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Mobility user profiling for tailored sustainable nudging. First insights from the GreenGo experience

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Abstract

This contribution presents GreenGo, a smartphone application designed to promote sustainable mobility habits through user engagement and a data-driven approach. In alignment with the European Green Deal's objectives for smart and sustainable mobility, GreenGo collects mobility data while incentivizing environmentally friendly travel behaviours in according with principles of behavioural economics and user profiling to implement targeted nudging techniques. The paper outlines the ongoing transition from traditional mobility services to modern, personalized, and data-informed approaches. Particular attention is paid to the challenges of mobility data sharing, including concerns related to user trust, transparency, and privacy, showing how well-designed incentive mechanisms can be applied to foster active participation. Unlike other similar initiatives, GreenGo is not only designed to reward sustainable travel behaviour, but also to acknowledge and value users' willingness to share mobility data—recognizing such data as a crucial resource for optimizing transport services and benefiting the broader community. This dual objective adds value in terms of user engagement as individuals feel empowered to contribute to the common good.

To enable effective personalization, GreenGo adopts a continuous profiling methodology that integrates dynamic sensor-based data processing with occasional questions delivered by in app cards. This dual-layered approach captures both observable behaviours and the underlying motivations behind travel choices, offering a more holistic understanding of user preferences and addressing the limitations of purely behaviour-based analyses. GreenGo aims to provide local authorities with actionable insights to support the transition toward more sustainable mobility patterns through personalized engagement and reward strategies.

Keywords: Sustainable Mobility, Data sharing, Behavioural Economics, Digital Nudging, User Profiling, Mobile Applications.

1. Shaping Smart and Sustainable Mobility

In response to the challenges posed by digital transformation and climate change, the European Green Deal has clearly outlined a path toward sustainable and smart mobility by 2050, aiming for a 90% reduction in transport sector emissions through a smart and sustainable mobility strategy (European Commission, 2019). The transport sector was heavily impacted by the 2020 pandemic emergency, with public transport still facing

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persistent challenges. Collective services were significantly restricted due to measures aimed at limiting the free movement of people and enforcing social distancing. These containment and mitigation policies—amplified by media alarmism—resulted in a widespread decline in user trust and interest in public transportation (Helfers *et al.*, 2022) (Marcysiak and Marcysiak, 2023). This situation has highlighted how public perception plays a fundamental role in determining the attractiveness and overall effectiveness of transport systems. Building on this background, the European Mobility Strategy (European Commission, 2020) is based on three core pillars, being the first two: 'Sustainable Mobility', aimed at providing viable alternative transport options, and 'Smart Mobility', identified to fully unlock the potential of data-driven innovation.

In summary, two key aspects emerge as fundamental in the implementation of smart and sustainable mobility strategies: the need for comprehensive mobility data collection together with the opportunities deriving from their effective use; and the central role of users and citizens, whose habits, perceptions, and preferences not only define the target of urban mobility strategies, but also represent the key to their success (Carreras *et al.*, 2012).

This contribution addresses the concept of mobility profiles (Anable, 2005), intended as clusters that group together individuals who share similar habits, opinions, and approaches to mobility. The underlying need is to tailor strategies and initiatives aimed at promoting more sustainable mobility patterns, by applying nudging techniques and rewarding virtuous behaviours. The presented case study is the GreenGo project, developed within the framework of the POR-FESR Liguria 2021–2027 programme. The project consists in the development of a tool designed to collect data on users' mobility habits, with the dual purpose of proposing more sustainable solutions tailored to each individual and rewarding their commitment and willingness to change. Additionally, the data gathered can be made available to local authorities to provide an accurate picture of transport demand across the territory, thereby supporting more informed decision-making processes. In particular, authors focus on how to involve users in their mobility data sharing and nudging toward more sustainable choices.

The following Section 2 outlines the shift toward personalized mobility services, emphasizing the role of mobility data and the challenges in collecting it, especially from the user perspective. Section 3 explores benefits, concerns, and motivational levers in data sharing, introducing mobility user profiles useful for targeted nudging. Section 4 presents GreenGo, a smartphone app that promotes sustainable behaviour through rewards and continuous profiling, combining sensor data with brief, contextual questionnaires to capture both behaviour and motivation.

