TeMA

Journal of
Land Use, Mobility and Environment

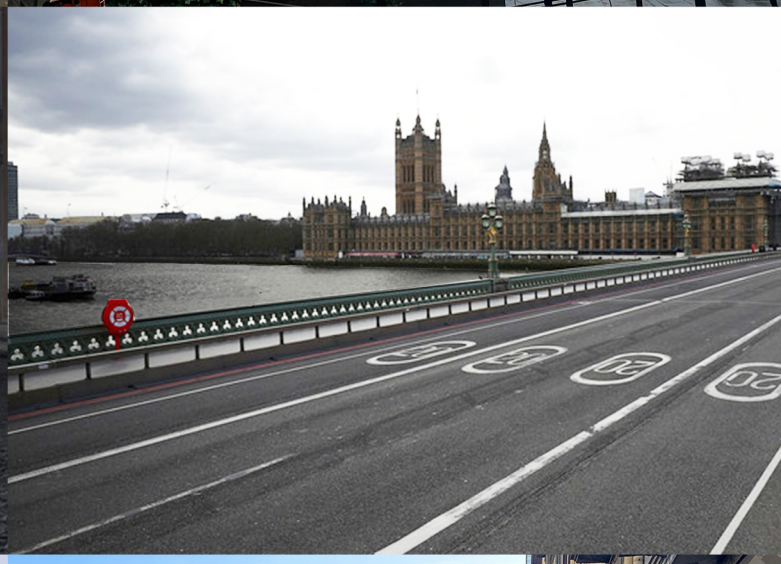
This Special Issue of TeMA - Journal of Land Use, Mobility and Environment, collects twenty-seven contributes of international researchers and technicians in form of scenarios, insights, reasoning and research on the relations between the City and the impacts of Covid-19 pandemic, questioning about the development of a new vision and a general rethinking of the structure and urban organization.

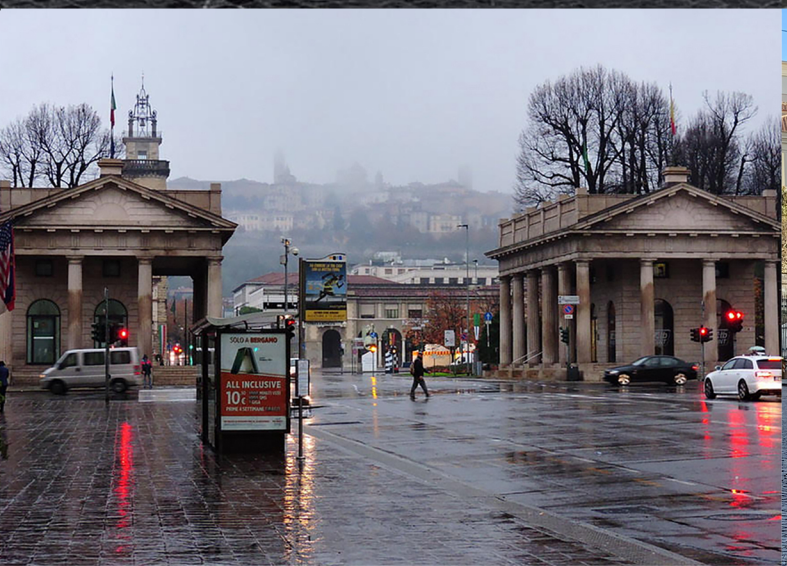
TeMA Journal offers papers with a unified approach to planning, mobility and environmental sustainability. With ANVUR resolution of April 2020, TeMA journal and the articles published from 2016 are included in the A category of scientific journals. From 2015, the articles published on TeMA are included in the Core Collection of Web of Science. It is included in Sparc Europe Seal of Open Access Journals, and the Directory of Open Access Journals.

Special Issue

Covid -19 vs City -20

scenarios, insights, reasoning and research





ISSN 1970-9889
University of Naples Federico II

TeMA Journal of
Land Use, Mobility and Environment

Special Issue

COVID-19 vs CITY-20
SCENARIOS, INSIGHTS, REASONING AND RESEARCH

Published by
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"

TeMA is realized by CAB - Center for Libraries at "Federico II" University of Naples using Open Journal System

Editor-in-chief: Rocco Papa
print ISSN 1970-9889 | on line ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n° 6 of 29/01/2008

Editorial correspondence
Laboratory of Land Use Mobility and Environment
DICEA - Department of Civil, Architectural and Environmental Engineering
University of Naples "Federico II"
Piazzale Tecchio, 80
80125 Naples
web: www.tema.unina.it
e-mail: redazione.tema@unina.it

Given the short time to produce the volume, the Editorial Board of TeMA Journal carried out the scientific quality audit of the contributions published in this Special Issue.

