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Assessing micro-mobility net benefits at the individual level: Evidence for two European countries

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A B S T R A C T

This study, comparing two European countries, explores the net benefits of e-scooters in interplay with their usage and user satisfaction. We surveyed 199 e-scooter users in Germany and 184 in Portugal. A novel framework based on an established model used to evaluate information systems' success is introduced, where net benefits, here, are ultimately expressed by the efficiency and effectiveness of e-scooters in undertaking short-distance trips. All in all, one can infer that pragmatic reasons, in terms of functionality and fulfillment of purpose, are the most important factors in the usage and satisfaction of e-scooters. Recreational reasons are, at most, a side effect. The number one explanation of e-scooter net benefits, conducting short-distance trips effectively and efficiently, is user satisfaction, which is reinforced by use. Price also plays a rather important role, while thoughts regarding sustainability and safety do matter but subordinately. Preponderantly, the countries' subsamples align with the full-sample model's findings, with some differences among them; nonetheless, no significant one can be found. All in all, both countries share comparable individual-level behaviors regarding e-scooters.

1. Introduction

Micro-mobility represents an emerging domain within the field of transportation and is defined as the undertaking of travel using micro vehicles (O'Hern & Estgfaeller, 2020). Micro vehicles range from both conventional to power-assisted options, mainly (electric) bicycles and scooters, but also relatively new inventions such as Segways or hoverboards (International, 2018). The relevance of micro-mobility services, alongside their usage, has rapidly increased throughout the past few years (Reck et al., 2022), with over 520.000 micro vehicles now being available in Europe (O'Brien, 2022). Due to the advancements in mobile computing, particularly shared micro-mobility services have gained massive popularity (Kaufman & Buttenwieser, 2018). Especially its indicated suitability concerning short-distance travel (Clewlow, 2018) – characterized by a flexible, affordable, and more climate-friendly mode of transportation – is frequently highlighted (Shaheen et al., 2020).

Electric scooters, commonly called e-scooters, are a type of micro vehicle that utilizes an electric motor powered by a rechargeable battery to propel. E-scooters are designed to be compact, lightweight, and convenient for short-distance trips and are typically rented via smartphone applications (Shaheen et al., 2020). They are equipped with handlebars and a platform for the rider to stand on. The rider controls the speed of the e-scooter through a throttle located on the handlebars (Society of Automotive Engineers International, 2019). E-scooters are commonly used in urban areas and have gained increasing popularity in recent years among users and planners/

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operators alike due to their alleged potential to tackle modern transportation challenges, such as reducing traffic congestion and environmental issues or improving mobility systems. This makes them an important area of research.

Though being a fairly recent domain of study, extensive research has already been conducted in certain areas – e.g., in regard to adoption (Eccarius & Lu, 2020), vehicle technology (Zhao et al., 2021), spatial planning (Tuncer & Brown, 2020), policymaking (Sareen et al., 2021), safety (Yang et al., 2020), and environmental sustainability (Reck et al., 2022), among others. Nevertheless, the topic of net benefits in relation to use and user satisfaction – especially in a European context – has not been thoroughly analyzed yet: we aim to provide a holistic view of e-scooters by closing this research gap and drawing conclusions from exemplary use cases.

In this research context, net benefits are defined by the efficiency and effectiveness of e-scooters in undertaking short-distance trips. With net benefits as the focal point, two related concepts must also be emphasized: e-scooter use and user satisfaction. Use refers to the frequency and duration of a user's rides, while user satisfaction expresses how well the service meets or exceeds users' expectations and needs. An elaborated derivation of all terminology can be found in 3 Research Model.

Hence, the study aims to answer the following research question:

- RQ1: Which factors drive satisfaction towards e-scooters, and how do their usage and satisfaction affect net benefits?

For a structured approach, two research objectives are proposed. We determine the antecedents of e-scooter use, user satisfaction, and net benefits by adapting the DeLone & McLean information systems success model (ISSM) (DeLone & McLean, 2003) in combination with further theoretical constructs. Furthermore, we point out how these antecedents change among Middle and Southern European countries, namely Germany and Portugal, through a multigroup analysis in partial least squares (PLS) path modeling and structural equation modeling (SEM) (Henseler et al., 2009). In this context and for such a use case, the conceptualized framework and the statistical method represent fitting ways to respond systematically to the above-stated research question, which is further emphasized in 4.3. Research Model Evaluation.

The overarching goal of this paper is to result in a comprehensive assessment of the net benefit aspect of micro-mobility (linked with use/ user satisfaction) and contribute to the theoretical body of research surrounding the domain by deriving industry-wide learnings based on the individuals' perspective. It is expected to provide a continuation point for future academic work and support practitioners in deriving implications regarding a roadmap for optimization measures within the micro-mobility industry.

The remainder of this article is organized as follows. In section 2, we review the literature on e-scooters. Section 3 develops our methodology and model used to examine the above-stated research question and its aims, while section 4 introduces our dataset. We present our results in section 5. This segment is followed by section 6, where the findings will be thoroughly discussed, and managerial and theoretical implications will be highlighted. Section 7 concludes this study.

2. Literature review

As stated earlier, the topic of e-scooters has proliferated in literature throughout recent years as an uptake of their presence has taken place (O'Hern & Estgfaeller, 2020). This literature review examines the current state of knowledge on e-scooters within its main domains – namely safety, injuries, spatial patterns, environmental impact, user/travel behavior, urban design, regulation, customer profiles and their usage, and adoption. Following the approach proposed by Snyder (2019) and common practice, we commence by reviewing the literature to then develop a customized research model that is, indeed, tailor-made to the concept of electric mobility.

Studies on the safety of e-scooter use, including accident rates, types of accidents, and injury severity, as well as potential solutions to improve e-scooter safety, are one focus of researchers. With the increasing popularity of e-scooters, there has been a growing concern about the safety of these vehicles and the potential for increased rates of injury among riders and pedestrians. In naturalistic riding experiments with a mobile sensing system, it was found that e-scooters pose safety challenges due to increased vibrations, speed variation, and constrained riding environments (Ma et al., 2021). Bloom et al. (2021) found that the leading cause of injury in e-scooter rides was loss of balance, accounting for almost half of all injuries. Only a minimal percentage of riders wore helmets; all traumatic brain injuries and closed head injuries occurred in unhelmeted patients. Several studies observed low helmet use rates (Störmann et al., 2020). At the time, a majority of incidents took place on regular streets. Finally, patients under the influence of alcohol and marijuana incurred greater facility costs, with Störmann et al. (2020) adding that e-scooter-related accidents generally represent a burden on emergency departments. Most patients were male, and fractures were the most common type of injury (Störmann et al., 2020). Specifically, injuries to the head, upper extremities, and lower extremities were found to be more common, while injuries to the chest and abdomen were less common. Injury severity was inconsistently reported, but most injuries were minor (Toofany et al., 2021). E-scooter riders are susceptible to varying degrees of traumatic injuries (Toofany et al., 2021). Said works emphasize the significance of raising public consciousness and promptly implementing safety measures to reduce accidents involving e-scooters (Yang et al., 2020).

Spatial patterns refer to how e-scooter usage is distributed across different geographic areas, such as neighborhoods, commercial districts, or transportation hubs. They can be influenced by various factors, including the availability of e-scooters, local regulations related to e-scooter usage, and the characteristics of the built environment. All reviewed journal articles underline the cruciality of e-scooter operators and city planners understanding spatial patterns to identify areas where e-scooter usage is most concentrated as well as areas where e-scooter services may be underutilized (Hosseinzadeh et al., 2021; Zou et al., 2020). Several studies agree that e-scooter popularity is positively affected by areas with a large concentration of people, such as around tourist sites, hotels, and transit stops. Plus, the sheer availability/supply of e-scooters is also regarded as a massive – seemingly intuitive – factor (Bai & Jiao, 2020; Huo et al., 2021; Merlin et al., 2021). However, while Huo et al. (2021) argue a high degree of transferability of the results acquired through a comparative study of five US cities, other authors' results show the significance of local differences (Bai & Jiao, 2020).

There is a significant disparity in terms of the environmental impact of e-scooters. On one hand, the benefits in direct comparison to a large portion of other mobility choices are significant, considering reduced traffic congestion, noise, energy consumption, and emissions (Guo & Zhang, 2021). On the other hand, doubts arise as a Greek study indicates that shared e-scooters are mainly replacing walking and public transport trips. This phenomenon would lead to the substitution of more eco-friendly modes and diminish the desired outcomes (Nikiforiadis et al., 2021). On the other hand, Baek et al. (2021) imply that some people would perceive the joint public transportation/e-scooter utility as greater than that of using automobiles for the whole journey, neutralizing the effect mentioned above or even restoring it, according to indications made by Laa and Leth (2020) and Guo and Zhang (2021), via the replacement of private car trips.