2. Tailor-made mobility

Nowadays citizens are becoming increasingly aware of how their lifestyle, shopping habits, and travel choices impact the environment. At the same time, they are also highly conscious of the difficulties caused by mobility issues: congestion, lack of parking, and high costs. These challenges generate both social and individual costs, including longer travel times, increased stress levels, reduced accessibility for vulnerable populations, and financial burdens for users who may not have viable alternatives. As a result, mobility services are evolving to meet user needs more effectively, becoming increasingly personalized and flexible. This transformation helps

make sustainable mobility solutions more appealing and accessible, enhancing both individual well-being and social equity (Oberoi, 2024).

The urban environment plays a crucial role in the implementation of Smart and Sustainable Mobility Strategy. In the context of 'smart' mobility, the opportunities encompass the promotion and facilitation of intermodal mobility solutions, with the aim of ensuring a seamless and comfortable travel experience, even within fragmented tripchains. This includes features such as electronic ticketing and the development of integrated digital platforms.

2.1 Mobility data

The rise of increasingly personalised and targeted mobility solutions, together with the implementation of a user-centred paradigm around which to shape a new transport service ecosystem, has now become an undeniable reality. Compared to the past, when mobility data collected by transport operators were generally not linked to individuals, today's GPS-enabled devices, payment cards, and advanced ticketing systems allow for more efficient and cost-effective data collection. These data can be anonymised (Young Libby et al., 2018). However, the risk of re-identification persists — for example, when multi-ple datasets are cross-referenced (Kondor et al., 2018). This and other privacy-related concerns represent a barrier to data sharing, as users increasingly become aware of the sensitivity and risks associated with their personal information (Cruickshanks, 2013).

Different transport sectors have distinct methods and interests in data collection, with public transport operators increasingly exploring innovative data sources to optimize planning and operations. A study by Urbano, Arena, and Azzone (Urbano eta al., 2025) high-lights the use of big data from various sources (smart cards, mobile phones, vehicle data) to support decision-making in public transport management, emphasizing the diversity of data types and sector-specific needs. Among these, the sector that tends to collect the largest volume of user-related data is that of travel planners and Mobility as a Service (MaaS) providers. By definition, these operators aggregate multiple services and platforms, relying heavily on user-related data as a fundamental element of their functionality. Murati (2023) categorises the types of mobility data required for the effective operation of MaaS into three main groups:

- *Transport service data*, such as stop locations, schedules, prices and fares, seat availability, accessibility features, etc.;
- *Contextual data*, related to traffic conditions, weather, and special events;
- *Demand data*, referring to users' mobility habits, preferences, and needs.

While the first two categories of data can, in principle, be sourced from libraries, databases, or information shared by transport operators and local authorities—often not without significant challenges and resistance (Murati, 2023)—demand data, by contrast, involve more private aspects of the user and are therefore more complex to collect, manage, and share. These data can be obtained through varying degrees of user awareness in terms of consent and sharing.

2.1 Data sharing

Most studies addressing the issue of mobility data sharing tend to focus on the problems arising among transport service providers (often in competition with each other) or

those related to the communication between public and private actors. Few authors, however, explore the issue from a user perspective. For example, Butler et al. (2021) in their analysis of barriers and risks associated with MaaS adoption, classify data and security concerns as supply-side barriers (rather than demand-side, as might be intuitively expected). From the user perspective, they note that the main concern is the potential misuse of personal and payment information, which could result in personal or financial security threats. There is growing awareness among individuals that their personal data has value and must be protected from entities that could exploit it for unlawful purposes. Drawing on broader studies of data-sharing barriers, Murati (2023) identifies five types of obstacles in the MaaS context: technical, motivational, economic, legal, and ethical. As commonly noted in the literature, these challenges primarily concern data sharing between transport operators and reflect their perspective—largely neglecting the user's point of view.

