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Spending Your Pay for a Sustainable Way: Measuring Individuals' Willingness to Financially Support Sustainable Mobility Initiatives

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Abstract

Climate change remains a critical and undeniable global issue. The mobility sector, and especially privately owned cars, are a huge contributor to greenhouse gas emissions (GGEs), driving the anthropogenic climate change. Thus, a need to transition towards sustainable mobility solutions is undeniable. However, sustainable mobility innovations and initiatives often struggle with securing long-term financial stability, especially after initial government funding ends. This emphasises a need for additional or alternative funding methods. Therefore, this research explores how sustainable mobility initiatives could secure long-term financial support through means of crowdfunding. This thesis uses theories from psychology and behavioural economics and adopts a user-centric approach, employing a survey to explore which factors influence an individual's willingness to financially support a sustainable mobility initiative. Notably, it focuses on the role of loss aversion, perceived attributes of the initiative (i.e. sustainability, convenience, and instrumental/financial benefits) and user engagement/previous experience with the initiative (based on frequency and duration of use).

Results challenge prevailing assumptions: neither loss-framed messaging nor perceived attributes or frequency of use significantly predict financial support, while only duration of use shows a modest positive correlation. Primary limitations lie in the generalisability of the research, the limited comparability of the loss and gain frame, and the constricting scope of our willingness to support score. Further limitations and implications for future research are discussed.

Keywords:

Sustainable Mobility, Initiatives, Long-Term Financial Stability, Crowdfunding, Loss-Aversion, Perceived Attributes, Between-Subjects Design.

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Spending Your Pay on a Sustainable Way: Measuring Individuals' Willingness to Financially Support Sustainable Mobility Initiatives

The topic of climate change has become an undeniable issue, creating concern to everyone who cares about the future of our planet. Despite many efforts to mitigate climate change, Greenhouse gas emissions (GGEs) have proceeded to increase annually (IPCC, 2014). The global transportation sector is one of the most significant contributors to GGEs, accountable for a substantial portion of this anthropogenic climate change. Private vehicle ownership, in particular, is a key driver of these emissions, exacerbating air pollution, urban congestion, and reliance on fossil fuels (Gilbert & Perl, 2008; IPCC, 2014, Kawabata et al., 2020). As highlighted by the IPCC Sixth Assessment Report, road vehicles are responsible for a majority, about 70%, of direct transport emissions (Jaramillo et al., 2022; Wengraf, 2012). Therefore, a need to transition towards sustainable mobility solutions is undeniable.

Sustainable mobility is defined as "the ability to meet the needs of society to move freely, gain access, communicate, trade and establish relationships without sacrificing other essential human or ecological values today or in the future." (Gottschalk et al., 2002, p.19). Sustainable mobility innovations, which encompass a wide range of technologies and services such as shuttle services or shared mobility platforms, offer the potential to mitigate the aforementioned negative impacts and create more environmentally sound, equitable, and economically viable transportation ecosystems (Jelti et al., 2023).

However, a persistent challenge for many of these innovations is securing long-term financial support. Initial funding, often from government sources, can provide crucial seed capital and momentum. Yet, once this initial phase ends and government support is discontinued, many promising initiatives face difficulties securing the finance needed to sustain or scale their impact. Many promising initiatives and innovations struggle to maintain user adoption and attract continued investment, leading to uncertainty and the hindering of

long-term impact (Adeyemi, n.d.; Long & Blok, 2021). Hence, it is necessary to investigate alternative and additional funding concepts that can ensure long-term financial stability for such innovations.

One increasingly popular approach is to involve users directly through crowdfunding. Crowdfunding enables people and businesses to raise money for their projects via open calls, offering prizes, selling stock shares, providing financial returns, or sometimes simply by offering (social) recognition in return (Messeni Petruzzelli et al., 2019; Adamska et al., 2024, Oliva, 2018). Crowdfunding has a lot of potential, according to the World Bank, the phenomenon has increased so prominently that crowdfunding investments are likely to surpass traditional forms of financing for new innovations (Messeni Petruzzelli et al., 2019).

While crowdfunding is increasingly recognised as a promising tool for supporting sustainable initiatives, most existing research focuses on its role in providing seed capital for launching new services (Testa et al., 2019; Richard, 2013). There is limited empirical work examining how crowdfunding can support the long-term financial stability of established services, particularly after government support is phased out or reduced, and additional or alternative funding methods are needed. This study addresses this gap by exploring the psychological and behavioural drivers that motivate existing users to provide ongoing or repeated financial support through crowdfunding.

To adopt crowdfunding as a long-term financing strategy, it is crucial to understand the factors that motivate individuals to provide financial support. This thesis adopts a user-centric approach, exploring which factors influence an individual's willingness to financially support a sustainable mobility initiative. Notably, we focus on the role of loss aversion, perceived characteristics/ attributes of the sustainable mobility initiative (i.e. perceived sustainability, perceived convenience and perceived instrumental/financial benefits) and user engagement/previous experience with the initiative (based on frequency and duration of use).

Hence, the research question that will guide this thesis is the following: What factors influence individuals' willingness to provide financial support for a sustainable mobility initiative? By addressing this research question and providing statistical results on users' choices, this paper will provide crucial information on how sustainable mobility initiatives could engage their users and achieve long-term financial stability.

We[1] will begin by providing the reader with a literature review, introducing the theoretical frameworks from both psychology and behavioural economics, demonstrating that current challenges require interdisciplinary approaches. This will be followed by presenting the hypotheses. A strategically compartmentalised methodology section follows, in which we explain the choice and use of a controlled experimental design embedded within a user survey. Here, we explain the case study used: a sustainable and shared shuttle service in Germany, called **NAH**SHUTTLE, operated through NAH.SH, and currently still subsidised by government funding. Succeeding the methodology section, we present the result of the research, which we then analyse and discuss in the latter discussion section. We conclude with a future outlook and recommendations for research and practice.

[1] Throughout this thesis, I will use the term 'we' instead of 'I', as the research was conducted in collaboration and with help from other people (Berfu Ünal, thesis supervisor; Anthony Armiger, NAH.SH; Lucio Meinhof). I was responsible for the conceptualisation, methodology, formal analysis, investigation, data curation, writing, editing, and visualisation of all research presented in this thesis. My supervisor and other collaborators were responsible for, or helped me with, the conceptualisation, validation, reviewing, further editing, and supervision.

2. Literature review:

Based on existing literature, behavioural economics offer insights about which factors might influence the willingness to financially support sustainable mobility initiatives. For example, as part of the Prospect Theory, the well-documented cognitive bias of Loss Aversion introduced by Kahneman and Tversky (1979) suggests that individuals are more sensitive to potential losses than to equivalent gains. This means that people are generally more willing to take action (e.g., support a system financially) if it helps them avoid a potential loss (e.g., the discontinuation of the service), compared to taking the same action when they expect to gain something of equal value (e.g., an improvement of the current system).

To take advantage of the phenomenon of loss aversion, one can use the Framing Effect. This cognitive bias, studied by Tversky and Kahneman (1981 & 1984), shows that people's decisions can be influenced by how options are framed. Identical or similar information can lead to very different responses depending on how the information is presented. This effect seems particularly accentuated when the presentation is framed in terms of gains or losses (Tversky and Kahneman, 1981 & 1984).

These concepts have been applied to sustainable behaviour, with studies showing that loss-framed messages can be more effective in promoting environmental actions (see e.g. Avineri & Waygood, 2012; Chen et al., 2022; Grazzini et al., 2018). For instance, research on sustainable consumption demonstrates that loss-framed messages induce more positive responses toward sustainable consumption behaviours, particularly in the early stages of behaviour change (Chen et al., 2022). In the context of sustainable mobility, this leads to our initial hypothesis that framing the discontinuation of a sustainable mobility innovation or service as a “loss” could motivate users to contribute financially to its continuation.

H$_1$*: A loss-framed message (emphasising the potential loss of a sustainable mobility service) will increase willingness to provide financial support, compared to a gain-framed message (emphasising the benefits of improving the service).*

Research suggests that pro-environmental behaviours, such as financially supporting a sustainable mobility initiative, can be motivated by perceived attributes/ characteristics of such initiatives. *Perceived convenience, perceived sustainability, and perceived instrumental or financial benefits* are identified to be among the key drivers that influence consumer choice and behaviour (see e.g. Post et al., 2024; Noppers et al., 2014, 2019; Steg & Vlek, 2009; Liobikienė & Miceikienė, 2022; J et al., 2024; Chowdhury, 2023).

According to Noppers et al. (2014) and Post et al. (2024), instrumental/ financial attributes cover an individuals' perception of the (positive or negative) outcomes or costs of possessing or utilising a sustainable innovation. Perceptions about outcomes for the environment, stemming from using or owning the service, fall under environmental attributes (hereinafter referred to as perceived sustainability; Noppers et al. 2014; Post et al. 2024). In a paper about the influence of convenience on sustainable transport behaviour by Liobikienė & Miceikienė (2022), convenience encompasses the quality of services, such as their punctuality, frequency, comfort, as well as the accessibility. In the same paper, convenience is understood as a primary factor that triggers sustainable mobility behaviour. Additionally, Noppers et al. (2019) state that the more favourably an individual perceives the attributes of a sustainable innovation, the more likely they are to accept and use it. It is therefore plausible that these perceptions also play a role in shaping consumers' willingness to financially support such sustainable innovations.

Different theories provide an explanation on how perceived characteristics could affect one's willingness to financially support a sustainable mobility initiative. For instance, research on environmental behavior is based on the assumption that people make rational choices and

select options that balance the highest advantages against the lowest costs, therefore individuals engage in behaviours they perceive as most beneficial (Steg & Vlek, 2009). Our behaviours, and choices, are influenced by cost-benefit analyses (Koopmans & Mouter, 2020). Known from behavioural economics, this framework suggests that individuals informally assess the trade-offs and expected consequences involved in, e.g., supporting a service. If the perceived attributes (whether convenience, sustainability, or financial benefits) are high and seen to outweigh the cost of support, individuals are more likely to act and support the system financially (Drèze & Stern, 1987; Kahneman & Tversky, 1984).

