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The role of consumer innovativeness and green perceptions on green innovation use: The case of shared e-bikes and e-scooters

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Abstract

The growing awareness of environmental issues can be linked to the demand for green transport innovations. Consumer behavior studies have pointed to the importance of consumer innovativeness (CI) and green perceptions in the adoption of green innovations. The purpose of this paper is to identify how users and nonusers of shared micromobility perceive the greenness of shared e-bikes and e-scooters and how CI affects shared microvehicle adoption. The paper also analyses the relationships between green perceptions and environmental referent cognitions—biospheric values, environmental knowledge, ascription of responsibility, and environmental attitudes. Shared e-bike and e-scooter users and nonusers in Copenhagen and Stockholm were surveyed using an online questionnaire. Results revealed that users consider themselves innovative and perceive the shared microvehicles as relatively green, while nonusers do not. When comparing users, CI and green perceptions relate to shared e-bike use, but notably, only CI is linked to shared e-scooter use. The results also show that environmental knowledge and environmental attitudes are related to green perceptions. The practical and theoretical implications of the results are discussed.

1 | INTRODUCTION

The increasing awareness of environmental issues can be linked to the higher demand for green innovations, particularly in the transport sector. Shared micromobility is presented as one of these green innovations as it is promoted as an innovative and green transport mode. Shared micromobility is a recently developed and diffused transport mode that uses electric or human-powered smaller scale, lightweight vehicles, such as bikes, e-bikes, and e-scooters, on an instant need basis (Oeschger et al., 2020; Reck et al., 2021).

Shared micromobility works by placing shared microvehicles in different parts of an urban area. User access is done by installing a provider's app on a smartphone. The user can then pick up the microvehicle from a designated docking station or a location suggested by the phone's GPS. Users typically pay a flat rate and then pay additional rates based on the duration of the trip (McKenzie, 2019; Populus, 2018).

Shared micromobility is designed as an alternative to conventional forms of transport. Three distinguishing features are essential to these microvehicles. First, they are shared modes of transport, meaning a user does not own the vehicles. They are shared with other users and only paid for when in use. Second, the microvehicles are predominantly accessed through the use of smartphones and apps. Finally, the microvehicles can be used anytime during the day as they do not require service personnel for usage (DuPuis et al., 2019). Because of these features, theoretically, shared micromobility offers not just new features or extensions of existing products but can also be considered innovative in terms of ownership and usage.

Because of these microvehicles' distinguishing attributes, the motivation behind their use can be different from other comparable transport modes. For instance, the decision to use a bike may rely on its cost and time savings and awareness of its positive effects on the environment and health (Claudy & Peterson, 2014; Fishman, 2016; Uttley & Lovelace, 2016). With shared micromobility, however, financial savings and health benefits might possibly not be the key motivators for their adoption. Using shared e-bikes and e-scooters are in some cases more expensive compared to owning a nonelectric bicycle. Shared e-bikes and e-scooters are also electric-powered, requiring less effort from their users. Thus, their use might not give the same amount of exercise as an ordinary bike would.

Although shared micromobility is gaining wider acceptance from commuters, it still caters mainly to a rather select group of commuters (Bieliński & Ważna, 2020). In much of the consumer behavior literature, consumer innovativeness (CI) has been an essential factor in adopting green innovations (Englis & Phillips, 2013; Jansson, 2011; Mutum et al., 2020). CI is the inherent trait of an individual that drives the use of innovations (Rogers, 2003). This view sees innovativeness as an individual's receptivity to new ideas, products, or services, and therefore influences the propensity to adopt innovations faster than others. Indeed, it has been demonstrated that CI can affect the relationship between attitude towards the environment and adoption of green behavior (Englis & Phillips, 2013; Li et al., 2021).

Apart from CI, green perceptions have also been shown to impact consumer decisions to adopt sustainable innovations (Jansson et al., 2011; Paparoidamis & Tran, 2019). Green perceptions are related to the degree of how consumers see the environmental benefits of an object. Previous studies have revealed that environmental attributes enhance the adoption of sustainable transport innovations (Heidenreich et al., 2017; Noppers et al., 2014), such as e-cars and e-bikes. Although shared micromobility is promoted as an environmental-friendly alternative to cars (Møller et al., 2020), there is scant research proving the greenness of the shared microvehicles, particularly those that are e-powered. One study showed that shared bikes could reduce up to 5417 tons of CO_2 in cities every year (Kou et al., 2020), while another research has presented that owned e-bikes' greenhouse gas emission fall within the range of that of ordinary bikes (Astegiano et al., 2019). According to Hollingsworth et al. (2019), although shared e-scooters still account for higher greenhouse gas emissions than shared bikes and e-bikes, the life cycle emissions connected with the shared e-scooter commute is still less than that of an average car. Nonetheless, instead of replacing car trips, shared e-bikes replace shared regular bikes, whereas shared e-scooters substitute taxi and car ridesharing trips and walking (James et al., 2019; Lazarus et al., 2020). In some cases, shared e-scooter trips also substitute trips made by public transport (Laa & Leth, 2020). Therefore, oftentimes, shared e-bikes and e-scooters are generating more trips or replacing other sustainable transport options, magnifying questions regarding their environmental relevance to consumers and society.

