Received: 16 November 2021 | Revised: 28 April 2022 | Accepted: 29 June 2022

DOI: 10.1002/cb.2090

RESEARCH ARTICLE

WILEY

A hierarchy of sustainable grocery shopping behaviours: Using Rasch modelling to explore adoption groups

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Abstract

Grocery shopping is a major contributor to unsustainable consumption in the developed world. This study constructs a hierarchy of sustainable grocery shopping (SGS), using a broad range of SGS consumption activities that contribute to an individual's aggregate grocery shopping. We confirm the suitability of Rasch modelling to construct the SGS hierarchy and, recognize the definitional equivalence between features of the Rasch model and Rogers' adoption groups. Our results are transformed into theoretically founded, empirically observed SGS adoption segments. SGS adoption groups are analysed with reference to multiple research streams. Our results show that the diffusion of SGS behaviours in a population is in its early stages and most SGS adoption segments undertake a limited number of SGS behaviours. Demographic characteristics do not contribute to explaining SGS membership, but personal values do. Personal values are also related to the observation of spill-over between items of similar behavioural difficulty, rather than within product categories. Only the most advanced SGS adoption groups consider sustainably sourced food as a decision criteria. We show the importance of investigating SGS with a systemic approach.

1 | INTRODUCTION

Our current way of life, and of consumption, in the Western world is not sustainable (Sheth et al., 2011). The problem with unsustainable consumption is not restricted to luxury items, but includes basic necessities like food (Thøgersen, 2010). Everyday behaviours that are repeated routinely, like grocery shopping, have a significant and cumulative societal and environmental impact (Moser, 2015; Verain et al., 2015); for example, groceries account for approximately one-third of an individual's environmental impact (Verplanken & Wood, 2006). Consumers' actions are also powerful signals for retailers and manufacturers (Buerke et al., 2017; Dietz et al., 2013; Tanner & Wölfing Kast, 2003) and changing demand induces shifts towards, for example more environmentally friendly agricultural practices (Tanner et al., 2004).

Consumers, supported by a rising prominence of discussions about the need for sustainability in mainstream media, and an increasing availability of sustainable/environmentally friendly food alternatives in mainstream supermarkets, are increasingly aware of sustainable consumption issues (Carrington et al., 2010; Henn et al., 2020; Newholm & Shaw, 2007).

Sustainable consumption is difficult to define and complex to investigate (Carrington et al., 2014; Jayawardhena et al., 2016). An abstract definition states that sustainable consumption needs to meet "the needs of the present while safeguarding Earth's life-support system, on which the welfare of current and future generations depends" (Griggs et al., 2013, p. 306). A more pragmatic approach asks ordinary consumers to name and categorize sustainable behaviours. This approach regularly leads to sustainable food and grocery shopping being established as one domain (Verplanken & Roy, 2015). Food is

also among the most frequently studied categories within sustainability research, often looking at individual food items or categories (Bangsa & Schlegelmilch, 2020).

Research into sustainable food and grocery shopping often focuses on a single sustainable behaviour or sustainable product categories like organically produced food (Aschemann-Witzel & Niebuhr Aagaard, 2014; Hanss & Böhm, 2013; Hughner et al., 2007; Thøgersen et al., 2012), fair trade (Andorfer & Liebe, 2012; Doran, 2009; Iweala et al., 2019) or local food shopping (Megicks et al., 2012). Another research stream takes a broader approach and studies shopping domains like ethical food shopping (Carrington et al., 2014) or ethical supermarket shopping (Jayawardhena et al., 2016; Memery et al., 2012; Williams et al., 2010).

The respondents in these studies are frequently highly involved, self-selected sustainable consumers, or, if a study looks at the entire population, all consumers are treated as if they were a homogenous group (Hughner et al., 2007; Verain et al., 2012). Most studies further base their investigation on one theory, or one aspect's influence on sustainable behaviour (e.g., demographic influences or spill-over theory).

This study takes a different approach and foregoes detailed, in-depth investigations for a more holistic, systemic view of sustainable grocery shopping (SGS). The study includes a broad range of SGS consumption activities that contribute to an individual's aggregate grocery shopping behaviour, segments consumers into adoption groups and investigates these groups' characteristics in view of different theories.

To research this, first, a hierarchy of SGS will be developed to investigate whether the pattern and sequence of undertaken SGS behaviours throughout a population is consistent. Rasch Analysis (Rasch, 1960)—an alternative measurement theory—is ideally suited to investigate a broad range behaviours (Kaiser et al., 2007). Acknowledging the heterogenous nature of sustainable consumers are subsequently segmented along the SGS hierarchy using Rogers' adoption groups (Rogers, 1995).

Multiple research streams/theories are applied to the SGS adoption groups' behaviour to explore and explain sustainable consumption behaviour, including the influence of demographics (Chekima et al., 2016; Finney, 2014; Tanner & Wölfing Kast, 2003; Verain et al., 2012; Wooliscroft et al., 2014), personal values (Biel & Thøgersen, 2007; Thøgersen & Ölander, 2006; Thomas & Sharp, 2013; Verplanken & Orbell, 2019), evidence of spill-over behaviours (Lanzini & Thøgersen, 2014; Maki et al., 2019; Thøgersen, 1999) and heuristics (Jayawardhena et al., 2016; Ölander & Thøgersen, 2014; Vega-Zamora et al., 2014).

The results of this study will extend our understanding of SGS by revealing a more systemic/holistic picture of the phenomenon, including the investigation of a broad range of behaviours and their behavioural probability for different adoption segments. Moving away from research that regards sustainable consumers as one homogenous groups, this study constructs theoretically founded, empirically observed SGS adoption groups and explores the influence of and relationship between key variables and theories. The result will increase our understanding of SGS adoption groups and provide important information for public policy makers and business mangers when designing interventions or campaigns aimed at increasing sustainable consumption behaviours for groups of the population.

2 | BACKGROUND: DEVELOPING SGS ADOPTION SEGMENTS AND THE ROLE OF KEY THEORIES IN EXPLORING THEIR CHARACTERISTICS

The following section discusses the hierarchical and cumulative structure of SGS and introduces Rasch modelling (Rasch 1060/80) as an alternative measurement theory that is particularly suitable for the context we investigate. It explains how the Rasch Model is used to construct the SGS hierarchy and to segment consumers along that hierarchy. This discussion results in Propositions 1a and 1b. The following sections introduce key models and theories that are frequently used to explore sustainable consumption, including the influence of demographics (Proposition 2), personal values (Propositions 3a and 3b), investigations of spill-over theory (Proposition 4) and the use of heuristics in sustainable consumption decisions (Proposition 5). All propositions are tested using the hierarchy of SGS behaviours, rather than related to a single sustainable behaviour, providing a systemic view of SGS and its major influences.

2.1 | Constructing an SGS hierarchy and SGS adoption segments

Many consumption domains are comprised of behaviours that differ in their difficulty; in the financial-, time-, or energy-related effort required to undertake that behaviour. Hierarchical consumption domains reflect a cumulative uptake of these behaviours. Easier - less costly, less time consuming, or relatively convenient - behaviours are taken up first, and only when these behaviours are undertaken, relatively more difficult behaviours are undertaken. A cumulative uptake of behaviours that follows a consistent pattern, has been observed in a range of domains, including the purchasing and ownership for durable goods and financial assets (Soutar & Cornish-Ward, 1997), for general environmental behaviour (Kaiser, 1999; Kaiser & Byrka, 2011; Kaiser & Lange, 2021), sustainable/ethical everyday consumption behaviour (Wooliscroft et al., 2014) or ethical/sustainable travel behaviour (Ganglmair-Wooliscroft & Wooliscroft, 2016, 2017, 2019).

This study investigates whether behaviours within the domain of SGS is also taken up cumulatively and consistently. For example, if consumers who follow a vegan diet they will also choose readily available fair trade chocolate and bring their own shopping bags to the supermarket, for this example, a vegan diet is assumed to be the most "difficult" to perform behaviour, followed by buying fair-trade chocolate and finally bringing your own bags, here assumed to be the easiest behaviour. In addition, the pattern in which the behaviours are taken up (the order of uptake) has to be consistent within a group.

The Rasch model (Rasch, 1960) is an efficient and effective tool for these types of investigation, assessing whether SGS behaviours

are taken up in a cumulative and consistent pattern. The model provides an alternative method to classical test theory (Salzberger, 2009). The model belongs to the family of logit models and its formula states that a positive response probability depends on an item's difficulty/endorsability and a person's characteristic on the investigated concept (Bond & Fox, 2007). In a Rasch Model, the difficulty of a behaviour is therefore not rated by the consumers but derived from "the linear equivalent of the endorsement probability of a behaviour in a given sample" (Tanner et al., 2004; p.98). The given Equation (1) is Rasch model formula.

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

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.

Described as probabilistic Guttman Scaling (Wright, 1997), it is not based on correlations, and is ideally suited to investigate behaviours that differ widely in their intensity (Kaiser et al., 2007). (Please see the Methodology section for a detailed discussion of the Rasch model application).