In addition to this economic perspective, the Theory of Planned Behaviour (TPB; Ajzen, 1991) also provides valuable insights. TPB proposes that behavioural intentions, which are the most immediate predictor of actual behaviour, are shaped, among others, by attitudes toward the behaviour. In the context of environmental psychology or more specifically, sustainable mobility, attitudes influenced by perceptions of convenience, sustainability, or financial/ instrumental benefits, could therefore successfully explain various types of environmental behaviour (Steg & Vlek, 2009; Kaiser et al., 1999). Hence, positive perceived attributes could increase the likelihood of financial support for a sustainable innovation.

The Value-Belief-Norm (VBN; Stern, 1999) theory, further explains why individuals engage in pro-environmental behaviours through a psychological lens. The theory connects *value* orientations – biospheric (concern for the environment and non-human nature), altruistic (concern for the welfare of others), hedonic (concern for maximising pleasure), and egoistic (self-interest and concern with personal cost and benefit) – with *belief* systems (e.g., regarding environmental consequences) and *personal norms* that can activate environmentally responsible behaviours, such as financially supporting a sustainable mobility service (Stern, 2000; Hollis, 2021). Value orientations reflect an individual's underlying beliefs and attitudes towards something; they are the key principles in life that serve as guiding frameworks, and

therefore, are of highest importance to humans (Schwartz, 1992; Ihemezie et al., 2021). In this context, perceived convenience and instrumental or financial benefits can be understood as aligning with the egoistic and hedonic value orientations, while perceived sustainability falls within the biospheric orientation (Hollis, 2021).

Importantly, empirical studies have demonstrated that the VBN framework is effective in predicting pro-environmental behaviour. For example, Ünal, Steg, and Granskaya (2019) found that personal norms, as described by the VBN theory, were strongly associated with higher acceptability of car use reduction policies in Russia. Similarly, Jakovcevic and Steg (2013) showed that in Argentina, value-activated personal norms led to greater acceptability of car use reduction policies and a higher intention to reduce car use. These findings indicate that moral or normative considerations, as outlined in the VBN theory, play a significant role in decisions to act pro-environmentally and to support sustainable mobility initiatives, including financially supporting.

According to the VBN theory, when individuals believe that something they value (e.g., a sustainable mobility service) is under threat, and they also believe that their actions can help protect or restore it, they are more likely to feel a personal responsibility to act. This sense of obligation, referred to as a personal norm, can motivate them to support the innovation financially.

Closely related to this VBN Theory is the Norm Activation Model (Schwartz, 1977). This model suggests that personal norms are activated by an awareness of the negative consequences of inaction and a sense of responsibility to act (Cheng et al., 2022). If individuals perceive a sustainable innovation to have a meaningful environmental or social impact, this awareness, paired with a belief in their ability to contribute, can activate personal norms, reinforcing the willingness to support financially.

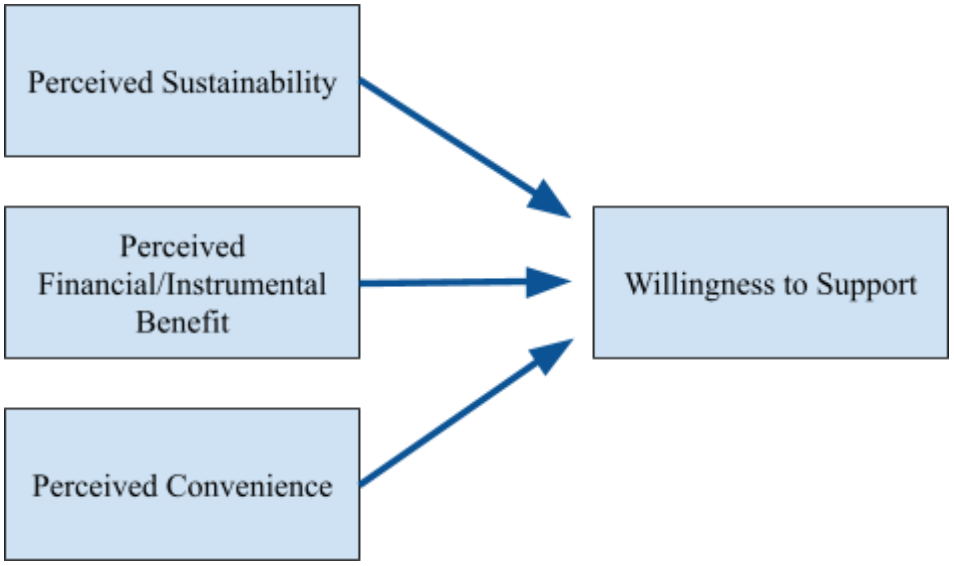
Furthermore, the Cognitive Dissonance Theory (CDT) initially proposed by Festinger (1957) is also relevant for determining why a high indication of perceived sustainability, perceived convenience, and perceived financial or instrumental benefits might be related to a high willingness to provide support. CDT posits that people want their actions to be in line with their attitudes. People strive for internal psychological consistency, so their actions are often oriented toward dissonance reduction. This means that in cases where individuals strongly perceive positive attributes from an innovation but do not support it financially, they are likely to experience cognitive discomfort from this inconsistency. This dissonance might create psychological pressure to align their actions with their beliefs. The specific way or reason why individuals resolve this dissonance depends on which attributes they value most. For example, someone who highly values environmental sustainability may decide to support the initiative financially to stay consistent with their pro-environmental attitudes. Another person who appreciates the convenience of the service might choose to contribute in order to maintain that ease in their daily life. Similarly, individuals who recognise clear financial or instrumental benefits may be motivated to provide financial support to ensure they continue to receive these advantages. In each case, the drive to reduce dissonance can lead to a higher willingness to financially support the innovation, even though the underlying motivations differ.

> ***H***$_2$*: Perceived convenience, perceived sustainability and perceived instrumental/financial benefits will be positively correlated to a higher willingness to provide financial support for a sustainable mobility initiative or innovation.*[2]

[2] See Figure 1 for a visual representation of Hypothesis 2

Figure 1

Constellation: Willingness to Support



The CDT does not only help explain the influence of perceived benefit, but it might also offer interesting insights into why the *frequency* and *duration* for which individuals are using a service, could influence their willingness to provide financial support. As mentioned above, CDT explains that people strive for dissonance reduction. This might suggest that frequent, and/or long-term users, equate their usage patterns of the service to a positive attitude towards it. Hence, dissonance reduction implies that continued support is the reasonable response, justifying their continued and previous use.

In addition to this, the Self-Perception Theory (Bem, 1972) states that individuals infer their attitudes from their behaviours, potentially leading frequent and long-term users to develop more positive attitudes towards the service, leading to a stronger inclination to support the innovation or initiative. Habit Formation Theory (Orbell & Verplanken, 2020) further supports this idea, proposing that repeated behaviours become integrated into daily routines, making individuals more invested in maintaining them. This could explain the third hypothesis that frequent or long-term users of sustainable mobility services might be more willing to provide financial support to ensure the service's continuation or expansion.

H$_3$*: Frequent and/or longer use of sustainable mobility services will be correlated to higher willingness to provide financial support.*

3. Method:

3.1. The Case Study

In order to answer the research question effectively, a sustainable mobility service called **NAH**SHUTTLE operated by NAH.SH was used as a case study. **NAH**SHUTTLE, formerly known as ‘remo’ (RendsburgMobil), is the shuttle express for the Rendsburg region in Germany. The innovative mobility project is a flexible on-demand transport system, and it aims to improve the overall mobility in the area and make it more sustainable. The **NAH**SHUTTLE offers a flexible alternative to traditional private and public transport by travelling without fixed routes or timetables. In order to provide a seamless and flexible mobility service for the entire region, **NAH**SHUTTLE has a dense network of virtual stops that are approximately 300 metres apart. The system is available on Fridays, Saturdays, and Sunday evenings and nights. The shuttle service has been available in the Rendsburg region and surrounding area since August 2021. The federal grant project was initially scheduled to run for three years while being financed at a total cost of around two million euros, shared by the district and the state. As the initial three years have passed, alternative and additional financing options for are currently intensively being sought after and examined. (“*Schleswig-Holstein.de”*, n.d.; “*Rendsburg Tourismus Marketing”,* n.d.; “*Neues Mobilitätsangebot”*, n.d.; A. Armiger, personal communication, March, 2025; T. Klatt, personal communication, March 11, 2025)

3.2. Participants

A survey was distributed to users of the **NAH**SHUTTLE sustainable mobility service. This study employed a targeted yet random sampling approach to gather data from a broad selection of **NAH**SHUTTLE users. In total, 249 people participated in the study. However, 125 responses were removed from the dataset because they were incomplete (63 people merely opened, yet did not continue filling out the survey). This resulted in uneven group sizes within the two experimental conditions. The final sample comprised 124 participants who were not entirely representative of the population, as 58.9% were male, 37.9% female, 2.4% non-binary / third gender, and 0.8% preferred not to say. Furthermore, a disproportionate amount of participants belonged to the age group of 18 to 24-year-olds (25.8%).[3]

3.2. Procedure

Given the psychological and behavioural nature of the topic, this research employed a controlled experimental design, embedded within a user survey. The methodology incorporated a between-subjects design in which participants were randomly assigned to either the control or experimental group using the Qualtrics randomiser. Participants were not informed about this experimental manipulation prior to filling out the survey, nor did they know of the precise objective of the study (i.e., participants were led to believe that the study primarily explored different forms of financial support, rather than it measuring factors that influenced their willingness to contribute financially, which was its true primary objective). In order not to give away the manipulation, which could possibly change the participants' responses, the aim of the study was slightly obscured in the consent and information sheet. Following completion of the survey, participants were presented with a debriefing form[4], explaining the true aim. After

[3] See Table 1 in the Appendix A for a more complete summary of the gender and age group distribution.

[4] See Appendix B for the original debriefing form in German, and a translated version in English

acknowledging the debriefing form, participants were still able to withdraw their participation, if desired.

Due to the multidisciplinary nature of the research, survey questions were inspired by a variety of sources in English and German (Chowdhury, 2023; Albatayneh et al., 2024), translated and adapted to the case study context. To ensure a correct integration, we created the survey under constant dialogue with NAH.SH. We developed the survey in German for ecological validity and piloted it with German native speakers to ensure clarity. Font size was adapted for accessibility, and for ease of use, a 5-point Likert scale was chosen, where '1= *disagree*', '2= *partially disagree'*, '3= *neither agree nor disagree'*, '4= *partially agree'*, and '5= *fully agree'*. The questionnaire was hosted and created in Qualtrics.