1.1 | Justification and purpose

Although research looking at the potential effect of shared e-bikes and e-scooters to society are growing (Abduljabbar et al., 2021), many questions about their users and environmental impact remain unclear. Shared micromobility providers, for example, argue that these microvehicles can serve as green alternative to short-trip distances traveled with cars. However, studies show that, in many cases, they substitute other sustainable forms of transport such as public transport and conventional shared bikes, or even replace walking (Bieliński & Ważna, 2020; Lazarus et al., 2020; Reck et al., 2021). To partially address this issue, it is important to know whether consumers perceive shared e-bikes and e-scooters as green. In particular, if shared e-bikes and e-scooters are truly environmentally friendly alternatives to cars, the motivation behind their use should be linked to users' knowledge about ecological issues and concern for the environment, and not solely based on their functional attributes. So far, research has demonstrated that cost-savings, convenience and enjoyment are common drivers for their use (Abduljabbar et al., 2021; Bieliński & Ważna, 2020). There is still limited knowledge as to how their green attributes affect their adoption. Due to the issues surrounding these microvehicles' greenness (Gössling, 2020; James et al., 2019; Kopplin et al. 2021), some consumers who are looking for green transport alternatives may not see the environmental benefits of using them, thereby constraining their diffusion among consumers.

On the other hand, if the use of shared e-bike and e-scooters can be regarded as innovative, its adoption should be linked to consumer innovativeness, and innovators and early adopters should be the ones motivated to adopt these microvehicles. Indeed, earlier findings point out the positive relationship between consumer innovativeness and green transport innovations (Jansson, 2011; Noppers et al., 2015). According to diffusion of innovation studies, it is important to tap the innovators and early adopters to encourage uptake of an innovation among the mainstream consumers and to thus increase its diffusion (Heidenreich et al., 2017; Li et al., 2021; Rogers, 2003), and in this case, making the environmental impact of shared micromobility more evident. Nevertheless, the application of CI in the adoption of sustainable transport needs further examination. Particularly, there is still limited understanding regarding consumer perception and reaction about the characteristics of innovations (Munkácsy & Monzón, 2018).

It is important to address perceptions of greenness and whether users consider themselves innovative to create a picture about how shared e-bikes and e-scooters can affect the future of transport and how they can contribute to transport industry's sustainable development. To date, no study has yet examined the relationship between perceptions of greenness and innovativeness and shared microvehicle use simultaneously.

The purpose of this paper is to identify how users and nonusers of shared micromobility perceive the greenness of shared e-bikes and e-scooters and how CI affects shared micromobility adoption. In addition, the paper analyses the relationships between green perceptions and environmental referent cognitions such as biospheric values, environmental knowledge, ascription of responsibility, and environmental attitudes since previous studies in related areas have pointed to these factors as important.

In innovation adoption research, a problem is often that questions to consumers are posed in terms of intentions to adopt and not actual adoption. In those studies, the strength is that consumers with different intentions can be compared, but the weakness is that intentions do not necessarily lead to actual adoption. To address this weakness, in this paper, we focus on actual adoption making it relevant to compare users and nonusers.

This paper also focuses on comparing users of e-bikes and e-scooters because of their technological attribute of being electric-powered and their increasing presence and relevance in cities. There are several reasons why the comparison between the two shared microvehicles is relevant. First, although both are promoted as green innovations and are part of shared micromobility, studies have shown that there are significant differences between the reasons why individuals use these vehicles. For example, shared e-bikes are used as complements to conventional shared bikes and for commuting, while shared e-scooters are used much more for recreational purposes and enjoyment (Bieliński & Ważna, 2020; Reck et al., 2021). Consequently, if shared e-bikes are used for functional purposes, while shared e-scooters for hedonic reasons, motivations behind use should also be different. Second, shared e-scooters are more recently introduced to the market than shared e-bikes, yet, their market share has grown and adoption has taken off faster (NACTO, 2019). Thirdly, policies are already in place for shared e-bike use, whereas many cities are still grappling with the regulation of shared e-scooters (Abduljabbar et al., 2021; Gössling, 2020). This lack of shared e-scooter regulations has resulted in issues surrounding their safety, relevance for transport, and environmental impact. Therefore, even though both shared microvehicles are comparable in many aspects, they also differ in certain ways.

As for preference and availability, indeed, these factors affect the decision to use these shared microvehicles as shown by the recent study by Reck et al. (2021). As their findings suggest that when these two microvehicles are available, functional factors, such as distance and elevation that can be covered, battery charge, and the purpose of the trip, become decisive in the choice to use either a shared e-bike or a shared e-scooter. Nevertheless, it also important to look at other motivations related to consumer characteristics, such as being green and innovative, as they also impact the decision-making process. This is also the reason why a comparison between these two shared microvehicles is important.

For clarity, microvehicles will be used as a collective term for e-bikes and e-scooters in this paper. Furthermore, the words green, environmental, and sustainable are used synonymously and encompass the ecological aspects of shared micromobility.

2 | THEORETICAL BACKGROUND

This paper focuses on the relationship of consumer innovativeness and green perceptions with green innovation use. This is significant for consumer behavior studies as this relationship is promoted as an important driver for consumers to adopt green innovations (Jansson, 2011; Mutum et al., 2020).

2.1 | Consumer innovativeness

Consumer innovativeness originated from the Diffusion of Innovations Theory (Rogers, 2003). Rogers (2003) defines consumer innovativeness as the time when an individual adopts innovations relative to others. The diffusion of innovations theory classifies consumers into five groups according to their time of innovation adoption—(a) innovators, (b) early adopters, (c) early majority, (d) late majority, and (e) laggards. Scholars and practitioners view consumer innovativeness as an important antecedent of early adoption (Frank et al., 2015). Individuals who are innately innovative are more likely to be risk-takers and able to cope with uncertainties (Thakur et al., 2016).

