**The role of consumer perceived value of recyclable materials on household recycling behaviours**


## Abstract

**Background:** This research investigates the role of consumer perceived value of recyclable materials on recycling behaviours in response to languishing English recycling rates, marked regional variations in recycling, and Government waste policy rhetoric which focuses on recognising the value of recyclables to increase recycling. **Methodology:** Data was collected through a structured self-administered questionnaire. An extended Theory of Planned Behaviour model was used to explore the influence of Attitude, Subjective Norms, Perceived Behavioural Control, Moral Norms, Environmental Awareness, and a novel construct for Value Perception on recycling behaviour. 226 residents of Newcastle upon Tyne, England participated in the study. The relationship between Ascribed Value and Value Perception was tested using Kendall's Tau, and partial least squares structural equation modelling was used to analyse the Theory of Planned Behaviour results. **Results:** Results indicate consumers perceived value in recyclable materials, however, the direct influence of Value Perception on Recycling Behaviour was non-significant but was significant when moderated by Moral Norms. Moral Norms, and Perceived Behavioural control were significant positive influences on recycling behaviours, however, Attitude and Subjective Norms were not. Environmental Awareness strongly influenced Value perception and had significant moderated effects on Recycling Behaviours through Attitudes and Moral Norms. **Discussion/Conclusion**: Results suggest that, whilst consumers in Newcastle do recognise value in recyclable materials, this perception does not translate directly into positive recycling behaviour, but instead influences behaviours through respondents intrinsic moral beliefs. This study provides a valuable starting

point for exploring the role of Value Perception in stimulating pro-environmental recycling behaviours.

**Keywords**: - recycling; theory of planned behaviour (TPB); value; perceived value; pro-environmental behaviour; recycling behaviour.

## 1. Background

In England, some 25.9 million tonnes of domestic waste is produced by households annually (Department for Environment Food and Rural Affairs (DEFRA), 2021a), and despite a mature recycling system and clear waste management targets, a large amount of recyclable household waste with a residual economic value is lost to incineration or landfill due to poor consumer waste sorting or disposal behaviours (DEFRA, 2023). England's well-developed waste infrastructure results from 30 years of environmental regulation including the Environmental Protection Act (UK Government, 1990), and Household Waste Recycling Act (UK Government, 2003) which introduced countrywide kerbside recycling, and European Union directives (European Commission, 1999; European Commission, 2008) which mandated a 50% recycling target by 2020. The UK Resource and Waste Strategy (DEFRA, 2018) set a recycling target of 65% by 2035, and the 2021 Environmental Protection Act (UK Government, 2021) introduced additional provisions to increase recycling rates. Despite this focus, household recycling rates remain below the 50% target at 44.1% in 2022 (6.2 million recycled from 23.1 million tonnes), whilst 14.3 million tonnes of waste arising from households went to landfill or incineration (DEFRA, 2023), indicating considerable volumes of recyclable materials are lost from the value chain. Barriers to recycling have been the subject of research to identify means of stimulating consumer recycling behaviour. Waste and Resources Action Programme (WRAP) (2022a) identified that most consumers regularly recycle and appear increasingly

aware of recycling benefits, yet a lack of knowledge of recyclable materials amplified by confusion arising from regional variations in recycling schemes negatively impacts recycling behaviour and subsequent recycling rates (Holmes et al., 2023). Clearly, consumers play a significant role in the realisation of government targets and transition towards sustainable, circular, waste management; consequently, action is required to encourage consumers to adopt recycling behaviour to achieve these ambitions.

### 1.1 Consumer Recycling Behaviours

With consumers' key role recognised, the reasons people do not recycle have been well-studied resulting in a comprehensive, yet contradictory body of literature (Thomas & Sharp, 2013; Geiger et al., 2019). Whilst Kollmuss and Agyeman (2002) concluded there appears no singular answer to stimulating consumer recycling behaviour, several considerations have emerged. Physical barriers to recycling include convenience factors such as adequate storage space or time to sort and clean items (Tonglet et al., 2004; Ramaya et al., 2012). Studies have also explored the impact of behavioural drivers including cultural norms (Culiberg & Elgaaied-Gambier, 2015), environmental concern (Kumar, 2019), and beliefs around the benefits of recycling (Liu et al., 2020; Juliana et al., 2022), with each study demonstrating the complexity underlying these drivers. However, Oke et al. (2021) assert that understanding consumer perceptions of waste provides the starting point for understanding behaviours.

Behavioural theories from social psychology including the Theory of Planned Behaviour (TPB) (Ajzen 1991), Value-Belief-Norm Theory (Stern, 2000), and Goal Framing Theory (Lindenberg, 2001; 2006) have been successfully and widely applied to environmental behaviour studies and clearly demonstrate the complexity of drivers influencing pro-environmental behaviours.

A review of the literature shows that TPB has been increasingly applied in studies of recycling behaviours since the mid-1990's when, for example Taylor and Todd (1995) utilised TPB to study waste and recycling. Following the introduction of mandatory kerbside recycling in 2003, TPB was used in a clutch of regional household recycling studies which demonstrated regional variations in behavioural drivers for recycling in England (Davis & Morgan, 2008; Nigbur & Lyons, 2010; Tonglet et al., 2004). However, there is a notable absence of recent studies of regional recycling behaviours, and both Barr (2007) and Steg and Vleck (2009) assert that a robust understanding of drivers is critical for successful implementation of initiatives capable of delivering swift and widespread behavioural change. This case study aims to address this knowledge gap through the inclusion of a Value Perception (VP) construct within the TPB model.

TPB postulates that behaviour stems from a cost-benefit evaluation of undertaking a behaviour as influenced by Perceived Control, Attitude, and Subjective Norms, and these three central constructs are used to evaluate and model behavioural intention. Ajzen (2020) asserts TPB provides a complete model for any behaviour, however, the model's utility has been challenged for failing to encompass the complex spectrum of drivers influencing behavioural intention (Sneihotta et al., 2014) such as financial incentives, environmental concern, and convenience (Onel & Mukherjee, 2017). Onel and Mukherjee's (2017) evaluation of multiple behavioural models, including TPB, concluded that a holistic theoretical model encompassing numerous factors supports fuller understanding of behavioural influences, which supports Ajzen's (1991) assertion that extending the TPB model with additional factors increases its predictive power.

Whilst TPB was devised to predict behaviour by measuring behavioural intention (Ajzen, 2002), de Bruin et al. (2012) found that intention explains only 20-30% of the behavioural variance: termed the intention-behaviour gap. Consequently, some studies, for example Onel

and Mukherjee (2017) and Juliana et al. (2022), favour utilising questions which measure self-reported behaviour; an approach used in this study.

### 1.2 Consumer Perception of Recyclable Waste Value

The literature on consumer perceived value (CPV) of waste and its influence on recycling behaviour is limited, and there is no commonly adopted single definition for CPV associated with waste materials. CPV studies emerged in relation to purchasing behaviours and are theoretically grounded in marketing literature, in which CPV results from the consumer's perceived cost-benefit of an item or transaction (Gale & Wood, 1994; Zeithaml, 1988). CPV was distilled into four categories by Holbrook (1999): economic value; social value; hedonistic value; and ethical value. CPV was further found to be influenced by dimensions including quality, price, and emotional or social consumer gain by Sweeney and Soutar (2001). Studies exploring environmentally friendly purchasing indicate that CPV is also influenced by perceived environmental and social benefits, for example, Confente et al. (2020) found that green self-identity impacts CPV of biowaste-derived plastic products, and Lou et al. (2022) found that emotional, social, and environmental benefits influence purchase of pre-owned luxury goods. Whilst, in purchasing, benefit (and thus CPV) relates to consumer gain, in the waste context, benefit is realised upon item relinquishment, which may instead deliver wider environmental, economic, or societal benefits for example, therefore, the drivers underpinning CPV of recyclables may differ. Literature relating to the CPV of wastes suggests that economic value, functional value, and emotional value are likely to influence recycling behaviour, but discussion of environmental value is lacking. Several studies found that perceived functional value was a key driver for pro-environmental behaviours, especially items or materials with a clear perceived future usefulness, for example, glass jars have clearer future utility than plastic films creating greater CPV (Hou & Sarigöllü, 2021; Langley et al., 2011). Monetary value,

represented by financial incentives for recycling, was identified by Shevchenko et al. (2019) and Maki et al. (2016) as a key driver of e-waste and domestic waste recycling. Furthermore, both Hou and Sarigöllü (2021) and Martinho et al. (2015) identified that emotional attachment to an item, and even appealing packaging design, creates emotional CPV, though this is unlikely to manifest for most household wastes. Finally, cultural norms are identified as a variable in CPV, with western consumers more likely to have a lower CPV of waste materials, or even perceive them to be valueless (Green Alliance, 2020) than those in developing countries where individuals may directly profit from waste-picking and scavenging activities to source saleable materials (Browning et al., 2021; Borthakur & Govind, 2017). Abila and Kantola's (2019) study of financial incentives on household recycling found that 60% of respondents indicated CPV was a positive driver for recycling behaviour (comparable to convenience and environmental concern factors), yet they give no further discussion of CPV, illustrating the limited attention given to this topic.

