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Antecedents and outcomes of customer engagement with climate-friendly transportation services☆

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ABSTRACT

Despite widespread awareness of climate change, more environmentally friendly products often struggle to generate customer engagement (CE). To address this disconnect, the paper investigates the antecedents and outcomes of CE with climate-friendly services in the transportation sector through two empirical studies. Study 1 uses an online experiment (n = 261) to investigate CE with an e-cargo bike delivery service, employing PLS-SEM to test how openness-to-experience, conscientiousness, and message framing affect CE. Results show that both personality traits positively influence CE, and that altruistic message appeals generate significantly higher CE than egoistic appeals. CE, in turn, enhances consumer attitudes and purchase intentions. Study 2 (n = 400) extends the investigation to an EV hire service, testing the psychological mechanism underpinning message framing effects. It identifies that altruistic appeals enhance self-worth, which in turn increases CE with climate-friendly services. Together, the studies advance CE theory and offer guidance for designing communication strategies.

1. Introduction

Climate change represents an urgent global challenge, necessitating the need to reduce Greenhouse Gas (GHG) emissions across all sectors. Among these, transport is particularly critical, accounting for approximately 29% of all emissions in both Europe (EEA, 2024) and the USA (EPA, 2025). Within the transportation sector, road transport accounts for over 73% of emissions (EEA, 2024). Reducing GHG emissions from transportation, particularly road transportation, and transitioning toward more sustainable patterns of mobility, is thus vital for avoiding worst-case climate scenarios (Krüger & Tarach, 2022).

Two key technological innovations in transportation, namely e-cargo bikes and electric vehicles (EVs), present means to reduce carbon emissions from transportation, and are becoming more widespread. The global e-cargo bike market, for instance, is projected to grow from US $1.5 billion in 2022 to US$4.3 billion by 2030 (Grand View Research, 2023). E-cargo bikes, which can transport grocery shopping, other goods, and children, replacing many private cars and some van trips, can reduce CO_2 emissions by up to 90% compared to diesel vans used for last-mile deliveries (Verlinghieri et al., 2021) and could replace up to 77% of motorized shopping trips in urban areas (Carracedo & Mostofi, 2022). Similarly, EVs can reduce transport-related emissions by as much as 50% compared to conventional vehicles, even when accounting for emissions from the current electricity grid (IEA, 2023).

Despite clear environmental advantages, policy support, and high levels of climate change awareness among Western consumers (Lorenzoni & Pidgeon, 2006; Tobler et al., 2012), the uptake of climate-friendly transportation services remains limited, often failing to meet industry and stock market expectations (Zhang et al., 2024). Specifically, many offerings underperform commercially, struggling to achieve viable levels of customer uptake, retention, and engagement, thereby undermining both their financial viability and their environmental

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benefits.

Importantly, the environmental returns of these innovations depend less on their initial adoption than on their continued and consistent use over time (Buekers et al., 2014). Consequently, it is customer engagement, rather than initial uptake, that determines long-term value. This raises a critical question: at a time when firms face increasing pressure to demonstrate both environmental responsibility and economic return, how can businesses foster sustained engagement with services capable of meaningfully reducing environmental impacts?

The existing literature on Customer Engagement (CE) with climate-friendly products concentrates mainly on outcomes such as purchase intentions and usage (Kang & Moreno, 2020). For instance, much of this research concentrates on EVs' adoption, often drawing on the Theory of Planned Behavior, Diffusion of Innovation Theory, and the Technology Acceptance Model (Shanmugavel & Balakrishnan, 2023; Singh et al., 2020). These studies emphasize psychological, demographic, and contextual factors in explaining one-time adoption behaviors of climate-friendly products and services (Singh et al., 2020). However, systematic reviews and *meta*-analyses (Singh et al., 2020) reveal that CE theory (Hollebeek, 2011; Hollebeek et al., 2020; Hollebeek, Hammedi, et al., 2023) lacks application to climate-friendly transportation services. Consequently, the literature offers limited understanding of the cognitive, emotional, and behavioral investments consumers make in their interactions with climate-friendly products and services (Hollebeek, Hammedi, et al., 2023).

Moreover, while prior research focuses primarily on predicting one-time adoption, it pays limited attention to practical insights that support CE (Shanmugavel & Balakrishnan, 2023; Singh et al., 2020). Specifically, there is a lack of empirical evidence regarding the key antecedents of CE that managers can leverage to promote sustained use of sustainable transportation services. This represents a critical gap, as CE theory offers unique insights into the cognitive, emotional, and behavioral investments consumers make in their interactions with products and services (Hollebeek, Hammedi, et al., 2023).

This paper addresses these research gaps by applying CE theory to the underexplored transportation domain of climate-friendly services. It also identifies two key sets of antecedents influencing CE – dispositional psychological motivations (e.g., personality traits), and message framing in marketing communications – which are investigated through two interlinked studies. Study 1 investigates engagement in the context of an e-cargo bike delivery service and finds that the personality traits of openness-to-experience and conscientiousness are positively associated with CE, which in turn leads to more favorable attitudes and purchase intentions. Crucially, Study 1 establishes the superior efficacy of altruistic message appeals for fostering CE over egoistic appeals. Study 2 then builds upon this critical finding. It shifts the context to EV car hire services to confirm the consistency of the message appeal effect and, more importantly, theoretically extends the finding by investigating the underlying psychological mechanism. Both e-cargo bikes and EV car hire represent highly relevant services for real-world marketing applications, capable of generating both egoistic (e.g., convenience and cost savings) and altruistic (e.g., reduced carbon emissions and decreased urban air pollution) benefits. Consistent across both studies, altruistic message appeals elicit higher levels of CE than egoistic appeals. Drawing on self-worth theory (Crocker, 2010), Study 2 further demonstrates that altruistic appeals enhance consumers' self-worth in the context of climate-friendly services, which in turn strengthens CE.

Our work makes three main contributions to the literature. First, it responds to calls for the examination of "the theoretical interface of consumers' engagement with products, services, brands, or firms in an era of climate change" (Hollebeek, Filieri, et al., 2023, p.2). This recognizes that while there are substantial literatures relating to CE and the adoption of more climate-friendly patterns of consumption, consideration of their interaction is missing (Ojala, 2023). In responding to this research gap, we apply the CE model of Ndhlovu and Maree (2022), which incorporates the dimensions of absorption, affection, identification, and social connection and specifically considers a service context, to model the causes and consequences of engagement with climate-friendly services.

Second, we contribute to the wider literature on CE (Hollebeek et al., 2022), through a study of relations with personality traits. This responds to previous calls to better understand the psychological motivations of CE (An & Han, 2020; Hollebeek, Kulikovskaja, et al., 2023). Specifically, in Study 1, we focus on two of the "Big Five" personality traits (Hilbig et al., 2014; Zettler et al., 2022), namely conscientiousness, and openness-to-experience, which we conceptualize as important antecedents of CE with climate-friendly services. Empirical evidence, based on PLS-SEM analysis, validates hypothesized relationships.

Finally, the paper contributes to the literature regarding how marketing communications can affect CE with more climate-friendly services (Taufique, 2022). When promoting more sustainable alternatives, marketers can employ either altruistic or egoistic appeals (Birch et al., 2018; Fuller et al., 2022). For instance, organic food is sometimes promoted based on perceived health benefits to the consumer (egoistic appeal) or in other cases altruistically, as good for the environment (Septianto & Kemper, 2021). Likewise, e-cargo bike and EV hire services could be promoted using appeals to egoistic or altruistic benefits. For managers interested in determining which type of appeal is more effective, answers are not self-evident. For instance, altruistic appeals may appear more in keeping with climate related objectives but could reduce perceived personal relevance. Responding to this uncertainty, Studies 1 and 2 demonstrate that altruistic appeals work best for climate-friendly services. Study 2 extends this further by uncovering the underlying psychological process, based on the theory of self-worth (Crocker, 2010), through which altruistic message appeals stimulate greater CE for climate-friendly services.

2. Conceptual framework and hypotheses development

2.1. Customer engagement (CE) theory

The concept of CE has gained substantial attention from both scholars and practitioners in the marketing field (Hollebeek & Belk, 2021; Ndhlovu & Maree, 2022). Notably, the subject of CE is a pivotal research area (Marketing Science Institute, 2020, 2022). Within the CE literature, many studies seek to refine its conceptualization, and devise measurement scales adapted to diverse contexts (Hollebeek et al., 2014; Ndhlovu & Maree, 2022). The latter recognizes that the appropriate definition and measurement of CE may vary depending on the specific context (Brodie et al., 2011; Cuesta-Valiño et al., 2024; Hollebeek, 2011).