Consumer innovativeness is relevant to the study of shared e-bikes and e-scooters for two key reasons. First, these shared microvehicles can be considered innovative because of their sustainability and newness in the market (Lazarus et al., 2020). They are also innovative in comparison to other existing transport modes through their characteristics of being shared and e-powered. Furthermore, they are viewed as disruptors in the transport sector (Heineke et al., 2019), which is a strong indicator of innovative technologies, magnifying the suitability of consumer innovativeness in the study of shared e-bikes and e-scooters.

The second reason is that consumer innovativeness is a significant predictor of innovative transport forms, such as e-bikes (Simsekoglu & Klöckner, 2019), alternative fuel vehicles (AFV) (Heidenreich et al., 2017), shared e-cars (Joller, 2020), and shared bikes (Munkácsy & Monzón, 2018). In fact, there is a strong and positive direct effect of CI on the adoption of AFVs (Heidenreich et al., 2017). In other studies, researchers have shown that consumer innovativeness affects electric vehicle preferences (Morton et al., 2016) and purchase intention (Li et al., 2021). It has also been shown that CI moderates the effect of different antecedents of adoption and purchase intention of autonomous cars (Leicht et al., 2018). Based on these grounds, we propose the following hypothesis:

Hypothesis H1. Consumer innovativeness is positively related to the use of shared micromobility.

2.2 | Environmental referent cognitions

According to Nguyen and Johnson (2020) several factors, including internal factors, influence pro-environmental behavior. Internal factors are personal factors that are involved in the development of the pro-environmental behavior of an individual (Kollmuss & Agyeman, 2002). In this paper, we refer to these internal factors as environmental referent cognitions. These cognitions are environmental knowledge, biospheric values, environmental attitudes, and ascription of responsibility.

Environmental knowledge reflects the awareness of environmental problems caused by human activities (Fraj-Andrés & Martínez-Salinas, 2007). Empirical results have demonstrated that knowledge alone does not strongly predict pro-environmental behavior (Gifford & Nilsson, 2014; Kollmuss & Agyeman, 2002). However, knowledge is a significant predictor of attitude, and awareness of environmental problems elicits emotions that directly influence pro-environmental behavior (Bamberg et al., 2007; Rezvani et al., 2017). Furthermore, previous findings support that knowledge about environmental issues can encourage individuals to behave more sustainably (Gifford & Nilsson, 2014; Kautish & Sharma, 2020). In relationship to transport, studies have indicated that environmental knowledge is related to transport mode choice (Bai et al., 2020) and perceptions (Axsen & Sovacool, 2019; Egbue & Long, 2012). Because shared micromobility is to an extent marketed as a green transport mode, and thus, its adoption a pro-environmental behavior, we offer the following hypothesis:

Hypothesis H2. Environmental knowledge is positively related to users' green perceptions of shared micromobility.

Biospheric values reflect a person's concern about the welfare of the environment. As shown in previous studies, biospheric values are related to the performance of pro-environmental behaviors (Nguyen et al., 2016; Novoradovskaya et al., 2020). Indeed, the higher these values are, the more likely it is for an individual to perform pro-environmental actions (de Groot & Steg, 2010). Additionally, there is a significant link between biospheric values and the effect of a product's green attributes to purchase intention (Schuitema & de Groot, 2015). Apart from biospheric values' relation to intentions and behaviors, they are also related to an individual's preferences (van der Werff et al., 2013). Therefore, as biospheric values have a significant role in one's decision to act pro-environmentally, we can infer that these values can affect a person's perceptions on green innovations. In the transport sector Jansson and colleagues found that adoption of alternative fueled vehicles (such as electric cars) was significantly related to biospheric values (Jansson et al., 2011). Thus, we propose that:

Hypothesis H3. Biospheric values are positively related to users' green perceptions of shared micromobility.

Ascription of responsibility refers to the beliefs that one is responsible for his or her actions and consequences that come with them (Rezvani et al., 2017). Ascription of responsibility affects the feeling of moral obligation in the consequences of one's behavior (Huang et al., 2020; Klöckner, 2013). Consumers who see themselves as responsible for the environment tend to support pro-environmental behavior (Dagher & Itani, 2014). Therefore, people who feel responsible for the environmental consequences of their actions would be likely to adopt and purchase environmental products. This effect is more evident on green consumers compared to nongreen consumers (Barbarossa & De Pelsmacker, 2016; Jansson et al., 2011). Ascription of responsibility also can be related to intention to adopt green innovations through activating awareness and norms (Huang et al., 2020). In relation to transport, Rezvani et al. (2017) analyzed the significance of emotions and moral norms on pro-environmental behavior and found that ascription of responsibility regarding the negative impact of the use of car trigger emotions, which consequently affect the intention to act environmentally. Based on these previous findings, we propose that:

Hypothesis H4. Ascription of responsibility is positively related to users' green perceptions of shared micromobility.

Some consumers choose sustainable transport based on their pro-environmental attitudes (Martenson, 2018). Pro-environmental attitudes, which refer to an individual's favorable or unfavorable evaluation of the importance of the environment, accounts for a large part in the decision to adopt sustainable behavior (Jansson et al., 2017). Gardner and Abraham (2010) argue that attitude is a decisive factor in transport choice. A study of shared bikes has revealed that pro-environmental attitudes with green perceptions strengthen the perceived values of the transport mode and adoption intention (Wang et al., 2018). Nevertheless, other studies point out that attitudes are not a significant predictor of environmental behavior (Joshi & Rahman, 2015; Vicente-Molina et al., 2013). Because of these contradictions, more studies need to investigate the relationship between pro-environmental attitudes and behavior. If shared micromobility is in fact regarded as sustainable transport, users would have a strong and positive attitude towards it because it supports the preservation of the environment. However, if consumers possess high levels of pro-environmental attitudes and do not perceive shared micromobility as green, the promotion of green attributes of shared micromobility has not been effective and could be undermined by other factors. Therefore, we suggest that:

Hypothesis H5. Pro-environmental attitudes are positively related to users' green perceptions of shared micromobility.