### 1.3 English Waste Policy

In policy, waste is increasingly being considered a valuable resource. The DEFRA (2018) waste strategy entitled 'Our Waste, Our Resources' asserts the importance of helping consumers perceive waste material as valuable to stimulate behavioural change towards pro-environmental behaviours. This policy approach is mirrored in other countries including Australia (Commonwealth of Australia, 2018) and the USA (EPA, 2021). van Ewijk and Stagemann (2016) support this approach, arguing that increasing consumer cognisance of value would benefit recycling and material retention. In the past decade, Government initiatives have targeted ease of recycling which has moderately increased rates (WRAP, 2022b). More recently, Government attention turned to standardising waste collection services and mandating a universal set of materials for kerbside recycling across the country, which

estimated to have the potential to realise an economic benefit of £478m (WRAP, 2016). However, no initiatives have specifically targeted increasing CVP to encourage recycling. The planned introduction of a deposit returns scheme for single-use drinks containers in England in 2024 may instil value by effectively monetising waste (DEFRA, 2021b), however, this initiative is grounded in waste avoidance not increasing CPV, and critics argue the scheme might paradoxically increase waste volumes by signalling consuming recyclables is a green choice (van Doorne, 2021), demonstrating a challenge in encouraging consumers to adopt sustainable, circular, waste behaviours. With the policy narrative shift towards value recognition and retention, understanding the scale and role of CPV of recyclable materials is important for achieving policy goals.

Clearly consumers must be encouraged to recycle more to meet waste and sustainability goals, and van Ewijk and Stagemann (2016) argue that a value-based waste management system which educates consumers about environmental impact and best-available waste treatment are necessary to ensure consumers value waste, and consequently recycle. England's waste policy outlines a broad spectrum of value, measuring waste value by materials economic value and scarcity, social value, and environmental value arising from avoidance of pollution, plus energy savings (DEFRA, 2018). Therefore, this paper will explore the influence of CPV on consumer recycling behaviour by applying an extended TPB model which incorporates Moral Norms, Value Perceived, and Environmental Awareness in a case study of Newcastle Upon Tyne (hereafter Newcastle) in England. Newcastle City Council's Waste Strategy mirrors England's national strategy with a central objective to position waste as a resource to ensure 'waste is valued as a resource and managed accordingly' (NCC, 2019: 8). Yet despite targeted efforts to increase household waste recycling to 50% by 2020, and a future goal of 55% by 2025 (NCC, 2019), Newcastle achieved just 40.6% in 2020 (DEFRA, 2021a) presenting a valuable

opportunity for a case study focussing on the potential to leverage CPV to increase recycling rates.

This study has two key objectives: one, to understand if Newcastle consumers perceive value in recyclable wastes, and two, to identify the influence of consumer perceived value on recycling behaviour.

## 2. Hypothesised Structural Model Development

### 2.1 The Extended Theory of Planned Behaviour Framework

This study utilises Ajzen's (1991) TBP framework to explore the influence of CPV on recycling behaviour. TPB asserts that three factors influence intention to perform a behaviour, and thus indicate the likelihood of the behaviour being performed: (1) Attitude, "the degree to which performance of the behaviour is favourable or unfavourable", (2) Subjective Norms, "the perceived social pressure to perform or not to perform the behaviour", and (3) Perceived Behavioural Control the "perceived ease or difficulty of performing the behaviour" (Ajzen, 1991: p. 188).

TPB has been widely applied in studies exploring behavioural drivers and is posited as one of the most effective for evaluating consumer recycling behaviour (Onel & Mukherjee, 2017) with a key strength of TPB being its flexibility to be utilised in varied contexts. Consequently, TPB has been applied in wide-ranging studies of environmental behaviours including littering (Esfandiar et al., 2021), recycling (Yuriev et al., 2019), and disposal of discrete categories of waste including: domestic waste (Tonglet et al., 2004; Xu, et al., 2017), e-waste (Kumar, 2019; Mohamad et al., 2022), food waste (Graham-Rowe et al., 2015; Oehman et al., 2022), and textiles (Henzen & Pabian, 2019; Vilkaite-Vaitone & Jeseviciute-Ufartiene, 2021). TPB

assumes its three core factors have 'sufficiency' to accurately determine behaviour, yet Ajzen (2020) concedes additional discrete factors may be introduced to elucidate additional insights and consequently, TPB has been extended to incorporate constructs such as moral norms (Wan et al., 2017), past behaviour (Richetin et al., 2012), environmental awareness (Blok et al. 2015; Juliana et al., 2022), environmental values (Morgan et al., 2015), and even place attachment (Wan et al., 2021) to study the amount of variance of behaviour explained by these constructs. As a result, measurement items for recycling behaviour have been validated through application in over 40 studies (Yuriev et al., 2019), presenting TBP as a robust theoretical model for this study. Recently, CPV has been introduced into studies using TPB to explore recycling studies (Wang et al., 2021; Wang et al., 2023), however, the measurement items used arose from transactional marketing literature, and are inappropriate to meet the objectives of this research. Consequently, a novel 'Value Perception' construct which draws on value types identified through literature will be piloted. Additionally, in this study respondents will be asked to ascribe a degree of value ('Ascribed Value') to commonly recycled household materials to understand whether consumers do recognise value in such materials and enable the role of CPV in influencing recycling behaviour to be explored.

### 2.2 Research Hypotheses

In relation to objective one, as literature demonstrates multiple types of value are recognised in waste by consumers, therefore a degree of value is anticipated to be recognised in recyclable household materials. In this study, participants are asked to rate the value of commonly recyclable materials to provide an 'Ascribed Value' score to quantify value. Furthermore, a positive correlation is expected between Ascribed Value and the novel Value Perception construct as the Value Perception construct is designed to measure the degree of value recognised in recyclable materials: it is anticipated that those respondents who report higher

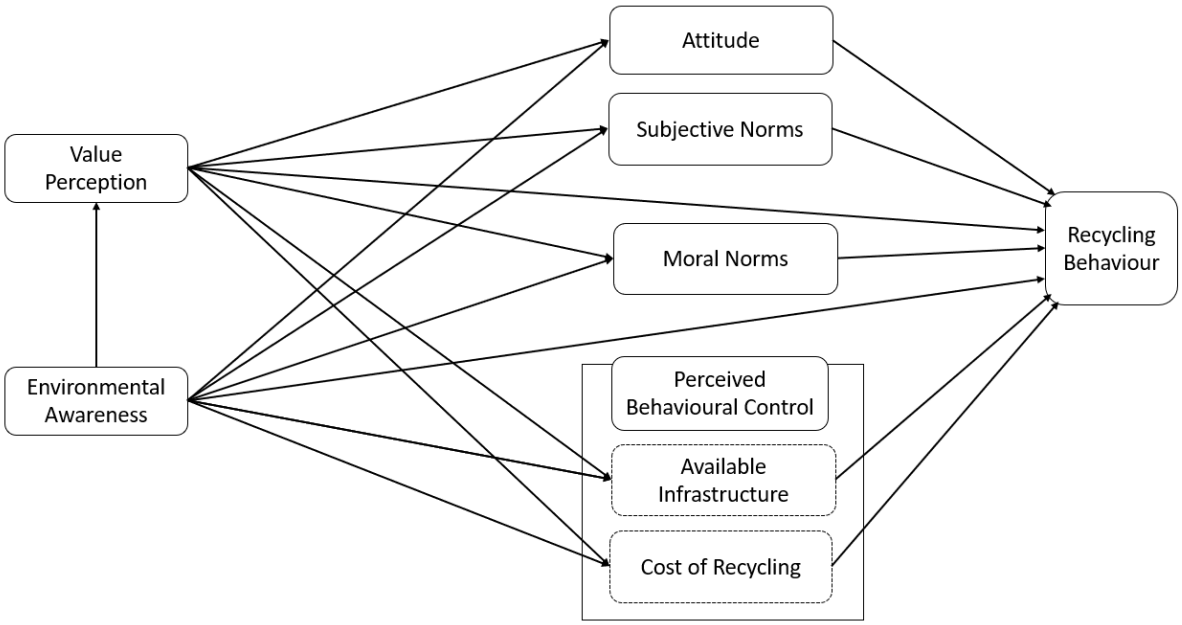
Ascribed Value scores would also have higher Value Perception scores The following hypotheses are proposed:

H1a: Ascribed Value is recognised in recyclable materials

H1b: Ascribed Value is positively correlated with Value Perception

Eighteen further hypotheses are proposed concerning objective two which will be tested using an extended TPB model. The theoretical framework, outlined in Figure 1, builds upon the TPB model from Juliana et al. (2022) which incorporates moral norms and environmental awareness, and through which the new Value Perception construct is introduced to explore its influence on recycling behaviours.

