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A systemic view of sustainable consumption behaviour in the context of disruption

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ABSTRACT

The purpose of this paper is to provide a holistic exploration of sustainable consumption behaviour in the aftermath of a major disruption. Using Rasch Modelling, a hierarchy of sustainable consumption behaviours post-disruption was constructed ($n = 1005$), consumers were grouped along the hierarchy based on the extent of their sustainable behaviour, and pre- and post-disruption behaviours were compared. The results indicate that consumer groups high in sustainable consumption behaviours further increased these behaviours post-disruption, whereas those with low sustainable consumption behaviours did not change. Our research finds that factors influencing sustainable consumption behaviour are complex and an external disruption did not lead to substantial behavioural change over time. This study makes an original contribution to theory by extending understanding of sustainability from a holistic perspective through the examination of a broad range of behaviours and multiple characteristics. Practically, the research is relevant for policy makers and those seeking to encourage sustainable behaviours.

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Sustainable consumption; systemic view; external disruption; consumption behaviour; behaviour change

Introduction

Growing awareness of the need to minimise negative impacts on the environment has come at a time of major disruption to consumers and consumption patterns. A recent global survey found that 60% of consumers said sustainability has become more important to them recently (Ads, 2022) and that 'if individuals like me do not act now to combat climate change, we will be failing future generations' (IPSOS, 2024). Research suggests that major disruptions, e.g. COVID-19 pandemic, causes consumers to rethink what is important to them and to consider their own efforts towards sustainable consumption (Palakshappa et al., 2022). However, it is unclear whether positive changes in consumer attitude during a disruption have translated into behavioural changes in sustainable consumption.

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Sustainable consumption is a consumption system in which interrelated behaviours are affected by multiple influential drivers (Falcão & Roseira, 2022). However, many studies with a behavioural (rather than attitudinal or intention) focus tend to investigate a single behaviour or domain, such as recycling. Few studies focus on a holistic view of sustainability consumption behaviour (Johnstone & Tan, 2015) investigating multiple sustainable behaviours and/or different influences on that behaviour. This research answers the call by Falcão and Roseira (2022) for more behavioural studies of sustainable consumption and utilises a survey of the general population to develop a holistic exploration of reported sustainable consumption and changes in behaviour following a major disruption.

Through a systemic examination, the aim of the paper is to:

(1) Provide a holistic view of sustainable consumption behaviours by constructing a hierarchy of reported sustainable consumption behaviours post-disruption (HSCB-PD)
(2) Explore post-disruption behaviour changes relating to HSCB-PD.
(3) Investigate different sustainable consumer groups with reference to demographic and psychological influences.

Along with insights into the ongoing effects of disruption on consumer behaviour, our research contributes to literature on systemic sustainable consumption, offering a hierarchy as a framework. The applied systemic view emphasises that different individual behaviours within the sustainable consumption domain are not undertaken in isolation but are situated in a context that is influenced by individual and societal characteristics. The HSCB-PD is used to investigate changes in sustainable consumption behaviours (SCB) and enables segmenting consumers into groups in relation to the intensity of their behaviour. We find that the average consumer undertakes few sustainable behaviours. Additionally, reported behaviour and any behavioural change is driven by personal values and perceived levels of knowledge and involvement, rather than being a response to the disruption.

Literature review

We review literature on sustainable consumption as a systemic construct and behaviour changes in response to disruptive events and develop research propositions for use in this study. In line with the study's holistic view we refer to a number of research areas that deal with consumption systems, disruption and behavioural change, heterogeneity of (sustainable) consumers, and a range of demographic influences and psychological motivators including personal values, general environmental attitudes, knowledge and agency. By highlighting multiple literature streams we provide key insights into this broad range of research areas.

Sustainability, sustainable consumption, and consumption systems

Sustainability, as a complex systemic construct, considers environmental, social, cultural, and economic aspects (Bangsa & Schlegelmilch, 2020; Elkington, 2018) in order to balance

current needs while protecting inter-generational development (Barone et al., 2020). Sustainable consumption comprises facets of consumer behaviour focused on environmental and social issues connected to production and consumption (Hanss & Böhm, 2012; Minton et al., 2018) and has become an important issue in marketing as people are increasingly aware of the impacts of unsustainable production and consumption (Lim, 2017; White et al., 2019). Despite definitions that reflect sustainability's complexity, most research on sustainable consumption focuses on individual behaviours and/or the environmental pillar of sustainability. Furthermore, less attention has focused on exploring multiple sustainable behaviours, or on the social aspect of sustainability that might include conscious consumerism, social justice, or buying local (Bangsa & Schlegelmilch, 2020; ElHaffar et al., 2020; Schoolman, 2020).

Our study emphasises the social pillar of sustainability, extending previous work on multiple environmental behaviours (e.g. General Ecological Behaviour, F. G. Kaiser et al., 1999). By focusing on broader areas of everyday sustainable consumption, we further complement investigations on multiple but specific ethical/sustainable behaviours (Ganglmair-Wooliscroft & Wooliscroft, 2016,2022). Our conceptualisation of sustainable consumption thereby regards consumers' underlying propensity to act in an environmentally friendly or sustainable way as a pseudo-latent variable of sustainable-ness (Ganglmair-Wooliscroft & Wooliscroft, 2016) or a trait-like disposition for environmental engagement (F. G. Kaiser & Byrka, 2011).

This systemic view of SCB uses a horizontal cross-sectional viewpoint (R. A. Layton, 2007) and focuses on a lower-level consumption system (Wooliscroft, 2019) that is influenced by personal characteristics, norms of consumption, business and government regulations (e.g. Sheth & Parvatiyar, 2021; Thøgersen, 2010). SCB and any changes in SCB materialise as a result of what happens at multiple levels rather than from discrete and singular actions (Domegan, 2021), and actors such as government or business provide context within which that behaviour occurs (Dietz, 2015; Thøgersen, 2010). Structural conditions 'frame and constrain individual choices' (Thøgersen, 2010, p. 171); for example, whether organic produce or staples are available in mainstream supermarkets, or when governments regulate the availability of plastic shopping bags.

A systemic view of SCB acknowledges that behaviours are affected by path dependencies and feedback loops. Path dependencies occur 'when what has happened at an earlier time affects the possible outcomes … occurring at a later point in time' (R. Layton & Duffy, 2018, p. 400). They exist at an individual level, when past choices hinder or enable sustainable behaviours (Wooliscroft, 2019) – for example, a past choice to live in a rural area might restrict current ways of commuting to work. Individual path dependencies also occur on a psychological level as a reflection of individuals' self-concepts – for example, if consumers define themselves as car afficionados, they are unlikely to choose public transport. On a societal level path-dependencies include the availability (or lack of) infrastructure – as an example, historic investments in roads rather than public transport. In addition, social norms can act as feedback loops that reinforce existing behaviours – for example, it is normal behaviour to own a car, or it is normal, expected behaviour to recycle.

Proposition 1: Individual Sustainable Consumption Behaviours are adopted consistently as part of a system of sustainable behaviour.

Disruptions and change in sustainable consumption behaviours

Understanding shifts towards more sustainable consumption is especially relevant in a post-pandemic world and has significant implications for marketing (White et al., 2019). Research indicates that the pandemic has created increased consumer awareness of environmental issues, sustainable consumption, and social responsibility (Severo et al., 2021), although few studies explore the subtleties of reported behaviour changes.

While there is evidence that consumer attitudes towards sustainable products are changing (Cerri et al., 2018), actual behaviours do not always follow, resulting in a not completely understood attitude-behaviour gap (Jayawardhena et al., 2016; Johnstone & Tan, 2015; Sudbury-Riley & Kohlbacher, 2016). Although consumers increasingly say that sustainability is important, the actual uptake of sustainable behaviour in the general population is very slow (Thøgersen & Schrader, 2012; Torma et al., 2018). One possible explanation for the lack of sustainable behaviour is that a lot of everyday behaviour is repeated frequently and decisions to engage in habitual (unsustainable) behaviour are characterised by low involvement (Thøgersen et al., 2012; Verplanken & Roy, 2015) and automatic responses (Wood & Neal, 2007). People respond automatically to repeated stable cues and circumstances (Verplanken & Wood, 2006) which trigger habitual behaviour (Wood & Neal, 2009) and maintain the unsustainable status quo.

In a relatively static environment, changing towards more sustainable shopping behaviour requires considerable effort and planning by a consumer (Carrington et al., 2014). Strong and well-established habits are hard to change, especially if the encountered environmental cues remain (Verplanken, 2006). Successfully establishing and maintaining new habits further rests on consumer perceptions of factors such as behavioural accessibility, desirability, and feasibility (J. B. Cohen & Andrade, 2018). Sustainable behaviours that are adopted must be do-able, seen as right, and contribute to well-being (including long-term economic well-being) (Netemeyer et al., 2018).

