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Sustainable Production and Consumption: The Influence of Social Norms

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Rialtas na hÉireann
Government of Ireland

ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency (EPA) is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

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We regulate the following activities so that they do not endanger human health or harm the environment:

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- the contained use and controlled release of Genetically Modified Organisms *(GMOs)*;
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- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

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EPA RESEARCH PROGRAMME 2021–2030

Sustainable Production and Consumption: The Influence of Social Norms

(2018-SE-MS-11)

EPA Research Report

Prepared for the Environmental Protection Agency

by

University College Cork

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This report is based on research carried out from February 2019 to August 2020. More recent data may have become available since the research was completed.

The EPA Research Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

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Executive Summary

Consumer behaviour represents acts or decisions that influence the direction of production and consumption activities, which are, in turn, driven by household and, ultimately, economic activities. For example, on a regular basis, households engage in activities that involve decisions on shopping and consumption that result in either sustainable or unsustainable waste production. These decisions often turn into habits and norms that drive behavioural attitudes and preferences, which are largely influenced by factors such as consumers' socio-economic background, community, beliefs (opinion), knowledge (information gap) and concern (e.g. concern for local businesses, farmers and environment). These decisions and waste disposal habits contribute towards national and global sustainability goals. In the drive towards sustainable production and consumption, social norms are broadly identified as key factors that influence decision-making. These factors fall into three main groups: (i) social expectations (ii) reference group and (iii) social influence. They drive behavioural preferences, which are often revealed through the exploration of collated survey data.

Studies have investigated linkages between the factors driving consumer behaviour and waste production patterns, but, as habits and norms evolve, the changing dynamics of consumer behaviour calls for renewed and refreshed understanding. To understand the drivers and/or social norms that influence sustainable production and consumption behaviours, both qualitative and, more often, quantitative research approaches are applied. Adopting a similar approach, this report documents a summary of developments and case findings in Ireland relating to the project entitled "Sustainable Production and Consumption: The Influence of Social Norms". The project deployed survey questions to capture respondents' knowledge of sustainability, awareness of environmentally friendly products and waste disposal norms. It focused on establishing and linking environmental factors influencing exhibited behaviours. The overall findings contribute to identifying gaps in sustainable behaviours, targeting groups for policy interventions and developing options for stimulating sustainable behaviour.

The analyses from this project led to a new understanding of the environmental barriers to planning, consumption and waste behaviour among Irish consumers. Four exogenous factors were identified as driving factors for sustainable consumption and waste behaviour, namely (i) environmental concern, (ii) environmental knowledge, (iii) opinion/belief and (iv) concern for local businesses. Structured hypothesised models determined and explained the relationship between and variance of environmental drivers of sustainable consumption and waste factors, represented as (i) planning habit, (ii) environmental bargain and (iii) waste habit. The findings have informed policy to support the transition to a more sustainable environment by identifying the gap between attitude and sustainable behaviour. To decrease waste and improve consumer behaviour (e.g. shopping and planning habits), increasing environmental awareness (e.g. through adverts and education campaigns) alone is insufficient. Identifying target groups for each area increases the stimulation of sustainable behaviours. The extracted survey data were used to conduct a regression analysis of socio-characteristic variables to identify groups or clusters for policy targets and/or interventions. For example, men (from gender linkage) were identified as being less likely to consume food sustainably, suggesting men as a group to target to stimulate the transition to sustainability. People living in rented accommodation, either shared or alone, were identified as another cluster that can be targeted in the transition towards sustainable consumption.

A key advantage of the approach adopted in this project was the questionnaire design. The questionnaire was used to create a metric of consumer behaviours, as well as to facilitate the exploration and measurement of regression and attitude–behaviour characteristics. The survey utilised a reusable questionnaire to collect data on consumer preference, knowledge and attitude, following which a behaviour dataset that could be used in further studies was created. This has potential to add value by creating constructs to measure consumer behaviour that can be updated at a desired frequency. This, in turn, will enable the measurement of the progress or regression

of relevant factors, which can be fed into other uses, such as for model calibration and support for model framework development. Such frameworks would enable assessment and establishment of baselines for current positions in relation to alternative options for a more sustainable future.

Finally, this report presents the potential of simulation scenarios from agent-based representations of households initialised with an aggregated Irish case setting. An agent-based model approach can integrate the dynamics of behavioural decisions that are reflected in several aspects of economic activity and the system. Agents can be consumers, producers or governments, as identified by the modeller. In the model presented in this report, household agents are attributed average life expectancy and regional disposal income levels, and the effects of various threshold ratios for monthly savings and expenditure on transport, energy and consumer goods are then examined. These dynamics affect household decisions that ultimately contribute to sustainable development goals set by governments and businesses.

The project had three key overall objectives: (i) to establish environmental barriers and link these to consumer behaviour (Work Package 2); (ii) to investigate drivers of sustainable consumer behaviour and link them to socio-demographic and economic characteristics (gender, average monthly income, household size and accommodation types) (Work Package 2); and (iii) to develop a model to enable consumers' and producers' reactive decisions to be incorporated in alternative policy designs and settings (Work Package 3).

1 Introduction

1.1 Background

This report presents a summary of developments from the sustainable production and consumption (SPAC) project. This was conducted over a period of 18 months as a medium-scale project aimed at contributing to understanding of the influence of social norms on sustainable production and consumption behaviours.

As countries progress towards resource efficiency through sustainable production and consumption activities, key strategies and policies can be identified as integral to achieving SPAC. These, in turn, contribute towards achieving the Sustainable Development Goals (SDGs). However, in several countries, progress on SDG12 (the measure of responsible production and consumption goal) is lagging in comparison with the overall mean score for all 17 SDG goals. Ireland is among the bottom five EU Member States in terms of SDG12 ranking (Sachs *et al.*, 2017). In this context, this project set out to achieve the following objectives:

1. to identify some SPAC policies and approaches from the literature and compare them;
2. to identify and apply appropriate methodologies to determine what drives SPAC behaviour in different groups and communities.

In a new research approach, this project establishes and links the causes of behavioural drivers through environmental factors. The research objectives contribute to identifying barriers to sustainable consumption behaviour for the attention of policymakers and the public. The findings also provide suggestions for stimulating sustainable behavioural change.

1.2 Research Objectives

This project is intended to contribute to the understanding of some of the grass-roots factors driving environmental beliefs (or opinion) and unsustainable decision-making. To move in the direction of more sustainable production and consumption behaviour, there is a need for policies that stimulate sustainable decisions driven by increased environmental concern, knowledge and awareness. Therefore, the first project task involved designing a questionnaire to generate the data that help to define and link the drivers of these decisions to consumer attitude and behaviour. The survey collected data that enabled us to address the following objectives:

1. to establish and link factors that act as barriers to sustainable consumer behaviour (Work Package 2, WP2);
2. to investigate drivers of sustainable consumer behaviour and link them to socio-demographic and economic characteristics (gender, average monthly income, household size and accommodation types) (WP2);
3. to develop a model for scenario simulations (WP3) to enable consumers' and producers' reactive decisions to be incorporated in alternative policy designs and settings.

1.3 Structure of the Research Report

The rest of the report is organised as follows. Chapter 2 provides a brief summary of the general literature and methodology. This is followed by presentation of the project findings in Chapters 3 to 6. Specifically, Chapter 3 presents the summary of findings on the objective "to establish and link factors that act as barriers to sustainable consumer behaviour", and Chapter 4 covers the objective "to investigate drivers of sustainable consumer behaviour and links to socio-demographic and economic characteristics". Chapter 5 provides a short overview of incentives to promote public transport use in Ireland, and Chapter 6 summarises the development of an agent-based model to explore consumer behaviour. The overall conclusion and recommendations are provided in Chapter 7.

2 Literature and Methodology

2.1 Introduction

This chapter provides a summary of the guiding literature and methodological approaches. The literature provides an avenue to identify SPAC studies that investigate behavioural values in relation to SPAC, based on the three main objectives mentioned in Chapter 1 (i.e. to establish and link factors that act as barriers to sustainable consumer behaviour; to investigate drivers of sustainable consumer behaviour and link them to socio-demographic and economic characteristics; and to develop a model for scenario simulations to enable consumers' and producers' reactive decisions to be incorporated in alternative policy designs and settings). Achievement of these study objectives will enable identification of target areas for development or improvement, while observations of sustainable consumption patterns will help to identify gaps in the area of SPAC as well as opportunities for future research and suitable approaches.

In the project title, the keyword "sustainable" has several definitions. In the context of this study, the United Nations' definition is used to guide the study focus. It is described as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987). This description is then applied to the terms "production" and "consumption", which in the case of this study mean production and consumption activities. For the purpose of this study, "production" is considered to be production of waste. Several aspects of production and consumption activities are affected by behavioural decisions. Adopting a sustainable approach to such decisions benefits both the environment and society. Furthermore, in the context of the project topic, "social norms" falls under or is explained by subjective norms, which are cognitive factors that drive or influence behaviour. The influence can, for example, be in the form of belief, social pressure or outcome evaluation. The keywords sustainable, production and consumption provide a guideline for the literature exercise.

The literature exercise was guided by grounded theory, which is a literature search approach that can be directed by focusing on a specific field of research, a specific search engine or specific keyword search terms to reveal relationships in data (Wolfswinkel *et al*., 2013). A five-stage approach was used to conduct a rigorous literature review. The five stages comprised (i) the "definition" stage, which involved defining the criteria for inclusion/exclusion, identifying the fields of research, determining the appropriate sources and deciding on specific search terms; (ii) the "search" stage; (iii) the "selection" stage, which involved refining the sample; (iv) the "analysis" stage; and (v) the "presentation", which involved the representation and structuring of contents and articles, as guided by Wolfswinkel *et al*. (2013). In a review of the factors influencing consumption in different fields or disciplines, Ribeiro *et al*. (2018) followed selected steps in the grounded theory of Wolfswinkel *et al*. (2013): (i) identification of disciplines and fields that address consumption, (ii) search and collection of literature and (iii) analysis and synthesis of the literature. To identify relevant literature that would help achieve this project's goal of filling the research gap, the ScienceDirect website was used to search for academic articles containing the terms listed in Box A1.1. This approach is time saving and more precise than conducting a search without keywords, with observations from the relevant literature guiding the process.

2.2 Literature

Several sustainability-related studies have had the common goal of establishing drivers of and barriers to sustainable consumer behaviour, developing theories and hypotheses to explain developments and patterns of behaviour (Ajzen, 1985, 1991, 2005). Comprehensive theoretical frameworks and models have been developed and extended over time to explain consumption habits and, ultimately, consumer behaviour. Understandably, theories have been structured towards understanding the dynamics of consumer behaviour, and a common presence of shopping planning and waste behaviour can be identified. For example, the theory of planned behaviour has largely been used to understand and predict human attitudes and social behaviour (Ajzen,

1985, 1991, 2005) and was initially explained through attitudes, subjective norms, intentions and behavioural control (Corral, 2003).