A more consumer-centric approach is taken in the examined literature on e-scooter user behavior, including the impact of e-scooters on overall travel behavior and the potential for e-scooters to complement or replace other modes of transportation. It is strongly connected to the domain of urban design, which promotes more sustainable, livable urban environments as well as the integration into the local transportation mobility infrastructure through the reduced dependency on cars. In particular, the topic of first-mile and last-mile transportation is investigated in this context, as e-scooters are found to be complements to public transit by various researchers (Bai & Jiao, 2020; Merlin et al., 2021). This aspect depicts a widespread point of view: Baek et al. (2021) show evidence of e-scooters being a competitive transportation mode in last-mile situations alongside their first-mile value. E-scooters can increase accessibility for multimodal public transit trips, mostly short-distance ones (Liu & Miller, 2022). Besides this, a study suggests that e-scooter riders are willing to travel longer distances to ride on certain types of roads, such as bikeways, multi-use paths, tertiary roads, and one-way roads. They also prefer shorter and simpler routes, and the slope is not a determinant of e-scooter route choice due to the vehicle's electric power (Zhang et al., 2021). Another one also found that people who travel by bicycle or motorcycle are not attracted to e-scooters (Nikiforiadis et al., 2021). These findings can assist policymakers in incorporating e-scooters into their administered cities (Nikiforiadis et al., 2021). Takeaways may be applied to the regulatory landscape of e-scooters, including the policies and regulations implemented by cities and transportation agencies to manage e-scooter use (public–private partnerships) to avoid asynchronous market developments (Sareen et al., 2021).

Customer profiles refer to the demographic characteristics of e-scooter riders, such as age, gender, income, and education level. Understanding customer profiles is important for e-scooter operators and city planners in order to develop targeted strategies and ensure that e-scooter services are accessible to a wide range of users, which is closely linked to their adoption and usage. A study from Vienna, Austria, by Laa and Leth (2020) examines the socio-economic profiles and usage patterns and finds that e-scooter users are likelier to be young, male, and highly educated. This factor is unanimous with other further research but entails the risk of opening the gender mobility gap (Bai & Jiao, 2020; Merlin et al., 2021; Nikiforiadis et al., 2021). Other pieces of work identified several factors that significantly influence shared e-scooter usage, including gender, helmet use, exposure to shared e-scooters, ownership of an e-scooter, riding locations, opinions on speed limits, and trip purposes (Guo & Zhang, 2021).

Researchers found that respondents' usage and adoption of e-scooters are based on distinct reasoning patterns that are dependent on different behavioral determinants that influence the level of intention. At times, a so-called value-action gap may be present, complicating determining the genuineness behind one's motives (i.e., the disconnect between what people value and how they actually

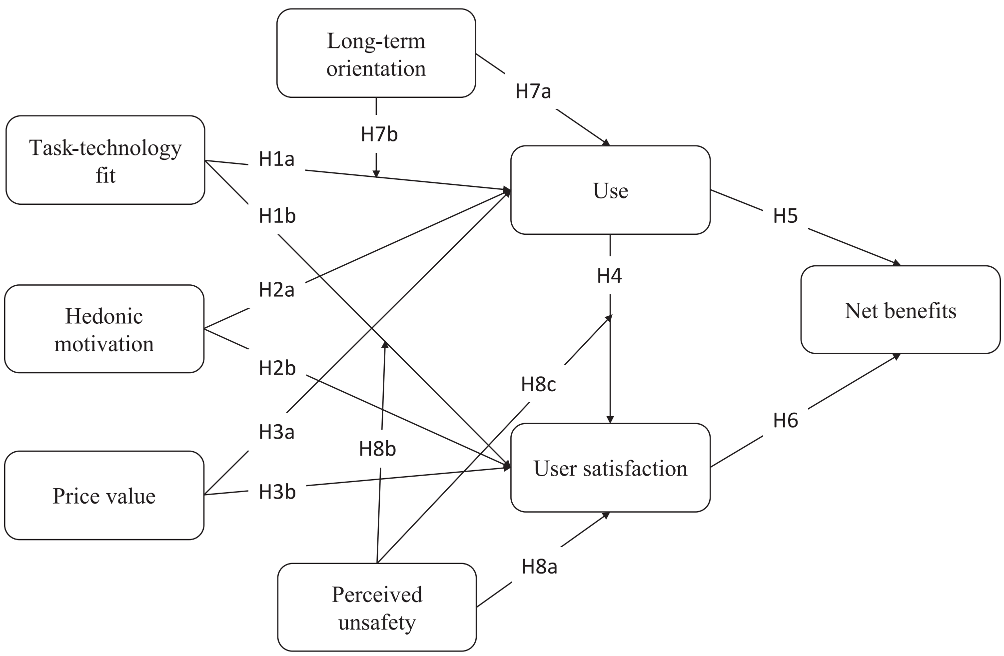

Fig. 1. Research model.

act in regard to environmental sustainability) (Eccarius & Lu, 2020).

Some areas of e-scooter research have received more attention than others. This aspect is likely due to the rapid pace of developments and the relatively recent emergence of the technology. The lack of in-depth research applicable to e-scooter usage in Europe, due to the majority of studies being based on data from the United States, highlights the need for further investigation. In contrast to other areas of mobility studies, e.g., electric vehicles (Cruz-Jesus et al., 2023), there is a clear *lacuna* that can be identified in this particular case. This study aims to bridge the gap that has arisen and advance the research domain by providing valuable insights into the net benefit assessment, including usage and satisfaction aspects, of e-scooters in a European context.

3. Research model

Given the ubiquity of e-scooters and the absence of a comprehensive and cohesive theoretical framework to measure their net benefits, we developed a new theoretical model drawing on the updated DeLone and & McLean ISSM (DeLone & McLean, 2003) as its central tenet due to its number of validated measures (Petter et al., 2008) that can be reused to assess the proposed success dimensions. A preceding model was brought forward before by DeLone and McLean (1992). The model has been applied to several types of use cases and is currently the most widely used assessment framework in information systems research (Urbach & Müller, 2012). The core principles of the theoretical model around use, user satisfaction, and net benefits remained unchanged, while the antecedents – namely information quality, system quality, and service quality – were modified to better suit the context of e-scooters: functionality-related as well as sociopsychological factors about the usage of and satisfaction with e-scooters were utilized as a basis for the interchanged theoretical dimensions (Aman et al., 2021; Bretones & Marquet, 2022). Additionally, moderators have been put in place accordingly. The proposed research model is visualized in Fig. 1; the associated instrumentation can be found in Appendix A.

Task-technology fit is a concept in information systems research that refers to the degree to which a technology or information system supports and enhances an individual's ability to effectively perform their work tasks. It is influenced by the characteristics of both the task being performed and the technology being used and is affected by factors such as the user's skills, knowledge, and experience, as well as the design and functionality of the technology itself (Goodhue & Thompson, 1995). Task-technology fit relates to e-scooter use and user satisfaction in the sense that if the e-scooter technology fits well with the task or purpose of the user (here: undertaking short trips), it can lead to higher usage and satisfaction respectively with the e-scooter experience. For example, if a user wants to use an e-scooter for a short commute to work and the technology of the e-scooter enables them to easily navigate traffic and arrive at their destination quickly and safely, a high degree of task-technology fit is given. Based on that, we posit:

H1a: Task-technology fit has a positive influence on the use of e-scooters.
H1b: Task-technology fit has a positive influence on user satisfaction of e-scooters.

Derived from the multi-motive information systems continuance model (Lowry et al., 2015), a primary enhancement we propose in introducing new antecedents is to consider and assess a prevailing type of motivation and belief: the hedonic one. Hedonic motivation is the drive to engage in an activity because it brings pleasure, enjoyment, or entertainment. It is motivated by the positive emotions and feelings associated with the activity rather than any external reward or incentive (Van der Heijden, 2004). In the context of e-scooter use, hedonic motivation may be a relevant factor as it is supposed to offer the rider an enjoyable and exciting experience. The sensation of riding an e-scooter, the speed, and the perception of freedom and autonomy that arguably come with it can all be sources of pleasure and enjoyment for the rider. Those who are hedonically motivated may be more likely to choose e-scooters as their preferred mode of transportation because it provides them a positive and pleasurable experience rather than just a means of transportation. In light of this, we suggest:

H2a: Hedonic motivation has a positive influence on the use of e-scooters.
H2b: Hedonic motivation has a positive influence on user satisfaction of e-scooters.