As our research focuses on climate-friendly transportation services, we employ the framework developed by Ndhlovu and Maree (2022), which presents a refined model and measurement scale for CE that is tailored to service-oriented settings. Following Ndhlovu and Maree (2022), CE is the psychological state and observable behaviors that arise from the collaborative process of value co-creation, resource integration, and service exchanges within consumer-brand interactive service systems. Previous studies established that CE entails mutually beneficial interactions between consumers and focal subjects such as brands, websites, or services (Brodie et al., 2019; Storbacka et al., 2016).

Echoing Ndhlovu and Maree (2022), we identify four dimensions of CE: affection, identification, absorption, and social connection. While the first three dimensions primarily capture consumers' psychological states, the fourth dimension encompasses both psychological and behavioral aspects. In the context of climate-friendly services, we define each dimension as follows. Affection refers to consumers' passionate, positive feelings towards specific interactions with the climate-friendly service (Hollebeek et al., 2014). Identification refers to the extent to which customers perceive themselves as aligned with, or belonging to, the climate-friendly service (So et al., 2014). Absorption indicates immersion and strong concentration during consumers' interactions with a

climate-friendly service (Dwivedi, 2015). Finally, social connection refers to interconnected customers who actively engage in value co-creation through interactions with the climate-friendly service (Ndhlovu & Maree, 2022).

In the contemporary marketing literature, fostering CE has become a key strategy for building and maintaining strong relationships between companies and their customers (Venkatesan, 2017). Recognizing its significance, prior studies examine the consequences of CE. For instance, Kumar and Pansari (2016) examine the role CE of in enhancing firm performance, Brodie et al. (2013) in fostering consumer loyalty, Vivek et al. (2014) in stimulating word-of-mouth communications, and (So et al., 2024) in enhancing customers' well-being. However, the effects of CE in the context of climate-friendly transportation services remain underexplored. In this study, we aim to first theorize two potential positive effects of CE. This approach establishes the importance of CE within the context of climate-friendly services.

2.2. Consequences of CE

The world faces pressing environmental challenges, such as climate change, which prompt greater interest in climate-friendly services (Singh et al., 2020). This research first addresses the critical question of how CE shapes consumer attitudes and influences their uptake of more sustainable services.

2.3. Influence of CE on consumer attitude towards climate-friendly services

Our research hypothesizes that CE positively influences consumer attitudes towards climate-friendly services, a claim supported by CE theory and previous studies (Hollebeek, 2011; Hollebeek et al., 2019). CE is characterized by focused thinking, feelings of passion, energy, enthusiasm, and activation (Hollebeek, 2011), with CE in turn contributing to positive attitudes toward service offerings (Bergel et al., 2019). Moreover, marketing studies establish that CE fosters favorable attitudes towards products, companies, and brands (Vivek et al., 2014). In social psychology, stronger engagement is associated with intensified motivational experiences, leading to more favorable attitudes (Higgins & Scholer, 2009). Therefore, we propose that:

H1a: CE is positively related with favorable consumer attitudes toward climate-friendly services.

2.4. Influence of CE on purchase intention towards climate-friendly services

Striving for consistency between attitudes and behaviors is a fundamental aspect of human psychology (Smith & Swinyard, 1983). Accordingly, we hypothesize that CE positively influences consumer purchase intentions toward climate-friendly services. Relationship marketing theory, which underpins much of the CE literature (Hollebeek, 2011), highlights the importance of interactions and relationships between value-generating stakeholders in shaping purchase intentions (Verhoef et al., 2010). Research in various contexts, though not specifically climate-friendly products, provides empirical support, finding a positive relationship between CE and purchase intentions (Prentice et al., 2019; Zheng et al., 2022). Additionally, engaged consumers often demonstrate higher levels of commitment (Hollebeek, 2011) and trust (So et al., 2014), which further drive purchasing behavior. This also aligns with social exchange theory, which posits that consumer engagement enhances perceived value, thereby encouraging purchases. Therefore, we propose that:

H1b: CE is positively related with consumer purchase intentions toward climate-friendly services.

2.5. Antecedents of CE

The current research examines two sets of factors influencing CE. First, we investigate the psychological motivations underpinning CE, addressing two of the "Big Five" personality traits (openness-to-experience and conscientiousness), in line with calls for a deeper understanding of CE's psychological drivers (Hollebeek, Kulikovskaja, et al., 2023). These traits represent enduring dispositional characteristics that directly influence individuals' behavior and shape their interactions with the environment (Hilbig et al., 2014). While previous studies highlighted the impact of personality traits on CE in online contexts (e.g., Ul Islam & Rahman, 2017), there is limited research on how these traits affect engagement with climate-friendly services. We specifically focus on conscientiousness and openness-to-experience, as these traits are most closely associated with climate-related behaviors (Brick & Lewis, 2016; Milfont & Sibley, 2012).

Second, we consider message framing as a contextual factor influencing CE, offering practical insights for marketers and policymakers. Effective message framing can significantly affect consumer perceptions, attitudes, and decisions (Kronrod et al., 2012; White & Peloza, 2009). The following sections discuss each antecedent of CE in the context of climate-friendly transportation services.

2.6. Influence of openness-to-experience on CE with climate-friendly services

Research on personality traits provides valuable insights into how individuals engage with innovative services and technologies. Openness-to-experience encompasses several key characteristics that shape consumer behavior, including intellectual curiosity, appreciation for novel ideas, and independent thinking (George & Zhou, 2001). Studies consistently show that individuals scoring high on this trait demonstrate greater willingness to adopt new products and services (McCrae & Costa, 1997). This innovative mindset manifests particularly strongly in digital environments, where such individuals actively participate in brand communities and engage extensively through social media platforms (Islam et al., 2019).

The emergence of climate-friendly transportation services, including e-cargo bikes and EV sharing, represents a significant development in addressing environmental sustainability challenges (Carracedo & Mostofi, 2022). These services have gained increasing prominence as policymakers worldwide emphasize "green logistics" initiatives in response to climate change concerns and energy resource constraints (Caggiani et al., 2021; Shanmugavel & Balakrishnan, 2023). Building on these insights, we propose that openness-to-experience plays a crucial role in the adoption of climate-friendly services. Individuals scoring highly on this trait characteristically embrace innovation and novel solutions, suggesting they would be particularly receptive to sustainable transportation alternatives that address both environmental concerns and mobility needs. Therefore, we propose that:

H2a: Openness-to-experience is positively associated with CE with climate-friendly services.

2.7. Influence of conscientiousness on CE with climate-friendly services

The relationship between personality traits and sustainable behavior offers valuable insights into the adoption of climate-friendly services. Conscientiousness, a fundamental personality trait, manifests through adherence to social norms, goal-directed behavior, and the capacity for long-term planning and delayed gratification (Roberts et al., 2014). Previous research consistently demonstrates that conscientious individuals tend to make more responsible health-related decisions and are more committed to fulfilling their obligations (Ross et al., 2009).

In the context of environmental challenges, innovative transportation solutions represent promising alternatives. E-cargo bikes and

EV sharing services offer mechanisms to reduce environmental impacts while addressing community transportation needs (Cooper et al., 2019), delivering both efficient and sustainable transportation (Lenz & Riehle, 2013; Shanmugavel & Balakrishnan, 2023). These electrically powered services can yield both immediate local benefits and long-term environmental advantages (Transport for London, 2009). The characteristics associated with conscientiousness suggest a natural alignment with sustainable transportation adoption. Conscientious individuals typically demonstrate a strong sense of responsibility (Milfont & Sibley, 2012) and carefully consider long-term implications of their choices (Kairys & Liniauskaite, 2015). This orientation toward future consequences positions them to appreciate the comprehensive environmental benefits of sustainable transportation, from reduced emissions to improved air quality (Narayanan & Antoniou, 2022). Therefore, we propose that:

H2b: Conscientiousness is positively associated with CE with climate-friendly services.

2.8. Influence of message appeal on CE with climate-friendly services: The role of self-worth

Effective marketing communications require clear and persuasive messages that protect and enhance the self (Alicke & Sedikides, 2009) while encouraging engagement (Kim et al., 2022; Kronrod et al., 2012). A commonly used framework distinguishes between egoistic appeals, which emphasize personal benefits, and altruistic appeals, which highlight societal or environmental benefits (White & Peloza, 2009). Our hypotheses examine which type of appeal more effectively drives CE with climate-friendly services and why.

We argue that altruistic appeals are more effective than egoistic appeals in encouraging CE with climate-friendly services. While egoistic appeals emphasize self-centered benefits, such as convenience or cost savings to the individual user, altruistic appeals highlight social and community benefits, such as reducing carbon emissions or supporting sustainability, aligning with altruistic motivations (Green & Peloza, 2014). Climate-friendly services inherently relate to socially responsible consumption, emphasizing positive environmental and societal outcomes (Berger & Corbin, 1992). Research indicates that socially responsible behaviors align with other-oriented values rather than self-interest (Webb et al., 2008). Consequently, altruistic appeals are more *congruent*, and thus persuasive, for promoting engagement with climate-friendly products (Rouf et al., 2025).

