

# Is caring about the environment enough for sustainable mobility? An exploratory case study from South Tyrol (Italy)

Giulia Isetti<sup>a,\*</sup>, Valeria Ferraretto<sup>a</sup>, Agnieszka Elzbieta Stawinoga<sup>b</sup>, Mirjam Gruber<sup>a</sup>, Nives DellaValle<sup>c,d</sup>

<sup>a</sup> Eurac Research, Center for Advanced Studies, Viale Druso 1, 39100 Bolzano, Italy

<sup>b</sup> Eurac Research, Head Office, Viale Druso 1, 39100 Bolzano, Italy

<sup>c</sup> Institute for Renewable Energy, Eurac Research, Via A. Volta, 13/A, 39100 Bolzano, Italy

<sup>d</sup> Joint Research Centre, European Commission, Via E. Fermi 2749, 21027 Ispra, VA, Italy

## ARTICLE INFO

### Article history:

Received 15 January 2020

Received in revised form 3 June 2020

Accepted 3 June 2020

Available online xxxx

### Keywords:

Sustainable mobility

Sustainable behavior

Lifestyle

E-mobility

South Tyrol

Rural areas

## ABSTRACT

Sustainable mobility has a positive impact on quality of life, in both urban and rural contexts. Policies aimed at promoting greener travel behaviors – at European, as well as at state and regional level – require a deep knowledge of differing mobility cultures across European regions. In order to better understand the relationship between the (stated) propensity towards sustainability, reported mobility patterns and users' lifestyles in rural areas, an exploratory study was conducted in South Tyrol, a rural region in Northern Italy that strives to become a model region for sustainable alpine mobility by 2030. More specifically, an online survey on sustainable mobility was administered to the inhabitants, exploring motivations, preferred incentives and drivers that may lead towards the adoption of sustainable mobility solutions (with a focus on e-mobility). By analyzing how pro-environmental self-identity interacts with consumers' heterogeneity, results show that heterogeneity exists in the individual pro-environmental identity measure. Based also on evidence from the literature that extrinsic rewards might negatively impact intrinsic motivations to engage in a certain behavior, this study warns policy-makers of potential unintended consequences of current policy tools used to incentivize the adoption of sustainable means of transport, such as the provision of monetary incentives for electric vehicles.

## 1. Introduction

The modern transport sector “is one of the main contributors of [environmental] impacts due to its role in air pollution, greenhouse gases and CO<sub>2</sub> emissions” (Vagnoni and Moradi, 2018). Transportation accounts for 28.3% of the European (EU28) total energy related CO<sub>2</sub> emissions (Railway Handbook, 2017). Road transport is by far the most polluting, accounting for 93.2% of the sectors' emissions (Railway Handbook, 2017). Although technological innovation in the automotive industry has allowed for modes of transport to become more efficient and therefore less polluting, numerous studies have shown that CO<sub>2</sub> emissions have still increased due to, among other things, increasing individual mobility, travel habits, car dependency, etc. (Kamruzzaman et al., 2015; Darido et al., 2014; O'Mahony et al., 2012; Chapman, 2007). In order to mitigate climate change and pollution levels and to improve the quality of life for citizens, the European Union has set ambitious targets of CO<sub>2</sub> reduction to be reached by 2030.<sup>1</sup> Within these policy frameworks set at the EU level, member states are left free to determine strategies and targets appropriate to their specific circumstances. It then becomes the responsibility of the individual regions and

cities to put those policies into practice, adapting them to the local context and assessing their feasibility and, at a later stage, effectiveness.

Therefore, policies aimed at promoting greener travel behaviors – such as the implementation of incentives for low-emission alternative energies and vehicles, public transport, the encouragement of mainstream consumers active travel (cycling and walking), and bicycle and car-sharing/pooling schemes to reduce congestion and pollution – require a deep knowledge of differing mobility behaviors and patterns at a local level in order to be effective.

In the past decades, literature on how to incentivize sustainable mobility has been flourishing, especially in the context of urban areas (e.g. Canitez, 2019; Semanjski et al., 2016; Herrador et al., 2015; Poslad et al., 2015), since higher levels of population density, congestion and pollution urgently demand solutions. On the other hand, studies on rural/semi-rural mobility agree on the dominant and indispensable role of the private car and the resulting lack of environmental sustainability (Soder and Peer, 2018). Rural areas face several challenges in their path towards sustainable mobility, as demographic dispersion leads to a greater need for travel and a higher dependence on motorized private vehicles (Obrecht et al., 2017), since distances are greater and public transport scarcer. In other words,

\* Corresponding author.

E-mail addresses: [giulia.isetti@eurac.edu](mailto:giulia.isetti@eurac.edu), (G. Isetti), [valeria.ferraretto@eurac.edu](mailto:valeria.ferraretto@eurac.edu), (V. Ferraretto), [Agnieszka.Stawinoga@eurac.edu](mailto:Agnieszka.Stawinoga@eurac.edu), (A.E. Stawinoga), [Mirjam.Gruber@eurac.edu](mailto:Mirjam.Gruber@eurac.edu), (M. Gruber), [nives.della-valle@ec.europa.eu](mailto:nives.della-valle@ec.europa.eu), (N. DellaValle).

<sup>1</sup> See [https://ec.europa.eu/clima/policies/transport\\_en](https://ec.europa.eu/clima/policies/transport_en), <https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/2030-energy-strategy>.

the modern lifestyle is much more dependent on individual mobility (i.e. the availability of a car) in rural areas than in urban areas (Mattiola, 2014).

Yet, in some areas, in terms of sustainable development, rural areas have the potential to perform as well as, if not better than urban areas (Akgün et al., 2015), for example in the production of healthy food, energy from alternative sources and environmentally-friendly technologies. This may also apply to the mobility sector, even though this has received little attention in academia.

A switch to a more sustainable mobility behavior and lifestyle through the adoption of Electric Vehicles (EVs) can significantly reduce air pollution, fossil energy use (Peters et al., 2018) and other negative impacts of traditional mobility (i.e., petrol and diesel cars). Yet, the electrification of mobility should not be seen as a cure-all solution; rather it should be viewed as a mitigation to those forms of mobility that cannot be substituted by public transport, cycling or walking. This applies particularly to rural and remote areas, where individual mobility is more difficult to discourage for various reasons (e.g., poor public transport connections). In this context, EVs can at least mitigate some negative impacts of private mobility, such as traffic-related noise and air pollution, even if it doesn't address the problems of congestion and the visual intrusion of vehicles (Scuttari and Isetti, 2019). Moreover, a prevalence of two-car households and the space for home charging are arguments in favor of rural EVs, as along with leveraging on the higher mileage they usually reach in rural areas, which translates into a greater operational cost advantage (Fornahl and Werner, 2015; Newman et al., 2014; Kester et al., 2020).

Traditional policies such as the strengthening of the charging infrastructure, the provision of financial subsidies, driving privileges, or tax rebates have been proven to positively influence consumers' intentions to adopt EVs (Zhang et al., 2011), yet the magnitude of their efficacy is often lower than expected (Li et al., 2017; Sierchula et al., 2014; Egbue and Long, 2012). One reason for this might be that these policies do not consider consumers' heterogeneity, as they predominantly target mainstream consumers (Green et al., 2014; Sousa et al., 2016). A variety of factors can influence the adoption of greener mobility behaviors at the individual level. To analyze these factors in rural areas the following research question is posed: What factors are associated with pro-environmental self-identity?

In this context, the aim of the present study is to explore how pro-environmental self-identity interacts with consumers' heterogeneity in terms of mobility patterns and socio-demographic factors, with the final aim of providing insights for policy-makers into the design of sustainable mobility policies and incentives, particularly in relation to EVs. However, the study does not aim to present holistic results on how this interaction takes place, first, because the authors are aware that the data on which this paper is based might suffer from self-selection bias (see Section 3.1 Survey design and participants). Second, conclusions cannot be drawn for urban areas, as the study focuses on the predominantly rural area of South Tyrol, a region in Northern Italy that strives to become a model region for sustainable alpine mobility by 2030. Given its low population density of 71.3 inh/km<sup>2</sup> (ASTAT, 2018), South Tyrol can be considered a predominantly rural area according to the Eurostat classification.<sup>2</sup> Thus, as we have seen, it might be considered an ideal setting for EVs.

### 1.1. Case study South Tyrol

South Tyrol is an alpine region in Northern Italy that covers an area of 7400 km<sup>2</sup>, with approx. 527,750 inhabitants<sup>3</sup> of whom more than half live in rural areas<sup>4</sup> (56.1%). Because of its morphology, characterized by mountains and valleys, only 5.5% of the overall territory can be considered amenable to settlement (ASTAT, 2011a).

The region relishes a considerable level of self-government, based on a vast range of exclusive legislative and executive powers and a fiscal regime that allows the region to withhold large parts of the levied taxes. Such

privileges have been granted for historical reasons, mostly in order to protect the minorities of German and Ladin speakers. These two groups, minorities in Italy, constitute the majority of the population at regional level (69.41% speak German and 4.53% Ladin, ASTAT, 2011a).

Thanks to its strategic position, nestled in the heart of the Alps and connecting Italy and Northern Europe, South Tyrol has always represented an important junction for goods in transit: commerce is therefore the backbone of the local economy. Other relevant economic sectors are services, industry, crafts, agriculture and tourism. With the average annual GDP per capita PPS equal to €42,200<sup>5</sup> and an unemployment rate of about 3.1% (ASTAT, 2018), South Tyrol boasts one of the most prosperous regional economies in Europe.