Within this paper, to accommodate for language barriers and to adapt to the English nature of this thesis, all German terms from the study are translated into English at the discretion of the researcher. While care was taken in translation, certain nuances of meaning may not be entirely retained.

The survey was open for responses for a period of three weeks in March and April 2025. Distribution methods primarily included app-based recruitment, targeting registered **NAH**SHUTTLE users. In the first week, we distributed the survey via an in-app banner. After only limited initial responses, additional methods were implemented. These methods included: drivers asking passengers to fill out the survey; us posting a link to the survey on a regional **NAH**SHUTTLE Reddit channel; and us sending a push notification to users in the Rendsburg area. During the final weekend, we also printed and hung posters with a QR code and call to action, directly in the shuttles.

Participants were informed that the survey would take 5–10 minutes to complete, that participation was voluntary, and that they could withdraw at any time. As an incentive, participants could win one of 10 exclusive NAH.SH goodie bags. The survey was anonymous,

and the data was stored securely and scheduled for deletion after a maximum of 10 years. Only participants aged 18 or above, who explicitly gave informed consent, could proceed.

3.3. Measures

The survey consisted of multiple parts, yet for the sake of this explanation, the entire survey can be separated into four blocks.[5] The survey started with block 1, where participants were presented the consent form, followed by questions collecting demographic information and self-reported use. Block 2 measured individuals' willingness to support (through hypothetical supporting opportunities). In block 3, the survey collected information about three different perceived attributes. In the final block, participants could leave feedback and indicate if they wanted to partake in the lottery. The survey was then wrapped off with a debriefing.

3.3.1. Block 1

The informed consent form disclosed the research topic and purpose, assured confidentiality, and gave the participants an idea of what they could expect. This included, for example, the estimated time for completion of 5–10 minutes. Participants were also provided with the researcher's email address in case they wanted to ask further questions. Participants were informed that the survey was completely anonymised so that no personal information would be linked to their responses. Finally, participants had to confirm that they were 18 years or older and that they explicitly consented to participating in the study.

In the next part of the survey, two items were asked to capture demographic baselines, such as the age of participants (in ranges) and their gender.[6]

3.3.1.1. Self-Reported Use of the Initiative

In the final part of the first block, the survey captured the self-reported use of the initiative. Participants were asked to indicate how frequently and for how long they have used

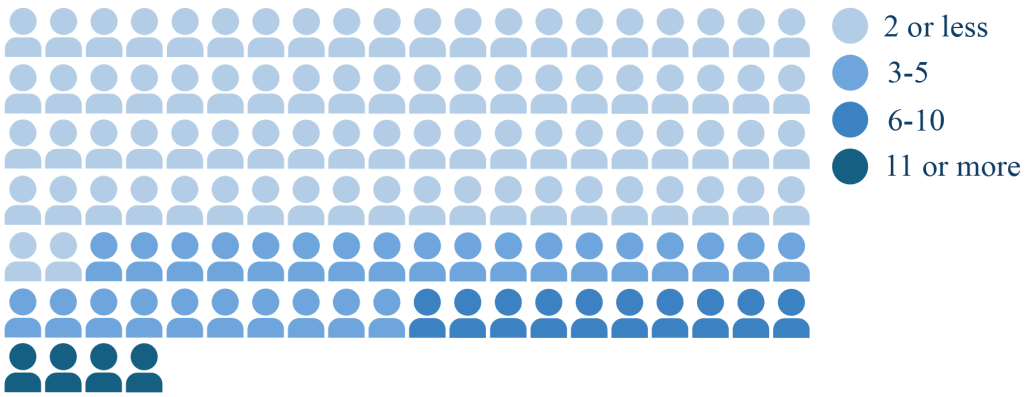
[5] See Appendix C for a visualisation of the survey structure divided into four blocks
[6] See Appendix A for the exact Gender options and age ranges used

the shuttle service. The frequency was measured in ranges of: 2 or less times a month, 3–5 times a month, 6–10 times a month, and 11 or more times a month. The duration of use was measured in ranges of 1–3 months, 4–6 months, 7–12 months, 13–23, and 24 or more months/ since the beginning of the service. See Figure 3 and 4 for the distribution of self-reported use. As the shuttle service only rides on weekends, and the initiative has only existed for about three to four years, these ranges were specifically adapted to the case study of the **NAH**SHUTTLE. They were chosen in active dialogue with NAH.SH.

The timeframes for the duration of use, can be imagined as categories (e.g., ‘new user', ‘recent user’, ‘medium length user’, 'established user’, and ‘long-term user’). As we expected, the differences to stagnate after a certain time (i.e., the difference between a 24-month user and a 30-month user being smaller compared to the difference between a 1-month and 6-month user), the duration was measured in ever-increasing periods. We follow the same logic for customer’s frequency of use. Frequency of use can be imagined in the following categories: ‘rare user’, ‘occasional user’, ‘regular user’, ‘frequent user’. Participants were presented the aforementioned timeframes/frequency ranges instead of the categories, as the categories could be interpreted differently from participant to participant, making generalisability and between-subject comparisons more complicated.

Figure 3

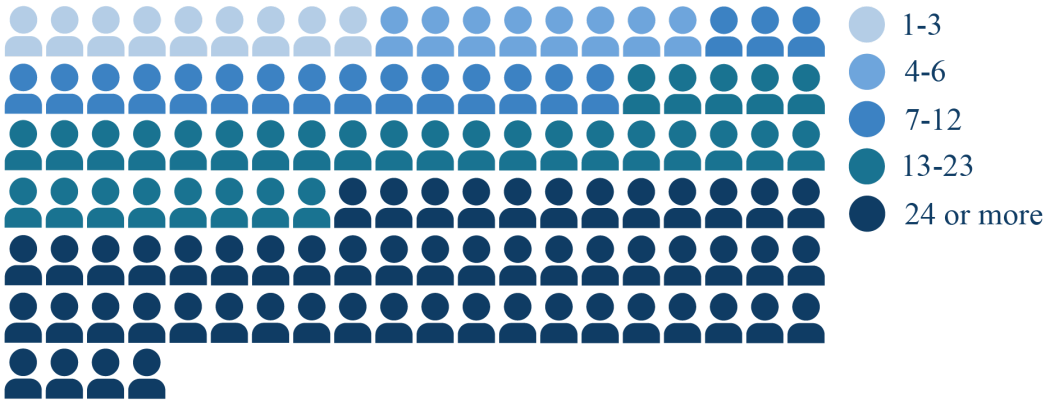
Self-Reported Use: Frequency of Use Distribution



Note. 2 or less times a month (66.1%), 3–5 times a month (22.6%), 6–10 times a month (8.1%), and 11 or more times a month (3.2%), n = 124

Figure 4

Self-Reported Use: Duration of Use Distribution



Note. 1–3 months (7.3%), 4–6 months (6.5%), 7–12 months (14.5%), 13-23 (26.6%), and 24 or more months/ since the beginning of the service (45.2%), n = 124.

3.3.2. Block 2: Experimental Manipulation

In Block 2, participants were randomly assigned to either the loss-framed (n = 57) or gain-framed (n = 67) group. As a result of this allocation, this part of the study differed between the two groups. For the purposes of this study, the **gain-framed group** is referred to as the "**control group**" and the **loss-framed group** as the "**experimental group**", consistent with practices in prior behavioural research where the gain frame often serves as a reference point for comparison (see e.g., Tversky & Kahneman, 1981). According to prospect theory, individuals are generally risk-averse in the domain of gains, making the gain frame a psychologically more stable reference point. The loss frame, in contrast, is expected to provoke a shift toward risk-seeking behaviour. By comparing choices under gain and loss frames, one can directly observe the effect of framing, with the gain frame serving as the experimental

"baseline" against which deviations caused by the loss frame are measured (see e.g. Tversky & Kahneman, 1981). However, it should be noted that both groups received active manipulations and thus both constitute experimental conditions.

Participants received group-specific priming texts differing in framing orientation.[7] A short description of the provided service was followed by a section presenting the necessity of either additional or alternative funding. The experimental group received a priming text explaining the service's need for financial support to sustain itself. The control group received a message that was focused on the system's success, the desire to improve it, and the necessity of additional funding to do so. The participants were then presented with hypothetical proposals of how financially supporting the service could express itself. After this, they were asked to indicate their preferences and how strongly they could imagine the proposed actions. It was clearly stated that indicating what actions they would partake in carried no binding responsibility, and that we were merely looking for alternative financing options that the users could imagine.

3.3.2.1 Dependent Variable: Willingness to Support

Willingness to support the initiative financially was measured with different dependent variables. The first measure included hypothetical scenarios presented as items (e.g., I am willing to sponsor a virtual bus stop; I am willing to pay comfort surcharges). Participants were asked to indicate their agreement to these statements on the aforementioned 5-point Likert scale, ranging from '1= disagree' to '5= fully agree'.

In the second and third measures, respondents indicated whether they could imagine a comfort surcharge in the form of a basic base fee (a fixed amount that is charged for using the service regardless of the distance travelled) and/or a kilometre fee (a usage-dependent fee that is calculated based on the distance travelled, much like in a taxi). Participants could also

[7] See Appendix D for the original German and translated English version of the priming messages

choose both options, or indicate that neither option sounded interesting to them. If they opted for a comfort surcharge, they were asked to specify how much they would pay for each of the chosen options. The option for a basic base fee spanned the range from €0 to €5, and the kilometre performance fee ranged from €0 to €0.80 per km.

Following the assumption that a higher Likert scale score and a higher indicated comfort surcharge can be translated to a higher willingness to support the system financially, we used participants' responses to calculate a composite "Willingness to Support" score. For this, we created the following formula:

$$w = \mu l + b + k$$

w = willingness to support

μl = mean of Likert scale items (bus stop sponsoring and comfort surcharge)

b = basic base fee (normalised)

k = kilometre fee (normalised)

First, the Likert scale responses related to financial support (specifically, willingness to sponsor a bus stop and to pay a comfort surcharge) were averaged to create a single Likert scale based score. Next, the monetary willingness-to-pay values indicated for the basic base fee and the kilometre fee were normalised by dividing each value by its respective maximum possible value. These normalised monetary scores were then added to the mean of the Likert scale items to form a composite willingness score.

