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# Improving sustainable mobility in university campuses: the case study of Sapienza University

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**Abstract**

The pursue of sustainable mobility is one of the greatest environmental challenges nowadays. It requires a people mind shift, where the use of private vehicles give way to different modes of public transport like buses, bicycles, car sharing, electric cars, and walking lanes. This new call to make mobility sustainable has already been undertaken by policymakers and public managers in many urban contexts around the world, as well as, more recently, by the managers of university systems. The paper shows the work developed in 2018 for the Sapienza Sustainable University Mobility Plan (SUMP). The study stems from the need to understand and improve, in the sustainability direction, modes of travel for the students and staff of one of the oldest universities in the world, and one of the largest in Europe (112,142 students enrolled and 23,101 between academic staff and no academic staff), with its premises located in a complex and challenging urban context such as the city of Rome. The SUMP has been developed in two phases. The first one investigated travel patterns and the reasons for the modal shift and highlighted the main issues. The second phase defined strategies and interventions to be implemented in the short, medium, and long term to make students and staff's mobility more environmentally sustainable. The methodology used in the fact-finding stage was the online survey that was carried out through the use of a diversified questionnaire for staff and students of the University. The sample of students who participated in the survey amounted to 14,719 units, while the sample of faculty and staff was 9,403. The main questionnaire outcomes showed that the attitudes recorded were largely different between faculty and staff and students. While for the first ones the choice of private vehicles is the first option (36%), for students public transport is the prevailing preference (78%). According to the critical aspects found in this first stage, the SUMP objectives were defined, leading to the identification of macro-areas of intervention and specific actions. At a policy and strategic level, the attention was focused on the guidelines issued by the United Nations, the European Commission, and the Network of Universities for Sustainable Development, of which Sapienza University is a member. For this reason, the identification of strategies and interventions results from the combination of the first phase analysis, the Sapienza Governance objectives, and the national and international context in which the SUMP was drafted. Five macro-areas of intervention have been identified: Smart Strategies, Pedestrian Mobility, Cycling, Local Public

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Transport, Private Transport, and for each one specific intervention to be implemented in different time frames have been defined.



*Keywords:* sustainability; university campus; transportation; sustainable modes of transportation.

## 1. Introduction

The growing population in urbanised areas creates increasing congestion and environmental pollution problems, which lead to a decrease in quality of life. To address the problem, the European Commission began to promote the concept of sustainable urban mobility plans (SUMPs) as an integrated planning approach that addresses all modes and forms of transport in cities and their surrounding areas. This concept has also been transferred to areas smaller than cities, like neighbourhoods (Val & de la Cruz, 2020) or university campuses. These represent an ecosystem, that can be external or fully embedded in an urban context. They attract people often covering long distances to reach different places in different hours of the day, thus requiring a sustainable planning approach. Various transport policies and plans have been adopted internationally to improve the overall quality of mobility around university campuses. A well-known case study is a strategy of linking the university plan with the city transport plan through the implementation of the superblocks in the city of Barcelona. A further significant example is the University of Bristol, which has linked up the various premises around the city by developing a combined travel plan for staff and students. Another important example is provided by the Polytechnic of Turin. Here, based on the transport behaviours and mobility needs of all university members, the plan proposed a strategy of regulation between cycle lanes and parking (P. Papantoniou,2020). In line with the most modern international universities, aware of pursuing eco-sustainable mobility policies, the Sapienza Sustainable University Mobility Plan (hereafter SUMP) arises from the need to know and improve, in the direction of sustainability, modes of travel for the students and employees of one of the oldest and largest universities in the world, with its premises located in an urban context as complex and full of challenges as the city of Rome. The SUMP objective has been to defines strategies to optimise the systematic travel of students and staff aiming to reduce the use of private cars in favour of environmentally friendly modes of transport and to ensure the satisfaction of the mobility needs of staff, in compliance with the objectives of reducing energy consumption, environmental and social costs (Newman, P et al. 1989). The SUMP is placed in a broader national and international context, responding to different needs such as (i) the work of the International Sustainable Campus Network (ISCN), a nonprofit association of the world's leading colleges and universities representing more than 30 countries working together to integrate sustainability into operations, research, and teaching; and (ii) sharing the goal of spreading the culture and good practices of sustainability, defined by the Network of Universities for Sustainable Development (NUSD), focused on environmental sustainability and social responsibility.

