies. A circular economy is an economic system that regenerates natural systems and keeps materials within the production-consumption loop and out of the environment. The specific focus of the study – plastic-related sustainability practices and the circular plastic economy – was motivated by growing environmental issues resulting from unsustainable plastic consumption, particularly in cities.

There is currently a struggle within policy circles to manage plastic waste and promote behaviour change within households. This is also linked to the knowledge gap in social sciences relating to understanding social and behavioural change. For instance, transitions theories and traditional social theories have mostly ascribed change to the socio-cognitive efforts of social actors (Archer 1995; Strengers & Maller 2014). These perspectives not only undervalue material relations in sustainability transitions but also overlook the underlying network of practices that constitute the societal system. Given this background, this thesis addresses the overall research question: *how can plastic-related household practices be transformed for enabling the transition of cities to circular plastic economies?*

The thesis utilises practice theory to answer the overall research question. Practice theory argues for the shift of research and policy focus from behaviour, attitudes, and choices to the bundle of activities that are performed daily to create social order. This thesis, therefore, posits that the transformation of household practices is important to accelerate circular transitions. Focusing on plastic-related household practices, this study adopts a pragmatic paradigm which enables a mixed-methods approach to collect empirical data to answer the overall research question. The study employs a systematic literature review, conceptual analyses, and a case study approach. Low-income households in Surulere, Lagos were selected as case studies to generate contextual insights and theoretical contributions beyond the dominant Western

studies. The methods of data collection in low-income households include in-depth interviews, home tours, directed photography and short surveys. Household data collection is supplemented with key informant interviews with sustainability experts in Australia and Nigeria. These expert interviews provide policy and practice perspectives on the overall research question.

As a PhD by Publication, five papers are developed in this thesis to answer sub-questions derived from the overall research question. The particular focus of each of the papers is shown in figure 10.1. Two of the papers are published as academic articles in high-ranking journals (Q1); one paper is submitted and under review in another high-ranking journal (Q1); one paper is submitted as a book chapter in an edited book, and another paper is close to submission to a journal. The five papers provide evidence on a circular plastic economy framework; emerging concerns in urban consumption; a plastic materiality framework; a sustainability practice framework and insights into grassroots mobilisation to facilitate the transition of cities to circular economies.

Figure 10.1 *Doctoral research process and stages of papers*

Regarding the overall research question, this thesis is structured as follows. Chapter 1 establishes the importance of transitioning to CPEs in cities and alongside chapter 2, identifies the important strengths of practice theory in addressing knowledge gaps in transition theories

by taking a household perspective on circular transitions in cities into account. This relates to the ability of a practice perspective to zoom in on the constituent elements of household activities while also zooming out on the web of practices that create complex systems.

Chapter 3 discusses how the pragmatic paradigm, an exploratory research design, a systematic literature review, conceptual development and case study methodology enable this thesis to answer the research question by focusing on plastic-related practices in low-income households. Chapter 4 conceptualises a circular plastic economy to be a teleoaffective formation composed of general understandings such as sustainable socio-ecological integration, (non-)discursive formations and the constellation of practice complexes (Welch 2017). Here, it is theorised that the transition to CPEs can be enabled by transforming current plastic-related compound sustainability practices into integrative practices (Schatzki 2002; Warde 2013). This involves establishing formal guidelines, processes and skills that achieve clearly defined CPE goals. Thereafter, it is important to consolidate those integrative sustainability practices into practice complexes that then form CPE teleoaffective formations at domain and societal scales.

The systematic literature review in Chapter 5 further reveals the need to explore solutions to sustainability challenges in households through a practice perspective. Chapter 5 reveals that emerging themes in research include concerns about unsustainable consumption patterns of urban households; the influence of income level on the adoption of a sustainability lifestyle; low level of sustainability knowledge in urban households; inefficient management of urban resources and mixed effect of technology on household consumption. Theoretical approaches to studying consumption and sustainability include theoretical models (e.g., the Multi-Regional Input-Output model) and social theories (e.g., the social construction of technology and Consumer Culture Theory). Suggested strategies for sustainability transitions include local-level intervention, economic and technological initiatives and research focus on practices.

In chapter 6, this thesis shows that plastic manifests household practices through its materiality dimensions. Plastic facilitates the reproduction of household practices through the interaction between the “corporal”, “spatiotemporal” and “functional” dimensions of its materiality. The five main categories of plastic-related practices identified in urban low-income households are hygiene-related, comfortability and entertainment, storage, food-related and child-rearing

practices. Furthermore, the importance of plastic in low-income households extends beyond economic considerations to encompass the anchorage of meanings such as sustenance, convenience, and safety. This partly explains the complications resulting from policy strategies that mainly aim to ban plastic materials and instead, points to the need for transforming plastic-related household practices.

Chapter 7 posits that plastic consumption in urban households can be transformed by consolidating sustainability activities into "integrative" sustainability practices. In this sense, plastic-related sustainability practices can be integrated with well-defined guidelines and processes to deliver sustainability outcomes. As further discussed in chapter 8, plastic-related sustainability practices including "contractive", "protractive" and "regenerative" practices can be embedded into urban households by addressing grassroots environmental justice issues and leveraging communities of practice (Wenger-Trayner & Wenger-Trayner 2015). Finally, as expanded in chapter 9, this thesis suggests a more nuanced analysis of sustainability considerations in research and policy and advancing resourcefulness through innovation by combination in design and practice. The discussion in these chapters, therefore, provides insights on how to achieve the two aspects of CPE transitions, that is, transforming compound into integrative practices and embedding sustainability practice complexes into wider societal systems to form a CPE teleoaffective formation.