Price value refers to the perceived worth or utility of a product/service in relation to its cost. It emphasizes that consumers' perceived value of a product or service is not solely based on the actual price paid but also on their assessment of the quality, features, and benefits of the product or service. In other words, consumers may be willing to pay a higher price for a product or service if they perceive it to be of higher quality or if it provides them with greater benefits. On the other hand, they may be reluctant to pay a lower price for a product or service if they perceive it to be of lower quality or if it provides them with limited benefits (Venkatesh et al., 2012). Therefore, in the context of e-scooters, the price value may depend on consumers' perception of their quality, features, and benefits, as well as their individual preferences and needs. Taking this into consideration, we postulate:

H3a: Price value has a positive influence on the use of e-scooters.
H3b: Price value has a positive influence on user satisfaction of e-scooters.

According to Venkatesh and Bala (2008), use – in the sense of usage behavior – is defined as the extent to which an individual uses a particular information system to perform his or her job or complete a task. It encompasses the frequency, duration, and intensity of system use. This definition focuses on the observable actions of individuals using a system rather than their intentions or attitudes toward it. In the context of e-scooters, usage behavior can refer to how often and for how long a user rides the e-scooter. User satisfaction refers to the feeling of pleasure or contentment an individual experiences after using a product or service. It is a subjective evaluation based on comparing the user's expectations and the actual performance of the product or service (Wu & Wang, 2006). In the context of e-scooters, user satisfaction refers to the degree to which users' expectations and needs are met or exceeded by the e-scooter service. A high level of user satisfaction indicates that users find e-scooters to be a valuable and desirable mode of transportation and are likely to use them again in the future or even recommend them to others. Building on this, it is suggested:

H4: E-scooter use has a positive influence on user satisfaction of e-scooters.

The success dimension net benefits pertains to the degree to which information systems contribute to the success of various stakeholders. The dimension integrates the previous individual impact and organizational impact dimensions of the original version of the DeLone & McLean ISSM (DeLone & McLean, 1992) as well as other impact measures, such as workgroup impacts and societal impacts, into a single dimension (DeLone & McLean, 2003). This study focuses on the individual level; therefore, the net benefits are expressed through individual performance, which is consistent with the original DeLone and McLean ISSM proposition. It describes that both use and user satisfaction influence the impact of individual performance (DeLone & McLean, 1992). Ultimately, DeLone and McLean (2003) grant a certain degree of liberty regarding the context-specific measurement but, once again, vocalize the suitability of the chosen construct (Petter et al., 2008). The term "performance" refers to efficiency and effectiveness in performing e-scooter-related tasks (Tam & Oliveira, 2017) – specifically, undertaking trips of short distances. This concept encompasses factors such as task performance, job efficiency, and overall usefulness, which assesses how much a user perceives that using a particular technology/system can enhance their performance (Davis, 1989). This line of thought is summed up in the concept of net benefits. Therefore, we posit:

H5: E-scooter use has a positive influence on the net benefits of e-scooters.
H6: E-scooter user satisfaction has a positive influence on the net benefits of e-scooters.

The concept of long-term orientation refers to a cultural dimension identified in sociology that describes the extent to which a society values long-term planning and perseverance versus short-term thinking and instant gratification. Societies with a high long-term orientation emphasize the importance of persistence, hard work, and a focus on the future. These societies are often characterized by values such as thrift, persistence, and respect for traditions (Bearden et al., 2006). These individuals may closely assess how well e-scooters fit their long-term transportation needs and goals for usage purposes. Given current global megatrends, individuals with a strong long-term orientation may consider e-scooters an appropriate and useful way of tackling long-term transportation challenges, such as reducing traffic congestion, air pollution, and carbon emission −environmental sustainability concerns are reflected via long-term orientation in this study. Hereby, the technology is closely assessed simultaneously in regard to its fit to fulfill the task at hand. It depicts a value system that comes into play with regard to e-scooter usage – as a determining factor out of the pre-utilization period. Thus, the following hypotheses are formulated:

H7a: Long-term orientation has a positive influence on the use of e-scooters.
H7b: Long-term orientation will moderate the effect of task-technology fit on the use of e-scooters, such that the relationship will be stronger among people with a higher long-term orientation.

Perceived (un)safety refers to the subjective evaluation of the level of safety or risk toward one's well-being (Osswald et al., 2012) associated with using an e-scooter – frequently based on the available information. A variety of factors influence this perception. The perceived safety of e-scooters can significantly impact the feeling of satisfaction, as users are likely to assess the potential safety-related outcomes and the sense of security during usage. If a person perceives e-scooters as unsafe or risky, they are likely to feel dissatisfaction in using them, even if they are interested in the experience or find it pleasurable. On the other hand, if a person perceives e-scooters to be relatively safe, they may also be more likely to enjoy the experience. *Perceived (un)safety usually arises from using electric scooters (*i.e.*, it's a consequence of use and therefore a post-adoption construct) and directly affects user satisfaction.* With heightened levels of perceived unsafety, the frequency or extent of their usage may have a reduced impact on overall satisfaction. At the same time, it leads to a greater awareness of potential risks associated with e-scooters, such that greater emphasis is placed on their expediency. Consequently, the following propositions are made:

H8a: Perceived unsafety has a negative influence on user satisfaction of e-scooters.
H8b: Perceived unsafety will moderate the effect of task-technology fit on user satisfaction with e-scooters, such that the relationship will be stronger among people with higher perceived unsafety
H8c: Perceived unsafety will moderate the effect of the use on the user satisfaction of e-scooters, such that the relationship will be weaker among people with higher perceived unsafety.

4. Methodology

4.1. Measurement items

All items used to measure the model constructs were adapted from the literature with slight modifications to fit the context of e-scooters, as revealed in Appendix A. Moreover, six socio-demographic questions related to gender, age, marital status, education degree, professional situation, and income were included in the questions. Also, the country of residence was inquired.

Most items were measured using seven-point scales, ranging from “strongly disagree” (1) to “strongly agree” (7). Use is displayed via another seven-point range scale. Gender was coded using a 0 or 1 dummy variable where 1 represented women. Age was measured in years, as was the educational level. Marital status, professional status, and country of residence were given the corresponding terms, while income was classified on a metric scale. All constructs were modeled using reflective indicators.

The study employed two approaches to assess the presence of common method bias. First, Harman’s one-factor test was utilized (Podsakoff et al., 2003), revealing that none of the factors individually accounted for a significant portion of the variance. Specifically, the first factor explained only 36.7 % of the total variance, suggesting a lack of dominant bias. Second, the marker variable technique (Lindell & Whitney, 2001) was employed. It involves incorporating a theoretically irrelevant marker variable into the model and questionnaire. The maximum shared variance observed between this marker variable and other variables was 0.011449 (1.1 %), which is considered low (Johnson et al., 2011). Consequently, these findings do not indicate the presence of common method bias.

4.2. Data collection

The research design, as shown in Fig. 1, was carefully constructed to ensure its robustness. A questionnaire was developed in English, drawing from normative literature and the research team’s experience, and efforts were made to minimize embedded bias through cross-checking constructs and their associated items. An online questionnaire survey was employed and distributed via email to university groups in Germany and Portugal as well as shared through professional social networking sites and relevant online forums as it was considered the most suitable way to maximize overall exposure – to ensure heightened levels of participation. The tool employed was Qualtrics, which is a survey tool developed for researchers with advanced surveying needs and is presently one of the most prominent solutions in this area (please see https://www.qualtrics.com). Participation was voluntary and adhered to ethical standards.

A pilot study was conducted with 30 respondents to test the measurement instrument and confirm a proper methodology. This initiative served the purpose of ensuring appropriate data collection (as required to test the hypotheses), verifying the reliability and validity of the measurement scales, and assessing the overall comprehensibility of respondents. The results confirmed the validity and reliability of the measurement scales. The constructs remained unchanged, with either minor linguistic modifications to eliminate ambiguity or a few items removed due to low correlation. Data from the pilot study were not included in the main study to increase data reliability and reduce potential bias – ultimately, as a means of triangulation.

Data collection took place in Germany and Portugal over a one-month span between April and May 2023. Although some cultural differences between the two audiences were expected, it is reasonable to assume that the two samples are compatible in terms of background and work experience. The total number of recorded responses received was 539. After removing all incomplete questionnaires, 397 complete ones were left over. Of this number, 383 responses (199 for Germany and 184 for Portugal) are valid. These response levels align with other studies that follow a similar research design.