Figure 1: Theoretical Framework



TPB asserts that Attitude and Perceived Behavioural Control, comprising Available Infrastructure and Cost of Recycling, together with Subjective Norms are sufficient to predict behavioural intention, and thus the behaviour itself. However, Ajzen (1991) acknowledged their relative influence, and significance is variable across behaviours or contexts. This variation is supported by literature with some studies reporting all three to be significant (Nigbur & Lyons, 2010; Onel & Mukherjee, 2017; Rizali et al., 2020), whilst others report that Attitude (Juliana et al., 2022; Tonglet et al., 2004), Subjective Norm (Botetzagias et al., 2015), and Perceived Behavioural Control (Greaves et al., 2013; Ramaya et al., 2012;) are non-significant influences on recycling behaviour. As evidence suggests that in England recycling is normalised and well understood (WRAP, 2022a), and infrastructure barriers are low, the following hypotheses are proposed:

H2a: Attitude is positively related to Recycling Behaviour
H2b: Subjective Norm is positively related to Recycling Behaviour
H2c: Available Infrastructure is positively related to Recycling Behaviour
H2d: Cost of Recycling is positively related to Recycling Behaviour

Ajzen (1991) recognised Moral Norms as a positive indicator of behavioural intention, and Moral Norms are frequently used to study pro-environmental behaviours. Recycling studies by Botetzagias et al. (2015) and Rizali et al. (2020) identified Moral Norms to have strong significant influence on behaviour. Furthermore, Moral Norms is sometimes posited as synonymous with Attitude, and its inclusion offers additional nuance for behavioural understanding (Wan et al., 2017). Therefore, the following hypothesis is proposed:

H3: Moral Norm is positively related to Recycling Behaviour

Environmental Awareness is an individual's comprehension and concern with environmental issues and sustainable solutions (Ramaya et al., 2012). Literature suggests a positive relationship between Environmental Awareness and pro-environmental behaviours (Bratt, 1999; Lili et al., 2021), including recycling (Ramaya et al., 2012). Furthermore, Juliana et al. (2022) identified that Environmental Awareness operated through Attitude to positively influence recycling behaviour. As English consumers have been exposed to numerous pro-recycling campaigns (WRAP, 2022a), high environmental awareness regarding recycling is assumed, which Shevchenko et al. (2019) found to increase CPV. Consequently, the following hypotheses are proposed:

H4a: Environmental Awareness is positively related to Recycling Behaviour
H4b: Environmental Awareness is positively related to Value Perception
H4c: Environmental Awareness is positively related to Attitude

To expand on Juliana et al.'s (2022) model, the influence of Environmental Awareness with the remaining constructs will also be explored. Environmental Awareness might influence respondents' own intrinsic values and moral ideas about recycling, however it is unlikely that awareness will extend to Subjective Norms, as this construct measures influences the expectations of others. Therefore, the following hypotheses are proposed:

H4d: Environmental Awareness is not positively related to Subjective Norms
H4e: Environmental Awareness is positively related to Moral Norms

Awareness of environmental issues relating to recycling is likely to increase an individual's knowledge of or engagement with recycling infrastructure and, as with moral norms, environmental knowledge may also influence self-assessment of the ease of engaging in recycling. Therefore, the following hypotheses are proposed:

H4f: Environmental Awareness is positively related to Available Infrastructure
H4g: Environmental Awareness is positively related to Cost of Recycling

The literature has shown that Consumers are more likely to recycle items perceived as having value (Hou & Sarigöllü, 2021; Shevchenko et al., 2019), with several studies (Abila & Kantola, 2019; Wang et al., 2021; Wang et al., 2023) identifying CPV's positive influence on recycling intentions. Therefore, the following hypothesis is proposed:

H5a: Value Perception is positively related to Recycling Behaviour

To fully explore the influence of Value Perception in this extended TPB model, the relationships with the remaining constructs will be explored. As with Environmental Awareness, perceiving materials as having value can be expected to positively influence respondents' attitudes towards recycling. It is unlikely that Value Perception will influence the sense of social pressure to recycle due to the lack of normalisation of thinking about recyclables in this way and instead it is more likely that respondents' self-accountability or sense of green self-identify will determine behaviours. Therefore, the following hypotheses are proposed:

H5b: Value Perception is positively related to Attitude
H5c: Value Perception is not positively related to Subjective Norms

H5d: Value Perception is positively related to Moral Norms

Value Perception is unlikely to affect respondents' views of the ease of recycling or Available Infrastructure. However, Value Perception may influence views on Cost of Recycling if, for example, functional value is in play, this may alter respondents' perception of the cost-benefit of undertaking recycling, as identified by Langley et al. (2011) and Hou and Sarigöllü (2021). Therefore, the following hypotheses are proposed:

H5e: Value Perception is not positively related to Available Infrastructure

H5f: Value Perception is positively related to Cost of Recycling

Existent studies have identified which materials consumers frequently choose to recycle (Abila & Kantola, 2019), and which are most often incorrectly missed from recycling (WRAP, 2022b), yet the subject of CPV of recyclable materials has not been studied, and direct assumptions about CPV for recyclable materials cannot be made. Therefore, addressing the gap in understanding which materials are considered valuable is important for establishing the role of CPV in recycling behaviours. Hypothesis 6 therefore proposes that consumers' Value Perception of recyclable materials is congruent with the Ascribed Value of recyclable wastes: it is further hypothesised that high Ascribed Value will positively influence recycling behaviours:

H6: Ascribed Value is positively correlated with Recycling Behaviour

## 3. Methodology

The research hypotheses outlined were tested through data collected using a structured self-administered questionnaire which utilised validated measures and a widely used analytical process (Kumar, 2019; Juliana et al., 2022). The research was approved by the DELETED FOR PEER REVIEW Ethics Committee (ETH2223-0017).

### 3.1 Survey Sample

No database was available to enable probability sampling, therefore study participants were recruited using a non-probability self-selection sampling approach with potential participants engaged through posts in online social and professional networking platforms. Door-to-door distribution of invitations to participate to households in post-codes with low response rates (NE4, NE7, NE13) was undertaken to increase the representativeness of the results. No incentives were offered for participation.

The inclusion criteria for the study were respondents must be aged 18 or older and resident in Newcastle postcodes. G*Power software calculated that, with a medium effect size (0.2), a power of 0.80, and an error probability of 0.05, the minimum sample size required for correlation analysis to be valid was 193 (Faul et al., 2009). 226 responses met the inclusion criteria and are analysed in the results.

### 3.2 Questionnaire Design

The questionnaire comprised of three sections. Section one presented measurement items for the eight TPB model constructs randomly assigned into 4 groups to avoid fatigue. Items to test self-reported Recycling Behaviour (4 items, e.g. '*I usually separate my waste and recycle all possible materials*'), Attitude towards recycling (5 items, e.g. '*I am interested in recycling my*

*household waste*'), Subjective Norms, the expectations and actions of friends and family (3 items, e.g. *'My family expects me to engage in recycling behaviour'*) and degree of Environmental Awareness (5 items, e.g. '*Recycling is a major way to reduce wasteful use of landfills*') were adapted from studies by Ramaya et al. (2012) and Juliana et al. (2022). Statements to test Moral Norms relating to recycling behaviours (3 items, e.g. '*Not recycling goes against my principles*') were adapted from Tonglet et al. (2004) and statements to test the two component measures of Perceived Behavioural Control (Available Infrastructure, 2 items, e.g. '*I am familiar with the recycling facilities in my area*'; and Cost of Recycling, 2 items, e.g. *'I have enough time to sort the materials for recycling'*) were adapted from Ramaya et al. (2021). Lastly, statements for Value Perception (5 items, e.g. *'I am more likely to recycle recyclable materials that I perceive to be valuable'*) were developed by the author using a deductive approach whereby measurement items were devised to match validated TPB measurement item styles and were informed by the existent literature around CPV types (Boateng et al., 2018). All items employed a five-point Likert scale answer scheme from 1'strongly disagree' to 5 'strongly agree as advocated by Ajzen (2020), this was limited to 5-points and included a neutral position to enable participants to sufficiently express their views (Martons-Williams, 1986) whilst avoiding frustration and survey fatigue sometimes experienced with a more nuanced 7-point scales. Both the adapted and author devised questions were tested for ambiguity of wording and robustness of measures employed through a pilot survey, as recommended by (Fowler, 1995).

Section two contained questions which asked respondents to Ascribe Value to 7 commonly recycled categories of household materials including Metal cans and drinks containers and plastic bottles using a six-point scale in which 0 represents 'none at all', and 5 'very valuable'.

Section three contained demographic questions relating to age, gender, education, and postcode. A full list of questions is included in Table 4.