Only a few studies have examined users' willingness to share location data. Kayikci and Kabadurmus (2022), in their literature review of MaaS adoption barriers, address the issue of service acceptability and point out risks of data loss, manipulation, and theft. Similarly, Bokolo (2023), in assessing the adoption of electric and shared mobility, highlights the need to ensure the confidentiality of travel data in compliance with privacy regulations. Kondor et al. (2018) demonstrate that even anonymised mobility datasets can pose significant privacy risks. When combined with other data sources, these datasets may enable re-identification of individuals and lead to potential misuse of personal information. Ekpo et al. (2024) offer a comprehensive review of security and privacy issues in MaaS, identifying recurring concerns such as data security, insider threats, identity management, and broader implications for user privacy and trust in data-sharing practices. Finally, Monreale and Pellungrini (2023) focus on the risks associated with the collection and processing of mobility data. Their work presents concrete methods for reducing the likelihood of user re-identification, proposing privacy-preserving solutions to address the increasing tension between data utility and user protection.

3. Sharing mobility data. Benefits, concerns and leverages

The transportation sector has undergone a significant transformation from being data-poor to data-rich, a shift that offers notable benefits but also raises concerns related to data management and privacy. The Open Data Institute (Ctrl-Shift, 2018) identifies three primary advantages of leveraging personal travel data: (i) enhanced accessibility and personalization for users, (ii) improved efficiency and innovation for organizations, and (iii) the capacity to address systemic transportation issues, ultimately benefiting society. These benefits can lead to improvements in transportation services and quality of life; however, they are heavily dependent on user trust. Without trust, and without users' willingness to share their personal information, the potential to optimize transportation systems remains limited.

Some studies highlight the advantages of collecting user data across different aspects of transportation. Chan et al. (2020) focus on the use of GPS tracking to improve public transportation services, while Kong et al. (2019) discuss the benefits of user data in the context of Smart City applications, particularly for Smart Navigation and Smart Transportation. Casquero et al. (2022) outline how the collection of user data can enhance passenger experiences by optimizing travel times and enabling crowdsourced

traffic reporting. Not only public transportation systems, but also operators of other transport modes, such as railways, car-sharing services, and bike-sharing systems, benefit from the collection of user data. These operators use data on ticket purchases, boarding and alighting points, travel times, and service usage to improve their services. For instance, sharing services are based on monitoring usage patterns, gathering substantial data that can also be utilized by local authorities and other stakeholders to improve the urban mobility ecosystem. However, travel planning services, such as for example Google Maps, Moovit, and Citymapper, represents one of the closest relationships between users and service providers in terms of data sharing (Tavmen, 2020). These apps collect data either anonymously or linked to user profiles, and it is essential that users retain control over their data privacy. The collection of location data is typically performed for three main purposes: (i) to personalize the user experience, providing real-time traffic updates, nearby public transport stops, service disruptions, and route suggestions; (ii) to improve services for other users through the collection of real-time data on traffic conditions, crowding on public transport, and service interruptions; and (ii) for user profiling and targeted advertising, often in collaboration with third-party providers.

It is crucial that service providers establish a relationship of trust with their users, as three key factors influence users' willingness to share their data: (i) the presence of trust between the user and the service provider, (ii) transparency in the use of data, which allows users to understand how and by whom their information is being used, and (iii) the awareness that their data sharing will lead to benefits, either for themselves or the broader community.

Studies on the acceptability of sharing personal data for mobility services are relatively few, with most focusing on the willingness to use services rather than the willingness to share data. Apanasevic and Rudmark (2021) suggest that the greatest barrier to the use of user data is the perceived loss of anonymity. As transportation systems traditionally operated anonymously, without requiring specific user information, the shift towards innovations like trip planners and electronic ticketing systems introduces passenger tracking, necessitating a change in habits that users may find difficult to accept. To address this, authors suggest focusing on two key issues: offering adequate incentives for users to share their location data and ensuring transparency in data usage while obtaining user consent at the outset of app usage. Financial incentives, transparency, and trust have in fact been highlighted as crucial factors in encouraging users to share their data. Brückner (Brückner, 2022) investigates the role of financial incentives, which are seen as a perceived benefit alongside personalization, convenience, and gamification.

The available literature on crowdsourcing provides useful references to understand the main concerns that arise in this domain. Crowdsourcing is a data collection technique that relies on the voluntary contributions of user groups, such as citizens, who are willing to contribute to the development of a specific project, with the advantage of involving large numbers of people and thus large amounts of data (Nandan, Pursche and Zhe, 2014).