Based on a survey on the travel behaviour of students and staff, the output of the SUMP was to develop and implement an action plan for mobility in the different university premises in order to control and optimise flows and develop strategies for the creation of sustainable spaces (Silva and Fereira, 2008).

## 2. Materials and method

### *2.1. The mobility survey*

An extensive survey of the mobility behaviours of students and staff has made it possible to understand the travel patterns of Sapienza University and highlight its main critical issues. The survey comprised two questionnaires, one aimed at students and another at staff. The questionnaires include:

- Personal information, role and place of study and work.
- Travel characteristics: Home-University and University-Home trip and trips between the different University locations.

- Information and motivations that lead to the use of the prevailing vehicle: car, motorcycle and moped, public transport, bicycle (costs, property, willingness to use more sustainable forms of mobility).
- Information on travel-related perception and attitudes (Van den Berghe et al., 2020).
- Other information not addressed in this study.

The questionnaires were administered online over a period of 3 months. Two reminders were sent to non-respondents to increase the response rate (Christensen et al., 2015). During the same time frame, students and staff were solicited to participate in the survey also informally in various contexts such as lectures, workshops, meetings, and through short informational texts disseminated in some locations. The questionnaire was sent to 107,340 students and 23,101 staff who study or work at Sapienza sites located throughout the metropolitan city area.

### *2.2. The sample*

Approximately 14% of students (14,719 respondents out of 107,340) and 41% of employees (9,403 respondents out of 23,101) responded to the questionnaire. Summarising the main characteristics of the sample of students, female students seem to have participated more in the survey (64% of respondents is female). About half of the students travel to Sapienza University five times a week (48%). Two out of three students live with their parents (67%) (Table 1). Even among the staff sample, the proportion of women interviewed (58%) was higher than the proportion of males (42%). Two out of three employees travel to Sapienza University five times a week and about half of them live with their families (Table 2). Young students and older employees showed more interest in participating in the study. While the former are enthusiastic about their new adventure at Sapienza, willing to contribute to improving it, the latter know the city's dynamics and intend to provide advice to improve the current travel conditions.

Table 1. Key characteristics of the Sapienza's student.

| Key characteristics | Percentage (%) |
|---|---|
| Is female | 64 |
| Its only daily employment is studying | 60 |
| Enrolled in the first two years of University | 47 |
| Enrolled in the bachelor's degree | 47 |
| Attends school five days a week | 48 |
| Lives with parents | 67 |

Table 2. Key characteristics of the Sapienza's staff.

| Key characteristics | Percentage (%) |
|---|---|
| Is female | 58 |
| Have been working at Sapienza for more than 10 years | 50 |
| Attends five days a week | 67 |
| Lives with partner with/without children | 52 |

### *2.3. Characteristics of travel*

The vast majority of students (86%) live in the Province of Rome, and their main destinations are located in the city center (Città Universitaria about 43%; San Pietro in Vincoli about 10% and Policlinico Umberto I about 9%). The average travel time is 74 minutes when moving from home to the University and 81 minutes when returning from the University to their homes. In terms of modal choice, the predominant transport mode of students (the one on which the most time is spent) is public transportation (78% overall). More in detail: 28% by Bus/Tram/Trolleybus, 27% by train, 23% by subway. 15% of students travel by private motor vehicle, split between 9% of car users as drivers, 3% as passengers, and 3% of motorcycle/scooter users. Finally, only 7% of students reach his/her destination walking and 1% by bicycle (Fig. 1).

The staff also lives mainly in the province of Rome (92%). Similarly to the students, their main destinations are located in the city center (Città Universitaria about 45%; Policlinico Umberto I about 11%, San Pietro in Vincoli about 10%). The average travel time for staff is reduced by about 15-20 minutes compared to that recorded by students. In fact, the average travel time for staff is 55 minutes when moving from home to the University and 65 minutes when returning from the University to their homes. University workers, compared to students, use public transport in 42% of cases (16% by Bus/Tram/ Trolleybus, 14% by train, and 15% by subway) and private motor vehicle in 49% of cases (36% car as a driver, 6% as a passenger, and 7% by motorcycle/scooter). Only 5% of staff reach the destination on foot and 2% by bicycle.