The sample’s characteristics can be seen in Fig. 2. Referring to the total sample, the split between male and female participants is 55.6 % vs. 43.1 %, representing a sample fairly equally distributed by gender, with a slight surplus of men. 1,5% of respondents identify as other. Regarding males and females, Germany and Portugal show very similar splits. The largest age group within the

		Total		Germany		Portugal	
Measure	Value	%	N	%	n	%	n
Gender	Male	55.6%	213	58.8%	117	52.2%	96
	Female	43.1%	165	39.7%	79	46.7%	86
	Other	1.3%	5	1.5%	3	1.1%	2
Age	18-34	60.6%	232	55.8%	111	65.8%	121
	35-54	34.5%	132	35.2%	70	33.7%	62
	55+	5.0%	19	9.0%	18	0.5%	1
Education degree	Highschool or lower	31.3%	120	41.2%	82	20.7%	38
	Undergraduate	33.7%	129	30.2%	60	37.5%	69
	Graduate or higher	35.0%	134	28.6%	57	41.8%	77
Profession al situation	Student	33.2%	127	21.6%	43	45.7%	84
	Employed	60.1%	230	71.9%	143	47.3%	87
	Unemployed/ retired	6.8%	26	6.5%	13	7.1%	13
Income	< 1500 EUR	31.8%	128	25.3%	42	36.4%	86
	1500 EUR to 3000 EUR	36.6%	147	48.8%	81	28.0%	66
	> 3000 EUR	26.9%	108	45.8%	76	13.6%	32

Fig. 2. Sample characteristics (summary).

sample is individuals between the ages of 25 and 34, constituting 37.1 % of the participants. This observation stays consistent within Germany and Portugal with only minimal deviations. The predominant pool of participants is single, making up 63.2 % of the total sample. In both Germany and Portugal, the majority fall into this category. With about 1/3 of the overall sample, a Bachelor's degree encompasses 33.7 % of the total sample and represents the biggest educational group with a slight edge. Notably, while this is also true in Germany, the Portuguese sample consists of more Masters and postgraduate graduates. The difference can be spotted in the economic status as well: while more than 25 % in the German sample have a net household income of €2000 to €3000, 1/5 of Portuguese respondents earn between €1.000 and €1.500, closely trailed by the value of €1500 to €2000. Overall, almost half are regular employees. Significant variance can be found in this case, too. In Germany, employees constitute a higher percentage of the sample at 59.8 %. At the same time, in Portugal, the figure is 37.5 %, and comparably more students (full-time and working) successfully took part in the survey. Detailed descriptive statistics relating to the respondents' characteristics can be found in Appendix B. It shows sample characteristics for the total and German and Portuguese samples.

4.3. Method

Partial least squares (PLS), a structural equation modeling (SEM) approach, were employed to evaluate the research model. SEM is a comprehensive research methodology that integrates various components of the research process. It represents an analytical technique that combines descriptive methods (e.g., factor analysis) with explanatory techniques (e.g., linear regression). SEM encompasses a psychometric aspect by modeling latent (unobservable) variables and an econometric perspective focused on estimating cause-effect relationships between these nearly independent constructs: measurement and structural models. The measurement model component's upside is that it accounts for errors associated with the indicators (items) used to measure each construct. Utilizing multiple items to measure each construct minimizes and controls the impact of measurement errors, which is particularly crucial when dealing with latent dimensions, as is the case in this study. In the structural model (hypothesis testing), SEM allows researchers to model multiple independent and dependent variables (constructs) concurrently.

SEM is widely recognized as one of the most popular analytic methods in the social sciences due to its numerous advantages. There are two primary approaches to conducting SEM: PLS, compared to covariance-based techniques, has the advantage of having to make fewer assumptions, i.e., regarding sample sizes, variables, and residual distributions (Chin, 1998). PLS is considered suitable when the sample size is at least ten times larger than the number of paths (Gefen & Straub, 2005). Following the approach outlined by Anderson and Gerbing (1988), separate analyses were conducted to assess the measurement and structural models. The SmartPLS 4 software (Ringle et al., 2022) was utilized for evaluation.

5. Data analysis and results

5.1. Measurement model

Considering that our model exclusively incorporates reflective constructs, we assessed the measurement model using internal consistency, convergent validity, and discriminant validity (Hair Jr et al., 2021). We assessed composite reliability (CR) and Cronbach's alpha (CA) to verify internal consistency, which all surpassed the threshold of 0.70, as recommended by Hair Jr et al. (2021). The internal consistency was met (Appendix C shows that CA and CR values are higher than 0.70). Convergent validity was assessed by examining the average variance extracted (AVE). We confirmed convergent validity with the Fornell and Larcker (1981) criterion being met by having an AVE value exceeding 0.50 (Appendix C) (Götz et al., 2009). Three criteria were considered for the evaluation of discriminant validity. Firstly, per the proposal made by Fornell and Larcker (1981), AVE's square root should be greater than the correlation of all remaining constructs. The second criterion, as stated by Götz et al. (2009), requires cross-loadings to be lower than the loadings of each respective indicator (shown in Appendix D). Additionally, the HTMT (heterotrait-monotrait ratios) (Appendix E) are below 0.90, further supporting discriminant validity (Henseler et al., 2015). In summary, based on the results, we can confidently conclude that our measurement model is adequate. It exhibits strong indicator reliability, construct reliability, convergent validity and discriminant validity.

5.2. Structural model and hypotheses

Since the measurement model results validate proper construct and indicator reliability and convergent and discriminant validity, we move forward with testing the structural model. We analyzed the standardized path coefficients to examine the hypotheses and associations between constructs. The significance of the path coefficients was assessed using the bootstrap resampling method in which multiple resamples from the original dataset are generated by randomly selecting observations with replacement. Each bootstrap sample is then used to estimate the model parameters, creating a distribution of parameter estimates (Hair Jr et al., 2021). Resampling was performed with 5,000 iterations. Furthermore, we conducted a multigroup analysis to compare the model parameters for Germany and Portugal. This process allows us to explore potential significant variations between the constructs and gain insights into differences at the country level (Henseler et al., 2009).

5.2.1. Full-Sample model

The results related to the model testing are shown in Fig. 3. Eleven of the fourteen hypotheses are supported. The model explains 33.4 % of the variation of use. The task-technology fit (H1a; $\beta = 0.408$, $p < 0.001$), price value (H3a; $\beta = 0.184$, $p < 0.001$), and long-term orientation (H7a; β = 0.123, p < 0.01) have a positive influence on use, supporting H1a, H3a, and H7a. Hedonic motivation is not significant in explaining use; thus, H2a is not supported. The model explains 70.9 % of the variance in user satisfaction. The relationship of task-technology fit (H1b; β = 0.453, p < 0.001), hedonic motivation (H2b; β = 0.254, p < 0.001), price value (H3b; β = 0.108, p < 0.01), use (H4; β = 0.193, p < 0.001), and perceived unsafety (H8a; β = -0.074, p < 0.05) are statistically significant in explaining user satisfaction, thus H1b, H2b, H3b, H4, and H8a are supported. The model explains 73.2 % of the variance in net benefits. User satisfaction has a positive, significant effect on net benefits (H6; β = 0.849, p < 0.001). Use shows no significance in explaining net benefits; thus, H5 is not supported.

H7b – the influence of long-term orientation towards a stronger relationship of task-technology fit on use – has been supported (H7b; β = 0.089, p < 0.01). The hypothesized moderation effect H8b (β = 0.087, p < 0.05) is also significant while H8c (β = -0.073, p > 0.10) is not. For those who scored high on perceived unsafety, the effect of task-technology fit on user satisfaction was stronger. Besides this, our assumption – if perceived unsafety increases, the effect of the use on user satisfaction decreases – cannot be confirmed (Fig. 4). The PLS-SEM model testing results can be found in Appendix F.