When constructing a measure/hierarchy, the Rasch Analysis investigates whether the empirical data fits the theoretical model (Salzberger, 2009); whether the behaviour is indeed taken up cumulatively and consistently within a population (Wooliscroft et al., 2014). That the empirical data fits the Rasch Model criteria is a requirement for the subsequent goals of the current study, which leads to Proposition 1a:

> **Proposition 1a.** The uptake of sustainable grocery shopping behaviours is cumulative and consistent within a sample of ordinary consumers – and the data fits the assumptions of the Rasch model.

Sustainable (grocery) shopping consumers are not one homogenous group but differ in their level of engagement, the level of effort consumers are willing to employ or the "difficulty" they are willing to overcome to adopt a behaviour. Rogers (1995) developed his classic framework for adoption groups, splitting consumers into innovators (2.5% of the population), early adopters, (13.5%), early and late majority (34% each), and Laggards (17%).

Results of a Rasch analysis using behavioural data provide a base for calculating these adoption groups (Ganglmair-Wooliscroft & Wooliscroft, 2016). In a Rasch analysis, respondents and individual behaviours are projected onto one dimension. The position of behaviours/items on the SGS dimension reflects the perceived behavioural cost of undertaking that behaviour (Henn et al., 2020; Kaiser & Lange, 2021). The position of an individual on the SGS dimension reflects the effort a person is willing to employ and the size of barriers they are prepared to overcome to behave sustainably (Ganglmair-Wooliscroft & Wooliscroft, 2016; Henn et al., 2020).

The item characteristic curve (ICC) or response expectation curve (Bond & Fox, 2007) in a Rasch Model shows the theoretical curve for an item's difficulty on the horizontal axis, and the probability of agreeing to (undertaking) an item on the vertical axis. As seen in Figure 1, the shape of a Rasch model's logistic ICC curve and the cumulative adoption function in Diffusion of Innovation (Rogers, 1995) are by definition identical.

The Rasch Model reveals the structure of the behavioural variable and suggests information about the level of adoption of the behaviour in the sample population (Ganglmair-Wooliscroft & Wooliscroft, 2016). Based on the equivalence of Rogers' cumulative adoption function and Rasch Model's Item Response Curves (Ganglmair-Wooliscroft & Wooliscroft, 2016) and the range of SGS behaviours undertaken, as well as the position of respondents on the SGS dimension, results of the Rasch Model can be transformed into five classic adoption groups (Rogers, 1995). These SGS adoption segments reveal the likelihood of adopting and undertaking sustainable behaviours at a particular stage (Noppers et al., 2015). Proposition 1b reflects the heterogenous nature of SGS consumers and explores the suitability of Rasch Analysis results to be transformed into SGS adoption groups.

> **Proposition 1b.** Recognizing the definitional equivalence between Rasch's ICC curves and Rogers' S-shaped cumulative adoption function, SGS consumers can be segmented into five empirically supported SGS adoption segments.

2.2 | The influence of demographic characteristics on sustainable consumption

Demographic characteristics are regularly included in studies exploring sustainable consumption, although their influence is generally limited, and – if significant relationships are found – findings are non-conclusive. There is some evidence that females report higher levels of environmentally friendly behaviour (Chekima et al., 2016; Diamantopoulos et al., 2003; von Meyer-Höfer et al., 2015), with education also found as significant predictor in some studies (Chekima et al., 2016).

The price of sustainable/environmentally friendly alternatives, particularly for food, is reported as a perceived barrier to act (Aschemann-Witzel & Niebuhr Aagaard, 2014), but income has repeatedly been found as non-significant predictor of the level of sustainable consumption (Tanner et al., 2004; Tanner & Wölfing Kast, 2003; Wooliscroft et al., 2014). An exploration of green/sustainable consumers relying on demographic variables is not sufficient (Finney, 2014; Verain et al., 2012).

> **Proposition 2.** Demographic variables, including income, are not significant when predicting SGS adoption group membership.

2.3 | The influence of personal values on sustainable consumption

In response to the generally limited and/or inconsistent explanation of demographics, a prominent research stream in sustainable

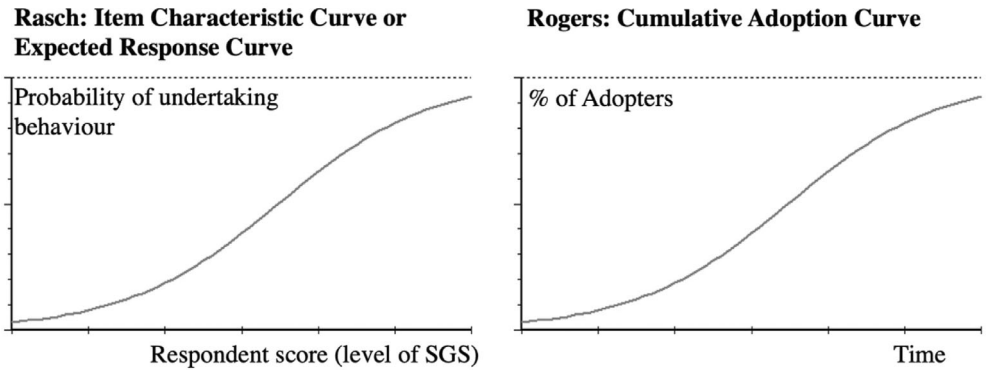

FIGURE 1 Identical nature of Rasch's ICC and Rogers' cumulative adoption curve.

consumption explores personal values and resulting attitudes and motivation driving behaviour (Verplanken & Orbell, 2019). Values are defined as "desirable transsituational goals varying in importance, which serves as a guiding principle of the life of a person" (Schwartz, 2006 p.1). A person's values system provides the background for the formation of consumer attitudes (Tarkiainen & Sundqvist, 2009) and motivation that subsequently influence behaviour (Ganglmair-Wooliscroft & Wooliscroft, 2016; Kaiser & Byrka, 2011; Thøgersen & Ölander, 2006; Valor & Martínez-de-Ibarreta, 2021).

Schwartz's (1992) universal value system provides the foundation for most studies relating to environmentally friendly/sustainable behaviour (De Groot & Steg, 2008; Steg et al., 2014). The classification of over 50 values can be projected onto a two-dimensional space. The first dimension distinguishes between openness to change and conservativism – values that stress independence and self-direction versus values related to tradition. The second dimension differentiates between self-transcendence values and self-interest values – values like universalism and benevolence versus power and achievement (Schwartz, 1992). Environmental/sustainable behaviours are especially related to the self-transcendence versus self-interest (also referred to as self-enhancement) dimension and studies may best focus on self-transcendence versus self-enhancement values (De Groot & Steg, 2008, p.333).

Self-transcendence values, particularly universalism and benevolence, correlate positively with sustainable consumption behaviour (Biel & Thøgersen, 2007; Ganglmair-Wooliscroft & Wooliscroft, 2019; Thøgersen & Ölander, 2006; Thomas & Sharp, 2013). Universalism is defined as an "appreciation, tolerance, and protection for the welfare of all other people and of nature" (Schwartz, 2012, p.7). Self-interest values, including power achievement, and hedonism (categorized between self-enhancement and openness to change), on the other hand, are frequently negatively associated with sustainable behaviour (Steg et al., 2014) as sustainable behaviours might be perceived as inconvenient rather than "fun" (Barr et al., 2011; Budeanu, 2007).

> **Proposition 3a.** Self-transcendence values (universalism and benevolence) are positively associated with higher SGS adoption group membership.

> **Proposition 3b.** Self-interest values (power, achievement and hedonism) are negatively associated with higher SGS adoption groups.

2.4 | The extent of spill-over behaviour in sustainable consumption

Spill-over theory suggests that "a change in attitude and/or behaviour concerning a specific activity … may "spill over" into related areas" (Thøgersen, 1999, p.56). The theory explores if and when a behaviour (or behaviour change) results in a subsequent change of a related behaviour that focuses on the same personal goal (Henn et al., 2020). Spill-over is often researched in the context of values as the influence of values transcends specific situation (De Groot & Steg, 2008).

Maki et al. (2019) meta-analysis revealed that spill-over effects relating to sustainable consumption are generally small, with stronger effects found for intentions to undertake a related sustainable behaviour, compared to actual behaviour. Spill-over effects in sustainable behaviours occurs in related behaviours that are similarly difficult to undertake (Ganglmair-Wooliscroft & Wooliscroft, 2017; Henn et al., 2020; Lanzini & Thøgersen, 2014; Thøgersen & Ölander, 2003). Even small spill-over effects or increased intentions have a strong signalling effect, and foster support for policy changes and other related sustainability interventions (Hanss & Böhm, 2013; Maki et al., 2019).

> **Proposition 4.** Spill-over occurs between SGS behaviours that are similarly difficult to undertake.