Environmental referent cognitions will partly determine the intention of an individual to perform actions that have less negative impact on the environment (Kollmuss & Agyeman, 2002). Consequently, we argue that these factors will affect consumers' green perceptions of shared micromobility, that is, the extent to which they perceive the transport mode as environmental-friendly, and, therefore, influence their decision to adopt it. Consumers who perceive the green attributes of products enjoy the consumption of these products because they are behaving sustainably (Tezer & Bodur, 2020). According to Jansson et al. (2011), adopters of eco-innovations are more inclined to perceive the green attributes of the adopted eco-innovations than nonadopters. As shared micromobility is partly promoted on its ecological benefits, we argue that green perceptions of shared micromobility are connected with the consumer decision to use the transport mode. Hence, we hypothesize that:

Hypothesis H6. Green perceptions of shared micromobility are positively related to its use.

3 | METHODOLOGY

3.1 | Participants and data collection

A panel research company was engaged in collecting data. It sent out the first email invitations to its panel members to participate in the online survey in February 2020. Participants were screened based on their residence and age. Only residents of Copenhagen and Stockholm who were between 16 and 65 years old during the survey period were asked to participate. They were the ones who had access to both shared microvehicles as shared e-scooters can only be used by those who are older than 16 years of age. As for selecting research locations, Copenhagen and Stockholm were chosen because it is in these cities that shared e-bikes and e-scooters have been launched first in the Nordic region (Wachunas, 2019). Therefore, commuters from both cities have had access to shared micromobility for a similar length of time. These cities are also comparable in size, socio-demographic profiles, and weather conditions, minimizing the differences that can be attributed to cross-cultural and weather condition divergence. Practically, the survey was conducted in two cities to increase the number of possible participants and have access to more users of shared micromobility.

Since the number of target respondents, 750 for each city, was not reached initially, reminders were sent out until the quota was achieved in March 2020. In total, 1501 respondents were asked to answer the questionnaire based on whether they have used shared micromobility in the past year or not. If they answered yes, they were asked which shared micromobility (e-bike or e-scooter) they used more often. The participants were grouped into nonusers ($n = 515$), shared e-bike users ($n = 400$), and shared e-scooter users ($n = 586$).

3.2 | Measures

The survey had four parts. In the first part, the participants were asked if they had used shared e-bikes and e-scooters, which allowed the segmentation of the participants into three groups, (a) shared e-bike users, (b) shared e-scooter users, and (c) nonshared micromobility users.

The second part of the survey was used to identify the participants' innovativeness. This part assessed whether early transport innovation adopters embrace shared e-bikes and e-scooters as quickly as other novelties in the transport sector. The question was adopted from the study of Noppers et al. (2015) about the role of product attributes in the adoption of sustainable technology.

The third part concerned the participants' green perceptions of shared micromobility and the environmental referent cognitions that have been identified by Kollmuss and Agyeman (2002) which was measured using a Likert 5-point scale (from 1, completely disagree, to 5, completely agree). Environmental knowledge measures were adopted from the study of Bamberg et al. (2007) regarding how personal norms affect the decision to use public transport. The questions that measured biospheric values came from the study of Bouman et al. (2018), in which they tested measures related to environmental behaviors and beliefs. The ascription of responsibility questions were adopted from the study of Rezvani et al. (2017) about the significance of emotions and moral norms on pro-environmental behavior. To evaluate the pro-environmental attitude of the participants, measures have been adopted from Jansson and colleagues' study (2017) regarding the role of norms and opinion leadership in the adoption of electric vehicles. Finally, the measures for green perceptions that lead to use or nonuse of shared micromobility came from Noppers et al. (2015) about the relationship between environmental attributes and the adoption of electric cars.

An overview of the questions regarding environmental referent cognitions is presented in Table 1. The word "shared micromobility" was replaced by "shared e-bike" or "shared e-scooter" in the green perception questions, if they were users, depending on which shared microvehicle they reported to use in the questionnaire.

The variables' reliability was tested using Cronbach's alpha and was found to be acceptable, as shown in Table 1. The validity of the variables was analyzed using confirmatory factor analysis (CFA). CFA is appropriate because the scales have already been tested in other research (Hair et al., 2014). The CFA results are found in the Appendix Table A2. The CF = 888.312(125); CFI = 0.96; and RMSEA = 0.064).

The questions in the fourth part asked about the participants' socio-demographic information: (a) gender, (b) age, (c) possession of driver's license, (d) highest educational attainment, and (e) monthly net income. The distribution of the participants based on their socio-demographic characteristics can be found in the Appendix Table A1.

3.3 | Analysis

We applied Linear and Multiple Logistic Regression, *t* test, and Analysis of Variance to achieve the paper's objectives. Linear regression was applied to assess the relationships between the environmental referent cognitions and green perceptions of shared micromobility. To test the relationships between green perceptions and consumer innovativeness, and shared micromobility use, logistic regression analysis was used due to the dependent variable being categorical, in this case, use or nonuse (Pallant, 2016). On the other hand, multiple regression is appropriate when the dependent variable is continuous, which in this study is the case for green perceptions (Pallant, 2016). Finally, to assess and compare mean results between different groups, we used ANOVA and *t* test. These tests are utilized to check for significant differences between and among groups (Pallant, 2016), such as groups based on gender, income, or based on car innovativeness adopter segments.