Over time, theories have been adopted and/or extended to inform and support the development of survey questions (variables) and explanatory factors (constructs). For this reason, this study does not explicitly adapt previous theories; rather, it applies an understanding of theories to structure hypotheses of environmental attitudes to explain behavioural patterns. With the understanding of hypotheses as individual conjectures and theories as multiple hypotheses that are logically linked together and can be tested empirically (Hair *et al*., 2016), this study will determine and explain relationship patterns and variances between established constructs and subject variables, specifically through a hypothesised model path analysis.

2.3 Research Indicators

Ireland has drawn up national policies to achieve SPAC, and all relevant government departments have developed national framework plans. Despite this, several indicators suggest that Ireland's SPAC performance is poor, such as organic farm land as a percentage of total farm land (1.7% in 2017; Eurostat, 2019), household waste of 580 kg per capita in 2016 (Eurostat, 2018) and an SDG12 score of 46.9/100 in 2017 (Sachs *et al*., 2017). Figure 2.1 shows the gap between Ireland's score on the responsible production and consumption measure (SDG12) and the mean score for EU Member States.

SPAC resonates with the global aim of attaining the SDG12 (on responsible production and consumption), which seeks to a reduce food and general waste and increase awareness of sustainable development and lifestyles (United Nations, 2015). Hence, this project presents research goals and methodologies that aim to support SDG12.

2.4 Consumption, Waste and Consumer Behaviour

The aim of linking consumption and associated waste is made more complex by expected population and economic growth. In the case of Ireland, population and economic growth is expected to contribute to an increase in demand for food and associated waste by 2040. In 2016, the average waste generated per capita across the EU Member States amounted to 480 kg (Eurostat, 2018). In the same year, Ireland recorded a waste level of more than 580 kg per capita, positioning it as the sixth-largest producer of waste per capita in the EU. This has stimulated a policy drive to reduce household waste and, ultimately, the country's carbon footprint as a necessary contribution towards sustainable consumption and production activities (Government of Ireland, 2018). This is also coupled with the growing challenges of addressing climate change and seeking to achieve the United Nations SDGs (United Nations, 2015).

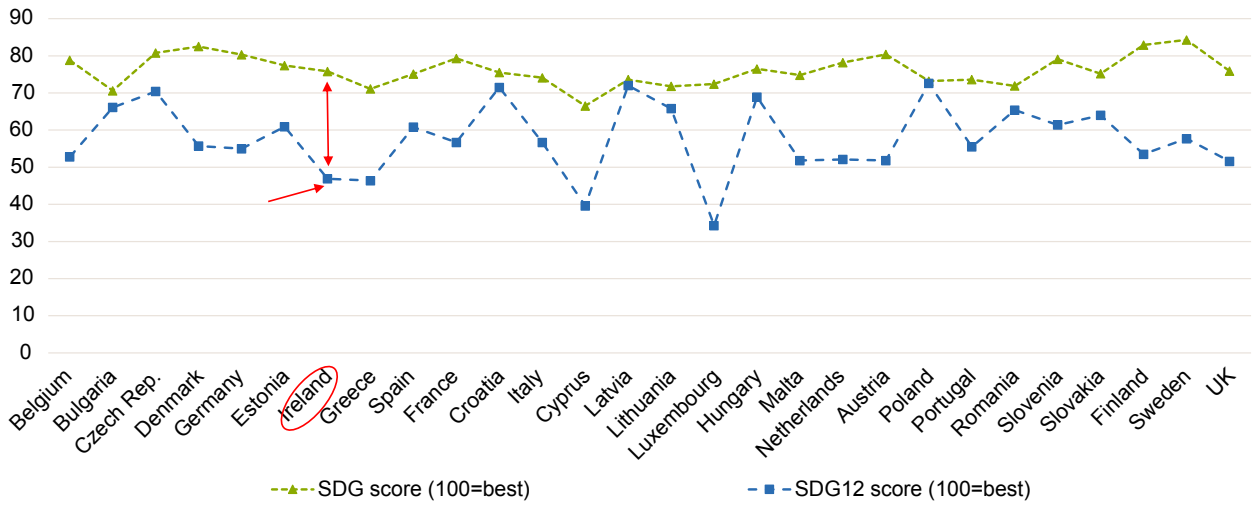

Figure 2.1. Mean SDG total scores and SDG12 scores for the EU Member States in 2017. SDG scores sourced from Sachs *et al*. (2017). Note that Czech Rep. refers to Czechia.

Several aspects of production and consumption activities are affected by behavioural decisions. The chain of value from food production and consumption activities (food value chain) and related waste footprint arising from household decisions is an area of research interest (Heller and Keoleian, 2003; Reisch *et al*., 2013). An example of areas in which waste may increase as a result of increasing production and consumption activities at selected food supply chain stages is shown in Figure 2.2. Influencing decisions within these stages can stimulate the change in behaviour towards responsible consumption and production activities. In the case of Ireland, population and economic growth by 2040 is expected to contribute towards an increase in food demand and associated waste. Along the food production and consumption chain, private households account for the largest proportion of food waste (Monier *et al*., 2010; Schanes *et al*., 2018). Fresh fruit and vegetables account for up to 50% of household food waste across the EU, and it has been suggested that 14% of such waste could be avoided by implementing targeted prevention strategies aimed at changing consumer behaviour, such as storing, planning and cooking routines (Waitt and Phillips, 2016; De Laurentiis *et al*., 2018).

Consumers unintentionally waste food as a result of unsustainable household practices and routines that have turned to habits and become the new norm (Stefan *et al*., 2013; Schanes *et al*., 2018). Breaking these habits requires policy interventions that promote

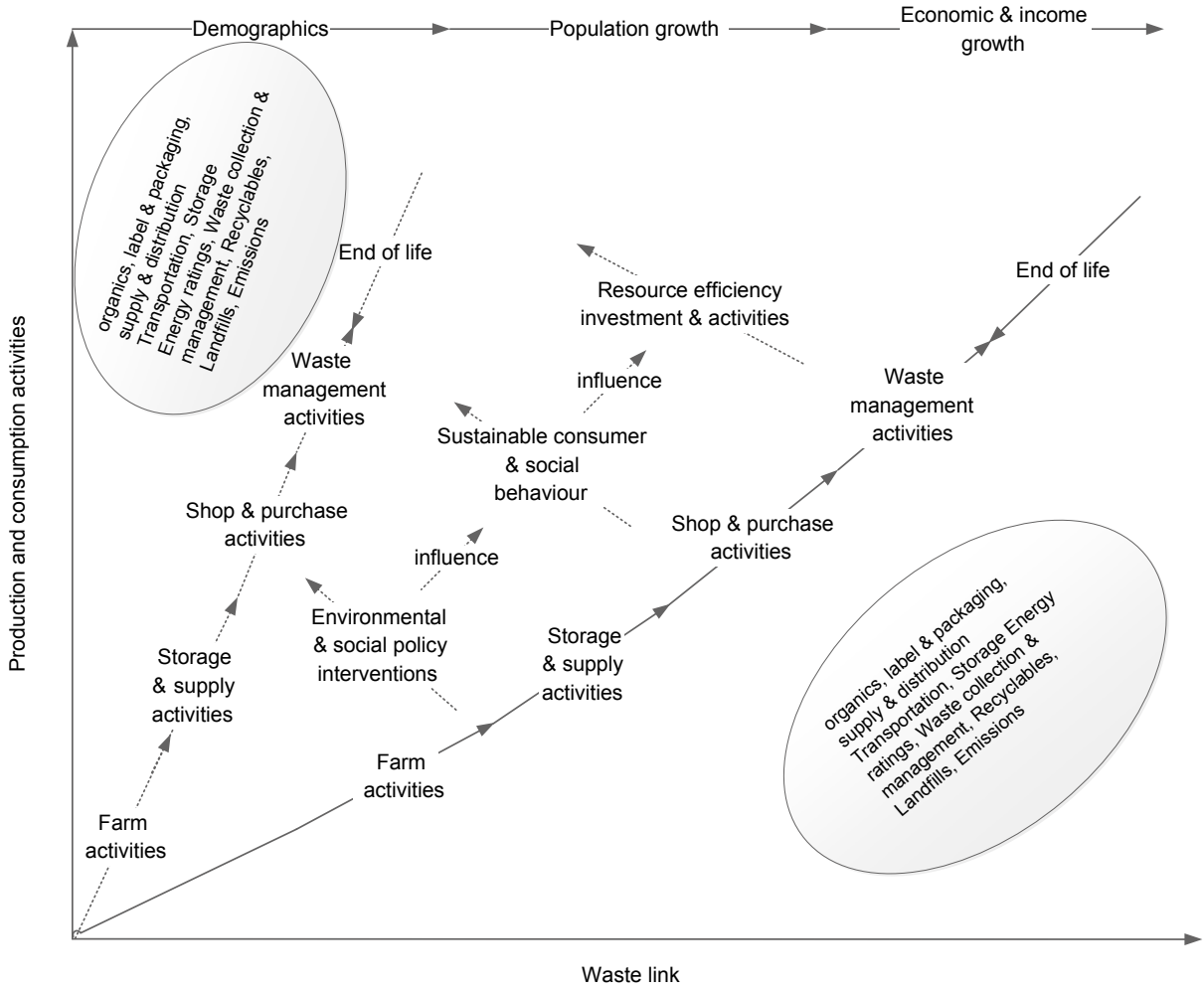

Figure 2.2. Examples of potential areas of intervention to break the link between waste and production–consumption activities, which if not addressed will increase in line with the expected growth in population and income. A scenario for the potential impact of sustainable interventions comes through "environmental and social policy", "sustainable consumer and social behaviour" and "resource efficiency investment and activities".

sustainable behaviour by increasing sustainability awareness (information and knowledge) and bringing about a change in beliefs or opinions. Research findings from other countries have shown that more sustainable and ethical food consumption can be stimulated through increasing involvement, perceived consumer effectiveness (confidence), certainty, social norms and perceived availability (Vermeir and Verbeke, 2006). Based on these understandings, survey questions were structured to provide data to determine the link between patterns of shopping, food and waste attitudes, and consumer behaviour driven by concern, knowledge, environmental beliefs and/or opinions. The following topics were considered for inclusion in the survey:

- knowledge of sustainability [ranking of understanding of sustainability terms, such as “sustainability”, “sustainable production and consumption” (SPAC), “sustainable development goals” (SDGs), “carbon tax”, “ecolabels” and “organic and inorganic”];
- awareness of existing sustainability policies and campaigns, such as rank knowledge of “community compost schemes”, “free trade Ireland”, “community reuse programme”, “live green” (online education), etc;
- shopping methods; and
- food disposal/waste habits.

2.5 General Methodology

The questionnaire was limited to Irish residents and comprised a total of 119 questions (variables) in five sections covering the following topics:

1. consumer profile and socio-economics;
2. social influences on consumption;
3. shopping and food-purchasing habits;
4. waste management habits and views;
5. environmental awareness and views.

A total of 437 local responses were recorded between 9 July and 4 December 2019. Both paper and online distribution approaches were applied after approval by the University College Cork ethics committee and steering committee members. Distribution mechanisms included network notifications and shared links [one LinkedIn article on the project investigator’s account and five Twitter posts on a newly created project account (@spac_ucc)], 1100 InMail LinkedIn message adverts (a paid advert for 3 days), two Facebook posts on team members’ accounts, a newsletter circulated to the institution’s network, project website link integration, posters on noticeboards, 1000 pamphlet handouts in Cork city and word of mouth.