### 3.3 Data Analysis

The presence of Ascribed Value was established through analysis of means scores, then the relationship between Ascribed Value and Value Perception was tested using Kendall's Tau to test hypotheses 1a and 1b. Partial least squares structural equation modelling (PLS-SEM) was used to analyse the TPB results to test the remaining hypothesis. Both PLS-SEM and the older covariance-based SEM (CB-SEM) have demonstrable utility in recycling behaviour studies and consensus arising from extensive testing in the literature is that both are robust and offer complementary capabilities (Hair et al., 2017). However, PLS SEM was considered the more robust methodology, as unlike CB-SEM, it is better suited to studies with complex research models and limited data-sets (Legate et al., 2021), and importantly, for testing new constructs (Hair et al., 2019; Sarstedt et al., 2016) particularly within theoretical model extensions (Ringle et al., 2020). Furthermore, PLS-SEM has been widely utilised in studies applying TPB (Kumar, 2019; Juliana et al., 2022; Wan et al., 2021) and as such enables comparison of results. Thus PLS-SEM was considered most appropriate for analysing the relationships between the constructs explored in this study.

As recommended by Hair et al. (2021), the measurement model was first tested to establish internal validity and reliability, and discriminant validity before the structural model was analysed. PLS-SEM is considered suited to analysing relationships with smaller sample sizes and for theory development (Legate et al., 2021; Ringle et al., 2020;), and thus is appropriate for this study.

To address hypothesis H6, the relationship between Ascribed Value (AV) and Recycling Behaviour (RB) is explored through descriptive and inferential statistical methods, and the influence of demographic variables on AV is similarly analysed to identify key trends and extract detailed insights on how AV influences RB.

## 4. Results

### 4.1 Profile of Respondents

298 responses were received. The demographic profile of respondents is presented in Table 1 and can be summarised: 68% female, 32% male; aged between 18-79, with 50% between 30-49; 85% of all respondents have completed education at or above high school level. All nine postcode areas in Newcastle were represented, however three (NE3, NE5, NE15) collectively account for 57% of all responses. Responses to recycling behaviour questions indicate 93% of respondents recycle regularly.

*Table 1 Demographic Characteristics of Study Respondents*

| | Category | Frequency | Percentage |
|---|---|---|---|
| Gender | Female | 153 | 67.7 |
| | Male | 72 | 31.9 |
| | Prefer not to say | 1 | 0.4 |
| Age | 18-29 | 18 | 8.0 |
| | 30-39 | 48 | 21.2 |
| | 40-49 | 65 | 28.8 |
| | 50-59 | 41 | 18.1 |
| | 60-69 | 37 | 16.4 |
| | 70-79 | 17 | 7.5 |
| Relationship Status | Married / Partnership / In relationship | 158 | 69.9 |
| | Single | 45 | 19.9 |
| | Divorced / Separated | 14 | 6.2 |
| | Widowed / Widower | 5 | 2.2 |
| | Prefer not to say | 4 | 1.8 |
| Education Level | High School (i.e., GCSE) | 29 | 12.8 |
| | College (i.e., A Level / HNC / NVQ etc) | 43 | 19.0 |

| | | | |
|---|---|---|---|
| | University - Higher Education | 150 | 66.4 |
| | Prefer not to say | 4 | 1.8 |
| Post Code Area | NE1 | 5 | 2.2 |
| | NE2 | 17 | 7.5 |
| | NE3 | 52 | 23.0 |
| | NE4 | 11 | 4.9 |
| | NE5 | 38 | 16.8 |
| | NE6 | 19 | 8.4 |
| | NE7 | 27 | 11.9 |
| | NE13 | 7 | 3.1 |
| | NE15 | 39 | 17.3 |
| | Prefer not to say | 11 | 4.9 |

### 4.2 Ascribed Value and Value Perception

The results of the value ascribed to recyclable materials (Table 2) reveal that median and mode values were 4 and 5 respectively for most materials, except for metal foils & trays and plastic pots & trays which had lower Ascribed Value scores. Means and standard deviation scores indicate that glass bottles and metal cans & drinks containers have the greatest Ascribed Value and lowest standard deviation indicating greater consensus of value than plastic pots & trays which has notably lower average scores and the highest standard deviation of all materials.

*Table 2 Measures of central tendency for material types*

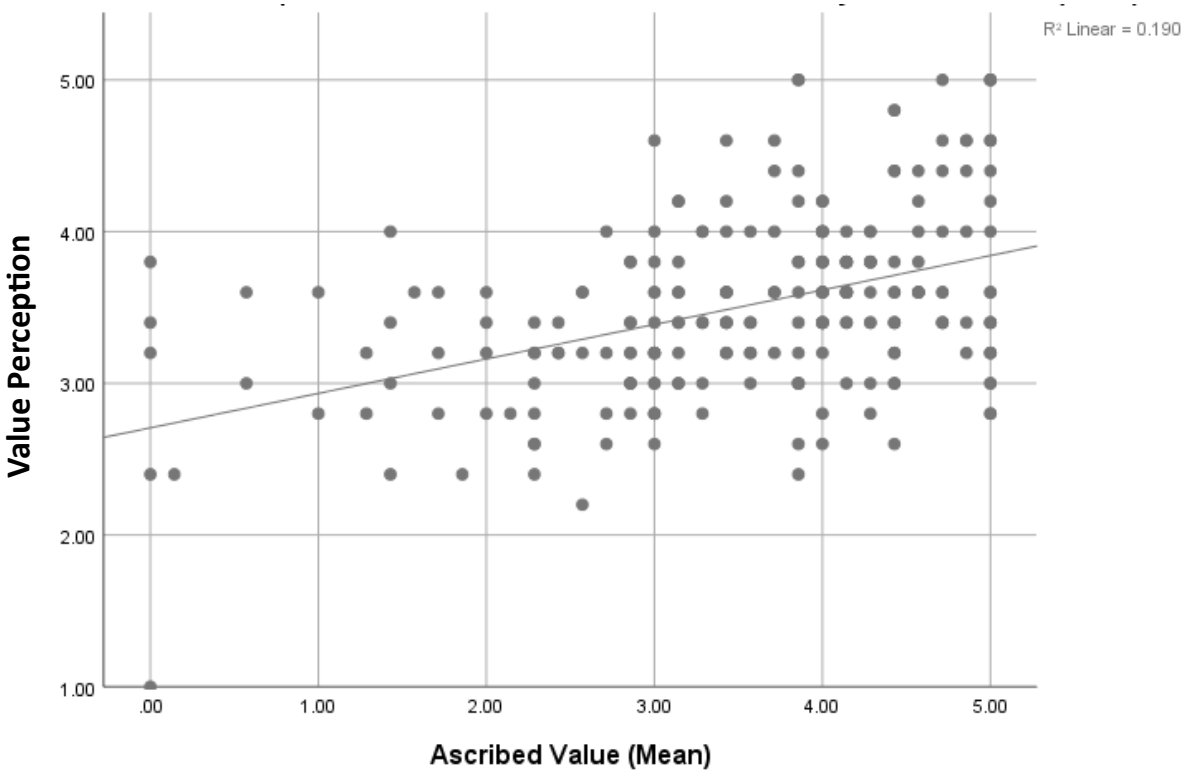
| | **Glass Bottles & Jars** | **Metal Cans & Drinks Containers** | **Plastic Bottles** | **Batteries** | **Paper & Card** | **Metal Foils & Trays** | **Plastic Pots & Trays** |
|---|---|---|---|---|---|---|---|
| **Median** | 4 | 4 | 4 | 4 | 4 | 4 | 3 |
| **Mode** | 5 | 5 | 5 | 5 | 5 | 4[a] | 3 |
| **Mean** | 3.82 | 3.79 | 3.58 | 3.48 | 3.42 | 3.39 | 3.17 |
| **Std. Dev.** | 1.298 | 1.319 | 1.413 | 1.555 | 1.471 | 1.407 | 1.458 |
| **Range** | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

a. Result is bimodal at 3 and 4

The mean Ascribed Value across all materials was 3.52 from a highest possible value of 5, with the mode 4. A mean result >0.001 indicates some value is ascribed to the materials. Thus, the results indicate consumers ascribe, and therefore recognise, a medium-high value across commonly recyclable materials.

A significant moderate positive correlation was observed between Ascribed Value and Value Perception using Kendall's Tau ($\tau b=0.298$, $\rho=<0.0001$) according to thresholds in Botsch (2011) (Figure 2). Thus, H1a and H1b are supported.

*Figure 2: Scatterplot illustrating the correlation of Value Perception with Ascribed Value*




### 4.3 Internal Reliability and Validity

An assessment of factor loadings across all model measurement items returned one item with a factor loading <0.5 (VP3) (Table 3) which would ordinarily be removed from the analysis

(Hair et al., 2019) prior to structural model analysis. However, this item was retained as Hair et al., (2017) asserts that loadings between >0.40 and <0.7 are commonly experienced in exploratory studies. Furthermore, analysis within Smart PLS indicated internal consistency and convergent validity could not be increased by removing VP3. However, it is acknowledged that the reliability of results for VP may be lower than the established measures. Descriptive statistics for and correlations between measures are provided in Table 4.