We propose further that the alignment between altruistic appeals and climate-friendly services enhances self-worth, which in turn fosters greater engagement with these services. According to conditional self-worth theory, the latter is a cognitive assessment, based on a person's perception of themselves as a valuable individual (Crocker & Wolfe, 2001). Important sources of self-worth include approval from others and contributing to society, heightening feelings of being a valuable and good person (Leary & Baumeister, 2000). Generally, individuals seek to maintain and enhance their self-worth (Alicke & Sedikides, 2009) and may seek to do so through consumption (Razmus & Laguna, 2024).

By emphasizing societal and environmental benefits, altruistic appeals can reinforce an individuals' feelings of being socially responsible, boosting assessments of self-worth (Schneider & Weber, 2022). Specifically, altruistic appeals prime alignment with socially admired values (Green & Peloza, 2014), enhancing perceived approval from others and societal contributions, increasing self-worth (Reed et al., 2007). Consequently, we expect altruistic appeals to be more effective than egoistic ones in promoting self-worth.

Furthermore, self-worth is an important driver of CE. When a consumer feels good about themselves because of their interaction with a good or service, they are likely to feel affinity, affection, and social connection with the stimuli (Hollebeek, 2013). For instance, when consumers connect with a company's social initiatives, it influences their self-concept, leading to enhanced loyalty, advocacy, and "extra-role" behaviors like citizenship (Bhattacharya & Sen, 2003). This reasoning is consistent with notions that increases in positive self-regard mediate the effect of values affirmation on prosocial behavioral intentions (Schneider & Weber, 2022). Consequently, we propose that:

H3a: Altruistic appeals (vs. egoistic appeals) will lead to a higher level of CE with climate-friendly services.
H3b: The positive impact of altruistic appeals on CE with climate-friendly services is mediated by enhanced self-worth.

3. Research methodology

This section describes the methodologies employed in two preliminary studies, undertaken prior to both Study 1 (context of an e-cargo bike delivery service), and Study 2 (context of EV hire service). The purpose of the preliminary studies was to develop the format of the advertisements used in the main studies. The first preliminary study was an intercept survey in the town of Hexham (North East England), conducted on two busy market days. Intercept studies are ideally suited to showing respondents real stimuli, and generate consumer data equivalent to, or superior in quality to, that from alternative means (Bush & Hair, 1985). At the point of interception (market town square), interviewers positioned an e-cargo bike, to help stimulate discussions and explain the service. The intercept survey collected responses from n = 87 shoppers (56% male, 35% aged 55–64, 40% 65 + years) on their mode of transport used for shopping, prior knowledge of e-cargo bikes (69% had seen an e-cargo bike previously), as well as potential reasons for using an e-cargo bike delivery service. The survey also identified salient egoistic (e.g., saving time whilst shopping, avoiding bespoke journeys to collect shopping, avoiding carrying heavy shopping bags, and purchasing larger volumes/ amounts of products) and altruistic (reducing fuel emissions and traffic congestion, and supporting local businesses) motivations for service adoption.

Having identified salient motivations, a second preliminary study piloted advertisements with relevant egoistic and altruistic messaging. One hundred UK adults (65.0% female, 35.0% male; M_{age} = 40.46), recruited from the Prolific research panel, participated in this online study for a nominal payment. At the outset of the study, participants received information regarding what an e-cargo bike is, to ensure they understood the concept. Participants were then randomly assigned to either the egoistic message or altruistic message appeals condition. We adapted methods from recent research (Luttrell & Petty, 2021) to manipulate messaging differently in each condition. Specifically, in the *egoistic message appeal* condition, participants read advertisement messages that highlighted egoistic benefits (e.g., saving you physical effort, saving you time), while in the *altruistic message appeal* condition, participants viewed the same advertisement but featuring altruistic benefits (e.g., good for our planet, good for our local businesses).

As part of the pilot studies, respondents completed a manipulation check question asking, "To what extent do you believe the message in the advertisement highlights either egoistic or altruistic benefits," on a 9-point scale (1 = "egoistic benefits," 9 = "altruistic benefits"). ANOVA results from SPSS validated the success of the message framing by indicating that participants in the altruistic message appeal condition reported a higher score (M = 6.46, SD = 1.76; F(1, 98) = 18.11; $p <$ 0.001), while those in the egoistic message appeal condition reported a significantly lower score (M = 4.82, SD = 2.08; F(1, 98) = 18.11; $p <$ 0.001). Therefore, the success of the message framing manipulation in the advertisements provided assurance of egoistic/altruistic message appeals in our studies.

The two main studies are interlinked. Study 1 focuses on e-cargo bike delivery and examines two key antecedents: dispositional psychological motivations (i.e., personality traits) and message framing (i.e., egoistic/altruistic message appeals) in marketing communications. It demonstrates the superiority of altruistic message appeal for fostering CE and how the latter influences consumer attitudes and purchase intentions.

Building on Study 1′s findings, Study 2 extends theory development regarding the antecedents and outcomes of CE with climate-friendly services. It does so by investigating the underlying mechanism behind the effectiveness of altruistic appeals, proposing that enhanced self-worth mediates their impact on engagement. Drawing on the theory of self-worth (Crocker, 2010; Crocker & Wolfe, 2001), Study 2 contrasts with prior research that attributes the success of altruistic appeals to public accountability (Green & Peloza, 2014), arguing instead that, in the context of climate-friendly transportation services, engagement is driven by increased self-worth. Study 2 also extends the examination of message appeals to the context of EV car hire, enhancing the generalizability of this strategy for marketers and policymakers.

3.1. Study 1

3.1.1. Data collection

A fresh sample of 261 UK adults recruited via Prolific took part in Study 1 in exchange for payment (see Table 1 for sample profile). In the study, we captured six constructs outlined in our conceptual model (see Fig. 1), namely: advertising message appeal (altruistic versus egoistic), consumer attitude, consumer purchase intention, CE (including the four lower-order reflective constructs), openness-to-experience personality trait, and conscientiousness personality trait.

The study began in a similar fashion to the second pilot, briefly introducing and explaining what an e-cargo bike is, and then assigning participants to either the egoistic or altruistic message appeal condition. They then reviewed one of the advertisements developed through the preliminary studies, featuring e-cargo bikes (see Appendix A for stimuli). Participants in the *egoistic message appeal* condition were presented with messages highlighting egoistic benefits, while those in the *altruistic message appeal* condition were exposed to messages featuring altruistic benefits, using the same stimuli as in the second pilot study.

After reviewing the advertisements, participants subsequently reported their attitude toward the e-cargo service using three items on 9-point scales ("bad/good," "unfavorable/favorable," and "negative/positive"; adapted from Gorn et al. (2008). This was followed by a two-item measurement for consumer purchase intention; adapted from Edson Escalas (2008). Participants then completed measurements of CE adapted from Ndhlovu and Maree (2022), consisting of four Lower-Order Constructs (LOCs): absorption (3 items), affection (6 items), identification (4 items), and social connection (7 items). Additional questions captured the personality traits of openness to experience (10 items) and conscientiousness (9 items), adapted from John et al. (1991) and Walczuch and Lundgren (2004), respectively. All responses on the measurements of CE and personality traits used 9-point scales (1 "strongly disagree" to 9 "strongly agree"). A 9-point Likert scale was chosen over 5- or 7-point alternatives to maximize response variance, enhance the discriminatory power of the measures, and improve the statistical quality of the data, consistent with the psychometric recommendations for complex constructs. Finally, participants answered demographic questions relating to age, gender, occupation, and highest level of education attained.

Table 1
Sample profile.

Variable		Frequency	Percent
Gender	Female	131	50.2
	Male	130	49.8
Residence	Rural area	71	27.2
	Urban town	121	46.4
	City	69	26.5
Age	18–24	44	16.9
	25–29	50	19.2
	30–34	48	18.4
	35–39	66	25.3
	40–44	30	11.5
	45–49	15	5.7
	50–54	8	3.1
Education level	GCSE or equivalent	3	15.3
	A-Level	75	28.7
	Undergraduate level	100	38.3
	Master level	37	14.2
	PhD	9	3.5
Do you or you household have a car?	Yes	215	82.4
	No	46	17.6
How do you rate the quality of public transport in your locality (1 = very poor; 9 = very good)	1	15	5.7
	2	22	8.4
	3	39	14.9
	4	20	7.7
	5	29	11.1
	6	40	15.3
	7	51	19.5
	8	32	12.3
	9	13	5.0

N = 261.