Furthermore, it may perhaps be convenient to talk about sustainability transitions in general terms as a process that requires systemic and holistic change. However, this thesis has shown that practices as the object of such change are complex and enduring. Therefore, beyond blanket policies that aim to achieve systemic transitions, this thesis emphasises the importance of understanding the uniqueness of practice configurations in each socio-technical domain and therefore, developing specific strategies that enable their reconfiguration. The thesis also shows (chapter 6) that plastics (and by extension, materials) are more than tools that practitioners utilise to perform practices. Instead, plastics (and materials) actively influence practitioners and practices through their inherent physical features, spatiotemporal attributes, and functionalities. The materiality of plastic thus provides additional intervention point(s) for enabling transitions from compound to integrative practices, and from integrative to the CPE teleoaffective formation. Reconfiguration in this sense could be through breaking the links

between the elements of existing practices or creating new links through an innovative combination of materials.

In answering the overall research question, this thesis provides several contributions to theory and research: an exploration of less-researched household practices in transitions theory; the contribution of new insights and concepts to practice theory from new material, economic and city contexts. These contributions to knowledge also identified significant implications for policy and practice: the conceptualisation of the integration of household practices with broader socio-economic and urban management systems; the derivation of insights and lessons to facilitate grassroots involvement in circular transitions, and the implications of a practice perspective for realigning socio-technical systems.

Throughout the thesis, some implications and recommendations for research, policy and practice are identified and discussed. For instance, there is a need for more empirical studies on the impact of materiality on social formation in social sciences. Also, sustainability policies must be inclusive and address environmental justice issues. For design, it is important to be conscious of the way goods, services and innovations would impact sustainability practices among consumers or households. Table 10. 1 further summarises the recommendations drawn from across the chapters for research, policy, and practice. Each recommendation is ranked based on the level of importance or significance it holds for research, policy, and practice. Importance or significance level refers to the capacity of each domain to directly act on and achieve the listed recommendation.

Table 10.1 *Summary of study recommendations for research, policy, and practice*

S/N	Recommendations	Theory / Research	Policy	Design / Practice	Relevant Chapters
1	Circular transition strategies must be well-coordinated, trans-local, holistic, and integrative	Moderate relevance	High relevance	High relevance	Chapters 8 and 9
2	Collaborate to redesign and reconfigure elements of existing practices including materials (e.g., infrastructures), meanings (e.g., guidelines, rules, and values) and competences (e.g., skills and processes)	High relevance	High relevance	High relevance	Chapters 4, 7, 8 and 9
3	Scale up, sustain, and guide the transformation of circular solutions by leveraging communities of practice	Moderate relevance	High relevance	High relevance	Chapter 8
4	Broadening of policy, practice and research focus to impact practices as the underlying building blocks of social structures	High relevance	High relevance	High relevance	Chapters 4, 5, 7 and 9

5	Adopt comparative analysis and systems thinking to address practice complexities during an intervention	High relevance	High relevance	High relevance	Chapters 4, 7 and 8
6	Further development of a theoretically informed understanding of materiality and material agency beyond anthropocentric perspectives	High relevance	Moderate relevance	Moderate relevance	Chapter 6
7	Urban sustainability solutions should be designed to address environmental justice issues e.g., by being inclusive, simple, affordable, and efficient	Moderate relevance	High relevance	High relevance	Chapters 7 and 8
8	Adopt strategies that optimally integrate downstream circular solutions (e.g., recovery, recycling, and waste to energy) with upstream circular solutions (e.g., designing alternative sustainable materials)	High relevance	High relevance	High relevance	Chapter 8
9	Investigate various sociomaterial combinations that can facilitate circular practices and design policies that optimise them in a circular economic system	High relevance	High relevance	Moderate relevance	Chapters 4, 7, 8 and 9
10	Engage in a more nuanced analysis of sustainability considerations in practices (e.g., in households and businesses)	High relevance	High relevance	High relevance	Chapter 9
11	Optimise resourcefulness in socio-technical systems through innovation by combination	Moderate relevance	Highly relevant	Highly relevant	Chapter 9

As discussed in chapter 1, this thesis converges the discussions from multi-disciplinary areas of consumption studies, practice theory, sustainability transitions and circular economy. First, this thesis addresses the consumption of plastic in urban households and its sustainable transformation. Second, the findings of this thesis advance the discourses on sociomaterial arrangements and day-to-day practices. Lastly, through the literature review and discussion of findings, this thesis conceptualises how a CPE is configured and identifies the strategies to achieve the CPE in cities. It is important to note that a CPE as conceptualised in this thesis is an aspect of a broader circular economy that includes the regeneration of myriad materials and the restoration of natural systems.

10.2 Limitations and future research directions

This research encountered some limitations in the systematic review conducted to explore the emerging sustainability concerns in urban household consumption. As stated in chapter 5, the selection of studies for the systematic review was limited to cities, three databases, peer-reviewed articles, and those published in the English language. These selection criteria could overlook other findings from other cultural and geographical contexts such as rural areas, non-

academic publications and studies that are written in other languages. Furthermore, while the systematic literature review attempted to capture data as widely as possible across household and country income, and practice categories, the synthesis was limited by period to studies conducted after 2015 when the SDGs were adopted. Although this was a deliberate choice to focus on urgent and topical sustainability issues in consumption literature, it nonetheless restricted the historical analysis of sustainability challenges in cities.

The foregoing is perhaps also reflective of the research as a whole. The study adopted case-study, explorative and descriptive research designs but through a cross-sectional lens to take a snapshot of plastic-related practices in low-income households. This limits the research in terms of the benefits of a historical, comparative longitudinal study such as identifying periodic trends in practices and measuring the impacts of circular practices. Longitudinal studies may be more appropriate for future studies looking to facilitate the adoption of circular practices in urban households. While this study was eventually able to draw out insights and lessons for cities, it is recommended that future studies compare practices across different settings to evaluate cross-cultural patterns in practices. Moreover, adopting pragmatism as a research paradigm enables the study to be flexible with data collection and analysis processes but limits the extent to which the student researcher could be rigorously objective in answering the research questions. Other scholars have written and acknowledged the influence of research as a practice in itself on the research subject (Sin 2005; McClintock, Ison & Armson 2003).