South Tyrol is also known for being Italy's Green Region (Fondazione Impresa, 2014). It is a model province in the renewable energy sector and on its way to becoming energy self-sufficient. As such, it has been the object of several studies on sustainability, especially in regard to transport and mobility (Scuttari and Isetti, 2019; DellaValle and Zubaryeva, 2019; Nocera et al., 2018; Scuttari et al., 2016; Brida et al., 2014). All these conditions contribute to make South Tyrol one of the regions with the highest quality of life in Italy.<sup>6</sup>

### 1.2. Mobility in South Tyrol

A key reason to choose South Tyrol for our case study is that it also ranks highly as a green region in the mobility sector. In particular, "Green Mobility", a regional initiative coordinated by STA (the managing authority of transport infrastructure), embodies the area's mobility governance system and has the mission to transform South Tyrol into a model region for sustainable alpine mobility by 2030. They aim to achieve this by using specific measures that act on three different levels, which can be graphically represented using the sustainable mobility pyramid (Fig. 1).

At the bottom of the pyramid are measures whose aim is to avoid traffic, for example, by incentivizing home office solutions, carpooling, and other actions that allow the elimination of all unnecessary traffic. The next level is the transfer of traffic: mobility that cannot be avoided should be transferred to public transportation where possible, e.g., by intensifying bus routes and by introducing an integrated transportation system that comprises cableways, railways and a bus system that facilitates urban and sub-urban mobility (Brida et al., 2014).

Yet, since the region is mountainous, few transit corridors and only the most popular touristic areas are well and frequently connected to major urban areas by public transport, and remote areas are difficult to serve. For example, South Tyrol records only 30.1 km of railway network per 1000 km<sup>2</sup> of surface, in comparison with the national average of 53.7 (ASTAT, 2011b). Other means to achieve the transfer of traffic include the expansion of the pedestrian and cycle infrastructure, a network of 462 km (ASTAT, 2017).

A survey conducted by ASTAT (2016) on a representative sample of 600 households revealed that 46.9% of the South Tyrolean population living in rural areas drive their car everyday vs. 31.9% of those living in urban areas. As a means of transport to travel most of the distance between their homes and their workplace/school, 53.4% of the South Tyrolean population use private cars, followed by buses (17%), bikes (16.2%) and trains (8.3%). Also in this case, those living in rural areas rely more on private cars to travel from home to work/school than those living in urban areas (62.4% vs. 41.9%).

Since not all traffic can be avoided or transferred, measures aimed at improving traffic must be implemented: e-mobility plays a prominent role at the top of the pyramid, mitigating at least some negative effects of traffic, such as noise and air pollution. To incentivize e-mobility, the following measures have been adopted: a €4000 subsidy for EV purchase (€2000 for plug-in hybrids) and exemptions from car tax for the first five years, followed by tax relief from the fifth year onwards. Moreover, there has been a heavy investment in charging infrastructure, energy operators

<sup>2</sup> The classification of European regions at NUTS3 level can be found here, along with a detailed description of the methodology: <https://ec.europa.eu/eurostat/web/rural-development/methodology>.

<sup>3</sup> ASTAT (retrieved 31.12.2017).

<sup>4</sup> In municipalities with <10,000 inhabitants (Source: ASTAT, 2018).

<sup>5</sup> In 2014. Source: <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/bolzano>.

<sup>6</sup> Il Sole 24 Ore, Italy's most important financial newspaper, ranked Bolzano, South Tyrol's capital, the second most livable city in Italy in 2019: <https://lab24.ilssole24ore.com/qualita-della-vita/Bolzano>.

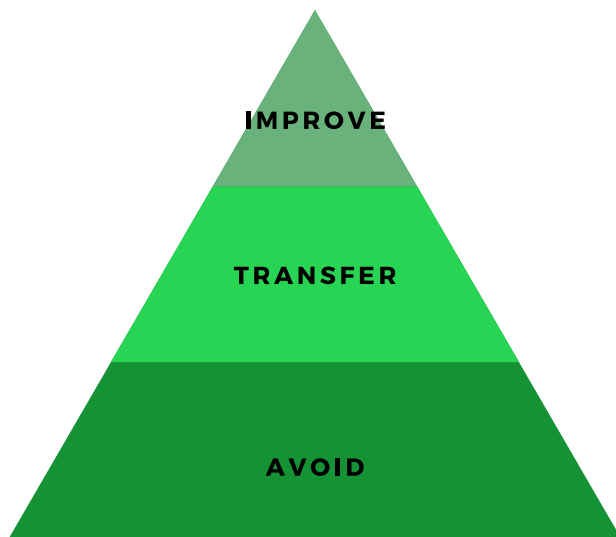


Fig. 1. The pyramid of sustainable mobility. Source: adapted from [greenmobility.bz.it](https://greenmobility.bz.it)

have signed interoperability agreements and car sharing systems and leasing contracts have eased accessibility to EVs.

The charging infrastructure for EVs, with 300 public and semi-public charging points in 2019, is more extensive than in the rest of the country (Scuttari and Isetti, 2019). South Tyrol has the highest number of EV registrations in Italy, with 655 Battery Electric Vehicles (BEVs) registered between 2012 and 2018, while 11,680 were registered in the rest of the country in the same time frame (GreenMobility; UNRAE, 2019). While this number may seem remarkable, the fact that the area has among the highest new vehicle registrations in the country should be taken into consideration. According to official data, in 2017 total vehicle ownership in South Tyrol amounted to 95 cars/100 inhabitants (ASTAT, 2017). The figure is distorted by the fact that the registration taxes of new vehicles in South Tyrol are among the lowest in Italy, so many of the vehicles registered in the region might actually circulate elsewhere. Only 0.16% of total registrations in South Tyrol in 2018 were BEVs, which shows there is still potential to further promote the adoption of EVs in the region (see also DellaValle and Zubaryeva, 2019) and beyond.

## 2. Literature review

The connection between mobility behavior and lifestyle in the reduction of emissions and the broader goal of sustainable development has been highlighted by various scholars (Le Gallic et al., 2018; Sippel et al., 2018; Van Acker et al., 2016). Moreover, Chuang et al. (2020) revealed that worldviews influence social attitudes to sustainable mobility and concretely that “the worldviews have a systematic and comprehensive impact on how people assess sustainable mobility debates” (p. 4034). Furthermore, policies towards sustainable mobility play a crucial role in the mitigation of climate change within national and supranational strategies (Keyvanfar et al., 2018). Specific policies can contribute to promoting sustainable lifestyles, but these policies are particularly effective if they are tailored to the heterogeneity and differing targets of consumer behavior (Markvica et al., 2020; Green et al., 2014; Li et al., 2017).

In particular, traditional policies (such as regulation, taxes, and subsidies) have relied on the rational choice theory, which assumes that individuals choose an alternative course of action only in response to changes in information and economic incentives. However, extensive evidence has shown that individual decisions systematically deviate from these assumptions (Loewenstein et al., 2011). As an example, to promote more sustainable mobility patterns, governments might implement tailored strategies that tap into pre-existing motives to engage in pro-environmental behaviors.

A pre-existing motive that can be exploited in the design of complementary policies relates to the way individuals think of themselves with respect to the environment.

Inspired by self-categorization theory (Turner, 1985; Tajfel et al., 1971), the economic theory of identity (Benabou and Tirole, 2011; Akerlof and Kranton, 2000) interprets identity as a stored knowledge translated into a pluralism of facets (Sen, 2006), each of which is associated with identity-specific guiding behavioral scripts. In this framework, individuals comply with identity-specific scripts in order to avoid cognitive dissonance from self-concept updating and to maintain self-consistency (Akerlof and Kranton, 2000; Festinger, 1957). Moreover, they self-define by inferring their type based either on their past conduct or on situational cues that make a particular identity facet salient (Benabou and Tirole, 2011). As a result, interventions that make a particular identity facet salient can be effective at eliciting changes in behavior, since individuals who self-define in terms of the primed identity will align their behavior with the norms of this identity.

The role of self-identity in pro-environmental behavior has already been introduced in the UK “as a significant behavioural determinant to reduce CO<sub>2</sub> emissions” (Whitmarsh and O'Neill, 2010 p. 305, see also Bradley et al., 2020). In particular, the concept of pro-environmental self-identity has been exploited by the UK Department for Environment, Food and Rural Affairs (DEFRA) as a “catalyst behaviour” to prompt environmentally-friendly lifestyles (Whitmarsh and O'Neill, 2010). According to this notion, taking up a new environmentally-friendly behavior may lead to the adoption of other pro-environmental behaviors, potentially decreasing the costs of pro-environmental policies. This connection has been supported by several studies (Peters et al., 2018; Whitmarsh and O'Neill, 2010; Fekadu and Kraft, 2001).

In fact, the adoption of sustainable energy technologies such as EVs for environmental reasons strengthens environmental self-identity and promotes “consistent sustainable energy behaviour” (Peters et al., 2018, p. 234). However, the same study revealed that the reasons for purchasing EVs are crucial: a strong environmental self-identity is found only if the EVs are purchased for environmental reasons. A literature review of motivators and barriers relating to electric mobility in Europe reveals that although the main motivators for the transition to e-mobility on the individual level are environmental values and beliefs, economic and technical benefits are also important, along with lifestyle, personal and demographic factors (Bireselioglu et al., 2018; Axsen et al., 2013).

Therefore, while making pro-environmental self-identity salient might result in a positive change in pro-environmental behavior (Patel et al., 2020), it is not clear whether it will elicit the same effect on mobility behavior. As a result, understanding the social and demographic perceptions of people who adopt a sustainable mobility style, and thus, a more sustainable lifestyle, is fundamental within this research and policy area. Sovacool et al. (2018) argue that demographic characteristics such as gender, age and employment influence preferences on purchasing EVs. In their study in the Nordic region of Europe, results indicate that EVs are mostly bought by highly skilled men aged 30–45 (see also Hjorthol, 2013). Moreover, given that having children naturally makes people think about the future and care about the environment (Asensio and Delmas, 2015), it might be that the presence of children in the household also predicts pro-environmental behaviors, including those relating to sustainable mobility.