The cover image is a photo collage of some cities during the Covid-19 pandemic quarantine (March 2020)

TeMA Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of land use, mobility and environment. Domains include: engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science and complex systems.
With ANVUR resolution of April 2020, TeMA Journal and the articles published from 2016 are included in A category of scientific journals. From 2015, the articles published on TeMA are included in the Core Collection of Web of Science. TeMA Journal has also received the *Sparc Europe Seal* for Open Access Journals released by *Scholarly Publishing and Academic Resources Coalition* (SPARC Europe) and the *Directory of Open Access Journals* (DOAJ). TeMA is published under a Creative Commons Attribution 3.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

TeMA Journal of
Land Use, Mobility and Environment

Special Issue

COVID-19 vs CITY-20
SCENARIOS, INSIGHTS, REASONING AND RESEARCH

Contenets

TeMA
Journal of
Land Use, Mobility and Environment

TeMA Special Issue | Covid-19 vs City-20, 305-314
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6092/1970-9870/6856
Received 13th May 2020, Available online 19th June 2020

The resilient city and adapting to the health emergency.

Towards sustainable university mobility

Francesca Pirlone [a*], Ilenia Spadaro [b]

[a] Department of Civil, Chemical and Environmental Engineering
University of Genoa, Genoa, Italy
e-mail: francesca.pirlone@unige.it
ORCID: https://orcid.org/0000-0001-5429-4284
* Corresponding author

[b] Department of Civil, Chemical and Environmental Engineering
University of Genoa, Genoa, Italy
e-mail: ilenia.spadaro@unige.it
ORCID: https://orcid.org/0000-0002-8454-2629

Abstract

The concept of a resilient city is an increasingly critical one. Resilience represents the ability of an urban system to adapt to an external event. In the past, urban resilience was mainly addressed to natural rather than anthropic risks.

Considering the Covid-19 pandemic emergency, the relationship between urban resilience and anthropic risk, especially health risk, has inevitably distorted the "normality" to which we were accustomed. The emergency has had significant long-term effects on the times, uses and organization of cities. Adaptability requires the synergic work of all actors who live or work in a city. This mobility-focused research aims to highlight the importance of the Quadruple Helix principle by analysing the specific measures that each actor -Public Authorities, Research, Enterprises and Citizens- can implement to reduce health risk.

The paper outlines the contribution of the University of Genoa within the confines of a ministerial project to promote sustainable mobility for students, when travelling between home and university, using prizes/incentives. This good practice will play an increasingly important role in the return to normality

Keywords

Resilience; Quadruple helix principle; University students' sustainable mobility

How to cite item in APA format

Pirlone, F., Spadaro, I. (2020). The resilient city and adapting to the health emergency. *Tema. Journal of Land Use, Mobility and Environment*, 305-314. http://dx.doi.org/10.6092/1970-9870/6856

1. The resilient city and adaptation to the health emergency

The concept of a resilient city is an increasingly critical one. Resilience represents the ability of an urban system to adapt to an external event and quickly return to normal.

The concept of resilience, as a response to environmental, socio-economic and political uncertainty and risk, has captured the attention of academics and decision-makers in all disciplines, sectors and scales (Brown, 2013, Cascio, 2009, Meerow & Newell, 2015).

Urban resilience refers to "the ability of an urban system - and all the ecological and socio-economic networks that make it up on a temporal and spatial scale - to maintain or quickly return to the desired functions in the face of a disturbance, adapting to change" (Collier et al., 2016). A resilient city reduces or avoids risk situations, establishes procedures to manage emergencies and to restore the damaged system after the event (Wamsler et al., 2013).

"Any eventual disaster or emergency is impossible to plan, but to implement a scalable, adaptable system and an organizational structure so that the affected communities can recover quickly from the harmful event is possible. The origin of most of these disasters depends on climate change …" (De Simone, 2015).

In the literature there are many studies related to resilience from natural events, such as seismic, hydrogeological, and in general related to climate change.

Considering the Covid-19 pandemic emergency, the relationship between urban resilience and anthropic risk, especially health risk, has inevitably distorted the "normality" to which we were accustomed.

The emergency has had significant long-term effects on the times, uses and organization of cities. Adaptability requires the synergic work of all actors who live or work in a city. From healthcare to high street retail, transport to food and medical supply chains, the coronavirus (Covid-19) outbreak, has exposed the limited resilience of our cities (Chong,2020). The immediate priority of those who govern the territory is obviously aimed at health and solving the critical issues connected to the pandemic. But according to the "learning-by-doing" approach, the crisis can be an opportunity to learn from how the cities have responded to this event. We can therefore rethink the way we plan, design and manage our cities, implementing the best strategies to build more resilient and responsive cities if other similar crises occur. As with any analysis involving natural or anthropic risks, a complete knowledge framework is essential. Through knowledge, the priority to interventions, to the distribution of resources by addressing them primarily to services (health, school, commercial, ..), areas and people most vulnerable is possible to give. In addition, the cognitive framework also allows to evaluate whether the good practice valid elsewhere can be applied in another territorial context if it has similar characteristics (number of inhabitants, surface area, prevalent uses, ..). Everyone's collaboration is also needed to respond to emergency. Communication, awareness and training allow to increase and share knowledge in order to make it a common factor to ensure citizen safety.

"Cities can be understood as complex-adaptive systems that have the opportunity to manage their resilience towards sustainability through processes of transformation" (Olazabal, 2017). The interconnectedness and dependencies of cities' many systems mean coordination is central to achieving effective resilience. (Chong,2020). Adaptability does not depend only on the actions carried out by public authorities, but it requires the synergic work of all the actors who live or work in a city.