It was estimated that 15 minutes would be required to complete the questionnaire. Online responses accounted for 436 of the total of 437 validated responses. The almost complete absence of validated paper responses can be attributed to the design and length of the questionnaire and the timing of the distribution period, which started during the busy summer season when many Irish people are on holiday or otherwise occupied. Most paper responses were invalid because they were returned incomplete, which is a limitation of a lengthy paper questionnaire. The software was set so that it would not allow the online questionnaire to be submitted unless all questions had been answered. Figure 2.3 shows responses by gender. A survey of this size can act as a pilot study for larger datasets to understand consumer behaviour and attitude gaps but the responses cannot be considered to represent the larger consumer population in Ireland.

A general overview of the project study approach is depicted in Figure 2.4. The pattern or flow of links (arrows) indicates the tasks carried out at each stage and the options that could be undertaken. The principal stages are identifying literature to support the theoretical approaches that guide the research and survey methods, identification of groups to be targeted by the study, deciding on the analytical methods to be used, a comparison with other studies and recommendations.

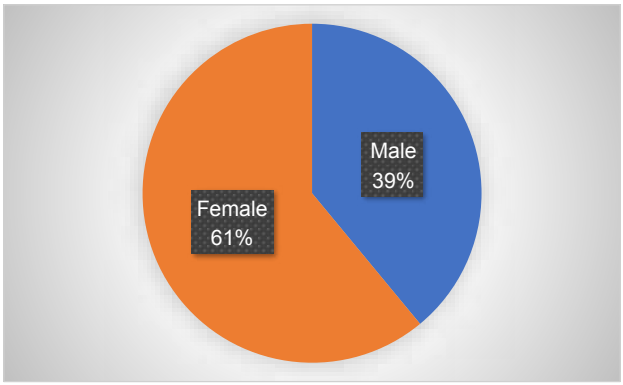

Figure 2.3. Validated survey responses by gender (*n*=437).

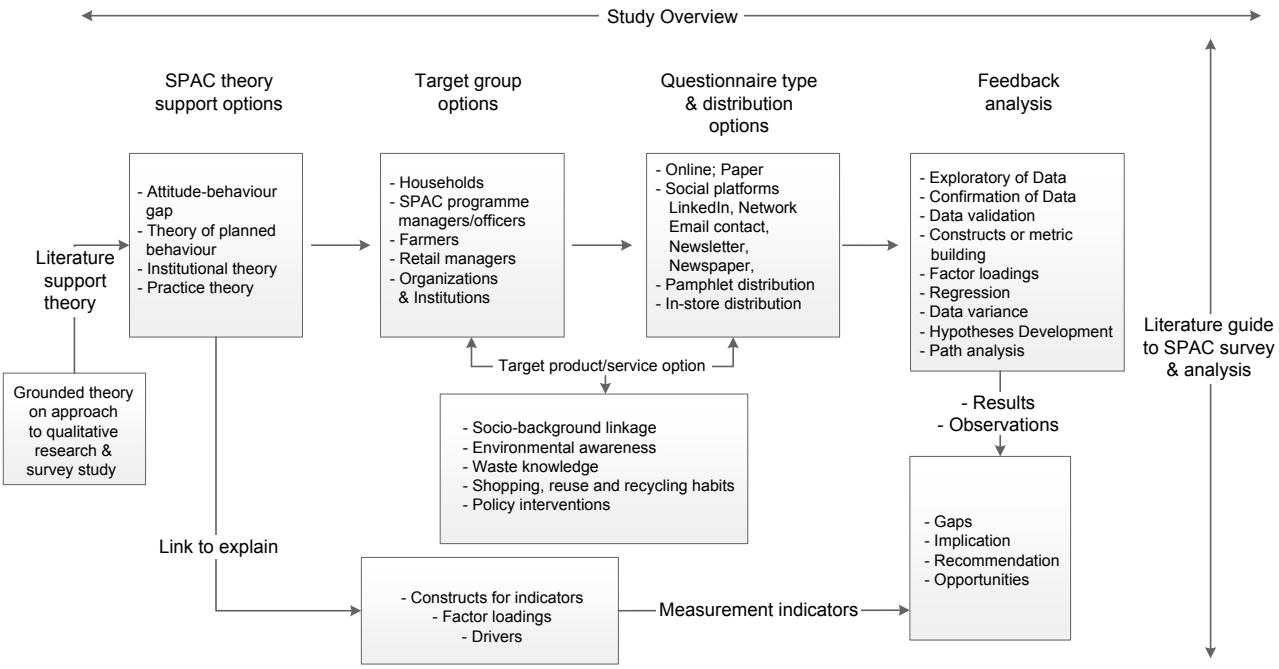

Figure 2.4. SPAC study approach.

3 Findings Part I: Establishing and Linking Environmental Barriers to Consumer Behaviour

3.1 Introduction

This chapter investigates environmental barriers to sustainable consumption and waste behaviour. Decisions emanating from consumer behaviour are evidenced through several economic and household activities. When undertaken on a daily basis, these decisions often turn into habits and routines that become norms at the social level. These drive behavioural attitude and preference. These decisions are largely influenced by consumers' socio-economic background, community, environmental awareness and understanding of sustainability (Barber, 2007; Szerényi *et al*., 2011), beliefs (opinion), knowledge (information gap) and concern (e.g. environmental concern and concern for local businesses). Undertaking these decisions in sustainable ways contributes to improved waste disposal methods, waste reduction and, ultimately, sustainable consumer behaviour. To understand some of the driving factors behind these decisions, the chapter summarises the methodology and analysis undertaken using the first set of recorded survey data from this project.

3.2 Analytical Approach

Several methodological approaches to exploring the dynamics of consumer behaviour are identifiable in the literature. Examples are the use of factor analysis in the case of 244 Romanian consumers (Stefan *et al*., 2013), undertaking a multiple regression analysis in a study of 456 educated young adults from Belgium (Vermeir and Verbeke, 2008) and the use of analysis of variance (ANOVA) in a survey conducted face to face with 97 participants from northern Mexico (Corral, 2003).

In this chapter, a common approach is used to validate and analyse the first set of recorded survey response data. The first dataset included 306 responses, which met requirements for the minimum of 250 responses to qualify for the methods of analysis used (exploratory and confirmatory factor analyses). These two techniques also utilise alternative measures of reliability of model fitness, including statistical verification measures such as the chi-squared statistic, the goodness of fit index (GFI), the comparative fit index (CFI) and root mean square error of approximation (RMSEA) (Wuensch, 2008). These techniques produce values that are comparable with recommended values for process validation (Byrne, 2010). Exploratory factor analysis was applied to explore the pattern of relationships in the dataset, while confirmatory factor analysis was applied to confirm the hypotheses of relationships using diagrams of path analysis to represent and explain linkages between identified variables and factors (Matsunaga, 2010; Yong and Pearce, 2013). This analytical approach is used to identify environmental factors and barriers to sustainable consumption and waste behaviour within the dataset.

A summary of the respondents' demographic characteristics is provided in Table 3.1. It shows the respondents grouped by gender, age, marital status, employment status and type, income and education.

Observations from the exploratory factor analysis were confirmed by the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of measures of the strength of relationships among variables. The KMO test is useful when there are fewer than 30 variables being examined, when there is a sample size greater than 250 and when questions use a scale such as 1 to 5 (Field, 2018). SPSS and AMOS 26 packages were used, providing an easy user interface to model the hypothesised structures that contribute to realising the study goals.

A reliability test called Cronbach's alpha was conducted to minimise the overarching effect of any item in a factor. Confirmatory factor analysis was used to structure hypothesised models to determine the pattern of relationships between extracted factors and the variance of environmental drivers of sustainable consumption and waste. Confirmatory factor analysis

Table 3.1. Demographic characteristics of respondents (%) ($n = 306$)

Socio-demographic characteristic	Percentage (%)
Gender	
Male	39.2
Female	60.8
Age group	
18–24	25.5
25–34	30.4
35–44	21.9
45–54	15
55–64	5.6
65–74	1.6
≥75	0
Marital status	
Single	47.4
Married	36.6
Divorced	1.6
Widowed	2.3
Partners or co-habiting	12.1
Household size (residing with participant)	
0	19.3
1	12.4
2	17.3
3	14.7
4	16.7
≥5	19.6
Education status	
No formal education	0.3
High school leaving certificate	5.9
Undergraduate student	14.7
University/college graduate	31.4
Postgraduate or Masters	39.2
Doctorate	6.2
Other	2.3
Employment status	
Employee	81
Self-employed	7.5
Stay-at-home husband or wife	1.6
Unemployed	8.2
Retired	1.6
Employment type	
Full time	66.3
Part time	21.2
Not applicable	12.4

Table 3.1. Continued

Socio-demographic characteristic	Percentage (%)
Average monthly income (€)	
<1000	21.9
1000–1499	13.1
1500–1999	13.1
2000–2499	17.3
2500–2999	11.8
3000–3500	9.5
>3500	13.4

was performed to structure the hypothetical equation model, which answers the following questions:

1. What pattern of environmental relationships is identifiable among the list of variables presented?
2. Which environmental attitudes and behaviours are represented and how do these explain developments in the factors?

3.3 Findings

The survey data passed robust tests for exploration. The descriptive statistics confirmed the suitability for further analyses. The KMO measure was acceptable, confirming that the sample was of adequate size, and Bartlett's test indicated a significant presence of strong relationships among the variables.

Seven positive factors were extracted from the exploration factor analysis. These also explain the presence of a relationship between linked variables (questions) and the represented factors, based on reliable extraction methods with eigenvalues of >1 and factor loadings of ≥0.4. The reliability analysis also confirmed the presence of relevance for the grouped questions per construct. Extracted factors represent potential metrics and were renamed as:

1. environmental concern (attitude);
2. environmental knowledge (information gap);
3. environmental belief;
4. concern for local business (attitude);
5. planning habit (behaviour);
6. environmental bargain (a negotiating behaviour over a discount or lower price);
7. waste habit (behaviour).

These factors form the hypothetical bases for identifying and linking environmental causes and gaps to consumer behaviours (Figure 3.1).

3.4 Confirmatory Factor Analysis to Explain Consumer Behaviour

The confirmatory factor analysis model is validated with fitness measures of GFI, CFI and RMSEA, which confirmed the adequacy of the hypothesised models to explain developments and/or patterns in the sample data. These fitness measures re-confirmed the exploratory factor analysis loading hypotheses, with significant factor loadings of > 0.4 and a critical ratio of values of > +1.96 or < –1.96.

The study findings show that the highest correlation estimate is for correlation between environmental concern and concern for local businesses (0.693), followed by correlation between environmental concern and environmental knowledge (correlation estimate 0.492) and between environmental knowledge and concern for local businesses (correlation estimate 0.416). These results suggest the value of environmental knowledge and that the resulting information gap is a barrier to environmental concern and concern for local business. There is a negative correlation between environmental concern and environmental bargain (correlation estimate –0.342), reflecting people's propensity to consider products based on price discount, irrespective of organic and eco-labels (indicating the level of environmental concern, based on the statistical inferences and linkages observed). Environmental bargaining behaviour has a negative relationship with waste habits (correlation estimate –0.203). There is a significant ($p < 0.05$) positive relationship between waste habit and planning habit, with a correlation estimate of 0.16.