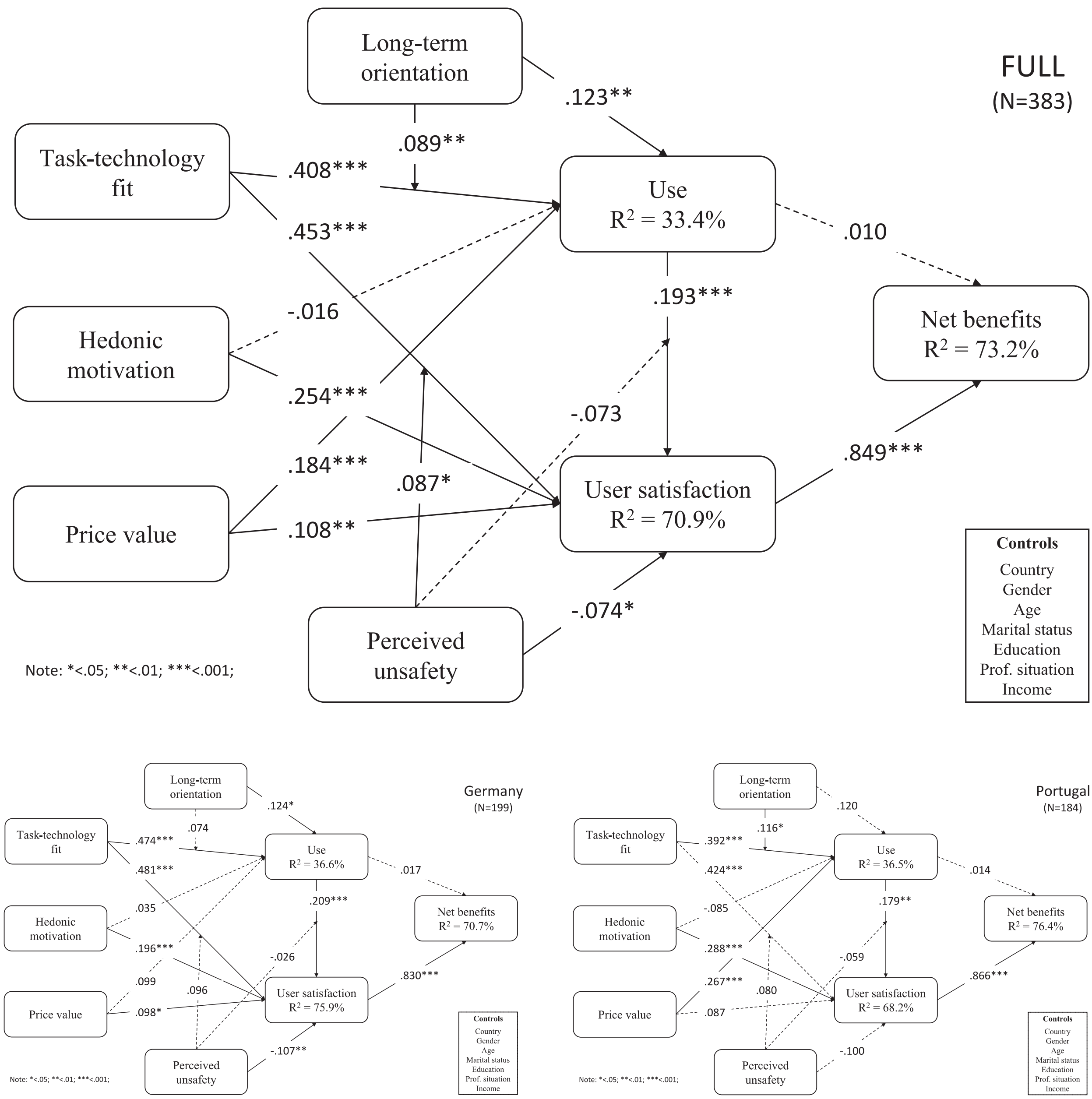

Fig. 3. Path models by group.

5.2.2. Germany and Portugal

In the majority of cases, the structural models for the data sets in Germany and Portugal are in accordance with the full-sample model. A couple of exceptions are the case, specifically regarding the values for price value, perceived unsafety, and long-term orientation.

On the one hand, the German sample shows no significance in the relationship between price value and e-scooter use, defeating H3a ($\beta = 0.099$, $p > 0.10$). On the other hand – in the case of the Portuguese data sample – H3 b's ($\beta = 0.087$, $p > 0.10$) significance concerning the influence of price value on user satisfaction is not supported. The findings of the total sample confirm H8a and H8b, however only H8a is confirmed in Germany (H8a; $\beta = -0.107$, $p < 0.01$), and H8b is not supported; in Portugal, both H8a ($\beta = -0.100$, $p > 0.10$) and H8b ($\beta = 0.080$, $p > 0.10$) are not supported, stating that perceived unsafety does not explain user satisfaction and neither does it moderate the effect of task-technology fit on user satisfaction. In Germany (H8c; $\beta = -0.026$, $p > 0.10$) and Portugal (H8c; $\beta = -0.059$, $p > 0.10$) – the results of H8c are in line with the full sample, not describing the moderation effect of perceived unsafety of use on user satisfaction. Moreover, though both H7a and H7b can be explained in the full-sample model, this is only true for H7a ($\beta = 0.0124$, $p < 0.05$) in Germany and H7b in Portugal ($\beta = 0.116$, $p < 0.05$). Despite some possible differences, the multigroup analysis reveals that no relationship shows a significant difference between both countries. All multigroup analysis testing results can be found in Appendix F.

6. Discussion

6.1. Discussion of findings

Over the past few decades, extended and adapted versions of the DeLone & McLean ISSM have been applied to explain net benefits in technology usage. However, to our knowledge, this model has never been used in the context of e-scooters. Our findings are manifold and offer a variety of interesting insights into the interplay between use, user satisfaction, net benefits, and their corresponding antecedents.

The findings indicate the importance of pragmatic reasons for e-scooter usage and user satisfaction, which are strongly related to task-technology fit. Interestingly, hedonic motivation does not explain usage. One might assume that fun plays a major role in e-scooter usage, but in reality, e-scooters are primarily seen as a means of undertaking short-distance trips. Enjoyment is an accompanying effect that relates to satisfaction but is not a primary reason for usage. This assertion is further supported by the relative importance of price value in the overall sample, reinforcing the case for pragmatism due to the significance of monetary value as a deciding factor.

Surprisingly, the usage itself does not directly explain net benefits. While this may seem counterintuitive at first glance, it is worth noting that over 50 % of the sample consists of young adults below 34. Similar to the concept of digital natives, this demographic is commonly described as technology-savvy individuals who are already well aware of the benefits of using new technologies and have been exposed to emerging concepts throughout their lifetimes. They may consider the actual benefit enhancement to be a given rather than something that needs to be tested. Under a certain degree of task-technology fit, functional e-scooters are therefore perhaps considered a hygiene factor: the increase in net benefits, i.e., undertaking short-distance trips effectively and efficiently, is perceived as the norm while deviations from it cause personal inconvenience. Linked to this factor, users could anticipate potential "shortcomings" and evaluate a technology realistically: an omitted extent of use is not coupled with better satisfaction if a high sense of unsafety is in place. The path coefficients of long-term orientation and perceived unsafety with the other constructs, if a relationship of significance, are much farther on the lower end compared to other antecedents than initially presumed. This facet means that thoughts regarding sustainability and potential risks do matter for an individual in the context of e-scooters, but they are subordinate drivers.

With an overall of 44 UN-recognized countries in Europe (United Nations, 2023), this study introduces samples of two countries as representative examples to review them in the European context: the selected countries, Germany and Portugal, have witnessed significant developments in major cities. Also, these countries were chosen to provide a diverse perspective, considering their distinct geographic locations and economic differences within the European continent. Germany, located in Central Europe, boasts the strongest economy, while Portugal, in the Southwest, has an average economic standing (Eurostat, 2022).

Interestingly, most of the hypotheses tested in this study demonstrated similar outcomes in both countries. However, notable

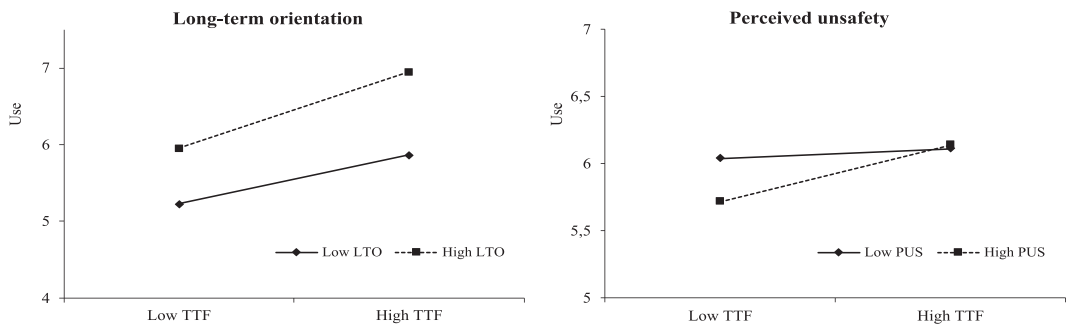

Fig. 4. Moderation effects.

differences were found regarding the influence of price value on e-scooter use and user satisfaction. In Germany, price value positively impacted e-scooter user satisfaction, whereas in Portugal, it did not play a significant role. Conversely, price value affected use in Portugal, whereas this relationship was not observed in Germany. The price related to the usage of e-scooters appears to be a barrier for Portuguese individuals to use them initially. However, once they decide to use them, the price becomes less influential in enhancing satisfaction. In Germany, pricing has a marginal effect on usage but contributes to the overall feeling of contentment.

To a lesser extent, a similar phenomenon occurs concerning long-term orientation. Generally, in the German sample, future-directed thinking and sustainable practices act as gatekeepers to the sole use of e-scooters. Portuguese users seem to be less inclined to this behavior on average, but if they are, a deeper level of expectations towards the technology is exhibited regarding its fulfillment of the purpose (i.e., tackling long-term transportation challenges).