Moser and Kleinhüchelkotten (2018) based their study on contradictory literature on the main drivers of pro-environmental behavior. While an intent-oriented research perspective highlights the motivational aspects, an impact-oriented perspective emphasized the importance of people's socioeconomic status. Their regression analysis showed that environmental self-identity is the main predictor of environmental behavior, but people's income level best predicts environmental impacts or, in other words, the actual ecological benefits (Moser and Kleinhüchelkotten, 2018).

Several studies emphasize this relationship between socio-demographic profiles and mobility patterns (Besagni and Borgarello, 2020; Haustein and Jensen, 2018). Additionally, gender differences in the use of mobility have been acknowledged. Miralles-Guasch et al. (2016) show that women generally use more sustainable transport modes in both urban and rural areas. Accordingly, women's use of mobility and knowledge could be a crucial factor in public policy for sustainable mobility.

The states or governments have a particularly great degree of creative power in the implementation of sustainable mobility and play an important



role in this process by regulating air quality, fuel type, emissions of pollutants from cars etc. They can also “facilitate fundamental technological innovations through regulations, incentives and subsidies (Vergragt and Brown, 2007, p. 1105). In a laboratory experiment, Kacperski and Kutzner (2020) reveal that “monetary and symbolic incentives are effective in changing the behavior towards ‘greener’ charging choices” (p. 151). Zhu et al. (2020) recognized the potential of personalized incentives for the acceptance of sustainable travel behaviors by the general public and thus developed a personalized control system which could learn individuals’ preferences and assist the creation of personalized incentives. In an analysis of the realization of sustainable transport in Bahrain, Alsabbagh (2020) found that it can be achieved through regulatory and economic measures but in order to create public acceptance, which is essential for this kind of mobility change, fiscal incentives to car technologies seem necessary. Moreover, Van Malderen et al. (2012) highlight the role of workplaces in mobility debates, aiming to identify good practices in the mobility policies of companies in Belgium. They claim that the characteristics of a company are crucial for the appropriate promotion of either bicycles or public transport. However, “financial incentives, provision of facilities, diffusion of information and parking management all play an important role in mobility management” (Van Malderen et al., 2012, p. 11).

The difference between the mobility preferences of rural and urban areas has already been mentioned in Section 1. As widely reported in the literature, the ownership or use of a car is considered essential for a modern lifestyle and access to local goods and services in rural areas due to the decreasing quality of public transport (Kamruzzaman et al., 2015, p. 3464, Banister, 2008; Gray et al., 2006; McDonagh, 2006; Higgs and White, 2000; Shucksmith and Philip, 2000; Farrington et al., 1998; Shucksmith and Chapman, 1998; Nutley, 1985, 1996; Moseley, 1979).

Mattioli (2014) analyzed the “mobility gap” between car-owning and carless households in Great Britain and noticed a significant difference between rural and urban areas. While those with no car in urban areas find modal alternatives to the car relatively easily, those in rural and peripheral areas are immobile or must rely on a lift from others. Furthermore, reduced mobility has been associated with an increasing risk of social exclusion (Kamruzzaman et al., 2015; see also Yigitcanlar et al., 2019). Therefore, the rate of car use is higher and it is used for longer distances in rural areas compared to urban areas, which translates into higher per capita CO<sub>2</sub> emissions in rural areas, even though emissions from other sources, such as leisure activities, production and delivery of regional products, may be lower. Consequently, there is still more need for research because rural areas should be targeted independent of urban areas and receive special policy attention (Kester et al., 2020; Kamruzzaman et al., 2015). This paper aims to fill this gap.

### 3. Data and methods

#### 3.1. Survey design and participants

In order to answer our research question, a questionnaire was designed with the aim of collecting information about mobility patterns, lifestyle, and the propensity towards sustainable behaviors and mobility of the South Tyrolean population. In addition, major sociodemographic characteristics of persons (gender, age range, qualification, size of the family group, education, income, work) were investigated. The questionnaire contained a total of 60 closed questions and was part of a larger experimental study of which some results are presented in DellaValle and Zubaryeva (2019).

Data were collected via a Facebook survey, designed with Opinio.<sup>7</sup> Facebook, a social media tool (King et al., 2014; Thornton et al., 2016), was selected for its cost-effectiveness, rapid connection to potential participants, and its ability to grant as much diversity as data gathered through more traditional methods (Rife et al., 2016). Participants were 18 or over, living throughout South Tyrol and reached through Facebook and asked to complete a survey about sustainable and electric mobility. Paid advertising using Facebook's Ad program was carried out over two weeks in February

2018. Advertising was targeted by location (South Tyrol) and language (German and Italian). In order to motivate respondents to participate, as suggested by the existing literature on the topic (King et al., 2014; Thornton et al., 2016), a prize (100 tickets for a local cinema) was promised to the first 100 respondents. In total, 591 participants completed the survey, leading to a response rate of 49.5% of the 1193 people who clicked on the link. This alternative measure of response rate for Facebook surveys is suggested by King et al. (2014, p. 243). This sample will be referred to as “Facebook respondents”.

Due to the sampling procedure described above, the participants’ distribution across age groups was positively skewed, as the proportion of young people and adults was higher than that of seniors (only 1.4% are older than 65). For this reason, participants are also better qualified than the reference population: 37.9% have a university degree, significantly more than the 10.6% share of the resident population according to 2011 census data (ASTAT, 2018). Younger people are more sensitive to the topic of sustainability and more inclined towards sustainable forms of mobility than elderly people, as are more educated people (e.g. Nakanishi and Black, 2015; Munira and San Santos, 2017). Therefore, since the survey explicitly stated its focus on sustainable mobility, this mismatch between reference population and sample might indicate that the study suffers from self-selection bias. With regard to the geographical origin of the participants, it should be noted that the majority of municipalities in South Tyrol have <10,000 inhabitants, while only six municipalities have between 10,000 and 100,000 inhabitants and only the capital city, Bolzano/Bozen, has >100,000. Therefore, it can be assumed that 44% of our sample lives in rural settings (in municipalities with <10,000 inhabitants), while 56% of them live in urban settings (in municipalities with >10,000 inhabitants, including the capital city).

In parallel with the above-mentioned sampling, a focused study was conducted on existing users of EVs in South Tyrol. To reach this target an online survey was sent, thanks to a strategic cooperation with a local energy provider, to customers who had an EV charging station installed. Respondents were filtered according to their place of residence (South Tyrol) and ownership of a BEV/PHEV (Plug-in Hybrid Electric Vehicle). In total, one hundred people were reached, 51 of whom completed the entire questionnaire. The aim of this parallel study, which will be discussed in more detail in a future paper by the authors, was to investigate user experience with EVs. At the same time, some questions comparable to the questionnaire aimed at the broader audience were added in order to allow a certain degree of comparativeness. The high response rate to the survey supports the theory that people are more likely to respond to surveys when asked about a topic they are passionate about, as is often the case with EV users, especially early adopters (a high response rate was also reported in other studies collected by Hjorthol, 2013). This sample will be referred to as “EVs owners”.

#### 3.2. Variables

To support the aim of this study, we focused on a set of questions related to: (a) mobility patterns, (b) pro-environmental self-identity, and (c) the most important factors when purchasing a car/EV. Questions (c) were comparable with those targeted at owners of EVs in South Tyrol. The three sets of questions will be explained in detail within this section.

##### a. Mobility patterns

In order to measure current mobility behaviors and revealed behaviors towards sustainability, four questions related to different types of vehicles and their respective CO<sub>2</sub> emissions were individuated (grams of CO<sub>2</sub> per passenger kilometer).<sup>8</sup> In these questions, participants were asked to indicate the mode of transport used to go “on holiday”, “to work/to the university”, “to go shopping”, “in your free time (sport, visiting relatives/friends, day trips)”.

These variables were saved as ordinal variables with respective modalities: “Plane”, “Car”, “Scooter”, “Bus/Tram/Metro”, “Train”, “By foot/bike”, from the highest to the lowest CO<sub>2</sub> emissions. The question related to passenger transport for holidays has only four ordinal categories: “Plane”, “Car”, “Train”, “Others”. Guided by the literature, it was decided to treat the

<sup>7</sup> <https://survey.opinio.net/>.

<sup>8</sup> European Environment Agency (EEA), 2014

question related to holidays separately (Barr and Prillwitz, 2012; Barr et al., 2010; Becken, 2007) and to summarize the other three questions that express everyday mobility habits using the median value. This variable will be referred to as “mode of transport most frequently used in everyday life”.<sup>9</sup> Indeed, a sustainable mobility behavior in everyday life, such as going to work or shopping, is not necessarily associated with similar sustainable behavior when choosing a means of transport when planning a holiday. A large body of literature confirms that individuals are less likely to consider their environmental impact when choosing transport for a holiday (Barr and Prillwitz, 2012; Barr et al., 2010; Becken, 2007).

In order to measure current mobility behaviors and revealed behaviors towards sustainability, two additional questions were used. The first related to “the number of flights the person took last year” and the second related to “the type of fuel the person uses”. Regarding the fuel question, the possible answers were petrol, diesel and eco-friendly fuels (a category which includes natural gas, hybrid cars, hydrogen, electric) as well as those not using the car at all.

Throughout the paper, we will refer to these four questions – mode of transport used during holidays, everyday life, number of flights and type of fuel – collectively as “mobility patterns”. These questions function as proxies to assess the consistency between revealed behavior and intentions.