With the advent of portable devices, crowdsourcing has gained various possible applications and sources of information—Mobile Crowdsourcing (MCS)—raising questions about the use of data provided by users (Kong *et al.*, 2019) emphasize the potential of crowdsourcing to improve public transportation planning and private mobility services, such as personalized trip planning and parking space forecasting.

Nevertheless, some issues in user willingness to share are identified, mainly related to the trade-off between data accuracy and resource consumption, as well as privacy risks. Also Nandan et al. (Nandan, Pursche and Zhe, 2014) identifies several barriers to user participation in crowdsourcing, including privacy concerns, device limitations, and network constraints.

Motivating user involvement in crowdsourcing initiatives can be achieved through various strategies, such as offering direct benefits, forming a critical mass of participants, and automating the data-sharing process. Benefits, such as financial compensation or rewards, can encourage users to share their location data, but these incentives need to be sustained over time to prevent service abandonment.

Casquero et al. (2022) also examine persuasive strategies to encourage the use of urban travel applications, which often involve data sharing. These strategies include offering rewards, badges, challenges, social comparisons, and feedback mechanisms. These strategies can help maintain user engagement, especially when incentives are tied to ongoing participation. The study also addresses the issue of the app churn, reporting that a significant percentage of users stop using applications after the initial phase. To mitigate this, creating a sense of community or collective goal-setting can help sustain interest in the service. Social tools, such as the ability to connect with friends or participate in community-based challenges, can promote continued use.

From a privacy perspective, concerns about data sharing are perceived differently depending on users' age and habits. Younger individuals, often more familiar with technology, tend to be less concerned about privacy risks, while older users express more reservations due to a lack of understanding of the potential dangers. Trust and transparency play a key role in alleviating privacy concerns, as individuals are more likely to share their data with trusted service providers. Becker et al. (Becker *et al.*, 2021) also identify other privacy-related factors, including the need for companies to explain why data is collected, how it is used, and how it is stored. Ensuring security and accountability, particularly in preventing unauthorized access and data breaches, is another crucial element in building user trust.

The barriers to sharing mobility data are varied and depend on individual characteristics, user needs, and perceptions, all of which can evolve over time. These barriers can be classified into three main categories: privacy concerns, technical challenges, and lack of engagement. To encourage data sharing, it is important to balance the perceived benefits with the risks, offering economic, social, or gamified incentives while maintaining transparency and control over the data collection process. Understanding the specific characteristics of different user segments is essential for designing effective nudging strategies that motivate users to share their mobility data and engage with mobility services.

3.1 Mobility behaviours and profiles

Recent studies (Becker et al., 2021) highlight the importance of segmenting users based on their mobility preferences and behaviours, such as Bus Dependents, Car-Predisposed, Non-motorized Lovers, Autonomous Environmentalists, and Motorbike Enthusiasts. These profiles provide valuable insights into the most effective nudging techniques for different user groups. Economic incentives are particularly effective for younger individuals and women, while non-economic incentives have a stronger impact

on non-motorized users and public transport users. Social tools, however, have limited relevance across user groups.

Forbes et al. (2014) drawing on the work of Anable (2005), present an alternative categorization system for user behaviours to identify different behavioural levers. Specifically, they distinguish between:

- *Devoted Drivers*: these individuals believe that successful people drive, and they have no intention of reducing car use. They dislike using public transport (PT), find cycling uncomfortable, and walking too slow. They are unconcerned about fit-ness or the environment.
- *Image Improvers*: they enjoy driving and do not wish to reduce car use, dislike PT, but view cycling as a good way to stay fit. They have moderate environmental awareness and are open to using active mobility more frequently.
- *Malcontented Motorists*: these drivers are unhappy with driving but still prefer it over cycling. They find issues with using PT and have low environmental awareness. A significant percentage of female drivers belong to this category.
- *Active Aspirers*: they want to reduce car use and agree that buses may be faster, although they encounter issues with public transport. They identify as cyclists and consider walking healthy. They feel a strong moral obligation toward the environment and are highly motivated to use active transportation modes.
- *Practical Travelers*: they use cars only when necessary, believing that cars degrade quality of life. They enjoy cycling and walk when it is more practical than cycling. They are concerned about local pollution and congestion but are not motivated by climate change. they do not intend to reduce car use or increase PT use.
- *Car Contemplators*: these individuals view cars as a status symbol and believe that car use should be unrestricted. They prefer buses over bicycles but encounter problems with PT. They have a neutral attitude towards the environment and are not motivated by fitness. They tend to be younger, with a high proportion of students in this category.
- *Public Transport Dependents*: they dislike driving but believe people should be allowed to drive and would prefer to travel by car more frequently.
- *Car Free Choosers*: they dislike driving and view cars as contributing to unhealthy lifestyles. They believe car use should be reduced and have no issues with using public transport. They favour active mobility and are eager to use active transport modes.

