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Shared practices and experiences of University Mobility Management. Exploring scalability at the municipal level

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Abstract

Mobility management (MM) gained importance to improve urban transport flows' efficiency, aiming at reducing private mobility's externalities such as congestion, emissions and land consumption. The focus is on encouraging citizens to develop more sustainable travel habits, considering that commuting generates the most significant impacts. For this reason, MM strategies prove beneficial when shared between companies operating in the same area. Such collaboration is rare due to the specific features of each company, with data collection for mobility planning emerging as one of the most critical challenges. Universities are a particular case because they daily attract both: students and workers. Italian universities are collaborating to achieve common practices in MM. One of these actions consists in the elaboration of a common questionnaire for the survey of mobility habits, to collect a set of data comparable between different kind of institutions and urban contexts, and to share best practices in MM policies and interventions. University communities address these issues as students are directly affected by urban transport and are often interested in developing sustainable practices. This contribution explores how they can be a source of good MM practices that can be transferred and shared with companies and institutions in the same area. In particular Mobility as a Service (MaaS) would be investigated. When talking about data collection and changing mobility habits, MaaS emerges as a useful tool for both goals. Experiences within academic communities could help to better design the service based on users' needs for example by considering which mobility services should be included, balancing costs and incentives, and assessing the acceptance of participants to systematically share their travel information. This can lead to more consistent data collection, resulting in more efficient management of flows and better targeting of future interventions.

Keywords: Mobility Management; Mobility-as-a-Service; University Community; Data-Driven

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1. Introduction

It is well known that cities are pivotal engines of territories, ultimately delivering agglomeration economies, increasing accessibility and productivity, and creating dense concentrations of households and businesses. But while urbanization is a key driver of growth and development in modern countries, it is not all positive: while cities account for around 60% of global GDP, they are also estimated to be responsible for around 70% of global carbon emissions and over 60% of resource use, and transport in particular contributes to significant negative externalities - noise, air pollution and congestion. Such assumptions allow us to invest in innovation and implementation of sustainable mobility on a global scale. There is no real definition of sustainable mobility, although perhaps one of the most widely accepted is that of the World Business Council for Sustainable Development, which describes sustainable mobility as that which meets society's needs for freedom of movement, access, communication, trade and relationships without compromising other essential human or environmental needs, now or in the future (2004). Considering negative contribution of daily transport, the interest of companies in the mobility of their employees has steadily increased in recent years, thanks to the operational benefits that mobility can bring, government regulations and/or incentives, and their altruistic sense of responsibility (Cairns et al., 2010; Enoch and Potter, 2003; Roby, 2010). As Mobility Management (MM) is one of the most widely used approaches to manage and organize the demand for mobility in a sustainable way, a new figure of the so-called "Mobility Manager MM" has emerged in the largest companies and local authorities to facilitate the implementation of mobility policies (Vanoutrivespi et al., 2010), and an increasing number of them have implemented an Employer Transport Plan (ETP) to reduce the number of employees commuting alone by car. Universities, as public administrations (and, in fact, territorially very extensive), are also involved in such measures, also claiming a leading role in raising the awareness of a very inclusive community that covers new young generations (Delponte et al., 2022). The MM's role is to define the trade-off between mobility demand and supply and then to identify the interventions that can be implemented according to the infrastructural conditions of the area: to get to the heart of the MM's work, concrete actions may be the introduction of car-pooling and car-sharing solutions, the implementation of a collective company service or incentives for the use of public transport or alternative vehicles such as bicycles and electric scooters. In addition, a company can choose to introduce smart working solutions, change working hours through differentiation and make shifts more flexible. In fact, commuting was one of the many aspects of our lives that were profoundly changed by the Covid-19 pandemic: it was during this period that we saw how MM also became part of corporate welfare policy (Babapourdijojin and Gentile, 2024). Fewer research explored the nature and effects of the mobility managers' role or some papers dealt partly and occasionally with the issue. Concerning the impact of the mobility managers on the commuting behavior of employees, (Chorus et al., 2006) stated that such a role may be useful to correct the misperceptions transit by travelers; but, generally, the impact may be indirect through the measures he/she implement, depending mainly on the level of his/her involvement (Van Malderen et al., 2013, 2012). Furthermore, from a legislative point of view, the role of MM is not yet precisely defined, as well as the content and limits of the effectiveness of Commuting Plans (CP), although, as already mentioned, sustainable mobility has greatly increased its sphere of influence. The lack of transport data seems to be the crucial barrier to be overcome to make MM and CP more incisive. To respond to this gap, Mobility-as-a-Service is advocated as a new tool that will allow (and in some cases already does) 1. users to commute daily more conveniently and comfortably through an integrated service of travel planning and overarching ticketing, and 2. planners to get information about mobility habits that are systematically tracked and recorded. Within this framework, the paper aims to explore the role of universities as a committed community in the implementation of MM policies (section 2) and the use of MaaS as a key tool in the collection of data and the application of the resulting policies (4). In section 3, University of Genoa case-study is used to analyze the quantitative results to draw meaningful conclusions (5).