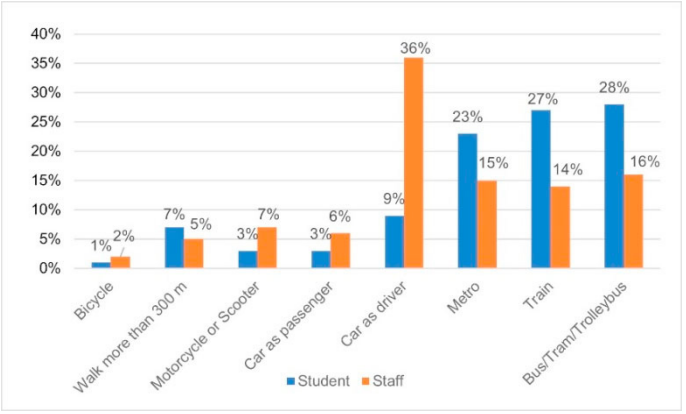


Fig. 1. % of trips made by the predominant mode (the one on which the most time is spent)

## *2.4. Perceived travel difficulties*

Based on the personal travel experience, respondents were asked to rate perceived travel difficulties during their Home-University and University-Home trip (Fig. 2 and Fig.3). Ratings range from 0 (not perceived a concern) to 5 (highly important). For students, the main difficulties are related to their experience with public transport. The most significant difficulties (those that received evaluation 5) are: excessive crowding of PT (59%); punctuality of the PT (52%); presence and regularity of the PT (48%). Difficulties not important or not perceived as a concern are: the high cost of parking (69% of ratings equal to 0 or 1); difficulty in find parking (59%); the presence of physical barriers (54%); availability of spaces for bicycles (70%); poor bicycle safety (68%); the presence of safe bicycle paths (66%) (Fig. 2).


Fig. 2. General travel difficulties (Student)

Also, for employees, the main difficulties are those related to using public transport, specifically: excessive crowding of the PT (46%); punctuality of the PT (41%); presence and regularity of the PT (39%). On the other hand,

the following are not perceived as difficulties by staff respondents: the high cost of parking (61%); difficulty in find parking (43%); presence of physical barriers (49%); availability of spaces for bicycles (63%); poor bicycle safety (61%); presence of safe bicycle paths (60%) (Fig. 3).

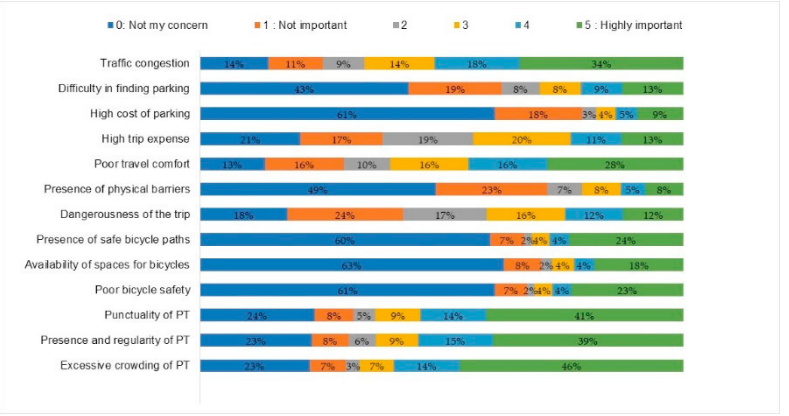


Fig. 3. General travel difficulties (Staff)

Finally, the questionnaires showed that more than 50% of respondents (students and staff) believe that using electric cars and buses and encouraging car-pooling among colleagues are proposals that would improve mobility in Rome.

## 3. Goals

The definition of SUMP goals stemmed from both the results of the student and employee travel survey conducted during the first phase, as well as relevant community, national and municipal policy guidelines. The ten defined goals led to identifying macro areas of intervention and specific interventions. The following figure shows the activities carried out in the different phases of the SUMP development process.

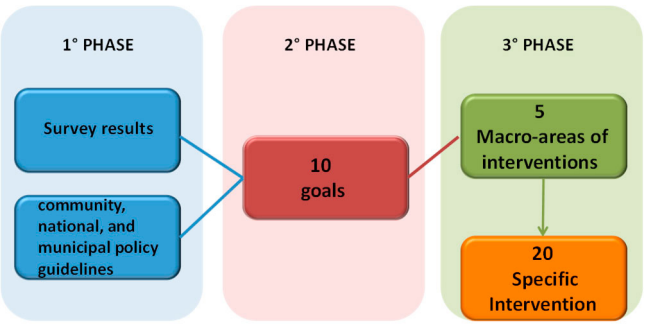


Fig. 4. Flowchart of SUMP phases

The survey results taken into account were:

- the findings related to the emerged critical issues;
- the proposals for improvement with a high level of satisfaction among Sapienza students and academic staff.