Another, relatively easier way of changing automatic (and unsustainable) consumption behaviour is through the encountered situational and environmental cues (Verplanken & Orbell, 2019). The pandemic changed the situational context affecting daily habits of hygiene, shopping, eating, travelling and socialising (Salon et al., 2021), and gave some people time to reflect on life, personal priorities and larger societal questions (Büssing et al., 2020). These widespread and pervasive changes to daily life suggest that this disruption made changes in everyday sustainable behaviours more likely.

Proposition 2: Changes in environmental cues provided an opportunity for established (unsustainable) habits to be disrupted, and an enduring adoption of new sustainable consumption behaviours.

Differences in (sustainable) consumer segments in the face of disruptions

Sustainable consumers are not one homogenous group (Hughner et al., 2007), and everyday SCBs are not adopted by all consumers at the same time. One approach to investigating a population's engagement and adoption of SCBs in a population is by utilising Rogers' Diffusion of Innovation Theory (1995). The theory explains how

innovations – products, behaviours or ideas that are perceived as new (Lockett & Littler, 1997) – spread through a population. The percentage of a population that adopts a new product/behaviour at different times is normally distributed, and the corresponding cumulative diffusion curve takes an S-shape (Rogers, 1995). The speed at which an innovation is adopted is reflected in the steepness of the adoption curve. This steepness is influenced by factors such as the relative advantage (including expected benefits and costs of adoption), compatibility (e.g. with past experiences, individual values and social norms), complexity of the new product/behaviour as well as its trialability and observability (Rogers, 1995).

Our research considers domain specific innovativeness (Bartels & Reinders, 2011) relating to the category of sustainable products or behaviours. Domain specific innovativeness, like sustainable-ness (Ganglmair-Wooliscroft & Wooliscroft, 2016), is a continuous variable, and any classification of consumers 'into discrete categories is a conceptual device … a simplification that aids the understanding' (Rogers, 1995, p. 261). Four or five adoption groups are frequently studied as they provide an efficient and effective base to study consumers' characteristics (Ganglmair-Wooliscroft & Wooliscroft, 2016): Innovators and Early Adopters (2.5% and 13.5% of the population – these two groups are frequently studied together), Early and Late Majority (34% each), and Laggards (16%).

Proposition 3: Sustainable Consumers are not one homogenous group and can be segmented effectively based on their 'sustainable-ness', their propensity to adopt sustainable behaviours.

Consumption studies about abrupt changes in the macro environment, the effects of sudden disruptions, and coping with disruptive events without precedent, are relatively sparse (Pullen, 1993). Recently, Campbell et al. (2020) proposed a framework of adaptive response to change, considering consumer and market responses to interruptions to the norms, beliefs, routines, and practices of everyday life, while Cardoso et al. (2020) considered the long-term effects of destabilising life changing events on individuals and families, and Cavanan (Canavan, 2023) investigated the disruption to everyday consumption during the COVID-19 pandemic. However, as Hyman et al. (2021) suggest, marketing scholars have mostly focused on disruption in the context of technology and innovation e.g. innovation in the cultural industry due to disruptions (Decrop & Dumont, 2023).

While some consumers have a positive outlook in the face of disruption and a fresh start mindset (Price et al., 2018), this does not always translate into permanent behaviour change. Bucher et al. (2022) report that those who remodelled their behaviour unexpectedly discovered positive things during the crisis and did not want to go entirely back to their former lifestyles. For this group, their behaviours 'often started as substitutive behaviours for needs stemming from habitual consumption patterns which over time gradually transformed into independent consumer behaviours' (Bucher et al., 2022, p. 51). However, only about 8% of participants in the Bucher et al. study established long-term changes.

There are mixed findings from other studies of the pandemic on sustainable consumption behaviour about whether a major disruption like COVID-19 has increased or decreased sustainable attitudes and intentions. Dangelico et al. (2022) found that some

consumers increased their purchase frequency and willingness to pay for sustainable products whereas Hüttel and Balderjahn (2022) highlighted how vulnerable populations were impacted negatively regarding their sustainability intentions.

We argue that the disruption created by the pandemic presents a valuable opportunity to gain new insights into sustainable consumption behaviour changes of different sustainable consumer segments. People were able to pause and reflect on the impacts of their consumption and are transitioning towards being more sustainable (M. J. Cohen, 2020) in different ways and at different paces.

Proposition 4: Sustainable Consumer Segments report different levels of behaviour change in response to disruption.

Factors that influence sustainable consumption behaviours

There are many potential drivers and motives for SCBs – internal, social, situational, psychological, and demographic factors (Aboelenien et al., 2023; Budeanu, 2007; Moisander, 2007; N. Nguyen & Johnson, 2020). Calls for research that better understands overall key factors, as opposed to individual drivers, that increase or hinder sustainable behaviour (T. N. Nguyen et al., 2016; White et al., 2019), emphasise the need for a holistic, sustainable consumption system approach to exploring SCBs. Reflecting our holistic approach, we forgo a detailed exploration of one specific personal influence in favour of broadly discussing a range of potentially influential personal factors including demographics, values, environmental attitudes, eco-literacy, perceived consumer effectiveness, and willingness to pay for sustainable products, as summarised in Table 1.

Proposition 5: The adoption of sustainable behaviours differs between groups of consumers with reference to demographic and psychological characteristics.

Proposition 5a: *Demographic variables are generally weak predictors of sustainable behaviour.*

Proposition 5b: *Personal values like self-transcendence are important drivers of sustainable behaviour.*

Proposition 5c: *Environmental knowledge and perceived agency variables are important drivers of sustainable behaviour.*

Proposition 5d: *Willingness to pay more is a strong predictor of sustainable behaviour.*

Our literature review reflects the interrelatedness of multiple individual behaviours that are embedded in the consumption system and emphasises the need for a study with the aim of examining the complexity of sustainable behaviours and behaviour change, in light of a major disruption.

Table 1. Potential drivers and motives for sustainable consumption behaviour.

Potential drivers of SCBs	Background literature
Demographics	Demographic variables in sustainable consumption studies are routine but their influence is generally limited and often inconclusive (Finney, 2014; Verain et al., 2012). There are some positive relationships between SCB and age (Bulut et al., 2017; Gilg et al., 2005), education (Chekima et al., 2016) and being female (Chekima et al., 2016; Diamantopoulos et al., 2003; von Meyer-Höfer et al., 2015). Repeated studies of incomes do not identify a significant role in this context (Ganglmair-Tanner & Wölfing Kast, 2003; Tanner et al., 2004; Wooliscroft et al., 2014, 2022). Exploring sustainable/ green consumers using only demographic variables is insufficient to understand behaviour (Finney, 2014; Verain et al., 2012).
Personal Values	Personal value systems are foundational for sustainable attitudes and motivations that influence behaviour (F. G. Kaiser & Byrka, 2011; Thøgersen & Ölander, 2006; Valor & Martínez de Ibarreta, 2021). Studies of values that drive sustainable consumption most often build on Schwartz (1992, 2012) universal value system (De Groot & Steg, 2008; Steg et al., 2014) with self-transcendence values, specifically universalism and benevolence, correlating most strongly with the behaviours (Biel & Thøgersen, 2007; Thøgersen & Ölander, 2006; Thomas & Sharp, 2013). Self-interest values (e. g. hedonism) are negatively associated (Steg et al., 2014). Sustainable behaviour values research focuses on self-transcendence versus self-interest dimensions (De Groot & Steg, 2008).
General Environmental Attitude/ Environmental World View	New Environmental (or Ecological) Paradigm (NEP) is 'the world's most widely used measure of environmental concern' (Dunlap, 2008, p. 3). It contains 15 items that measure 'a worldview that influences attitudes and beliefs toward more specific environmental issues' (Dunlap et al., 2000, p. 428). The scale is described as measuring general environmental attitude (Hawcroft & Milfont, 2010) and is employed in predicting specific environmental attitudes and/or behaviours (Dunlap, 2008). NEP has received considerable critique (Bernstein & Szuster, 2019; Dunlap, 2008) but is adopted in the absence of an acceptable alternative (Bernstein & Szuster, 2019).
Eco-literacy	Eco-literacy is the level of consumer knowledge and understanding about environmental issues and eco-friendly products (Cheah & Phau, 2011). Wei et al. (2018) subjective eco-literacy scale measures the knowledge a consumer perceives they have of environmental issues and environmentally friendly products. This eco-literacy scale has been successfully utilised by marketing scholars (see Matin et al., 2021; Wang & He, 2022). Given that sustainability includes environmental, social and economic dimensions we adapted the Wei et al. (2018) scale to measure sustainable product and issue knowledge.
Perceived consumer effectiveness	Perceived consumer effectiveness (PCE) measures consumers perceptions of their individual actions on solving a context-specific problem (Ellen et al., 1991). Linked to socially conscious attitudes PCE is a good predictor of environmentally conscious behaviour (Ellen et al., 1991; Wesley et al., 2012) and a good predictor of ecological concern (Kinnear et al., 1974). PCE is a well-established evaluation of self-reported individual action in various contexts (Wei et al., 2018). We adapt Wei et al. (2018) scale by modifying items to encompass a broad spectrum of sustainability issues.
Willingness to pay more	Willingness to pay more (WTPM) is the extent to which consumers are willing to pay more for environmentally friendly products (Laroche et al., 2001). WTPM is correlated with consumers perceived knowledge and environmental involvement (Amyx et al., 1994; Schmuck et al., 2018). We adapt the well-established four item scale (Wei et al., 2018) to measure items related to the disruption and changes in sustainable behaviour.