2. The role of universities in Mobility Management

Schools and universities play a significant role in increasing mobility load, with the latter being responsible for the majority of commuting, which is recognized for its impact on urban traffic management. Also, university commuting has been proven to be its most relevant impact on the environment (Tolley, 1996). Universities consist in an interesting case since they gather both students and workers, which have different habits, needs and opportunities. De Angelis et al. (2021) state that for short to medium commuting trips, students are more likely to use sustainable modes of

transport. In contrast, professors and administrative staff, whose commuting behavior differs in terms of timing and regularity, are more likely to own a car and tend to be influenced towards its use, especially in case of family needs. Also, Longo et al., (2015) illustrate how employees are more concerned about travel time, while students consider transport costs and generally have variable travel times, they also make transfers between multiple locations within a typical day. Hidalgo-González et al., (2022) suggests that the academic community is increasingly oriented towards active and sustainable mobility, not only during their time studying or working at the university, but also in their later lives. Therefore, these types of institutions prove to be strategic for testing sustainable mobility strategies. Moreover, younger people, who constitute a significant portion of the academic community, are often more interested in environmental issues and tend to be early adopters of new technologies (Szmelter-Jarosz and Suchanek, 2021). Technological progress led to the proliferation of new forms of mobility – such as shared one – characterized by high levels of connectivity and real-time data sharing. Similar innovative solutions requires indeed massive mobility-related data collection, to support responsive design of transport services and enable effective MM. Efforts made by providers and administrations to digitize the public transportation sector, along with widespread connectivity networks, facilitate the acquisition of the information needed to monitor and manage urban traffic. However, the presence of numerous modal forms, even if interconnected and digitized, contributes to a fragmentation of the travel chain. This abundance also introduces additional actors as data owners, thus complicating the process of journeys' analysis for urban mobility planning and hampering mobility management flows. MM concept was firstly introduced in Italy in the late 1990s as a soft measure to improve transport planning, with a focus on home-to-work travel. Present decree stated that, companies with more than 300 employees per local unit should appoint a Company Mobility Manager, whose main responsibility is to develop Company Commuting Plan, thus contributing to the global sustainable transition of urban mobility (Ministero dell'Ambiente, 1998). Italian legislation also introduced the role of the Territorial Mobility Manager whose purpose is to coordinate and integrate actions proposed by each Company Mobility Manager across the territory under its competence (Ministero dell'Ambiente, 2000). Over the years, MM concept has been widened to include school environment, too. School Mobility Manager was introduced with the aim of rationalizing students' and staff mobility through the analysis and strategies implemented by School Commuting Plan (Presidenza della Repubblica Italiana, 2015). Similar upgrade required to consider a multiplicity of users with varying needs and preferences, including both workers and students. It has to be said that, despite the diversity among these categories, they do not exhibit significant differences in travel habits, as their journeys are often aligned with school schedules. As far as universities are concerned, instead, as was mentioned above, variety of users represents a quite relevant challenge in terms of Mobility Management. Moreover, given that Italian legislation does not foresee this case, University Mobility Manager acts as a combination of both company and school ones. While the latter can rely on proper definitions and guidelines for their competences and activities, University Mobility Manager is not considered by Italian legislative framework which raises the question of which ones should they comply to. Considering students, academic and administrative staff mobility within a common plan is thus particularly challenging since it is important to find a balance between tailored measures and shared solutions to be scalable and transferable to other urban contexts. At the same time, while each institution has its own unique characteristics, universities show common features and roles within the territories they inhabit. Whether structured into campuses or spread throughout urban areas, starting from their common triple goal of education, research and territorial dissemination (the so-called 'third mission'), they share the ability to attract large numbers of people and concentrate investments aimed at facilitating their mobility, given also their impact on the local transport system. To support strategical and coordinated actions, as well as best-practices sharing and transfer, universities join national and European alliances, thus enhancing mutual relations. At the same time, they develop deep and enriching exchange with the territories in which they are located, due to their innovation and educational role and responsibilities. Strategies for sustainable urban mobility and knowledge transfer can be part of the 'third mission' that academic institutions aim to fulfil in addition to education and research activities. This prompts universities to engage in dialogue and cooperation. to promote strategies upscaling and best practices enhancing the experience of the entire academic community while mitigating the impact of their respective movements within surrounding areas.