#### b. Pro-environmental self-identity and behavior

Eight statements in the questionnaire measure one's attitudes towards environment protection as part of one's self-identity on a seven-point Likert scale from (1) “strongly disagree” to (7) “strongly agree”, based on the measure of Whitmarsh and O'Neill (2010). The items measure the degree of pro-environmental self-identity and of pro-environmental behavior related to the fields of domestic energy and mobility. More specifically, participants were asked to indicate their agreement with the following statements: “I think of myself as someone who is very concerned with environmental issues”, “Respecting the environment is an important part of my identity”, “I turn off the lights when I am not using them”, “I buy energy-efficient appliances”, “I drive economically (braking or accelerating gently)”, “I walk, cycle or take public transport for short journeys (less than 3 km)”, “I share car journeys with someone else”, “I cut down the amount I fly”.

#### c. Most important factors when purchasing a car/most important incentives for EVs

The questionnaire also included two questions about the factors influencing the purchase of a car and the incentives for electric mobility. The aim of these questions was to provide clearer insights on how to promote sustainable mobility with traditional policy tools and on the most relevant obstacles that people are still facing in the adoption of more sustainable lifestyles. The same questions were included in the questionnaire that specifically targeted South Tyrolean EV owners.

In these questions, each respondent had to order the items according to a seven-point scale from (1) “not important” to (7) “extremely important”. Furthermore, to support the aim of the study, we defined two variables expressing the most important and the least important item selected by an individual. The factors which are important when purchasing a car were: fuel type, operation costs, space, price, CO<sub>2</sub> emissions and autonomy. In comparison, the incentives for EVs were: car sharing, subsidies, free parking, leasing, use of the bus lane, toll-free highway, better infrastructure.

### 3.3. Methods

Data were analyzed using SPSS version 25.0 statistical software (IBM Corp., 2017). Generally, absolute and relative frequencies were calculated to explore distributions of categorical and ordinal variables. Additionally, for ordinal variables, median values (Me) were calculated. The independent Chi-squared test was used to assess for the existence of associations between qualitative variables.

<sup>9</sup> The answer option “plane” is not reported in Table 1 for this question, as plane is not regarded as a mode of transport frequently used in everyday life.

In a first step, a Principal Component Analysis (PCA) was conducted in order to identify different dimensions existing among the items related to the aspect of pro-environmental self-identity and behavior (b). The criteria of eigenvalue higher than 1 was chosen as a principal threshold for factors selection. Subsequently, the major loadings of each item to selected factors was considered in order to obtain the final solution. The median values of the respective items were calculated to operationalize the created components.

To answer the research question and explore how pro-environmental self-identity interacts with consumers' heterogeneity, we performed a cluster analysis using the SPSS® Two Step clustering method (SPSS Inc., 2007). This method allows the handling of large datasets and is capable of dealing with both continuous and categorical variables. In order to reveal natural clusters within the dataset, in line with suggestions from the literature we decided to focus on socio-demographic patterns (age group, presence of children, education level, income) and on mobility patterns (mode of transport most frequently used in everyday life, mode of transport most frequently used on holiday, number of flights during the past year and fuel type). Once clusters were identified, we tested the existence of differences in the distribution of the components related to pro-environmental self-identity and behavior across the clusters. To this aim, the Kruskal-Wallis *H* test was applied, which is a rank-based nonparametric test used to compare the distribution of continuous or ordinal variables between two or more groups.

The last analysis we performed concerns incentives for EVs (c). More specifically, we used the Mann-Whitney *U* test to statistically test the existence of differences between EVs owners and Facebook respondents in the importance attributed to incentives for EVs. The Mann-Whitney *U* test belongs to the family of rank-based nonparametric tests such as the Kruskal-Wallis *H* test, but is used when the comparison is made between two groups only (in this case, EVs owners and Facebook respondents). The values of the mean ranks (MR) measuring average value of scores being ranked from lowest to highest are indicated in brackets after the respective groups under comparison. Therefore, the group with the highest mean rank is the group with the greatest number of high scores in it.

## 4. Results

This section illustrates the main results of the study. Table 1 reports the relative frequencies for the chosen variables. In relation to the set of variables regarding the most important factors when purchasing a car/most important incentives for EVs, relative frequencies indicate how many times that particular item gained the highest score (7) among Facebook respondents.

### 4.1. Pro-environmental self-identity and green mobility

The Principal Component Analysis (PCA) was conducted on the eight items measuring the degree of pro-environmental self-identity in order to identify the variables underlying them. Following the eigenvalue criteria described in the section above, three components were extracted. Considering major loadings for each item in the extracted factors (expressed below next to the statements), finally, two dimensions were individuated, accounting for 53.2% of the total variability:

- Component 1 consists of five questions and refers to *Pro-environmental self-identity*: “Respecting the environment is an important part of my identity” (0.77), “I think of myself as someone who is very concerned with environmental issues” (0.76), “I buy energy-efficient appliances” (0.70), “I drive economically (braking or accelerating gently)” (0.66), and “I turn off the lights when I am not using them” (0.58). In this component, statements regarding respondents' identity have the highest loadings – hence the name – but the component also includes statements about behaviors, which we deem to be consistent with said identity.
- Component 2 consists of the other three items and refers to *Green mobility*: “I share car journeys with someone else” (0.71), “I cut down the amount I fly” (0.53) and “I walk, cycle or take public transport for short journeys (less than 3 km)” (0.51).

**Table 1**

Characteristics of survey sample (N = 591).

	%
<b>Demographics</b>	
Female	46.5
Male	52.3
Prefer not to say	1.2
Age [18–25]	21.7
Age [26–40]	47.5
Age [41–64]	29.4
Age [>65]	1.4
Children [yes]	36.4
Children [no]	63.6
Education [primary]	6.4
Education [secondary]	48.6
Education [tertiary]	37.9
Education [PhD]	7.1
Income [<12,000€]	12.9
Income [12,001–24,000€]	19.0
Income [24,001–35,000€]	31.8
Income [35,001–60,000€]	17.6
Income [>60,000€]	5.4
Prefer not to say	13.4
City size [<2000]	14.7
City size [2001–10,000]	29.3
City size [10,001–100,000]	29.3
City size [>100,000]	26.7
<b>Mobility patterns</b>	
Mode of transport most frequently used in everyday life [car]	45.2
Mode of transport most frequently used in everyday life [scooter]	4.1
Mode of transport most frequently used in everyday life [bus/tram/metro]	12.0
Mode of transport most frequently used in everyday life [train]	5.9
Mode of transport most frequently used in everyday life [by foot/bike]	32.8
Mode of transport used on holiday [plane]	27.1
Mode of transport used on holiday [car]	58.7
Mode of transport used on holiday [train]	10.8
Mode of transport used on holiday [other]	3.4
Number of flights during the past year [0]	40.4
Number of flights during the past year [1–2]	36.4
Number of flights during the past year [>2]	23.2
Fuel type [petrol]	38.2
Fuel type [diesel]	45.3
Fuel type [eco-friendly]	16.4
<b>Ranking: most important factor when purchasing a car</b>	
Fuel type	16.9
Operating costs	10.7
Space	6.3
Price	48.4
CO2 emissions	9.0
Autonomy	8.8
<b>Ranking: most important incentive for EV</b>	
Car sharing	10.7
Subsidy	40.6
Free parking	14.6
Leasing	2.9
Use of the bus lane	4.6
Toll-free highway	5.6
Better infrastructure	21.2

This discrepancy between *Pro-environmental self-identity* and *Green mobility* is confirmed by the descriptive analysis of the relative frequencies for the two components, reported in Table 2. As previously mentioned in the introduction, although protecting the environment can be part of one's self-identity, it might not necessarily result in always engaging in sustainable mobility patterns.

#### 4.2. Clustering socio-demographic factors and mobility patterns

The analysis reveals that the most important predictors of cluster membership are age group and presence of children. This result suggests that mobility patterns are highly influenced by these two factors. This is in line with what has already been mentioned in the introduction, that age and the presence of children might affect mobility behaviors. The clustering

**Table 2**

Measures of pro-environmental self-identity (N = 591).

	%
<b>Degree of agreement with <i>Pro-environmental self-identity</i> statements (Component 1)</b>	
Strongly disagree [1]	0.5
Disagree [2]	0.3
More or less disagree [3]	2.2
Undecided [4]	5.8
More or less agree [5]	22.0
Agree [6]	34.9
Strongly agree [7]	34.3
<b>Degree of agreement with <i>Green mobility</i> statements (Component 2)</b>	
Strongly disagree [1]	6.6
Disagree [2]	6.1
More or less disagree [3]	9.3
Undecided [4]	19.5
More or less agree [5]	22.2
Agree [6]	17.1
Strongly agree [7]	19.3

procedure yielded three clusters: (a) “Multimodal Youth” (31.8% of the sample), (b) “Highly skilled travelers” (19.6%), (c) “Established car-drivers with children” (48.6%). Table 3 illustrates the characteristics of the three clusters, which can be summarized as follows:

##### a. Multimodal youth

This group is characterized by a large presence (66%) of people between 18 and 25 years old, reporting a lower income in comparison to the other two groups (32% of them earn less than €12,000 per year). “Multimodal youth” do not have children and in most cases completed secondary education, due to their young age. A smaller proportion (20%) also

**Table 3**

Profile of the sample data (N = 591).