Methodology

Context and data collection

The New Zealand pandemic context offers a fruitful setting for the study of enduring behaviour change in SCB in the face of a major disruption. In the first years of the COVID-

19 pandemic, between March 2020 and May 2022, consumers experienced severe limitations – a National Emergency, closed national borders and prolonged stay-at-home periods – but, in combination with the country's geographic characteristics, these measures resulted in little illness and minimal deaths (Wooliscroft et al., 2022). By not facing the realities of death and disease, we argue that during the acute phase of disruption, New Zealand consumers had more mental space available for conscious deliberation. Following the removal of restrictions on personal life, New Zealanders – like citizens in many other countries – were eager to 'get back to normal', while also dealing with the worldwide economic challenges.

An online survey of 1005 New Zealand consumers, with broad demographic characteristics (see Table 2), was conducted by a commercial market research company in the second half of 2022 when almost all restrictions had been lifted, everyday life had returned 'back to normal' and the country's borders had reopened. The researchers' contract with the market research company specified stringent data quality protocols (including several attention checks and requirements about no missing data in key item batteries) and we subsequently received 1005 useable responses. The survey was undertaken in compliance with the requirements of Massey University's Human Ethics Committee's Low Risk framework, Project 4,000,025,284. A project information statement was provided, and an online survey consent click mechanism was used by subjects to signify their informed consent to proceed with the study. The survey included 27 sustainable behaviour questions that cover different intensities of sustainable consumption and explored if these behaviours had changed post-disruption.

Rasch modelling, as outlined later in paper, is a theoretically sound and efficient alternative to other classic scale development approaches such as confirmatory factor analysis. Rasch analysis (1960/80) was used to develop the HSCB-PD and, using Rogers's (1995) adoption of innovation framework, the position of respondents in the hierarchy was used to segment respondents. HSCB-PD adoption segments were explored further, using scales capturing drivers and motives of sustainable consumption (see Table 1). The following section discusses the development of a HSCB-PD.

Table 2. Demographic characteristics.

Age	%	**Household Income (NZ$)**	%
under 30 years	20	under 30,000	14
30 to 39 years	17	30,000 to 49,999	16
40 to 49 years	17	50,000 to 69,999	16
50 to 59 years	17	70,000 to 89,999	13
60 to 69 years	15	90,000 to 109,999	16
70 years & older	14	110,000 to 129,999	7
Employment Status	**%**	130,000 to 149,999	6
self-employed	10	150,000 and over	14
employed (full time)	44	**Gender**	**%**
employed (part time)	13	male	48
home maker	5	female	51
retired	17	non-binary/rather not say	1
student	6		
unemployed	5		

Item construction for hierarchy of sustainable consumption behaviour post-disruption

The item construction for the HSCB-PD is based on a detailed analysis of 30 depth interviews with fans of three brands with sustainability at their heart. The interviews were conducted in the second half of 2020 during the height of the COVID-19 pandemic, while restrictions on everyday life in New Zealand, including a full border closure, were in place. Interviews were analysed by the study authors and six areas (or themes) of sustainable consumption were extracted: sustainable/conscious shopping, local/regional shopping, food growing/organic, reducing consumption, avoiding waste, and transportation. The themes are weighted towards the social pillar of sustainable behaviour, to complement existing scales that emphasise pro-environmental behaviours (F. G. Kaiser et al., 1999). As the themes were often broad and abstract ('supporting local'), the researchers explored direct quotes to obtain more concrete sustainable consumption behaviours ('I support my local café'). To avoid omitting areas of public conversation that were not discussed in the 30 interviews, these results were cross-checked by analysing 42 popular media articles about sustainable consumption issues published in New Zealand during the time of the interviews. This process resulted in the development of 27 sustainable consumption behaviours that were part of the conversation during the pandemic. Two Supplementary Tables contain detailed information about the development and specific extraction of the items and the final wording for each item.

The aim of this item development process was to gain a comprehensive view and cover the bandwidth of the phenomena of interest (Wooliscroft et al., 2014) by including items that cover different intensity (or 'difficulty') of SCBs post-disruption. Rasch Modelling (discussed in the next section) promotes this approach allowing the inclusion (and subsequent addition or removal) of any item that is part of the phenomenon of interest (Henn et al., 2020). Extending existing scales (Ganglmair-Wooliscroft & Wooliscroft, 2022a; F. G. Kaiser et al., 1999) and in line with the observed social discourse, the items emphasise the social pillar of sustainable behaviours. Reflecting the broad view of this study SCB items do not refer to a specific product, except for two questions relating to food (waste) and transportation. In the survey, respondents were asked to indicate which of the SCBs they undertake post-disruption, and state whether each behaviour has declined, stayed the same, or increased since the start of the pandemic.

Rasch analysis to construct a behavioural hierarchy

Sustainable consumption includes behaviours that require wide-ranging levels of personal commitment – personal energy and attention, time, financial resources, or foregoing conveniences (Ganglmair-Wooliscroft & Wooliscroft, 2022a). Sustainable (Ganglmair-Wooliscroft & Wooliscroft, 2022a), ethical (Ganglmair-Wooliscroft & Wooliscroft, 2016; Wooliscroft et al., 2014) and/or environmentally friendly (F. G. Kaiser & Byrka, 2011; F. G. Kaiser et al., 1999) behaviours have been shown to be cumulative, with consumers who undertake relatively difficult behaviours such as costly ones – being also likely to undertake easier behaviours – e.g. recycling. The Rasch Model (Rasch, 1960/80) is ideally suited for these situations where items are cumulative and spread across a broad dimension, as it is not based on correlation (F. G. Kaiser et al., 2007).

Different sustainable behaviours share 'a common theme' (Salzberger, 2009, p. 55), and the level of engagement in these behaviours reflects a consumer's trait-like disposition to consume sustainably – sustainable-ness – that can be viewed as a pseudo-latent variable (Ganglmair-Wooliscroft & Wooliscroft, 2016). 'Every response set is determined by multiple factors' (Salzberger, 2009, p. 225), and unidimensionality of a construct is always 'a relative matter' (Andrich, 1988, p. 9). This research conceptualises a person's sustainable behaviour as a representation of an underlying trait ('sustainable-ness') and the engagement with different sustainable behaviours reflects that personal trait. If a trait or underlying latent variable determines the manifest response, a unidimensional investigation of the phenomena using the Rasch Model is appropriate (Salzberger, 2009).

The Rasch Model is part of the family of logit models (Bond & Fox, 2013) and its formula states that the probability of a positive response is dependent on an item's difficulty – also referred to as 'endorsability' (Ewing et al., 2005) – and a person's characteristic on the concept under investigation (Bond & Fox, 2007). The difficulty/endorsability of a particular behaviour is thereby not assessed by the respondents, but derived from 'the linear equivalent of the endorsement probability of a behaviour in a given sample' (Tanner et al., 2004, p. 98).

$$P_{ni}(x_{ni} = 1) = \frac{e^{\beta n - \delta i}}{(1 + e^{\beta n - \delta i})}$$

with:
P_{ni} $(x_{ni}=1)$ = the probability that person n endorses (x = 1)
i δ_i = the item location parameter of item i
β_n = the person parameter for person n

Equation 1. Rasch Model Formula

The original model (Equation (1), applied here, deals well with binary (Yes/No) data. Studies by Tanner et al. (2004) have shown that binary input data in a Rasch Model leads to even better – less arbitrary – results, compared to more sophisticated (Likert-type) data. While the input data is binary, results of a Rasch Model are presented in logits, an (interval) scale that allows the interpretation of differences between item locations (Ganglmair-Wooliscroft & Wooliscroft, 2016).

As Rasch modelling is able to deal with cumulative items that are not expected to correlate (strongly) while observing a common theme and is also able to deal with binary responses it is an effective and efficient alternative to other scale development approaches. The Rasch Model provides an ideal form of measurement (Bond & Fox, 2007) and it is the researcher's task to establish whether the empirical data conforms to the model to a satisfactory extent (Salzberger, 2009). Sophisticated analysis software like RUMM2030+ provide a range of indicators to establish the theoretical quality of the Rasch analysis (Rummlab, 2015), including checks to investigate the scale's unidimensionality, validity and reliability (Baghaei, 2008; Mui Lim et al., 2009; Salzberger, 2009).

Item fit statistics for individual items are particularly important and include a Chi-square probability (with a non-significant result expected) and an Item Residual Statistic (expected to be within ±2.5, Salzberger, 2009). Once the satisfactory fit of every item is established, summary statistics can be consulted. In RUMM2030+ these include an overall

Chi-square statistic (expected to approach non-significance), and a Person-Separation Index (interpreted similar to Cronbach's alpha).