2.1 Mobility as a Service for data collection of the academic community

The emerging trend of Mobility-as-a-Service (MaaS) could support sustainable transition of transport systems, as well as gather useful information for MM, thanks to its strongly data-driven nature. MaaS integrates various forms of mobility and related services in a single platform characterized by a user-oriented approach, aiming to reach connectivity, accessibility and affordability requested by latest transport policies (MaaS Alliance AISBL, 2017). MaaS can integrate public and private modes of transport giving users tailor-made services at convenient and combined fares. A MaaS service does not provide additional transport capacity but rather integrates existing transport modes (ERTICO - ITS Europe, 2019). Public transport is usually the backbone of the system, that also includes shared mobility, ride-hailing, parking services, and so on. The services provided for users include journey planning, even across different modes of transportation, ticketing information, and payment for every step of a multi-modal trip. This can be executed as a pay-per-use scheme, or a subscription based on users' travel past and future trips. The system can in fact calculate the best applicable fare without requiring the user to make the effort of planning in advance to choose a season ticket. Additionally, users can receive information about possible delays or changes in their journey. Data are strategic for MaaS operability, specifically for optimal routing, information about combined mobility solutions in a given moment and for a certain user, for retrieving shared vehicles availability and their booking, to provide real-time information. MaaS providers serve as both data users and generators. They require data to organize services for customers and also have the potential to collect real-time information about users' journeys. It is acknowledged that public and private companies are often reluctant to share their data. Private companies may be concerned about competitiveness, while public transport operators may face challenges due to limited resources, both financial and human, for data management, as it may not be their primary focus. At the same time, data gathered by MaaS providers could be valuable for MM and transport planning (MaaS Alliance AISBL, 2018). A significant advancement in data sharing will be taken with the MaaS4Italy project that was promoted by the Italian Department for Digital Transformation (DTD) with the support of the Ministry of Infrastructure and Transport (MIT). MaaS4Italy aims to experiment MaaS in different territories, with the State acting as a regulatory body for the definition of rules and standards, as well as an enabler by directly contributing to the implementation of an open and shared platform for the integration of mobility data and services ("Mobility as a Service for Italy," 2023). Achieving a high level of standardization in data collection, management, and mobility strategies requires significant effort, expertise, and funding. For this reason, Maas4Italy has selected three pilot cities and seven territories to harmonize local-based experiments under a common national layer. In fact, although many MaaS initiatives are emerging, full implementation is still far due to regulatory and technological barriers. (Le Pira et al., 2023). Also, according to Caballini et al., (2023), MaaS experiences are unique and tied to their own local cultural, behavioral, and infrastructural context. It is then important to balance the top-down and bottom-up approaches to address the specificities of each experience, while allowing to identify commonalities and perform transferability and efficiencies at larger scales. An example of single MaaS initiatives performed accross territories can be seen in Corporate MaaS (CMaaS) that emerged as the application of MaaS to Corporate Mobility, offering a service provided by employers for their workers. This service aims to both enhance working conditions and contribute to smart and sustainable mobility (Amaral et al., 2021). Hesselgren et al., (2020) propose CMaaS as a sandbox for MaaS experimentation in work sites or campuses. They assume that working places have limited area and more control over users, which limits variables or barriers that wider scale implementation could present. It is also noted that CMaaS offers the opportunity to develop a well-functioning MaaS system by learning from employees' habits, thus permitting to define more personalized services for end-users. In this context, universities provide such a protected and controlled environment, similar to the one proposed by Hesselgren et al., (2020) to explore the potential of MaaS with fewer variables than in an urban context. However, the diversity of users, including professors, administrative staff, and students, each with their unique characteristics, habits, and needs, give the experimentation a level of reality that is difficult to achieve in a typical corporate setting. Furthermore, universities are interconnected and can collaborate to share best practices, both among themselves and with the surrounding communities. It is important to note that universities play a crucial role as key stakeholders in MaaS4Italy. Their involvement addresses the critical need for data standardization in bottom-up MM and MaaS experiences. In this regard, experimenting MaaS within university settings enables the scalability of internally applied strategies, promoting sustainable mobility across larger portions of the city and making a significant contribution to urban transport planning. In this direction, many Italian universities are working together to address mobility issues. It is notable indeed that within the Italian Universities Network for Sustainable Development (RUS), Working Group on Mobility issues is currently working to deliver a standardized survey to guide