2.5 | Heuristics and sustainable consumption

Another increasingly prominent research stream investigates sustainable shopping as behaviour that is low involvement or even directed by automatic and unconscious processes (Ölander & Thøgersen, 2014). Roughly 40% of decisions are repeated (Wood & Neal, 2009) and daily actions often follow a pattern (Wood & Neal, 2007). Grocery shopping and shopping for food is traditionally characterised as low involvement and includes only limited decision making (Jayawardhena et al., 2016; Tarkiainen & Sundqvist, 2009). It

frequently relies on heuristics. When consumers rely on heuristics, the way choices are presented can strongly influence the decision – the context and presented cues become decisive (Ölander & Thøgersen, 2014). Nudging, an umbrella term covering a range of techniques to change behaviour (Sunstein, 2014) applies heuristics like framing and priming (Ölander & Thøgersen, 2014), or communicates expectations about normal behaviour (Huitink et al., 2020).

When consumers use heuristics, they only consider a small number of product attributes and attributes like organic, fair trade, socially responsible, and so forth, are used as simple heuristic cues (Vega-Zamora et al., 2014). This presents a particular challenge for sustainable food shopping because if an attribute is not top of mind, it does not get any attention at all within the heuristic decision-making process (Verplanken & Roy, 2015). Sustainable attributes do not change, or substantially increase, the cognitive effort employed when deciding whether to buy a sustainable/organic product and only dedicated green consumers consider the cue "sustainable" at all. (Thøgersen et al., 2012).

When food shopping is conducted with a habitual mindset, decision making becomes even more shallow and highly abbreviated (Verplanken & Wood, 2006). Habits are "a form of automaticity in responding which develops as people repeat actions in stable circumstances" (Verplanken & Roy, 2015, p.247). Grocery shopping is an example of repeatedly undertaking a behaviour in a stable environment, key requirements for the formation of habits (Tam, 2010; Verplanken & Orbell, 2019; Wood & Neal, 2007, 2009). Once habits are formed the context and related cues trigger the behaviour without the mediation of goals (Verplanken & Roy, 2015; Wood & Neal, 2007). The automaticity of habits also explains why, once they are established, providing information to increase consumer knowledge and motivation is not effective (Verplanken, 2018; Verplanken & Roy, 2015) and standard interventions and information-based campaigns have little effect to increase sustainable consumption (Ölander & Thøgersen, 2014; Schultz & Kaiser, 2012).

> **Proposition 5.** The relative importance of sustainable/ethical food attributes systematically differs between SGS segments and "sustainable" cues are only important for highly engaged adoption groups.

3 | METHODOLOGY

A total of 509 New Zealanders were surveyed using an online sample obtained through a commercial marketing research company. The sample covers a broad range of New Zealanders (see Table 1 for demographic characteristics of the sample). The average age of respondents is 47 years. A comparison with the New Zealand population reveals an over representation for 18–24 year olds (15% of this sample; the closest available comparison from official data is for 20–24 year olds: 9% of population which would extrapolate to 13% of the population) and an underrepresentation of 25–34 year olds (15% of sample, 20% of population). All other age brackets are within 1.5% of the population estimates (Figure.NZ, 2021). A total of 59% of respondents are in some form of employment, 17% are retired, 9% are in some form of education, 7% are homemakers and 7% unemployed.

The household income of respondents spreads widely, with an average of NZ$ 70,000–79,000 reported. Compared to official statistics, this shows an under-representation of high income groups (average household income NZ$ 105,000) particularly in the highest income group (>NZ$ 200,000; StatsNZ, 2020). The shape of the income distribution (except for the highest income group) is comparable with representative country wide data (Edmunds, 2020).

3.1 | Item development for sustainable grocery shopping hierarchy

Item development for the SGS hierarchy started with food and grocery related questions from an existing scale that covers everyday sustainable/ethical consumption behaviour in general (Ganglmair-Wooliscroft & Wooliscroft, 2019; Wooliscroft et al., 2014), followed by an exploration of recommendations for SGS in the popular media ("how to" lists), and academic papers dealing with lists and areas of sustainable (grocery) shopping. Personal observation in different supermarkets and specialist stores (organic stores, specialist butchers and bakers and upmarket supermarkets) in New Zealand was the final step in the item development process, ensuring that the included items are available, and behaviour can be undertaken by New Zealand consumers. (Please see Appendix A for details on item development and the consulted literature.)

This process resulted in 35 items related to environmental and social aspects of SGS. Our item development process fulfils the requirements for Rasch-model based behavioural measures. When applying the Rasch Model the set of items should cover the width of the phenomena under investigation (Salzberger, 2009; Wooliscroft et al., 2014), but there is no requirement for inclusion of all possible behaviours. "The scale-freeness of Rasch model based measures allows the use of any item that is an indicator of the underlying characteristic, or stated another way, that falls into the same class of behaviours. Thus, the measure does not depend on a specific set of items" (Henn et al., 2020, p. 4).

To reduce cognitive load on respondents, questions were presented in binary (yes/no) format, with respondents being asked whether they undertake a particular behaviour "always or almost always". Results from binary answer formats are reliable and reduce the cognitive effort required by respondents (Dolnicar et al., 2011; Dolnicar & Grün, 2013). Tanner et al. (2004) showed that binary answer formats are appropriate when using a Rasch Model as more elaborate answer formats (e.g., Likert type 1-to-5 scales) make responses more arbitrary, reducing the quality of the data at hand. The Rasch Model also allows binary input, while the model results are presented on an interval (logit) scale, allowing meaningful interpretation between items (Ganglmair-Wooliscroft & Wooliscroft, 2016).

TABLE 1 Demographic characteristics of the sample ($n = 509$).

Demographic characteristics of the sample			
Age	%	*Household (HH) income in NZ$*	%
18–24 years	16	Under $20,000	9
25–34 years	15	20,000–29,999	8
35–44 years	16	30,000–39,999	10
45–54 years	19	40,000–49,999	9
55–64 years	15	50,000–59,999	8
65+ years	19	60,000–69,999	6
Gender	%	70,000–79,999	6
Male	48	80,000–89,999	6
Female	52	90,000–99,999	6
Employment status	%	100,000–109,999	7
Self-employed	9	110,000–119,999	4
Employed (full time)	36	120,000–129,999	2
Employed (part time)	14	130,000–139,999	4
Home maker	7	140,000–149,999	3
Retired	17	150,000–159,999	3
Student	9	160,000–169,999	2
Unemployed	8	170,000–179,999	1
		180,000–189,999	1
		190,000–199,999	1
		200,000+	4

Note: Household income ranging from 1 = <NZ$ 20,000 to 20 = >NZ$ 200,000; HH income average 7 (=NZ$ 70,000–79,999); *SD* = 5, variance = 25. Age data were collected in years and grouped for this table; average 48 years, *SD* 18, variance 320.

3.2 | Application of the Rasch model

The Rasch Analysis was conducted using RUMM2030, a specialised analysis software (Andrich et al., 2003a, 2003b). The Rasch Model is an ideal mathematical model (see Equation 1) (Bond & Fox, 2007; Fischer & Molenaar, 1995; Linacre, 1992) and observations will always diverge from that ideal situation (Salzberger, 2009). It is the researcher's task to examine whether a divergence from the ideal model is still acceptable. Conducting a Rasch analysis follows a process similar to a stepwise regression analysis where at each step every is compared to the mathematical model, and, if the item does not fit the Rasch Model, it is further examined.

RUMM2030 provides item characteristic curves (ICC) for each item/behaviour. An ICC presents the theoretical curve for an item's difficulty – it reveals the expected probabilities of adopting a particular behaviour. The theoretical ICC curve is compared with empirically observed adoption. When empirical observations closely match the theoretically expected ICC, the item/behaviour fits the Rasch Model. Figure 2 shows two ICCs for hypothetical items/behaviours. The vertical axis shows the probability of undertaking an item. The horizontal axis represents respondents' level of the focal characteristic. People who are located further from the origin, have higher levels of SGS. The points on the ICCs are the empirical observations and represent

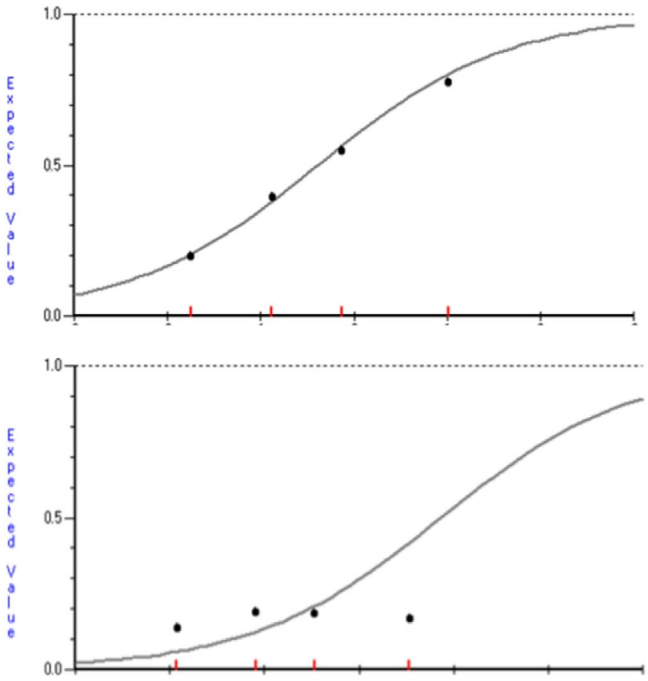

FIGURE 2 Theoretical ICCs with well-fitting (top) and mis-fitting (bottom) empirical observations. [Colour figure can be viewed at wileyonlinelibrary.com]