4. Case study: GreenGo

The aim of this work is to emphasize the value of mobility data by explicitly incorporating the user perspective, with the goal of identifying potential levers for promoting data sharing and encouraging the adoption of more sustainable travel behaviours. As highlighted in the literature, a key factor lies in ensuring fair user compensation and building trust between data owners and data users.

These objectives are at the core of the GreenGo project, which seeks to actively engage users in more sustainable mobility practices. Unlike other similar initiatives, GreenGo aims to reward users not only based on their travel behaviours, but also for their active contribution to data sharing—recognizing the value of the information they

provide and encouraging citizens to contribute to the common benefit of better mobility services and planning.

In this context, profiling mobility behaviour is essential to better understand users' choices and habits, and to effectively apply nudging techniques toward more sustainable modes of transport. GreenGo moves beyond static and dynamic techniques by adopting a continuous profiling approach, combining sensor data and user-smartphone interactions to more accurately align mobility profiles with users' characteristics.

The GreenGo project is developed within the framework of the POR-FESR Liguria 2021–2027 programme, an EU co-funded programs that support regional development through initiatives focused on innovation, digitalization, sustainability, and business competitiveness. In line with the abovementioned principles of smart and sustainable mobility, the GreenGo project pursues two main and complementary objectives:

- Data collection on user mobility: to provide local administrations with an increasingly reliable database supporting the planning of services and strategies aimed at enhancing the efficiency of mobility services and achieving goals such as the green transition and emissions reduction. Data sharing is strictly limited to public authorities, with blockchain technologies employed to build user trust.
- Application of nudging, gamification, and rewarding mechanisms: based on continuous profiling of users' habits, choices and underlying motivations, with the aim of encouraging virtuous behaviour, fostering a shift toward more sustainable choices.

This is achieved through a mobile application that users can download and install on their smartphones. After registering and providing consent to activate location services, the application uses specific algorithms to collect: (i) quantitative data on users' movements, such as distances travelled, times, and speeds; (ii) data regarding the mode of transport; and (iii) information on the routes taken. These data are complemented by additional inputs provided manually by users, including demographic information, manual tagging of trips, and responses to flash questions or in-app surveys. The collected information not only enriches the dataset available to public administrations for mobility planning but also supports the identification of user mobility profiles by characterizing their travel behaviours and decision-making patterns. This, in turn, enables the implementation of tailored nudging and rewarding strategies.

However, the availability of data—and consequently, the ability to accurately identify mobility profiles and assign the most appropriate engagement strategies—depends on the level of sharing chosen by the user. Users can decide the accuracy and granularity of the information they provide. The quantity and type of data shared significantly influence the algorithm's ability to correctly assign a mobility profile, and therefore the potential benefits users may receive.

At its current stage, the GreenGo smartphone application is being tested internally by the research team, primarily to assess pattern recognition algorithms and their applicability within the local context. The next phase will involve a pilot study with a broader academic community to evaluate the scalability of the continuous profiling approach and to better align the service with end-user expectations and needs.

4.1 User engagement and profile validation methodology

As outlined in Section 3.1, the assignment of a mobility profile to each user is crucial both for guiding more sustainable choices and for assessing users' propensity for

behavioural change. The assignment to a specific profile is primarily based on individuals' travel habits, such as their preferred mode of transport for regular trips, their willingness to use public transport, and their attitudes toward active mobility.