At the policy and strategic level, the attention has been focused toward directions issued by:

- United Nations (through the 17 Sustainable Development Goals (SDGs) of the 2030[1]);
- European Commission (mainly with the "White Paper on Transport Policy" for the period 2010-20202, and the 2017 "Sustainable Urban Mobility: European Policy, Practice and Solutions");
- NUSD;

[1] https://www.un.org/sustainabledevelopment/sustainable-development-goals/

- Rome Municipality.

The NUSD Sustainable Mobility Working Group "aims to discuss and implement academic mobility management policies and interventions and to draw up Home-Work Travel Plans by encouraging sustainable mobility, promoting the use of public transport or shared transport, limiting access to university buildings of private cars with traditional fuels"[†]. It is important to highlight that in this context, NUSD also joined the "Global Climate Emergency Letter", which aims to engage as many networks and institutions as possible to show commitments to achieve SDGs 4 (Education) and 13 (Climate Change). Last but not least, the Municipal Administration of Rome provides the guidelines through the Sustainable Urban Mobility Plan. The in-depth analysis of the survey results of the first phase of the SUMP and the national and international policy and strategic guidelines have further confirmed the willingness of SUMP to contribute to the sustainability and improvement of climate conditions through the identification of 10 specific objectives:

1. Encourage greener practices;
2. Promote sustainability through web services;
3. Increase and facilitate walk-to-work travel;
4. Encourage bicycle travel;
5. Reduce the use of polluting private vehicles;
6. Promote shared mobility services;
7. Introduce more sustainable modes of mobility;
8. Promote the use of public transport;
9. Optimise the use of indoor urban spaces and parking;
10. Support mobility choices and improve road safety through training and information (Usami D.S., 2020).

## 4. Action plan

The identification of strategies and interventions arises from combining the results of the First Phase analyses, the objectives declared by the Governance of Sapienza and the national and international context in which the SUMP was drawn up. Moreover, the proposed strategies and specific interventions respond to the need of connecting in a more sustainable way several Sapienza headquarters, located in the central area of Rome as well as in the peripheral ones. It is worth mentioning that the majority of them are part of a unique and particular urban context since they are located in the historic centre of Rome where a sustainable urban mobility system, allowing citizens to move freely and safely with respect to the environment, is crucial (Persia et al., 2016).

Five macro-areas of intervention have been identified, and specific interventions to be implemented in different time horizons have been defined. These are: Smart Strategies (7 specific interventions), Pedestrian Mobility (2 specific interventions), Cycling Mobility (5 specific interventions), Public Transport (4 specific interventions), Private Transport (2 specific interventions). The process required interaction with other institutional actors, and some interventions have been proposed in collaboration with the Rome Mobility Agency and the public transport operator (Atac). The following table summarises the five Macro Areas of Intervention of the Action Plan and the related Specific Interventions; a short description of each specific intervention is also provided.

Table 3. Macro-areas of interventions and specific interventions

| Macro – area | Specific Intervention | Short Description |
|---|---|---|
| **SMART STRATEGIES** | *Sapienza Mobility Portal* | • Online mobility platform with a crowdsourcing tool to allow staff and students to report critical issues and propose interventions and/or solutions to improve the mobility system |
| | *Car Pooling App* | • For-free use of Rome Car Pooling App by Sapienza staff and students<br>• Implementation of 10 car-pooling parking slots within the |