3.1.2. Data analysis

Partial Least Squares Structural Equation Modeling (PLS-SEM) was selected to estimate the two models in our research. PLS-SEM enabled us to simultaneously examine both measurement and structural models, making it particularly well-suited for investigating the antecedents of outcomes (Hair, Sarstedt, et al., 2019), such as purchase intention and consumer attitude in this study. We selected PLS-SEM over covariance-based SEM based on two key advantages. First, the former method excels in both predictive analysis and theory validation, aligning with our research objectives (Sarstedt et al., 2019). Second, PLS-SEM provides robust capabilities for analyzing hierarchical models, which proved essential for examining the multidimensional structure of CE in this study. Simpler methods (e.g., t-tests, OLS regression, or PROCESS), were deemed inappropriate because they cannot account for the measurement error of latent variables and do not capture the multidimensional nature of CE as a higher-order construct (HOC). This hierarchical modeling approach enabled us to capture the complexity of CE by examining both its lower-order constructs and its HOC (Hair et al., 2013). The studies utilized SmartPLS V4.1.0.8 (Ringle et al., 2022).

3.1.3. CE as a HOC

To capture the hierarchical component model of CE, we implemented an extended repeated-indicators approach (Ringle et al., 2012). This methodological choice allowed us to model CE as a HOC composed of four distinct dimensions: absorption, affection, identification, and social connection. Our selection of the extended repeated-indicators approach was supported by the balanced distribution of indicators across these LOCs, meeting the criteria established by Becker et al. (2012) for hierarchical modeling.

CE was treated as an extended repeated indicators approach HOC, and we followed the analytical procedures of Sarstedt et al. (2019). First, we assessed the LOCs in terms of internal consistency (Cronbach's alpha, composite reliability [CR], and P_A), convergent validity (indicator reliability, average variance extracted), and discriminant validity. Second, we assessed the reliability and validity of the HOC CE on its relationship with its LOCs. The constructs absorption, affection, identification, and social connection are interpreted as CE construct's indicators. The relationship between the CE construct and its underlying constructs are considered as loadings, despite being represented as coefficients in the path model. Finally, we calculated the reliability and validity of the CE construct by assessing internal consistency (Cronbach's alpha, composite reliability [CR], and P_A), convergent validity (AVE), and discriminant validity (heterotrait-monotrait ratio of correlations [HTMT]) (Sarstedt et al., 2019).

3.1.4. Measurement model assessment

We conducted an analysis of the measurement model, to evaluate the loadings of the indicators, the reliability of the constructs, as well as the

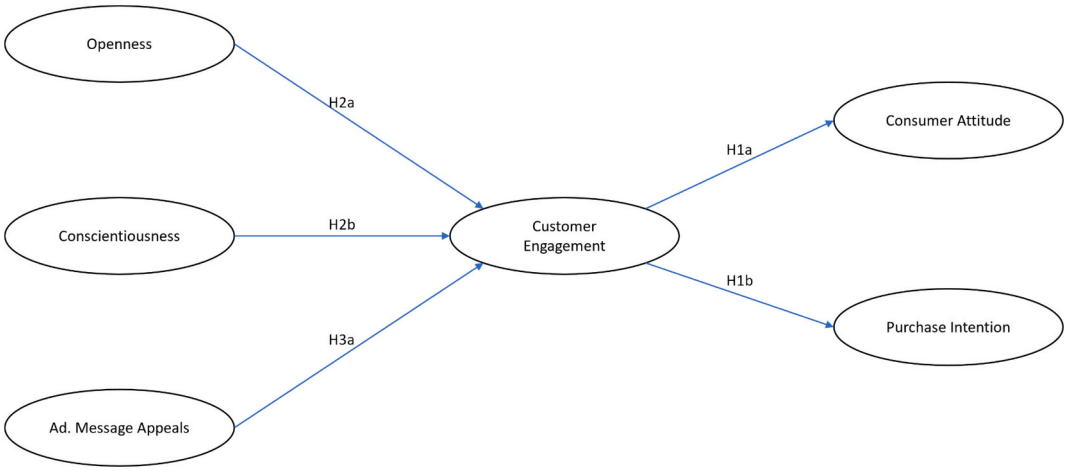

Fig. 1. Conceptual Model (Study 1).

convergent and discriminant validity. Table 2 provides an elucidation of the internal consistency (Cronbach's alpha, composite reliability [CR], and P_A), and convergent validity (AVE). Except for four measurement items (COS1, COS5, COS6, COS7, COS8) related to the conscientiousness construct, and five measurement items (OPE1, OPE2, OPE3, OPE4, OPE5) related to the openness-to-experience construct, all other items' loadings were above the criterion of 0.708. Consequently, the aforementioned measurement items for conscientiousness and openness-to-experience were removed from the analysis. The internal consistency, and convergent validity scores all exceeded the established thresholds of 0.70 and 0.50, respectively (Hair et al., 2021). Hence, the measurement model demonstrated a high level of internal consistency and convergent validity (Bagozzi & Yi, 1988).

3.1.5. Discriminant validity

The assessment of discriminant validity was conducted in accordance with the methodology proposed by Hair, Risher, et al. (2019), utilizing the Heterotrait-Monotrait ratio (HTMT) (Henseler et al., 2015). All of the correlations between the constructs were found to have an HTMT ratio below 0.85, indicating that the model demonstrates discriminant validity (see Table 3).

3.1.6. Results: Structural model assessment

First, structural model collinearity (VIF) was investigated. Table 4 details the results, which indicates a lack of collinearity issues because all of the values are below the cutoff value of 5 (Hair, Risher, et al., 2019). Second, the model underwent assessment through 5,000 subsamples in a bootstrapping approach in order to validate the hypotheses. Table 4 presents the outcomes pertaining to path linkages. The analysis indicates that the structural model accounts for 15.04% of the variance for CE, 36.05% of consumer attitude, and 44.30% of purchase intention. Fig. 2 illustrates the findings of the model. Table 5 evaluates the out-of-sample predictive performance of the model.

The analysis indicates a significant and positive effect of CE on consumer attitude (H1a: $\beta = 0.6004$, $t = 9.0942$) and on consumer purchase intention (H1b: $\beta = 0.6656$, $t = 10.1806$). Moreover, the analysis identifies significant antecedents of CE, encompassing variables relevant to marketing (i.e., framing of advertisement messages) and dispositional personality traits (i.e., openness-to-experience and conscientiousness). Specifically, we find that an altruistic message appeal leads to higher levels of CE with the e-cargo bike delivery service compared to the egoistic message appeal (H3a: $\beta = 0.3248$, $t = 2.8327$, $p = 0.00646$).

Regarding personality traits, according to the results of the hypotheses testing presented in Table 4, there is a substantial and positive effect of openness to experience on CE (H2a: $\beta = 0.1870$, $t = 3.4119$), and conscientiousness on CE (H2b: $\beta = 0.2419$, $t = 4.1019$). Taken together, these results provide support for all hypotheses (H1a, H1b, H2a, H2b, and H3a). Therefore, all hypotheses are accepted.

Finally, we undertook PLSpredict analysis. Comparing the root mean squared error (RMSE) values between the partial least squares structural equation modeling (PLS-SEM) and linear modeling (LM) techniques, it is evident that the LM prediction error indicators exhibit higher values than those of PLS-SEM. Hence, the data and analysis presented in the study demonstrate a substantial level of predictive capability (Shmueli et al., 2019).

3.2. Study 2

3.2.1. Overview

The second study retests the effect of message appeals on CE in a different context (EV car hire) and further investigates the underlying mechanism, specifically examining the mediating role of self-worth between the message appeal and CE. Mirroring Study 1, CE was treated as a HOC, consisting of four lower-order constructs: absorption (3 items), affection (6 items), identification (4 items), and social connection (7 items), all adapted again from Ndhlovu and Maree (2022). Five items that capture self-worth derive from Cast and Burke (2002). Fig. 3 illustrates the conceptual model tested in Study 2.

3.2.2. Data collection and analysis

In total, 400 UK adults, who did not participate in Study 1, were recruited for Study 2 via Prolific, in exchange for payment. Study 2 commenced in a manner akin to the first study, with a brief explanation of an EV hire service, followed by the random assignment of participants to either the egoistic or altruistic message appeal condition. Salient altruistic and egoistic message appeals relevant to EVs were derived from survey data (Statista, 2025) and the academic literature (Gautama et al., 2015).

Participants in the egoistic message appeal condition received messages emphasizing the egoistic advantages of the EV hire service (save your money, save your time), whereas those in the altruistic message appeal condition encountered statements highlighting altruistic benefits (good for the environment and good for the community). Appendix B presents the specific advertisements. After reviewing these advertisements, participants reported their self-worth and CE. All responses on the measurements of CE and self-worth used 9-point scales (1 "strongly disagree" to 9 "strongly agree"). Finally, participants answered the same demographic questions as those included in Study 1.