4 | RESULTS

Table 2 shows the distribution of adopters based on the descriptions found in the second column of the table. Users refer to users of shared e-bikes and e-scooters, while nonusers are those who have not tried these transport modes. It is clear that circa 84 percent of the users consider themselves to belong to the innovators, early adopters and early majority of adopters of innovations in transport. With a stark contrast, almost 50 percent of the nonusers consider themselves as either a part of the late majority or a traditionalist group.

Based on the users and nonusers' responses to consumer innovativeness, and *t* test results comparing the group means ($t = -16.42$, df = 1282.08, $p < .001$) of nonusers (mean = 3.31, SD = 0.94) and

TABLE 1 Adopter segments for micromobility users and nonusers

Knowledge[a] (Cronbach's $\alpha = 0.80$)
Driving a car on gasoline and diesel contributes to greenhouse gas emissions that warm the atmosphere
The increase in greenhouse gases is mainly caused by human activities
Carbon dioxide, which is a greenhouse gas, is emitted when using fossil fuels
Biospheric values[a] (Cronbach's $\alpha = 0.87$)
It is important for me to prevent environmental pollution
It is important for me to protect the environment
It is important to me to respect nature
It is important to me to be in unity with nature
Ascription of responsibility[a] (Cronbach's $\alpha = 0.91$)
I feel partly responsible for the increase in the use of fossil fuels such as oil/ gasoline/diesel
I am partly responsible for the problems related to fossil fuels in society today
I feel partly responsible for global warming
Pro-environmental attitude[a] (Cronbach's $\alpha = 0.93$)
We are approaching the limit of the number of people the earth can support
If things continue on their present course, we will soon experience a major ecological catastrophe
The balance of nature is very delicate and easily upset
When humans interfere with nature, it often produces disastrous consequences
Green perceptions[a] (Cronbach's $\alpha = 0.93$)
Use of shared micromobility, in general, would contribute to solving air pollution in residential areas caused by traffic
Use of shared micromobility, in general, would contribute to solving environmental pollution caused by traffic
Use of shared micromobility, in general, would contribute to solving climate change due to the emission of greenhouse gases from traffic
Use of shared micromobility, in general, would contribute to solving the depletion of natural resources like oil

[a]Initial question: Indicate to what extent you agree or disagree with the statements below (scale from 1, completely disagree, to 5, completely agree).

users (mean = 2.49, SD = 0.95), there is a significant difference between innovativeness of the two groups. ANOVA results also show that there is a significant difference between the innovativeness of nonusers, shared e-bike users, and shared e-scooter users ($F = 109.69$, df = 2.00, MS = 100.22, $p < .01$). However, the t test indicates that between shared e-bike (mean = 2.59, SD = 1.02) and e-scooter (mean = 2.52, SD = 0.90) users, no significant difference between innovativeness can be demonstrated (t = 1.04, df = 786.12, $p < .05$).

As for green perceptions, t test ($t = 4.33$, df = 1184.80, $p < .001$) comparing nonadopters (factor score = −0.14, SD = 1.05) and adopters (factor score = 0.09, SD = 0.95) reveals that there is a significant difference between green perceptions of shared micromobility of users and nonusers. ANOVA also reveals that green perceptions between nonusers, shared e-bike users, and shared e-scooter users differ ($F = 32.71$, df = 2.00, MS = 29.66, $p < .001$). In general, users perceive shared e-bikes and e-scooters as green, whereas nonusers do not. Between users, t test shows (t = 4.74, df = 896.03, $p < .001$) that significant difference between green perceptions of shared e-bike (factor score = 0.29, SD = 0.09) and shared e-scooter users (factor score = 0.01, SD = 0.97) exists. Although both user groups perceive their respective used shared microvehicles as green, the perceived greenness of shared e-bikes is higher for shared e-bike users than the perceived greenness of shared e-scooters for shared e-scooter users.

Linear regression results shown in Table 3 indicate that knowledge and pro-environmental attitudes are significantly related to the green perceptions of micromobility. In the model, biospheric values and ascription of responsibility have no significant relationship with the green perceptions of micromobility.

Finally, logistic regressions were conducted to determine the strength of the relationships between the independent and the dependent variables (Table 4). Four logistic regression models were run using the different user group classifications as dependent binary variables. The consumer innovativeness scale was reversed so that innovators were denoted 5 and traditionalists were denoted 1 to be consistent with the scale of the green perception. Socio-demographic variables served as control variables in the study.

In the first model (Cox & Snell R^2 = 0.300), green perceptions ($p < .001$) and innovativeness ($p < .001$) have a significant relationship in the use of micromobility. These results support our two hypotheses about the positive relationship between perceived greenness and consumer innovativeness in the use of micromobility. Interestingly, gender ($p < .05$), age ($p < .001$), possession of a driver's license ($p < .05$), and income ($p < .05$) are related to use. Between nonusers and shared e-bike users, green perceptions and innovativeness correlate to the decision to use shared e-bikes. As Model 2 (Cox & Snell R^2 = 0.234) shows, there is a significant relationship between being innovative ($p < .001$) and green perceptions of shared e-bikes ($p < .001$), and the likelihood to use these vehicles. Gender ($p < .05$), age ($p < .001$), and income ($p < .05$) are also statistically significantly related to the use of shared e-bikes.