*Table 3: Construct Reliability and Validity Indications*

| | | **Indicator Reliability** | **Internal Consistency** | | **Convergent Validity** |
|---|---|---|---|---|---|
| **Construct** | **Item** | **Factor loadings** | **Cronbach's Alpha** | **Composite Reliability (CR)** | **Average Variance Extracted (AVE)** |
| | | >0.50 | >0.60 | >0.70 | >0.50 |
| Recycling Behaviour | RB1 | 0.872 | 0.748 | 0.840 | 0.57 |
| | RB2 | 0.861 | | | |
| | RB3 | 0.770 | | | |
| | RB4 | 0.755 | | | |
| Attiutude | AT1 | 0.766 | 0.637 | 0.846 | 0.734 |
| | AT3 | 0.768 | | | |
| | AT4 | 0.839 | | | |
| | AT5 | 0.631 | | | |
| Subjective Norms | SN1 | 0.692 | 0.621 | 0.835 | 0.717 |
| | SN2 | 0.878 | | | |
| | SN3 | 0.824 | | | |
| Moral Norms | MN1 | 0.832 | 0.799 | 0.864 | 0.565 |
| | MN2 | 0.859 | | | |
| | MN3 | 0.859 | | | |
| Available Infrastructure | AI1 | 0.854 | 0.808 | 0.886 | 0.722 |
| | AI2 | 0.859 | | | |
| Cost of Recycling | CR1 | 0.776 | 0.831 | 0.888 | 0.666 |
| | CR2 | 0.912 | | | |
| Environmental Awareness | EA1 | 0.798 | 0.735 | 0.842 | 0.643 |
| | EA2 | 0.521 | | | |
| | EA3 | 0.847 | | | |
| | EA4 | 0.726 | | | |
| | EA5 | 0.821 | | | |
| Value Perception | VP1 | 0.777 | 0.694 | 0.779 | *0.425* |
| | VP2 | 0.660 | | | |
| | VP3 | *0.416* | | | |
| | VP4 | 0.552 | | | |
| | VP5 | 0.778 | | | |

To test the validity of the measurement model, internal consistency was evaluated using Cronbach's Alpha and Composite Reliability (CR) (Table 2). Cronbach's Alpha ranges between 0.831 and 0.621: as each construct has fewer than ten measurement items a Cronbach's Alpha of 0.6 is considered an acceptable threshold (Ursachi et al., 2015; Pallant, 2021) and all items fall in this range. CR values ranged between 0.888 and 0.779, exceeding the recommended threshold of 0.70 (Hair et al., 2010) indicating reliability of the measurement model. Convergent validity was tested to further assess internal reliability using Average Variance Expected (AVE) which indicates how much of the variance within the construct is explained by the measurement items. AVE is recommended to be >0.50 (Hair et al., 2019), and all items exceed this threshold except for Value Perception. However, Fornell and Larcker (1981) posit that AVE scores >0.4 can be considered significant if CR is >0.7, thus Value Perception is also considered significant.

*Table 4 Descriptive statistics for measurement items*

| Construct | Measurement Item | Range | Minimum | Maximum | Mean | Standard Dev |
|---|---|---|---|---|---|---|
| Attitude | AT1 - I believe that my recycling behaviour will reduce the volume of waste going to landfills | 4 | 1 | 5 | 4.26 | 0.759 |
| | AT2 - I believe that my recycling behaviour will help conserve natural resources | 4 | 1 | 5 | 3.89 | 0.839 |
| | AT3 - I feel good about myself when I recycle | 4 | 1 | 5 | 3.96 | 0.753 |
| | AT4 - I feel responsible when I recycle | 4 | 1 | 5 | 4.25 | 0.642 |
| | AT5 - I am interested in recycling my household waste | 4 | 1 | 5 | 4.15 | 0.793 |
| Available Infrastructure | AI1- I am familiar with the recycling facilities in my area | 4 | 1 | 5 | 3.79 | 1.015 |
| | AI2 - I am familiar with the materials accepted for recycling in the recycling facilities in my area | 4 | 1 | 5 | 3.92 | 0.901 |
| Cost of Recycling | CR1 - I have enough space to store the materials for recycling | 4 | 1 | 5 | 3.63 | 1.148 |
| | CR2 - I have enough time to sort the materials for recycling | 4 | 1 | 5 | 4.06 | 0.836 |
| Environmental Awareness | EA1 - Recycling is a major way to reduce pollution | 4 | 1 | 5 | 3.86 | 0.852 |
| | EA2 - Recycling is a major way to reduce wasteful use of landfills | 4 | 1 | 5 | 4.41 | 0.860 |
| | EA3 - Recycling is a major way to conserve natural resources | 4 | 1 | 5 | 4.00 | 0.816 |
| | EA4 - Recycling saves energy | 4 | 1 | 5 | 3.69 | 0.859 |
| | EA5 - Recycling will help provide a better environment for next generation | 4 | 1 | 5 | 4.23 | 0.724 |
| Moral Norms | MN1 - It would be wrong of me not to recycle my recyclable materials | 4 | 1 | 5 | 4.33 | 0.706 |
| | MN2 - I would feel guilty if I did not recycle my recyclable materials | 4 | 1 | 5 | 4.22 | 0.855 |
| | MN3 - Not recycling goes against my principles | 4 | 1 | 5 | 4.03 | 0.848 |
| Recycling Behaviour | RB1 - I usually separate my waste and recycle all possible materials; | 4 | 1 | 5 | 4.31 | 0.738 |
| | RB2 - I make an effort to recycle all possible materials | 4 | 1 | 5 | 4.31 | 0.806 |
| | RB3 - I strictly follow local guidance on the separation and disposal of recyclable materials | 4 | 1 | 5 | 3.94 | 0.959 |
| | RB4 - I have practiced waste recycling for some time | 3 | 2 | 5 | 4.46 | 0.633 |
| Subjective Norms | SN1 -My family expects me to engage in recycling behaviour | 4 | 1 | 5 | 3.55 | 0.894 |
| | SN2 - Most people who are important to me recycle | 4 | 1 | 5 | 3.85 | 0.853 |
| | SN3 - Most people who are important to me would approve me engaging in recycling behaviour | 4 | 1 | 5 | 4.12 | 0.730 |
| Value Perception | VP1 - I recycle because recyclable materials can be reprocessed into new goods | 4 | 1 | 5 | 4.19 | 0.612 |
| | VP2 - I recycle because recyclable materials can be sold on for reuse | 4 | 1 | 5 | 3.22 | 1.035 |
| | VP3 - I am more likely to recycle recyclable materials that I perceive to be valuable | 4 | 1 | 5 | 3.00 | 1.149 |
| | VP4 - I recycle because recyclable materials have a monetary value | 4 | 1 | 5 | 2.72 | 0.943 |
| | VP5 - I recycle because recycling helps to protect the environment | 4 | 1 | 5 | 4.41 | 0.656 |

### 4.4 Discriminant Validity

Fornell and Larkers (1981) Criterion was used to determine discriminant validity (Table 5). This criterion tests relationships between constructs to identify that theoretically unrelated measures are indeed unrelated and testing their intended construct. Fornell and Larker's Criterion asserts validity is established if the correlation between any two constructs is lower than the square root of the AVE (emboldened). Correlation values are below the construct AVE square root except between Value Perception and both Environmental Awareness and Attitude: consequently, further analysis using Heterotrait-monotrait ratio analysis (HTMT) was performed.