PLS-SEM was used to analyze the data, given its ability to estimate the parameters of latent variables, which are essential for understanding HOCs (Becker et al., 2012). Measurement items' loadings and

Table 2
Measurement items' loadings, internal consistency and convergent validity (Study 1).

Construct	Items	Item loading	α	CR	P_A	AVE
Openness-to-experience	I see myself as:		0.8526	0.8925	0.8756	0.6251
	OPE1: original, comes up with new ideas.	0.8439				
	OPE2: curious about many different things.	0.7966				
	OPE3: ingenious and a deep thinker.	0.7577				
	OPE4: has an active imagination.	0.7046				
	OPE5: inventive.	0.8414				
Conscientiousness	I see myself as:		0.7416	0.8491	0.7514	0.6037
	COS1: does a thorough job.	0.7228				
	COS5: tends to be lazy*.	0.7151				
	COS6: perseveres until the task is finished.	0.8347				
	COS7: does things efficiently.	0.8048				
	COS8: makes plans and follows through with them.	0.8002				
Customer engagement			0.8571	0.8978	0.8409	0.8999
Absorption			0.9164	0.9473	0.9178	0.8569
	ABS1: Time would fly if I used an e-cargo bike service.	0.9113				
	ABS2: I would be absorbed if I used an e-cargo bike service.	0.9113				
	ABS3: I would get carried away if I used an e-cargo bike service.	0.9155				
Affection			0.9601	0.9681	0.9603	0.8350
	AFF1: I would feel good if I used an e-cargo bike service.	0.9287				
	AFF2: I would feel proud to use an e-cargo bike service.	0.9325				
	AFF3: I would feel very positive if I used an e-cargo bike service.	0.9348				
	AFF4: Using an e-cargo bike service would make me happy.	0.9452				
	AFF5: Using an e-cargo bike service would stimulate my interest to learn more about it.	0.8407				
	AFF6: I love the e-cargo bike service.	0.8965				
Identification			0.9128	0.9388	0.9174	0.7934
	ID1: If someone praises an e-cargo bike service, it would feel like a personal compliment.	0.9137				
	ID2: If someone criticizes an e-cargo bike service, it would feel like a personal insult.	0.8391				
	ID3: If I would talk about an e-cargo bike service, I would say "we" rather than "they".	0.8909				
	ID4: An e-cargo bike service's successes are my successes.	0.9171				
Social connection			0.9572	0.9648	0.9581	0.7970
	SOC1: I would be willing to exchange ideas with other people about an e-cargo bike service.	0.8607				
	SOC2: In general, I would like to get involved in discussions about an e-cargo bike service.	0.9212				
	SOC3: I would like to participate in activities around an e-cargo bike service.	0.9200				
	SOC4: If an e-cargo bike service initiates discussions online, I would be willing to take part.	0.8977				
	SOC5: I would like to actively participate when people talk about an e-cargo bike service.	0.9307				
	SOC6: I would be interested in using additional functions from an e-cargo bike service.	0.8921				
	SOC7: I would respond to an e-cargo bike service's promotional offers.	0.8218				
Consumer attitude			0.9645	0.9769	0.9647	0.9337
	EVA1Indv: What's your impression of the e-Cargo bike delivery service? Bad − Good	0.9637				
	EVA2Indv: Unfavourable − Favourable	0.9728				
	EVA3Indv: Negative − Positive	0.9624				
Purchase intention			0.8945	0.9498	0.9012	0.9043
	PI1: How likely are you to use such an e-Cargo bike delivery service? − Very unlikely − Very likely	0.9458				
	PI2: How likely are you to call or email to arrange to use such an e-Cargo bike delivery service? Very unlikely − Very likely	0.9561				

Notes: *Italics used for second-order construct*; *: reverse item; α: Cronbach's alpha; CR: composite reliability; PA: reliability metric weight A; AVE: average variance extracted.

convergent validity are reported in Table 6. Both self-worth for subjects in the egoistic and altruistic message appeal conditions, measurement items' reliability and validity results are reported in Table 6. Table 7 addresses discriminant validity.

All the measurement items were above the threshold of 0.708 item-factor loading, the internal consistency (CR, Cronbach's alpha, P_A) were all above the cut-off value of 0.70, convergent validity (AVE) for all constructs were above the threshold of 0.50. Regarding discriminant validity, Heterotrait-monotrait ratio of correlations [HTMT] were below the threshold of 0.85 between the constructs (Hair, Risher, et al., 2019). CE was treated as an extended repeated indicators approach HOC, and we followed the analytical procedures of Sarstedt et al. (2019). After establishing the constructs' reliability, convergent validity, and discriminant validity, the next section explains the structural model and the hypotheses mediation results.

3.2.3. Study 2. Structural model results

The collinearity of the structural model (VIF) was examined first, indicating an absence of collinearity difficulties, as all values are below the threshold of 5 (Hair, Risher, et al., 2019). The model was evaluated using 5,000 subsamples in a bootstrapping method to validate the hypotheses. Table 8 details the results concerning path links. The analysis reveals that the structural model explains 22.70% of the variance in CE. All VIF values of 1.00 indicate no multicollinearity issues in the model, ensuring the reliability of the mediation analysis.

Regarding H3 (altruistic message appeal −> self-worth −> CE), complementary mediation was established (β = 0.0500, *t.* value = 2.1170, *p.* value = 0.034). Both the direct path from altruistic message appeal to CE (β = 0.2790, *t. value* = 4.7670, *p.* value = 0.0230) and the path through self-worth to CE (β = 0.3291, *t. value* = 7.045, *p.* value = 0.000) were significant. An altruistic message appeal influences CE both directly and indirectly through self-worth, with both paths being significant and working in the same direction (positive). This indicates that

Table 3
Discriminant validity ratios (Study 1).

	Absorption	Ad. Messageappeal	Affection	Conscientiousness	*Customer engagement*	Consumer attitude	Identification	Openness	Purchase intention	Social connection
Absorption	(0.9256)									
Ad. Message appeal	0.0318 (0.0309)	–								
Affection	0.5377 (0.5069)	0.2076 (0.2027)	(0.9140)							
Conscientiousness	0.1469 (0.1288)	0.0265 (−0.0116)	0.3637 (0.3276)	(0.7770)						
Customer engagement	0.8039 (0.7622)	0.1568 (0.1561)	0.8025 (0.7590)	0.2484(0.3075)	(0.7646)					
Consumer attitude	0.2957 (0.2796)	0.1567 (0.1925)	0.7674 (0.7392)	0.4332(0.3866)	0.8102 (0.6004)	(0.9660)				
Identification	0.7351 (0.6738)	0.1637 (0.1567)	0.5729 (0.5394)	0.1213(0.1099)	0.8486 (0.7846)	0.3512 (0.3320)	(0.8910)			
Openness-to-experience	0.1636 (0.1529)	0.0226 (−0.0187)	0.1790 (0.1772)	0.4171(0.3609)	0.2988 (0.2712)	0.1732 (0.1607)	0.2013 (0.1913)	(0.7910)		
Purchase intention	0.4124 (0.3742)	0.2027 (0.1325)	0.6780 (0.2547)	0.2353(0.2096)	0.6802 (0.6656)	0.6597 (0.6127)	0.5638 (0.5136)	0.1481 (0.1276)	(0.9510)	
Social connection	0.6018 (0.6212)	0.0980 (0.0957)	0.6939 (0.6161)	0.3601(0.3280)	0.7963 (0.8010)	0.4996 (0.4790)	0.6457 (0.6056)	0.3492 (0.3283)	0.6493 (0.6021)	(0.8930)

Notes: *Italics used for second-order construct;* (Fornell-Larcker correlation).

Table 4
Hypotheses results (Study 1).

H. No	Hypothesis	Path Coefficient	t-value	*P*. value	VIF value	*f*-square	H outcome
H1a	Customer engagement –> Consumer attitude	0.6004	9.0942	0.0000	1.0000	0.5637	Accepted
H1b	Customer engagement –> Purchase intention	0.6656	10.1806	0.0000	1.0000	0.7953	Accepted
H2a	Openness-to-experience –> Customer engagement	0.1870	3.4119	0.0007	1.1500	0.0358	Accepted
H2b	Conscientiousness –> Customer engagement	0.2419	4.1019	0.0000	1.1497	0.0599	Accepted
H3a	Ad. Message Appeal –> Customer engagement	0.3248	2.8327	0.0046	1.0000	0.0310	Accepted

Notes: H: hypothesis.