Furthermore, this study utilised qualitative and quantitative methods. Due to data collection constraints (see section … and below), case studies could only be collected in one country context and survey responses were limited to a small number. Although the study was initially conceived as a comparative analysis of low-income households in Melbourne, Australia and Lagos, Nigeria, the COVID-19 pandemic disrupted the research plans when the student researcher was unable to leave Lagos. This resulted in the adaptation of the study's methodology. A comparison of households had to be abandoned and likewise, any detailed attempt to anchor case studies' survey results within a larger sample became constrained. Comparative analyses and larger sample sizes would be beneficial to a study on practices by

addressing issues of context more directly and enabling a better understanding of complex systems.

Additionally, while this study identifies some environmental and social justice issues in low-income household practices, the latter was not the central focus of the research. Future studies on practices may focus on justice issues in households, including the issue of gender. Given that women constitute the majority of the participants in this study and are more concerned about environmental issues (Tranter 2011; Xiao and McCright 2012), future studies may also explore gender roles in maintaining and disrupting existing practices or reforming new ones in different social domains (e.g., communities and workplaces).

Lastly, this study explores circular transitions but mainly from the frame of practice theory. It would be recommended that future studies actively combine multiple theoretical frameworks to advance multi-disciplinary concepts and theoretical understanding.

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This thesis has provided knowledge and policy contributions to multidisciplinary areas of circular economy, consumption studies, sustainability transitions and practice theory. Overall, this thesis advances how understanding and transforming practices can be a catalyst for domain-specific and systemic transitions. Therefore, this thesis answers the call for practice theory scholars to move beyond retrospective analyses of change by conceptualising how the transformation of practices can enable emerging sustainability transition agendas.

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APPENDICES

Appendix A

Swinburne Ethics Approval Letter

Olamide Shittu

From: Sally Fried
Sent: Thursday, 4 July 2019 8:43 AM
To: Vivienne Waller
Cc: RES Ethics; Andi Nygaard; Aisling Bailey; Olamide Shittu; RES Grants
Subject: SHR Project 2019/215 - Ethics Clearance

To: Dr Viv Waller, FHAD

SHR Project 2019/215 - Transitioning from Plastic Consumption in Low-Income Suburban Households: A Comparative Social Practice Analysis of Australia and Nigeria
Dr Viv Waller, Dr Aisling Bailey – FHAD/A/Prof Andi Nygaard, Olamide Shittu (Student) – CUT
Approved duration: 04-07-2019 to 01-09-2022 [Adjusted]

I refer to the ethical review of the above project by a Subcommittee (SHESC3) of Swinburne's Human Research Ethics Committee (SUHREC). Your responses to the review as e-mailed on 3 July 2019 were put to the Subcommittee delegate for consideration.

I am pleased to advise that, as submitted to date, ethics clearance has been given for the above project to proceed in line with standard on-going ethics clearance conditions outlined below.

- The approved duration is 04-07-2019 to 01-09-2022 [unless an extension request is subsequently approved].
- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the *National Statement on Ethical Conduct in Human Research (2018)* and with respect to secure data use, retention and disposal.
- The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor, and addition or removal of other personnel/students from the project, requires timely notification and SUHREC endorsement.
- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.
- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project. Information on project monitoring and variations/additions, self-audits and progress reports can be found on the Research Internet pages.
- A duly authorised external or internal audit of the project may be undertaken at any time.

As advised, please submit a modification request in order to add the Research Assistant, once they have been appointed, to the project.

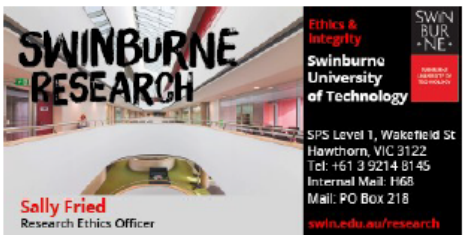
Please contact the Research Ethics Office if you have any queries about on-going ethics clearance, citing the Swinburne project number. A copy of this e-mail should be retained as part of project record-keeping.

Best wishes for the project.

Yours sincerely,

Sally Fried

Secretary, SHESC3



21/01/2020

Ref: 20201222-3365 : Transitioning from Plastic Consumption in Low-Income Suburban Households: A Comparative Social Practice Analysis of Australia and Nigeria

Approved Duration: 1 September 2019 to 1 February 2022

Chief Investigator Associate Professor Andi Nygaard

I refer to your request to modify the approved protocol for the above project. The request was put to a SUHREC/SHESC delegate for consideration.

I am pleased to advise that, as modified to date, the project may continue in line with standard ethics clearance conditions previously communicated and reprinted below. Please note that information on self-auditing, progress/final reporting and modifications/additions to approved protocols can now be found on the Research Ethics Internet pages.

Please contact the Research Ethics Office if you have any queries about on-going ethics clearance, citing the project number. A copy of this correspondence should be retained as part of project record-keeping and forwarded to relevant members of the project team.

As before, best wishes for the project.

Yours sincerely,

Ms Sally Fried

Research Ethics Office

Swinburne University of Technology

P: 9214 8145 | E: resethics@swin.edu.au

Appendix B

SEMI-STRUCTURED INTERVIEW TOPICS (KEY-INFORMANTS)

Project Title:
Transitioning from Plastic Consumption in Low-Income Households: A Comparative Social Practice Analysis of Australia and Nigeria

Investigators and Other Project Personnel

Chief-Investigator: **Associate Prof. Andi Nygaard**
Centre for Urban Transitions, Faculty of Health, Arts and Design
Swinburne University of Technology

Co-Investigator: **Dr Aisling Bailey**
Department of Sociology, Faculty of Health, Arts and Design
Swinburne University of Technology

Student Investigator: **Olamide Shittu**
Centre for Urban Transitions, Faculty of Health, Arts and Design
Swinburne University of Technology

Background information

1. Please tell me about yourself.
    - What is your background? (For example, education, employment, relationship to households and plastic waste management)