In GreenGo, the main source of information derives from the tracking of users' trips, with precision and frequency depending on the level of data sharing selected by each user. For example, individuals who regularly commute by private car are likely to be classified as *Devoted Drivers* rather than *Car-Free Choosers*. However, how can we be sure that their use of the car reflects a true preference, rather than a reluctant acceptance of the only available alternative, thereby indicating that they may actually belong to the group of Malcontented Motorists?

When assigning a mobility profile, it is essential to go beyond the mere observation of behaviours and to capture the underlying motivations driving these choices. This requires considering socio-demographic characteristics, social influence, as well as users' opinions and attitudes toward technological innovation and sustainable mobility.

To address this complexity, the GreenGo project adopts a mixed profiling approach that combines dynamic profiling — based on the continuous collection of mobility data from users' trips — and static profiling — based on questionnaires and flash cards designed to investigate specific topics and assess users' choices and characteristics.

Since users' habits and preferences are expected to evolve toward more sustainable behaviours over time, and given the dual nature of the profiling approach (static and dynamic), the GreenGo profiling method is defined as continuous.

Focus group and statistical survey. Following an user-centred approach, user experience and interface must be tested to ensure alignment with end-users' expectations and needs. Specific activities involving potential users will be conducted to assess the system's acceptability and, if necessary, to adapt its configuration accordingly. The evaluation will also investigate users' willingness to adopt the service, their readiness to share mobility data, and will include an initial verification of the consistency be-tween the shared data and the assigned mobility profile.

From a methodological perspective, the project plans to implement engagement and involvement with potential users, aimed at validating behavioural hypotheses while simultaneously gathering information to support the app's development in terms of technology acceptance, user experience, and perceived barriers. To ensure that the investigation is effectively aligned with the development phases, specific user targets will be identified and engaged through different research methods.

During the research and development phase, the analysis will include both a focus group and a statistical survey designed to assess users' propensity to adopt mobility apps, their willingness to share mobility data, and the consistency of their behaviour with the previously described mobility profiles.

The focus group will specifically involve university students under the age of 25 from the city of Genoa, Italy, divided between public transport users and non-users. Given the expected higher familiarity with technology among this group—due to both their age and educational background—the activity will focus on evaluating the application's interface and user experience (UI/UX), including testing experimental versions of the app.

Conversely, the CATI (Computer-Assisted Telephone Interviewing) survey will target a nationally representative sample of individuals over the age of 25. This group is generally considered less familiar with new technologies and less willing to share

personal data, therefore, the survey will specifically investigate their attitudes toward data sharing, perceived barriers, and potential incentives.

The issues around the mobile application usage, mobility data sharing, and behavioural profile assignment will be common across all stages of investigation.

Methodologically, the insights gained from these activities will serve as a foundation for designing the questionnaires administered to GreenGo users that will be presented in the next sub-section. Together with the results from dynamic profiling based on sensor-collected mobility data, these inputs will contribute to refining the mechanisms for assigning mobility profiles to users with continuous profiling.

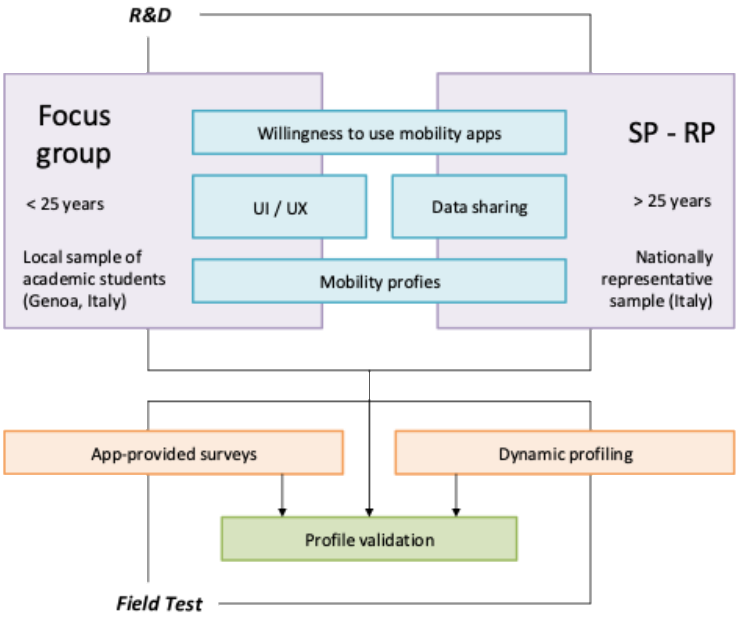

Figure 1: Summary diagram of user engagement and mobility profile validation.