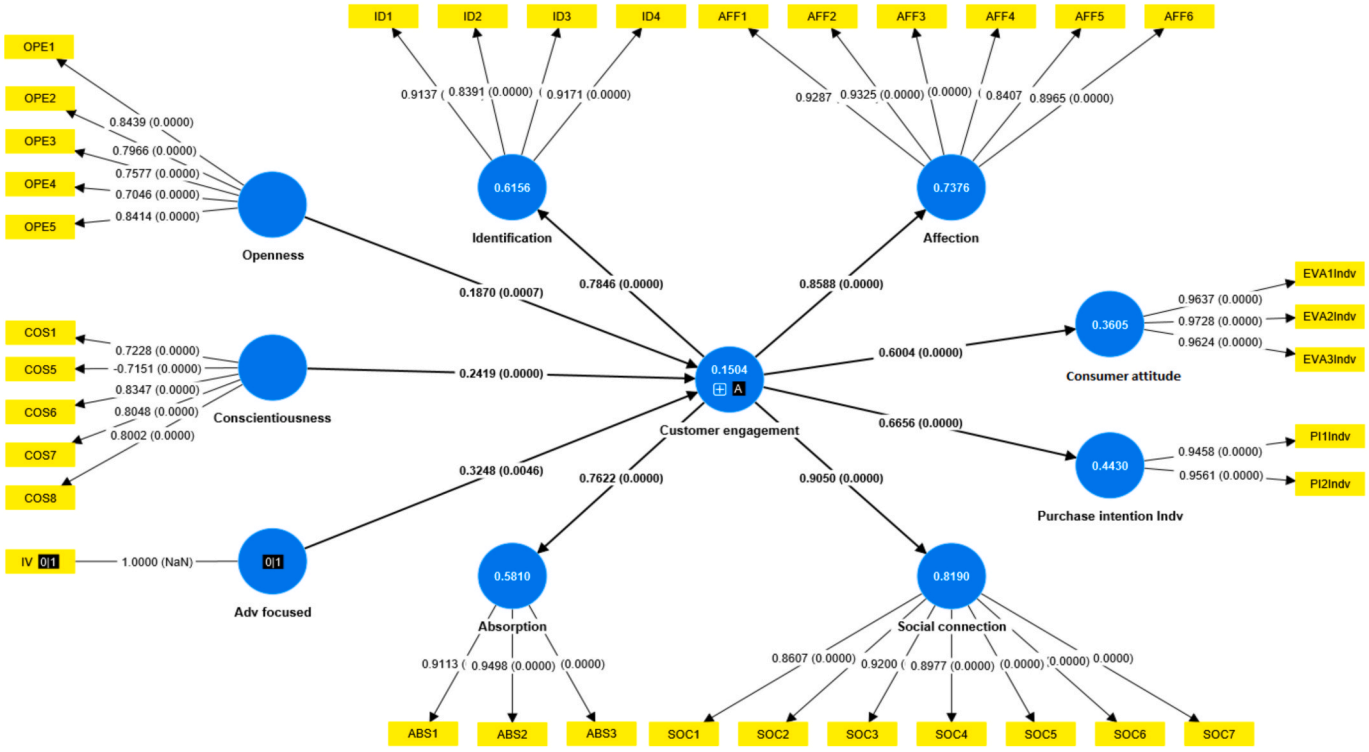

Fig. 2. Model results (Study 1). *Note: Message appeal is a categorical experimental variable (0 = egoistic, 1 = altruistic) with loading fixed at 1.00 per PLS-SEM convention for single-item manifest variables.*

self-worth partially mediates the relationship while enhancing the total effect, meaning that the influence of altruistic message appeal on CE is

Table 5
PLSpredict assessment (Study 1).

Item	PLS-SEM		LM
	RMSE	$Q^2_{predict}$	RMSE
EVA1Indv	1.8128	0.0658	1.8429
EVA2Indv	1.8200	0.0439	1.8335
EVA3Indv	1.7738	0.0390	1.8155
PI1Indv	2.5237	−0.0421	2.6181
PI2Indv	2.5095	0.0079	2.5803

strengthened both through its direct impact and through its ability to increase self-worth, which in turn increases CE. Therefore, both H3a and H3b are accepted.

In the alternative condition (egoistic message appeal −> self-worth −> CE), no mediation effect was found ($\beta = 0.045$, *t. value* = 1.235, *p.* value = 0.217). Consistent with expectations (Hollebeek, 2013), while the direct relationship between egoistic message appeal and CE was not significant ($\beta = 0.045$, *t. value* = 1.235, *p.* value = 0.217), the path from self-worth to CE showed significance ($\beta = 0.345$, *t. value* = 6.791, *p.*

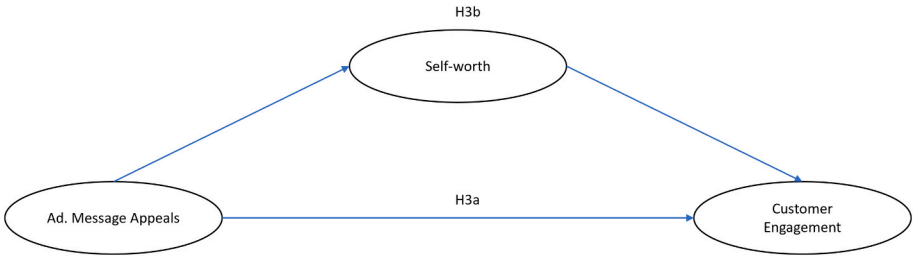

Fig. 3. Conceptual Model (Study 2).

Table 6
Measurement items' loadings, internal consistency and convergent validity (Study 2).

Construct	Item	Item loading	A	CR	P_A	AVE
Self-worth (egoistic condition)	Engaging with the service advertised would make me feel that:		0.9610	0.9620	0.9700	0.8650
	ISW1: I am a person of worth, at least on an equal basis with others.	0.8850				
	ISW2: I have a number of good qualities.	0.9380				
	ISW3: I have much to be proud of.	0.9590				
	ISW4: I take a positive attitude toward myself.	0.9440				
	ISW5: On the whole, I am satisfied with myself.	0.9210				
Self-worth (altruistic condition)	Engaging with the service advertised would make me feel that:		0.9531	0.9540	0.9640	0.8420
	OSW1: I am a person of worth, at least on an equal basis with others.	0.8711				
	OSW2: –I have a number of good qualities.	0.9291				
	OSW3: I have much to be proud of.	0.9392				
	OSW4: I take a positive attitude toward myself.	0.9361				
	OSW5: On the whole, I am satisfied with myself.	0.9121				
Customer engagement			0.9150	0.9310	0.9280	0.8630
Absorption			0.9670	0.9680	0.9700	0.6190
	ABS1: Time would fly if I used an electric car hire service.	0.9371				
	ABS2: I would be absorbed if I used an electric car hire service.	0.9532				
	ABS3: I would get carried away if I used an electric car hire service.	0.9211				
Affection			0.9642	0.9643	0.9713	0.8501
	AFF1: I would feel good if I used an e-cargo bike service	0.9431				
	AFF2: I would feel proud to use an electric car hire service.	0.9472				
	AFF3: I would feel very positive if I used an electric car hire service.	0.9472				
	AFF4: Using an electric car hire service would make me happy.	0.9350				
	AFF5: Using an electric car hire service would stimulate my interest to learn more about it.	0.8761				
	AFF6: I love the electric car hire service.					
Identification		0.8811	0.9001	0.9092	0.9301	0.7701
	ID1: If someone praises an electric car hire service, it would feel like a personal compliment.	0.8991				
	ID2: If someone criticizes an electric car hire service, it would feel like a personal insult.	0.8411				
	ID3: If I would talk about an electric car hire service, I would say "we" rather than "they".	0.8701				
	ID4: An electric car hire service's successes are my successes.	0.8982				
Social connection			0.9601	0.9612	0.9672	0.8093
	SOC1: I would be willing to exchange ideas with other people about an electric car hire service.	0.8783				
	SOC2: In general, I would like to get involved in discussions about an electric car hire service.	0.9212				
	SOC3: I would like to participate in activities around an electric car hire service.	0.9172				
	SOC4: If an electric car hire service initiates discussions online, I would be willing to take part.	0.9002				
	SOC5: I would like to actively participate when people talk about an electric car hire service.	0.9240				
	SOC6: I would be interested in using additional functions from an electric car hire service.	0.8983				
	SOC7: I would respond to an electric car hire service's promotional offers.	0.8552				

Notes: *Italic: second-order construct;* α: Cronbach's alpha; CR: composite reliability; P_A: reliability metric weight A; AVE: average variance extracted.

Table 7
Discriminant Validity (Study 2).