Model 3 (Cox & Snell R^2 = 0.334) presents the regression results for shared e-scooter users and nonusers. Like shared e-bike users, there is a statistically significant relationship between being innovative ($p < .001$) and green perceptions of shared e-scooters ($p < .05$) and the likelihood of use. Among socio-demographic variables, age ($p < .001$) and income ($p < .05$) are significantly correlated to the use of shared e-scooters. Finally, between users (Cox & Snell R^2 = 0.084), only green perceptions ($p < .001$) are related to the decision to use a shared e-bike or a shared e-scooter. On the other hand, innovativeness (p = .145) does not seem to play an important role in distinguishing use decisions. Age ($p < .001$) and possession of a driver's license ($p < .05$) are correlated to the use of either a shared e-bike or a shared e-scooter.

TABLE 2 Adopter segments for micromobility users and nonusers

Adopter segment[a]	Description	Adopters	Nonadopters
1. Innovators	I am a type of person who closely follows new technological developments in the field of transport and who dares taking risks by being the first to purchase an innovative transport mode.	6.71%	1.47%
2. Early adopters	I am a type of person who envisions potential advantages in innovative products in the transport field in the field of transport and who is one of the first to make use of these advantages and to profit from those.	24.08%	4.76%
3. Early majority	I am a type of person who is interested in innovative products in the transport field but at the same time is pragmatic. First, I would like to take time and be persuaded by the advantages that an innovative transport possesses. My decisions are (mainly) based on the recommendations of existing users.	52.91%	45.46%
4. Late majority	I am a type of person who is not thrilled by innovative products in the transport field, but who rather appreciates security. It is safe to purchase an innovative transport when it has been on the market for some while and offers obvious advantages.	10.30%	31.84%
5. Traditionalists	I am a type of person who is traditional and has little affinity with innovative products in the transport field. I do not like changes in life and I purchase an innovative transport only when the existing model I use is not produced anymore.	6.00%	16.47%

[a]Question: Please choose the option that best describes you (only one option selectable).

TABLE 3 Multiple regression of green perceptions of micromobility

Model green perceptions	β	SE
Ecological attitude	0.218**	0.037
Environmental knowledge	0.086*	0.041
Ascription of responsibility	0.053	0.029
Biospheric values	0.064	0.040

*$p < .05$.
**$p < .001$, $R^2 = 0.127$, RMSE $= 0.934$.

Table 5 summarizes the results of the six hypotheses of this research and their significance levels.

5 | DISCUSSION

Consumer innovativeness and green perceptions are significantly related to the use of shared micromobility. Both factors have positive relationships with the use of shared e-bikes and shared e-scooters, although there is a weaker connection between use and green perceptions among shared e-scooter users than shared e-bike users. Indeed, according to Englis and Phillips (2013), people who have a higher tendency to accept innovations are those who are concerned about the environment and its conservation. These results are also consistent with previous studies that demonstrate that the use of shared transport can be related to innovativeness (Hwang & Griffiths, 2017; Joller, 2020; Munkácsy & Monzón, 2018) and green perceptions (Mattia et al., 2019; Wang et al., 2018).

Comparing users, shared e-bike users are more driven to use shared e-bikes because of their perceived relatively low negative environmental impact. Shared e-scooter users perceive less the environmental benefits of shared e-scooters. These results indicate that shared e-scooter users do not primarily use these microvehicles because of their perceived greenness.

Several reasons may have caused the unexpected insignificant relationship between green perceptions and e-scooters. On the one hand, this could be because of the issues surrounding the use of shared e-scooters. Shared e-scooters have arrived on the streets of Copenhagen and Stockholm, like in many other cities, more or less overnight. Therefore, regulations were not in place regarding their use, which resulted in shared e-scooters blocking pedestrians and accidents related to the usage of inexperienced riders (Gössling, 2020). These problems resulted in negative perceptions of shared e-scooters in general, which in turn could have affected how consumers perceive the greenness of the microvehicles. On the other hand, this could also be attributed to the shared e-scooter's substitution of walking or public transport, or its use for recreational purposes in many cases, whereas shared e-bikes are used to complement other existing green transport modes, such as public transport and conventional shared bikes. Shared e-bikes have also been around longer than shared e-scooters, making consumers more familiar with their attributes, and nonelectric bikes, generally, are regarded as a form of green transport.

Between users and nonusers, shared micromobility users are more likely to perceive the environmental benefits of shared microvehicles than nonusers, suggesting that users have positive environmental attitudes towards shared micromobility. These findings validate the argument that users perceive the promotions regarding the greenness of shared micromobility. As for nonusers, they tend not to support the environmental assertions of microvehicle sharing. This can likely be attributed to the nonenvironmental issues related to its use and parking, in which nonusers see how the microvehicles are parked after use and also how they are disposed (Hardt &

TABLE 4 Logistic regression results

Dependent variables	Model 1 1 = users 0 = nonusers		Model 2 1 = E-bike 0 = nonusers		Model 3 1 = E-scooter 0 = nonusers		Model 4 1 = E-scooter 0 = E-bike	
Independent variables	B	exp. β	B	exp. β	B	exp. β	B	exp. β
Green perceptions	0.259**	1.296	0.673**	1.960	0.199*	1.220	−0.349**	0.706
Innovativeness	0.749**	2.115	0.545**	1.725	0.747**	2.111	0.110	1.117
Constant	1.291**		0.193**		1.235**		1.342**	
Cox & Snell R^2	0.300		0.234		0.334		0.084	
Controls								
Gender (Male = 0, Female = 1)	−0.390*	0.677	−0.371*	0.690	−0.279	0.756	0.154	1.166
Age	−0.085**	0.006	−0.055**	0.946	−0.097**	0.908	−0.034**	0.966
Driver's license (Yes = 0, No = 1)	−0.396*	0.673	0.099	1.105	−0.593	0.553	−0.837*	0.433
Education	0.038	1.039	0.001	1.001	0.045	1.047	0.024	1.024
Income	0.162*	1.176	0.178*	1.191	0.206*	1.228	−0.064	0.938

*$p < .05$.
**$p < .001$.