This mobility-focused research aims to highlight the importance of the Quadruple Helix principle by analysing the specific measures that each actor - Public Authorities, Research, Enterprises and Citizens - can implement to reduce health risk (Fig. 1).

"Users in the Quadruple Helix framework can also be defined in several ways depending on the context of the arena (the fourth helix) and what value adding activities they bring to civil society. Thus, users can be businesses, organizations, citizens, society, and many more things" (Hasche et al., 2019). These four "key actors promoting a democratic approach to innovation through which strategy development and decision-

making are exposed to feedback from key stakeholders, resulting in socially accountable policies and practices (Carayannis & Campbell, 2011). Citizens insights are crucial for understanding future cities that are not only functional effective and efficient but also sociable and liveable etc. To become a sociable smart city that is of meaning to its citizens, a strong position for citizens in the design process is required to address people's values (Van Waart & Mulder, 2014).

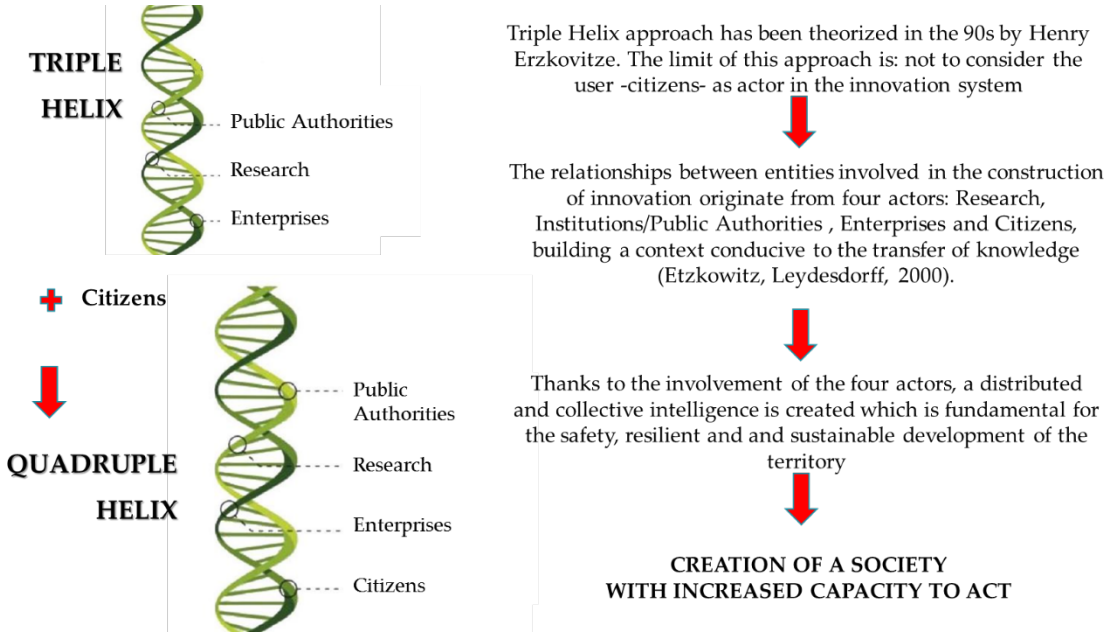


Fig. 1 The concept of Triple and Quadruple Helix for a multi-stakeholder governance resilience process

Among the subsystems, or priority themes at urban level, there is certainly mobility.

During the lockdown phase, the cities were emptied of private means and partially also of public ones. This immobility has been associated with a considerable reduction of harmful emissions into the atmosphere. From May 4, in Italy the phase 2 entered during which partial reopening of some activities is expected. Due to the fear of contagion, the population is moving towards less sustainable modal choices: the use of local public transport will be reduced in favour of greater use of the private vehicle perceived as safer. The expected scenarios are therefore worrying in terms of sustainability.

The subsequent phases foresee a general reopening of the activities. Then in universities, as in the rest of urban areas, to plan strategies to promote sustainable home-university mobility will be essential. Universities are certainly a delicate aspect to manage in pandemic times. In fact, they have an important impact on cities given the number of people who gravitate to them. At this regard, the paper considers an existing good practice in the university setting that can improve system resilience in this post Covid recovery period.

2. The PRINCE project as good practice towards sustainable university mobility

Universities are one of the major attractors / generators of traffic and they have an important impact both on the organization of urban mobility, and on education and behaviour related to the mobility choices of the population. In this regard, in 2017 ISTAT estimated that in Italy about 30 million people move every day to reach their place of study (18.5%) or work (over a third of the population equal to 35.5%). The displacements generated by the school system have a significant impact on the mobility of the area because they are very concentrated in certain time slots. At the same time, the concentration of hours can help