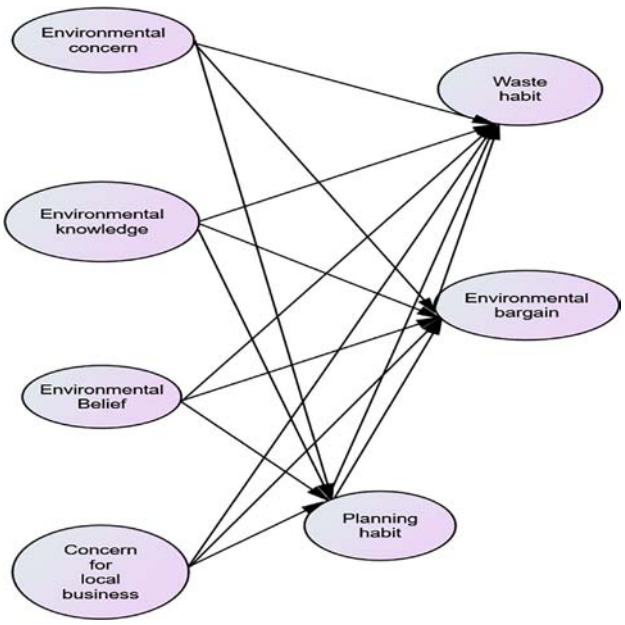

Figure 3.1. Observation template for model 2 path analysis as a hypothesised confirmatory factor analysis sample.

Factors 1–4, namely environmental concern and knowledge, concern for local businesses and environmental belief, are hypothesised to be drivers of bargaining, planning and waste behaviours (factors 5–7). The reliability of the variables underlying each of these factors is influenced by random measurement errors, while each of the observed variables is regressed onto its corresponding factor. The first four factors are intercorrelated to signal the driving force of knowledge, belief (opinion) and concern for consumers. These findings suggest that environmental bargaining behaviour should be a priority target area for policy influence. It implies that producers and retailers play a major role in influencing consumers' decisions through price differences between organic and non-organic products (non-organic products are cheaper).

Observations from the hypothesised path estimates indicate that consumers' attitude to environmental concern is significant and explains the negative variance (undesirable development or pattern) in environmental bargaining behaviour. The same bargaining behaviour is significant in explaining the negative variance in the waste habit. This further suggests that a lack of environmental concern can be a barrier to sustainable waste behaviour, through unintentional negative environmental bargaining decisions.

3.5 Views to Increasing Environmental Awareness for Sustainable Behaviour

The path between environmental concern and planning and waste behaviour established a lack of environmental knowledge, which is linked to an information gap. To move in the direction of more SPAC behaviours, societies need interventions to

promote environmental knowledge and sustainable behaviour.

Environmental knowledge, environmental concern and concern for local businesses are suggested as three key determinants that explain the variance in consumers' planning, shopping and waste habits. Significant variance in these key determinants explains consumers' shopping habits and resulting acts of environmental bargaining when customers observe price discounts when shopping. Consumers' willingness to embrace environmental concerns is affected as they unintentionally opt for non-environmentally friendly products when available at discount. Consumers' willingness to embrace environmental concerns is further influenced by their knowledge of the environment, which explains why households waste food despite having better intentions (Stefan *et al*., 2013; Schanes *et al*., 2018). Another explanation for these developments can be related to the gap between ethical purchase intentions and the actual buying behaviour of ethically minded consumers (Carrington *et al*., 2010).

A primary condition for the stimulation of sustainable shopping and waste behaviour is an increase in consumers' knowledge and awareness. One way to achieve this is to target the areas of "environmental concern" and "concern for local businesses", which are identified as important to consumers who carry out environmental production activities such as recycling and shopping from eco-labels. The results from this study support the findings from similar and previous studies, which identified that efforts should be geared towards increasing consumers' awareness of the health, environmental and social benefits of organic food production and consumption (Azzurra *et al*., 2019).

3.6 Conclusion

In exploring the topic of groceries and grocery shopping, the environmental drivers of planning, shopping and waste behaviours were extracted and linked. Four environmental constructs were proposed as driving factors for consumer planning, shopping (environmental bargaining) and waste behaviour, namely environmental concern, environmental knowledge, concern for local businesses and environmental belief. Environmental knowledge, environmental concern and concern for local businesses were found to be the three determinants that explain partial variance in consumers' planning, shopping and waste habits. The environmental drivers explained 3.6% of the variance in planning habits, 14.4% of the variance in environmental bargaining behaviour and 9.5% of the variance in waste habit.

The findings suggest that consumers' environmental concerns are negatively affected by consumers unintentionally opting for non-environmentally friendly products on discount. A primary condition of stimulating sustainable shopping and waste behaviours is to increase consumers' knowledge and awareness to counter barriers to adoption of the attitudes of environmental concern and concern for local businesses. The summary of the study findings is depicted in Figure 3.2, which shows the observed SPAC drivers, suggested barriers, gaps and an action plan.

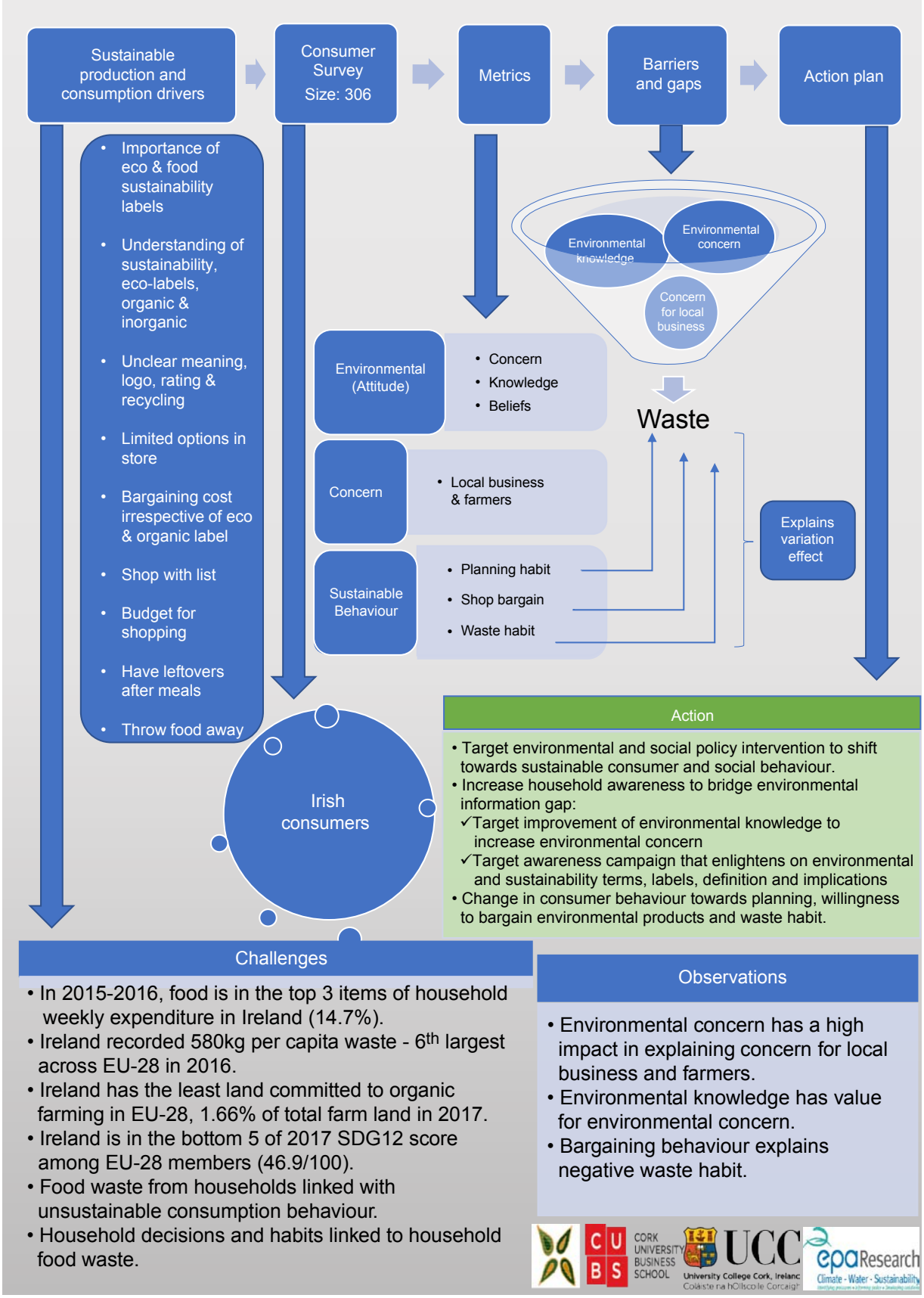

Figure 3.2. Barriers to and gaps in sustainable consumer behaviours.

4 Findings Part II: Investigating Drivers of Sustainable Consumer Behaviour and Linkages to Socio-demographic and Economic Characteristics

4.1 Introduction

This chapter aims to identify the presence of attitude–behaviour gaps and is specifically for the attention of policymakers and the public. It provides a summary of the applied methodology steps to investigate drivers of consumer behaviour, and it sets out to establish any linkage or relationship between socio-demographic and economic characteristics.

4.2 Analytical Approach

This chapter applies methodology steps similar to those set out in Chapter 3 (namely exploratory and confirmatory factor analyses). This chapter additionally extends the methodological application by combining it with an ordinal regression. In this way the presence of clusters within the increased set of response data can be determined. The extended methodology approach also determines the presence of a positive or negative causality for the identified sustainable consumption variables. This further helps to determine the reasons behind the relationship between social and sustainable consumption behaviour variables.

As the study progressed, the response sample size increased, reaching 318 by the time of the second case study, with a gender beakdown of 60.4% female and 39.6% male. Details of respondents' monthly income, accommodation type, household size and age group are provided in Table 4.1. The dataset that the study employed included 22 variables (questions) that passed chi-squared statistics, model fitness measures of GFI, CFI and RMSEA and reliability tests. This resulted in the extraction of five factors, each of which is explained by one or more of the 22 variables. The factors extracted formed the constructs below and are structured as the dependent variables driving sustainable consumption behaviour:

1. sustainable food purchasing;
2. environmental awareness;
3. purchasing influencers;
4. shop planning; and
5. food waste habits.

Table 4.1. Data distribution for independent variables (*n* = 318)

Characteristic	Percentage (%)
Average monthly income in €	
< 1000	21.7
1000–1499	13.5
1500–1999	12.6
2000–2499	17.3
2500–2999	11.9
3000–3500	9.7
> 3500	13.2
Accommodation type	
Privately rented	26.7
Private/owned	52.2
Shared rented	21.1
Household size	
0	19.5
1	12.9
2	17.3
3	14.5
4	16.4
≥ 5	19.5
Age group	
18–24	25.2
25–34	30.8
35–44	21.7
45–64	15.1
55–64	5.7
65–74	1.6

Note: Privately rented accommodation means renting an entire residence, e.g. a three-bedroom house. Private/owned accommodation means living in self-owned accommodation. Shared rented accommodation means living with others in a rented residence, e.g. renting one bedroom in a three-bedroom house.