Household practices around plastic consumption

2. Perceptions about the prevalence and trend of plastic consumption in Melbourne/Lagos
    - Plastic purchase and waste management
3. Perceptions about households' plastic consumption patterns
    - Distinction between low-income and high income-households in terms of consumption and disposal of plastic
4. Participant's view on the correct use and disposal of plastic materials in low-income households
5. Participant's view on noticeable differences across suburbs in Lagos and Melbourne in plastic usage and disposal (attitudes/knowledge/understanding about environmental sustainability and its influence on the domestic activities they engage in)

Policy interventions in domestic practices around plastic consumption

6. The role of participant's organisation in making plastic consumption sustainable in Melbourne/Lagos
    - For instance, waste management, community events, sustainability education, policy implementation etc.)
7. Participant's evaluation of the existing policy initiatives to make household plastic consumption sustainable
    - The differences and relationships between external policy interventions and personal motivations of households to consume plastic sustainably
8. Participant's views on targeting domestic practices for policy interventions rather than individual behaviours

9. Suggestions on initiatives that could assist households to consume plastic sustainably (differences on types of initiatives depending on areas/suburbs/income type)
10. Perceptions of how households can more proactively take key roles in sustainable plastic consumption/plastic waste management (perceptions of key barriers and enablers)

SEMI-STRUCTURED INTERVIEW TOPICS (HOUSEHOLDS)

Project Title:
Transitioning from Plastic Consumption in Low-Income Households: A Comparative Social Practice Analysis of Australia and Nigeria

Investigators and Other Project Personnel

Chief-Investigator: **Associate Prof. Andi Nygaard**
Centre for Urban Transitions, Faculty of Health, Arts and Design
Swinburne University of Technology

Co-Investigator: **Dr Aisling Bailey**
Department of Sociology, Faculty of Health, Arts and Design
Swinburne University of Technology

Student Investigator: **Olamide Shittu**
Centre for Urban Transitions, Faculty of Health, Arts and Design
Swinburne University of Technology

Background information

1. Please tell me about your household.
    - Information about background (for example, income, education, employment, and size of household)

Domestic practices around plastic consumption

2. Domestic activities engaged in when using plastic
    - Types of plastic consumed, frequency of consumption, time of activities, domestic space of activities engagement (this is to understand the when, where, and how plastic is used in the household)
3. Reasons for using plastic in domestic activities
    - Social, environmental, financial, personal reasons (this is about the reflections that participants have around the usage of plastic in their domestic activities)
4. Evaluation of household skills in using plastic in domestic activities
    - Purchase, usage (durability), storage, disposal competences/knowledge (this is about the knowledge and the practical skills of households when making decisions about domestic activities around plastic consumption)
    - How the participants/households reconcile/make sense of the relationship between environmentally sustainable considerations and domestic activities
5. Other materials used in domestic activities alongside plastic
    - Types, durations, frequency, reasons, combination skills, disposal skills (this is about understanding the functionality of plastic in connection with some other materials for any given domestic activity involving plastic consumption)
6. Factors that would make participants/households to change their use of plastic (this is in terms of reusing, changing types, reducing, and recycling plastic)

Appendix C

Authorship Indication Form

Swinburne Research

Authorship Indication Form

For HDR students

NOTE

This Authorship Indication form is a statement detailing the percentage of the contribution of each author in each submitted/published 'paper'. This form must be signed by each co-author and the Principal Supervisor. This form must be added to the publication of your final thesis as an appendix. Please fill out a separate form for each published paper to be included in your thesis.

DECLARATION

We hereby declare our contribution to the publication of the 'paper' entitled:

Sustainability practices and materiality: Transforming plastic consumption in urban households

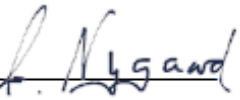
First Author

Name: Olamide Shittu Signature: 

Percentage of contribution: 80 % Date: 09 / 05 / 2022

Brief description of contribution to the 'paper' and your central responsibilities/role on project:
Concpetualisation, methodology, investigation, analysis, writing, reviewing, editing

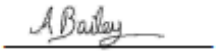
Second Author

Name: Christian Nygaard Signature: 

Percentage of contribution: 15 % Date: 23 / 05 / 2023

Brief description of your contribution to the 'paper':
Conceptualisation, supervision, analysis, writing, reviewing, editing

Third Author

Name: Aisling Bailey Signature: 

Percentage of contribution: 5 % Date: 23 /05 /2022

Brief description of your contribution to the 'paper':
Conceptualisation, supervision, analysis, writing, reviewing, editing

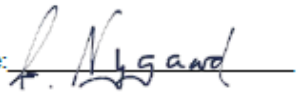
Fourth Author

Name:_____Signature:_____

Percentage of contribution: ____% Date: __/__/____

Brief description of your contribution to the 'paper':

Principal Supervisor:

Name: Christian A. Nygaard Signature: 

Date: 23 / 05 / 2023

In the case of more than four authors please attach another sheet with the names, signatures and contribution of the authors.

Authorship Indication Form

Appendix D

Publications and Presentations

Journal Articles

Shittu, O 2020, 'Emerging sustainability concerns and policy implications of urban household consumption: A systematic literature review', *Journal of Cleaner Production*, vol. 246, no. 119034, https://doi.org/10.1016/j.jclepro.2019.119034.

Shittu, O 2021a, '"Almost everything in the house now is plastic": Foregrounding plastic materiality in household routines and practices', *Sociological Research Online,* pp. 1-18, https://doi.org/10.1177/13607804211034887.

Shittu, O, Nygaard, C & Bailey, A (2021), 'Sustainability practices and materiality: Transforming plastic consumption in urban households', *Resources, Conservation & Recycling,* [Manuscript submitted for publication 21 Sept 2021].