The development of a Rasch scale includes a number of checks to establish the final scale's validity. Items need to spread across the entire bandwidth of the scale, without large gaps, and individual items need to fit the theoretical model to a satisfactory extent (Baghaei, 2008; Mui Lim et al., 2009). Unidimensionality is established by comparing the fit of individual items to the theoretical model, and by ensuring that item residuals do not follow a particular pattern (Salzberger, 2009). A principal component analysis of item residuals should show that the first component of residual does not stand out (Salzberger, 2009).

In addition, items have to be invariant against different groups in the population, an important theoretical merit of the Rasch Model termed 'Specific Objectivity' (Rasch, 1977). Invariance is checked by investigating Differential Item Functioning (DIF) for (demographic) sub-groups (Brush & Soutar, 2022; Salzberger et al., 2014). In RUMM2030+ DIF is investigated by examining specially provided graphics or a two-way ANOVA statistic (Rummlab, 2015, non-significant results are expected). Finally, the response pattern of people has to follow the Rasch Model prediction (Mui Lim et al., 2009) – again established by investigating Person Residuals (expected to be within ± 2.5). Once the outlined checks have been undertaken, the scale – or hierarchy, to emphasise its cumulative characteristic – has theoretical merit.

Once the theoretical merit of a Rasch hierarchy has been established, any respondent's location represents the person's characteristic on the concept of interest. In the current study the person location acts as an indicator of the perceived barriers that a consumer is willing to overcome (Henn et al., 2020; F. G. Kaiser & Lange, 2021) when undertaking SCBs post-disruption – an indication of their behavioural consumption sustainable-ness (Ganglmair-Wooliscroft & Wooliscroft, 2016).

Sustainable consumers are not a homogenous group and the HSCB-PD person location can be used to split respondents into segments that display different intensity – or different levels of adoption (Ganglmair-Wooliscroft & Wooliscroft, 2016, 2022a). Rogers (1995) framework is particularly suitable for the identification of segments in the current analysis because the S-shaped cumulative diffusion function is by definition identical to an Item Response Curve in a Rasch Model (Ganglmair-Wooliscroft & Wooliscroft, 2016).

Analysis and results

The 1005 respondents broadly follow New Zealand population characteristics in terms of age (18 years and older), gender and income (with an under-representation of the highest income group). A summary of the demographic characteristics can be seen in Table 2. The average age of respondents is 48 years, the average household income is NZ$ 80000–89,999 and 67% of the respondents are in some kind of employment.

In addition to the HSCB-PD item battery and the demographic variables, the questionnaire included questions and item batteries to investigate potential drivers and motives for sustainable consumption (Proposition 4) including: Benevolence and Universalism (Schwartz, 2012); the New Ecological Paradigm (NEP: Dunlap & Van Liere, 1978; Dunlap et al., 2000); Sustainable Literacy and Perceived Sustainable Effectiveness (both scales adapted from Wei et al., 2018) and Willingness to Pay (item developed in conjunction with HSCB-PD).

The 15 NEP items were summarised into one variable representing General Environmental Attitude, as suggested by Dunlap (2008). Sustainable Literacy, Perceived Sustainable Effectiveness (both scales adapted from Wei et al., 2018) and Willingness to Pay all strongly loaded onto one factor (factor loadings between 0.65 and 0.93) and average summated values was used in subsequent analysis to represent these constructs. The mean values for the scales are NEP = 3.59; Sustainable Literacy = 2.78; Perceived Sustainable Effectiveness = 3.39; Willingness to Pay = 2.71 (all 5-point scales with 1 = strongly disagree, 5 = strongly agree). The two transcendence values, universalism, and benevolence were measured using a commonly used aggregate format: average value for Universalism = 5.05; Benevolence 5.54 (8-point scale with 0 = opposed to my principles; 1 = not at all important, 7 = supremely important).

Constructing the hierarchy of sustainable consumption behaviour post-disruption

To explore Proposition 1, the HSCB-PD was constructed and 1005 responses to the 27 SCB questions were entered into RUMM2030+ (Rummlab, 2015), a software program for conducting Rasch Analysis. The SCB items represent a key part of the survey, and the researchers negotiated with the market research company that any respondents who had missing data in that item battery would be replaced. This process resulted in all 1005 received responses being suitable for the Rasch Analysis. Items were in binary format (0=no, 1=yes), which is theoretically suitable for Rasch Analysis (Tanner et al., 2004) and is ideal when constructing Rasch hierarchies for behavioural consumption data (Ganglmair-Wooliscroft & Wooliscroft, 2016, 2022; Wooliscroft et al., 2014).

The construction of a Rasch hierarchy follows an iterative process. Similar to a stepwise regression analysis (Ganglmair-Wooliscroft & Wooliscroft, 2022b; Soutar & Cornish-Ward, 1997) after an iteration, every individual item is compared to the theoretical model using fit statistics provided by RUMM2030+. Items that diverge unacceptably from the theoretical model are investigated in more detail and might have to be excluded from further analysis. The Chi-square fit statistic applied in RUMM2030+ is sensitive to larger sample sizes and the fit of the items to the theoretical Rasch Model was first established using a smaller sub-sample. The smaller sample is less susceptive to producing a significant Chi-square statistic and the scale development process is based on sharper/clearer fit statistics. Specifically, all 1005 cases were read into RUMM2030+ and the item location of *Run1*, containing all 27 variables, was saved and used as an item anchor for the random sub-sample of 350 cases. Once all items in the sub-sample fitted the theoretical Rasch Model to a satisfactory extent (Item Residual ±2.5 and non-significant Chi-square test), the same process was replicated using the full dataset (1005 cases).

This process led to a result where all but two of the items in the final hierarchy would have met item-fit statistics in the large ($n = 1005$) sample. The two items that fitted the sub-sample (Chi-square test less prone to significant results), but not the full sample (1005 cases, and prone to significant Chi-square results) were 'I consciously buy from businesses that source ethically' and 'I think about what things are made of' (borderline in the sub-sample). Further analysis revealed that any subsequent deletion did not lead to changes in the remaining items' location or fit. The items that fitted the sub-sample but not the full sample were considered important parts for capturing the social pillar of sustainable

consumption behaviours and the decision was therefore made to keep these items in the analysis.

This process resulted in the deletion of 7 items: *I support local cafes and restaurants, I consume sustainably, I consciously buy from businesses that care about the environment, I grow my own vegetables, I think about where things come from, I think about how things are made, and I buy second-hand*. These items are not interpreted consistently by the respondents and diverge unacceptably from the Rasch Model's theoretical foundations (Salzberger, 2009).

The remaining 20 items fit the Rasch Model well, with all Fit Residuals ≤ ±2.5 and all Chi-square values ≥ 0.01 (Salzberger, 2009; see Table 3). Although compared to classical statistical methods, Rasch analysis does not place as much value on overall/summary fit statistics, the provided statistics are favourable with the Chi-square test approaching non-significance (0.00041; Andrich et al., 2003), and a Person Separation Index (PSI; interpreted similarly to Cronbach's alpha), of 0.82. There is no evidence of Differential Item Functioning (interpreted similarly to systematic item bias) for demographic sub-groups (age, gender and income; Brush & Soutar, 2022; Salzberger, 2009). Individual items fit the theoretical model to a satisfactory extent and item residuals do not following a strong pattern (Salzberger, 2009; Eigenvalue of residual components: 2.0; 1.5; 1.4; 1.3) suggesting sufficient unidimensionality relative to the concept being measured (Andrich, 1988). Finally, people's response pattern follows the model's prediction (Mui Lim et al., 2009) with no Person Residual outside ± 2.5. These results support the psychometric quality of the HSCB-PD scale.

Table 3 shows the items included in the final HSCB-PD in the order of their location with the easiest (and most often undertaken) behaviours at the bottom and behaviours that are most difficult to undertake at the top (for completeness, deleted items are listed at the bottom of Table 3). Fit Residuals and Chi-square probabilities for each item emphasise the psychometric quality of HSCB-PD. Looking at the sequence of items, the HSCB-PD makes sense; easier behaviours relate to avoiding waste, extending the use of items, or generally buying less. The middle of HSCB-PD in New Zealand includes a range of behaviours relating to the social pillar of sustainability, for example shopping locally and supporting the local economy. The highest and most difficult part of the hierarchy is taken up by sustainable purchasing behaviours (buying Fairtrade or organic) – behaviours that also require financial commitment.

In a Rasch analysis, respondents and items are projected onto the same dimension. Figure 1 shows results for 1005 New Zealand consumers with respondents (left) and items (right). The items are targeted well and spread along the HSCB-PD continuum and respondents follow a normal distribution. Rasch analysis entails that although the input data was binary, final item locations are provided in logits and the distance between items can be meaningfully interpreted. Behaviours close together indicate opportunities for spill-over behaviours (Maki et al., 2019; Thøgersen, 1999); they are frequently undertaken together or indicate the next logical behaviour to undertake.