4.2 Questionnaire

The survey posed to interviewees will serve as a test for the subsequent shortened questionnaire to be presented during user registration phase, as well as for the questions that will be periodically proposed as *cards* to users during the normal operation of the smartphone application. These tools will have a double purpose: verifying users' mobility profiles over time and maintaining their engagement to prevent app churn.

The main objective is to gather sufficient information about the motivations behind users' transportation choices, thereby enabling a better characterization of the mobility data collected through the smartphone's sensors. The questionnaire covers the following areas:

- *General information,* to define the socio-demographic characteristics of the sample.
- *Daily habits,* to better understand users' behavioural patterns in everyday life.
- *Mobility choices and motivations,* to identify the reasons behind the selection of one or more transportation modes.
- *Perceptions and barriers toward sustainable mobility,* to assess possible obstacles and attitudes regarding the topic.

- *Opinions and vision,* to explore users' expectations and perspectives on mobility evolution.
- *Technology and data sharing,* to evaluate the acceptability of digital tools and the willingness to share mobility-related information.

The questionnaire is designed to encourage users to answer as sincerely as possible, minimizing the likelihood that responses are influenced by the desire to appear more virtuous in order to obtain a reward. To achieve this, respondents are presented with enriched scenarios, including images, that help them immerse themselves in realistic situations and respond according to how they would actually behave. Additionally, some questions apply the personas method to define user profiles while removing the element of judgment. The personas are carefully crafted to minimize the risk of social desirability bias or the tendency to choose the "best" or most socially acceptable profile.

Questionnaire scoring. Each option in a selection of targeted questions is rated according to how well it reflects the behaviour of the identified mobility profiles. Points are assigned to each option on a scale from 0 - no alignment - to 3 - strong alignment. For instance, responses indicating a preference for driving and a lack of intention to reduce car use are associated with motorized profiles. In contrast, answers showing a willingness to adapt behaviour based on the context or to choose the most convenient transport mode are more likely to align with the active aspirer or the practical traveler profile, and so on. Each user is assigned the mobility profile that achieves the highest score, calculated from the sum of the scores of their questionnaire responses. Following fig. 2 shows example of the scoring system.

Question	*Principal mean of transport to work*			
Answer	Private car	PT	Bicycle	Car sharing
Profile	**Score**			
Devoted driver	3	0	0	2
Image improver	3	2	1	3
Malcontented motorist	3	1	0	1
Active aspirer	2	3	3	2
Practical traveler	1	3	3	1
Car contemplator	0	1	3	1
Public trasport dependent	0	1	2	1
Car free chooser	0	3	3	2

User XX					
Question	*Q1*	*Q2*	*Q3*	*Q4*	Total
Answer	b.	c.	a.	b.	
Profile	**Score**				
Devoted driver	3	1	0	0	4
Image improver	1	2	0	2	5
Malcontented motorist	1	2	2	0	5
Active aspirer	3	2	1	0	6
Practical traveler	1	1	3	1	6
Car contemplator	0	1	2	1	4
Public trasport dependent	2	2	3	3	10
Car free chooser	0	2	2	1	5

Figure 2: Scoring system for assessing user mobility profiles based on questionnaire responses. (left) Each answer option from selected questions is rated on a scale from 0 to 3. (right) The user's corresponding profile is the one with highest score based on their answers.

These questions are administered in two key stages: first, during the registration phase to establish the user's initial profile, and second, during usage, to assess mobility habits and monitor any changes. This subsequent assessment phase is achieved through the occasional distribution of *cards* – short, randomized questions that require the user to answer one or two optional questions. This system aims to engage actively those users most motivated to contribute, while also providing a discreet opportunity for the attention of less inclined users, without imposing obligations. To encourage both information sharing and openness to behavioural change, the abovementioned reward mechanisms will be used to encourage users in active contribution.