4.3 Findings and Conclusion

First, the results of the factor analyses suggest that sustainable food purchasing has a positive and significant relationship with environmental awareness, reconfirming that it increases sustainability. Second, the analysis identified a positive link between sustainable food purchasing behaviour and reduced food waste, establishing the former as a key driver of food waste habits. Third, the construct of purchasing influencers produced a negative impact on shopping planning and waste habits, indicating the influence that peers, family and role models (people in our social environment) have on sustainable consumption behaviour. Fourth, there was also a significant positive, but weak, relationship between grocery planning and food waste habits.

The study results showed that environmental awareness positively drives sustainable food purchasing. Consumers are more likely to purchase sustainable products, such as locally sourced products or organically produced products, if they are aware of the importance of this type of food consumption.

The findings from the ordinal regression of socio-characteristics (gender, average monthly income, household size and accommodation types) show that there is no significant link (positive or negative) between gender and the variables constituting the constructs of environmental awareness and sustainable food purchasing. However, women are more likely than men to purchase goods produced by local farmers, which is considered a type of sustainable consumption behaviour.

There was a significant relationship between gender and the constructs of food waste habits (the variable of having food left over after a meal) and grocery planning behaviour (the variable of writing a shopping list). Women were found to be more sustainable food consumers, in that, compared with men, they were less likely to waste food after a meal and more likely to exhibit shopping planning behaviour. This result is similar to other studies that examined gender and sustainable consumption behaviour in EU Member States (Cecere *et al*., 2014; Secondi *et al*., 2015). This suggests that women are a greater influencing driver for more sustainable food consumption behaviour than men.

Consumers on a higher income (>€3500 per month) were more likely than those on a lower income (€1500–2499 per month) to understand the terms “sustainable” or “sustainable development goals”. However, consumers on a lower income (i.e. €1000–1999 per month) were more likely to exhibit sustainable food purchasing behaviour; specifically, the presence of eco-labels or sustainability labels on products was likely to influence their purchasing decisions. Although these observations are contradictory, as eco-products are typically more expensive than less sustainable products, purchasing power, driven by income level, can play a role in purchase quantity and ultimately household waste levels. Similarly, Lavelle *et al.* (2015) observed that Irish households on a higher income consume less sustainably than those on a lower income, while evidence from other studies suggests that a high level of “awareness” is not always a prerequisite for sustainable purchasing behaviour (Martinsson and Lundqvist, 2010; Reid *et al*., 2018). It is recommended that further research be carried out to establish why those on a higher income in Ireland are less likely to consume sustainably.

Household size exhibited a significant positive relationship with sustainable food purchasing, specifically purchasing products with eco-labels; in other words, small households are more likely to exhibit sustainable food purchasing behaviours. In addition, analyses of consumers’ behaviour and type of accommodation suggested that consumers who do not own homes (i.e. who rent a whole residence or share a rented residence with others) were less likely to budget before shopping.

In conclusion, the results of this study indicate that environmental awareness is a driver of sustainable food purchasing. However, to decrease food waste and improve consumer behaviour (e.g. shopping and planning habits), increasing environmental awareness (e.g. through adverts and education campaign) alone is insufficient. It is necessary to identify target groups so that the stimulation of sustainable behaviours can be increased. Target groups can be defined according to gender, income range group, accommodation types and other variables.

5 Findings Part III: Views on Incentives to Promote Public Transport Use in Ireland

5.1 Introduction

This chapter provides a short overview of incentives to promote public transport use in Ireland. It aims to explore consumer views of incentives that contribute to the transition towards sustainable consumption, with a focus on transport mode taken to the shops. The food production and consumption value chain begins with agricultural activities and includes production, storage, processing, packaging, wholesale and retail activities through to consumption and waste activities. These involve transport at every stage of activity, resulting in emissions that increase with population and economic and income growth when conducted inefficiently and in a non-environmentally friendly manner. Along the food production supply chain, actors such as farmers and distributors, as well as consumers who buy the final products from stores, participate in regular shopping activities using different modes of transport. Influencing decisions at each stage can contribute to sustainable responsible consumption and production activities.

5.2 Analytical Approach

The absence of suitable environmental and public transport policy interventions affects the rate of transition to sustainable consumption. To contribute to addressing this challenge of transitioning to sustainable consumption, Irish residents were surveyed in order to identify the key areas that should be addressed by environmental and social transport policy interventions. It is worth noting that the top five counties of residence of respondents were Cork (accounting for 63.2% of respondents), Dublin (11.8%), Galway (3.4%), Tipperary (3.4%) and Kerry (3.1%). The study was initiated at University College Cork, resulting in the sample being biased towards County Cork residents. The final questionnaire was distributed through social networks and LinkedIn InMail adverts to interested parties. The survey, which was available from 7 July to 4 December 2019, attracted a total of 423 respondents, who were asked to rank, on a Likert scale from “poor (won’t work)” to “excellent”, four incentives to promote the use of public transport that have already been adopted in other EU Member States:

1. a fee or congestion charge for cars entering the city centre during working hours;
2. fining bus operators for unjustifiable delays per minute;
3. a reusable ticket per route/area within a certain timeframe (e.g. a reusable 2-hour ticket that is valid for different buses in the same area);
4. a receipt, issued to commuters in the event of a public transport delay, that can be given to employers (issued by the transport operator).

Each incentive was tested in models against groups of socio-demographic factors. Each socio-demographic factor, i.e. age, gender, household size, education, monthly income and regular mode of transport to the shop, represented an independent nominal variable in the models tested. For example, the distribution of answers to the question on the mode of transport used to travel to the shops in the past 12 months was as follows: by walking 7.6%, by bicycle 3.8%, by bus 22.2% and by private car 66.4%.

To gain better-validated insights, the statistical technique of ordinal regression analysis was used to determine the level of acceptance of the four incentives to encourage the use of public transport. It considered common standards to validate the dataset and interpreted results. These involved observations of model fitting information, goodness of fit, parameter estimates, cell information and test of parallel lines to accept or reject related hypotheses. The methodology also involved the use of a reference group; in this case, the automatic rank selection by model was used for the socio-demographic characteristics. For example, “age group” was coded using 1 for the youngest age group and 6 for the oldest age group. In the case of transport modes, private cars were compared with alternative modes of transport modes, as private car users accounted for the largest proportion of respondents.

5.3 Findings and Conclusion

The findings showed significant positive correlations between each incentive and the modes of transport targeted by the interventions (summarised in Table 5.1). The table shows the mode of transport whose users were most likely to respond to particular incentives, if introduced. It also shows a negative response from car users in comparison with the three other transport modes. This indicates that car users are likely to be less in favour of these incentives.

The survey revealed that bus and bicycle users are more likely to respond to the suggested incentives; however, these accounted for only 26% of the sample. Notably, cyclists were supportive of all policy interventions, but with a significantly higher preference for "a congestion charge during working hours" and "a bus ticket reusable within a 2-hour timeframe". These suggested incentives would attract consumers from the related groups, e.g. bus users. On the other hand, our findings suggest that car users are the group least interested in all incentives and, as such, are the least willing to support the suggested approaches to promote public transport. This may be driven by their perception of the impact the incentive would have on a car user. More attention should be given to incentives to encourage car users, the largest survey group, to switch to public transport. This is a known problem and reflects a research gap that needs to be addressed if the successful use of sustainable transport is to be achieved.

Table 5.1. Consumer views of the promotion of public transport, relative to their regular transport mode for shopping

	Transport mode		
Incentive	Walk	Bicycle	Bus
Congestion fee or charge on city cars	+0.645	+1.313	–
Fine to bus operators following a delay	–	+0.932	+1.076
Reusable 2-hour ticket on different buses in same area	+0.392	+1.597	+0.666
Receipt for commuters to use as proof of delay at workplace	+0.430	+0.906	+1.143

Note: numbers show the increasing probability of respondents using each specific transport mode following the introduction of the incentives.

The evaluation of these suggested incentives contributes to the assessment of policy options aimed at identifying groups with the attitude and willingness to use public transport and making the public transport option more attractive. Our findings contribute to the discussion on sustainable transport driven by sustainable consumer behaviour. The ability to influence consumer behaviour is connected to the presence of challenging and limited alternative transport modes and facilities. We recommend that a larger dataset is created and interrogated; in other words, we see this study as a pilot study for larger scenarios. An infographic depicting the main findings of the case study is given in Figure 5.1.

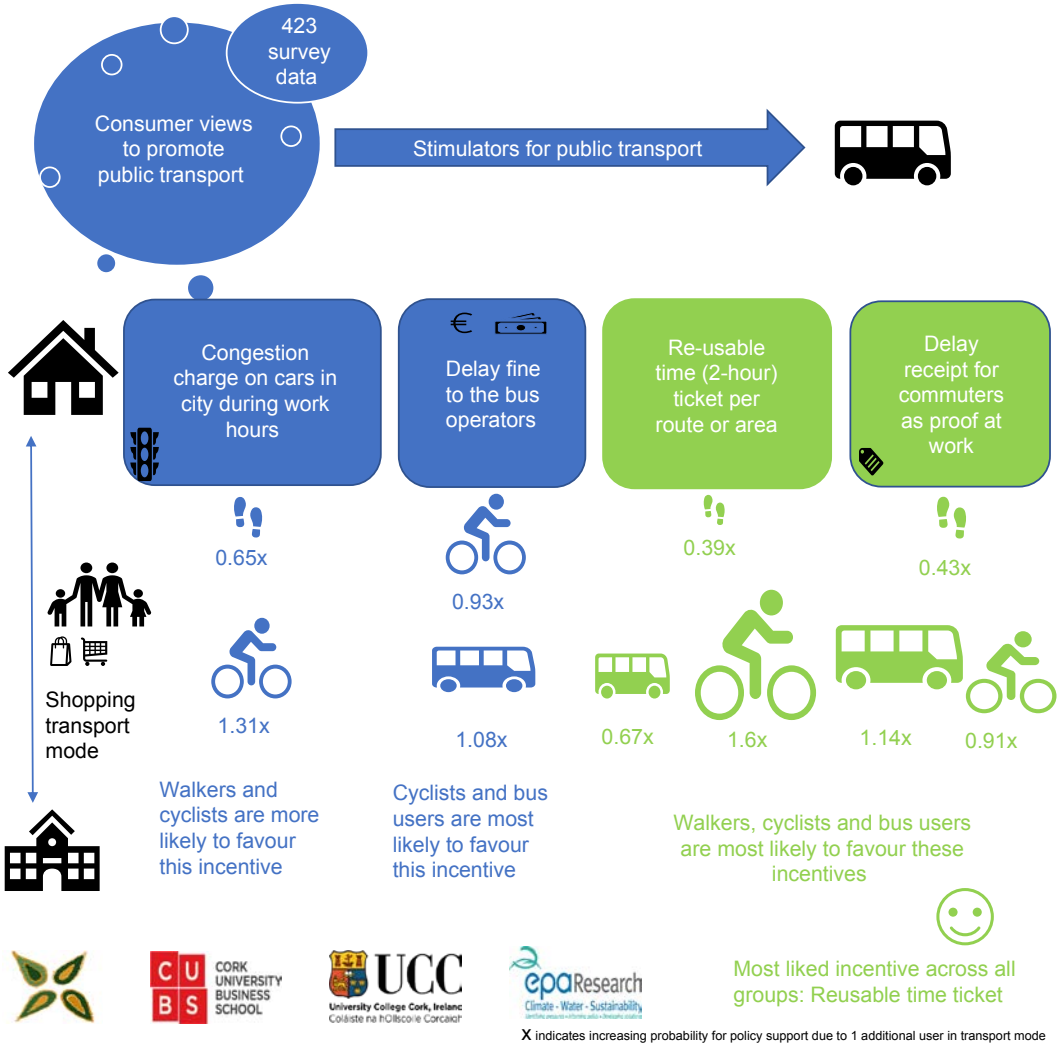

Figure 5.1. Infographic of the case study on options to promote public transport use.