Following the construction of the HSCB-PD, and confirmation that behaviours are taken up cumulatively and consistently, changes in behaviour since the start of the pandemic have been explored (Proposition 2). Figure 2 uses the item locations from Figure 1 to show the (lack of) change in behaviour for each sustainable behaviour: the percentage of people who have decreased behaviour is shown on the left (blue), followed

Table 3. Item location and fit of HSCB-PD (# identifier refers to the sequence in the dataset – see Figure 1).

#	Item Label	Location	Fit Residual	Chi-square Prob.
15	I always buy organic	2.12	−0.12	0.66
10	I always buy Fairtrade	1.96	−1.97	0.26
19	I always buy from bulk bins	1.71	0.59	0.09
13	I shop at farmers markets	0.74	1.51	0.18
27	I avoid food not grown in New Zealand	0.71	0.97	0.38
26	I avoid using the car	0.69	1.90	0.18
11	I think about the working conditions of factory workers	0.67	−1.33	0.05
5	I consciously buy from businesses that source ethically	0.30	−2.37	0.02
3	I consciously buy from businesses that align with my personal values	0.08	−2.19	0.04
18	I encourage others to support local businesses and cafes	0.03	0.06	0.55
2	I shop at small local stores	−0.02	1.28	0.29
16	I avoid plastic packaging	−0.06	−1.67	0.14
12	I select New Zealand made items to support the local economy	−0.49	−1.19	0.34
24	I pay attention to product labels before buying	−0.62	−0.96	0.32
8	I only buy what I need to reduce my impact on the environment	−0.67	−1.31	0.39
23	I think about what things are made of	−0.69	−2.50	0.01
6	I make do with items I have rather than buying new products	−1.11	1.54	0.06
7	I look for product information before buying	−1.21	0.46	0.16
17	I avoid food waste	−1.89	0.14	0.76
9	I choose items that I will use for a long time	−2.23	−0.95	0.41
Deleted items that did not fit the Rasch Model to a satisfactory extent:				
- *I support local cafes and restaurants,*				
- *I consume sustainably,*				
- *I consciously buy from businesses that care about the environment,*				
- *I grow my own vegetables,*				
- *I think about where things come from,*				
- *I think about how things are made*				
- *I buy second-hand.*				

by people who report no change in that particular sustainable behaviour, and on the right (orange) people who report an increase in that behaviour. The change index (% increased minus decreased behaviour) is on the right.

For all sustainable behaviours in the HSCB-PD, an overwhelming majority of people have not changed their behaviour ('no change' for 66–91% of respondents). Behaviours that are easiest to undertake are more likely to have changed, particularly for the change index (increase – decrease).

Percentage of the respondents who report a decrease (left, shaded blue), no change (middle, see through) or increase (right, shaded orange); number on the right shows the Change Index (CI): (% increase minus % decrease).

As a next step, Proposition 3 was investigated by grouping respondents according to their position on the HSCB-PD, taking advantage of the theoretical similarity between Rogers (1995) distribution of adoption and the Rasch Model (Ganglmair-Wooliscroft & Wooliscroft, 2016, 2022a; Rogers, 1995). This theory driven segmentation corresponds also to natural breaks in respondents' distribution along the HSCB-PD (see Figure 3).

To explore Proposition 4, changes in SCB for every item in the HSCB-PD were analysed. Table 4 shows the percentage of respondents within each HSCB-PD adoption group whose behaviour has decreased ('-'), stayed the same ('=') or increased '+' and a *Change Index (CI; increase minus decrease behaviour within group)*. Negative CIs are shaded blue (darker shade indicates stronger decrease) and positive CIs are shaded orange (darker

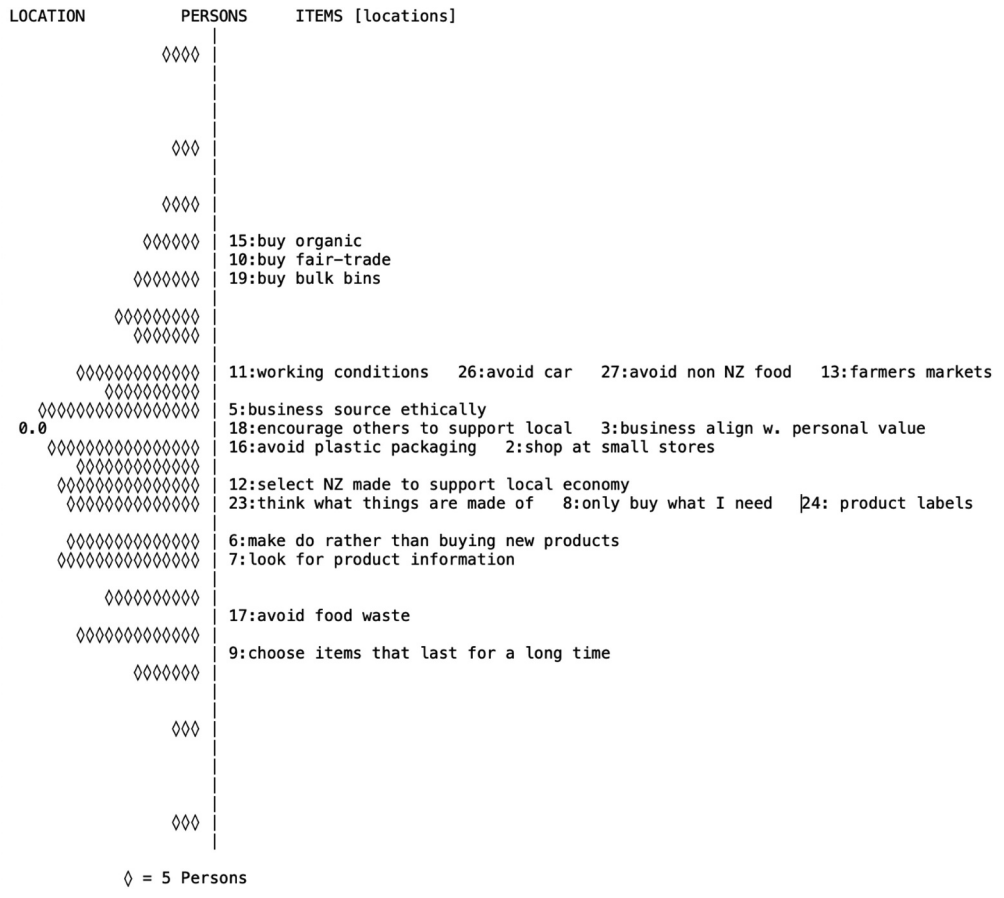


Figure 1. Item-Person Location: distribution on the HSCB-PD. (see # number in Table 3 for full wording of item).

shade indicates stronger increase). Increases in SCB are essentially confined to two high HSCB-PD segments (Innovators and Early Adopters; Early Majority) with SCB-PD Innovators & Early Adopters' showing a highly positive (>20%) CI except for the three most difficult behaviours. SCB-PD Laggards, the group with the lowest sustainable consumption also reports very little change; the mean for 'no change' over all 20 behaviours is 90% and only one behaviour's CI is medium-positive (10–19%), 'I make do with items I have rather than buying new'. People who did not consume sustainably before the pandemic still don't undertake more sustainable behaviours. Interestingly, even for the two high HSCB-PD segments who report many changes, CI increases are highest for the easiest sustainable behaviours, relating to frugality and savings.

The final analysis steps investigate the HSCB-PD groups' demographic and psychographic characteristics – Proposition 5 (a-d). Table 5 summarises the influence of potential drivers and motives and provides a holistic overview of demographic and psychographic HSCB-PD Group characteristics. Psychographic characteristics are organised in decreasing order of abstraction (from personal values to general environmental attitudes and specific environmental attitudes.)