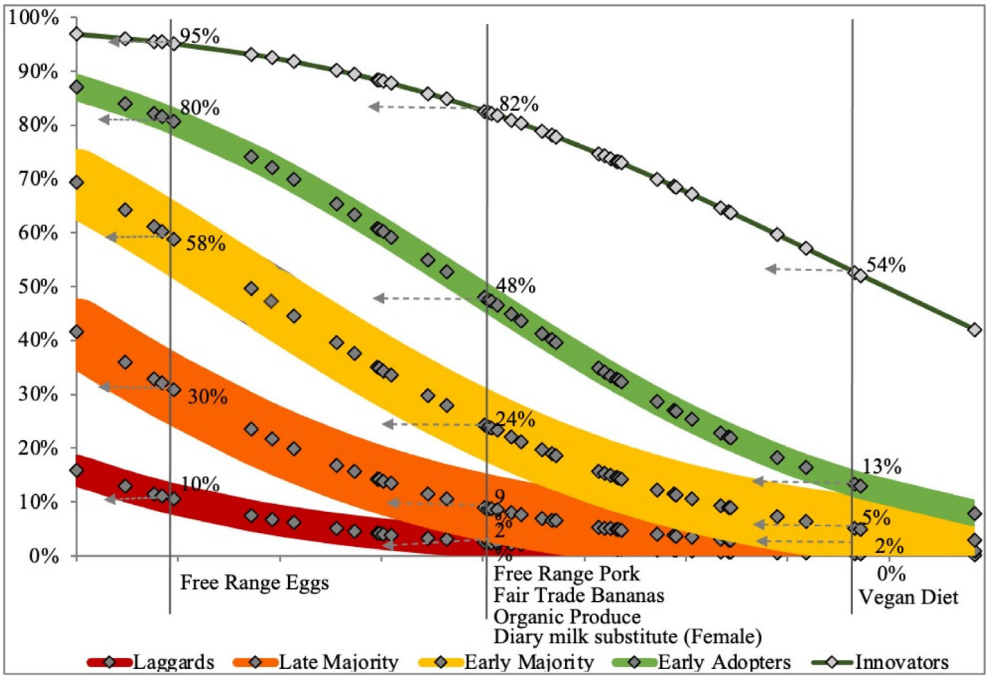

FIGURE 3 SGS adoption groups [Colour figure can be viewed at wileyonlinelibrary.com]

"actual mean scores of groups of homogenous respondents" (Salzberger & Koller, 2013; p.1310). The ICC on the top shows a well-fitting item, where empirical observations closely follow the ideal, while the observations on the bottom ICC reflect a mis-fitting item/behaviour. The observed values do not follow the theoretically expected curve and the item would have to be investigated further or deleted from the analysis.

In addition to graphic displays of ICCs, RUMM2030 provides individual item fit statistics: a Chi-Square (χ^2) probability (a non-significant result is required, indicating that the item does not diverge significantly from the expected) and a Residual Statistic (expected to be within $+/-2.5$).

Specific objectivity (Rasch, 1977) is a key characteristic of the Rasch Model: in order to fit the theoretical Rasch Model to a satisfactory extent, empirical data has to be invariant against possible groupings (Brush & Soutar, 2022; Salzberger et al., 2014). Differential-item-functioning (DIF) is used to investigate specific objectivity by looking for groups within a dataset that undertake a behaviour consistently different – and have a consistently different answer probability. RUMM2030 provides efficient ways to investigate DIF using a two-way ANOVA (Andrich et al., 2003a, 2003b; Ewing et al., 2005) and provides graphics to visually explore group specific discrepancies from the ideal model.

This analysis investigated DIF for gender, age and income groups. Items with DIF are split into population sub-groups (e.g., age groups) and re-investigated. If – after splitting the item for different sub-groups – the new items fit the model, they stay in the analysis. If the newly created, split items still diverge unacceptably from the theoretical Rasch model, they are removed from the analysis.

At the end of this iterative process – all included items have to fit the Rasch model to a satisfactory extent. The overall model fit is examined using overall χ^2probability (again, a non-significant result is preferred) and a person separation index, interpreted similarly to Cronbach's alpha. In addition to individual item fit, individual person fit is also investigated with RUMM2030 providing a residual statistic for every respondent (a value < $+/-$ 2.5 is expected to reflect appropriate person fit; Andrich et al., 2003b).

Rasch Measurement Theory was designed to improve the quality of measurement in social sciences (Wright, 1997) and it "is regarded by many [psychometricians] as the gold standard against which summated scales summarizing item responses have to be assessed" (Kreiner, 2007, p.268). During the development stages of a Rasch scale, a number of checks ensure that the final scale has validity. Validity is supported if items spread across the entire bandwidth of the measure, there are no big gaps between items and individual items fit the Rasch Model to a sufficient extent (as indicated by the item fit statistics, residuals and chi-square tests), with the last criterion also a sign for construct uni-dimensionality of the investigated construct (Baghaei, 2007; Mui Lim et al., 2009; Salzberger, 2009). Items also have to be invariant against different groups in the population ("Specific Objectivity", Rasch, 1977), established by looking at DIF (Brush & Soutar, 2022; Salzberger et al., 2014) and peoples' pattern of responses has to follow what was predicted by the Rasch Model (person error < $+/-$ 2.5; Mui Lim et al., 2009).

Once the Rasch analysis has been concluded and final results have been scrutinized using different quality checks as discussed above, behavioural probabilities for respondents can be calculated by using the person location (delta – δ, see Equation 1), representing the level of SGS a respondent undertakes, and the item location (= difficulty of undertaking a particular behaviour, beta – ß, in Equation 1). Similarities between the Rasch model's ICC and the cumulative adoption curve, allow a transformation of SGS results into Rogers' adoption groups (see Figure 3).

TABLE 2 Personal values and relative importance of food related attributes.

Personal values and relative importance of food related attributes		
Value scale (Schwarz, 2012)		
Please indicate how important the following are as guiding principle on your life, scale ranging from −1 = opposed to my principles; 1 = not important to 7 = extremely important		
Self-transcendence values:		
1. Universalism: That is … broadmindedness, beauty of nature & arts, social justice, a world at peace, equality, wisdom, unity with nature, environmental protection		
2. Benevolence: That is … helpfulness, honesty, forgiveness, loyalty, responsibility		
Self-interest values:		
1. Power: That is … social power, authority and wealth		
2. Achievement: That is … success, capability, ambition, influence on people and		
3. Hedonism: That is … gratification of desires, enjoyment in life, self-indulgence		
Relative importance of five food attributes (required to add-up to 100%)		
Price	Quality	Convenience
Health	Sustainably Sourced Food	

3.3 | Variables included to examine characteristics of SGS adoption groups

SGS adoption groups were examined regarding their demographic characteristics, underlying values, and the relative importance of food characteristics. Frequently investigated demographic variables like gender, age, employment status and income were supplemented by information about weekly absolute and relative spending on groceries. The amount of discretionary spending a household has available per week is used as an indicator for (perceived) financial flexibility and the possibilities of paying for non-essential (luxury) items.

Two Self-transcendence values - universalism and benevolence - and three self-interest values - power, achievement and hedonism were included in the analysis, as this dimension is considered particularly important when investigating environmental/sustainable behaviour (De Groot & Steg, 2008; Thomas & Sharp, 2013).

The final question related to the relative importance of price, quality, health, convenience and sustainably sourced food when shopping for groceries. For details, please refer to Table 2.

4 | CONSTRUCTING A SGS HIERARCHY USING RASCH MODELLING

To construct the SGS hierarchy, all 509 responses were read into RUMM2030 (Andrich et al., 2003a). The initial analysis revealed that one item (buying other Fair Trade products) did not fit the Rasch Model and was deleted. A number of the remaining 34 items showed DIF as they were undertaken at different stages by age or gender subgroups within the population (no DIF was found for income). Items with DIF were split to reflect their respective subgroups.

Over 40+ year olds have a consistently higher probability of buying New Zealand grown fruit and vegetables and of supporting local suppliers, while under 40-year olds are more likely buying free-range eggs. For fair trade chocolate, 18–24 year olds have an even higher probability of buying than 25+ year olds.