optimize demand. This through the promotion of zero or low emission collective mobility practices such as piedibus, bicibus, carpooling and the correct organization of the public transport service.
Universities can also be an example for modal cultural change, promoting the implementation of practices in favour of green mobility. Universities play a key role in the formation of future generations and in the dissemination of knowledge within society, also with reference to the ability to promote sustainable development, that is, a development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Sachs, 2015; Brundtland, 1987).
In addition, schools and universities play a key role in terms of education, facilitating dissemination of sustainable mobility practices for travel every day.
The increase in the sustainability of home-school, home-university (and home-work) travel also improves the liveability and healthiness of the environments around these structures, as well as the safety of the routes themselves by reducing the circulation of private vehicles.
University of Genoa, like others, has joined to the Italian University Network for Sustainable Development, RUS, promoted by the Conference of Italian University Rectors, CRUI, and works through its Commission, Sustainable Unige. The RUS Network is the first experience of coordination and sharing between all Italian universities committed to the topic of environmental sustainability and social responsibility. Sustainable universities are those institutions that transform a precise political choice into a long-term transversal process. This process considers the issues of environmental protection, community well-being, social equity and economic development "in an integrated way". Within the Sustainability Commission there are several working groups, including that of sustainable mobility.
This paper describes a good practice that the University of Genoa is carrying out precisely through its Sustainability Commission. This good practice is PRINCE "AWARDS and INCENTIVES for modal change", a project funded, in 2018, by the Italian Ministry for Environment, Land and Sea Protection as part of the "National experimental program of sustainable mobility home-school and home-work". The project intends to promote sustainable mobility (public transport such as buses, underground, car-bike sharing, bicycles, feet, ...) for students, when traveling between home and university, using prizes / incentives. The general objective of the project is in fact the definition and promotion of incentives/reward/discounts which seek to encourage students to change their choices and behaviour by using clean and sustainable means of transport for urban journeys to go to university.
The PRINCE project involved seven different partners: leader partner is the Municipality of Genoa -Mobility Department - and the other partners are companies related to the world of urban transport, technological companies and the University of Genoa.
The main actions of the project are: analysis of student travel behaviour; the development of new technological systems, with the implementation of ICT tools and the creation of an APP; the definition and implementation of loyalty and incentive policies (Fig. 2).
The innovation introduced in the project is precisely linked to the introduction of incentive policies to change the mobility habits of university students towards more sustainable forms. Changing mobility habits is not a simple process and it is usually forced through the introduction of restrictive policies or structural actions such as expensive parking fee or traffic calming interventions o limitations zone.
The new proposed way to promote urban sustainable mobility instead provides the use of incentive policies as leverage for sustainability. In literature there are few examples of research developed on the topic of incentives. An example in this regard is provided by Petri et Al, who "seek to increase the use of sustainable means of transport in urban areas - to improve air quality- through good mobility practice rewarding or of mobility demand management systems (credit market mobility-tradable mobility credit). and using rewards / incentive as one of the possible solutions" (Petri et al., 2016). Herrador et al introduce other positive

aspects: "The breakthrough of this business model is that it enhances awareness of sustainable mobility practices, increasing their attractiveness as perceived by the stakeholders with diverse benefits; citizens (and indirectly, the municipalities) initiate a new consumption pattern of "coupons culture" linked to sustainable mobility, the urban economy is stimulated, and the use of mobility services grows, providing a new business opportunity Incentive-based and behavioural tools, seeking to encourage consumers to change their choices and actions, are example of additional policy measures that can be taken" (Herrador et al., 2015). In the logic of the project, an appropriate mix of restrictive policies and incentives (monetary and social) based strategies could represent a winning strategy to encourage students to reduce by a significant percentage the mileage made with private cars or scooters in the urban environment, or to switch to other means of transport. This solution presents interesting elements of scalability and replicability in other situations with similar characteristics; for example, for other systematic trips (home-work) that the population usually carries out every day.

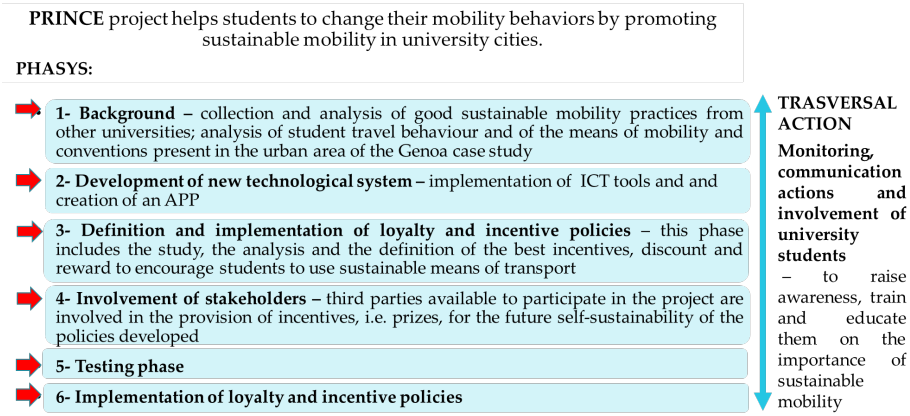
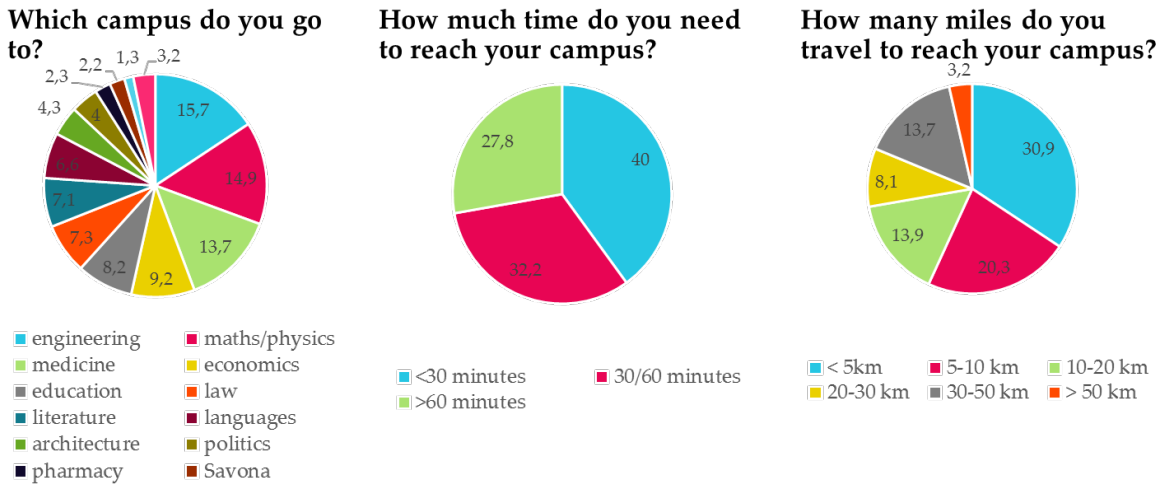