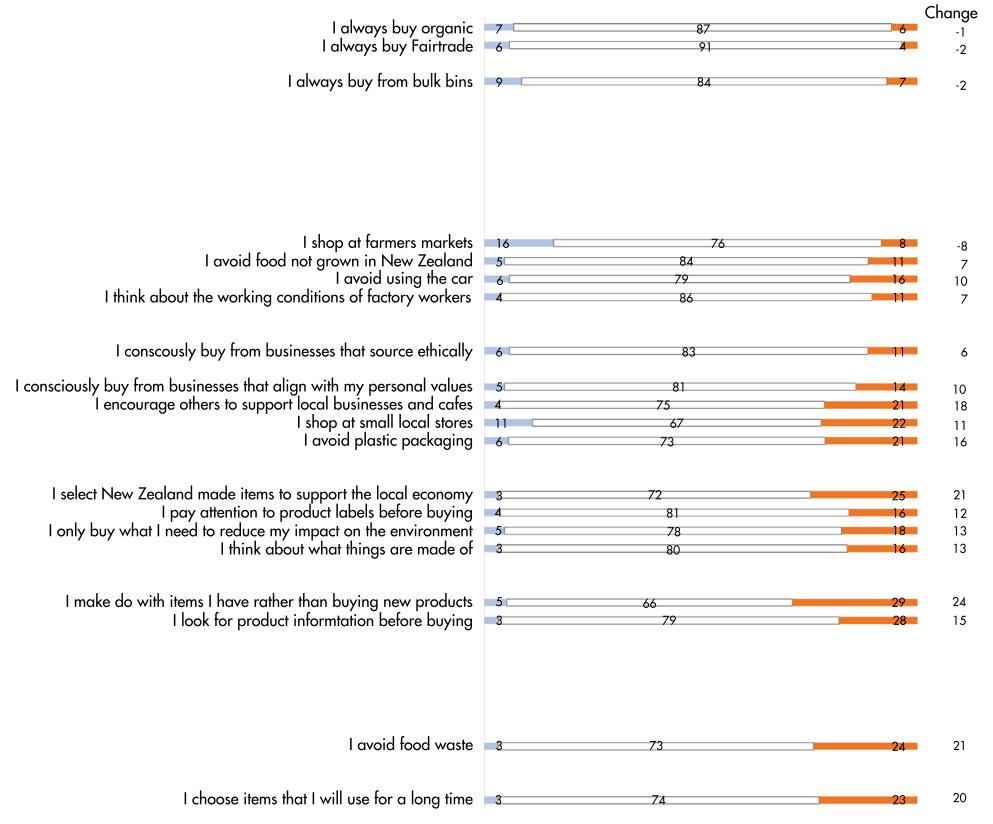


Figure 2. Change of HSCB-PD.

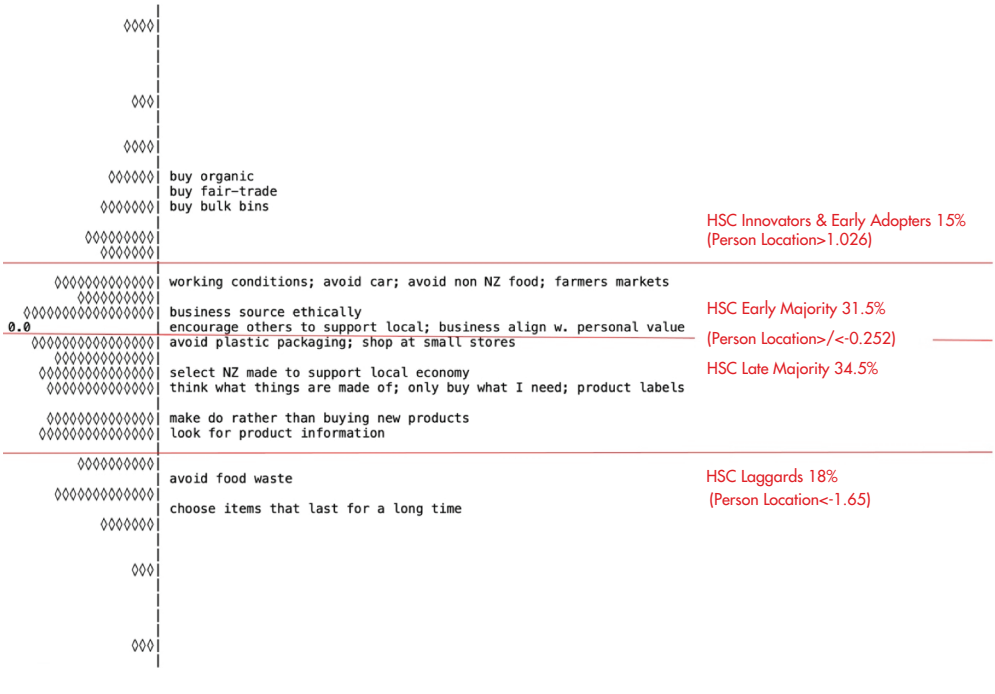


Figure 3. Four consumer adoption groups along the HSCB-PD items.

Table 4. Change in HSCB-PD behaviours for Adoption Groups.

	SCB-PD Laggards				SCB-PD Late Majority				SCB-PD Early Majority				SCB-PD Innovators & Early Adopters			
	"-"	"="	"+"	*CI*	"-"	"="	"+"	*CI*	"-"	"="	"+"	*CI*	"-"	"="	"+"	*CI*
I always buy organic	3	95	2	*-1*	8	88	4	*-3*	8	87	5	*-3*	7	77	16	*8*
I always buy Fairtrade	3	96	1	*-2*	6	93	1	*-5*	7	89	4	*-4*	7	81	12	*5*
I always buy from bulk bins	7	91	2	*-5*	7	88	5	*-2*	11	83	6	*-5*	9	73	18	*9*
I shop at farmers markets	7	91	2	*-5*	17	78	5	*-13*	22	69	9	*-13*	13	64	23	*10*
I avoid food not grown in New Zealand	6	92	2	*-4*	4	89	7	*3*	6	81	13	*7*	3	67	30	*27*
I avoid using the car	5	88	7	*2*	6	80	14	*8*	7	76	17	*10*	6	66	28	*22*
I think about the working conditions of factory workers	3	93	4	*1*	3	90	7	*4*	4	84	12	*8*	3	74	23	*19*
I consciously buy from businesses that source ethically	5	93	2	*-3*	6	89	5	*-1*	7	78	15	*8*	5	66	29	*25*
I consciously buy from businesses that align with my personal values	4	92	4	*0*	4	89	7	*3*	5	76	19	*14*	5	63	32	*27*
I encourage others to support local businesses and cafes	5	91	4	*-1*	3	78	19	*17*	4	73	23	*19*	5	52	43	*38*
I shop at small stores	11	81	8	*-2*	12	70	18	*6*	11	63	26	*15*	10	49	41	*30*
I avoid plastic packaging	7	87	6	*-1*	5	79	16	*11*	7	64	29	*21*	3	60	37	*34*
I select New Zealand made items to support the local economy	3	91	6	*3*	3	78	19	*15*	3	64	33	*29*	3	53	44	*41*
I pay attention to product labels before buying	3	95	2	*-1*	4	84	12	*8*	4	73	23	*19*	4	69	27	*23*
I only buy what I need to reduce my impact on the environment	6	90	4	*-1*	5	84	11	*7*	4	72	24	*19*	5	60	35	*30*
I think about what things are made of	3	93	4	*1*	4	85	11	*8*	3	74	23	*20*	4	68	28	*24*
I make do with items I have rather than buying new products	5	78	17	*12*	6	70	24	*19*	5	61	34	*29*	5	52	43	*38*
I look for product information before buying	4	90	6	*1*	3	82	15	*13*	3	76	21	*18*	4	62	34	*30*
I avoid food waste	3	88	9	*6*	3	75	22	*19*	4	68	28	*24*	3	58	39	*36*
I choose items that I will use for a long time	3	89	8	*5*	3	81	16	*13*	2	68	30	*28*	5	54	41	*36*
Average		*90*		*0*		*83*		*7*		*74*		*13*		*63*		*26*

% in segment whose behaviour has: '-'decreased; '=' stayed the same; '+' increased. *CI (Change Index)* = (% increase minus % decrease): blue = negative *CI* (light < 10%; blue ≥ 10%); orange = positive *CI* (yellow <10%; orange 10-19%; red ≥ 20%)

None of the demographic variables is significantly related to a HSCB-PD consumer group, while psychographic variables do show significant and important differences between segments. The pattern of results for links between psychological influences and HSCB-PD group membership is consistent from the importance of universalism and overall environmental attitudes down to more specific sustainable attitudes (knowledge & agency) and to willingness to pay more.

Discussion and implications

This research enables a holistic picture of sustainable consumption following a major disruption and makes a number of important contributions that clarify and extend understanding of SCB as a system.

Our study contributes to the sparse literature that considers SCB as a holistic and complex systemic construct (Bangsa & Schlegelmilch, 2020; Elkington, 2018; Ganglmair-Wooliscroft & Wooliscroft, 2022a). Research in SCB mostly has a singular focus (i.e. one consumer segment or a specific product or behaviour) and generally utilises self-selected sustainable consumers. Our work adopts a much called for holistic method for understanding average consumers' SCB. It provides empirical evidence of taking a systemic approach to tackle global issues related to sustainable consumption (Wooliscroft, 2021). Building from this deeper understanding across-the-board the study investigated a number of propositions.

First, we used a broad sample of consumers to develop a hierarchy of HSCB-PD identifying easy and more difficult to adopt SCBs. **Our findings support Proposition 1**:

Table 5. Summary of HSCB-PD group characteristics: potential drivers and motives for SCB.