Presentations

Swinburne Research Conference, Swinburne University of Technology, 2019
- PhD Thesis Poster

Building Bridges Research Conference, Swinburne University of Technology, 2019
- Chapter 5: Emerging sustainability concerns and policy implications of urban household consumption

Soap Box on Circular Economy, Swinburne University of Technology, 2019
- PhD Thesis

State of Australian Cities (SOAC) PhD Symposium, 2019
- PhD Thesis

Research Interactive Forum, Lagos Business School, 2020
- Chapter 5: Foregrounding plastic materiality in household routines and practices

CUTransitions Talk, Swinburne University of Technology, 2021
- Chapter 6: Foregrounding plastic materiality in household routines and practices

Going Circular, Swinburne University of Technology, 2021
- Chapter 8: Grassroots strategies for environmental governance and circular cities

HDR Symposium, Swinburne University of Technology, 2021
- PhD Thesis

CUTting Edge Conference, Swinburne University of Technology, 2022
- PhD Thesis

What If? Series, Swinburne University of Technology and Boroondara Council, 2022
- PhD Thesis

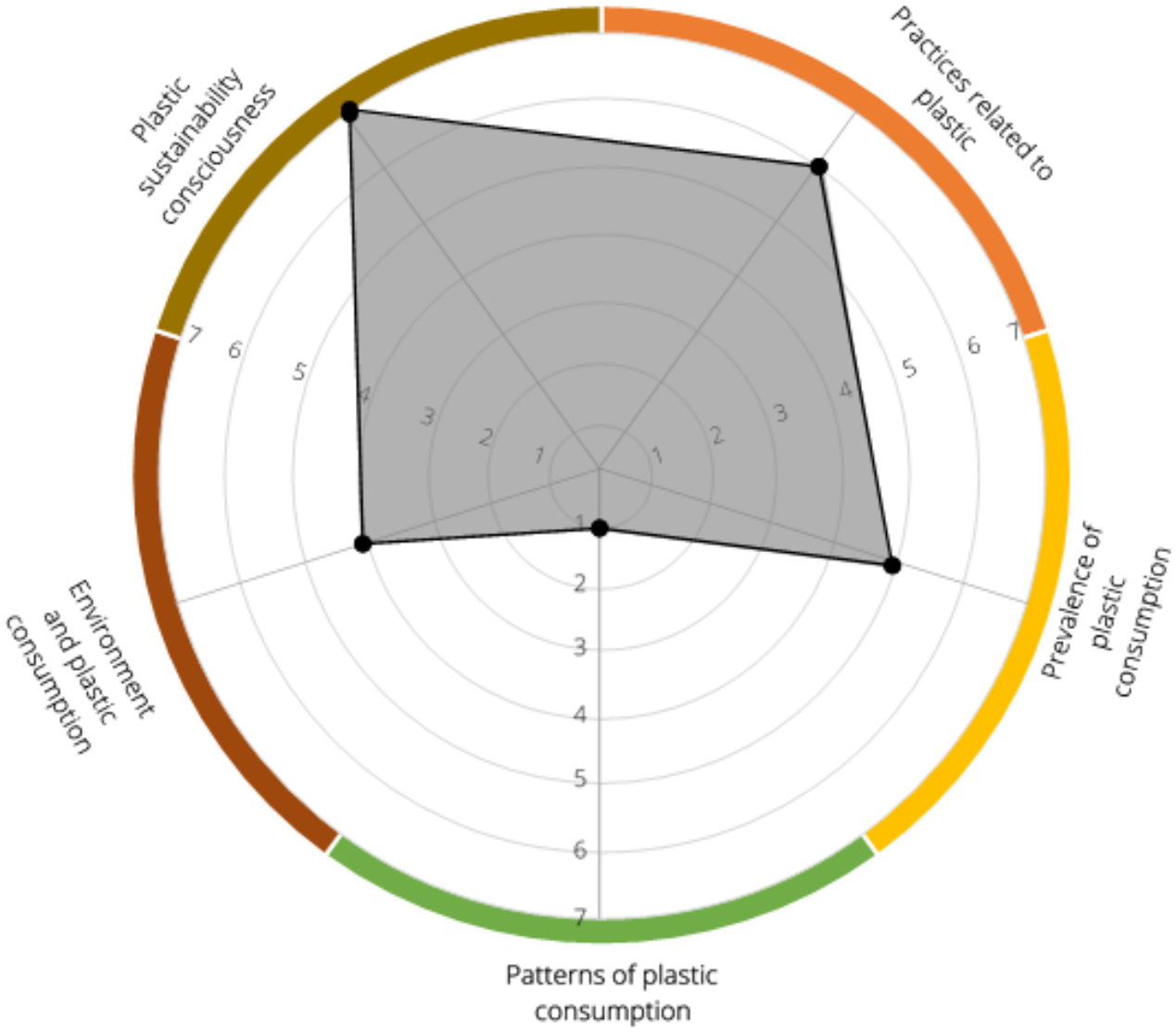
International Sustainability Transitions Conference, Online, 2022
- Chapter 8: Grassroots strategies for environmental governance and circular cities

Book Chapters

Shittu, O 2021b, 'Grassroots strategies for environmental governance and circular cities: Lessons from Lagos and Melbourne', in K McCormick, J Evans, YV Palgan & N Frantzeskaki (eds), *Research agenda on sustainable cities and communities,* Edward Elgar Publishing [Manuscript submitted for publication 15 Oct 2021].

Plastic Consumption –

How Sustainable are our Plastic-related Practices?



With a focus on sustainability, this study seeks to understand plastic use in the activities people perform in their households.

The study is being conducted in Melbourne, Australia and Lagos, Nigeria. The study seeks to explain the reasons why families purchase plastic materials and the extent to which environmental considerations are considered. This study aims to determine possible ways for minimising environmental harm in response to current practices of plastic use.

We would be glad if you could permit us to ask you some questions about the study.

What this project is about and why it is being undertaken

In cities, oceans, waterways and lakes, plastic waste is posing a significant problem. Due to the ways in which people and firms use and dispose of plastic materials, we are facing problems with flooding and water pollution.

This study is part of a project that tries to understand what can be done to ensure people and households use plastic materials in a sustainable way. Your help and assistance in this research can, therefore, help us to keep our cities environments clean, liveable, and healthy.