Fig 2 The phases of the PRINCE project

The background phase of the project began with an analysis of the state of the art of good practices developed by other universities in the field of sustainable mobility. Subsequently, this phase focused on the Genoa case study. Initially, by distributing a survey to the users of the university (students, teachers, administrative staff), students 'mobility behavior was analyzed and the students' journey to the campus was mapped. 4,613 users answered the questionnaire, including 4,029 students. The survey asked useful questions to know the direction of the move (neighborhood or municipality of origin and university campus where you go); about the means used, the times and the distance travelled to reach the university (Fig. 3).



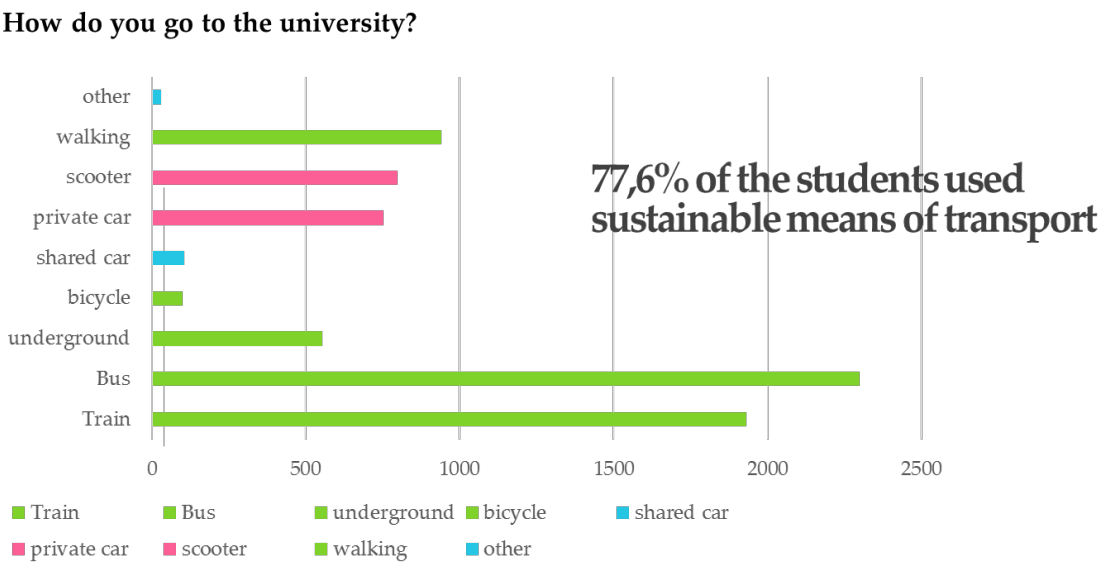


Fig. 3 Answers to the survey: how the Genoa University students travelled before the Covid19 emergency

This initial phase was fundamental to intersect the information obtained and try to understand how the current offer of public transport available and the places of origin (residence) and arrival (University) affect the students' mobility choices. In fact, a close correlation has emerged between these two aspects: Faculties located near the stops of the Metro network or the railway stations are mostly reached using public transport. But even universities without public parking or in restricted traffic areas are generally reached by students with sustainable means. As for distance, the questionnaire showed that the least sustainable students are those who live closest to the faculties (distance less than 5 km) who use the scooter.