Characteristics	Cluster A “Multimodal youth”	Cluster B “Highly skilled travelers without children”	Cluster C “Established car drivers with children”
N (%)	188 (31.8%)	116 (19.6%)	287 (48.6%)
Age of respondents			
18–25	66%	3.4%	0%
26–40	31.9%	87.1%	41.8%
41–65	2.1%	6.9%	56.4%
>65	0%	2.6%	1.7%
Children			
Yes	2.1%	2.6%	72.5%
No	97.9%	97.4%	27.5%
Education level			
Primary	6.9%	0%	8.7%
Secondary	72.9%	6.9%	49.5%
Tertiary	20.2%	79.3%	32.8%
PhD	0%	13.8%	9.1%
Income (€)			
<12,000	32.4%	5.2%	3.1%
12,001–24,000	17%	23.3%	18.5%
24,001–35,000	19.7%	50%	32.4%
35,001–60,000	3.7%	12.9%	28.6%
>60,000	0.5%	0%	10.8%
Prefer not to say	26.6%	8.6%	6.6%
Mode of transport most frequently used in everyday life			
Car	47.3%	3.4%	60.6%
Scooter	3.2%	5.2%	4.2%
Bus/tram/metro	17%	20.7%	5.2%
Train	6.9%	11.2%	3.1%
Bike/by foot	25.5%	59.5%	26.8%
Mode of transport used on holiday			
Plane	35.1%	54.3%	10.8%
Car	44.7%	20.7%	83.3%
Train	16%	17.2%	4.9%
Other	4.3%	7.8%	1%
Number of flights during the past year			
0	43.6%	5.2%	52.6%
1–2	39.9%	35.3%	34.5%
>2	16.5%	59.5%	12.9%
Fuel type			
Petrol	56.4%	40.5%	25.4%
Diesel	27.7%	27.6%	64.1%
Eco-friendly	16%	31.9%	10.5%



holds a university degree. The mode of transport most frequently used, both in everyday life and on holiday, is the car (47% for everyday life, 45% on holiday). However, in both cases the predominance of the car is not marked: in 35% of the cases “Multimodal youth” travel by plane, in 25% they walk or bike in everyday life. This may be due to mobility patterns that have not yet been established at this stage of life or are more context-dependent than other groups.

#### b. Highly skilled travelers without children

The second group is largely (87%) represented by people between 26 and 40 years old. Like “Multimodal youth”, “Highly skilled travelers” do not have children, but in most cases (almost 80%) hold a university degree. A small proportion (14%) also completed a PhD. This cluster significantly differs from the other two as they travel by plane more often: the plane is the most frequently used mode of transport for holidays (54%), and the number of flights taken during the previous year was high (more than two in 60% of the cases). In everyday life, on the other hand, a large majority (66%) indicates “By foot/bike” as the mode of transport most frequently used. For the small proportion who prefers the car (21% on holiday and only 3% in everyday life), eco-friendly fuels are preferred in 32% of cases, the highest proportion throughout the three groups.

#### c. Established car-drivers with children

The third and last group is composed of people older than the others: 56% of this group are aged 41–65, with 42% aged 26–40.<sup>10</sup> Unlike the other groups, the majority (72%) of participants have children. The reported income is higher than that of the other groups: 29% declare earnings between €35,001 and €60,000 per year, 11% more than €60,000. The completed level of education appears to be more evenly distributed between secondary and tertiary education. Regarding their mobility habits, this group markedly prefers the car over other alternatives both in everyday life (61%) and on holiday (83%). In everyday life, cars are followed by “By foot/bike” with 27% of responses, while on holiday the “plane” gathered only 11% of preferences. This strong preference may be explained by the presence of children, either because it makes traveling by car less expensive and more flexible than by plane, or because traveling by plane appears to be a less sustainable choice. This group also showed a preference for diesel-powered cars: this fuel is indicated in 64% of the cases, compared to 25% for petrol and only 11% for more eco-friendly fuels, amounting to the lowest proportion throughout the different clusters.

### 4.3. Clusters' interaction with measures of pro-environmental self-identity and green mobility

Statistically significant differences among groups ( $\chi^2(2) = 19.45$ ,  $p$ -value = 0.000) indicated that the *Pro-environmental self-identity* is weaker among “Multimodal Youth” (254.36), while it increases among “Highly skilled travelers” (300.55), and finally becomes more pronounced among “Established car-drivers with children” (321.44). The differences are significant between “Multimodal Youth” and “Young adults” ( $p$ -value = 0.048) and “Multimodal Youth” and “Established car-drivers with children” ( $p$ -value = 0.000). There are no significant differences between the three types of individuals respectively to the distribution of *Green mobility* component ( $\chi^2(2) = 5.59$ ,  $p$ -value = 0.061).

The results of the Kruskal-Wallis  $H$  test indicate that, despite representing the least environmentally-friendly category in their mobility behavior (predominantly traveling with diesel-powered cars), “Established car-drivers with children” perceive that protecting the environment is part of their identity. In contrast, “Multimodal Youth” report the lowest levels of pro-environmental self-identity. For “Established car-drivers with children”, these results confirm the insight that although protecting the environment can be part of one's self-identity, this might not necessarily result in always engaging in sustainable mobility patterns. On the contrary,

“Multimodal Youth” displayed the lowest score of pro-environmental self-identity, consistent with their revealed mobility patterns. It might be that for “Multimodal Youth” it is difficult not only to establish mobility patterns, but also other behavioral patterns on which they can infer their self-identity.

### 4.4. Incentives for EVs

As Table 1 illustrates, 48.4% of Facebook respondents indicated price as the most important factor (score = 7) when purchasing a car and 40.6% deem subsidies the most important incentive (score = 7) for EVs, followed by infrastructure (21.2%). In both cases, economic factors prevail over the other alternatives. For the sake of completeness, median and mean values calculated on the distribution of each incentive separately are also reported. The order of incentives from the most important to the least important is the following (in parentheses, the median value followed by mean value): subsidy (6; 5.51), free parking (5; 5), better infrastructure (5; 4.4), toll-free highway (4; 3.78), leasing (3; 3.37), use of the bus lane (3; 2.94), car sharing (2; 3).

In order to statistically test the existence of differences in the importance of incentives among the three clusters, Kruskal-Wallis  $H$  tests were used. All three clusters judge the importance of considered incentives in the same way and the tests did not detect any differences (carsharing  $\chi^2(2) = 4.34$ ,  $p$ -value = 0.114; subsidy  $\chi^2(2) = 1.86$ ,  $p$ -value = 0.395; parking  $\chi^2(2) = 1.34$ ,  $p$ -value = 0.511; leasing  $\chi^2(2) = 1.01$ ,  $p$ -value = 0.605; bus lane  $\chi^2(2) = 3.45$ ,  $p$ -value = 0.178; highway  $\chi^2(2) = 1.98$ ,  $p$ -value = 0.371; infrastructure  $\chi^2(2) = 0.71$ ,  $p$ -value = 0.700).

The same set of questions was submitted to existing owners of EVs in South Tyrol in order to assess whether the preferred incentives by those that actually bought an EV differed or rather were similar to those indicated by users still using ICE (Internal Combustion Engine) vehicles. Also, in the case of EV owners, the preferred incentives (score = 7) to buy an EV were subsidies (34.7%), confirming the importance of the economic factor, and charging infrastructure improvement (20.4%). A less obvious appreciated incentive is free parking for EVs, which is as important as monetary incentives (34.7%). Here median and mean values for EVs owners are provided in order of the most important to the least important: free parking (6; 5.73), a subsidy (6; 5.63), better infrastructure (5; 4.67), use of the bus lane (4; 3.88), toll-free highway (4; 3.88), leasing (2; 2.63), car sharing (2; 2.33).

Mann-Whitney  $U$  tests were used to statistically test the existence of differences between EV owners and Facebook respondents respective to the importance of incentives for EVs. Respective to the following items – carsharing, subsidies, highway and infrastructure – there are no differences between these two samples (carsharing  $z = -1.88$ ,  $p$ -value = 0.060; subsidy  $z = 0.02$ ,  $p$ -value = 0.984; highway  $z = 0.54$ ,  $p$ -value = 0.592; infrastructure  $z = 0.78$ ,  $p$ -value = 0.435). Differences exist for incentives such as parking, leasing and bus lanes (parking  $z = 3.73$ ,  $p$ -value = 0.000; leasing  $z = -3.05$ ,  $p$ -value = 0.002; bus lane  $z = 3.22$ ,  $p$ -value = 0.001). In general, Mann-Whitney  $U$  tests confirm our intuition that parking incentives are more important for EV owners (413.17) than for Facebook respondents (312.43). Similarly, the use of the bus lanes represents a more important incentive for EV owners (402.67) than for Facebook respondents (311.3). On the contrary, leasing is more important for Facebook respondents (323.38) than for EV owners (236.66).

## 5. Discussion and conclusions

In this study, we investigated how socio-demographic variables interact with pro-environmental self-identity with the aim of providing South Tyrolean policy-makers with insights on how to design effective policies to promote more sustainable mobility behaviors. We did this by conducting a cluster analysis of responses to a survey on sustainable mobility administered to residents of this Italian alpine region, aiming to shed light on the relationship between pro-environmental self-identity and pro-environmental mobility patterns.

<sup>10</sup> The remaining 1% is composed of seniors (over 65). The other seniors in the sample fall within the group of “Highly skilled travelers without children”

In particular, results showed that while the distribution of the *Green mobility* measure does not differ across the three clusters, those groups reveal heterogeneous responses to the *Pro-environmental self-identity* measure, with “Established car-drivers with children” displaying the highest score. These results confirm that even if individuals with children seem to think more about the environment, this does not necessarily translate into more sustainable mobility behaviors. This might be due to contextual factors that users with children have to deal with in comparison with their counterparts without children, especially in rural areas (see also Whitmarsh and O'Neill, 2010). Future research causally testing the effect of campaigns priming pro-environmental identity on EVs purchases should address the question left opened by this exploratory study, namely whether they are effective or not.