Construct	Absorption	Affection	*Customer engagement*	Identification	Self-worth (ego condition)	Message appeal	Self-worth (altruistic condition)	Social connection
Absorption	(0.9370)							
Affection	0.6420	(0.9222)						
	(0.6090)							
Customer engagement	0.8410	0.8230	(0.7870)					
	(0.7380)	(0.7363)						
Identification	0.737	0.653	0.8660	(0.8781)				
	(0.6800)	(0.6171)	(0.8070)					
Self-worth (ego condition)	0.272	0.345	0.3570	0.2931	(0.9301)			
	(0.2580)	(0.3321)	(0.3451)	(0.2761)				
Message appeal	0.121	0.09	0.1180	0.1231	0.0481	(0.5150)		
	(0.0691)	(0.0521)	(0.0771)	(0.0521)	(0.0071)			
Self-worth (altruistic condition)	0.318	0.366	0.3414	0.2680	0.6581	0.1581	(0.9181)	
	(0.3001)	(0.3512)	(0.3293)	(0.2521)	(0.7952)	(0.1521)		
Social connection	0.669	0.751	0.8321	0.6720	0.3131	0.0971	0.2482	(0.8991)
	(0.6342)	(0.7232)	(0.7122)	(0.6090)	(0.3001)	(0.0772)	(0.2372)	

Notes: *Italic: second-order construct;* (Fornell-Larcker correlation).

Table 8
Hypotheses results (Study 2).

H. No.	Hypothesis	Path Coefficient	t-value	*P.* value	VIF value	Path outcome
H3a	Altruistic message appeal −> Customer engagement	0.2790	4.7670	0.0230	1.0000	Accepted
H3b	Altruistic message appeal −> self-worth −> Customer engagement	0.0500	2.1170	0.0340	1.0000	Accepted
	Self-worth (altruistic condition) −> Customer Engagement	0.3291	7.0461	0.0000	1.0000	Accepted
	Egoistic message appeal −> self-worth −> Customer engagement	0.0452	1.2350	0.2170	1.0000	Rejected
	Egoistic message appeal −> Customer engagement	0.0453	1.2350	0.2171	1.0000	Rejected
	Self-worth (egoistic condition) −> Customer engagement	0.3451	6.7910	0.0000	1.0000	Accepted

Notes: H: hypothesis.

value = 0.000).

Finally, PLSpredict analysis was employed to examine the predictive power of the model. This revealed that all of the indicators in the LM prediction errors are greater than PLS-SEM when comparing the Root Mean Squared Error (RMSE) values of the PLS-SEM and the LM methods, indicating an initial high predictive power (Shmueli et al., 2019). We employed the cross-validated predictive ability test (CVPAT), which indicated that the endogenous constructs exceed the IA benchmark and the LM benchmark, as presented. Therefore, the model possesses predictive validity (Sharma et al., 2023).

4. Discussion

4.1. Theoretical implications

This paper contributes to the literature by considering CE in relation to climate-friendly transportation services, responding to calls for investigating CE in a diverse range of contexts (Islam et al., 2019). We employ the conceptualization of CE introduced by Ndhlovu and Maree (2022), which is tailored to service-oriented settings and incorporates the dimensions of affection, identification, absorption, and social connections, thus relating to both the psychological and behavioral aspects of CE. The research findings support the notion that CE is a multidimensional construct (Hollebeek et al., 2019), for which co-creation is integral in a service setting (Hollebeek & Macky, 2019; Ndhlovu & Maree, 2022). We also demonstrate the appropriateness of the model and scale of Ndhlovu and Maree (2022) beyond its original context, which the authors acknowledged warranted further research.

Previous research calls for further investigation at the interface between consumers' personality and CE (Hollebeek, Kulikovskaja, et al., 2023), building on qualitative insights (Marbach et al., 2016) and quantitative evidence that highly conscientious customers engage with brands differently (Hollebeek, Kulikovskaja, et al., 2023). Study 1 extends this literature through the identification that both openness-to-experience and conscientiousness are positively associated with CE for a climate-friendly service. These findings dovetail with the theory that openness-to-experience, as a personality trait, is associated with receptiveness to novel ideas and services (George & Zhou, 2001). Conscientious individuals typically possess a heightened sense of responsibility and commitment to environmental sustainability (Milfont & Sibley, 2012), which is reflected in higher engagement with climate-friendly services. The results thus suggest that CE varies according to congruence with personality traits. Furthermore, while previous studies connected these personality traits to general pro-environmental attitudes and behaviors (Soutter & Mõttus, 2021), our study contributes by demonstrating their direct influence on ongoing CE—a more dynamic and multidimensional construct encompassing cognitive, emotional, and behavioral elements (Hollebeek, Hammedi, et al., 2023). This insight advances the literature beyond prior work that focuses primarily on attitudes or one-time adoption measures (Shanmugavel &

Balakrishnan, 2023; Singh et al., 2020).

The framing of communications affects recipients' engagement (Onofrei et al., 2022) prompting considerable interest in the interface between content and CE (Berger et al., 2023). In the context of green goods, previous message framing studies consider the effects of: narrative style on message credibility (Kim et al., 2022), assertiveness on compliance intentions and click through rates (Kronrod et al., 2012), and how the number of claims made affects brand attitude (Olsen et al., 2014). In contributing to this literature, Studies 1 and 2 demonstrate the superiority of altruistic over egoistic message appeals in the context of climate-friendly services. This is consistent with evidence that being perceived as altruistic is a key motivation for choosing green goods (Griskevicius et al., 2010), so that in the context of climate-friendly services, congruent altruistic message primes will be more effective in stimulating engagement. Study 2 sheds further light on the relationship between message appeal and CE, identifying that altruistic message appeals influence CE both directly and indirectly through self-worth. This is consistent with notions that altruistic appeals prime alignment with socially admired values (Green & Peloza, 2014), enhancing self-worth, which in turn increases consumers' engagement with more socially beneficial (climate-friendly) services. The latter reflects how self-worth can drive CE – when a consumer feels good about themselves because of their interaction with a good or service they are likely to feel affinity, affection, and social connection with the product (Hollebeek, 2013).

Finally, there is considerable interest in the outcomes of CE (Onofrei et al., 2022; Pansari & Kumar, 2017). This study contributes evidence regarding the positive effects of CE (Bazi et al., 2023; Dwivedi, 2015; Hollebeek & Macky, 2019; Hollebeek et al., 2019; Ul Islam et al., 2017), extending it to climate-friendly services. We find that CE is positively related with both consumer attitude and purchase intentions towards e-cargo bike deliveries. This is consistent with theory that CE generates positive spill-over effects in terms of more favorable attitudes and purchase intentions (Hollebeek et al., 2019).

4.2. Managerial implications

Thousands of new, more environmentally friendly products and services are launched globally every year (McKinsey & Company, 2023). While some gain traction and market share, many of these initiatives, while typically motivated by good intentions and a desire to make a difference, struggle to be commercially viable and fail to meet their objectives (Vedula et al., 2022). This paper generates three main actionable insights for managers of climate-friendly products and services.

Firstly, the results highlight to managers the importance of cultivating CE, which generates enhanced consumer attitudes and purchase intentions. Marketing efforts for more environmentally friendly goods and services often lack focus and the failure rates of new green products are high (van Doorn et al., 2021). Drawing on Ndhlovu and Maree (2022), this paper provides managers with an appropriate framework for conceptualizing CE with services, identifying the importance of consumers as active co-creators, and engaging in activities which generate affection for, and identification, absorption, and social connection with the service. Managers of climate-friendly services should thus benchmark how customers engage with their initiative in terms of affection, absorption, identification, and social connection, and design service touchpoints that map explicitly onto these four elements. For example, EV hire services could create user communities where members share their experiences and environmental impact metrics, to increase social connection, while e-cargo bike services could organize community events and trials showcasing the practical benefits of their offering to enhance affection and identification. To foster absorption, service providers could use app-based features, such as journey tracking or carbon-saving dashboards, that encourage deeper engagement with the service.

Secondly, managers should be cognizant that CE with climate-friendly services varies according to personality traits. Managers can incorporate personality traits into their segmentation, targeting, and positioning activities, with, as noted by Islam et al. (2019) promotional materials personalized in accordance with personality traits. For instance, the research finds that CE with e-cargo bike delivery services is higher amongst those who are more open-minded to new experiences, suggesting that they are more likely to be early adopters. Promotional materials targeting those scoring highly on the openness-to-experience trait can stress the novelty of the service and the ability to be an early adopter. Our research reveals how managers can leverage personality traits for more effective marketing strategies. While personality traits themselves are not directly controllable, understanding their influence enables sophisticated targeting and positioning approaches. Specifically, managers can: (1) partner with market research firms to identify customer segments based on personality profiles, (2) customize marketing messages for different personality segments (e.g., highlighting novelty for those high in openness-to-experience), (3) develop targeted social media campaigns using platform analytics that correlate with personality traits, and (4) design service features that appeal to specific trait-based segments. For instance, e-cargo bike services could emphasize their innovative nature to attract early adopters who score highly on openness-to-experience, while highlighting community benefits for conscientious customers.