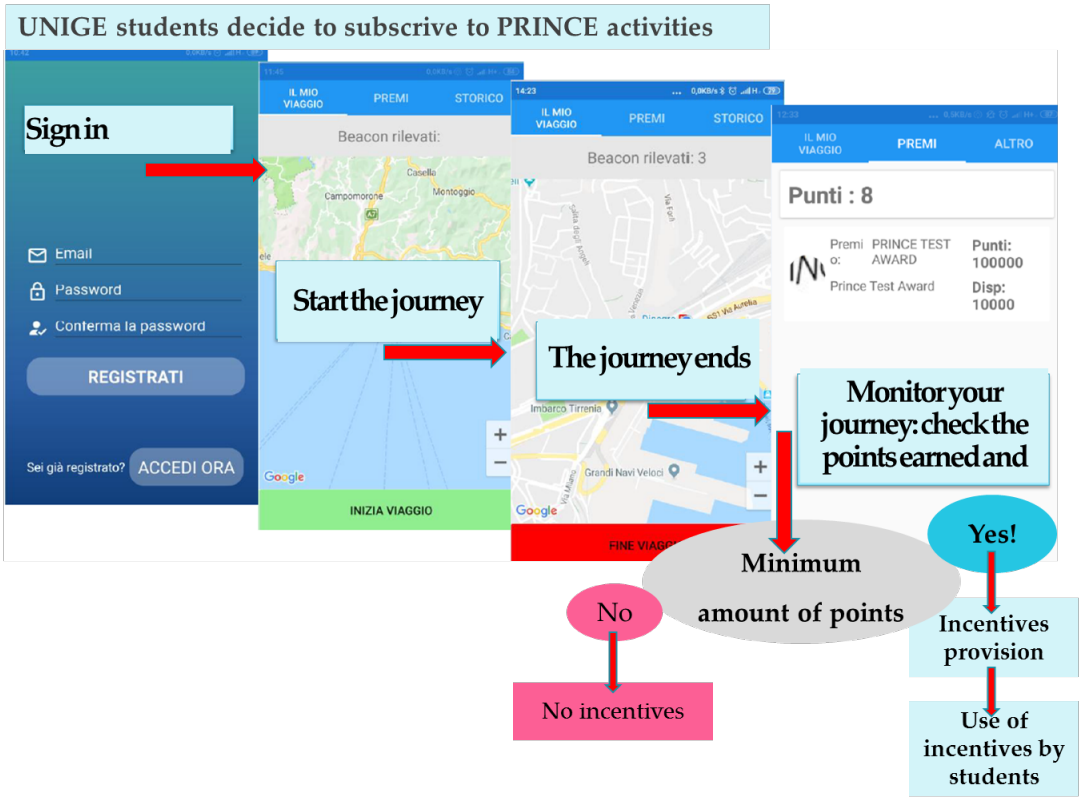


Fig. 4 ICT solutions and incentives approach to support sustainable university mobility

The next phase of the project concerned the design and implementation of ICT solutions for "smart" mobility, created specifically for students' needs in order to encourage and monitor changes in their travel habits to reach the university. Local buses, shared bikes and cars have been equipped with beacons: small devices that allow the control of the location - route -, the duration of the trip and the type of means used. University students are invited to download an App, designed by the PRINCE partners, which transfer their travel information through the beacons connected to a web platform. Thanks to this technology, student's travel from home to University and vice versa is possible to map.
The first two phases are preparatory to that of defining the incentive as a reward. The project, through the involvement of third parties, therefore awards prizes to those who use sustainable means to go to the university. The App, through rules, modifies the information relating to sustainable travel in points that correspond to prizes such as discounts tickets for public transport or for entrances to theatres, museums, coupons, ... In addition, at the end of each trip, on the App the student can view the percentage of CO_2 saved thanks to the use of sustainable means (Fig. 4).
The last activity carried out by the project partners before the health emergency linked to Covid-19 was the test phase in December 2019. This phase was carried out to monitor the functioning of the PRINCE application - detection of beacons and implemented rules -. About a hundred students participated in the test phase who, by filling out a travel diary, helped the project to detect some critical issues that have been solved.

3. University mobility in the post lockdown: a new challenge for the actors of the Quadruple Helix towards a resilient city

Mobility is certainly one of the most delicate issues to manage in the post lockdown. Mobility, at least in the short term, will be revolutionized by significant changes in the modal choices induced by the search for safety from contagion.
In today's situation (i.e. circulation of Covid-19-2), according to the INAIL 2020 classification, the entire public transport system must be considered a medium-high risk environment, with the possibility of higher risk during peak times for metropolitan areas with high urbanization.
A study conducted by Urban Radar analyzed the variations in the use of public transport by combining their data with those of CityMapper, World Population Review, GitHub and Moovit. The European cities analysed are six: London, Paris, Barcelona, Stockholm, Milan and Berlin; (Urban Radar, 2020). The study highlighted how the use of public transport has already decreased before the containment measures came into force, then suffering a sharp fall after the adoption of these measures. The reduction in demand varies, for example, from 60% in Stockholm to over 80% in Milan.
This worrying scenario forces researchers and public administration to try to counter a strong risk that, in terms of environmental sustainability, it can lead to a worsening compared to the already problematic previous status quo.
There are many actions already undertaken in the mobility system for the various means such as sanitation, disinfection and sanitization measures, organizational measures, prevention and protection measures; there are many solutions that have yet to be studied.
In this context there is the problem of university mobility which, especially in phase 3, will see a partial or total reopening of the University. Mobility policies also at university level are therefore necessary to be reviewed. These strategies aim to evaluate adequate home-university mobility policies aimed at not increasing congestion, traffic and pollution at urban level.
Adaptability, as underlined in the first paragraph, does not depend only on the actions carried out by public authorities, but it requires the synergic work of all the actors of a city. The paper introduces the concept of a

Quadruple Helix, where the relationships between entities involved in the construction of innovation originate from four subjects: research, institutions, businesses and the population, building a context conducive to the transfer of knowledge (Etzkowitz & Leydesdorff, 2000). Thanks to the involvement of the four actors, a distributed and collective intelligence is created which is fundamental for the safety, resilient and sustainable development of the territory. This innovation allows the creation of a society with greater ability to act.