While this intuition is worthy of a formal causal investigation in future research, our study reveals potential heterogeneous responses to interventions. In particular, this study warns policy-makers of potential unintended consequences from current policy tools, such as the provision of monetary incentives to purchase EVs.

Despite being perceived as the most supportive measures by respondents, monetary incentives might be detrimental for some individuals who would have been already motivated to purchase EVs. In particular, these incentives might dampen the intrinsic motivation to engage in a certain behavior (Frey and Oberholzer-Gee, 1997; Mellström and Johannesson, 2008; Gneezy and Rustichini, 2000a), especially when they are too small (Gneezy and Rustichini, 2000b). This is especially true for hybrid or electric cars, for which image concerns play a crucial role. In this case, extrinsic rewards, notably monetary incentives, make the reasons why the individual is buying an EV unclear, e.g., whether he/she is engaging in pro-environmental behaviors, “to do good” or “to do well” (Gneezy et al., 2011; Sexton and Sexton, 2014). Thus, in order to prevent backfiring effects, when designing monetary incentives to promote the purchase of EVs, policy-makers should take into account how these interact with pre-existing motivations.

Finally, we add to the study of Rode et al. (2015) by concluding that it is crucial to investigate heterogeneity prior to a policy large-scale implementation. In particular, the presence of non-monetary mechanisms in the population, such as a high degree of pro-environmental self-identity, might make a policy ineffective when it offers incentives that are perceived as being too small.

Our findings therefore confirm that “furthering environmentally-friendly lifestyles and establishing green habits might be easier if one focuses first on the less costly behaviors before then tackling more costly behaviors”. Users are more likely to engage in eco-friendly behaviors starting with actions that require less sacrifice (Binder and Blankenberg, 2017). Therefore, future regional policies aimed at boosting a sustainable mobility lifestyle should first focus on other issues such as extending cycle paths, improving public transport and simplifying inter-modality before offering monetary incentives for purchasing EVs.

The present study has several limitations, which provide opportunities for future research. First, as stated above, participants with a more marked environmental awareness were more likely to participate in the survey, which might have affected the sample representation. Moreover, retrieved data on mobility patterns rely on self-assessment by respondents rather than actual behavior, which remains unobserved and might be subject of future research. From the statistical point of view, working with ordinal variables and consequently with non-parametric tests such as Kruskal-Wallis didn't allow causality to be inferred from our results. Further research should find alternative ways of measuring mobility patterns and pro-environmental self-identity in order to understand the direction of causality. Finally, results relate to the local conditions and policies of South Tyrol. For this reason, they cannot be generalized without appropriate adaptation to other local realities.

Despite these limitations, the present study provides useful insights into the design of more effective policies promoting sustainable mobility: given the peculiarities of a rural area such as South Tyrol, where EVs may significantly reduce pollution and increase quality of life, subsidies may not

always succeed in encouraging the adoption of those vehicles for individuals already intrinsically motivated to do so (“Established car-drivers with children”). Contextual factors may also hinder such behavior change. Instead, insights from actual EV users point to incentives other than subsidies that could prove more effective, such as free parking and improvements in the charging infrastructure, in which the local administration should continue to invest.

## Declaration of competing interest

None

## Acknowledgments

**Funding:** This work was financially supported by Jaguar Land Rover Italia. We extend our thanks to Philipp Corradini, Gerhard Vanzi, Harald Pechlaner, Claudia Marina Lanzidei and Alyona Zubaryeva (Eurac Research) for their assistance throughout the project, to the project partners that helped in distributing the survey - Alperia SpA, IDM Südtirol - Alto Adige and Green Mobility (STA), and to the respondents that kindly took the time to complete the survey, allowing this research to be possible. We thank finally the anonymous reviewers for their careful reading of our manuscript and their many insightful comments and suggestions. The authors thank the Center for Advanced Studies (Eurac Research) for covering the Open Access publication costs.

## References

- Akerlof, G.A., Kranton, R.E., 2000. Economics and identity. *Q. J. Econ.* 115, 715–753. <https://doi.org/10.1162/003355300554881>.
- Akgün, A.A., Baycan, T., Nijkamp, P., 2015. Rethinking on sustainable rural development. *Eur. Plan. Stud.* 23, 678–692. <https://doi.org/10.1080/09654313.2014.945813>.
- Alsabbagh, M., 2020. Methodological framework for adopting sustainable transport measures. *International Journal of Global Warming* 20 (1), 37–60. <https://doi.org/10.1504/IJGW.2020.104619>.
- Asensio, O.I., Delmas, M.A., 2015. Nonprice incentives and energy conservation. *Proc. Natl. Acad. Sci.* 112 (6), E510–E515. <https://doi.org/10.1073/pnas.1401880112>.
- ASTAT, 2011a. Censimento della popolazione [Population census]. from: <https://astat.provincia.bz.it/censimento-generale-popolazione-abitazioni.asp>, Accessed date: 26 March 2019.
- ASTAT, 2011b. Mobilità e traffico in provincia di Bolzano [Mobility and traffic in South Tyrol]. from: [https://astat.provincia.bz.it/news-pubblicazioni-info.asp?news\\_action=4&news\\_article\\_id=418283](https://astat.provincia.bz.it/news-pubblicazioni-info.asp?news_action=4&news_article_id=418283), Accessed date: 13 May 2020.
- ASTAT, 2016. Indagine multiscope sulle famiglie [Multipurpose survey on households]. from: [http://www.provincia.bz.it/news/it/news.asp?news\\_action=4&news\\_article\\_id=597923](http://www.provincia.bz.it/news/it/news.asp?news_action=4&news_article_id=597923), Accessed date: 18 May 2020.
- ASTAT, 2017. Mobilità e traffico in provincia di Bolzano [Mobility and traffic in South Tyrol]. from: [https://astat.provincia.bz.it/news-pubblicazioni-info.asp?news\\_action=4&news\\_article\\_id=631059](https://astat.provincia.bz.it/news-pubblicazioni-info.asp?news_action=4&news_article_id=631059), Accessed date: 13 May 2020.
- ASTAT, 2018. Alto Adige in cifre [South Tyrol in figures]. from: <https://astat.provincia.bz.it/alto-adige-cifre.asp>, Accessed date: 26 March 2019.
- Axsen, J., Orlebar, C., Skippon, S., 2013. Social influence and consumer preference formation for pro-environmental technology: the case of a U.K. workplace electric-vehicle study. *Ecol. Econ.* 95, 96–107. <https://doi.org/10.1016/j.ecolecon.2013.08.009>.
- Banister, D., 2008. Rural accessibilities and mobilities. In: Becker, U., Böhmer, J., Gerike, R. (Eds.), *How to Define and Measure Access and Need Satisfaction in Transport*. Dresdner Institut für Verkehr und Umwelt e.V. (DIVU), Dresden.
- Barr, S., Prillwitz, J., 2012. Green travellers? Exploring the spatial context of sustainable mobility styles. *Appl. Geogr.* 32 (2), 798–809. <https://doi.org/10.1016/j.apgeog.2011.08.002>.
- Barr, S., Shaw, G., Coles, T., Prillwitz, J., 2010. “A holiday is a holiday”: practicing sustainability, home and away. *Journal of Transport Geography* Tourism and climate change 18 (3), 474–481. <https://doi.org/10.1016/j.jtrangeo.2009.08.007>.
- Becken, S., 2007. Tourists' perception of international air travel's impact on the global climate and potential climate change policies. *J. Sustain. Tour.* 15 (4), 351–368. <https://doi.org/10.2167/jost710.0>.
- Benabou, R., Tirole, J., 2011. Identity, morals, and taboos: beliefs as assets. *Q. J. Econ.* 126 (2), 805–855. <https://doi.org/10.1093/qje/qjr002>.
- Besagni, G., Borgarello, M., 2020. A bottom-up study on the relationships between transportation expenditures and socio-demographic variables: evidences from the Italian case study. *Travel Behav. Soc.* 19, 151–161. <https://doi.org/10.1016/j.tbs.2020.01.001>.
- Binder, M., Blankenberg, A.K., 2017. Green lifestyles and subjective well-being: more about self-image than actual behavior? *J. Econ. Behav. Organ.* 137, 304–323. <https://doi.org/10.1016/j.jebo.2017.03.009>.
- Bireselioglu, M.E., Demirbag, M.K., Yilmaz, B.K., 2018. Electric mobility in Europe: a comprehensive review of motivators and barriers in decision making processes. *Transp. Res. A Policy Pract.* 109, 1–13. <https://doi.org/10.1016/j.trra.2018.01.017>.
- Bradley, G.L., Babutsidze, Z., Chai, A., Reser, J.P., 2020. The role of climate change risk perception, response efficacy, and psychological adaptation in pro-environmental behavior:



- a two nation study. *J. Environ. Psychol.* 68, 101410. <https://doi.org/10.1016/j.jenvp.2020.101410>.
- Brida, J.G., Deidda, M., Pulina, M., 2014. Tourism and transport systems in mountain environments: analysis of the economic efficiency of cableways in South Tyrol. *Journal of Transport Geography* 36, 1–11. <https://doi.org/10.1016/j.jtrangeo.2014.02.004>.
- Canitez, F., 2019. Pathways to sustainable urban mobility in developing megacities: a socio-technical transition perspective. *Technological Forecasting and Social Change* 141, 319–329. <https://doi.org/10.1016/j.techfore.2019.01.008>.
- Chapman, L., 2007. Transport and climate change: a review. *J. Transp. Geogr.* 15 (5), 354–367. <https://doi.org/10.1016/j.jtrangeo.2006.11.008>.
- Chuang, F., Manley, E., Petersen, A., 2020. The role of worldviews in the governance of sustainable mobility. *Proc. Natl. Acad. Sci.* 117 (8), 4034–4042. <https://doi.org/10.1073/pnas.1916936117>.
- Darido, G., Mariana, T.M., Shomik, M., 2014. Urban transport and CO2 emissions: some evidence from Chinese cities. *Wiley Interdisciplinary Reviews: Energy and Environment* 3 (2), 122–155. <https://doi.org/10.1002/wene.71>.
- DellaValle, N., Zubaryeva, A., 2019. Can we hope for a collective shift in electric vehicle adoption? Testing salience and norm-based interventions in South Tyrol, Italy. *Energy Res. Soc. Sci.* 55, 46–61. <https://doi.org/10.1016/j.erss.2019.05.005>.
- Egbue, O., Long, S., 2012. Barriers to widespread adoption of electric vehicles: an analysis of consumer attitudes and perceptions. *Energy Policy* 48, 717–729. <https://doi.org/10.1016/j.enpol.2012.06.009>.
- European Environment Agency (EEA), 2014. CO2 emissions from passenger transport. from: <https://www.eea.europa.eu/media/infographics/co2-emissions-from-passenger-transport/view#tab-related-publication>, Accessed date: 26 March 2019.
- Farrington, J., Gray, D., Martin, S., Roberts, D., 1998. Car Dependence in Rural Scotland. The Scottish Office Central Research Unit, Edinburgh.
- Fekadu, Z., Kraft, P., 2001. Self-identity in planned behavior perspective: past behavior and its moderating effects on self-identity-intention relations. *Soc. Behav. Personal. Int. J.* 29 (7), 671–685. <https://doi.org/10.2224/sbp.2001.29.7.671>.
- Festinger, L., 1957. *A Theory of Cognitive Dissonance*. Vol. 2. Stanford University Press, Stanford.
- Fondazione Impresa, 2014. . from: <https://www.fondazioneimpresa.it/>, Accessed date: 26 March 2019.
- Fornahl, D., Werner, N., 2015. New electric mobility in fleets in the rural area of Bremen/Oldenburg. In: Leal Filho, W., Kotter, R. (Eds.), *E-Mobility in Europe, Green Energy and Technology*. Springer, Cham, pp. 237–251. [https://doi.org/10.1007/978-3-319-13194-8\\_13](https://doi.org/10.1007/978-3-319-13194-8_13).
- Frey, B.S., Oberholzer-Gee, F., 1997. The cost of price incentives: an empirical analysis of motivation crowding-out. *Am. Econ. Rev.* 87, 746–755. <https://www.jstor.org/stable/2951373?seq=1>.
- Gneezy, U., Rustichini, A., 2000a. A fine is a price. *J. Leg. Stud.* 29, 1–17. <https://doi.org/10.1086/468061>.
- Gneezy, U., Rustichini, A., 2000b. Pay enough or don't pay at all. *Q. J. Econ.* 115 (3), 791–810. <https://doi.org/10.1162/003355500554917>.
- Gneezy, U., Meier, S., Rey-Biel, P., 2011. When and why incentives (don't) work to modify behavior. *Journal of Economic Perspectives* 25 (4), 191–210. <https://doi.org/10.1257/jep.25.4.191>.
- Gray, D., Shaw, J., Farrington, J., 2006. Community transport, social capital and social exclusion in rural areas. *Area* 38 (1), 89–98. <https://doi.org/10.1111/j.1475-4762.2006.00662.x>.
- Green, E.H., Skerlos, S.J., Winebrake, J.J., 2014. Increasing electric vehicle policy efficiency and effectiveness by reducing mainstream market Bias. *Energy Policy* 65, 562–566. <https://doi.org/10.1016/j.enpol.2013.10.024>.
- Haustein, S., Jensen, A.F., 2018. Factors of electric vehicle adoption: a comparison of conventional and electric car users based on an extended theory of planned behavior. *Int. J. Sustain. Transp.* 12 (7), 484–496. <https://doi.org/10.1080/15568318.2017.1398790>.
- Herrador, M., Carvalho, A., Feito, F.R., 2015. An incentive-based solution of sustainable mobility for economic growth and CO2 emissions reduction. *Sustainability* 7, 6119–6148. <https://doi.org/10.3390/su7056119>.
- Higgs, G., White, S., 2000. Alternatives to census-based indicators of social disadvantage in rural communities. *Prog. Plan.* 53, 1–81. [https://doi.org/10.1016/S0305-9006\(99\)00021-5](https://doi.org/10.1016/S0305-9006(99)00021-5).
- Hjorthol, R., 2013. Attitudes, Ownership and Use of Electric Vehicles - a Review of Literature, TØI Report, 1261/2013. Institute of Transport Economics, Norwegian Centre for Transport Research <https://www.toi.no/getfile.php?mmfileid=32442>.
- IBM Corp., 2017. IBM SPSS Statistics for Windows. Version 25.0. IBM Corp., Armonk, NY.
- Kacperski, C., Kutzner, F., 2020. Financial and symbolic incentives promote 'green' charging choices. *Transport. Res. F: Traffic Psychol. Behav.* 69, 151–158. <https://doi.org/10.1016/j.trf.2020.01.002>.
- Kamruzzaman, M., Hine, J., Yigitcanlar, T., 2015. Investigating the link between carbon dioxide emissions and transport-related social exclusion in rural Northern Ireland. *Int. J. Environ. Sci. Technol.* 12 (11), 3463–3478. <https://doi.org/10.1007/s13762-015-0771-8>.
- Kester, J., Sovacool, B.K., Noel, L., de Rubens, G.Z., 2020. Rethinking the spatiality of Nordic electric vehicles and their popularity in urban environments: moving beyond the city? *J. Transp. Geogr.* 82, 102557. <https://doi.org/10.1016/j.jtrangeo.2019.102557>.
- Keyvanfar, A., Shafaghat, A., Nasiru Zakari, M., Salim Ferwati, M., 2018. Driving behaviour and sustainable mobility-policies and approaches revisited. *Sustainability* 10 (4), 1152. <https://doi.org/10.3390/su10041152>.
- King, D.B., O'Rourke, N., DeLongis, A., 2014. Social media recruitment and online data collection: a Beginner's guide and best practices for accessing low-prevalence and hard-to-reach populations. *Canadian Psychology/Psychologie Canadienne* 55 (4), 240–249. <https://doi.org/10.1037/a0038087>.
- Le Gallie, T., Assoumou, E., Maizi, N., 2018. Investigating long-term lifestyle changes: a methodological proposal based on a statistical model. *Sustainable Development* 26 (2), 159–171. <https://doi.org/10.1002/sd.1727>.
- Li, W., Long, R., Chen, H., Geng, J., 2017. A review of factors influencing consumer intentions to adopt battery electric vehicles. *Renewable and Sustainable Energy Reviews* 78, 318–328. <https://doi.org/10.1016/j.rser.2017.04.076>.
- Loewenstein, G., Rabin, M., Camerer, C., 2011. *Advances in Behavioral Economics*, Russell Sage Foundation and Princeton University. Press, New York and Princeton.
- Markvica, K., Millonig, A., Haufe, N., Leodolter, M., 2020. Promoting active mobility behavior by addressing information target groups: the case of Austria. *J. Transp. Geogr.* 83, 102664. <https://doi.org/10.1016/j.jtrangeo.2020.102664>.
- Mattioli, G., 2014. Where sustainable transport and social exclusion meet: households without cars and car dependence in Great Britain. *Journal of Environmental Policy & Planning* 16 (3), 379–400. <https://doi.org/10.1080/1523908X.2013.858592>.
- McDonagh, J., 2006. Transport policy instruments and transport-related social exclusion in rural Republic of Ireland. *J. Transp. Geogr.* 14, 355–366. <https://doi.org/10.1016/j.jtrangeo.2005.06.005>.
- Mellström, C., Johannesson, M., 2008. Crowding out in blood donation: was Titmuss right? *J. Eur. Econ. Assoc.* 6 (4), 845–863. <https://doi.org/10.1162/JEEA.2008.6.4.845>.
- Miralles-Guasch, C., Montserrat, M.M., Marquet, O., 2016. A gender analysis of everyday mobility in urban and rural territories: from challenges to sustainability. *Gender Place and Culture* 23 (3), 398–417. <https://doi.org/10.1080/0966369X.2015.1013448>.
- Moseley, M.J., 1979. *Accessibility: The Rural Challenge*. Methuen, London.
- Moser, S., Kleinhückelkotten, S., 2018. Good intents, but low impacts: diverging importance of motivational and socioeconomic determinants explaining pro-environmental behavior, energy use, and carbon footprint. *Environ. Behav.* 50 (6), 626–656. <https://doi.org/10.1177/2F0013916517710685>.
- Munira, S., San Santoso, D., 2017. Examining public perception over outcome indicators of sustainable urban transport in Dhaka City. *Case Studies on Transport Policy* 5 (2), 169–178. <https://doi.org/10.1016/j.cstp.2017.03.011>.
- Nakanishi, H., Black, J.A., 2015. Travel habit creation of the elderly and the transition to sustainable transport: an exploratory research based on a retrospective survey. *Int. J. Sustain. Transp.* 10 (7), 604–616. <https://doi.org/10.1080/15568318.2015.1059526>.
- Newman, D., Wells, P., Donovan, C., Nieuwenhuis, P., Davies, H., 2014. Urban, sub-urban or rural: where is the best place for electric vehicles? *Int. J. Automot. Technol. Manag.* 14 (3–4), 306–323. <https://doi.org/10.1504/IJATM.2014.065295>.
- Nocera, S., Cavallaro, F., Irranca Galati, O., 2018. Options for reducing external costs from freight transport along the Brenner Corridor. *European Transport Research Review* 10 (53), 1–18. <https://doi.org/10.1186/s12544-018-0323-7>.
- Nutley, S., 1985. Planning options for the improvement of rural accessibility: use of the time-space approach. *Regional Studies* 19 (1), 37–50. <https://doi.org/10.1080/09595238500185051>.
- Nutley, S., 1996. Rural transport problems and non-car populations in the USA. *J. Transp. Geogr.* 4 (2), 93–106. [https://doi.org/10.1016/0966-6923\(96\)00002-6](https://doi.org/10.1016/0966-6923(96)00002-6).
- Obrecht, M., Rosi, B., Potrc, T., 2017. Review of low emission zones in Europe: case of London and German cities. *Technicki Glasnik-Technical Journal* 11, 55–62. <http://orcid.org/0000-0001-8301-7382>.
- O'Mahony, T., Peng, Z., Sweeney, J., 2012. The driving forces of change in energy-related CO2 emissions in Ireland: a multi-Sectoral decomposition from 1990 to 2007. *Energy Policy* 44, 256–267. <https://doi.org/10.1016/j.enpol.2012.01.049>.
- Patel, J.D., Trivedi, R.H., Yagnik, A., 2020. Self-identity and internal environmental locus of control: comparing their influences on green purchase intentions in high-context versus low-context cultures. *J. Retail. Consum. Serv.* 53, 102003. <https://doi.org/10.1016/j.jretconser.2019.102003>.
- Peters, A.M., van der Werff, E., Steg, E., 2018. Beyond purchasing: electric vehicle adoption motivation and consistent sustainable energy behaviour in the Netherlands. *Energy Res. Soc. Sci.* 39, 234–247. <https://doi.org/10.1016/j.erss.2017.10.008>.
- Poslad, S., Ma, A., Wang, Z., Mei, H., 2015. Using a smart city IoT to incentivise and target shifts in mobility behaviour—Is it a piece of pie? *Sensors* 15 (6), 13069–13096. <https://doi.org/10.3390/2Fs150613069>.
- Railway Handbook, 2017. Energy consumption and CO2 emission, focus on passenger rail services, International Energy Agency (IEA), International Union of Railways (UIC). from: [https://uic.org/IMG/pdf/handbook\\_jea-uic\\_2017\\_web3.pdf](https://uic.org/IMG/pdf/handbook_jea-uic_2017_web3.pdf), Accessed date: 26 March 2019.
- Rife, C.S., Cate, K.L., Kosinski, M., Stillwell, D., 2016. Participant recruitment and data collection through Facebook: the role of personality factors. *Int. J. Soc. Res. Methodol.* 19 (1), 69–83. <https://doi.org/10.1002/hbe2.164>.
- Rode, J., Gómez-Baggethun, E., Krause, T., 2015. Motivation crowding by economic incentives in conservation policy: a review of the empirical evidence. *Ecol. Econ.* 117 (C), 270–282. <https://doi.org/10.1016/j.ecolecon.2014.11.019>.
- Scuttari, A., Isetti, G., 2019. E-mobility and sustainable tourism transport in remote areas. *Zeitschrift für Tourismuswissenschaft* 11 (2), 237–256. <https://doi.org/10.1515/tw-2019-0014>.
- Scuttari, A., Volgger, M., Pechlaner, H., 2016. Transition management towards sustainable mobility in Alpine destinations: realities and realpolitik in Italy's South Tyrol region. *J. Sustain. Tour.* 24 (3), 463–483. <https://doi.org/10.1080/0969582.2015.1136634>.
- Semanjski, I., Lopez Aguirre, A.J., De Mol, J., Gautama, S., 2016. Policy 2.0 platform for mobile sensing and incentivized targeted shifts in mobility behavior. *Sensors* 16 (7), 1035. <https://doi.org/10.3390/s16071035>.
- Sen, A., 2006. *Identity and Violence: The Illusion of Destiny*. W.W. Norton & Co, New York.
- Sexton, Steven E., Sexton, Alison L., 2014. Conspicuous conservation: the Prius halo and willingness to pay for environmental bona fides. *J. Environ. Econ. Manag.* 67 (3), 303–317. <https://doi.org/10.1016/j.jeem.2013.11.004>.
- Shucksmith, M., Chapman, P., 1998. Rural development and social exclusion. *Soc. Rural. Sociologia Ruralis: Journal of the European Society for Rural Sociology* 38, 225–242. <https://doi.org/10.1111/1467-9523.00073>.
- Shucksmith, M., Philip, L., 2000. *Social Exclusion in Rural Areas: A Literature Review and Conceptual Framework*. The Scottish Executive Central Research Unit, Edinburgh.