In the next 30 minutes we will ask you about your use of plastic: why you use plastic, how it compares with other materials/options, your views on the use of plastic and the environment you live in, and what the government could do to help families minimise environmental harm in response to current plastic use.

This project has received ethics approval from Swinburne University of Technology (SHR Project 20201222-3365).

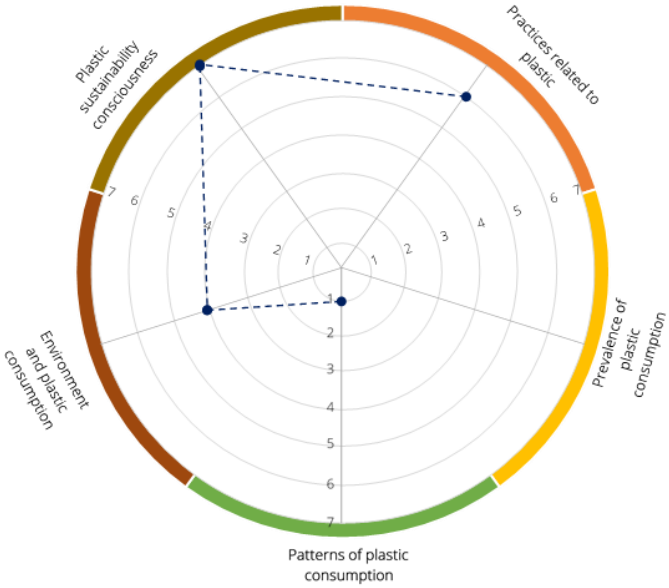
Project and researcher interests

This PhD project is being undertaken through the Centre for Urban Transitions, Swinburne University of Technology, Australia. Those involved include the student researcher's academic supervisors and research assistants.

Participant rights and interests

You must be at least 18 years of age to answer this questionnaire. By completing this questionnaire, you agree to be part of this study. You can decide to stop filling in this questionnaire at any time.

This study has obtained ethics approval from the Swinburne University of Technology's Human Research Ethics Subcommittee (SHR Project 20201222-3365). All personal information you provide is de-identified and will only be used for the purposes set out in the information statement accompanying this questionnaire and reiterated below. If you have any hesitations about how your information will be used following today, please contact Mr Olamide Shittu (oshittu@swin.edu.au). You have the right to withdraw from the study within 7 days of participation.



How to fill the questionnaire

The questionnaire will take about 30 minutes to complete. Please make sure you follow all instructions when answering the questions.

You will need to do the following:

- Complete the demographic section. It includes a few background information about your household.
- In the next sections, you should answer each question by giving a rating on a scale from 1 to 7 in the title box of each section. The question is followed by some prompts to guide you. Space is provided for each section to give reasons for your answers.
- When you have answered all the questions, plot each rating on the compass diagram provided in the questionnaire. In the example provided on the previous page, the 'Practices related to plastic' question was rated '6'. 'Patterns of plastic consumption' was rated '1'. this example (opposite) the 'Moving around' question was rated as a '5'. After plotting the diagram, you should then draw a line to connect the points together.
- After the diagram is complete, you should sort the household and pollical-economic sustainability strategies into the provided grids with reasons.

When answering the questions, you should think about your household and not just your individual consumption pattern. If a question does not apply to your household or you do not have enough details to provide, you should think outside your household to your community or neighbourhood and provide information about what takes place there.

Research output

By participating in this study, you would be able to help Australia and Nigeria to become better countries. You would also help other people to live better when you share your stories with us. Governments would also be able to organise programmes that assist households in using plastic in a sustainable way in Melbourne and Lagos. The information we collect will help us to publish articles, present at conferences and write the student researcher's PhD report. We will give all participants false names and will not mention any private information about a participant without their consent, but we may mention the location and description of participants to give clarity to our findings.

Demographic information

Please take a minute to answer the demographic questions below. We want to get some background information about your household. Tick the box (or boxes) next to the corresponding answer (or answers) for each question.

How old is the head of your household?

a) 18-29 ☐ b) 30-39 ☐ c) 40-49 ☐ d) 50-59 ☐ e) 60 and above ☐

How long have you been staying at your current address?

a) <1 year ☐ b) 1- <5 years ☐ c) 5- <10 years ☐ d) 10 years or more ☐

How many people live in your household?

a) 1-3 ☐ b) 4-6 ☐ c) 7-9 ☐ d) 10 and above ☐

What types of occupation are those in your household involved in?

a) Managers ☐ b) Professionals ☐ c) Technicians and trades workers ☐
d) Community and personal service workers ☐ e) Clerical and administrative workers ☐
f) Sales workers ☐ g) Machinery operators and drivers ☐ h) Labourers ☐

What is the highest educational qualification held from those in your household?

a) Postgraduate degree level ☐ b) Graduate diploma and Graduate certificate level ☐
c) Bachelor degree level ☐ d) Advanced diploma and diploma level ☐
e) Certificate level ☐ f) Secondary education ☐ g) Primary education ☐
h) Pre-primary education ☐ i) Other education ☐

What is the combined total average weekly income for your household?

Melbourne: a) Negative/Nil income ☐ b) $1-$199 ☐ c) $200-$299 ☐
d) $300-$399 ☐ e) $400-$599 ☐

Lagos: a) Negative/Nil income ☐ b) N1-N19,999 ☐ c) N20,000-N39,999 ☐
d) N40,000-N59,999 ☐

Practices related to plastic

Practices are the bundles of activities that we perform in our daily lives. They are made up of the material items we use; the skills we develop to use them; the rules and regulations we follow, and the meanings we give to those activities.

Now think about your daily household activities and ask yourself:

Is plastic as an indispensable part of my household's daily activities?