*Table 5: Discriminant Validity Calculations: Fornell and Larker's Criterion and HTMT analysis*

| Fornell and Larker's Criterion | Attitude | Available Infrastructure | Cost of Recycling | Environmental Awareness | Moral Norms | Recycling Behaviour | Subjective Norms | Value Perception |
|---|---|---|---|---|---|---|---|---|
| **Attitude** | **0.755** | | | | | | | |
| **Available Infrastructure** | 0.254 | **0.857** | | | | | | |
| **Cost of Recycling** | 0.387 | 0.353 | **0.847** | | | | | |
| **Environmental Awareness** | 0.674 | 0.269 | 0.366 | **0.752** | | | | |
| **Moral Norms** | 0.674 | 0.359 | 0.453 | 0.567 | **0.850** | | | |
| **Recycling Behaviour** | 0.486 | 0.557 | 0.577 | 0.440 | 0.711 | **0.816** | | |
| **Subjective Norms** | 0.388 | 0.238 | 0.269 | 0.303 | 0.367 | 0.222 | **0.802** | |
| **Value Perception** | *0.656* | 0.234 | 0.302 | *0.734* | 0.558 | 0.440 | 0.333 | **0.652** |

Note: Square root of each construct is emboldened above, figures in italics indicate where discriminant validity is not observed

| HTMT | Attitude | Available Infrastructure | Cost of Recycling | Environmental Awareness | Moral Norms | Recycling Behaviour | Subjective Norms | Value Perception |
|---|---|---|---|---|---|---|---|---|
| **Attitude** | | | | | | | | |
| **Available Infrastructure** | 0.345 | | | | | | | |
| **Cost of Recycling** | 0.524 | 0.561 | | | | | | |
| **Environmental Awareness** | 0.849 | 0.392 | 0.521 | | | | | |
| **Moral Norms** | 0.868 | 0.496 | 0.618 | 0.709 | | | | |
| **Recycling Behaviour** | 0.592 | 0.768 | 0.774 | 0.543 | 0.865 | | | |
| **Subjective Norms** | 0.541 | 0.336 | 0.395 | 0.391 | 0.475 | 0.27 | | |
| **Value Perception** | 0.758 | 0.311 | 0.401 | 0.893 | 0.58 | 0.495 | 0.411 | |

Note: in HTMT discriminant validity is indicated by results <0.90

HTMT, introduced by Henseler et al (2015), is regarded as a more sensitive measure for confirming discriminant validity with smaller sample sizes (Hair et al., 2017) as in this study. Whilst a threshold of <0.85 is considered generally reliable for HMTM (Hair et al., 2017), Hair et al. (2022) provides that where possible similarities may exist between construct measures, as in exploratory studies such as this, values < .90 are sufficient to indicate that discriminant

validity has been achieved. Cross-loadings for measurement items were analysed and, one item was identified with a difference <0.1 (AT2), and as recommended by Hair et al., (2017) this item was removed from all subsequent analysis. Consequently, HTMT for all constructs measured between 0.893 and 0.270, indicating discriminant validity was established. Discriminant validity between Environmental Awareness and Attitude (0.849) and Environmental Awareness and Value Perception (0.893) could be considered poor, however, within the exploratory context of this study, these results are considered acceptable. All results reported hereafter exclude AT2.

A review of the Pearson correlation of the model constructs indicates that all are significantly positively correlated with one another, with correlation values ranging from a very high correlation between Environmental Awareness and Attitude ($r$ =0.732, ρ<0.001), to a very low correlation between Value Perception and Available Infrastructure ($r$ =0.193, ρ<0.001) (Table 6).

*Table 6: Pearsons correlation between constructs*

| | Attitude | Available Infrastructure | Cost of Recycling | Environmental Awareness | Moral Norms | Recycling Behaviour | Subjective Norms | Value Perception |
|---|---|---|---|---|---|---|---|---|
| Attitude | 1 | | | | | | | |
| Available Infrastructure | .257** | 1 | | | | | | |
| Cost of Recycling | .352** | .349** | 1 | | | | | |
| Environmental Awareness | .732** | .289** | .360** | 1 | | | | |
| Moral Norms | .692** | .360** | .421** | .561** | 1 | | | |
| Recycling Behaviour | .485** | .564** | .542** | .435** | .708** | 1 | | |
| Subjective Norms | .374** | .230** | .261** | .291** | .359** | .214** | 1 | |
| Value Perception | .529** | .193** | .201** | .608** | .363** | .256** | .260** | 1 |

**. Correlation is significant at the 0.01 level (2-tailed).

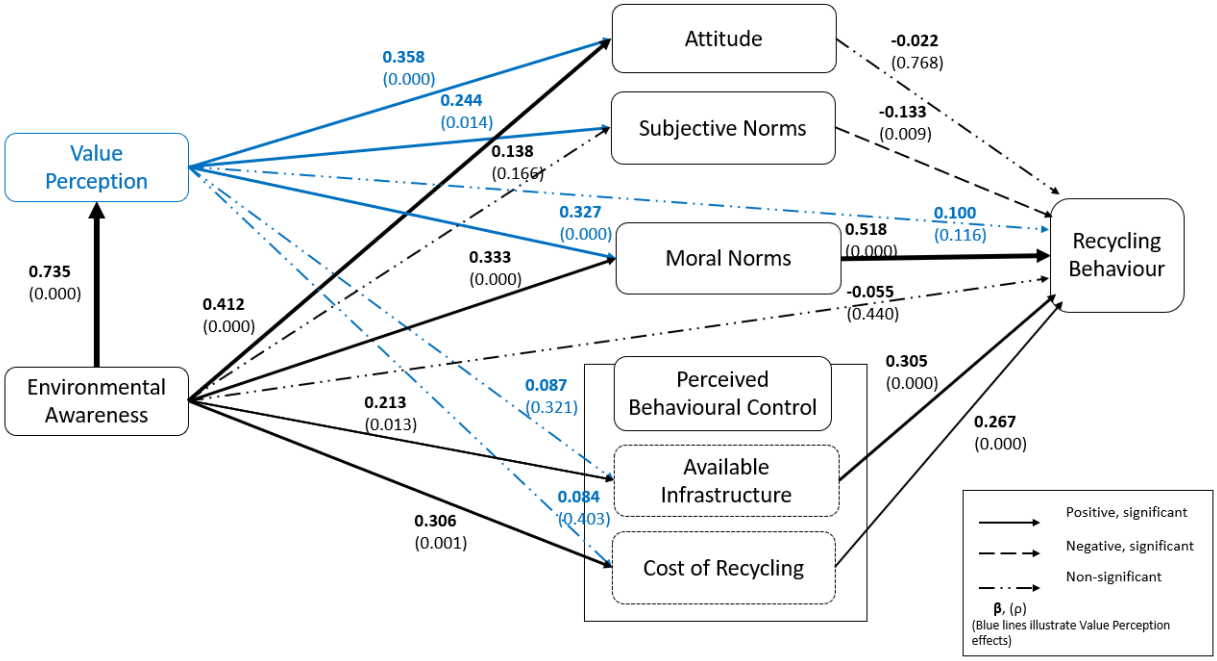
### 4.5 Structural Model Testing

To test the hypotheses for objective two, the structural model was tested using a bootstrapping approach with a sample of 5,000 as recommended by Hair et al. (2017). The results are presented in Table 7 and Figure 3.

*Table 7: Structural Model Assessment Summary*

| | Relationship | Std Beta (β) | Std Error | T-Values | p Values | Hypothesis Decision | $R^2$ | $F^2$ | $Q^2$ |
|---|---|---|---|---|---|---|---|---|---|
| | | >0.2 | | >1.96 | <0.05 | | | | |
| H2a | Attitude -> Recycling Behaviour | -0.022 | 0.073 | 0.295 | 0.768 | Not Supported | 0.672 | 0.001 | 0.185 |
| H2b | Subjective Norm -> Recycling Behaviour | -0.133 | 0.051 | 2.597 | 0.009 | Not Supported | | 0.043 | |
| H2c | Available Infrastructure -> Recycling Behaviour | 0.305 | 0.053 | 5.699 | 0.000 | Supported | | 0.231 | |
| H2d | Cost of Recycling -> Recycling Behaviour | 0.267 | 0.054 | 4.978 | 0.000 | Supported | | 0.159 | |
| H3 | Moral Norm -> Recycling Behaviour | 0.518 | 0.058 | 8.968 | 0.000 | Supported | | 0.373 | |
| H4a | Environmental Awareness -> Recycling Behaviour | -0.055 | 0.071 | 0.773 | 0.440 | Not Supported | | 0.004 | |
| H4b | Environmental Awareness -> Value Perception | 0.735 | 0.039 | 18.779 | 0.000 | Supported | 0.540 | 1.174 | 0.531 |
| H4c | Environmental Awareness -> Attitude | 0.412 | 0.066 | 6.203 | 0.000 | Supported | 0.514 | 0.161 | 0.445 |
| H4d | Environmental Awareness -> Subjective Norms | 0.138 | 0.099 | 1.386 | 0.166 | Supported | 0.128 | 0.010 | 0.088 |
| H4e | Environmental Awareness -> Moral Norms | 0.333 | 0.087 | 3.840 | 0.000 | Supported | 0.378 | 0.082 | 0.320 |
| H4f | Environmental Awareness -> Available Infrastructure | 0.213 | 0.086 | 2.473 | 0.013 | Supported | 0.080 | 0.023 | 0.064 |
| H4g | Environmental Awareness -> Cost of Recycling | 0.306 | 0.092 | 3.324 | 0.001 | Supported | 0.138 | 0.050 | 0.127 |
| H5a | Value Perception -> Recycling Behaviour | 0.100 | 0.063 | 1.574 | 0.116 | Not Supported | | 0.012 | |
| H5b | Value Perception -> Attitude | 0.358 | 0.074 | 4.824 | 0.000 | Supported | | 0.121 | |
| H5c | Value Perception -> Subjective Norms | 0.244 | 0.099 | 2.455 | 0.014 | Not Supported | | 0.031 | |
| H5d | Value Perception -> Moral Norms | 0.327 | 0.085 | 3.867 | 0.000 | Supported | | 0.079 | |
| H5e | Value Perception -> Available Infrastructure | 0.087 | 0.088 | 0.992 | 0.321 | Supported | | 0.004 | |
| H5f | Value Perception -> Cost of Recycling | 0.084 | 0.100 | 0.836 | 0.403 | Not Supported | | 0.004 | |

*Figure 3: Results of the Structural Model Assessment*




All determinants of recycling behaviour were assessed, and it is observed that Moral Norms (β=0.518, ρ=<0.001), Available Infrastructure (β= 0.305, ρ=<0.001), and Cost of Recycling (β=0.267, ρ=<0.001) are positively related to recycling behaviour, whilst Subjective Norms (β= -0.113, ρ=0.009) was found to have significant negative relationship, together accounting for 67% of the variance of recycling behaviour. Attitude (β=-0.022, ρ=0.768) was found to

have an insignificant relationship to recycling behaviour. Thus H2c, H2d and H3 were supported, but H2a and H2b were not.