In constructing this composite score, the Likert scale items were intentionally weighted more heavily than the individual comfort surcharge values. This approach reflects our concern that monetary amounts may be interpreted differently by different participants, complicating between-subject comparisons and potentially skewing results. For example, a €2 basic base fee might represent a high willingness to pay for a cost-conscious participant, whereas another

participant might view €2 as a negligible amount, thus indicating a lower relative willingness. By emphasising the Likert scale based responses, we aimed to reduce the influence of such subjective interpretations of monetary values. As the final Willingness to Support score is a hybrid construct, internal consistency (e.g., Cronbach's alpha) is not applicable.

3.3.3. Block 3: Perceived Attributes

The consecutive part operationalised three key perceived characteristics, namely: perceived sustainability, perceived financial or instrumental benefit, and perceived convenience. Each was assessed with five items, where participants were asked to indicate their agreement to proposed statements on a 5-point Likert scale ranging from '1= disagree' to '5= fully agree' (as previously described). *Perceived sustainability* was measured with the following five items: Reduces CO_2 footprint, improves air quality, reduced traffic congestion, fights climate change, and contributes to a greener future (*a=.87, Mdn = 4.00, IQR = 3.40–4.65)*. *Perceived financial/instrumental benefit* was also measured with five items: Cheap way to get from A to B, reduces transport costs, has lower everyday cost compared to a private car, avoids unexpected cost related to car ownership, saves time (*a= .76, Mdn = 4.20, IQR = 4.00–4.80)*. Lastly, another five items were used to measure *perceived convenience*: Efficient way to get from A to B, easily accessible, frequency and availability needs are met, reliably integrable into everyday life, similar comfort to private car. (*a= .73, Mdn = 3.80, IQR = 3.20–4.40)*.[8] A higher average score across all five items of a category would thus indicate more agreement with the general topic of the category (e.g., fully agreeing with all items of the *perceived sustainability* category would indicate that the user perceived the system as very sustainable).

[8] See Appendix E for the original and translate Likert scale items used

3.3.4. Block 4: Debriefing, Lottery, and Additional Feedback

Following the completion of the previous three blocks, participants were debriefed about the true aim of the research (see Appendix B). Participating individuals were offered to enter a lottery to win one of 10 exclusive NAH.SH goodie bags, provided by NAH.SH at no additional cost to the researchers. In order to enter the lottery, participants had to enter their email of choice. The email could not be traced back to any of the responses and was saved separately. The 10 winners were randomly selected and personally contacted by the research team. After the winners were identified, and the gifts sent, all contact data related to the lottery was deleted.

Participants were also offered to leave feedback with further ideas related to the survey. We did not integrate this data into the statistical analysis of the results. However, we did a short thematic review of the feedback as it still offers good insight for future research, enlightens possible limitations, and reflects the customers' wishes for future use. As such, in combination with other interesting findings from this research, the written feedback will be sent to NAH.SH for their future operations.

3.4. Data Analysis

All statistical analyses were conducted using RStudio. Prior to hypothesis testing, data were screened for missing values, normality, and scale reliability. Variables with missing values were inspected, and cases where data collection was incomplete or a lot of data was missing were excluded from the analysis. An assessment of normality using the Shapiro-Wilk test, histograms, and Q-Q plots, revealed that none of the composite scores nor their residuals were normally distributed ($p < .001$) violating the assumption of normality. Therefore, we report medians and interquartile ranges (IQR) as measures of central tendency and spread. Since the data were non-normally distributed, we did not carry out regression analyses.

For scale construction, Cronbach's alpha was calculated to assess the internal consistency of multi-item measures (e.g., perceived sustainability, convenience, and financial/instrumental benefit), and composite scores were created by averaging the relevant items.

To test the first hypothesis (H_1) and assess the impact of message framing on willingness to support the **NAH**SHUTTLE service, participants in the loss-framed condition were compared to those in the gain-framed (control) condition using the non-parametric Wilcoxon rank-sum test (Mann–Whitney U test). To examine the second hypothesis (H_2), whether perceived sustainability, perceived financial benefit, and perceived convenience predict the willingness score, Spearman's rank-order correlations were conducted. For the third Hypothesis (H_3), which proposed that more frequent or longer-term use of the shuttle service would be associated with a higher willingness to provide financial support, Spearman's rank-order correlations were applied.

The effect size for the group comparison (Hypothesis 1) was calculated using the rank-biserial correlation (r), and all statistical tests were two-tailed with a significance level set at $\alpha = 0.05$. Visualisations (scatter plots, box plots, histograms) were created using the ggplot2 and corrplot packages in R.

4. Results

4.0. Descriptive Statistics

The final sample consisted of 124 participants. The score measuring willingness to support presented us with a median of 3.5 (*IQR = 2.50-4.40*). Perceived sustainability, convenience, and financial benefit scores were generally high (see Table 2). The internal consistency of the scales was acceptable (Cronbach's α: sustainability = .87, convenience = .73, financial/instrumental = .76).

Table 2

Descriptive statistics for the perceived attributes scores: perceived sustainability, perceived convenience, and perceived financial and instrumental benefit.

Variable	n	Median	IQR	Alpha
Perceived Sustainability	124	4.0	3.40-4.65	.87
Perceived Convenience	123	4.0	3.20-4.40	.73
Perceived Financial/ Instrumental Benefit	124	4.4	4.00-4.80	.76

Note. IQR stands for Interquartile Range, alpha refers to Cronbach's alpha, measuring the internal validity of the scores.

Before conducting inferential analyses, the distribution of responses for the key willingness-to-support items was examined. Table 3 presents the distribution of Likert scale responses for both the willingness to sponsor a bus stop and willingness to pay a comfort surcharge. These distributions indicate that, while a substantial portion of participants reported low willingness to provide financial support, there is also a notable group expressing high willingness, especially for the comfort surcharge option. [9]

[9] See Table 4 in Appendix A for the distribution of responses indicating the amount that participants would pay for a basic base fee and/ or kilometre fee

Table 3

Distribution of Likert Scale Responses: Bus Stop Sponsoring and Comfort Surcharge

	n	1= '*disagree*'	2= '*partially disagree*'	3= '*neither agree nor disagree*'	4= '*partially agree*'	5= '*fully agree*'
Bus Stop Sponsoring	123	45 (36.6%)	11 (8.9%)	18 (14.6%)	33 (26.8%)	16 (13%)
Comfort Surcharge	124	30 (24.2%)	14 (11.3%)	11 (8.9%)	40 (32.3%)	29 (23.4%)

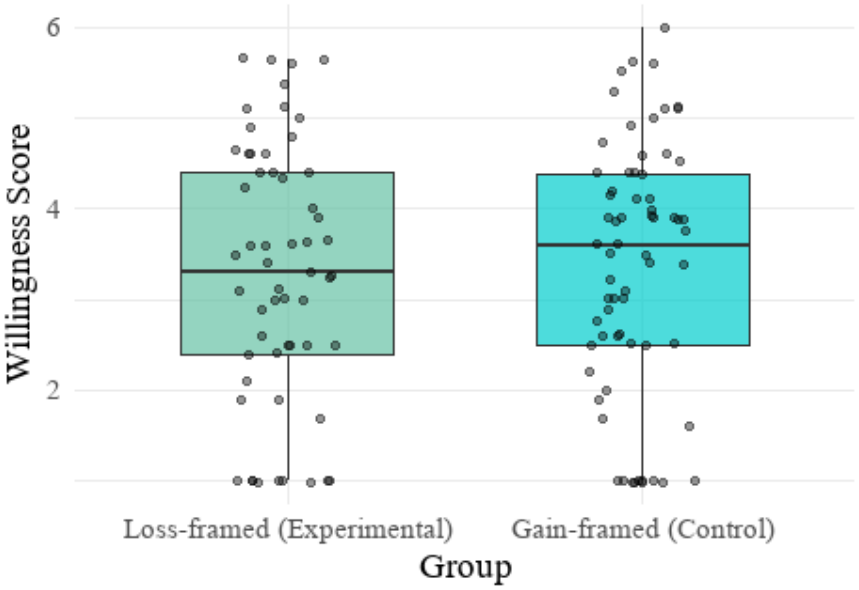
Note. Table 3 displays the distribution of Likert scale responses for willingness to sponsor a bus stop and willingness to pay a comfort surcharge. Percentages rounded to the first decimal place.

4.1. Hypothesis 1: Effect of Message Framing

Both a visual comparison (See Figure 5) and a Mann-Whitney U test indicated no statistically significant difference between the loss-framed experimental group (*n = 57, Mdn = 3.30, IQR = 2.40-4.40*) and the gain-framed control group (*n = 67, Mdn = 3.60, IQR = 2.50-4.39*), W = 1865.5, p = .827. Together with a small effect size (r = 0.020), the results suggested no meaningful difference between groups, and indicated that the framing manipulation had no measurable effect on willingness to provide financial support. Given the lack of a significant difference and the similarity in distributions, data from both groups were merged for the subsequent analyses of H_2 and H_3.

Figure 6

Box plot: Willingness Score by Group



Note. The box plot displays the distribution of willingness scores for participants in the loss-framed (experimental) and gain-framed (control) groups. The horizontal line in each box represents the median, the box indicates the interquartile range, and individual dots represent participant scores. No statistically significant difference was found between groups.

4.2. Hypothesis 2: Perceived Attributes as Predictors of Willingness to Support

Spearman's rank-order correlation showed that none of the perceived attributes were significant predictors of an individual's willingness to support the initiative financially. Perceived sustainability was not significantly correlated with willingness to support ($\rho = 0.083$, $p = .361$). This suggests that there was no statistically significant monotonic relationship between an individual's perception of how sustainable a service is and their willingness to provide financial support. Perceived convenience was also not significantly correlated with willingness to support ($\rho = -0.004$, $p = .961$). Surprisingly, in comparison to perceived sustainability and convenience, the correlation of perceived financial benefits was negative,

however, it also did not reach statistical significance ($\rho = -0.128, p = .155$) and could therefore easily be due to chance. Overall, with these findings, we fail to support H_2.