The two SGS behaviours taken up differently according to gender are buying milk substitutes (soy-, nut-milk) & using recycled/reusable bags for vegetables. Females find these two sustainable behaviours easier to undertake than males.

Table 3 shows all 40 items included in the final SGS hierarchy (accounting for the six split items), their location on the hierarchy (Rasch Location in logits) and each item's fit statistic. All items included fit the Rasch Model to a satisfactory extent: All Fit Residuals <2.5; all χ^2 Probabilities >0.01 (non-significant results are required). The SGS hierarchy's overall fit statistics are good with a χ^2 probability of 0.31 and a Person separation index (PSI – to be interpreted similar to Cronbach's alpha) of 0.75. The items spread across the bandwidth of the SGS hierarchy, there are no big gaps between items (see Rasch location logits in Table 3) and items with DIF were split to reflect groups that interpret a behaviour systematically different. All Person Errors are within the acceptable range (residuals < +/−2.5), indicating that peoples' pattern of responses follows the pattern predicted by the Rasch model. The SGS hierarchy is a valid instrument and results can be used in further analysis.

No mainstream supermarkets – the most difficult and rarest behaviour is shown at the top and the and the easiest, and most often undertaken sustainable behaviour – Buying NZ grown fruit and vegetables (for 40+ year olds) – at the bottom of the hierarchy. Behaviours higher up in the SGS hierarchy require increasingly more effort – in terms of cognitive effort or time and/or monetary commitment or are less easily available. For example, it is more time consuming to find an independent butcher, and more inconvenient to adjust to the limited availability of organic staples in a mainstream supermarket, with the latter also carrying a noticeable price premium in New Zealand.

These results support Proposition 1a: The uptake of SGS behaviours is cumulative and consistent within a sample of ordinary consumers – and the data fits the assumptions of the Rasch model.

5 | CONVERTING RASCH RESULTS INTO SGS ADOPTION GROUPS

This research acknowledges the homogenous nature of sustainable consumers in terms of their engagement with SGS consumption. The Rasch Model results are grouped and transformed into Rogers' (1995) adoption groups by putting item locations (β) and person/group characteristics (δ) into the formula in Equation 1. The five SGS adoption groups are shown in Figure 3. The thickness of the five lines represents the size of the group (Rogers, 1995): the thin dark-green line at

TABLE 3 Items in the final SGS hierarchy

Item label	Rasch location in logit	Fit residual[a]	Probability[b]
No mainstream supermarkets	2.27	−0.56	0.58
Diary milk substitutes (male)	1.71	−0.51	0.75
Vegan diet	1.68	−0.20	0.26
Organic eggs: 40 years plus	1.44	−1.60	0.20
Organic meat	1.30	−0.58	0.90
Buying at organic shops	1.07	−0.40	0.36
Organic dairy products (yogurt, cheese)	1.06	−1.58	0.47
No meat from supermarkets	1.02	−0.54	0.57
Organic staples (flour, sugar, rolled oats)	0.88	−1.37	0.50
Fair trade chocolate: 25 years plus	0.79	−1.37	0.25
Vegetarian diet	0.71	1.72	0.03
Organic milk	0.53	−0.45	0.06
Fair trade coffee	0.52	−1.67	0.62
Meat substitutes (soy or other plant derived)	0.51	0.49	0.40
Supporting local suppliers: 18–39 years	0.48	0.55	0.83
Locally roasted coffee	0.45	0.53	0.62
Buying direct from producer	0.42	−1.10	0.46
Sustainable fish	0.21	−2.22	0.23
Purchasing at farmers market	0.19	−0.69	0.72
Organic eggs: 18–39 years	0.14	−1.70	0.20
Buying from independent butcher	0.04	0.20	0.81
GM free food	−0.01	−0.08	0.70
Diary milk substitutes (Female)	−0.08	−0.42	0.88
Organic produce (fresh fruit and vegetables)	−0.11	−1.05	0.52
Fair trade bananas	−0.12	0.12	0.89
Free range pork	−0.14	−0.34	0.14
Buying from independent bakery	−0.33	2.02	0.05
Avoiding products on basis of company reputation	−0.60	0.41	0.89
Fair trade chocolate: 18–24 years	−0.64	0.29	0.44
Palm oil free	−0.66	0.04	0.55
Free range chicken	−0.67	−1.50	0.47
Supporting local suppliers: 40 years plus	−0.78	−2.10	0.44
Recyclable/reusable bags for fruit and vegetables (male)	−0.87	0.64	0.38
NZ grown fruit and vegetables: 18–39 years	−1.08	−1.71	0.56
Locally produced food	−1.29	−1.75	0.32
Free range eggs	−1.67	1.13	0.55
Avoiding excessive product packaging	−1.73	−0.24	0.79
Recyclable/reusable bags for fruit and vegetables (female)	−1.77	−0.15	0.06
NZ grown fruit and vegetables: 40 years plus	−2.15	−1.83	0.29

[a]Fit residual within +/− 2.5.
[b]χ^2 probability >0.01.

the top represents SGS innovators (2.5% of the population), followed by the mid-green SGS early adopters (13.5%), SGS early majority and SGS late majority (in yellow and orange) make up 34% each, followed by the dark-red SGS laggards (17%) at the bottom.

The y-axis represents the probability of undertaking a SGS behaviour and the diamond shaped markers along the x-axis visualize the different SGS behaviours with easiest behaviour towards the left and the hardest behaviours towards the right of Figure 3.

Cutting vertically through the graph reveals the probability of SGS adoption groups undertaking a particular behaviour. The bottom of Figure 3 provides exemplary SGS behaviours; for example, free range eggs have a 95% probability of being purchased by SGS Innovators, and an 80% probability for SGS early adopters, followed by a 58% and 30% probability for the SGS Early and SGS late majority. SGS Laggards have a probability of approximately 10% of buying free range eggs. When the focus shifts towards the more extreme side of SGS behaviours, SGS innovators still have an over 53% probability of following a vegan diet, but even for the SGS early majority this probability drops to 13% - for all other groups the probability of undertaking a vegan diet is negligible.

These results support Proposition 1b: Recognizing the definitional equivalence between Rasch's ICC curves and Rogers' S-shaped cumulative adoption function, SGS consumers can be segmented into five empirically supported SGS adoption segments.

6 | EXPLORING THE INFLUENCE OF CONSUMER CHARACTERISTICS ON SGS ADOPTION GROUPS

The following section investigates the links between five SGS adoption groups and key theoretical approaches used to study sustainable behaviour: demographic influences, personal values, spill-over theory and low-involvement decision making/heuristics. For all statistical tests, the small group size of SGS innovators (by definition 2.5% of the sample) was taken into account by either running chi-square (χ^2) tests with Fisher's exact tests or running an additional two-way ANOVA test with a combined SGS innovator\early adopter group, resulting into more even group sizes. The combined ANOVA tests supported the original results and the following conclusions.

6.1 | SGS adoption groups and demographic characteristics, including income and spending

The analysis of demographic characteristics revealed no significant relationship between SGS adoption groups and age, gender, employment status and household income (see Table 4).

As part of the survey, respondents also indicated the absolute amount of money their household spends on groceries in an average week. That value was used to calculate an estimate of the relative proportion of household income spent on groceries (as one of 15 spending categories included in the survey). Respondents further estimated how much discretionary spending their household had available per week. These variables reflect the role of groceries within a household's budget and are an indication of financial flexibility. Grocery spending per week (in NZ$), proportion of overall income spent on groceries (in percent), and available discretionary income per week (in NZ$) do not differ significantly between SGS adoption groups. These results endorse the call for investigations to go beyond demographic characteristics when explaining sustainable behaviour (Finney, 2014; Verain et al., 2012).

TABLE 4 Demographic characteristics of SGS adoption groups.

Variable	*p*-value	Statistical test used
Age (μ)	.33	ANOVA test
HH income (μ)	.51	ANOVA test
Employment status	.18	Fisher's exact test
Gender	.17	Fisher's exact test
NZ $ spending on groceries (μ)	.97	ANOVA test
Proportion of HH income spent on groceries (μ)	.33	ANOVA test
Discretionary $ amount available (μ)	.99	ANOVA test

Note: All results not significant at $p > .05$. μ, mean; HH, household income.

This result supports Proposition 2: None of the demographic variables, including income and other indicators of financial flexibility within a household significantly predict SGS adoption groups.

6.2 | SGS adoption groups and personal values

Personal value dimensions (Schwarz, 2012) as guiding principle of peoples' lives and their link to SGS adoption groups are explored next. As Table 5 shows, the average importance of benevolence and universalism differs significantly between SGS laggards/SGS late majority and SGS early adopters/SGS innovators. SGS early majority only differ from some other SGS groups. The average importance of achievement, power and hedonism does not significantly differ between the five SGS adoption groups (for all $p > .05$). Please see Table 5 for details.