6 Development of an Agent-based Model to Explore Consumer Behaviour

6.1 Introduction

This chapter summarises the development of a model based on a progressive approach (stage-by-stage development). It presents a trial run on three represented agents (household, producer and government) to test a range of scenarios based on policy conditions within production and consumption contexts. These present an opportunity to broaden sustainability research and the application of agent-based models to explore consumer behaviour and the testing of policy efficacy.

6.2 Modelling Sustainable Consumption and Consumer Behaviour

Different schools of thought have suggested the development and application of models that account for the integration and interplay of human decisions and behaviour (An, 2012). As described by Fadiran *et al*. (2017):

> A number of definitions exist for [the agent-based model] in the literature but, based on practical applications, it can simply be described as a decentralised approach to model design where the active entities (i.e. the agents) which can be individuals, companies, assets, communities are identified by the modeller. The behaviours (i.e. main drivers, memory) of these active entities are then defined and put into a certain environment where connections between all defined parameters can be established.

The SPAC agent-based model (SPACAM) is an alternative approach aimed at achieving a behavioural representation of consumer decisions without having to deal with the data limitations that often plague empirical analysis. Upon completion, it can be adopted to assess many of the planned or recommended policy strategies before implementation.

The modus operandi of the SPACAM is to explain socio-economic phenomena through the model of artificial stakeholders (household consumers, shop suppliers and producers, and government). It feeds in sensitivity shocks from the collated survey data, with a view to generating explanations and observing trickle-up effects. It is structured to simulate connections in the real economy and many other facets of household decisions based on specifications and rules. It further aims to populate a starting range of 5000–500,000 household agents, 20–50 shop/producer agents and one government agent supported by data from the Central Statistics Office (CSO).

The framework for the first three agents (government, producer and consumer agents) is structured with representable decision functions, with a view to evaluating:

- alternative policy sensitivity with respect to efforts geared towards attaining SDGs in the context of Ireland;
- policy effects on sustaining production and consumption activities;
- the efficacy of any given policy as regards driving sustainable consumer behaviour.

Owing to the project timeline of 18 months and the small size of the project team, the model was developed incrementally, i.e. in phases that integrate representable functions and data in testing and validating scenarios, policy methods and recommendations. More time will be required at each stage if the model is to be expanded by the addition of more agents. This report documents the development of phase 1 of SPACAM.

6.3 Model Development Phase 1 Case Scenario: Influencing Household Decisions through Energy Technology Investment

The development of SPACAM is applicable to several simulation scenarios and is subject to further

upgrades. Potential areas for simulation are depicted in Figure 6.1. The consumer agent population forms the basis of the first stage of development of the agent-based model. The consumer agents make up the household population and are embedded with attributes that influence decision-making. The questionnaire designed for this project includes a section containing questions linked to energy technology for residential areas. The responses motivate the researcher's approach to modelling house purchase for the first scenario observation. The survey aimed to determine respondents' awareness of heat pump and solar technology grant incentives. Figure 6.2 shows that 53% of respondents were aware of the existence of a solar technology grant in Ireland.

Findings from studies by the Economic and Social Research Institute (ESRI) (e.g. Collins and Curtis, 2017) indicate that the Irish housing market presents an opportunity to add value to the housing stock by encouraging energy-efficient building (with better energy ratings). As an increase in the energy efficiency of buildings will result in higher house prices and reduced energy usage, resulting in cost savings, the impact of more energy-efficient building

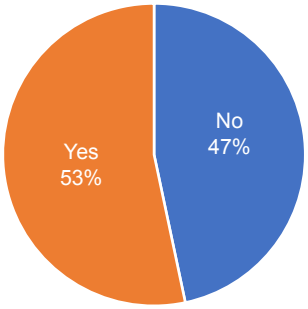

Figure 6.2. Awareness of a solar technology grant incentive (*n* = 437).

on house purchases was examined using the agent-based model, taking into account the survey respondents' income levels, age group and county. The methodology enables the observation of trends or patterns that are the result of the underlying dynamics influencing house purchase decisions over a selected period.

Financial factors were also taken into consideration and included thresholds in mortgage payback period, consumer savings level, house prices and several other household expenses (see Figure 6.3).

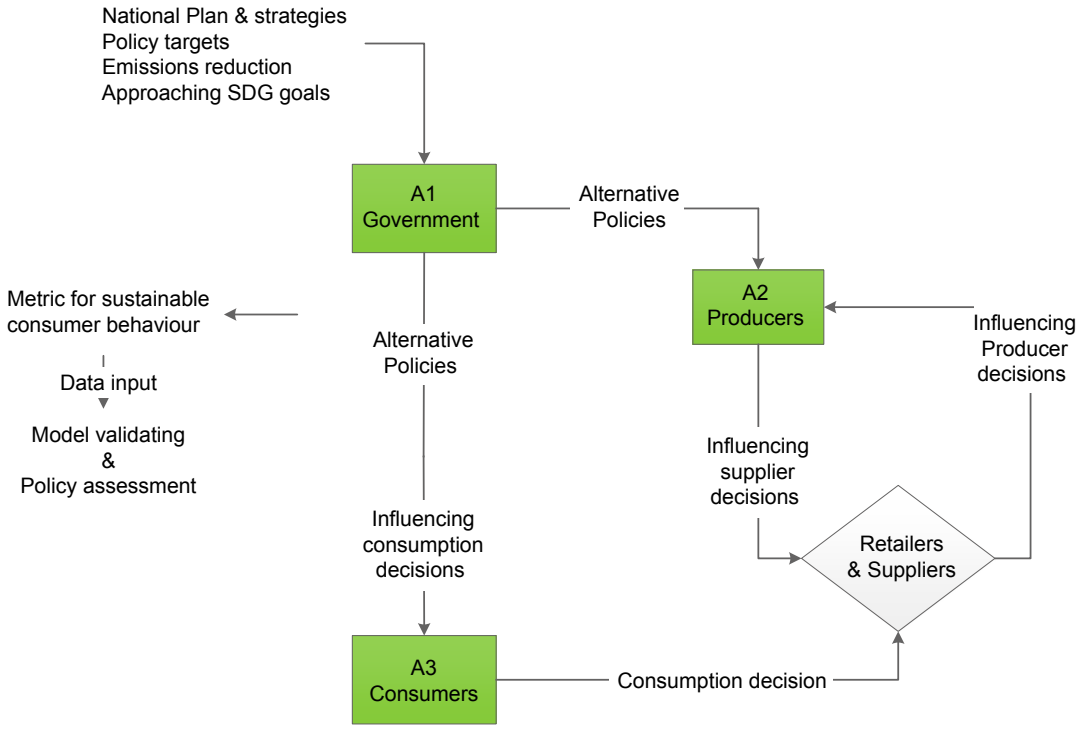

Figure 6.1. Represented agent model for SPACAM development. A1, A2 and A3 denote proposed represented agent numbers.

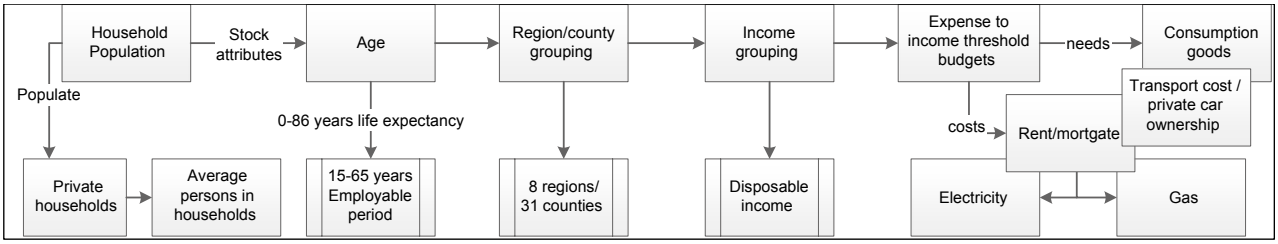

Figure 6.3. Layout of household attributes.

6.4 Methodology – Household Decision Model

This section describes the attributes and assumptions underpinning the development of phase one (1) that enable the execution of developmental scenarios. The model builds on the transport agent-based model developed by Fadiran *et al*. (2018a,b, 2021). The following attributes are used to develop a case scenario that aims to observe findings from household decisions based on agent population by age and county. These attributes or features (assigned initial values or data) are further summarised and presented in Table 6.1. A summary of the conditions further guiding the case study scenario is provided in Table 6.2, showing conditions for house price and building energy rating. A summary of conditions influencing household mortgage decisions is shown in Table 6.3, such as average house price in each county, household disposable income and average number of persons per household. The agent representation of households is attributed with the features of age, county and income. Agents are populated at 10% of the Irish 2016 household population (170,230, out of a total of 1.7 million).

- Households make decisions on whether or not to purchase a house based on disposable income earned over *x* years and savings accrued during employment (i.e. aged 18–65 years).
- Payback threshold period (in years) is used to determine if the household (i) qualifies for a mortgage and (ii) using a mortgage calculator, can afford to make the repayments. A household agent's mortgage application is assumed to once more incur the average cost of rented accommodation, which varies from county to county.
- This study used a payback measure to calculate mortgage affordability and to inform the decision on housing purchase. This takes into consideration interest rate (random), loan size (based on average house size for a household of a particular size) and accumulated savings.
- The impact of changing energy expenditure on the pattern of or trends in household decisions was observed.