[†] https://reterus.it/mobilita/

| Macro – area | Specific Intervention | Short Description |
|---|---|---|
| | | campuses |
| | *Sapienza Vehicles Fleet* | • Replacement of the University Administration fleet of cars available to with electric vehicles |
| | *Charging stations* | • Implementation of 12 charging stations within the campuses |
| | *Smart Working* | • Hiring of 50 smart-workers (part time and full time) equipped with workstations provided by the Administration Departments. |
| | *Sharing Services* | • Discounted fares of sharing services (electric scooters, electric cars) for staff and students |
| | *Sustainable Mobility Hubs* | • Internal campus hub (Piazzale della Minerva) free from vehicle parking with charging stations for electric vehicles, parking slots for car-pooling vehicles and cycling stations<br>• External hub (Piazzale Aldo Moro) for all citizens service of all users with charging stations for electric vehicles, racks for bicycles, parking slots for car sharing |
| **PEDESTRIAN MOBILITY** | *Safety Inspections* | • Road Safety Inspections of the road network connecting Sapienza campuses and headquarters |
| | *Pedestrian paths* | • Design of pedestrian paths network map connecting departments, points of interest within the Campus and public transport stops with information on the routes and walking travel times |
| **CYCLING MOBILITY** | *Cycling lanes* | • New Cycle paths network ("Ciclotangenziale Sapienza" project) connecting Sapienza headquarters; the proposed routes cross and converge towards the existing paths in the city |
| | *Racks* | • Installation of 15 new racks in the headquarters<br>• Racks installation program, in collaboration of the Municipality of Rome, undertaking to install, every year, at least another ten new racks. |
| | *Cycling stations* | • Construction of 8 cycling stations in the campuses equipped with anti-theft systems, protective shelters, information totems on urban cycling and charging points for electric bikes. |
| | *Sapienza Merchandising* | • Introduction of cycling equipment (bells, helmet, cyclist poncho, branded waterproof seat cover, bike anti-theft, applicable lights, cyclist gloves, bottle holder for the bike) in the Sapienza branded products catalogue |
| | *Awareness raising campaigns* | • Campaign on the importance of cycling, including Living Labs involving the scientific community and operators and dedicated events and workshops |
| **PUBLIC TRANSPORT** | *Bike friendly bus lines* | • Identification of bus lines for implementing solutions to transport bikes outside the vehicles |
| | *Re-organisation of Public Transport Network* | • Use of the Sapienza Mobility Portal crowdsourcing tool, to allow students and staff to report critical issues<br>• Crowdsourcing data analysis to solve problems identified and find solutions to improve the quality of the service provided |
| | *Visual Communication* | • Installation of multidirectional signs indicating the points of interest, direction, bus stops and orientation maps in each headquarter<br>• Installation of VMS reporting real-time information on the timetables of subways, buses and trams and waiting times at stops (long term scenario) |
| | *Bus stops* | • Survey of state of the art aimed at highlighting and analysing all critical issues and pedestrian safety lacks<br>• Re-design and/or relocation of bus stops |
| **PRIVATE** | *Re-organisation of parking* | • Reduction of conventional parking slots in favour of car- |

| Macro – area | Specific Intervention | Short Description |
|---|---|---|
| **TRANSPORT** | *areas* | pooling and electric cars<br>• Reduction and/or prohibition of parking in architectural value areas (Piazzale della Minerva) |
| | *Road safety information campaigns and training* | • The annual organisation of a "road safety and sustainable mobility conference"<br>• The high-risk driving behavior survey campaigns<br>• Organisation of road safety awareness days for students |

## 5. Conclusions

Sustainable Urban Mobility Plans are essential tools to define the strategies and interventions able to satisfy the mobility of people in a sustainable way. However, there is a lack of scientific contribution aimed at providing a specific template for university mobility managers to develop an action plan for an efficient and effective sustainable university mobility plan (Papantoniou et al., 2019). This paper describes the approach adopted to draft the Sapienza Sustainable University Mobility Plan (SUMP). The approach was tailored to the campus' characteristics and students and employees' needs. In the first phase, an online survey for staff and students was carried out in order to understand the characteristics of travels, to highlight the main issues and define SUMP's objectives. Results showed that students mainly use public transport, whilst staff are more addicted to private vehicles. In the second phase, macro-areas of interventions and specific interventions for each area have been identified, taking into account. The results of the first phase analyses the objectives declared by the Governance of Sapienza and the national and international context in which the SUMP was drawn up. The Sapienza SUMP aims at satisfying the needs of students and university staff considering the technical, economic, social and environmental sustainability of the proposed interventions. In addition, the Plan considers the fact that, besides the main Campus, Sapienza headquarters are dislocated in several areas of Rome and both are embedded into the overarching mobility context of the city that see other end-users of the mobility services sharing with the Sapienza user's infrastructures and services. For this reason, the Sapienza SUMP may be used as a reference for other university campuses having one or more headquarters located in an established urban environment.

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