4.3. Hypothesis 3: Usage Patterns and Willingness to Support

A Spearman test revealed no statistically significant correlation between frequency of use and willingness to support ($\rho = –0.135, p = .135$). However, there was a small but statistically significant positive correlation between duration of use and willingness to support ($\rho = 0.183, p = .042$). Thus, H_3 is partially supported, with results indicating that longer use duration, but not frequency, is modestly associated with greater willingness to support the service financially.

4.4. Additional Descriptive Insights

In addition to the structured survey items, participants were invited to leave open-ended feedback regarding their experiences and suggestions for the **NAH**SHUTTLE service. While these qualitative responses were not included in the statistical analyses, they provide valuable context for interpreting the quantitative results and offer deeper insight into the factors that may influence willingness to financially support sustainable mobility innovations.

A thematic review of the feedback revealed several recurring concerns and desires among users. The most prominent themes centred around requests for expanded service hours and days, with many participants expressing a need for **NAH**SHUTTLE to operate not only on weekends but also during weekday evenings and late nights. There was also significant demand for broader geographic coverage, especially in rural areas and specific towns currently underserved by the service. Despite these suggestions for improvement, numerous users expressed overall satisfaction and appreciation for the service.

5. Discussion

This study set out to identify the psychological and behavioural factors influencing individuals' willingness to provide financial support for sustainable mobility innovations, using the service of **NAH**SHUTTLE as a case study. Based on previous research on the adoption of mobility innovations and other sustainable behaviour (see e.g. Post et al., 2024; Noppers et al., 2014, 2019; Steg & Vlek, 2009; Liobikienė & Miceikienė, 2022; J et al., 2024; Chowdhury, 2023; Kawabata et al., 2020; Avineri & Waygood, 2012; Chen et al., 2022), we focused on: perceived sustainability, perceived convenience, and perceived instrumental or financial benefits; the effect of loss aversion; and the relevance of duration and frequency of use for determining willingness to support a mobility initiative. We applied an experimental approach to address the lack, and potential, of crowdfunding-related research in the sustainable mobility sector. Thus, this study aims to contribute to the body of literature on how sustainable mobility initiatives or innovations could secure long-term financial support through means of crowdfunding, especially for innovations where initial funding has decreased or been phased out.

While our empirical results yielded mixed findings, the underlying theories provided critical insights into general mechanisms driving user behaviour and, therefore, the potential links between the variables of this study.

5.1. Hypothesis 1

The findings indicated, contrary to expectations, that the loss-framed message did not significantly increase willingness to provide financial support compared to the gain-framed message. As such, we rejected Hypothesis 1. Prior research had demonstrated that loss-framed messages can effectively promote sustainable behaviours, particularly in early-stage interventions (Chen et al., 2022). The reasoning is based on the psychological process of loss-aversion (Kahneman & Tversky, 1979), proposing that individuals are more motivated to

act when faced with potential losses than equivalent gains. Our findings indicate that such a process does not take place in the context of willingness to finance sustainable mobility initiatives.

One reason for the current finding might be that due to ethical considerations and agreements with **NAH**SHUTTLE, we were restricted in how explicitly we could frame the loss and gain messages. Because the topic is sensitive for the company, we were only allowed to implicitly create a sense of gain and loss, refraining from writing anything that is not true or that could cause unnecessary distress for the users. Therefore, we could not, for example, explicitly write that the service will discontinue if the users do not financially support the **NAH**SHUTTLE. This potentially diluted the strength of our experimental manipulation, making it difficult to determine how strongly users perceived a loss or gain that could have influenced their willingness to support the service financially. The absence of a significant framing effect suggests that, in this context, loss aversion and message framing may not be as influential as previous behavioural economics research has suggested (e.g. Kahneman & Tversky, 1979; Chen et al., 2022). This finding aligns with recent work indicating that the effectiveness of loss-framed messages can be context-dependent and may be diluted when the perceived stakes or personal relevance are low (Bosone & Martinez, 2017).

The qualitative responses also provide insight into the (lack of) effectiveness of the loss-framed messaging used in the experiment. Notably, none of the open-ended comments referenced a fear of losing the service or expressed concern about its discontinuation, despite the loss-framed message highlighting this possibility. Instead, participants overwhelmingly focused on how the service could be improved and expanded. This suggests that the loss frame may indeed not have been salient or credible enough to elicit a sense of urgency or loss aversion among users. It is possible that participants did not perceive the threat of losing the service as realistic, or that their desire for service improvements outweighed the concerns about

potential loss. Thus, following from the responses and the limited salience of the framing, it can be assumed that the potential gain and loss did not carry the same weight, leading to a dilution of the loss aversion effect.

5.2. Hypothesis 2

Furthermore, perceived sustainability, perceived convenience, and perceived financial/instrumental benefits were no significant predictors of willingness to support. Hence, we also reject Hypothesis 2. This finding stands in contrast to prior research, which has shown that perceived characteristics can predict the acceptability and adoption of mobility innovations such as connected automated vehicles (Post et al., 2024) or people's adoption intentions to join a car-sharing initiative (Lohmeyer et al., 2024). In these studies, perceived attributes, including sustainability, convenience, and cost savings, were often found to be essential determinants of behavioural intention and actual adoption.

As **NAH**SHUTTLE is associated with many perceived positive attributes, we had the expectation that these will drive willingness to support the initiative. However, our results suggest that high perceptions of sustainability, convenience, and financial benefit alone may not be sufficient to motivate financial support for such services.

One plausible explanation for this lack of association could be a ceiling effect: a phenomenon where a large proportion of participants rate variables at or near the maximum possible value, limiting variability and obscuring potential relationships (Uttl, 2005). Most respondents rated the attributes highly, resulting in limited variability and thus reducing the statistical power to detect meaningful relationships.

Another possible explanation is that other psychological and contextual factors, not directly measured in this study, may play a more decisive role in shaping willingness to support. For example, the literature on sustainable mobility and policy acceptance increasingly points to the importance of perceived fairness and trust in the service provider as critical

determinants of public support or sustainable behaviour (Thaller et al., 2023; Isaacson et al., 2024; Garg et al., 2023).

It is also possible that the nature of the support requested, financial contributions versus simple behavioural adoption, requires a higher threshold of motivation. While perceived attributes may be sufficient to encourage use or acceptance, willingness to pay or support financially may require additional drivers, such as a stronger sense of identification with the service.

A last possible explanation that we would like to offer, is that the way we measured willingness to support, might have been too explicit, excluding people that would like to support, just not in the ways that we proposed. In psychology, it is relatively common to measure general intentions, so a possible approach would have been to bluntly ask participants to indicate how willing they are to financially support the NAHSHUTTLE. We could have requested them to indicate their willingness on a Likert scale, without presenting expressions of this support (e.g., financing a bus stop or paying a comfort surcharge). The reason we opted for explicit questions, was because we wanted to limit the possible effect of the well-documented intention-behaviour gap (Sheeran, 2002). People might indicate an intention (to support the innovation), without this intention directly translating into action. As this study measures intentions through self-reported willingness to support, rather than actual financial behaviour, we chose to ask explicit questions related to a realistic action, in the hope of increasing the generalisability and applicability of these findings to real-world behaviours.

5.3. Hypothesis 3

Finally, from the usage variables, only the duration of service use showed a modest positive association with willingness to support, while usage frequency did not. As such, we partially supported H_3. This is in line with the notions from Cognitive Dissonance Theory (Festinger, 1957) and Habit Theory (Orbell & Verplanken, 2020) that longer-term users may

develop a stronger psychological commitment to the service. Longer uses might therefore also foster psychological feelings of ownership, increasing an individual's willingness to contribute financially to the continuity of the service. However, the negative yet non-significant correlation between usage frequency and willingness highlights a paradox: while long-term users felt obligated to support, a higher frequency of usage might not foster the same emotions.

One possible explanation for this lies in the distinction between loyalty and need. Duration of use may reflect a deeper, more affective form of loyalty or psychological commitment to the service, developed over time through repeated positive experiences and integration into daily routines (De Vos & Witlox, 2017; van Lierop & El-Geneidy, 2016). In contrast, frequency of use may primarily indicate immediate need or convenience, without necessarily fostering a sense of attachment or responsibility. This distinction is well-documented in the service and transport literature. For example, Kawabata et al. (2020) states that frequency of use by itself is not necessarily a good indicator, as this usually includes so-called captive users, those who use a service by need rather than an actual choice (Kawabata et al., 2020; Ingvardson & Nielsen, 2019; van Lierop & El-Geneidy, 2016). Derived from this, loyalty, which comes with the predisposition to support a service, often develops with time and repeated satisfactory experiences, rather than with sheer frequency of use (Lierop & El-Geneidy, 2016).

A real-life example of this can be found in public transport systems. Daily commuters who use the bus or train simply because they lack alternatives (e.g., no car, inconvenient cycling routes) may use the service frequently, but their attachment to it is minimal, they are "captive users". In contrast, someone who has chosen to use public transport over many years, even as their circumstances change and alternatives become available, is more likely to have developed a sense of loyalty or identification with the service. These feelings could in turn be

related with greater willingness to recommend the service or to support it in other (financial) ways (see e.g. Maciejewska et al., 2023).

Connecting this back to the theoretical framework, the Value-Belief-Norm (VBN) theory suggests that pro-social behaviours such as financial support are more likely when personal norms are activated by a sense of identification and responsibility (Stern, 2000). Duration of use may foster this identification and internalisation of supportive norms, while frequency alone may not be sufficient to activate such motivations. Thus, the finding that duration, but not frequency, of use predicts willingness to support the service financially is consistent with the idea that loyalty, built over time, is a stronger driver of pro-social support than immediate need or habitual use.

5.4 Theoretical and Practical Implications

This study offers several important implications for both theory and practice, particularly in the context of crowdfunding for sustainable mobility innovations.