Next, rate your household on a scale from 1 to 7, where 1 means plastic is indispensable and 7 means plastic is dispensable (can function without) to your daily household activities. {Record your rating in the box below.}

To give a rating on whether plastic is indispensable/dispensable to your household, ask yourself (the rating you give here should be a combination of each of the below points):

- What are the activities you can't do in your household without using plastic?
- What are the materials in your households made from plastic?
- What other material items do you use with plastic in your household activities?
- Do you have the skills required to properly reduce, reuse, and recycle plastic?
- What does it mean to you when you carry out your daily activities with plastic?
- Do you consider plastic having any inherent value in itself?

Use this space to note the reasons for your rating.

Continue your notes here using this space.

Prevalence of plastic consumption

Plastic materials have been around for a while. They have also become a part of our daily lives.

Now think about the use of plastic over the last ten years and ask yourself:

Are plastic materials more commonly used in my community now than before?

Next, rate your community on a scale from 1 to 7, where 1 means plastic materials are less common and 7 means plastic materials are more common. {Record your rating in the box below.}

To give a rating on whether plastic materials are less or more commonly used in your community, ask yourself (the rating you give here should be a combination of each of the below points):

- Do you think people generally use more plastic now than before?
- Are there more products that use plastic than before?
- Do you see your bin full of more plastic than before?
- Do you think plastic waste has been more of a challenge now than before?
- Do you think plastic waste is being managed properly in your community?

Use this space to note the reasons for your rating.

Continue your notes here using this space.

Patterns of plastic consumption

We use plastic in different ways, at different times and with different activities. Plastic also makes up the different materials we have in the household.

Now think about the way you use plastic in your household and ask yourself:

Are plastic materials more commonly used in my household now than before?

Next, rate your household on a scale from 1 to 7, where 1 means less plastic use and 7 means more plastic use. {Record your rating in the box below.}

To give a rating on whether plastic materials are less or more commonly used in your household, ask yourself (the rating you give here should be a combination of each of the below points):

- Is it possible to go shopping for the household without using or taking any plastic?
- Do you have more materials in your household that are made of plastic than before?
- Is it easy to avoid using plastic within your households?
- Are there some particular spaces in your household where you have more plastic materials?
- Are there some periods of the day or week where you use more plastic materials?
- Do you think it is easier to continue using plastic than to avoid it?

Use this space to note the reasons for your rating.

Continue your notes here using this space.

Environment and plastic consumption

There is a relationship between the way we use and dispose of plastic and the state of the environment. It is important to understand the nature of such a connection.

Now think about the way you use plastic in your household and ask yourself:

Do we consider the environment when we use plastic materials in my household?

Next, rate your household on a scale from 1 to 7, where 1 means there is a lot of room for improvement and 7 means there is very little room for improvement. {Record your rating in the box above.}

To give a rating on whether your household considers the environment, ask yourself (the rating you give here should be a combination of each of the below points):

- Are you aware of the impact of using plastic on the environment?
- Do you think about the environment whenever you use plastic materials in your household?
- Do you change the way you use plastic materials in your household because of the environment?
- Do you find it easy to reduce, reuse and dispose of your household plastic properly?
- How widespread is plastic waste in your community?

Use this space to note the reasons for your rating.

Continue your notes here using this space.

Plastic sustainability consciousness

A sustainable lifestyle is one where people consider the environmental, economic, and social footprint of their daily activities and make efforts to reduce the negative impact. Sustainable development is one where we meet our current needs within the earth's limited natural resources without jeopardising the ability of future generations to meet their needs.

Now think about the way you use plastic in your household and ask yourself:

Is my household very experienced in terms of sustainable plastic use?

Next, rate your household on a scale from 1 to 7, where 1 means there is a lot of room for improvement and 7 means there is very little room for improvement. {Record your rating in the box above.}

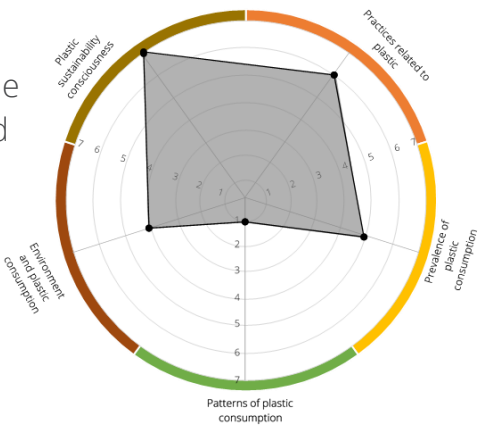
To give a rating on whether your household is very or less experienced in sustainable plastic use, ask yourself (the rating you give here should be a combination of each of the below points):