mobility patterns and attitudes' data collection, as well as to deepen potential role of universities within MaaS pilots. The implementation of shared MM practices could foster more effective and impactful role of research institutes towards their own territorial context and support the adoption of standardized data collection and MaaS experiences, thus benefitting from potential economy of scale (Hensher et al., 2021).

3. University MM up-scaling potential: Genoa case study

As it was previously mentioned, university may contribute relevantly in terms of traffic and congestion load within urban areas. University of Genoa (UniGe), in North-Western Italy, in this direction, is no exception. It counts approximately 40 000 people among students and workers. It can be easily understood how significant its contribution to the Genoese community, counting 580 000 inhabitants, may be –since it represents a 7% share of the global population. UniGe constitutes indeed among local stakeholders, both companies and public entities, the largest (ISTAT, 2021), due to its peculiar hybrid nature. Relying on both its qualitative variety as well as its quantitative weight, it is therefore evident that University Mobility Management proves to be extremely strategical in this context. In this direction, two elements should be pointed out:

- Mobility patterns and behaviors' data collection would allow UniGe MM as well as urban MM structures to benefit from the profiling of a large amount of users. Although the peculiar propensity of the investigated community, probably more environmentally conscious than the average and more novelty-prone, similar features of the dataset would enable significant upscaling on a urban basis;
- MM initiatives may act on relevant shares of users. Strong cooperation between local administration and UniGe may help reaching ambitious goals in terms of emissions reduction, as well as modal shift.

UniGe MM structure first act, after its institution in 2021, was therefore to comply to legal requirement to define its own Home-Commuting Plan (UniGe, 2022). Nevertheless, this first experience was dramatically affected by the lack of available and reliable data on students and workers mobility patterns and behaviors. Similar gap was mainly due to two different reasons. Firstly, the persistence of Covid-19 pandemic hampered updated dataset building. Mobility demand and public transport supply contraction (Delponte and Costa, 2022) due to health emergency, changed deeply and irrevocably users' preferences and behaviors, so that updated surveys were not reliable in the long-run. At the same time, the choice to refer to previously collected data showed significant criticalities is terms of lacking standardization and different research purposes, so that obtained database proved not fully coherent and consistent. Subsequent planning of MM initiatives within respective Home-University Commuting Plan, was therefore affected by poor data-collection, as well as to the need to refer to non-specific legislation. Similar conditions were shared among several Italian universities, so that it was decided to work jointly within RUS-Mobility Working Group to develop dedicated guidelines on University MM (RUS, 2022), as well as to define a shared survey structure to be delivered to students and workers. In details, investigated topic may be clustered as it follows:

- User profile;
- Home-University commuting;
- Modal choices and vehicles ownership;
- Mobility habits and patterns;
- Choices' reasons and satisfaction;
- Interest in Mobility-as-a-Service solutions.

Similar investigation aimed at building a consistent knowledge background to support subsequent actions' design implementation. In this direction, standardization of survey to be delivered within university communities may help to highlight potential commonalities and differences to address best-practices transfer and sharing, thus by-passing potential barriers linked to the absence of dedicated ministerial guidelines concerning university commuting.