From a theoretical perspective, the findings challenge the assumption, prevalent in the behavioural and innovation adoption literature, that simply highlighting a service's sustainability, convenience, or financial benefits is sufficient to drive user willingness to provide financial support. While these perceived characteristics have been shown to predict adoption and acceptability in other mobility contexts (Post et al., 2024; Lohmeyer, 2024), our results suggest that, in a crowdfunding setting, these factors alone may not be decisive. This calls for a refinement of models such as the Value-Belief-Norm (VBN) theory and the Theory of Planned Behavior (TPB), emphasising the need to account for additional drivers such as psychological ownership, trust, and perceived fairness in explaining financial support behaviours (Stern, 2000; Ajzen, 1991).

The lack of a significant framing effect, particularly the ineffectiveness of loss-framed messaging, also raises questions for classical Prospect Theory (Tversky & Kahneman, 1981).

Our findings align more closely with recent research in crowdfunding and sustainable transport, which suggests that gain-framed appeals, emphasising community benefits, hope, and positive change, are more effective than loss- or fear-based messaging in motivating financial contributions (Adamska et al., 2024). This indicates that the psychological mechanisms driving support in crowdfunding may differ from those in traditional consumer or voting contexts, especially when the perceived threat of loss is not salient or credible.

The finding that only duration of use, rather than perceived attributes or message framing, predicts willingness to support suggests that crowdfunding is most effective as a long-term solution, once a service has built a loyal user base. This supports a staged approach to funding: initial seed capital from government or institutional sources enables the service to establish itself and cultivate user loyalty, after which crowdfunding can be leveraged for ongoing financial stability. Practically, these findings suggest that sustainable mobility initiatives should prioritise securing seed funding to establish their services and focus on building long-term user relationships. Once a stable and loyal user base is in place, crowdfunding can be introduced as a viable mechanism for ongoing financial support, reducing reliance on external funding sources.

From a practical perspective, these findings imply that practitioners and policymakers should move beyond generic appeals to sustainability or cost savings when designing crowdfunding campaigns for mobility services. Instead, strategies that might be more effective should foster long-term engagement, psychological ownership, and a sense of community among users. The qualitative feedback in this study further highlights the importance of addressing concrete user needs (e.g., service hours or coverage) and integrating these improvements into campaign messaging. Finally, the results suggest that personalised, hope-driven communication strategies may be more persuasive than loss-framed appeals,

particularly in contexts where users do not perceive an immediate risk of service discontinuation.

5.5. Limitations

This research is constraint by several limitations that should be acknowledged. Firstly, the usage of self-report questionnaires might be limited due to biases, including self-report bias, resulting in a measurement error (Bauhoff, 2014; Stevens, 2024; Demetriou et al., 2015). Respondents might not always answer truthfully, or may interpret questions differently, leading to inconsistent responses. Secondly, despite efforts to reduce the intention-behaviour gap (Sheeran, 2002) by asking explicit questions, this remains a limitation. Meta-analyses of intention-behaviour relationships propose that intentions typically explain only 25%-30% of variance in actual behaviour (Sheeran, 2002; Prestwich & Kellar, 2014). Our study captures intentions at a single point in time, while actual financial support would occur later in different contexts, potentially widening this gap. The dynamic nature of intentions and the influence of changing circumstances are not captured in our design (Jekauc et al., 2024).

The study's external validity is also limited by its focus on a single case in a specific region: the **NAH**SHUTTLE service in the region of Rendsburg. This case study approach, while allowing for in-depth analysis, restricts the generalisability of findings to other regions, services, or cultural contexts (*"Evaluating the Strengths and Limitations",* 2024).

A methodological limitation involves our restricted ability to measure willingness to support. We could only include two Likert scale questions (and for those indicating a willingness to pay for a comfort surcharge, also those monetary indicators) assessing willingness to support the initiative financially, making it difficult to fully capture the construct's complexity. Our assumption that higher comfort fee amounts indicate greater willingness to support may not account for contextual or individual differences in willingness to pay. The hybrid willingness score, which combines Likert responses with normalised

monetary values, may have increased comprehensiveness but also introduced measurement error. For example, normalising monetary responses by the maximum possible value means the relative score depends on the chosen maximum (e.g. €0.80/km), potentially distorting results if the maximum were set differently. This approach may not fully capture all aspects of willingness to support, and alternative calculation methods could yield different outcomes.

Sampling and recruitment methods likely introduced self-selection bias (Elston, 2021). Individuals with stronger opinions about **NAH**SHUTTLE, whether positive or negative, may have been more motivated to complete the survey. The app-based recruitment strategy may have overrepresented frequent and technologically comfortable users, while those less engaged or less comfortable with technology may be underrepresented. Additionally, the survey's length (5–10 minutes) could have turned away less-engaged individuals, further skewing the sample toward more invested users.

Another limitation is the lack of a true neutral control group. In this study, the gain-framed message group was labelled as the "control group" and the loss-framed message group as the "experimental group." However, both groups were exposed to different message framings, meaning both are technically experimental conditions. This terminology was chosen for clarity and to align with common framing research, where the gain frame is frequently used as a reference point. Nevertheless, readers should be aware that neither group represents a true "no-treatment" or neutral control, but rather, the comparison between two active message frames. This may limit the generalisability of findings to situations where a true control (e.g., no message or a neutral message) is present.

5.6 Recommendations for Future Research

Building on these insights, several promising directions for future research emerge. First, it would be valuable to replicate this study in different regions and with a variety of sustainable mobility innovations, as service characteristics, pricing structures, and cultural

contexts may yield different patterns of willingness to support. Comparative studies could clarify when crowdfunding is most effective and how user engagement evolves over time, especially as initiatives transition from initial launch phases, which often might be supported by government or institutional seed funding, toward long-term financial sustainability.

Given the central finding that duration of use, rather than perceived attributes or message framing, predicts willingness to support, future research should investigate how the drivers of financial support differ between the initial launch phase and the long-term sustainability phase of mobility initiatives. This includes examining the processes by which user loyalty and psychological ownership develop, and how these can be leveraged to foster ongoing financial commitment. A more precise measurement of loyalty that goes beyond simple duration or frequency of use, would be particularly valuable, as loyalty encompasses not only continued use but also advocacy and a willingness to recommend the service to others (van Lierop et al., 2018; Kawabata et al., 2020).

Including a broader range of predictors is also recommended. Especially in the context of crowdfunding, future studies should include variables such as trust in the service provider, perceived fairness of funding mechanisms, and the influence of social norms (Bergquist et al., 2023). These factors may play a more decisive role in motivating financial contributions than perceived attributes alone, particularly as the service matures and initial novelty fades.

Methodologically, future studies should also seek to measure actual financial contributions rather than intentions, and where possible, experimentally manipulate message framing in more ecologically valid or salient ways. Incorporating a true neutral or no-message control group would help further isolate the effects of different framing strategies. Additionally, integrating qualitative methods, such as interviews or in-depth analysis of open-ended feedback, could help uncover “hidden” factors and lived experiences that quantitative surveys may overlook (Grosvenor, n.d.).

It should also be noted that, offering different forms of financing might yield different results. However, for legal reasons, this study could not for example directly ask participants about their willingness to support the service through donations. Future research in settings where this is possible could yield more direct and actionable insights.

By addressing these avenues, future research can deepen our understanding of the psychological and contextual factors that drive ongoing user-based financial support, ultimately helping sustainable mobility initiatives achieve lasting impact in the global transition to low-carbon transport.

6. Conclusion

The present research investigated what motivates users to financially support sustainable mobility innovations, using the **NAH**SHUTTLE service as a case study. The central research question asked: “What factors influence individuals' willingness to provide financial support for a sustainable mobility initiative?”. Based on established theories such as the Value-Belief-Norm (VBN) theory, Prospect Theory, and prior findings in the mobility innovation literature, the study proposed three hypotheses. Firstly, that loss-framed messaging would increase willingness to support, secondly, that higher perceived attributes would positively correlate with a higher willingness to support, and lastly, that user engagement (measured through usage frequency and duration) would further help us predict financial commitment.

The findings challenge several of these assumptions. Neither the frequency of use, nor the perceived attributes, or the anticipated effect of message framing, held significant support. These results diverge from classic Prospect Theory, as we expected that loss-framed appeals would be more persuasive. Instead, the results reveal that only duration of use presents a modest positive association. This suggests that long-term engagement, rather than immediate practical utility or persuasive messaging, is more influential in motivating financial support.

That duration, but not frequency of use, offers significant results could lie in the distinction between loyalty and need. Frequency of use may reflect immediate need or convenience. Whereas long-term use might reflect a choice, a deeper, more affective form of loyalty or psychological commitment to the service. Longer duration might nurture a sense of attachment or responsibility through repeated positive experiences. Hence, this research shows that although factors such as perceived attributes, loss-aversion, and user engagement might be effective in other contexts, duration of use as a predictor for a willingness to financially support

sustainable mobility initiatives shows more promise. This highlights the importance of psychological ownership and loyalty developed over time.

Given this finding, we suggest that further research should investigate how loyalty can be utilised and enhanced in order to motivate existing users to provide ongoing or repeated financial support through crowdfunding. The goal being to fill the gap on how to foster long-term financial stability for sustainability innovations.

The broader implications of this research reach beyond the **NAH**SHUTTLE case to global efforts addressing climate change through sustainable mobility. Achieving long-term financial stability for such initiatives requires moving beyond simple appeals to sustainability or cost savings, and instead fostering lasting user engagement and community identification. This insight is critical as cities and regions worldwide seek scalable, user-driven solutions to reduce transport emissions. Ultimately, the transition to sustainable mobility is not only a technological or policy challenge but a human one, requiring communities to invest financially and emotionally in new ways of moving and living together. Every act of support, no matter how local, contributes to the global fight against climate change.

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Appendix A

Distribution Tables

Table 1

Demographics: Age and Gender Distribution

Gender	**Male**	**Female**	**Non-Binary / Third Gender**		**Prefer Not To Say**	
n = %	73 (58.9%)	47 (37.9%)	3 (2.4%)		1 (0.8%)	
Age Range	**18 - 24**	**25 - 34**	**35 - 44**	**45 - 54**	**55 - 64**	**64 +**
n = %	32 (25.8%)	26 (21%)	20 (16.1%)	26 (21%)	15 (12.1%)	5 (0.4%)

Note. n stands for sample size. Percentages rounded to the first decimal place.