It was found that perceived safety did not explain the relationship with user satisfaction in Portugal, while in Germany, it did have a significant impact. Concrete explanations for the outlined observations, possibly due to cultural and/or economic reasons, among others, could be a future point of investigation. In contempt of these differences, none of them were statistically significant. Therefore, while some discernible distinctions exist, Germany and Portugal exhibit similar patterns regarding individual-level attitudes toward e-scooters.

6.2. Theoretical implications

This research study makes several significant contributions to the existing theoretical framework. Firstly, it fills a gap in the academic literature by exploring areas that have received minimal attention in previous research. The findings provide valuable theoretical insights into the relationship between e-scooter use, user satisfaction, and net benefits as the point of focus, which have not been thoroughly investigated. Additionally, the study contributes to the field by emphasizing the importance of cross-cultural studies, exemplified by examining Germany and Portugal as representative countries in the European context. Although the overall results mostly align with the full-sample model, the most conspicuous differences indicate varying effects of price value, long-term orientation, and perceived unsafety (all statistically insignificant) between the two sub-samples.

Our findings underscore the significance of pragmatic reasons as the primary driver of e-scooter use and user satisfaction, ultimately leading to net benefits. These results support previous research highlighting the substantial influence of transportation needs on usage intentions and user satisfaction. However, our study also reveals that values and global motives have a certain degree of influence (Eccarius & Lu, 2020).

Previous research suggests that task-technology fit plays a vital role in driving technology usage, which has been supported by studies conducted by Tam and Oliveira (2016a), and ours finds the same. However, contradicting findings emerge when examining the relationship between hedonic motivation and usage intention, as no significant link has been found (Kopplin et al., 2021). Nevertheless, as hypothesized earlier, there is a confirmed association between hedonic reasons and user satisfaction (Lowry et al., 2015). This study shows the relative importance of price value and the negative impact of perceived unsafety on user satisfaction, as already observed in Aman et al.'s (2021) research analyzing e-scooter riders' app store reviews. Additionally, Bretones and Marquet (2022) also summarized the positive effect of price value on adoption/usage. As a moderating effect of perceived unsafety has not been confirmed in past research (Kopplin et al., 2021), our findings partially align with it.

Moreover, this research identifies long-term orientation, in the form of environmental concerns, as a significant factor influencing intention (Kopplin et al., 2021) and actual usage (Bretones & Marquet, 2022), respectively, which is consistent with this study. Generally, as the concept of usage intention is closely related to actual usage, results are transferrable to a great extent. Furthermore, our study confirms the positive and significant strong relationship between user satisfaction and net benefits, expressed through individual performance, as reported in previous research (Tam & Oliveira, 2016b; Urbach & Müller, 2012; Urbach et al., 2010). Furthermore, though there has been moderate support (Petter et al., 2008; Urbach et al., 2010), surprisingly, particularly the influence of use on user satisfaction has not been subject to extensive research (Urbach & Müller, 2012).

Notably, one of our study's most important and unexpected findings is the lack of a significant effect of use on net benefits. This aspect contradicts previous literature, which has consistently shown a significant relationship in this context (Petter et al., 2008). A contextual perspective may offer possible explanations, as the user demographic of young adults in e-scooters (Laa & Leth, 2020) may view the technological functionality as a basic requirement without providing any additional advantages beyond its intended purpose. Conclusions of this nature can also serve as a basis for future research and be further investigated.

The strength of this research lies in the alignment of the selected antecedents and moderators with the base model, as evidenced by the high explanatory power of our research model. Our full sample model explains 73.2 % of the net benefits of e-scooters, highlighting the need to augment the DeLone & McLean ISSM (DeLone & McLean, 2003) with context-specific antecedents and moderating effects. This result emphasizes the importance of developing tailored research models that consider the unique characteristics of the technology under study rather than solely relying on existing theories. Additionally, this study contributes to the normative literature by examining a longer timeframe of e-scooter use beyond experimental periods.

6.3. Managerial implications

This research has significant practical implications for decision-makers, e-scooter providers, policymakers, and other stakeholders in this field. It provides valuable insights that can be leveraged to complete exhaustion. From a practical perspective, our study reveals that pragmatic reasons have the most considerable impact on use, user satisfaction, and, ultimately, net benefits; intrinsic factors follow. We have also incorporated a cultural dimension into this research, as it can uncover further insights to improve the individual experience of using e-scooters. Therefore, it is crucial for key people to directly address these dimensions to ensure maximum optimization.

Considering the explicit purpose of e-scooters for short-distance trips, their functionality as a mode of transportation for first and last-mile travel is already well-established. This notion has been described by other scholars as well (Baek et al., 2021; Liu & Miller, 2022). Educating potential users accordingly and emphasizing this aspect when incentivizing activities is essential. Sharing operators who aim to enhance e-scooter adoption should actively address the concerns of potential but hesitant users regarding how e-scooters fit into their mobility routines (Eccarius & Lu, 2020). These campaigns should primarily target young adults (Nikiforiadis et al., 2021) as they constitute the majority of current and potential users. Policymakers and governments should strive for effective implementation of e-scooters within urban development plans, as it can amplify the role of micro-mobility (Hosseinzadeh et al., 2021).

Besides the actual ridership of e-scooters, the possible offers surrounding the technology, meeting customers' needs, and ensuring ease of use are crucial. For this reason, service providers should consider promoting the benefits of e-scooter usage rather than solely highlighting the service or product itself to encourage its adoption. City planners should address the competitive relationship for road space allocation by prioritizing allocating more space to cycling infrastructure and creating traffic-calmed zones (Laa & Leth, 2020), which would benefit e-scooter use. By doing so, potentially displacing higher CO2-emitting transport modes, positive environmental effects could be achieved as e-scooters become more attractive.

Regarding safety, it is crucial to establish public–private partnerships to develop and enforce safety regulations. For instance, legislation mandating the use of protective equipment by electric scooter riders can be implemented (Toofany et al., 2021). Lastly, pricing strategies should be carefully designed and tailored to specific cases by operators to ensure profitability without deterring potential customers. Analyzing the price sensitivity of each country and region is crucial. Government agencies could even consider subsidizing companies by offering their employees e-scooter fleets to achieve the mentioned positive effects.

6.4. Limitations and further research

While our research has yielded valuable insights into e-scooter net benefits and its surrounding constructs, it is important to acknowledge certain limitations. Firstly, the data we gathered was limited to only two countries that do provide a multidimensional approach – especially for Central and Southern European geographies – but may not fully represent the diversity of the European continent. Future research should aim to collect data from a broader range of countries within Europe and even explore regions beyond Europe to enhance the generalizability of our findings and provide a more global perspective. This expansion of data collection would also allow for the inclusion of additional variables, such as national cultural values as moderators and other personality traits, to provide a more comprehensive explanation of e-scooter use, user satisfaction, and net benefits. In this context, targeted explanations for differing behaviors across countries, which may arise from cultural differences, could be explored further. Generally, the study of behavioral patterns – whether across heterogeneous groups or within homogeneous populations – is a promising avenue for future research. While this research has offered some informed insights, drawing reliable conclusions was beyond its scope.

Secondly, our research uses cross-sectional data, measuring perceptions at a single point in time. However, it is important to recognize that perceptions can change over time as individuals gain more experience. This temporal aspect has implications for predictions over time, and both researchers and practitioners should consider it. Future research could incorporate longitudinal data and examine the research model at different periods to address this, offering deeper insights into the dynamics of e-scooter usage, satisfaction, and net benefits.

We also encourage researchers to conduct replication studies to validate or potentially challenge our findings. While we utilized the DeLone & McLean ISSM (DeLone & McLean, 2003) to explain e-scooter net benefits, future research could also draw on other theories and models to gain a more comprehensive understanding of this domain. Moreover, including larger sample sizes in future studies would further strengthen the robustness of the results.

Lastly, researchers could investigate other post-adoption outcomes – such as environmental friendliness compared to other transportation types, cost savings, and time savings – both on an individual and collective level.

7. Conclusion

The European micro-mobility sector has witnessed a surge in e-scooter usage, particularly in urban areas, leading to increased interest from the general public. However, there has been limited focus on the net benefit aspect of e-scooter usage. Our research aims to explore the factors that drive satisfaction with e-scooters and how their use affects net benefits, which are defined as the effectiveness and efficiency of undertaking short-distance trips. To achieve this, we examined the antecedents of these variables and how they differ between Germany and Portugal using statistical techniques, i.e., PLS-SEM and multigroup analysis.