Table 6.1. Populating household agent – initialised features

Features or attributes	Approach
Household population case	10% of Irish population – scenario case (using 2016 population distribution data per county)
Age distribution	0–85 ageing life (population with 2017 CSO levels)
County distribution	34 Irish administrative counties
Average monthly income per county	Disposable income (2017 estimated levels, using 1% annual growth rate extracted from the 2015 CSO estimation)
Mortgage expense budget – expense	30% of monthly income (threshold)
Private car/transport budget – expense	15% of monthly income (threshold)
Electricity household budget – expense	5% of monthly income (threshold)
Consumption goods budget – expense	10% of monthly income (threshold)
Savings	10% of income less total expense
Average persons per private household	2.4–2.8 – inputted range of household beds in the model setup (2016 levels)

Table 6.2. Scenario conditions

Scenario	Condition
1	Average house price per county in 2017
	Higher monthly electricity budget and measure of average household saving rate
2	Increase in house price by 10% following improved building energy rating (BER) value integration
	Difference in household savings after house purchase because of reduced electricity costs and lower overall running costs

Table 6.3. Household factors impacting mortgage decision

Factors	Conditions
Housing price (€)	Average per county – by number of bedrooms per house
Mortgage payback (years)	Interest rate, mortgage calculator, payback, 35-year threshold for households ≤35 years old, 30-year threshold for households >30 years old
Household disposable income	County based (2016 values)
Average number of persons per private household	2.4–2.8 (2016 values)

- The average house price in each county was included.
- Trends in the number of sales and sale values of standard houses and energy technology-fitted houses were compared over a selected period of time, taking into account payback period and electricity cost savings.

6.5 Findings and Conclusion

This research presents simulation scenarios from stock agent representations of households initialised with the aggregated Irish case setting. Household agents are attributed average life expectancy and average regional disposable income levels, and are then accorded threshold ratios for monthly savings, transport and energy costs and expenditure on consumption goods. Figure 6.4 shows the difference in trend or pattern between the value of a standard house (no technology fitted, i.e. business as usual) and a house fitted with energy-efficient technology. This development presents two possible outcomes:

1. Higher house prices due to energy technology and efficiency implementation block out the opportunity for lower-income households to purchase a house.
2. House prices are higher but energy technology and efficiency implementation contribute to energy cost savings and emission savings in the long term.

The first point suggests that there is a need for government interventions at the national level to drive the uptake of technology, in the form of subsidies (there are existing policies in this area) or other types of policies.

As the project was small and time was limited, this model is currently still in the development phase and is subject to further incremental improvements. Such improvements could include the inclusion of further details of house purchase or accommodation type (e.g. incorporating findings about accommodation from the survey carried out as part of this study), emissions data, mode of transport used to go shopping, fitted energy-efficient technologies, waste per household and specific energy-saving technologies (such as heat pumps and rooftop solar photovoltaic cells). This will potentially enable the evaluation of household or consumer decisions driven by energy policies targeting residential energy consumers, with the goal of identifying opportunities for carbon mitigation. Additionally, it will facilitate the identification of clusters that can be targeted in the transition to sustainable consumption.

Given the dynamics at play in the housing market and average income levels, there is a need for policy interventions that stimulate a faster transition to energy-efficient technology in residential buildings. Consumer awareness of building energy ratings and energy-efficient technologies also plays a role in sustainable consumer behaviour. This study presents a foundation or a basis for further studies to explore these questions in greater detail.

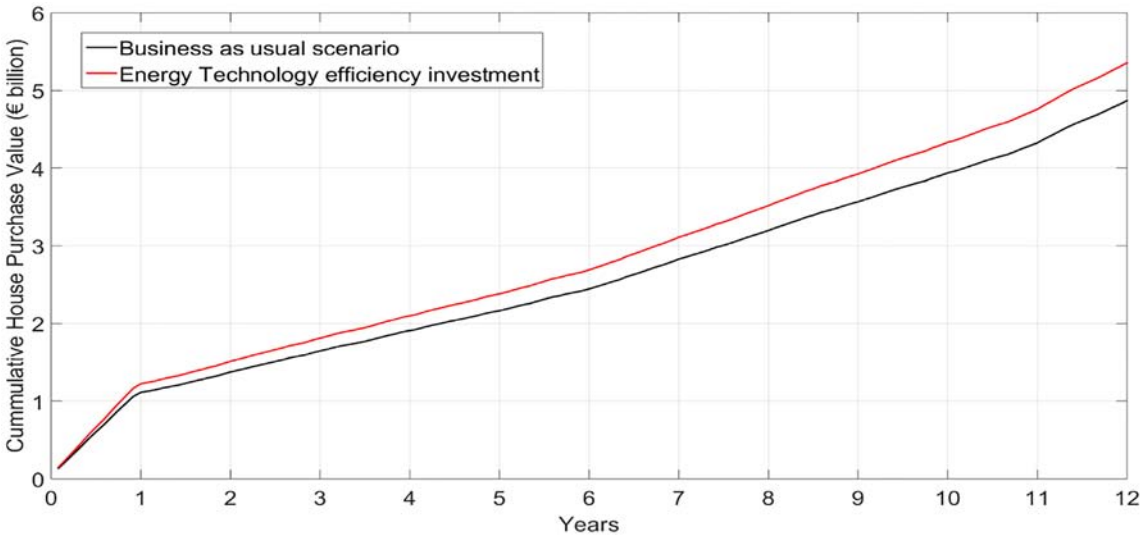

Figure 6.4. House purchase value over time.

7 Conclusions and Recommendations

In this study we analysed the results of a survey aimed at determining barriers to sustainable consumer behaviours. The survey included questions intended to explore respondents' knowledge of sustainability, their awareness of environmentally friendly products and their shopping methods and food disposal habits. Observations from the survey data analyses were presented in Chapters 3–5.

7.1 Core Findings

The findings revealed barriers to environmentally friendly planning, consumption and waste behaviour among Irish consumers. Based on the application of factor analyses, the study proposed four exogenous factors driving sustainable consumption and waste behaviour, namely (i) environmental concern, (ii) environmental knowledge, (iii) opinion/belief and (iv) concern for local businesses. Structured hypothesised models determined and explained the relationship between and variance of environmental drivers of sustainable consumption and waste factors, which could be categorised as (i) planning habits, (ii) environmental bargains and (iii) waste habits.

A further regression analysis of established consumption variables and socio-demographic variables led to the identification of groups or clusters to be targeted by policies and/or interventions (Figure 7.1). Men (from gender linkage) were identified as less likely to consume food sustainably, thus identifying them as a target cohort to stimulate the sustainability transition. People in rented accommodation, either shared or privately rented, were identified as another cluster that can be targeted by incentives to transition to sustainable consumption.

Views on and opinions of incentives to promote public transport in Ireland were reported in Chapter 5, using four examples of incentives already adopted in some other EU Member States. The findings identified target groups for specific incentives to promote public transport and revealed a research gap in the area of incentives to promote sustainable transport. We suggest that a larger dataset is needed, and propose that the case study could serve as a pilot for larger studies.

7.2 Further Research

The SPAC project developed and produced a reusable questionnaire, which can be used again to collate data on consumers' beliefs, knowledge, attitudes and behaviour in future research. The questionnaire has the potential to add value to further studies on consumer behaviour by creating constructs for metrics/ measurements of consumer behaviour and can be updated at a desired frequency. For example, annually

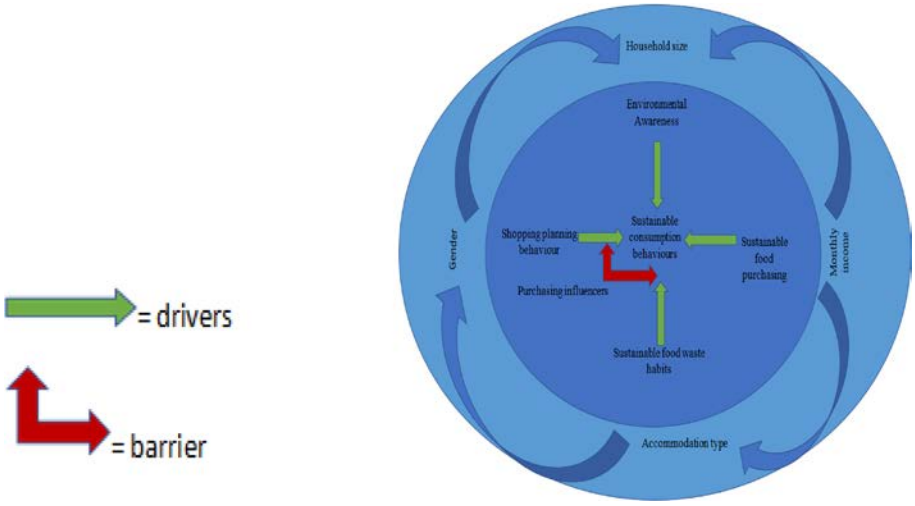

Figure 7.1. Constructs (factors) that affect sustainable consumption behaviour. Source: Colgan (2020).

updated models could facilitate the measurement of progress or regression, which can be applied in other areas, such as model calibration and simulation support.

Model frameworks can also be used to run and validate metrics to measure and compare over time improvement in consumers' attitudes and change in SPAC. This gives room for assessing and establishing the current, i.e. baseline position, versus alternative options for developing a more sustainable future. The metrics can provide a quantitative measurement of a wide range of current sustainability indicators, but in an integrated way across an identified supply chain system, alongside a model that integrates consumer behaviour in sustainable policies that drive the supply chain.

Owing to the short SPAC project timeline, the findings were limited. However, the data can potentially be exploited to investigate the following topics:

- waste and package disposal knowledge and the link with sustainable consumer behaviour;
- food waste and food package awareness and the link with consumer waste behaviour;
- consumers' policy views and approaches to household waste reduction;
- the relationship between consumers' policy and environmental awareness and household waste reduction;
- consumers' views of and willingness to purchase alternative energy-efficient products.

7.3 Recommendations

There are different approaches to influencing consumption decisions and patterns. This report argues that the most important is to increase consumers' awareness and understanding of sustainability, eco-labels and the differences between organic and inorganic labels and, more importantly, to increase consumers' willingness to pay for more environmentally friendly and healthy products. Changing consumer perceptions in these areas lead to change in consumers' purchase decisions and thereby influence the direction of production activities.

Consumers' level of environmental awareness and understanding influences how they shop and consume, which in aggregate influences the direction of demand and supply, as consumers' decisions are influenced by their level of environmental knowledge and concern. Identifying gaps in consumers' knowledge, attitude and behaviour would support policy developments targeting SDG12.

Furthermore, a comprehensive consumer environmental knowledge, understanding and awareness toolbox is required at the county level. This would enable a national action plan to bridge the gap to sustainable behaviour, as this would affect consumers' daily decisions, which, in turn, affect food production and consumption activities associated with the environment, lifestyle and health. These specific actions include the promotion of environmental educational campaigns, adverts and integration into curricula from primary to tertiary education, such as initiatives from Green School Ireland.

Further recommendations are as follows:

- Target environmental and social policy interventions to shift consumers towards sustainable and social behaviour.
- Increase households' environmental knowledge and awareness in order to increase environmental concern. Bridge the environmental information gap by creating targeted awareness campaigns that educate consumers on the implications of environmental policies/actions and help them understand the language and terminology associated with the environment and sustainability, for example by providing definitions of key terms (e.g. eco-label, organic, inorganic).
- Change consumer behaviour in favour of planning, willingness to bargain environmental products and improved waste habits.

7.4 Outputs and Activities

Project outputs are listed in Appendix 2, which provides details on working papers, policy briefs, a Master's thesis, presentations, public dissemination, social media participation and a newsletter release.