Table 4

Comfort Surcharge Distribution of Monetary Responses: Basic Base Fee and Kilometre Fee

	n	**€1**		**€2**		**€3**		**€4**		**€5**
Basic Base Fee	64	4 (6.3%)		28 (43.8%)		25 (39.1%)		4 (6.3%)		3 (4.7%)
	n	**€0**	**€0.10**	**€0.20**	**€0.30**	**€0.40**	**€0.50**	**€0.60**	**€0.70**	**€0.80**
Kilometre Fee	35	3 (8.6%)	3 (8.6%)	11 (31.4%)	5 (14.3%)	1 (2.9%)	11 (31.4%)	1 (2.9%)	0 (0%)	0 (0%)

Note. n stands for sample size. Percentages rounded to the first decimal place. Table 4 indicates the responses to the question of how much individuals could imagine paying for a basic base fee and/ or kilometre fee. The sample sizes are lower, as only participants that indicated a general interest in paying one or both of the offered comfort surcharges, were asked to indicate a specific monetary amount.

Appendix B

Debriefing Form (in German and Translated to English)

Debriefing Form – German (Original)

WAS GENAU WIRD ERFORSCHT?

Da viele nachhaltige Initiativen Schwierigkeiten haben, ihre langfristige finanzielle Tragfähigkeit zu sichern, ist es wichtig, alternative/zusätzliche Finanzierungsmöglichkeiten zu finden. Dazu können finanzielle Beiträge der Nutzer*innen gehören. Um nachhaltige Mobilitäts-Innovationen breiter zu fördern, müssen wir nicht nur verstehen, welche Finanzierungsformen Nutzer ansprechen und aber auch **welche Faktoren ihre Unterstützungsbereitschaft beeinflussen**. Dies ist das eigentliche Ziel und die Forschungsfrage dieser Studie.

Konkret werden auf Basis der Ergebnisse die folgenden drei Hypothesen getestet:

1. **Verlustaversion Hypothese (H1):** Die Formulierung einer Botschaft, die den potenziellen Verlust eines nachhaltigen Mobilitäts-Dienstes hervorhebt, erhöht die Bereitschaft, finanzielle Unterstützung bereitzustellen, im Vergleich zu einer Botschaft, die die Möglichkeit eines ähnlichen Gewinns (Verbesserung des Dienstes) hervorhebt.

2. **Hypothese des wahrgenommenen Nutzens (H2):** Personen, die in einer nachhaltigen Mobilitätsinnovation einen größeren Nutzen in Bezug auf Bequemlichkeit, Nachhaltigkeit oder finanzielle Vorteile sehen, sind eher bereit, sie finanziell zu unterstützen.

3. **Hypothese der häufigen Nutzung (H3):** Bei Personen, die häufig nachhaltige Mobilitätsangebote nutzen, ist die Bereitschaft zur finanziellen Unterstützung höher.

METHODIK

Zur Überprüfung der Hypothesen wurden die Teilnehmer per Zufallsprinzip entweder der Kontroll- oder der Versuchsgruppe zugeteilt. Beide Gruppen beantworteten nahezu identische Fragen, wobei sich lediglich die Formulierung des Erläuterungstextes zur gewünschten Unterstützungsform unterschied. Während die Versuchsgruppe eine verlustorientierte Botschaft erhielt, die den möglichen Wegfall des Dienstes in der Zukunft hervorhob, wurde der Kontrollgruppe eine gewinnorientierte Botschaft präsentiert, die das Potenzial und die Bereitschaft zur Verbesserung des aktuellen Systems betonte. Dies ermöglicht einen Vergleich der Antworten und eine Bewertung der Auswirkungen der Verlustaversion auf die Unterstützung nachhaltiger Initiativen oder Innovationen.

WARUM DAS WICHTIG IST

Diese Studie spielt eine zentrale Rolle bei der Entwicklung von Strategien zur langfristigen finanziellen Tragfähigkeit nachhaltiger Mobilitäts-Innovationen. Ihr Beitrag wird uns helfen, wirksame Wege zu finden, um finanzielle Unterstützung zu motivieren und Herausforderungen im Zusammenhang mit der langfristigen Finanzierung anzugehen. Dabei hilft es dem **NAH**SHUTTLE-Team herauszufinden, welche der vorgeschlagenen Arten der finanziellen Unterstützung von den **NAH**SHUTTLE-Nutzern bevorzugt werden und welche davon genutzt werden können, um aktuelle Systeme zu verbessern und sie finanziell nachhaltiger, widerstandsfähiger usw. zu machen.

Durch die Aufstellung der Hypothesen soll eine Wirkung in größerem Maßstab erzielt werden, die nicht nur auf den **NAH**SHUTTLE-Dienst beschränkt ist. Die gewonnenen Erkenntnisse können auf andere nachhaltige Mobilitäts-Initiativen angewandt werden und ihnen helfen,

langfristige finanzielle Stabilität zu erreichen und ihre ökologischen und sozialen Auswirkungen zu maximieren.

Wir danken Ihnen nochmals für Ihre Teilnahme. Ihr Feedback ist für uns von unschätzbarem Wert.

Debriefing Form – English (Translation)

WHAT EXACTLY IS BEING RESEARCHED?

Since many sustainable initiatives struggle to secure their long-term financial viability, it is important to find alternative/additional financing options. This may include financial contributions from users. To promote sustainable mobility innovations more broadly, we need to understand not only which forms of financing appeal to users, but also **which factors influence their willingness to support.** This is the actual aim and research question of this study.

Specifically, the following three hypotheses are tested based on the results:

1. **Loss aversion hypothesis (H_1):** A loss-framed message (emphasising the potential loss of a sustainable mobility service) will increase willingness to provide financial support, compared to a gain-framed message (emphasising the benefits of improving the service).

2. **Hypothesis of perceived benefit (H_2):**Perceived convenience, perceived sustainability and perceived instrumental/financial benefits will be positively correlated to a higher willingness to provide financial support for a sustainable mobility initiative or innovation.

3. **Hypothesis of frequent use (H_3):**Frequent and/or longer use of sustainable mobility services will be correlated to higher willingness to provide financial support.

METHODOLOGY

To test the hypotheses, the participants were randomly assigned to either the control or the experimental group. Both groups answered almost identical questions, with the only difference being the wording of the explanatory text on the desired form of support. While the experimental group received a loss-oriented message that emphasised the possible loss of the service in the future, the control group was presented with a gain-oriented message that emphasised the potential and willingness to improve the current system. This allows a comparison of responses and an assessment of the impact of loss aversion on support for sustainable initiatives or innovation.

WHY THIS IS IMPORTANT

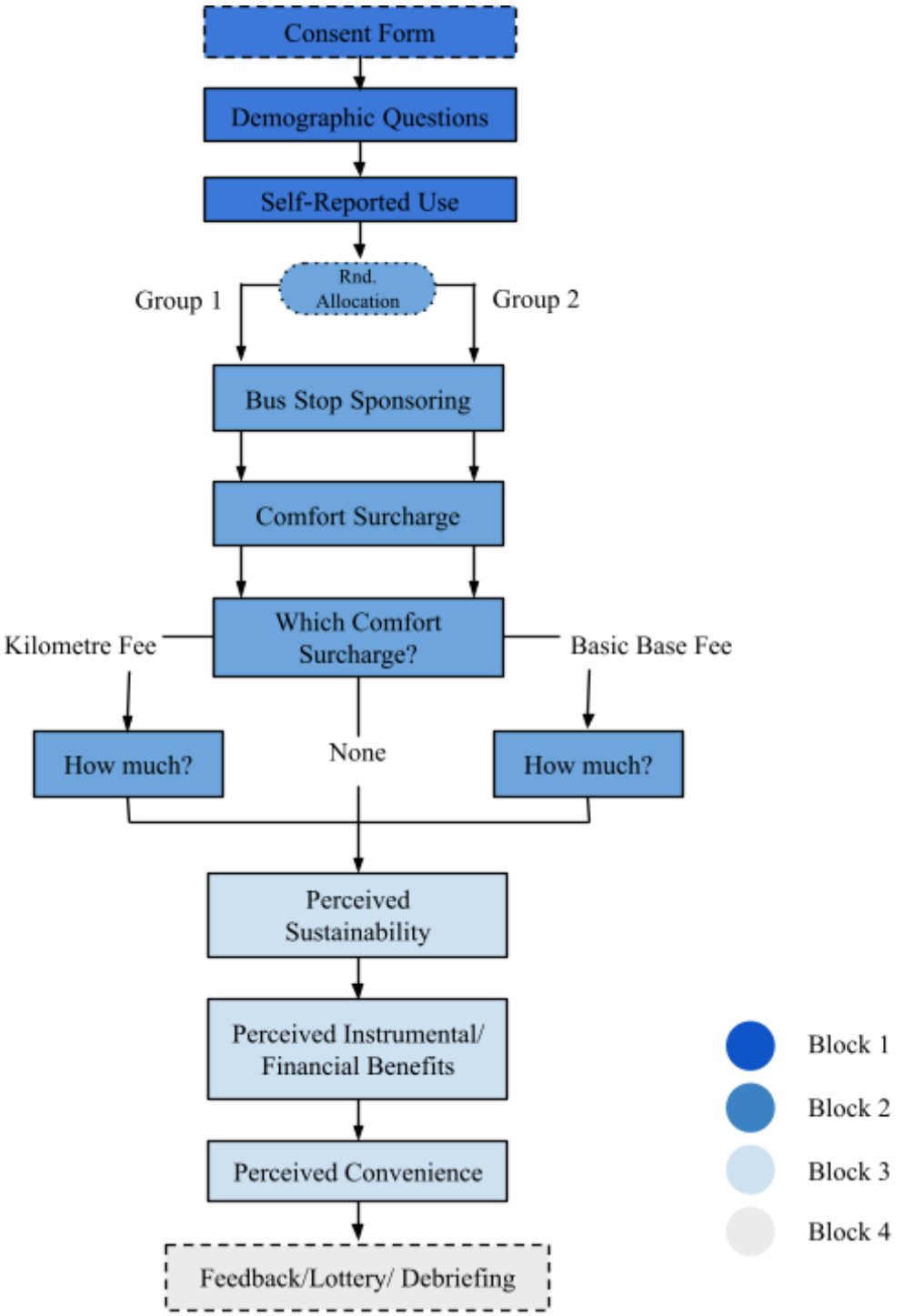
This study plays a central role in developing strategies for the long-term financial viability of sustainable mobility innovations. Your input will help us find effective ways to motivate financial support and address challenges related to long-term funding. It will help the **NAH**SHUTTLE team to identify which of the proposed types of financial support are favoured by **NAH**SHUTTLE users and which of them can be used to improve current systems and make them more financially sustainable, resilient, etc.