Our findings indicate that pragmatic reasons are the primary drivers, with elements of belief systems playing a more minor role. We observed that hedonic motivation does not significantly impact use and, surprisingly, that use itself does not explain net benefits – the other way around, user satisfaction does explain net benefits to a great extent. Neither does perceived unsafety moderate the relationship between use and user satisfaction. Possible explanations have been provided regarding the findings, taking into account the relatively young age of the target group and their presumed familiarity with technology. While there were a few differences within the subsamples, in fact, none of the variations were measured to be of significance. On a high level, individuals in both countries follow analogous behaviors concerning e-scooters. Consequently, we highlighted our study's academic contribution and implications for relevant stakeholders in practical settings. Our research provides valuable insights into e-scooter net benefits and underscores the importance of further exploration in this field.

CRediT authorship contribution statement

Nelson Daniel: Writing – original draft, Visualization, Investigation, Formal analysis, Data curation. **Frederico Cruz-Jesus:** Writing – review & editing, Validation, Supervision. **Carlos Tam:** Writing – review & editing, Validation.

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Appendix A. . Instrumentation (Survey and measurement Items)

Introduction

Hello, and thank you for participating in this survey!

WHY is it great that you take part?

By concluding this questionnaire, you support academic research aiming to assess the impact of e-scooter use on personal mobility and its driving factors among European countries and, therefore, directly contribute to the common understanding of this widely emerging technology.

WHAT is this survey about.

E-scooters, or electric scooters, are a type of personal transportation device that is powered by a rechargeable battery and can travel at speeds of up to ≈30 km/h. They are designed to be lightweight, compact, and easy to maneuver, making them a frequently used mode of transportation for short-distance trips in urban areas. With now over 500.000 vehicles available in Europe, the domain has gained increasing relevance in recent years – in particular through sharing providers, such as Lime, Bird, or TIER. In the public eye, e-scooters are mainly perceived as a convenient and environmentally friendly alternative to cars or public transport, hence their rapid rise in popularity.

HOW to participate?

– Please read the questions thoroughly and ensure you answer them to the best of your ability.
– It will take you approximately between 6–8 min to finish this survey.
– Your answers will be recorded anonymously for data analysis purposes only.

WHO to contact in case of questions?

This study is part of the academic research of [*name*], [*position*] at [*university name*].

Please feel free to contact me in case any questions arise: [*email address*].

Consent.

Dear participant, this is an online survey to evaluate your opinion on e-scooters' impact on personal mobility. There is no risk involved in answering any of the following questions/statements. Remember that your participation in this survey is voluntary, which means that you are free to participate or not, as well as give up at any time. However, your responses are very important, completely anonymous, and will be used only for academic purposes.

Please indicate your level of agreement for each of the following statements on a scale from 1 to 7, where 1 represents 1 "strongly disagree" and 7 "strongly agree":

Construct	Code	Item	Measurement	Adapted from
Task-technology fit	TTF1	E-scooters are enough for all my short-distance trips.	7-point scale	(Goodhue & Thompson, 1995)
	TTF2	I reach all my short-distance destinations on time with e-scooters.		
	TTF3	E-scooters are enough for my weekly needs.		
Hedonic motivation	HM1	Using e-scooters will be fun.	7-point scale	(Van der Heijden, 2004)
	HM2	Using e-scooters will be exciting.		
	HM3	Using e-scooters will be pleasant.		
	HM4	Using e-scooters will be interesting.		
Price value	PV1	E-scooters are reasonably priced.	7-point scale	(Venkatesh et al., 2012)
	PV2	E-scooters are good value for the money.		
	PV3	At the current price, e-scooters provide a good value.		
Use	USE1	How often do you use e-scooters? (1) "never" to (7) "several times each week"	7-point scale	(Venkatesh & Bala, 2008)
	USE2	How do you consider the extent of your current e-scooter use? (1) "non-use" to (7) "heavy use"		
	USE3	On average, I spend a significant amount of minutes using e-scooters each week.		
User satisfaction	SAT1	I am satisfied that e-scooters meet my short-distance trip needs.	7-point scale	(Wu & Wang, 2006)
	SAT2	I am satisfied with e-scooter efficiency.		
	SAT3	I am satisfied with e-scooter effectiveness.		
	SAT4	Overall, I am satisfied with e-scooters.		
Net benefits	NB1	E-scooters enable me to accomplish short-distance trips more quickly.	7-point scale	(Davis, 1989)

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(*continued*)

Please indicate your level of agreement for each of the following statements on a scale from 1 to 7, where 1 represents 1 "strongly disagree" and 7 "strongly agree":				
Construct	Code	Item	Measurement	Adapted from
	NB2	E-scooters improve my performance in undertaking short-distance trips.		
	NB3	E-scooters increase my productivity by allowing me to move more easily.		
	NB4	E-scooters enhance my effectiveness in short-distance trips.		
	NB5	E-scooters make it easier to accomplish tasks by enhancing mobility.		
	NB6	E-scooters are useful for short-distance trips.		
Long-term orientation	LTO1	Respect for tradition is important to me.	7-point scale	(Bearden et al., 2006)
	LTO2	Family heritage is important to me.		
	LTO3	I value a strong link to my past.		
	LTO4	I am willing to give up today's fun for success in the future.		
	LTO5	Traditional values are important to me.		
Perceived unsafety	PUS1	I believe that using e-scooters is dangerous.	7-point scale	(Osswald et al., 2012)
	PUS2	Using e-scooters requires increased attention.		
	PUS3	Using e-scooters makes me prone to distraction.		
	PUS4	I feel unsafe while using e-scooters.		
	PUS5	Using e-scooters increases the accident risk.		
Filters and controls	Cou	What is your country of residence?	Multiple choice	
	Gen	What is your gender?	Multiple choice	
	Age	What is your age (in years)?	Written answer	
	Mar	What is your marital status?	Multiple choice	
	Edu	What is the highest education degree you have earned?	Multiple choice	
	Prof	What is the best description of your current professional situation?	Multiple choice	
	Inc	What is your household's average monthly net income?	Metric scale	
	CMB1	What is your degree of knowledge about photography? (1) "totally unaware" to (7) "totally aware"	7-point scale	(Lindell & Whitney, 2001)
	CMB2	How well do you know about [*university name*]?(1) "totally unaware" to (7) "totally aware"	7-point scale	

		Total		Germany		Portugal	
Measure	Value	%	N	%	n	%	n
Gender	Male	55.6 %	213	58.8 %	117	52.2 %	96
	Female	43.1 %	165	39.7 %	79	46.7 %	86
	Other	1.3 %	5	1.5 %	3	1.1 %	2
Age	18–24	23.5 %	90	20.1 %	40	27.2 %	50
	25–34	37.1 %	142	35.7 %	71	38.6 %	71
	35–44	22.5 %	86	24.6 %	49	20.1 %	37
	45–54	12.0 %	46	10.6 %	21	13.6 %	25
	55–64	4.4 %	17	8.0 %	16	0.5 %	1
	65+	0.5 %	2	1.0 %	2	0.0 %	0
Marital status	Single	63.2 %	242	58.8 %	117	67.9 %	125
	Married	32.9 %	126	36.2 %	72	29.3 %	54
	Divorced	3.4 %	13	4.0 %	8	2.7 %	5
	Widow/widower	0.5 %	2	1.0 %	2	0.0 %	0
Education degree	Primary school/lower level of education	1.0 %	4	1.5 %	3	0.5 %	1
	Basic schooling	4.2 %	16	7.5 %	15	0.5 %	1
	Highschool	26.1 %	100	32.2 %	64	19.6 %	36
	Bachelor's degree	33.7 %	129	30.2 %	60	37.5 %	69
	Master's or Postgraduate degree	32.6 %	125	25.1 %	50	40.8 %	75
	PhD or higher	2.3 %	9	3.5 %	7	1.1 %	2
Profession-al situation	Full-time student	15.9 %	61	10.1 %	20	22.3 %	41
	Working student	17.2 %	66	11.6 %	23	23.4 %	43

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Measure	Value	Total		Germany		Portugal	
		%	N	%	n	%	n
	Employee	49.1 %	188	59.8 %	119	37.5 %	69
	Self-employed	11.0 %	42	12.1 %	24	9.8 %	18
	Retired	1.8 %	7	2.5 %	5	1.1 %	2
	Unemployed	4.2 %	16	3.0 %	6	5.4 %	10
	Not fit to work	0.8 %	3	1.0 %	2	0.5 %	1
Income	< 500 EUR	6.3 %	24	3.5 %	7	9.2 %	17
	500 EUR to 1000 EUR	13.1 %	50	9.5 %	19	16.8 %	31
	1000 EUR to 1500 EUR	14.1 %	54	8.0 %	16	20.7 %	38
	1500 EUR to 2000 EUR	16.7 %	64	14.6 %	29	19.0 %	35
	2000 EUR to 3000 EUR	21.7 %	83	26.1 %	52	16.8 %	31
	3000 EUR to 4000 EUR	14.9 %	57	18.6 %	37	10.9 %	20
	> 4000 EUR	13.3 %	51	19.6 %	39	6.5 %	12

Appendix C. . Means, Standard Deviations, Correlations, and reliability and validity measures (CR, CA, and AVE) of latent variables

.