TABLE 5 Summary of hypotheses' results

Hypothesis	Supported/rejected	Tested	Significance level
H1: Consumer innovativeness is positively related to the use of shared micromobility.	Supported	Models 1, 2, 3	$p < .001$
H2: Environmental knowledge is positively related to users' green perceptions of shared micromobility.	Supported	Linear regression	$p < .05$
H3: Biospheric values are positively related to users' green perceptions of shared micromobility.	Rejected	Linear regression	n.s.
H4: Ascription of responsibility is positively related to users' green perceptions of shared micromobility.	Rejected	Linear regression	n.s.
H5: Pro-environmental attitude is positively related to users' green perceptions of shared micromobility.	Supported	Linear regression	$p < .001$
H6: Green perceptions of shared micromobility are positively related to its use.	Supported	All regression models	$p < .001$

Abbreviation: n.s., nonsignificant at $p < .05$.
[Correction added on 29 September 2021, after first online publication: Table 5 has been corrected in this version.]

Bogenberger, 2019). Another reason can be that nonusers may perceive that shared micromobility does not substitute car use, but instead generates more trips or replaces other green transport modes.

As for the environmental referent cognitions, intriguingly, ascription of responsibility and biospheric values are not significantly related to the green perceptions of micromobility as expected. A reason for this could be that the questions about these cognitions focused on "me" and "I," whereas questions regarding environmental knowledge and environmental attitudes had a more collective framing. We can infer from this that when consumers perceive environmental problems as a societal issue and not an individual responsibility, their environmental motivation increases. According to White et al. (2019), collective action is a stronger driver for sustainable behavior because achieving sustainable behavior outcomes requires a large number of people to act. Another explanation for these results might be that there are interactions between these environmental referent cognitions that make their separation challenging.

Regarding consumer innovativeness, the trait significantly correlates to the use of micromobility, especially of shared e-scooters. Results also reveal that CI is more related to shared micromobility use than green perceptions. These results support research that consumer innovativeness is a crucial factor in the adoption of sustainable innovations (Li et al., 2021; Noppers et al., 2015). Although consumer innovativeness has been shown to be a significant predictor of e-bike purchase (Simsekoglu & Klöckner, 2019), no evidence shows that shared e-bike users are more innovative than shared e-scooter users, or the other way around. This implies that innovativeness alone cannot tell us whether a person would prefer a shared e-bike or a shared e-scooter.

Socio-demographic attributes are also relevant in the decision to use shared microvehicles. For instance, all models in this paper show that age is a significant variable in the decision to use shared micromobility. Young people are more inclined to use shared microvehicles than older individuals. This confirms previous studies that demonstrate that age is an important predictor of innovation adoption and sustainable behavior (Bartels & Reinders, 2011; Novoradovskaya et al., 2020). Gender, income, and possession of a driver's license also influence the use of shared micromobility. Higher income is linked to a higher likelihood of use, while possession of a driver's license and being female, on the other hand, correlates to the decrease in the likelihood of use. Studies have revealed that income is an important predictor of transport mode choice (Axsen & Sovacool, 2019; Heinen & Chatterjee, 2015). In the case of shared micromobility, low-income consumers may be driven away from the use of shared e-bikes and e-scooters because they find them expensive (Abduljabbar et al., 2021). As for possession of a driver's license, it has been shown that having a driver's license reflects an individual's desire to own a car. Nevertheless, it also increases the likelihood of person to join car-sharing schemes (Acheampong & Siiba, 2020). However, based on the results of the study, it has an opposite effect on shared micromobility. This may be because of the differences in the instrumental and symbolic benefits of cars and microvehicles (Simsekoglu & Klöckner, 2019). Although some studies have argued that females are more likely to behave pro-environmentally than males (Diamantopoulos et al., 2003; Gifford & Nilsson, 2014), issues regarding safety could be the reason behind the result of the lower likelihood of female use of shared micromobility, however further studies would be necessary to substantiate this conjecture.

6 | IMPLICATIONS

As the research findings reveal that green perceptions significantly relate to the use of shared micromobility, providers could target commuters who are currently nonusers but have strong environmental motivations by presenting the potential environmental benefits of shared micromobility if used to replace, for example, car trips. For current users, providers should remind them how their vehicles can be used to replace more environmentally harmful car traveling and keep introducing new product features and improvements, especially green ones.

Because of the differentiation between shared e-bikes and shared e-scooters, another practical implication is that targeted marketing strategies can be formulated to attract and retain more users of shared micromobility. As shared e-bike users perceive the greenness of shared e-bikes more than shared e-scooter users, marketing campaigns for shared e-bikes should be a mix of greenness and innovativeness. For shared e-scooters, campaigns should focus on new product features and improvements. These features should be easily observable and can be in the form of product extensions, as they induce more positive responses from consumers compared to improvements in core features (Paparoidamis et al., 2019).