- Sierzchula, W., Bakker, S., Maat, K., Van Wee, B., 2014. The influence of financial incentives and other socio-economic factors on electric vehicle adoption. *Energy Policy* 68, 183–194. <https://doi.org/10.1016/j.enpol.2014.01.043>.
- Sippel, M., Meyer, D., Scholliers, N., 2018. What about greenhouse gas emissions from students? An analysis of lifestyle and carbon footprints at the University of Applied Science in Konstanz, Germany. *Carbon Management* 9 (2), 201–211. <https://doi.org/10.1080/17583004.2018.1440851>.
- Soder, M., Peer, S., 2018. The potential role of employers in promoting sustainable mobility in rural areas: evidence from eastern Austria. *Int. J. Sustain. Transp.* 12 (7), 541–551. <https://doi.org/10.1080/15568318.2017.1402974>.
- Sousa, L., Ciriolo, E., Rafael Rodrigues Viera De Almeida, S., Troussard, X., 2016. Behavioural Insights Applied to Policy, European Report. Publications Office of the European Union [https://publications.jrc.ec.europa.eu/repository/bitstream/JRC100146/kjna27726enn\\_new.pdf](https://publications.jrc.ec.europa.eu/repository/bitstream/JRC100146/kjna27726enn_new.pdf).
- Sovacool, B.K., Kester, J., Noel, L., Zarazua de Rubens, G., 2018. The demographics of decarbonizing transport: the influence of gender, education, occupation, age, and household size on electric mobility preferences in the Nordic region. *Global Environmental Change-Human and Policy Dimensions* 52, 86–100. <https://doi.org/10.1016/j.gloenvcha.2018.06.008>.
- SPSS Inc., 2007. *SPSS for Windows, Version 16.0*. SPSS Inc, Chicago.
- Tajfel, H., Billig, M.G., Bundy, R.P., Flament, C., 1971. Social categorization and intergroup behaviour. *European Journal of Social Psychology* 1 (2), 149–178. <https://doi.org/10.1002/ejsp.2420010202>.
- Thornton, L., Batterham, P.J., Fassnacht, D.B., Kay-Lambkin, F., Calear, A.L., Hunt, S., 2016. Recruiting for health, medical or psychosocial research using Facebook: systematic review. *Internet Interventions* 4 (1), 72–81. <https://doi.org/10.1016/j.invent.2016.02.001>.
- Turner, J.C., 1985. Social categorization and self-concept: a social cognitive theory of group behavior. *Advances in Group Process: Theory and Research* 2, 77–121.
- UNRAE, 2019. Analisi del mercato autoveicoli in Italia [analysis of the motor vehicle market in Italy]. from. [http://www.unrae.it/files/Book%20UNRAE%202019\\_5e81efee08ac9.pdf](http://www.unrae.it/files/Book%20UNRAE%202019_5e81efee08ac9.pdf), Accessed date: 12 May 2020.
- Vagnoni, E., Moradi, A., 2018. Local Government's contribution to low carbon mobility transitions. *J. Clean. Prod.* 176, 486–502. <https://doi.org/10.1016/j.jclepro.2017.11.245>.
- Van Acker, V., Goodwin, P., Witlox, F., 2016. Key research themes on travel behavior, lifestyle, and sustainable urban mobility. *Int. J. Sustain. Transp.* 10 (1), 25–32. <https://doi.org/10.1080/15568318.2013.821003>.
- Van Malderen, L., Jourquin, B., Thomas, I., Vanoutrive, T., Verhetsel, A., Witlox, F., 2012. On the mobility policies of companies: what are the good practices? The Belgian case. *Transp. Policy* 21, 10–19. <https://doi.org/10.1016/j.tranpol.2011.12.005>.
- Vergragt, P.J., Brown, H.S., 2007. Sustainable mobility: from technological innovation to societal learning. *J. Clean. Prod.* 15 (11–12), 1104–1115. <https://doi.org/10.1016/j.jclepro.2006.05.020>.
- Whitmarsh, L., O'Neill, S., 2010. Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology, Identity, Place, and Environmental Behaviour* 30 (3), 305–314. <https://doi.org/10.1016/j.jenvp.2010.01.003>.
- Yigitcanlar, T., Mohamed, A., Kamruzzaman, M., Piracha, A., 2019. Understanding transport-related social exclusion: a multidimensional approach. *Urban Policy Res.* 37 (1), 97–110. <https://doi.org/10.1080/08111146.2018.1533461>.
- Zhang, Y., Yu, Y., Zou, B., 2011. Analyzing Public Awareness and Acceptance of Alternative Fuel Vehicles in China: The Case of EV. *Energy Policy, Asian Energy Security* 39 (11), 7015–7024. <https://doi.org/10.1016/j.enpol.2011.07.055>.
- Zhu, X., Wang, F., Chen, C., Reed, D.D., 2020. Personalized incentives for promoting sustainable travel behaviors. *Transportation Research Part C: Emerging Technologies* 113, 730–750. <https://doi.org/10.1016/j.trc.2019.05.015>.