Environmental Awareness was identified as positively related to both Value Perception (β=0.735, ρ=<0.001) and Attitude (β=0.412, ρ=<0.001). Therefore, both H4b and H4c are supported. Non-significant relationships were observed between Environmental Awareness and Recycling Behaviour (β=-0.055, ρ=0.440) and Subjective norms (β=0.138, ρ=0.166), therefore H4a and is not supported, and H4d is. Significant positive relationships were observed between Environmental Awareness and Moral Norms (β=0.333, ρ=<0.001), Available Infrastructure (β=0.213, ρ=0.013), and Cost of recycling (β=0.306, ρ=0.001), thus H4e, H4f and H4g are supported.

Analysis of Value Perception shows no significant relationship between Value Perception and Recycling Behaviour (β=0.100, ρ=0.116), consequently, H5a is not supported. Significant positive relationships were found with Attitude (β=0.358, ρ=<0.001), Subjective Norms (β=0.244, ρ=0.014) and Moral Norms (β=0.327, ρ=<0.001), and thus H5b and H5d are supported, but H5b is not. Value Perception was found to have a non-significant relationship with either Available Infrastructure (β=0.087, ρ=0.321), or Cost of Recycling (β=0.084, ρ=0.4031), and so H5e is supported whilst H5f is not.

Mediation analysis was undertaken to explore the mediating effects in the relationships between of Value Perception and Environmental Awareness on Recycling Behaviour. The results (Table 8) revealed a significant positive effect of Value Perception on Recycling Behaviour when mediated by Moral Norms (β=0.170, ρ=0.001)), and that Environmental Awareness has a significant positive relationship with Recycling Behaviour mediated by Value Perception and Moral Norms (β=0.125, ρ=0.001). Furthermore, Environmental Awareness also has significant positive relationships with Recycling Behaviour mediated through Moral

Norms (β=0.173, ρ=<0.001), Available Infrastructure (β=0.065, ρ=<0.023), and Cost of Recycling (β=0.082, ρ=0.006).

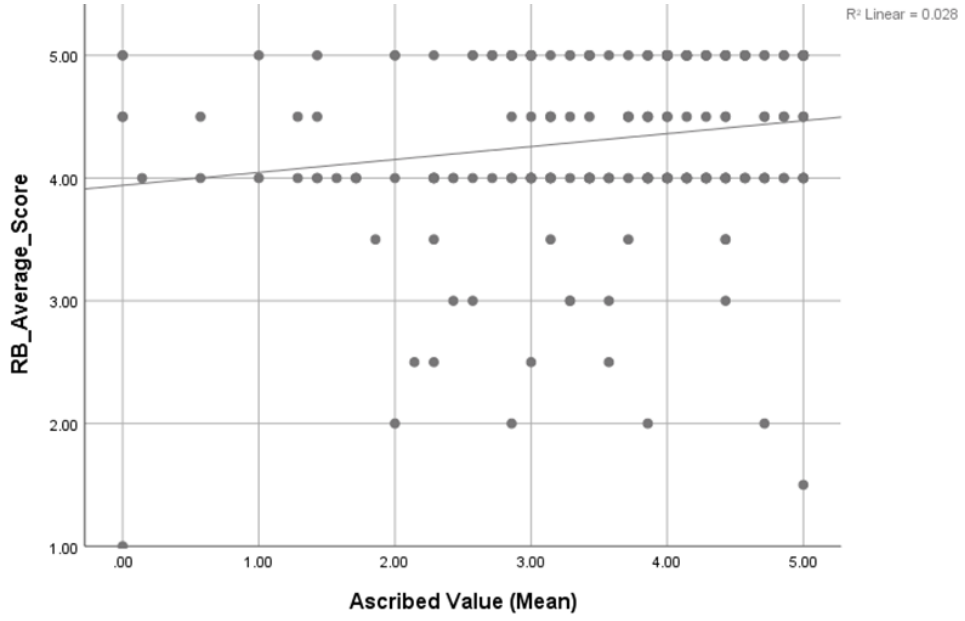
*Table 8: Results of Mediation Analysis*

| Relationship | Total Effects | | | Direct Effect | | | Indirect Effect | | | | Confidence Level | | Mediation Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | t | ρ | β | t | ρ | β | Std Error | t | ρ | Low 2.5% | High 97.5% | |
| Value Perception -> Moral Norms -> Recycling Behaviour | 0.278 | 2.960 | 0.003 | 0.100 | 1.574 | 0.116 | 0.170 | 0.051 | 3.311 | 0.001 | 0.079 | 0.281 | Full |
| Environmental Awareness-> Value Perception -> Moral Norms -> Recycling Behaviour | 0.441 | 6.615 | 0.000 | -0.055 | 0.773 | 0.440 | 0.125 | 0.039 | 3.190 | 0.001 | 0.058 | 0.212 | Full |
| Environmental Awareness-> Moral Norms -> Recycling Behaviour | 0.441 | 6.615 | 0.000 | -0.055 | 0.773 | 0.440 | 0.173 | 0.049 | 3.548 | 0.000 | 0.087 | 0.279 | Full |
| Environmental Awareness-> Cost of Recycling -> Recycling Behaviour | 0.441 | 6.615 | 0.000 | -0.055 | 0.773 | 0.440 | 0.082 | 0.030 | 2.746 | 0.006 | 0.033 | 0.154 | Full |
| Environmental Awareness-> Available Infrastructure -> Recycling Behaviour | 0.441 | 6.615 | 0.000 | -0.055 | 0.773 | 0.440 | 0.065 | 0.029 | 2.268 | 0.023 | 0.014 | 0.128 | Full |

## 4.6 Ascribed Value and Recycling Behaviour

Spearman's Rho was calculated for Ascribed Value and Recycling Behaviour and a significant positive correlation was observed between the variables (r=0.170,ρ=0.010). Whilst, H6 is supported, the correlation is weak (Figure 4) (Dancey and Reidey, 2007).

*Figure 4: Scatterplot illustrating the correlation between Ascribed Value and Recycling Behaviour*



Furthermore, analysis using Kendall's Tau revealed weak significant positive relationships between RB and both AV and VP Kendall's Tau (Table 9).

*Table 9: Kendall's Tau-b (τb) results for Ascribed Value, Recycling Behaviour, and Value Perception*

| | Ascribed Value (AV) | Recycling Behaviour (RB) | Value Perception (VP) |
|---|---|---|---|
| **Ascribed Value (AV)** | | .132* | .298** |
| | | 0.011 | 0.000 |
| **Recycling Behaviour (RB)** | .132* | | .144** |
| | 0.011 | | 0.007 |
| **Value Perception (VP)** | .298** | .144** | |
| | 0.000 | 0.007 | |

## 5. Discussion

This study examined household recycling behaviours amongst residents of Newcastle using an extended TPB model containing a novel Value Perception construct to explore whether CPV of recyclable waste positively influences recycling behaviours. It was hypothesised that respondents would recognise value in recyclable wastes, and respondents' self-reported Ascribed Value (to materials) is positively correlated to Value Perception, and that Ascribed Value would be positively correlated with Recycling Behaviour. It was also hypothesised that TPB constructs of Attitudes, Subjective Norms, Moral Norms, Available Infrastructure and Cost of Recycling would all positively influence Recycling Behaviour. Additionally, it was hypothesised that respondents' Environmental Awareness, would directly influence Recycling Behaviour as well as Value Perception, Attitude, Moral Norms, Available Infrastructure and Cost of recycling, and Value Perception, and no relationship would be present with Subjective Norms. Finally, hypotheses relating to the Value Perception variable held that there would be

a positive relationship with Recycling Behaviour, Attitude, Moral Norms, and Cost of Recycling but no relationship would be present with Subjective Norms or Available Infrastructure.