3.1 Survey results

As previously stated, data collection on UniGe community mobility patterns, behaviors and choices represents a key-factor to define tailored policies, as well as to address effective actions targeting sustainable mobility transition. In this direction, first interesting outcome concerns response rate. According to RUS benchmark study (2022), response rate varies significantly between students and workers, being the former less "responsive" than the latter. Students' average rate within Italian university context is approximately 12%, while workers around 36%. Present results

showed similar results for workers, UniGe response rate is indeed 32%, while students demonstrate strongly poor responsiveness, with a 4% share only. Similar insight supports the identification of a strong criticality concerning community engagement and consequent data collection. It is therefore evident that further measures need to be taken to boost community pro-activity. In this direction, it was investigated how MaaS solutions are perceived to assess whether similar experiences may improve data availability for University MM (Fig.1).

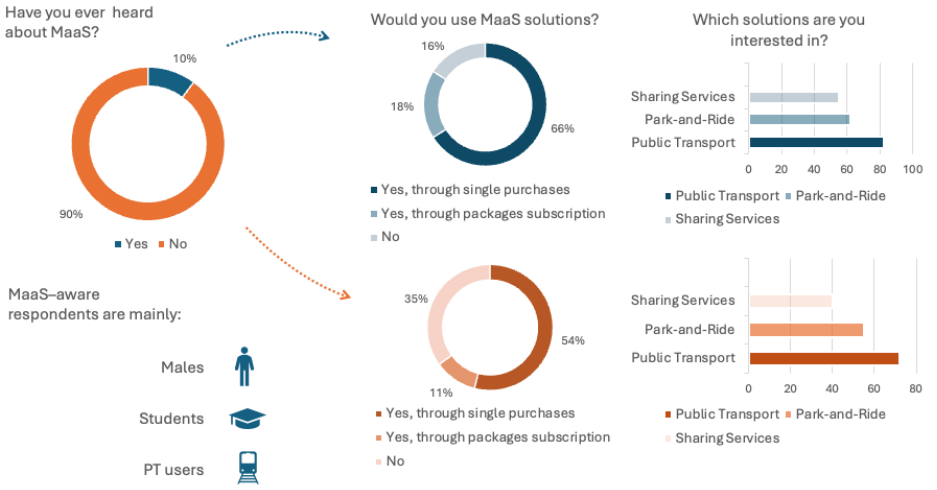

Fig. 1. MaaS awareness and preferences within UniGe community

The first addressed issue concerned therefore the previous knowledge about MaaS solutions. Obtained result showed that only 1 out of 10 respondents already heard of them. Similar outcome may be affected by the prevalence of workers among respondents, so that younger members of the community were under-represented. Nevertheless, approximately 44% among who states he/she did is Under30, they're mainly men (despite they constitute a 43% share of respondents), bachelor, master or PhD students that usually reach UniGe facilities using Public Transport solutions. Despite limited knowledge, potential value of MaaS was investigated also in terms of willingness-to-adopt and perceived benefits descending from MaaS subscription. A share of 54% of respondents stated that would be interested to choose MaaS options and an additional 11% share that would subscribe mobility packages on a regular basis. Similar shares grow respectively to 66% and 18% within the group of respondents who were already aware of MaaS solutions. Nevertheless, probably due to the absence of previous knowledge about similar solutions, most interesting transport services to be integrated within mobility packages proved to be the ones that nowadays benefit from ticket integration in Genoa, Public Transport -which is pivotal for 72% of respondents- and Park-and-Ride solutions –55% of them choose it, while sharing services do not exceed 44% threshold of the general sample of respondents. Answers become even more clear when people aware of MaaS solutions are addressed: Public Transport is chosen by a 82% share and Park-and-Ride by 62% of respondents. Travel cost reduction, both in timing and monetary terms, constitute main appealing feature of MaaS solutions for UniGe community members.

4. Discussion

Potential application of MaaS solutions were therefore investigated within UniGe community to address massive mobility data collection supporting MM initiatives. It is therefore evident that potential testing of MaaS solutions by UniGe students and workers, implies their significant and voluntary commitment to contribute to similar innovative experience. In this direction, it was particularly relevant to investigate UniGers previous knowledge and willingness-to-use of MaaS applications. Collected results show how poor is MaaS awareness within the university community. Similar outcomes may lead to conclude that wider urban community register even lower shares of knowledge about this topic, given the peculiar interest in innovation, technology and sustainability within similar contexts. It is also interesting to note that people that have already heard about MaaS -that following initial hypothesis are mostly young and educated- are more prone to test MaaS options and mobility packages than the other ones. Moreover, as far as mobility services are concerned, it is also worth noting that preferred services are the ones that respondents already

use to commute, and that, on an urban basis, already benefit from ticket integration. Conducted research on university community attitude towards MaaS may lead to draw some considerations:

- Awareness and knowledge on MaaS solutions is still limited. Similar lack of knowledge may hamper potential impacts of MaaS-related initiatives for several reasons. Firstly, people who state to know what MaaS is, are more likely to test it. Secondly, respondents tend to choose mobility services that already use. Wider information campaigns may lead them to use more of them, thus improving territorial accessibility;
- In terms of best-practices transfer and up-scaling, the university experience should interest every user segment, from students to teachers to employees. In this direction, targeted dissemination campaigns, as well as the definition of tailored mobility packages may support greater engagement even among older and less-technology-prone users.

Further investigation is necessary to determine the potential impacts of MaaS on the academic community. Additionally, it is important to note that the results of the questionnaires are linked to the local context and can vary based on the type of user involved, whether they are a student, professor, or administrative staff. Le Pira et al., (2023), for example, investigated acceptance on MaaS-like application within the entire academic community in southern Italy, observing a correspondence between user travelling for long distances by car and the willing to use a MaaS-like application. Moreover they noted that similar solutions are highly related to the reduction of private car use. At the same time, Kriswardhana and Esztergár-Kiss, (2024) proposing a questionnaire to Hungarian university students about their willingness-to-use MaaS, found that willingness to decrease car usage plays a minor role for students, while they noted that their multimodal transport choices favor MaaS acceptance.

It is therefore evident that MaaS applications have a strong local characterization, due to their bottom-up nature. Nevertheless, upscaling similar initiatives requires standardization for data sharing and to support networking and best practices transfer among companies and territorial administrations. Finally, data collection remains a critical aspect to be investigated as users are often reluctant to share their information: even when they recognise related potential benefits in terms of improved services for themselves or other users, they face barriers that operationally hampers effective data gathering (Le Pira et al., 2023). In the context of the so-called *third mission*, universities could facilitate communication and collaboration between local stakeholders, including companies, community groups and local authorities. This also involves acting as an impartial mediator, proposing solutions that address the needs of all parties and bringing them together to find common ground, while with regard to data management, academic institutions could consider experimenting with standardised sharing protocols to ensure an effective and ethical data use.

5. Conclusions

Mobility Management represents a key-tool to support sustainable mobility transition. Following a bottom-up mechanism, where companies and administrations provide data and action plans to be integrated by Territorial Mobility Managers, shared goals and practices may be implemented. It is therefore evident that tailored and effective actions design require indeed strong knowledge of mobility patterns, behaviours and preferences of the reference community. Nevertheless, past experiences concerning UniGe commuting plan, as well as results from the survey provided to UniGe community show how data collection prove extremely critical, thus requiring the application of innovative tools. MaaS, being a strongly data-driven and data-generator solution may represent a turning point:

- Universities may serve as an effective testbed for MaaS providers and administrations to develop pilots that extend beyond the CMaaS dimension. With the technical ability to manage data and experiment with data sharing standardisation, the university could propose strategies that could be adopted by local administrations and companies, supporting the future expansion of adopted actions and spreading their benefits within broader areas of the urban environment.
- At the same time, universities may benefit from similar experiences to collect a wide range of mobility data of students and workers, thus supporting actions' tailorisation and targetisation. Sustainable transport transition goals could be therefore more effectively and easily reached within UniGe community, but also on a territorial basis thanks to the quantitative relevance, as well as the strategical role in terms of best-practices transfer and dissemination. Reference community shows more variability in terms of users profile, mobility behaviours and attitude towards new technologies. Universities have the potential to achieve two key objectives in their role as educators. Firstly, they can train students in more sustainable mobility habits, which they are likely to adopt

also as future workers - thereby making their contribution continuous over time. Secondly, they can engage adult users, who are traditionally more resistant to such initiatives.

Nevertheless, results on the awareness and propensity of University of Genoa community to use MaaS solutions show how further actions would be needed both in terms of increasing knowledge base on MaaS concept and potential benefits descending from similar applications, that currently prove to be extremely limited, but also to deepen community attitude towards data-provision and sharing, key-element of the potential new relation between university and territorial administrations and stakeholders in terms of MM and sustainable transition.

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