Reasoning about the actions that the individual actors of the Quadruple helix can carry out can represent a solution to the approach of urban resilience towards the health emergency. The proposed methodology is therefore based on the proposal of specific actions that each of the actors - Public Authorities, Research, Enterprises and Citizens - can implement within risk scenarios. It can therefore be asserted that the resilience of the urban system is a function of the resilience of the various stakeholders which can mainly be grouped into the four actors of the Quadruple Helix. In particular, the function matured as part of a research developed by Pirlone and Spadaro 2020 is reported:

$$\begin{aligned}&\mathrm{Resilience}_{\mathrm{Urban\ system}}\\&= f(\mathrm{Resilience}_{PublicAuthorities};\ \mathrm{Resilience}_{Research};\ \mathrm{Resilience}_{Enterprises};\ \mathrm{Resilience}_{Citizens})\end{aligned} \tag{1}$$

Reasoning about the PRINCE project (described in paragraph 2), as a good practice that can be exported to other realities, the partnership (Public Authorities, Research, Enterprises) and the beneficiaries (students / Citizens) of the project represent the actors of the Quadruple Helix. They can contribute to increase the resilience of urban mobility through the definition and subsequent implementation of specific actions.

Through the definition of specific actions carried out by each actor, the resilience of university mobility, and therefore to the impact of urban mobility, is possible to contribute to increase. Initially, the project was promoted to change the mobility habits of students who used their own means of transport (such as scooters or cars) to reach university. The unsustainable students of the Genoese university before the lockdown were 25-30%. Following the health emergency, the project has acquired an even more important role since, as already mentioned, the number of students who will use private vehicles will likely grow, contributing negatively to congestion, traffic and pollution of our urban areas.

In this context, to think of new home-university travel plans - post-Covid, differentiated according to distance and temporality, is necessary.

For trips of less than 5-7 km, active mobility (pedestrian and cycle) must be promoted. The municipal administration can, for example, plan and create new emergency cycle paths and infrastructure for cyclists. But universities must provide new safe spaces to dedicate to bicycle parking (racks, lockers, ...). Several examples of emergency cycle paths are under construction in many Italian cities, including Genoa. For journeys of more than 5-7 km, journeys by public transport and the use of peripheral interchange parking lots, compared to the city center, are encouraged. On the part of the local public transport partners: buses, subways, car sharing, bike sharing, ... is necessary to adapt and strengthen the safety systems to guarantee the distance and the hygienic-sanitary controls. A careful planning of timetables, spaces and available means to strengthen intermodality is requested from the Municipality and from the local public transport companies.

The student, the fourth actor in the Quadruple Helix, must prove that he is responsible His responsibility must be manifested primarily in compliance with the rules laid down at national level by the government: reduction of travel, social distancing, mask, ... But just as important is the planning of your travel: times (time of day but also days of the week), selected means of transport (preferably sustainable ones or at least a mix of private and sustainable means).

The home-university travel plan - post-Covid together with the actions described, must consider a temporal reorganization of university activities, such as the planning of lessons in different time slots (in the evening

or on the weekend) can combine environmental, social and economic sustainability with reasonable degree of distance and health security.

The plan, originally in its aims, was created to provide indications on how to activate sustainable mobility practices, alternatives to the use of private cars, such as Bicibus and bike / car sharing. The home-university travel plan - post-Covid represents another opportunity for this policy, seeking to transform a tragic situation into an opportunity.

The launch of the PRINCE project with the involvement of the students of the Genoese University Poles should have started in April 2020. The Covid emergency and the lockdown led to the physical closure of the university structures and therefore to the blocking of home-university travel for students. The project therefore stopped on its principle activities, but other actions are still being developed. Such actions are useful to support the actors of the Quadruple helix in the planning choices of student mobility.

In phase 3, the PRINCE project, through the ICT tools (App and beacons) created and its incentive policy that rewards those who travel consciously, can therefore promote and encourage sustainable mobility in all its forms. The project can be important both to encourage the use of alternative means to the private means (target that following the health emergency has become even more important), and to monitor the use of such means by monitoring the movements of students with the App. This good practice will play an increasingly important role in the return to normality. In this context, the University can also confirm its role not only in training, but also as an important actor in the context of innovation in the cooperation of the Quadruple Helix. Role that opens the University to the needs of the territory, creating opportunities to broaden a public consensus around the issues of greatest interest and urgency, such as adaptation to the health emergency. In this way University can become a laboratory to experiment innovative and participatory solutions.

References

Brown, K. (2013). *Global environmental change I: A social turn for resilience? Progress in Human Geography*, Volume 38, Issue 1, 107–117.