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Abbreviations

CFI	Comparative fit index
CSO	Central Statistics Office
GFI	Goodness of fit index
KMO	Kaiser–Meyer–Olkin
RMSEA	Root mean square error of approximation
SDG	Sustainable Development Goal
SPAC	Sustainable production and consumption
SPACAM	Sustainable production and consumption agent modelling

Appendix 1 External Tables

Box A1.1. Literature search engine guide

Specific search entries used in the search on “article title, abstract and keywords”;

1. Sustainable; production; consumption; social; Ireland
2. Sustainable; consumption; social; Ireland
3. Sustainable; production; social; Ireland
4. Sustainable; production; consumption; norm; Ireland
5. Sustainable; consumption; norm; Ireland
6. Sustainable; production; norm; Ireland
7. Sustainable; production; consumption; behaviour; Ireland
8. Sustainable; consumption; behaviour; Ireland
9. Sustainable; production; behaviour; Ireland
10. Sustainable; production; consumption; attitude; Ireland
11. Sustainable; consumption; attitude; Ireland
12. Sustainable; production; attitude; Ireland
13. Sustainable; production; consumption; social
14. Sustainable; consumption; social
15. Sustainable; production; social
16. Sustainable; production; consumption; norm
17. Sustainable; consumption; norm
18. Sustainable; production; norm
19. Sustainable; production; consumption; behaviour
20. Sustainable; consumption; behaviour
21. Sustainable; production; behaviour
22. Sustainable; production; consumption; attitude
23. Sustainable; consumption; attitude
24. Sustainable; production; attitude

Note: “AND” = “;” (Boolean expression).

Appendix 2 SPAC Project Outputs

Working Papers

- Fadiran, G. and Onakuse, S., 2019. Identifying environmental barrier to planning, consumption and waste behaviour: a case study of Irish consumers.
- Colgan, J., Onakuse, S. and Fadiran, G., 2020. Analysis of barriers and drivers towards sustainable consumption behaviour from an Irish consumer perspective.

Policy Briefs

- Onakuse, S., Fadiran, G. and Colgan, J., 2019. Identification of attitude-behavioural gaps and targets for attention of policy makers and the public – to stimulate sustainable behavioural change. Available online: https://www.cubsucc.com/contentfiles/4.FBD%20Files/Part_I_Attitude-Behaviour_policy_brief.pdf (accessed 13 January 2022).
- Fadiran, G., Colgan, J. and Onakuse, S., 2020. Opinion piece: Consumer views on incentives to promote public transport use in Ireland. Available online: https://www.cubsucc.com/contentfiles/4.FBD%20Files/Part_II_Transport_opinion_policy_brief.pdf (accessed 13 January 2022).

Master's Thesis MSc (Commerce)

- Colgan, J., 2020. Analysis of barriers and drivers towards sustainable consumption behaviour from an Irish consumer perspective. MSc Thesis, University College Cork, Cork, Ireland.

Presentations and Development

- Colgan, J., Onakuse, S. and Fadiran, G., 2019. Towards sustainable production and consumption – understanding barriers and behavioural gaps. Cork University Business School, Postgraduate Research Symposium, 1 Lapp's Quay, Centre for Executive Education, 13 May 2019.
- Fadiran, G., 2019. Master's class lecture "Research methods and case study findings on Sustainable Production and Consumption (SPAC): The Influence of Social Norms". University College Cork, Cork, Ireland, 24 October 2019.
- Colgan, J., 2019. An analysis of sustainable consumption attitude-behaviour gaps. Research seminar presentation. Food Business and Development, University College Cork, Cork, Ireland, 10 December 2019.
- Fadiran, G., Onakuse, S. and Colgan, J., 2020. Identifying the presence and impact of environmental drivers to consumption and waste behaviour: the case of Irish consumers. Second international conference for sustainable production and consumption, Edinburgh, UK, 24–25 June 2020. Suspended because of Covid-19.
- Fadiran, G., Onakuse, S. and Colgan, J., 2020. Identifying the presence and impact of environmental drivers to consumption and waste behaviour: the case of Irish consumers. Poster presentation. EPA Research Programme Virtual Workshop, 28 October 2020.
- Fadiran, G., Onakuse, S. and Colgan, J., 2020. Identifying the presence and impact of environmental drivers to consumption and waste behaviour: the case of Irish consumers. Poster presentation. EPA/HSE Environment Conference, 2 November 2020.
- Fadiran, G., Onakuse, O. and Colgan, J., 2020. Consumer views on incentives to promote public transport use in Ireland. The International Conference on Resource Sustainability (icRS). Covid-19 transfer from 30 June to 2 July 2020 to 19–23 July 2021 (Virtual). University College Dublin, Dublin, Ireland.

Public Dissemination, Social Media and Newsletter

- Project website host and updates: https://www.cubsucc.com/csl.projects/
- Completed online survey link: https://forms.gle/BtWyw8rVgN6aKSSt8
- Onakuse, S., Fadiran, G. and Colgan, J., 2019. Consumer role to stimulating sustainable growth. LinkedIn article post, 11 July 2019: https://www.

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- Onakuse, S., 2020. Why it's time to stop blaming governments and look at our own consumption and sustainability. UCC CUBS podcast. RTÉ radio collaboration with University College Cork, Cork University Business School Podcast: Insights. Episode 13: https://www.cubsucc.com/podcast/
- Newsletter Edition 1: Welcome introduction to SPAC project and the team (1 July 2019): project website (https://www.cubsucc.com/csl.projects/) and https://www.cubsucc.com/contentfiles/4.FBD%20Files/SPAC_intro_Newsletter_V1_1.pdf
- Newsletter Edition 2: SPAC team update (9 April 2020).
- Project twitter account: @spac_ucc (https://twitter.com/spac_ucc)
- Project researchgate presence: https://www.researchgate.net/project/Sustainable-Production-and-Consumption-SPAC-The-Influence-of-Social-Norms

Technical Progress Reports

- Three technical and financial reports submitted to the EPA.

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL
Tá an Ghníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaol a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialú: *Déanaimid córais éifeachtacha rialaithe agus comhlíonta comhshaoil a chur i bhfeidhm chun torthaí maithe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcloíonn leis na córais sin.*

Eolas: *Soláthraímid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírithe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.*

Tacaíocht: *Bímid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaol atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaol inbhuanaithe.*

Ár bhFreagrachtaí

Ceadúnú
Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaol:
- saoráidí dramhaíola *(m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola)*;
- gníomhaíochtaí tionsclaíocha ar scála mór *(m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta)*;
- an diantalmhaíocht *(m.sh. muca, éanlaith)*;
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe *(OGM)*;
- foinsí radaíochta ianúcháin *(m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha)*;
- áiseanna móra stórála peitril;
- scardadh dramhuisce;
- gníomhaíochtaí dumpála ar farraige.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil
- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhíriú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a ídíonn an ciseal ózóin.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Uisce
- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uiscí idirchriosacha agus cósta na hÉireann, agus screamhuiscí; leibhéil uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

Monatóireacht, Anailís agus Tuairisciú ar an gComhshaol
- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil *(m.sh. tuairisciú tréimhsiúil ar staid Chomhshaol na hÉireann agus Tuarascálacha ar Tháscairí)*.

Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn
- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis cheaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

Taighde agus Forbairt Comhshaoil
- Taighde comhshaoil a chistiú chun brúnna a shainaithint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

Measúnacht Straitéiseach Timpeallachta
- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaol in Éirinn *(m.sh. mórphleananna forbartha)*.

Cosaint Raideolaíoch
- Monatóireacht a dhéanamh ar leibhéil radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Faisnéis Inrochtana agus Oideachas
- Comhairle agus treoir a chur ar fáil d'earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaol ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnteoireacht i ndáil leis an gcomhshaol *(m.sh. Timpeall an Tí, léarscáileanna radóin)*.
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhaíl ghuaiseach a chosc agus a bhainistiú.

Múscailt Feasachta agus Athrú Iompraíochta
- Feasacht chomhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil
Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d'Oifigí:
- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- Oifig um Chosaint Radaíochta agus Monatóireachta Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

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Sustainable Production and Consumption: The Influence of Social Norms

Authors: Gideon Fadiran and Stephen Onakuse

Consumer behaviour represents acts or decisions that influence the direction of production and consumption activities, which are, in turn, driven by household and, ultimately, economic activities. Households' production and consumption behaviours have an impact on the level of waste generated, which can be defined as sustainable or unsustainable. These decisions become habits and norms that drive behavioural attitudes and preferences, which are largely influenced by factors such as consumers' socio-economic background, community, beliefs (opinion), knowledge (information gaps) and concern (e.g. concern for local businesses, farmers and the environment). This research investigated the linkages between habits and norms that drive behavioural attitudes and preferences, and how consumers' socio-economic background, community, beliefs (opinion), etc. are identified as the driving factors of consumer behaviour and waste patterns.

Identifying Pressures

Ireland has drawn up national policies to achieve sustainable production and consumption (SPAC) levels through national framework plans from different governmental departments, including Sustainable Development Goal 12 (SDG12, on responsible production and consumption). Nonetheless, several indicators, such as organic farmland as a percentage of total farmland, household waste per capita and the SDG12 score, suggest a poor SPAC performance. Policy approaches aimed at improving the performances have been targeted at different sectors and stakeholders. This research is aligned with the global aim of attaining the SDG12, which includes reducing food and general waste and increasing awareness on sustainable development and lifestyles.

The findings from this research suggest that household decisions and waste disposal habits underpinned by more sustainable principles can contribute towards meeting national and global sustainability goals. The research also discusses a social policy intervention to (i) shift consumers towards more sustainable and social behaviour; (ii) increase households' environmental knowledge and awareness in order to increase environmental concern; and (iii) bridge the environmental information gap by creating targeted awareness campaigns that educate consumers on the language and terminology associated with the environment, sustainability, labels, definitions and implications. The research developed a comprehensive consumer environmental knowledge, understanding and awareness toolbox at the county level.

Informing Policy

There are different approaches to influencing consumption decisions and patterns. This report's findings indicate that it is important to increase consumers' awareness and understanding of sustainability, eco-labels and the differences between organic and non-organic labels and, more importantly, to increase consumers' willingness to pay for more environmentally friendly products. Changing consumer perceptions in these areas leads to change in consumers' purchase decisions and can thereby influence the direction of production activities. Consumers' level of environmental awareness and understanding influences how they shop and consume, which in aggregate influences the direction of demand and supply, as consumers' decisions are influenced by their level of environmental knowledge and concern. Identifying gaps in consumers' knowledge, attitude and behaviour would support policy development targeting SDG12.

Developing Solutions

This research sought to identify target areas to focus on in order to influence and stimulate sustainable production and consumption decisions and behaviour that could help Ireland meet national goals in this area. This project, through a survey of case studies, identified environmental barriers to planning, consumption and waste behaviour among consumers. Four external factors were identified as driving factors for sustainable consumption and waste behaviour, namely (i) environmental concern, (ii) environmental knowledge, (iii) opinion/belief and (iv) concern for local businesses. Potential groups or clusters for policy targets were also identified; for example, the survey indicated that men (from gender linkage) are less likely to consume food sustainably. People living in rented accommodation, either shared or alone, were identified as another group that can be targeted to activate more sustainable consumption behaviours. The project initiated the development of a model framework aimed at achieving a behavioural representation of consumer decisions that can deal with the data limitations that often plague empirical analysis.

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