Finally, the marketing of green goods and services often suffers from inappropriate and excessively complex messaging (Olsen et al., 2014). Compiling practical examples of the marketing of e-cargo bike delivery and EV hire services for this paper revealed that many employ egoistic message appeals. Managers should: (1) emphasize environmental and community benefits rather than personal advantages in advertising green services, (2) quantify the positive environmental impact of their services (e.g., carbon emissions saved) in an easily understood and concrete manner to emphasize the altruistic benefits, (3) showcase how their service contributes to broader sustainability and community goals, and (4) incorporate customer testimonials (social norms) that highlight altruistic motivations. Importantly, Study 2 reveals that altruistic appeals enhance customer self-worth, suggesting managers should frame their services as enabling customers to make a positive contribution to their community and the environment. Likewise, digital platforms facilitating climate-friendly services should make customers' positive environmental contributions visible (e.g., through carbon-saving dashboards), cumulative (e.g., through progress trackers), and socially shareable (e.g., through milestone badges), thereby strengthening self-worth and customer engagement. As this research identifies the superiority of altruistic messaging in generating CE with climate-friendly services, transport authorities and campaigners seeking to promote greener transportation should employ public campaigns that emphasize collective benefits and civic contributions.

5. Limitations and future research

While generating insights into the antecedents and outcomes of CE with climate-friendly services, this paper is not without limitations, which can guide future research. Firstly, the paper considers two transportation cases (e-cargo bike and EV hire services). While these cases are fundamentally different – e-cargo bikes typically offer a

delivery of goods and parcels service independent of the user, whereas EV hire focuses on personal, user mobility – future research could expand consideration of the model to other climate-friendly services such as those relating to renewable energy and circular fashion. Although we expect personality traits and message appeals to affect CE in a similar manner across sectors, issues relating to personal safety and security, and habits, may affect consumers' decision-making in transportation. Secondly, future research could seek to identify factors that moderate relations between altruistic message appeals and CE with climate-friendly products and services. For instance, purchasing power and price consciousness may be significant moderators (Andrews et al., 2014). Thirdly, having established the benefits of altruistic over egoistic message appeals for marketing climate-friendly services, future research could consider ways of further enhancing the effectiveness of the former. For instance, this could involve linking altruistic message appeals with social norms, given the latter's positive effect on engagement in environmentally friendly practices (Goldstein et al., 2008; Melnyk et al., 2021). Future research could further test the effectiveness of various types of altruistic message appeals by adding a more concrete, quantification of benefits, for instance reducing carbon emissions by up to 70%.

Finally, as this research is based on UK samples, future studies could examine whether cultural differences influence the findings. While this presents a limitation, the effects of dispositional psychological motivations, specifically openness-to-experience and conscientiousness, are likely to be generalizable. These traits are widely recognized as stable, cross-culturally valid constructs (Costa & McCrae, 1998), associated with pro-environmental behavior (Soutter & Mõttus, 2021). Therefore, we do not anticipate substantial variation in their positive influence on CE with climate-friendly services across cultures. However, the impact of message appeals (i.e., altruistic vs. egoistic) and its consequences may be more culturally sensitive. Prior research suggests that individuals in collectivist societies place greater emphasis on group harmony and communal relationships, whereas personal goals and autonomy are stronger motivators in individualist cultures (Bochner, 1994). It is therefore plausible that the positive effect of altruistic appeals on CE observed in this study may be amplified in collectivist contexts such as China and Japan. We encourage future research to explore this possibility and assess the cross-cultural robustness of our findings.

CRediT authorship contribution statement

Saleh Bazi: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jiexian Chloe Huang:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Conceptualization. **Matthew Gorton:** Writing – review & editing, Writing – original draft, Supervision, Software, Resources, Investigation, Funding acquisition, Conceptualization. **Barbara Tocco:** Writing – review & editing, Writing – original draft, Validation, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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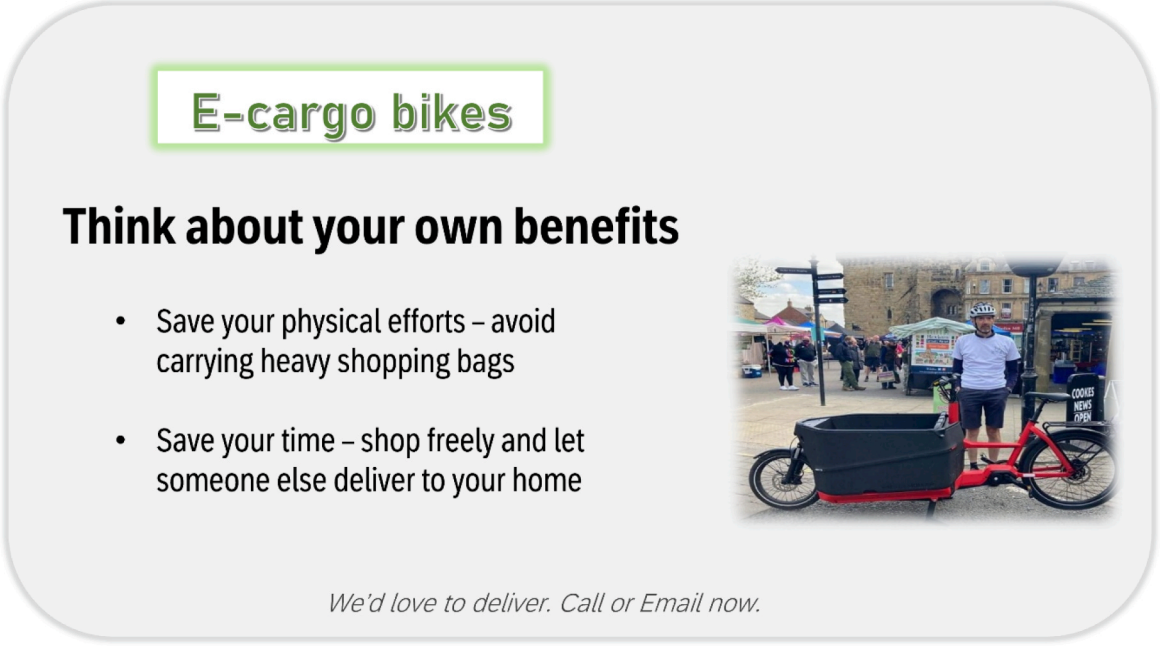
Appendix A. –Advertising stimuli for Study 1

a) Egoistic message framing version

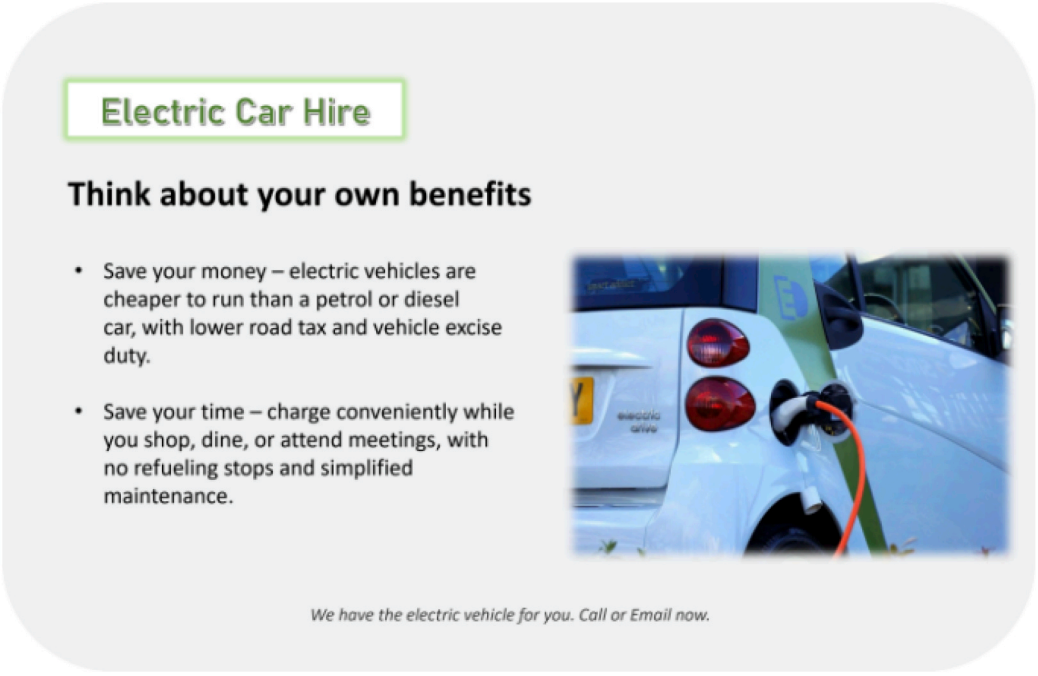


b) Altruistic message framing version

Note that the rider pictured gave consent for having their photograph taken for research purposes.

Appendix B. –Advertising stimuli for Study 2

a) Egoistic message framing version



b) Altruistic message framing version

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