These findings support previous research that emphasize the importance of self-transcendence values for sustainable consumption (Biel & Thøgersen, 2007; Ganglmair-Wooliscroft & Wooliscroft, 2019; Thøgersen & Ölander, 2006; Thomas & Sharp, 2013). Contradictory to some previous suggestions that sustainable behaviour is negatively correlated with self-interest values (Steg et al., 2014) and perceived as inconvenient and therefore "not fun" (Barr et al., 2011; Budeanu, 2007) – self-interest values, including hedonism are not significant predictors of SGS adoption group membership.

Results support Proposition 3a: Transcendence values, particularly universalism are significantly and strongly positively liked with SGS adoption groups.

Proposition 3b is not supported: Contrary to assumptions, self-interest values, including hedonism are not significantly related to SGS adoption groups.

6.3 | Spill-over behaviour in SGS adoption groups

The Rasch Model presents item/behaviour location in logits, allowing the meaningful interpretation of differences between items. Items

TABLE 5 Average importance of personal values for SGS adoption groups.

	SGS laggards	SGS late majority	SGS early majority	SGS early adopters	SGS innovators
Benevolence	4.4	4.8	5.3 →	5.5	6.0
Universalism	3.6	4.1	4.7	5.7	6.1
Non-significant differences ($p > .01$)					
Achievement					$\mu = 4.4$
Power					$\mu = 3.0$
Hedonism					$\mu = 3.3$

Note: Different grey-shadings indicate significantly different SGS groups ($p < .05$); white background = not significantly different from any other group; SGS early majority: → significantly different only from SGS early adopters/innovators.

TABLE 6 Evidence of spill-over for groups of SGS behaviours for each SGS adoption group

	Probability of undertaking behaviour				
	SGS laggards	SGS late majority	SGS early majority	SGS early adopters	SGS innovators
Spill-over behaviours F					
Free range chicken	4%	14%	35%	61%	88%
Palm-oil free	4%	14%	35%	61%	88%
Fair trade chocolate: 18–24 years	4%	14%	34%	60%	88%
Spill-over behaviours E					
Free range pork	3%	9%	24%	48%	83%
Fair trade bananas	2%	9%	24%	48%	82%
Organic produce (fresh fruit and vegetables)	2%	9%	24%	47%	82%
Diary milk substitutes (Female)	2%	8%	23%	47%	82%
Spill-over behaviours D					
Purchasing at farmers market	2%	7%	19%	40%	78%
Sustainable fish	2%	7%	19%	40%	78%
Spill-over behaviours C					
Buying direct from producer	1%	5%	16%	35%	75%
Locally roasted coffee	1%	5%	15%	34%	74%
Supporting local suppliers: 18–39 years	1%	5%	15%	33%	74%
Meat substitutes (soy or other plant derived)	1%	5%	15%	33%	73%
Fair trade coffee	1%	5%	14%	33%	73%
Organic milk	1%	5%	14%	32%	73%
Spill-over behaviours B					
Organic dairy products (yogurt, cheese)	1%	3%	9%	22%	64%
Buying at organic shops	1%	3%	9%	22%	64%
Spill-over behaviours A					
Vegan diet	0%	2%	5%	13%	53%
Diary milk substitutes (male)	0%	2%	5%	13%	52%

Note: Inclusion based on difference of <0.03 logits in the item difficulty (see Table 2 above).

that are located very close together on the logit scale have a similar difficulty – their situational and circumstantial barriers are very similar (Ganglmair-Wooliscroft & Wooliscroft, 2017; Kaiser & Lange, 2021; Otto et al., 2018; Tanner et al., 2004). These item bundles are examples where spill-over between SGS behaviours occurs. Table 6 shows examples for item bundles that take a very similar position on the SGS hierarchy (difference of item location between behaviours <0.03 logits, see Table 2 above) and each SGS group's probability of undertaking the behaviour. Item bundles have an almost identical probability of being undertaken within each SGS adoption group.

The SGS late majority and SGS laggards have a very low probability of showing any spill-over behaviours. The SGS early majority has

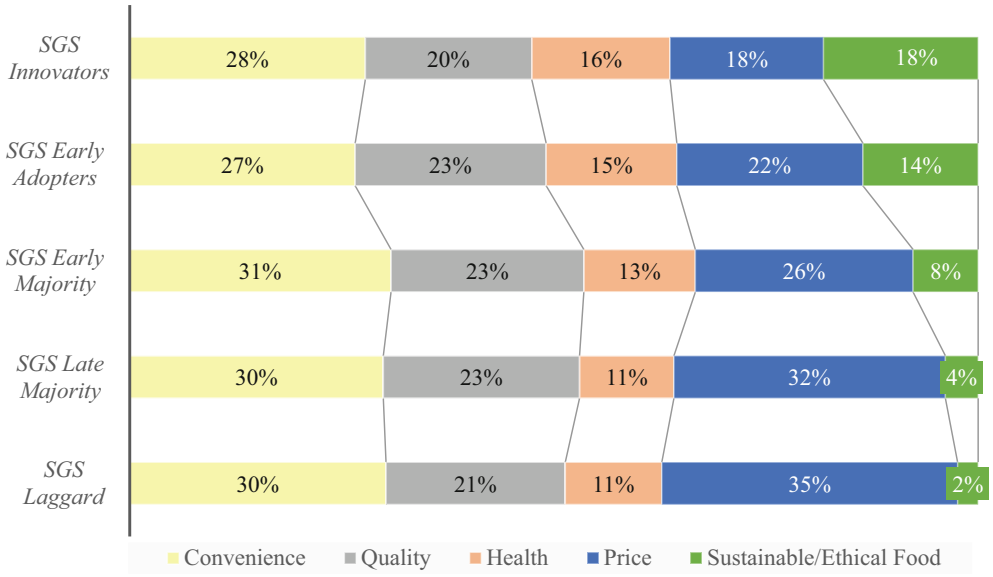

FIGURE 4 Relative importance of five food shopping characteristics. [Colour figure can be viewed at wileyonlinelibrary.com]

at least still a 34% probability of engaging in the easiest spill-over bundle, buying free range chicken, palm-oil free products and fair trade chocolate (for 18–24 year olds).

The related but incremental nature of SGS behaviours is visible in the broad middle block of the SGS hierarchy from buying direct from producer to organic milk. For SGS early adapters the probability of undertaken these seven behaviours lies between 32% (for organic milk) and 35% buying direct from producer. Each subsequent behaviour is very similar to the previous one (maximum logits 0.03), and the probability of engaging in this behaviour bundle is very similar.

None of the spill-over bundles relates to specific product categories, for example "organic". Spill-over effects rather happen between related, "similar" behaviours in terms of barriers that have to be overcome to undertake the behaviour (Henn et al., 2020; Lanzini & Thøgersen, 2014).

These results provide support for Proposition 4 with one constraint: Spill-over occurs between similar SGS behaviours, with similar referring to the level of difficulty, to the level of barriers that have to be overcome to undertake that behaviour, rather than to similarity in terms of one product category like organic or fair trade.

6.4 | SGS adoption groups and the relative importance of food attributes within limited decision making

To answer Proposition 5 respondents indicated the relative importance of price, quality, convenience, health, and sustainably/ethically sourced food as decision criteria when shopping for grocery. The sum of the five attributes adding up to 100% was forced in the questionnaire.

There is no significant difference in the average importance of convenience, health and quality between SGS adoption groups (ANOVA; p = .78, .13 and .54). All SGS groups rate convenience at approximately 30%, quality at approximately 20%, and health at approximately 13%.

The importance of price and of sustainably/ethically sourced food differs significantly (ANOVA; $p = <.01$; see Figure 4). The importance of price drops from 35% for SGS Laggards to 18% for SGS innovators while the importance of ethical/sustainably sourced food shows the opposite trend; SGS laggards assign it only 2% of overall importance, while SGS Innovators assign an importance of 18% (see Figure 4).

These findings support the suggestion that for a majority of consumers (SGS laggards, SGS late & SGS early majority = over 80% of consumers), sustainable/ethical food is not a decision criteria that receives any attention at all.

These results support Proposition 5: The relative importance of sustainable/ethical food attributes systematically differs by SGS adoption groups. The attribute is only considered by innovators and early adopters.

7 | DISCUSSION

This study investigates a broad range of SGS behaviours. SGS items were developed in line with Rasch Model requirements (Henn et al., 2020; Salzberger, 2009; Singh, 2004) where items have to cover the breadth of the phenomena. SGS is taken up in a cumulative and consistent manner within the New Zealand population, as indicated by the well-fitting Rasch model (see Proposition 1a). This result extends previous studies exploring behaviour uptake in environmentally friendly behaviour (Kaiser, 1999), everyday ethical consumption (Wooliscroft et al., 2014), or ethical travel behaviour (Ganglmair-Wooliscroft & Wooliscroft, 2016, 2017), but also unrelated domains like durable household goods (Soutar & Cornish-Ward, 1997).