Constructs	Mean	SD	CA	CR	(Aman et al., 2021)	(Anderson and Gerbing, 1988)	(Baek et al., 2021)	(Bai and Jiao, 2020)	(Bearden et al., 2006)	(Bloom et al., 2021)	(Bretones and Marquet, 2022)	(Chin, 1998)
(Aman et al., 2021) Task-technology fit	4.134	1.632	0.871	0.921	**0.892**							
(Anderson and Gerbing, 1988) Hedonic motivation	5.041	1.343	0.930	0.950	0.557	**0.910**						
(Baek et al., 2021) Price value	3.968	1.383	0.925	0.952	0.530	0.424	**0.933**					
(Bai and Jiao, 2020) Use	2.842	1.743	0.935	0.958	0.533	0.323	0.426	**0.940**				
(Bearden et al., 2006)User satisfaction	4.360	1.587	0.949	0.963	0.771	0.629	0.536	0.588	**0.931**			
(Bloom et al., 2021) Long-term orientation	4.277	1.486	0.907	0.934	0.296	0.242	0.232	0.274	0.259	**0.884**		
(Bretones and Marquet, 2022) Perceived unsafety	4.150	1.551	0.837	0.845	−0.179	−0.228	−0.022	−0.217	−0.262	0.031	**0.768**	
(Chin, 1998)Net benefits	4.498	1.575	0.958	0.966	0.722	0.613	0.499	0.510	0.855	0.243	−0.212	**0.910**

Appendix D. . PLS loadings and Cross-Loadings

.

Constructs		(Aman et al., 2021)	(Anderson and Gerbing, 1988)	(Baek et al., 2021)	(Bai and Jiao, 2020)	(Bearden et al., 2006)	(Bloom et al., 2021)	(Bretones and Marquet, 2022)	(Chin, 1998)
(Aman et al., 2021) Task-technology fit	TTF1	**0.897**	0.500	0.468	0.435	0.712	0.273	−0.175	0.659
	TTF2	**0.919**	0.551	0.479	0.497	0.723	0.259	−0.186	0.685
	TTF3	**0.859**	0.435	0.471	0.494	0.626	0.260	−0.117	0.585
(Anderson and Gerbing, 1988) Hedonic motivation	HM1	0.473	**0.897**	0.357	0.238	0.550	0.211	−0.238	0.552
	HM2	0.515	**0.934**	0.405	0.293	0.589	0.220	−0.192	0.581
	HM3	0.533	**0.904**	0.390	0.329	0.572	0.226	−0.215	0.550
	HM4	0.504	**0.903**	0.387	0.308	0.575	0.222	−0.186	0.546

(*continued on next page*)

(*continued*)

Constructs		(Aman et al., 2021)	(Anderson and Gerbing, 1988)	(Baek et al., 2021)	(Bai and Jiao, 2020)	(Bearden et al., 2006)	(Bloom et al., 2021)	(Bretones and Marquet, 2022)	(Chin, 1998)
(Baek et al., 2021) Price value	PV1	0.411	0.341	**0.903**	0.346	0.425	0.239	0.022	0.400
	PV2	0.515	0.418	**0.949**	0.413	0.530	0.190	−0.036	0.498
	PV3	0.543	0.418	**0.945**	0.425	0.533	0.225	−0.041	0.488
(Bai and Jiao, 2020) Use	USE1	0.491	0.302	0.386	**0.944**	0.570	0.257	−0.251	0.501
	USE2	0.529	0.342	0.421	**0.940**	0.572	0.245	−0.193	0.489
	USE3	0.481	0.262	0.393	**0.938**	0.514	0.274	−0.165	0.445
(Bearden et al., 2006) User satisfaction	SAT1	0.745	0.538	0.491	0.549	**0.913**	0.259	−0.233	0.793
	SAT2	0.708	0.594	0.508	0.529	**0.945**	0.228	−0.243	0.804
	SAT3	0.725	0.600	0.513	0.519	**0.948**	0.228	−0.240	0.814
	SAT4	0.693	0.608	0.483	0.593	**0.917**	0.250	−0.261	0.774
(Bloom et al., 2021) Long-term orientation	LTO1	0.299	0.203	0.185	0.238	0.222	**0.898**	0.019	0.206
	LTO2	0.239	0.208	0.193	0.225	0.226	**0.872**	0.024	0.199
	LTO3	0.204	0.172	0.207	0.209	0.178	**0.861**	0.066	0.204
	LTO5	0.293	0.259	0.231	0.286	0.276	**0.903**	0.008	0.244
(Bretones and Marquet, 2022) Perceived unsafety	PUS1	−0.106	−0.126	0.048	−0.176	−0.147	0.039	**0.772**	−0.120
	PUS2	0.033	0.117	0.046	−0.076	0.063	0.102	**0.458**	0.107
	PUS3	−0.174	−0.218	−0.053	−0.186	−0.270	0.028	**0.929**	−0.225
	PUS4	−0.119	−0.132	−0.001	−0.189	−0.148	0.048	**0.830**	−0.082
(Chin, 1998) Net benefits	NB1	0.617	0.526	0.415	0.420	0.747	0.214	−0.163	**0.890**
	NB2	0.668	0.558	0.458	0.459	0.793	0.191	−0.209	**0.932**
	NB3	0.681	0.541	0.470	0.493	0.785	0.262	−0.189	**0.915**
	NB4	0.711	0.544	0.484	0.534	0.825	0.223	−0.188	**0.935**
	NB5	0.663	0.569	0.446	0.481	0.782	0.246	−0.230	**0.924**
	NB6	0.595	0.610	0.446	0.384	0.732	0.192	−0.179	**0.858**

Appendix E. . Heterotrait-Monotrait Ratio of Correlations (HTMT)

.

Constructs	(Aman et al., 2021)	(Anderson and Gerbing, 1988)	(Baek et al., 2021)	(Bai and Jiao, 2020)	(Bearden et al., 2006)	(Bloom et al., 2021)	(Bretones and Marquet, 2022)	(Chin, 1998)
(Aman et al., 2021)Task-technology fit								
(Anderson and Gerbing, 1988)Hedonic motivation	0.616							
(Baek et al., 2021)Price value	0.585	0.453						
(Bai and Jiao, 2020)Use	0.590	0.343	0.455					
(Bearden et al., 2006) User satisfaction	0.847	0.669	0.567	0.624				
(Bloom et al., 2021)Long-term orientation	0.329	0.259	0.254	0.294	0.275			
(Bretones and Marquet, 2022)Perceived unsafety	0.154	0.206	0.061	0.216	0.215	0.078		
(Chin, 1998)Net benefits	0.789	0.650	0.526	0.536	0.897	0.259	0.182	

Appendix F. . PLS-SEM and multigroup analysis results

.

#	Constructs	Total		Germany		Portugal		MGA	
		β	P	β	P	β	P	β	P
H1a	TTF –> USE	0.408	0.000	0.474	0.000	0.392	0.000	0.082	0.439
H1b	TTF –> SAT	0.453	0.000	0.481	0.000	0.424	0.000	0.056	0.532
H2a	HM –> USE	−0.016	0.735	0.035	0.613	−0.085	0.197	0.120	0.209
H2b	HM –> SAT	0.254	0.000	0.196	0.000	0.288	0.000	−0.092	0.247
H3a	PV –> USE	0.184	0.000	0.099	0.191	0.267	0.001	−0.168	0.126
H3b	PV –> SAT	0.108	0.003	0.098	0.041	0.087	0.111	0.012	0.874
H4	USE –> SAT	0.193	0.000	0.209	0.000	0.179	0.001	0.031	0.687
H5	USE –> NB	0.010	0.728	0.017	0.738	0.014	0.723	0.003	0.958
H6	SAT –> NB	0.849	0.000	0.830	0.000	0.866	0.000	−0.036	0.512
H7a	LTO –> USE	0.123	0.005	0.124	0.043	0.120	0.055	0.003	0.970
H7b	LTO x TTF –> USE	0.089	0.005	0.074	0.082	0.116	0.017	−0.042	0.508
H8a	PUS –> SAT	−0.074	0.039	−0.107	0.008	−0.100	0.428	−0.007	0.867
H8b	PUS x TTF –> SAT	0.087	0.036	0.096	0.096	0.080	0.297	0.016	0.863
H8c	PUS x USE –> SAT	−0.073	0.090	−0.026	0.669	−0.059	0.415	0.033	0.735

Data availability

Data will be made available on request.

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