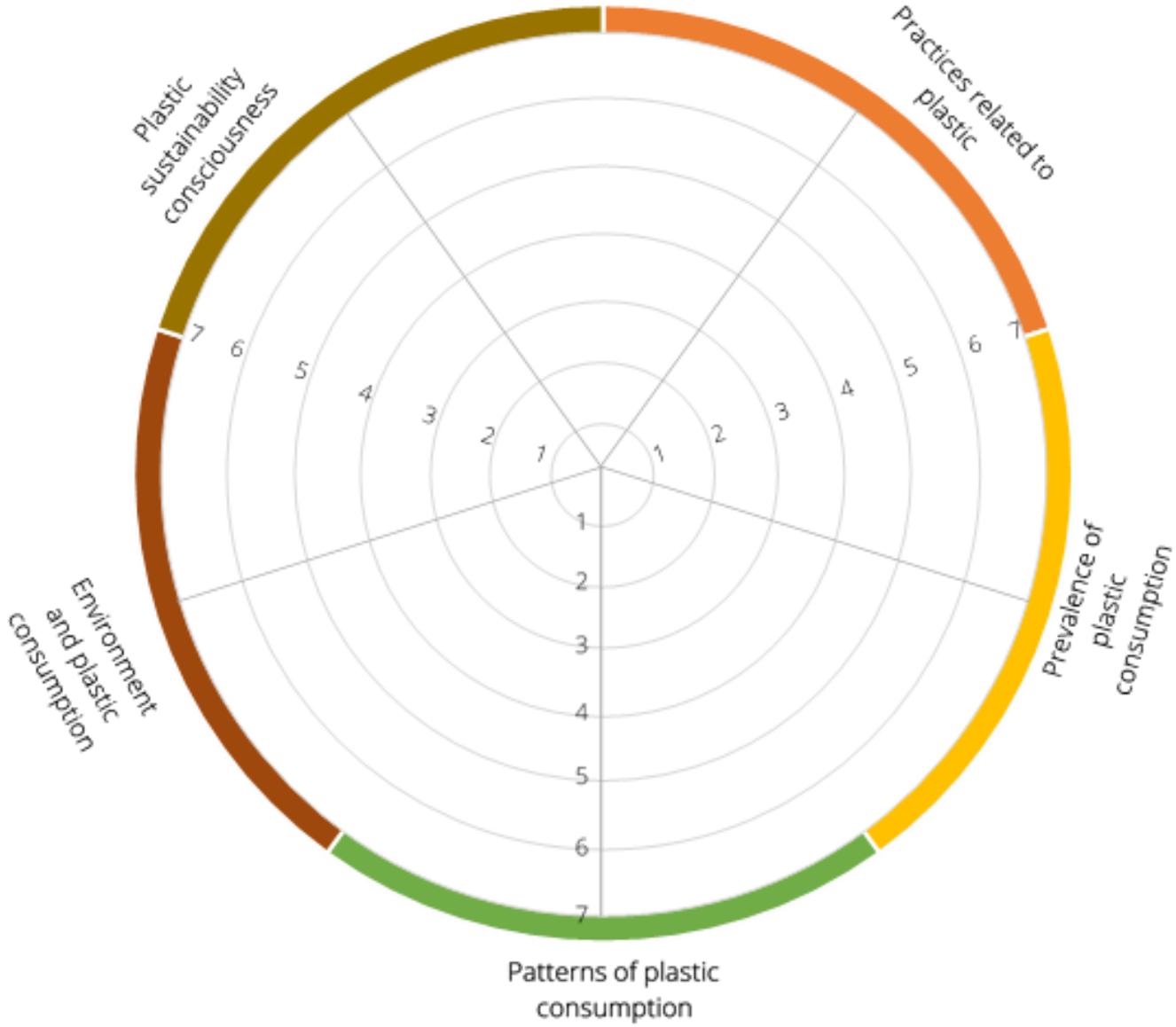
- Do people need to be educated on plastic recycling to promote sustainable development?
- Should people care about the way they purchase, use, and dispose of plastic for sustainable development?
- Do you think the current way we use plastic in households is sustainable?
- Do you think changing the way people use plastic in households would contribute to sustainable development?
- Do you reduce, reuse, and recycle the plastic used in your daily household activities?
- Have you changed your lifestyle to minimize your plastic footprint on the environment?

Use this space to note the reasons for your rating.

Continue your notes here using this space.

The following 'compass diagram' allows you to visualise your own household's plastic use. By drawing a line between each rating, the plotted diagram will immediately show you where your household is performing well in terms of sustainable household plastic use (fuller shape) and where there may be a need for improvements (small shape) as shown in the diagram on the right. The diagram on the right provides an illustration of a household performing well in some areas, but not so well in other areas.





Household sustainability strategies

Which of the following statements do you think could help your household to use plastic more sustainably? Carefully consider the statements and sort them into the grid below:

Have small containers to temporarily sort recyclables in the kitchen and other parts of the house	**1**
Learn about which plastic can be reused and recycled	**2**
Avoid purchasing products or services with single-use plastic	**3**
Reuse plastics in different household activities e.g., storage, gardening etc.	**4**
Use better alternatives to plastic e.g., metal and biodegradable materials	**5**
Change the household shopping activities e.g., buying fresh foods, shopping more often, patronising businesses that accept and reuse their plastic materials etc.	**6**
Change the household consumption activities e.g., home cooking, drinking tap water, having personal water bottle and coffee cups etc.	**7**
Take personal responsibilities e.g., educating others about reduce, reuse and recycling, joining community organisations etc.	**8**
Set guidelines for each household activity on the right way and time to use and dispose plastic materials around the household	**9**
Participate as a household in plastic-free movements/months	**10**

Now sort the above statements by writing their corresponding numbers into the grid from which one you consider to be the most practical to implement to least practical to implement:

Least practical	Not practical	Practical	Most practical

Household sustainability strategies

What are the reasons behind your most and least practical sustainability strategies?

What other sustainability strategies do you think you could implement in your household?

Political-economic sustainability strategies

Which of the following sustainability strategies do you think is important for policymakers and businesses to implement? Carefully consider the statements and sort them into the grid below:

Policymakers should put a ban on the sales, purchase and use of single-use plastic materials and packaging	**1**
Policymakers should educate households on how to reduce, reuse and recycle plastic and empower community sustainability organisations	**2**
Recycling services should provide small bins household can use to temporarily sort recyclables inside the house e.g., kitchen etc.	**3**
Policymakers should design policies that promote the reuse instead of disposal of plastic	**4**
Product designers and researchers should innovate sustainable alternatives to plastic	**5**
Policymakers and businesses should promote the sales of fresh products with less plastic packaging	**6**
Policymakers and businesses should promote and implement circular business practices where the lifecycle of plastic products is elongated	**7**
Policymakers and businesses should ensure households have easy accessibility and affordability to sustainable goods and services	**8**
Policymakers should implement regulations on the illegal dumping and disposal of plastic materials	**9**
Policymakers and businesses should encourage more participation in plastic-free movements/months	**10**

Now sort the above statements by writing their corresponding numbers into the grid from which one you consider to be the most important to implement to least important to implement:

Least important	Not important	Important	Most important

Political-economic sustainability strategies

What are the reasons behind your most and least important sustainability strategies?

What other sustainability strategies do you think policymakers and businesses could implement to make plastic consumption sustainable?

This questionnaire design is inspired by and adapted from https://www.placestandard.scot/#/home