The order of behaviours in the current hierarchy has face validity – SGS behaviours at the bottom of the hierarchy refer to popular and easily performed sustainable behaviour that are undertaken by a

TABLE 7 SGS adoption segments - summary of findings.

	SGS laggards[a] (17%)	SGS late majority[b] (34%)	SGS early majority[c] (34%)	SGS early adopters[d] (14%)	SGS innovators[e] (3%)
Probability of undertaking					
Easiest SGS behaviour: NZ grown fruit and vegetables (>40 year olds)	14%	42%	70%	87%	97%
Very difficult SGS behaviour: vegan diet	0%	2%	5%	13%	53%
Influence of demographic characteristics					
Age, gender, employment status, income	n.s.	n.s.	n.s.	n.s.	n.s.
Relative spending on groceries (to overall household income)	n.s.	n.s.	n.s.	n.s.	n.s.
Influence of personal values					
Importance of self-transcendence values	significantly lower than [d & e]	significantly lower than [d & e]	significantly lower than [d & e]	significantly higher than [a, b & c]	significantly higher than [a, b & c]
Importance of self-interest values	n.s.	n.s.	n.s.	n.s.	n.s.
Spill-over effect					
Qualitative interpretation of spill-over	hardly exists	limited spill-over in lowest item bundles	some evidence for spill-over	considerable spill-over	strong spill-over in all explored category
Examples for spill-over bundles (probability)					
Free range chicken/palm-oil free/ fair trade chocolate (18–24 years)	4%	14%	35%	61%	88%
Free range pork/fair trade bananas/organic produce/diary milk substitutes (females)	2%	9%	24%	48%	82%
Purchase at farmers market/ sustainable fish	2%	7%	19%	40%	78%
Relative importance of food attributes within limited decision making					
Attribute: sustainably sourced food	Irrelevant (2%)	Very low importance (4%)	Low importance (8%)	Some importance (14%)	Considerable importance (18%)

Note: n.s., not significant, $p > .05$.

sizeable proportion within the population, while items at the top of the hierarchy are difficult to perform and are reserved for a small group of dedicated sustainable food shoppers. The majority of consumers undertake a very limited number of SGS behaviours, extending and supporting Aschemann-Witzel and Niebuhr Aagaard (2014) and Thøgersen (2010). Similar to ethical/sustainable travel behaviour (Ganglmair-Wooliscroft & Wooliscroft, 2016), the diffusion of the SGS domain across the population is still in its early stages.

Consumers in our study differ widely in their uptake of SGS behaviours and the barriers they are willing to overcome. The current research applies Rogers' (1995) classic framework to derive empirically supported SGS adoption groups by recognizing the definitional equivalence between Rogers' S-shaped cumulative adoption function and Rasch's Item Characteristic Curve, replicating and extending the work of Ganglmair-Wooliscroft and Wooliscroft (2016). The SGS adoption segments show the likelihood of undertaking sustainable behaviours for each group, supporting Proposition 1b (Noppers et al., 2015).

Propositions 2 to 5 examined the influence of different theoretical drivers that explain sustainable behaviour – offering a more holistic view of SGS adoption groups and their characteristic. Results support findings that the influence of demographic characteristics is not consistent, and the inclusion of demographic characteristics is not sufficient when explaining sustainable behaviour (Finney, 2014). Age, gender, employment status and income are not significantly associated with SGS adoption groups.

The role of income is particularly interesting as consumers express a heightened willingness to buy sustainably sourced groceries (organic, etc.) if they were cheaper (Aschemann-Witzel & Niebuhr Aagaard, 2014). However, previous studies question whether the assumption that a reduction in the price of sustainable options would

increase sustainable consumption (Aschemann-Witzel & Niebuhr Aagaard, 2014; Tanner et al., 2004). Our results add to the research stream questioning the role of income and/or price of sustainable groceries by finding that income, the absolute and relative spending on groceries as well as financial flexibility (availability of discretionary spending) do not influence SGS adoption group membership.

Personal values, as non-context dependent guiding principles of (consumer) behaviour (Schwartz, 1992), do predict SGS group membership. As expected, self-transcendence values differ significantly between SGS groups (Biel & Thøgersen, 2007; Ganglmair-Wooliscroft & Wooliscroft, 2019; Thøgersen & Ölander, 2006; Thomas & Sharp, 2013). Their difference in values is substantial with, for example, universalism rising from an average of 3.6 for SGS Laggards to 6.1 for SGS Innovators (scale of −1 to 7; Proposition 3a). Self-interest values (power, achievement and hedonism) are not significant related to SGS adoption group membership. This contradicts some previous findings suggesting that self-interest values are (weakly) negatively correlated with sustainable behaviour (Barr et al., 2011; Steg et al., 2014). That these values do not hinder sustainable consumption in the SGS domain is an encouraging result (Proposition 3b).

Previous research explored spill-over effects relating to environmental behaviour, particularly associated with recycling (Lanzini & Thøgersen, 2014; Thøgersen & Ölander, 2003). The existence of spill-over is thought to be stimulated by (transcendence-) values as drivers of sustainable behaviour and it is suggested that spill-over exists between related behaviours (Maki et al., 2019; Thøgersen & Ölander, 2003). The SGS hierarchy provides further support for the notion of spill-over being linked to transcendence values, particularly universalisms. SGS early adopters or SGS innovator rate universalism significantly higher than SGS late adopters or SGS laggards and show evidence of spill-over in several areas of the SGS hierarchy (see Table 6).

The SGS hierarchy finds that the spill-over extends from "similar" or "related" items. Results show that similarity refers to the effort required rather than to one similar product category. For example, free range pork, fair trade bananas and organic produce are related (Table 6, spill-over behaviour E; and Figure 3) and spill-over effects are observed. In comparison, the category "organic" does not show spill-over effect and the probability of buying different organic items varies widely. For example, SGS early adopters have a 47% probability of buying organic produce, a 32% probability of buying organic milk and only an 18% probability of buying organic meat and the same is observed for the category of Fair Trade with SGS early adopters having a probability of 48% to buy fair trade bananas, 33% of purchasing fair trade coffee and 27% of purchasing fair trade chocolate (for over 25-year olds). Different levels of barrier in terms of availability, price or social norm are encountered for different fair trade products and spill-over does not occur.

Grocery shopping is frequently characterized as low involvement, limited decision making (Jayawardhena et al., 2016; Tarkiainen & Sundqvist, 2009). Previous research suggested that if consumers employ heuristics, sustainable/ethical product attributes become simple heuristic cues (Vega-Zamora et al., 2014) and the cue "sustainable" is only considered by dedicated sustainable consumers (Thøgersen et al., 2012). The current study did not focus on examining the decision making process in detail, but the use of heuristics can be inferred by exploring the relative weight consumers assign to five food shopping criteria: convenience, health, quality, price and sustainability. For SGS adoption groups, only SGS early adopters and SGS Innovators assign some importance (14% and 18%) to sustainably/ethically sourced food as purchasing criteria. For SGS laggards and the SGS late majority the relative importance of this characteristic drops to an almost negligible 2% and 4%. This finding provides further evidence that only for the most engaged SFS adoption segments consider the cue sustainably/ethically sourced food and only SGS innovators and SGS early adopters can be reached by typical information campaigns or sustainable packaging cues (Verplanken & Orbell, 2019). For all other SGS groups – who do not consider sustainable cues in their limited decision making - providing additional information or increasing awareness is likely to have little effect, and interventions should disrupt existing cues and change the decision landscape (Verplanken & Orbell, 2019; Verplanken & Wood, 2006). Nudging – for example by using anchoring heuristics and by making sustainable options more accessible (while making conventional products "harder to find") might also be beneficial (Ölander & Thøgersen, 2014) for these SGS segments.

Sustainably/ethically sourced food is negatively correlated with the importance of price. SGS innovators consider price only half as important as SGS laggards (18% versus 35% of relative importance). We support and extend Aschemann-Witzel and Niebuhr Aagaard's (2014) finding that a lower price for sustainable food options does not necessarily lead to increased purchasing. In our study, the low importance of sustainably/ethically sourced food in combination with a high importance of price as a major decision criteria for grocery shopping is not reflected in SGS groups' absolute or relative spending on groceries; the dollar amount of their weekly grocery bill or their reported proportion of overall household income that is spent on groceries. SGS innovators and SGS early adopters are, on average, not "richer" or spend more money on groceries, their higher engagement in SGS is more likely driven by self-transcendence values, supporting research that environmentally friendly sustainable consumption is strongly values driven (De Groot & Steg, 2008; Thomas & Sharp, 2013).

Table 7 collates the findings about SGS adoption segments, the probability of undertaking exemplary SGS behaviours and the influence of the investigated theories relating to demographics, personal values, spill-over effects and heuristics (Propositions 2-5). It provides a combined, holistic view of the SGS adoption segments.