By hypothesising, the aim is to achieve a larger scale impact that is not limited to the **NAH**SHUTTLE service. The knowledge gained can be applied to other sustainable mobility initiatives, helping them to achieve long-term financial stability and maximise their environmental and social impact.

Thank you again for your participation. Your feedback is invaluable to us.

Appendix C

Survey Structure



Note. Survey structure divided by blocks. Elements with dashed outlines represent parts that contain questions not included in the statistical analysis.

Appendix D

Priming Messages (Original German and English Translation)

The experimental group received a loss-framed message, while the control group received a gain-framed message.

Loss-Framed Message (Experimental Group) – German (Original)

NAHSHUTTLE (ehemals „remo“) ist ein flexibles On-Demand-Shuttle für die Region Rendsburg. Seit August 2021 ergänzt es den Nahverkehr ohne feste Linien oder Fahrpläne. Über ein Netz bestehender und virtueller Haltestellen (ca. 300 m Abstand) bietet es freitags, sonnabends und sonntags abends und nachts eine flexible Mobilitätslösung.

*Da viele innovative Mobilitäts-Projekte und On-Demand-Verkehre auf langer Hinsicht mit hohen Betriebskosten und begrenzten finanziellen Mitteln zu kämpfen haben, werden momentan intensiv alternative und zusätzliche Finanzierungsmöglichkeiten für **NAH**SHUTTLE gesucht und geprüft. Das Ziel ist es, dieses wichtige Mobilitätsangebot langfristig sicherzustellen.*

Nun wenden wir uns an Sie, unsere geschätzten Nutzer*innen.

Im Folgenden stellen wir Ihnen Fragen, mit denen wir ermitteln wollen, ob und durch welche Wege Menschen in der Region mit innovativen finanziellen Beiträgen die langfristige Sicherstellung des Dienstes unterstützen würden.

Die Antworten auf diese Fragen sind **NICHT** verbindlich und eine Umsetzung ist noch nicht garantiert. Wir sind lediglich auf der Suche nach alternativen Finanzierungsmöglichkeiten, die sich unsere Nutzer*innen vorstellen können.

Loss-Framed Message (Experimental Group) – English (Translation)

NAHSHUTTLE (formerly “remo”) is a flexible on-demand shuttle for the Rendsburg region. Since August 2021, it has supplemented local public transport without fixed routes or timetables. Through a network of existing and virtual stops (approximately 300 m apart), it offers a flexible mobility solution on Friday, Saturday, and Sunday evenings and at night.

*As many innovative mobility projects and on-demand transport services struggle with high operating costs and limited financial resources in the long term, alternative and additional financing options for **NAH**SHUTTLE are currently being intensively sought and examined. The aim is to secure this important mobility service in the long term. The goal is to ensure the long-term viability of this important mobility service.*

Now we turn to you, our valued users.

In the following, we ask you questions with which we want to determine whether and by what means people in the region would support the long-term security of the service with innovative financial contributions.

The answers to these questions are **NOT** binding, and implementation is not yet guaranteed. We are simply looking for alternative financing options that our users can imagine.

Gain-Framed Message (Control Group) – German (Original)

NAHSHUTTLE (ehemals „remo“) ist ein flexibles On-Demand-Shuttle für die Region Rendsburg. Seit August 2021 ergänzt es den Nahverkehr ohne feste Linien oder Fahrpläne. Über ein Netz bestehender und virtueller Haltestellen (ca. 300 m Abstand) bietet es Freitags, Sonnabends und Sonntags Abends und Nachts eine flexible Mobilitätslösung.

Durch die positive Resonanz der Nutzer*innen sehen wir großes Potenzial für eine Erweiterung des Angebots (e.g. Fahrzeuganzahl, Bediengebiet, Betriebszeiten), um noch mehr Menschen in der Region zu erreichen und die Mobilität weiter zu verbessern. Dies könnte nicht nur die Lebensqualität der Bürger*innen erhöhen, sondern auch einen wichtigen Beitrag zur Verkehrswende leisten. Die Hürde liegt bei der Finanzierung. Da solche Maßnahmen mit erheblichen Kosten verbunden sind, suchen wir derzeit nach zusätzlichen Finanzierungsmöglichkeiten.

Nun wenden wir uns an Sie, unsere geschätzten Nutzer*innen.

Im Folgenden stellen wir Ihnen Fragen, mit denen wir ermitteln wollen, ob und durch welche Wege Menschen in der Region mit innovativen finanziellen Beiträgen die Erweiterung/ Verbesserung des Dienstes unterstützen würden.

Die Antworten auf diese Fragen sind **NICHT** verbindlich und es wird auch nicht versprochen, dass sie umgesetzt werden. Wir sind lediglich auf der Suche nach zusätzlichen Finanzierungsmöglichkeiten, die sich unsere Nutzer*innen vorstellen können.

Gain-Framed Message (Control Group) – English (Translation)

NAHSHUTTLE (formerly “remo”) is a flexible on-demand shuttle for the Rendsburg region. Since August 2021, it has supplemented local public transport without fixed routes or timetables. Through a network of existing and virtual stops (approximately 300 m apart), it offers a flexible mobility solution on Friday, Saturday, and Sunday evenings and at night.

Due to the positive response from users, we see great potential for expanding our services (e.g., number of vehicles, service area, operating hours) to reach even more people in the region and further improve mobility. This could not only improve the quality of life for citisens, but also

make an important contribution to the transport transition. The hurdle lies in financing. Since such measures are associated with considerable costs, we are currently seeking additional funding opportunities.

Now we turn to you, our valued users.

In the following, we ask you questions to determine whether and how people in the region would support the expansion/improvement of the service with innovative financial contributions.

The answers to these questions are **NOT** binding, and implementation is not yet guaranteed. We are simply looking for alternative financing options that our users can imagine.

Note. Original priming texts were written in German. English translations are provided for reference; while care was taken in translation, subtle nuances may not be fully captured.

Appendix E

Likert Scale Items Asked to Assess Perceived Attributes (Original German and Translated to English)

Table …

Perceived Attribute	Original Item (in German)	Translated Item (in English)
Perceived Sustainability	Die Nutzung des **NAH**SHUTTLEs verringert meinen CO_2-Fußabdruck/ meine Umweltbelastung erheblich.	The use of the **NAH**SHUTTLE significantly reduces my carbon footprint/environmental impact.
	Nachhaltige Mobilitäts-Innovationen wie das **NAH**SHUTTLE verbessern die Luftqualität in meiner Umgebung.	Sustainable mobility innovations such as the **NAH**SHUTTLE improve the air quality in my area.
	Nachhaltige Mobilitäts-Innovationen wie das **NAH**SHUTTLE tragen zur Verringerung der Verkehrsbelastung bei.	Sustainable mobility innovations such as the **NAH**SHUTTLE contribute to reducing traffic congestion.
	Die Entscheidung, das **NAH**SHUTTLE anstelle eines privaten Autos zu nutzen, hat einen bedeutenden Einfluss auf die Bekämpfung des Klimawandels.	The decision to use the **NAH**SHUTTLE instead of a private car has a significant impact on combating climate change.
	Nachhaltige Mobilitäts-Initiativen wie das **NAH**SHUTTLE sind für die Schaffung einer umweltfreundlicheren Zukunft unerlässlich.	Sustainable mobility initiatives such as the **NAH**SHUTTLE are essential for the creation of a more environmentally friendly future.
Perceived Convenience	Das **NAH**SHUTTLE ist ein effizienter Weg, um von A nach B zu kommen	The **NAH**SHUTTLE is an efficient way to get from A to B
	Die **NAH**SHUTTLE-Dienste sind in meiner Umgebung leicht zugänglich.	The **NAH**SHUTTLE Service is easily accessible in my area.

	Die Verfügbarkeit und Häufigkeit der **NAH**SHUTTLE-Dienste entspricht meinen Bedürfnissen.	The availability and frequency of the **NAH**SHUTTLE Service meets my needs.
	Ich kann das **NAH**SHUTTLE zuverlässig in meinen (Tages-) Ablauf integrieren.	I can reliably integrate **NAH**SHUTTLE into my (daily-) routine.
	Die Nutzung des **NAH**SHUTTLEs ist ähnlich komfortabel wie die Nutzung eines privaten Fahrzeugs.	The use of the **NAH**SHUTTLE is as convenient as using a private vehicle.
Perceived Financial/ Instrumental Benefit	Das **NAH**SHUTTLE ist eine günstige Möglichkeit, von A nach B zu kommen	The **NAH**SHUTTLE is an affordable way to get from A to B.
	Das **NAH**SHUTTLE reduziert meine gesamten Transportkosten.	The **NAH**SHUTTLE reduces my overall transportation costs.
	Die Nutzung des **NAH**SHUTTLEs spart mir Geld im Vergleich zu den zu erwartenden alltäglichen Kosten, die mit dem Besitz/der Nutzung eines privaten Fahrzeugs verbunden sind (z. B. Aufladen/Betanken des Fahrzeugs, Reinigung, Versicherung).	The use of the **NAH**SHUTTLE saves me money compared to the expected everyday costs associated with owning/using a private vehicle (e.g. charging/fuelling the vehicle, cleaning, insurance).
	Nachhaltige Mobilitätsangebote wie das **NAH**SHUTTLE helfen mir, unerwartete Kosten zu vermeiden, die mit dem Besitz eines privaten Fahrzeugs verbunden sind (z. B. Strafzettel, Wartungen, Unfälle).	Sustainable mobility offers such as the **NAH**SHUTTLE helps me avoid unexpected costs associated with owning a private vehicle (e.g., parking tickets, maintenance, accidents).
	Die Nutzung des **NAH**SHUTTLEs spart mir Zeit	The use of the **NAH**SHUTTLE saves me time.

Note. Original items were presented in German. English translations are provided for reference; while both versions are shown, some linguistic or cultural nuances may not be fully preserved in translation.