Bruntland, Gro Harlem (1987). *Our common future. Report of the 1987 World Commission on Environment and Development*. Oxford, Oxford University Press.

Carayannis, E. G., Campbell, D. F. J. (2011). *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems*, pp 1-63, Springer, New York, NY, Print ISBN978-1-4614-2061-3, https://doi.org/10.1007/978-1-4614-2062-0.

Cascio, J. (2009). The next big thing: Resilience. *Foreign Policy*, 172, 92.

Chong, B. (2020). Five city resilience lessons from the coronavirus, Hong Kong. Retrieved from: https://www.arup.com/perspectives/five-city-resilience-lessons-from-coronavirus.

Collier, S., Newell, J. P, Melissa, S. (2016). Defining urban resilience: A review. *Landscape and Urban Planning*, 147, 38–49.

De Simone, C. (2015). Protezione Civile, *Enciclopedia Italiana* - IX Appendice, Online encyclopedia.

Del Borghi, A., Pirlone, F., Spadaro, I. (2019). Prince: buona pratica per promuovere la mobilità sostenibile tra gli studenti universitari, In *Università e governance della mobilità sostenibile*, Colleoni M., Rossetti M. (eds), Franco Angeli, Milano, ISBN 978-88-917-8811-5.

Etzkowitz, H., Leydesdorff, L. (2000). The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University-Industry-Government Relations. *Research Policy*, 29(2), 109-123.

Etzkowitz, H., Leydesdorff, L. (1995). The Triple Helix - University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development. Rochester, NY EASST Review 14, 14-19.

Hasche, N., Hoglund, L., Linton, G. (2019). *Quadruple helix as a network of relationships: creating value within a Swedish regional innovation system*, https://doi.org/10.1080/08276331.2019.1643134.

Herrador, M., Carvalho, A., Feito, F.R. (2015). An Incentive-Based Solution of Sustainable Mobility for Economic Growth and CO2 Emissions Reduction. *Sustainability*, 7: 6119-6148, https://doi.org/10.3390/su7056119.

INAIL (2020). *Documento tecnico sulla possibile rimodulazione delle misure di contenimento del contagio da SARS-CoV-2 nei luoghi di lavoro e strategie di prevenzione*, Italia.

INAIL (2020). *Indagine nazionale sulla salute e sicurezza sul lavoro*, INSuLa (in press).

International Transport Forum (2020). *COVID-19 Transport Brief. Transport Policy Responses to the Coronavirus Crisis*.

ISTAT (2018). *Spostamenti quotidiani e nuove forme di mobilità 2017*. Statistiche Report, Italia.

Meerow, S., Newell, J. P. (2015). Resilience and complexity: A bibliometric review and prospects for industrial ecology. *Journal of Industrial Ecology*, 19(2), 236–251.

Olazabal, M. (2017). Resilience, Sustainability and Transformability of Cities as Complex Adaptive Systems, *Urban Regions Now & Tomorrow*, pp 73-97, Springer, Wiesbaden, Print ISBN978-3-658-16758-5, https://doi.org/10.1007/978-3-658-16759-2.

Petri, M., Frosolini, M., Lupi, M., Pratelli, A. (2016). ITS to change behaviour: A focus about bike mobility monitoring and incentive — The SaveMyBike system, *2016 IEEE 16th International Conference on Environment and Electrical Engineering (EEEIC)*, Florence, pp. 1-6, https://doi.org/10.1109/EEEIC.2016.7555463.

Urban Radar (2020). Transportation trends in the first weeks of COVID-19: A Look at European Cities. Retrieved from: https://medium.com/@TwelveTone/transportation-trends-in-the-first-weeks-of-covid19-a-lookat-european-cities-dbcf94ff488.

Van Waart, P., & Mulder, I. (2014). Meaningful Interactions in a Smart City Distributed, *Ambient, and Pervasive Interactions*, pp. 617-628, Springer

Wamsler, C., Brink, E., Rivera, C. (2013). Planning for climate change in urban areas: From theory to practice. *Journal of Cleaner Production*, 50, 68–81.

Image Sources

Fig.1: "The concept of Triple and Quadruple Helix for a multi-stakeholder governance resilience process" is an elaboration of the authors

Fig.2: "The phases of the PRINCE project" is an elaboration of the authors

Fig.3: "Answers to the survey: how the Genoa University students travelled before the Covid19 emergency" is an elaboration of the authors

Fig.4: "ICT solutions and incentives approach to support sustainable university mobility", is an elaboration of the authors

Author's profile

Francesca Pirlone

Associate professor in town planning at Polytechnic School - University of Genoa, PhD, engineer. She is a teacher in three university courses of three Degree Courses. She has developed different lines of research, from requalification, natural risks, sustainability, waste, tourism, infrastructures and mobility, activities carried out in EU and national programs. Author of numerous publications and speaker at International and National Conferences.

IleniaSpadaro

Engineer, PhD and Assistant Professorin town planning; she carries out scientific activities at Polytechnic School, University of Genoa, where she is a teacher in courses on Territorial Planning. Her researches are focused on ensuring safety of a territory by natural risks, requalification of historical-cultural heritage, environmental sustainability themes: waste, tourism, mobility and transport, energy. Author of several publications and speaker at International and National conferences.