The results indicate that CPV is recognised across all commonly recyclable materials as illustrated by the Ascribed Value across materials (mean = 3.520, mode = 4, where 1 indicates minimal value and 5 high value. A moderate ($\tau b$=0.298, $\rho$=<0.001) correlation is observed between Ascribed Value and Value Perception using Kendall's Tau which suggests that the Value Perception construct reflects the amount of Ascribed Value reported. This result is important, as the CPV of household recyclables has not before been ascertained in the literature and provides new insights into how people think about recycling and material value. Based on these positive results, additional qualitative analysis of the types of Ascribed Value of different materials is recommended to elucidate their roles in influencing Value Perception.

Analysis of the theoretical model suggests that Value Perception does not directly influence Recycling Behaviour due to the non-significant impact observed ($\beta$=0.100, $\rho$=0.116), which may indicate either that the null-hypothesis is supported i.e., Value Perception has no direct effect on recycling behaviour, or that the data is insufficient to support the proposed hypothesis (Visentin et al. 2020), though as internal reliability and validity and discriminant validity was established the latter cannot be assumed. Value Perception is observed to have a significant positive influence on Attitude yet Attitude itself has a non-significant influence on recycling behaviour ($\beta$=-0.022,p=0.768). Whilst this appears paradoxical given 93% of respondents reported positive recycling behaviour, an 'Attitude-Behaviour gap' is widely acknowledged in TBP in which positive attitudes are expressed but not acted upon (Caruana et al., 2016). Consequently low-significance or non-significant influences from Attitude are commonplace in recycling studies (Wang et al., 2016; Juliana et al., 2022). This suggests whilst value is perceived, and informs attitudes, there may be unknown barriers to attitudes translating into

positive behaviours, or the study sample may have diverse beliefs underlying Attitudes which produce an insignificant result, as observed by Armitage and Conner (2001). The literature is divided on whether Moral Norms is interchangeable with Attitude (Wan et al., 2017), however commonly observed low discriminant validity in studies to support the view that it may be (Kaiser, 2006). Mediation analysis showed that Moral Norms has a positive mediating effect on Value Perception on Recycling Behaviour (β=0.170, ρ=0.001). This result, along with the slight negative effect of Subjective Norms on Recycling Behaviour (β=-0.133, ρ=0.009), indicates that respondents' self-accountability and self-imposed beliefs about right and wrong behaviour rather than social pressures drives positive recycling behaviour. Botetzagias et al. (2015) research into the role of Moral Norms proposes that the normalisation of recycling through long-term exposure may reduce the influence of Subjective Norms, as social effects become internalised and no longer influenced by social pressures.

Perceived Behavioural Control frequently has the strongest influence over behaviours (Ajzen, 1991), and this result is common in the recycling literature (Geiger et al., 2019). The results show that Perceived Behavioural Control has a significant positive influence on recycling behaviour, and Knussen et al. (2004) posit this reflects an established, well understood and easy to access recycling infrastructure, as existent in Newcastle. Value Perception was found to have non-significant effects on both Available Infrastructure (β=-0.087,ρ=0.321) and Cost of Recycling (β=-0.084,ρ=0.403) which suggests that Value Perception does not influence perceptions of recycling infrastructure of or the ease of carrying out recycling.

Like Value Perception, the direct influence of Environmental Awareness on Recycling Behaviour was found to be non-significant suggesting that any influence on recycling behaviour is moderated through other constructs. Environmental Awareness was found to have a strong effect on Value Perception (β=-0.735, ρ=<0.001), which suggests that those respondents who have a greater awareness of environmental issues are more likely to recognise

value in materials and further investigation of this relationship may offer opportunity additional insights into CPV in future. Environmental Awareness was found to have more significant indirect effects on Recycling Behaviour through mediators than Value Perception which suggests that environmental awareness and beliefs may have a more complex influence on positive recycling behaviours than Value Perception.

As the discriminant validity between Value Perception, Attitude, and Environmental Awareness are close to, but within, accepted thresholds identified through internal reliability and validity testing, this may contribute to the insignificant relationships observed (Hair et al., 2013), consequently, further validation of Value Perception measures alongside those for Environmental Awareness and Attitude is recommended to better understand the role of Value Perception on recycling behaviours.

The results from the structural model assessment along with the weak significant correlation between results indicate that as Ascribed Value does not readily translate into positive recycling behaviours, the current UK recycling strategy which focusses on the value of recyclables as a driver for increasing recycling, is likely to have limited success. Further exploration of the impact of different types of value ascribed to household recyclables is recommended to establish means by which CPV could be leveraged to increase positive recycling behaviours.

Nonetheless, the model has been shown to have predictive relevance, which presents this study as a basis for future research on the potential influence of CPV on positive recycling behaviours. The results suggest that encouraging the public to link value to recycling behaviours directly may be insufficient to achieve local or national recycling ambitions, and so a more nuanced approach is likely to be needed. Two policy recommendations to increase recycling rates via CPV emerge: firstly, as value is recognised and influences recycling behaviour though Moral Norms, recycling messaging and campaigns which target positive recycling behaviours would be most effective if they appeal to self-accountability and moral

imperative as advocated by Chan and Bishop (2013). Secondly, as Environmental Awareness has a positive effect in recycling through Value Perception and Moral Norm, raising awareness of environmental impacts, including the value that can be gained from materials being recycled should be considered.

### 5.1 Theoretical Contribution

The results of this study support the appropriateness of an extended TPB model for the investigation of recycling behaviour, and in introducing a Value Perception construct, offers a novel contribution to consumer recycling behaviour literature. This study has generated new insights which increase understanding of the complex drivers of consumer recycling, both generally and specific to Newcastle. This study offers a basis for further exploration of the role CPV may have in stimulating recycling behaviour to realise government ambitions, and for informing approaches employed in campaigns and initiatives to encourage recycling.

### 5.2 Limitations and Future Work

A number of limitations emerged alongside recommendations for future research. As illustrated by the sample demographics which are skewed towards females, those living in three postcodes, those aged 30-49, and with an interest in recycling, opportunistic sampling can result in skewed samples, which may reduce the validity of the results. Future studies would benefit from a larger, more representative sample, enabling more nuanced insights and reducing the likelihood of non-significant results (Andrade, 2020). Furthermore, this study focussed on Newcastle, an area with notably low recycling rates: by focusing on one city, the findings may not be applicable to other geographies, even within the same region. Nevertheless, this study recognised the gap in recent studies of regional recycling rate variations and provides a basis for comparison studies in other areas, to explore and contrast

recycling behaviour and the role of CPV in areas. A limitation of the TPB model is that it is intended to draw conclusions about behaviours through intentions, yet as studies have adapted the measures to include behaviour, for example, Juliana et al. (2022), this may result in an overstatement of behaviours being enacted which should be considered when reviewing findings. Furthermore, introducing a novel TPB construct with previously untested measurement items risks introducing reliability issues, as indicated by the Fornell and Larkers and HTMT results observed which whilst indicating relatability, highlight some potential weaknesses which could be reviewed, for example assessments of collinearity. Similarly, adaptation of existing validated measures to suit the study context introduces scope for misinterpretation affecting the results (Wang et al., 2018). Therefore, for future studies, additional testing of Value Perception measure items should be undertaken to develop a robust set of validated items, with testing through observational studies where true behaviours can be measured (Armitage & Conner, 2001).

## 6. Conclusion

As English rhetoric on waste shifts towards valuing materials and retaining recyclables in a circular value chain to meet recycling ambitions, it is pivotal to understand how consumer perception of recyclable materials' value influences recycling. This study has made the first attempt to understand the role of CPV on recycling behaviour in Newcastle using an extended version of Ajzen's (1985) TPB model, which explored the influence of Attitude, Subjective Norms, Perceived Behavioural Control, Moral Norms, Environmental Awareness, and a novel construct for Value Perception on recycling behaviour. The results indicate that consumers do ascribe value to recyclable materials, however, Value Perception does not directly influence Recycling Behaviours, but it does influence recycling behaviours through Moral Norms. Attitudes towards recycling were found to have no influence, and Subjective Norms a minor

negative effect on Recycling Behaviour. Value Perception and Environmental Awareness were found to positively influence Attitude, yet neither Attitude nor Value Perception was found to influence Recycling Behaviour. Environmental Awareness has a strong positive influence on Value Perception suggesting environmental value may be perceived. These findings offer new insights for ecopsychology by expanding the literature on how people's attitudes towards the environment and beliefs about recycling shape their pro-environmental actions. Two key recommendations are proposed: (1) further refine the Value Perception construct, including testing measures relating to typologies of value from the literature outside of household waste which are known to stimulate recycling to explore the role of Value Perception on behaviours; and (2) interventions aimed at increasing recycling rates in Newcastle should target increasing environmental awareness and CPV, with emphasis on appealing to residents moral imperatives.

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