From a policy and management perspective, the results not only imply the importance of continuous performance and environmental improvement but also that policies hindering diffusion and adoption need to be addressed. For example, in many cities today, passenger cars take up much of the available space for both driving and parking, which hinders other less environmentally harmful and congesting ways of individual travel, such as walking and cycling. The promoters of shared microvehicles need to address policymakers so that more space is devoted to greener transport modes both in terms of parking but also for safety reasons, for example, avoiding mixing microvehicles, and passenger cars.

Theoretically, this research contributes to the literature by confirming the significance of innovativeness and green perceptions in the use of sustainable innovations (Englis & Phillips, 2013; Li et al., 2021). Furthermore, we added understanding to the importance of distinguishing between related sustainable innovations, as both shared e-bikes and shared e-scooters are regarded as novel and serve similar purposes, thereby emphasizing the significance of more detailed approaches when it comes to studies in innovations.

This paper also furthers existing knowledge regarding the role of environmental referent cognitions in the green perceptions of innovations. Although our results regarding the impact of biospheric values and ascription of responsibility conflict with many previous studies, we provided a strong argument that to motivate people to behave pro-environmentally, they have to be driven in a collective manner rather than on an individual level.

7 | LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

The implications of this paper must be interpreted carefully as the research has been conducted in two Scandinavian cities only. Therefore, the implications might be more relevant for cities that share similar characteristics and should be corroborated by empirical studies in other cities. Nevertheless, the results and implications presented can serve as initial input for understanding consumer behaviors and a guide for future research.

A few other limitations of the current paper are also relevant for further research to address. First, we did not include a group of users who use both shared e-bikes and e-scooters. Including this group would help make a more comprehensive comparison between the two shared microvehicles. Nonetheless, it might be problematic to distinguish between different user behaviors and perceptions in such cases. In this paper, we also did not focus on the city comparison between Copenhagen and Stockholm, thereby not including a discussion regarding similarities and differences between the users and nonusers of the two cities.

An opportunity for further research is the application of consumer innovativeness and green perceptions of shared micromobility in other cities using a longitudinal approach. Because the research was only conducted in two cities using a survey, studies in additional cities using multiple surveys at different time points over a period can bring more insights into the motivation behind adoption and the development of these motivations. It would also be useful to replicate this research in other sustainable transport forms, like car-sharing and ride-sharing, or other sustainable innovations to substantiate the findings of this study. Finally, we suggest exploring the segmentation of users' and nonusers' innovativeness and its effects on adoption, and the impact of individual shared micromobility brands on user perceptions. As more and more providers of microvehicles emerge and use branding as a marketing strategy, it will be interesting to see in the future how consumers perceive differences between brands when it comes to innovativeness and greenness.

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CONFLICT OF INTEREST

No conflict of interest has been declared by the authors.

DATA AVAILABILITY STATEMENT

Data available on request from the authors

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APPENDIX A.

TABLE A1 Characteristics of the sample in Denmark and Sweden

	Copenhagen ($n = 750$)	Stockholm ($n = 751$)
Gender		
Male	41.20%	54.46%
Female	58.80%	45.54%
Age		
16–29	38.53%	25.30%
30–39	20.53%	20.91%
40–49	15.20%	22.37%
50–65	25.73%	31.42%
Education		
Elementary	6.13%	4.79%
High school	19.47%	32.09%
A few years of college studies	9.47%	15.98%
College studies completed	51.87%	40.88%
Started doctoral studies	1.47%	1.20%
Complete doctoral degree	2.80%	1.86%
Others	7.73%	2.93%
None of the above	1.07%	0.27%
Drivers license		
Yes	79.87%	80.03%
No	20.13%	19.97%
Income		
Less than 20,000 per month before tax	32.67%	17.18%
Between 20 and 35,000 per month before tax	26.27%	25.97%
Between 35 and 50,000 per month before tax	20.00%	27.30%
Between 50 and 65,000 per month before tax	5.73%	9.99%
Over 65,000 per month before tax	3.87%	6.66%
Prefer not to answer	11.47%	12.92%

TABLE A2 Confirmatory factory analysis of environment referent cognitions

	Factor				
	Green perceptions	Biosphe-ric values	Ascription of responsibi-lity	Attitude	Knowledge
Renting and using electric bicycles and / or electric scooters in general would help to reduce the environmental problems caused by car traffic	0.929				
Renting and using electric bicycles and / or electric scooters in general would reduce the climate problems caused by car traffic	0.919				
Renting and using electric bicycles and / or electric scooters in general would help reduce air pollution caused by car traffic in residential areas	0.869				
Renting and using electric bicycles and / or electric scooters in general would reduce society's dependence on fossil oil	0.812				
It is important for me to protect the environment		0.955			
It is important for me to prevent environmental pollution		0.791			
It is important for me to respect nature		0.740			
It is important for me to live in harmony with nature		0.616			
I am partly responsible for the problems of fossil fuels in society today			0.987		
I feel partly responsible for the increase in the use of fossil fuels as oil / gasoline / diesel			0.850		
I feel partly responsible for global warming			0.790		
The balance in nature is sensitive and easily disturbed				0.726	
When man intervenes in the course of nature, it often has disastrous consequences				0.694	
If development continues as hitherto, we will soon experience a major ecological disaster				0.664	
We are approaching the limit of the population the earth can give birth to				0.633	
Driving a car on gasoline and diesel contributes to greenhouse gas emissions that warm the atmosphere					0.775
The increase in greenhouse gases is mainly caused by human activities					0.706
Carbon dioxide, which is a greenhouse gas, is emitted when using fossil fuels					0.634