5. Discussion – Continuous profiling in GreenGo

As introduced in Section 1, mobility is undergoing a transition toward smarter and more sustainable models. This shift entails two key aspects: on one hand, fully leveraging the potential of data (as discussed in Section 3 in terms of opportunities, barriers, and enablers); on the other, the crucial role of users and citizens, whose habits and choices can drive change. Various strategies can promote sustainable behaviour, especially in the digital and IoT era. Smartphone applications, specifically designed for this purpose, offer strong support (Tancredi et al., 2024). While most studies focus on behaviour-change techniques, GreenGo distinguishes itself by highlighting the value of user mobility data. Sharing data becomes, itself, a sustainable practice to be encouraged alongside more familiar goals like reducing private car use or increasing active mobility. In fact, GreenGo aims to enhance transport system efficiency and, consequently, sustainability by collecting data from everyday users. Unlike most mobility services that use user data without acknowledgment, GreenGo fosters transparency and trust by allowing users to choose the quantity and granularity of data they share, while also rewarding data sharing as a valuable contribution. These incentive mechanisms can be supported by mobility providers or public administrations, both of which benefit from improved transport efficiency and reduced externalities.

To tailor persuasive strategies, GreenGo adopts a continuous profiling methodology that combines passive sensor data with occasional questionnaire responses. Traditional segmentation based on socio-demographics has evolved toward more sophisticated approaches focused on attitudes and motivations. European projects like SEGMENT have demonstrated the effectiveness of such segmentation (Anable and Wright, 2013), and more recent work (Semanjski and Gautama, 2016) has advanced automatic profiling through crowdsourced smartphone data—minimizing user effort while maximizing insight.

GreenGo leverages these advances through dynamic user profiling based on travel behaviour and periodic survey responses. These surveys draw on the concept of Golden Questions (Anable and Wright, 2013) a set of 18 selected questions that can be used to infer user mobility profiles form a standard questionnaire. Unlike traditional fixed-question formats, GreenGo deploys questions gradually and contextually—for example, through scenario-based cards that prompt realistic responses ("It's raining today, there's a transit strike—what do you do?"). This approach, together with the scoring point aim at detecting user prevalent mobility profile, based on his answers to the set of questions, reduces bias toward socially desirable answers and enhances engagement.

GreenGo delivers a quick, optional, yet robust question set that validates or updates data-driven mobility profiles from dynamic profiling. Integrated with its persuasive system, it rewards not only sustainable behaviours but also users' willingness to share valuable information for the benefit of the broader community.

6. Conclusion

This contribution presented GreenGo, a smartphone application that addresses the dual challenges of promoting sustainable mobility habits and involve users in their mobility data sharing. By examining the evolution of transport systems authors identified the critical role of comprehensive mobility data and active user participation in achieving smart and sustainable mobility goals.

The transition toward personalized mobility services, highlights the increasing importance of user data while raising significant privacy and trust concerns. Authors revealed that users' willingness to share mobility data depends on three key factors: trust between users and service providers, transparency in data usage, and perceived benefits from data sharing. In this context, the GreenGo project is presented, which distinguishes itself through its innovative approach to user profiling and incentive mechanisms. The project's continuous profiling methodology combines dynamic sensor-based data collection with targeted questionnaires, capturing both actual behaviours and underlying motivations. This approach enables more effective user segmentation and personalized nudging strategies.

Unlike conventional mobility applications that use data without acknowledgment, GreenGo recognizes data sharing as a virtuous behaviour deserving incentivization.

This experimental project requires further research to validate both the profiling methodology focusing on quantitatively assessing the accuracy of profile assignments and measuring the effectiveness of tailored nudging strategies in promoting sustainable mobility behaviours. Additionally, researchers might explore new user profiles specifically related to willingness to adopt innovative, data-driven mobility services.

By recognizing the value of both sustainable travel choices and data sharing, GreenGo offers a holistic approach to addressing urban mobility challenges. This integrated strategy has the potential to create a virtuous cycle where better data leads to improved services, which in turn encourages greater user engagement and more sustainable transportation choices, ultimately benefiting both individuals and communities.

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