SGS early adopters have, for example, a very high (87%) probability of buying NZ grown fruit and vegetables (for over 40 year olds) and still a 13% probability of following a vegan diet (a very difficult SGS behaviour to undertake). As is the case for all SGS adoption groups, SGS early adopters cannot be identified using demographic variables, but they report self-transcendence values significantly higher than SGS late majority or SGS laggards. The high importance assigned to self-transcendence values as guiding principles in this group's life serves as one explanation for the observation of spill-over behaviour. SGS early adopters show

empirical evidence for spill-over in several areas along the SGS hierarchy. As all segments, the key defining variable for spill-over is similar behavioural difficulty, similar barriers in terms of time, inconvenience or price that have to be overcome. When the focus shifts to attributes that are considered within the low-involvement grocery shopping context, SGS early adopters assign a relatively high importance (14%) to sustainably/ethically sourced food, showing their high engagement with the SGS domain and suggesting that they can be – at least partly – reached by targeted information or packaging cues about sustainable product attributes or behaviour.

7.1 | Managerial implications

The information provided in Table 7 can be used by managers and policy makers when designing targeted interventions for different SGS adoption segments. Managerial interventions need to take the current position of SGS adoption segments into account and be aware of the change required between currently undertaken behaviour and intended behaviour. The differences between behaviours in the SGS hierarchy are meaningful as they indicate how much effort is required to entice that segment to undertake an additional behaviour. What is normal behaviour for SGS innovators and SGS early adopters is almost unreachable behaviour for the SGS late majority – for example, SGS early adopters have a probability of 88% of buying free range chicken, while the SGS late majority only has a 14% probability. While one group (only) needs to be encouraged to continue the behaviour, the other group will require robust interventions to even consider trying free range chicken.

Demographically targeted interventions (for example for particular age groups) will have little appeal, as no particular demographic group is associated with one SGS adoption segment. Marketing or policy interventions that are aimed at SGS early adopters, or SGS Innovators should emphasize values within the self-transcendence dimension (Schwartz, 1992). The low importance of self-transcendence values for SGS laggards or the SGS late majority provide an additional challenge as these SGS adoption segments can neither be explicitly reached using demographic characteristics nor using self-transcendence values, for example by using appeals to save the environment. The segments also do not consider sustainable cues when shopping for groceries.

For SGS innovators and SGS early adopters information campaigns about sustainable food or packaging cues referring to sustainably/ethically sourced food might be beneficial. However, for all other SGS segments – approximately 80% of all consumers – sustainably/ethically sourced food hardly features in their decision making process. Typical information campaigns or initiatives to increase awareness will have limited success and interventions that disrupt existing cues and change the decision landscape should be used instead.

8 | CONCLUSION

There is increasing evidence that the Rasch model is ideally suited to investigate cumulative behaviour of ordinary consumers and that the pattern and order of uptake is consistent, irrespective of the domain investigated. The model's equivalence with Rogers' adoption curve (Ganglmair-Wooliscroft & Wooliscroft, 2016), enables the construction of theoretically sound, empirically based SGS adoption segments, emphasizing the heterogeneity in consumer engagement with SGS and the homogeneity within segments.

The influence of demographic variables (age, gender, employment and household income), but also of absolute and relative spending on groceries, on the SGS adoption group membership is not significant. Findings support the argument that demographic variables are not suitable to explain the SGS adoption groups. Self-transcendence values are significantly and positively linked with SGS adoption group membership. The importance of self-transcendence values provides some explanation for the existence of behavioural spill-over. Rasch Modelling allows the extraction of behavioural bundles where spill-over is present, including the probability how likely these behavioural bundles will be undertaken by different SGS adoption groups. Similar behaviour thereby refers to behaviour of similar difficulty – where consumers have to overcome similar barriers in terms of time, inconvenience or money – rather than product categories.

The repetitive and low-involvement nature of grocery shopping (Ölander & Thøgersen, 2014; Tarkiainen & Sundqvist, 2009; Wood & Neal, 2009), implies that only a limited number of attributes will be consulted when making a purchase decision. SGS adoption groups who rate self-transcendence values highly are also the only groups that consider sustainably/ethically sourced food when making a purchase decision. For SGS laggards or the SGS late majority this attribute is hardly considered important and does not feature in the decision making process.

This study explores the development of the SGS hierarchy and an investigation of influential variables. The investigated sample and the items included in the SGS hierarchy reflect the New Zealand situation. The demographic characteristics of the investigated respondents cover a broad range of the population and approaches representativeness of the population with two exceptions: an under-representation of 25–34 year olds (15% in the sample, 20% in the population), and an under-representation of very high income earners (>NZ$ 200,000.00). The SGS results presented provide a snapshot in time and are not generalizable, however, the method to analyse uptake of behaviour – Rasch modelling – can be generalized (Ganglmair-Wooliscroft & Wooliscroft, 2016, 2017). The limitations extends to New Zealand specific behaviours included in the SGS hierarchy. However, Rasch analysis is particularly well suited to deal with substitutions, additions and deletions of behaviours without changing the overall result (Henn et al., 2020). Rasch analysis is less dependent on sample characteristics than classic analysis techniques, allowing integration of and comparisons with additional SGS behaviours or comparisons with different contexts. The process of developing and analysing a SGS hierarchy is generalizable. Future research will expand the context of investigation to explore SGS behaviours in different countries, and explore how SGS adoption segments progress over time.

This study took a holistic approach to investigate the broad consumption domain of SGS and investigated the impact of major

variables, relating to key research streams, on SGS adoption groups. Trading off detailed, in-depth investigations of the "how" and "why", it complements and extends previous research and provides results that contribute to a systemic view of SGS, including a wide range of behaviours, and the influence of demographics, personal values and related theories including spill-over and ethical/sustainable cues as purchasing heuristics.

ACKNOWLEDGMENT

Open access publishing facilitated by Massey University, as part of the Wiley - Massey University agreement via the Council of Australian University Librarians.

FUNDING INFORMATION

This research was supported by a University of Otago, Otago Business School Research Grant.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available from the authors upon reasonable request.

ETHICS STATEMENT

The research has ethical approval from the University of Otago, Category B.

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How to cite this article: Ganglmair-Wooliscroft, A., & Wooliscroft, B. (2022). A hierarchy of sustainable grocery shopping behaviours: Using Rasch modelling to explore adoption groups. *Journal of Consumer Behaviour*, *21*(6), 1420–1439. https://doi.org/10.1002/cb.2090

APPENDIX: ITEM SELECTION FOR SGS HIERARCHY

	E/SCB original scale (Wooliscroft et al., 2014)	10 ways (Winkler, 2018)*	Shopping NZ herald (Laxon, 2012)*	Super-markets (Carter, 2020)*	Good shopping guide (The Good Shopping Guide, n.d.)*	Creutzig et al. (2018)	Ivanova et al. (2020)	Kaiser and Lange (2021)
Avoiding excessive product packaging	y						x	y
Avoiding products on basis of company reputation	x				y			
Buying at organic shops	x				y			
Buying direct from producer		x			y			
Buying from independent bakery					y		y	
Buying from independent butcher		x			y		y	
Diary substitutes (soy, nut-milk, etc.)					y		y	
Fair trade bananas	y		x	y	y			y
Fair trade chocolate	y			y	y			
Fair trade coffee	y			y	y			
Free range chicken	y		x	y			y	y
Free range eggs	x		x	y				y
Free range pork	y		x	y			y	y
Gm free food				x	x			y
Locally produced food	y						x	
Locally roasted coffee							y	
Meat substitutes (soy or other plant derived)						y	y	
No mainstream supermarkets	x							
No meat from supermarkets	x							
NZ grown fruit & vegetables						y	x	
Organic dairy products (yogurt, cheese)	y		x	y	y			y
Organic eggs	y		x	y	y			y
Organic meat	y		y	y	y			y
Organic milk	y			y	y			y
Organic produce (fresh fruit and vegetables)	x		x	y	y			y

	E/SCB original scale (Wooliscroft et al., 2014)	10 ways (Winkler, 2018)*	Shopping NZ herald (Laxon, 2012)*	Super-markets (Carter, 2020)*	Good shopping guide (The Good Shopping Guide, n.d.)*	Creutzig et al. (2018)	Ivanova et al. (2020)	Kaiser and Lange (2021)
Organic staples (flour, sugar, rolled oats)	y		x	y	y			y
Other fair trade products	y			y	y			y
Palm oil free				x				
Purchasing at farmers market		x					y	
Re-usable bags for fruits and vegetables	y							y
Supporting local suppliers	x	y			x		x	
Sustainable fish			x					
Vegan diet					x		x	
Vegetarian diet					x	y	x	x

Source of items included in the SGS hierarchy. "x" indicates items listed in the source; "y" indicates derived item, for example: "buy organic" was split to reflect organic categories available in mainstream NZ supermarkets. "*" Shopping guides (how-to lists) in the popular media frequently refer to ethical shopping: Consumption behaviours in studies dealing with sustainable or ethical behaviours are generally undistinguishable, both relating to environmental and/or social impacts of consumption (Sheth & Parvatiyar, 2021).