Demographic Characteristics				
Avg Household income	NZ$ 80.000,00 – 90.000,00			
Avg Household income/person	NZ$ 30.000,00 – 40.000,00			
Average Age	47.5 years			
Gender	48% Male / 52% Female			
Employment	Self-employed 10%; Full-time employed 44%; Part-time employed 13%; retired 17%; homemaker 5%; Student 6%, unemployed 5%			
Highest education	No qualification 4 %; Secondary School qualification 25%; Certificate or Diploma, 23%; Bachelor's degree 30%; Postgraduate Degree 18%			
# of people in HH	2.7			
	Laggards	Late Majority	Early Majority	Early Adopters / Innovators
Self-Transcendence Personal Values				
Benevolence	5.0	5.4	5.8 / 6.0	
Universalism	4.3	4.9	5.3 / 5.7	
General Environmental Attitude / Environmental Worldview				
NEP scale	3.3		3.6 / 3.7 3.7	
Sustainability Influencing Factors				
Sustainable Knowledge	2.2	2.5	3.0	3.6
Sustainable Agency	2.6	3.3	3.7	4.0
Willing to pay more	1.9	2.4	3.0	3.7

All shaded results sign < 0.01 (One-way Anova and Bonferroni post-hoc or Chi-square test)Rows/cells with white background = no significant difference between HSCB-PD groups

Individual Sustainable Consumption Behaviours are adopted consistently as part of a system of sustainable behaviour.

The HSCB-PD results show that the most difficult and easy SCBs pertain to financial behaviours; the most difficult relates to items perceived as expensive e.g. buying organic and Fairtrade, and the easiest concerning frugality e.g. extending the use of products or buying less. The middle of HSCB-PD includes social sustainability behaviours, e.g. shopping locally to support the local economy. The close proximity of multiple behaviours on the HSCB-PD supports that sustainable behaviours are not undertaken in isolation and behaviours are frequently undertaken in combination, emphasising the need to explore sustainable behaviours as a consumption system.

Our findings show that following a major disruption, the majority of New Zealand consumers undertake few sustainable behaviours consistent with previous research (Ganglmair-Wooliscroft & Wooliscroft, 2016; Wooliscroft et al., 2014). It is suggested that 'un-sustainable' behaviours undertaken by a majority of the population are reinforced by feedback loops that emphasise what is socially expected or 'normal' behaviour (Wooliscroft, 2019).

Second, we offer insights on post-disruption behaviour change. While researchers have suggested that the pandemic disruption created increased awareness of sustainability issues relating to the environment and consumption (Palakshappa et al., 2022; Severo et al., 2021), our study shows that very few people report an enduring change in SCBs post-disruption. **This research finds only limited support for Proposition 2**: *For the general population, disruptions in environmental cues (and any potential short-term behaviour change) did not result in enduring adoption of new sustainable behaviour that lasts past the disruption.*

Notably, with the exception of some 'saving' behaviours, many in the population (Laggards and Late Adopters; 50% of the population) undertake hardly any SCBs – pre- and post-disruption. Increased awareness and reflection on sustainable issues during the pandemic (Palakshappa et al., 2022; Severo et al., 2021) did not translate into enduring sustainable behaviours. With the end of COVID-19 restrictions, environmental cues returned to pre-disruption (e.g. restored product availability, revived work/social engagements). Consistent with previous research about the difficulty of changing strong habits (Verplanken & Roy, 2015) the majority of consumers report the same sustainable behaviours pre-/post-disruption – they returned to their normal habits and routines.

Proposition 3 is supported by this research: Sustainable Consumers can be segmented effectively based on their propensity to adopt sustainable behaviours.

Figure 3 highlights the usefulness of Rogers (1995) adoption criteria as a base for segmenting sustainable consumers along the HSCB-PD. The Rasch Model reveals the structure of the behavioural variable, providing information about the relatively static behavioural summary variable, while suggesting information about its level of (future) diffusion (Ganglmair-Wooliscroft & Wooliscroft, 2016). The limited change in reported sustainable behaviours suggests that 'sustainable behaviour' as a new idea or innovation (Lockett & Littler, 1997) is still at an early stage of diffusion and the speed of reported adoption in the population is slow – on the S-shaped adoption curve more than half of the population are still on the reasonably flat part of the curve (Rogers, 1995).

Building on Proposition 3, our findings further highlighted differences between sustainable adoption segments. The more common research focus examining one segment or product would preclude this insight from surfacing. **We find support for Proposition**

4: *Sustainable Consumer Segments report different levels enduring behaviour change in response to disruption.*

HSCB-PD Laggards and Late Majority report hardly any behavioural changes – and any change is based on 'saving money'– while consumer groups who are high on the HSCB-PD (Early Adopters/Innovators) report substantial increases in many sustainable behaviours. This indicates two salient points – those already engaged in sustainable behaviour pre-disruption are those that have made the most change, and those that didn't do anything before still don't do anything. Highlighting the absence of wide-reaching and enduring change in many groups is a major contribution to our knowledge of SCB and disruption. These findings are consistent with previous studies that found that self-described 'sustainable consumers' invested more time in sustainable behaviours because of the pandemic (Palakshappa et al., 2022), but they also support that very few in the general population establish positive long-term changes (Bucher et al., 2022).

Summarising the holistic view of this research, our study explored differences in demographic and psychological characteristics between the HSCB-PD segments.

We find support for Proposition 5 (a–d): *consumers in HSCB-PD segments differ with reference to their psychological characteristics, but not their demographic characteristics*.

Proposition 5a: Demographic variables are generally weak predictors of sustainable behaviour. For ***Proposition 5a***, we find no significant differences between HSCB-PD segments in terms of age, gender, household income or employment. While these results are contrary to some research that reports demographics as an influencing factor in SCB (Bulut et al., 2017; Gilg et al., 2005), they support growing evidence that demographic variables are not sufficient to understand sustainable behaviour (Finney, 2014; Thøgersen & Schrader, 2012)

As proposed, psychological variables – personal values (***Proposition 5b***) and environmental knowledge, including attitudes and sustainability agency ***(Proposition 5c)*** - have a significant influence on HSCB-PD segments.

Self-transcendence personal values (benevolence and universalism) are significantly more prominent among Innovators and Early Adopters, providing further evidence that personal values are a major driver of sustainable behaviour. Our findings support previous work using Schwartz (1992, 2012) universal value system (De Groot & Steg, 2008; Steg et al., 2014), and found consumers with strong universalism and benevolence were more likely to behave sustainably (Biel & Thøgersen, 2007; Thøgersen & Ölander, 2006; Thomas & Sharp, 2013).

While general environmental attitudes measured via the NEP (Dunlap et al., 2000) are relatively strong for all the HSCB-PD groups, they are still significantly lower for Laggards. Furthermore, sustainability influencing factors – sustainability knowledge, agency (perceived effectiveness) – is significantly different between all the groups, with Innovators reporting the highest and Laggards lowest in all three areas. Essentially, higher levels of knowledge and agency around sustainability are correlated with increasingly more SCBs. This finding builds on the work of Wei et al. (2018) who found that psychological factors such as knowledge and effectiveness are critical to green behaviour. We extend this by considering broader sustainability behaviours and specific HSCB-PD segment groups.

Finally, we find that willingness to pay more also has a significant impact on HSCB-PD segment membership ***(Proposition 5d),*** although both high HSCB-PD segments (Innovators and Early Adopters) are sensitive to items associated with cost (e.g. buying organic products). Price can be a barrier to purchasing sustainable 'green' products (Wei et al., 2018).

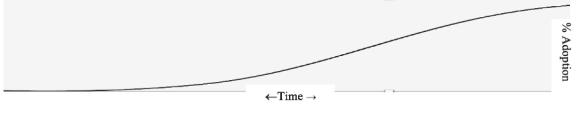
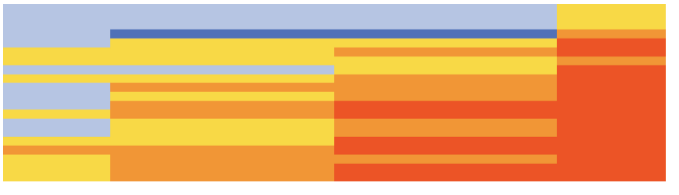
Table 6 summarises and visualises the main contribution of this research, specifically, the importance of investigating complex consumer behaviours such as SCB post-disruption in a holistic way by exploring different facets of the phenomena. The first column shows that we draw on multiple theoretical bases to develop a number of propositions, including – (P1) systemic views of sustainable consumption, (P2) heuristics and the importance of environmental cues, (P3) Roger's adoption segments and (P4) the heterogeneity of the population, (P5a) demographics, (P5b) personal values, (P5c) environmental attitudes – knowledge and agency as well as (P5d) willingness to pay. Therefore by examining multiple behaviours and theoretical bases our paper complements and extends studies that focus on an in-depth investigation of a specific behaviour, or one theoretical base.

The right-hand side of Table 6 highlights the systematic view gained by trading-off and complementing in-depth explorations to gain a better understanding of the complexity of sustainable consumption post-disruption. What is evident is that individual sustainable consumption behaviours are part of a system of consumption and changes and increases are related to various personal characteristics. Different segments of consumers have varied reactions to shifts in environmental cues and perceive barriers (and benefits) to sustainable behaviour differently – and psychological characteristics (e.g. personal values) as well as perceived knowledge influence their behaviour in a consistent way.

HSCB-PD Laggards and the Late Majority (approximately half of the population) report very little (no) change in their sustainable behaviours, while for the HSCB-PD Early Majority and particularly Early Adopters and Innovators, their already high engagement with sustainable behaviours increased further. These findings can be related to research on habits and the difficulty of changing established habits when environmental cues return to 'normal'– as explored in Proposition 2. In addition, it also follows from Roger's discussion about the speed of adoption (and resulting steepness of the adoption curve) being influenced by perceived relative advantages or barriers (costs) of undertaking sustainable consumption (Propositions 3 and 4). The lack of a major shift in sustainable consumption post-disruption might be explained using both these theoretical bases, but they also emphasise the need to explore consumption from a systemic point of view (Proposition 1).

Several psychological characteristics (Propositions 5b-d), from high-level personal values to knowledge, perceived environmental agency, environmental attitudes or specific constructs like willingness to pay are consistently, significantly and positively linked to HSCB-PD adoption segments. These findings suggest that any interventions targeted at increasing sustainable consumption need to be targeted towards specific HSCB-PD segments. For example, HSCB-PD Laggards or Late Majority who have not changed their (lack of) sustainable behaviours in spite of the changing environmental cues, might benefit from different types of interventions like nudging to overcome existing habits or information campaigns that strengthen these segments knowledge and perceived agency.

Table 6. Summary and visualisation of the main research contribution.

Theoretical Base and investigated Proposition	SCB-PD Groups: HSCB-PD Laggards (16 %)	HSCB-PD Late majority (34%)	HSCB-PD Early majority (34%)	HSCB-PD Innovators & Early adopters (16%)
Theoretical Base: **Systemic view of consumption & SCB** **P1**: Individual Sustainable Consumption Behaviours are adopted consistently as part of a system of sustainable behaviour.	*Choose items that will last a long time; Avoid food waste →*	*+ Look for product info; Make do rather than buying new; Pay attention to product labels; Buy only what is needed; Think about what things made of; Select NZ made to support NZ economy; Shop at small stores; Avoid plastic packaging →*	*+ Buy from businesses that align with personal values; Encourage others to support local; Buy consciously from businesses that source ethically; Shop at farmers markets; Avoid non-NZ grown food; Avoid using car; Think about factory working conditions →*	*+ Buy from bulk bins; Buy Fairtrade; Buy organic*
	Key findings: SCBs are not undertaken in isolation but taken up following a consistent and cumulative pattern. SCB-PD adoption groups undertake groups/bundles of SCB behaviours.			
Theoretical Base: **Habits, change and disruption & SCB** **P2**: Changes in environmental cues provided an opportunity for established (unsustainable) habits to be disrupted, and an enduring adoption of new sustainable consumption behaviours.	**Key findings**: With the return of pre-disruption structural/environmental cues, any temporal change in behaviour returned to 'normal'. Long established, strong habits associated with everyday un-sustainable shopping behaviour did not change post-disruption.			
Theoretical Base: **Adaptation of Rogers Diffusion of Innovation & SCB** **P3**: Sustainable Consumers are not one homogenous group and can be segmented effectively based on their 'sustainable-ness', their propensity to adopt sustainable behaviours.	 **Key Findings**: Visualising SCB-PD results on an S-shaped adoption curve:- a large part of the population is at an early stage of SCB; adoption the curve has a shallow angle indicating slow adoption			
Theoretical Base: **Consumer heterogeneity and SCB** **P4**: Sustainable Consumer Segments report different levels of behaviour change in response to disruption	 Heatmap of changes in 20 SCB-PD behaviours (based on Table 4) **Key Findings**: Any increases in SCB-PD are almost entirely constraint to 2 groups of (strongly) sustainable consumers; Consumers who undertook (very) few sustainable behaviours before the disruption either decreased or hardly changed their limited SCB-PD.			

(*Continued*)

Table 6. (Continued).

Theoretical Base and investigated Proposition	SCB-PD Groups: HSCB-PD Laggards (16 %)	HSCB-PD Late majority (34%)	HSCB-PD Early majority (34%)	HSCB-PD Innovators & Early adopters (16%)
Theoretical Base: **Demographic and SCB** **P5a**: Demographic variables are weak predictors of sustainable behaviour.	**Key Findings**: None of the investigated demographic characteristics significantly explains SCB-PD adoption group membership			
Theoretical Base: **Personal values & SCB** **P5b**: Personal values like self-transcendence are important drivers of sustainable behaviour.	(The darker the grey shading, the stronger the agreement/importance) **Key Findings:** Self-transcendence values (benevolence and universalism) are strongly and positively associated with SCB-PD group membership			
Theoretical Base: **Environmental knowledge & SCB** **P5c**: Environmental knowledge and perceived agency variables are important drivers of sustainable behaviour.	(The darker the grey shading, the stronger the agreement/importance) **Key Findings:** Environmental knowledge and perceived agency are strongly and positively associated with SCB-PD group membership			
Theoretical Base: **Willingness to pay & SCB** **P5d**: Willingness to pay more is a strong predictor of sustainable behaviour.	(The darker the grey shading, the stronger the agreement/importance) **Key Findings:** Willingness to pay more is strongly and positively associated with SCB-PD group membership			

Conclusion

This study took a holistic approach to investigate sustainable consumption systems and changes to sustainable behaviours following a major environmental disruption. A HSCB-PD hierarchy including 20 different sustainable behaviours was developed and four sustainable consumption segments (based on levels of SCB adoption) were identified. The HSCB-PD hierarchy and segments were examined in terms of nuanced changes to sustainable behaviours, multiple demographic characteristics and psychological influences, trading off details to provide a systemic picture from the consumer's perspective. The disruption accentuated the importance of relatively stable psychological characteristics for sustainable behaviours; results suggest that self-transcendent personal values (universalism and benevolence), combined with knowledge about and perceived agency related to sustainability are all predictors of the level of sustainable consumption. Demographic characteristics, including age and income, do not provide significant explanation. Notable increases in reported sustainable behaviour are only found for a select group of highly sustainable consumers (HSCB-PD Innovators and Early Adopters), who already behaved sustainably pre-disruption. Our findings reinforce that even a major disruptor like a pandemic, which created opportunities for people to reassess their life and habits (M. Kaiser et al., 2021), has not had the projected positive impacts on SCB.

A limitation of this study is that results are based on reported behaviour of consumers, rather than actual (observed behaviour). Relying on respondents recollecting their behaviour might lead to over-endorsement due to social desirability bias. However, a comparison of self-reported behaviours in our study and national statistics is encouraging; for example, buying organic food is the behaviour least often reported on HSCB-PD and has an actual market share of merely 2.5% in NZ (Organic Exporters Association of NZ, n.d..) while avoiding food waste is the second most undertaken behaviour in our study, and is undertaken by most New Zealanders (80–90% of depending on the type of activity) (Ministry for the Environment, 2023). However, future research should focus on actual behaviours. The items included in HSCB-PD and the results of the Rasch Model also need to be confirmed in future studies, including a detailed comparison with other existing scales measuring sustainable behaviours (F. G. Kaiser et al., 1999; Wooliscroft et al., 2014). While the presented HSCB-PD results fit the Rasch Model to a satisfactory extent and reflect sufficient unidimensionality (Salzberger, 2009), future research should further investigate the suitability of the Rasch Model, especially relating to the dimensionality of SCB.

The findings are important for practitioners and policy makers seeking to alleviate SCB barriers. In short, not a lot will happen without a whole system change – multilevel action is needed. Inherent in the system is the responsibility that governments and businesses shoulder in making change happen. Policy makers and marketers also have a role to play in solving the wicked problem of unsustainable consumption and production. Government and policy makers need to provide a (regulatory) framework and environment where sustainable behaviours are relatively easy to undertake in terms of time and financial effort. Government can implement policies that enhance people's agency regarding sustainable behaviours, e.g. implementing convenient curb side recycling, no-plastic policies, promoting buy local and food waste reduction campaigns. Government can also work with businesses, to encourage and implement greenwashing frameworks, clearer labelling regulations, transparent ethical supply chains and lower carbon emissions. Also, government needs to continue educating people to increase knowledge of sustainability issues. Marketers can also play a powerful role in raising awareness and knowledge about sustainability via media messaging which has the potential to create favourable perceptions about sustainable brands (Kautish & Khare, 2022) and forge transformational shifts towards sustainability (Lim, 2016; White et al., 2019). Identification of structural barriers and pathways to sustainable consumption need further research (Fuchs & Boll, 2018) if marketing practitioners are to improve their marketing efforts.

Sustainable consumption is a lifestyle choice – a reflection of a sustainable consumption system. For many New Zealand consumers, while sustainability might have been a topic of interest during the pandemic, other concerns and long-established habits have taken over since the immediate disruption subsided. Fundamentally, a major disruption does not have a big impact on overall SCBs.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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