The Urban Lab of Europe!

JOURNAL

PROJECT

AIR BREAK- Co-producing healthy clean commuting air spots in town

Ferrara, Italy

TOPIC

Air quality

EDIT 09 DECEMBER 2022
BY PIETRO L. VERGA, UIA EXPERT

AIR BREAK Journal Nr. 2

See on UIA website

This second Journal focuses on the achievements of- and challenges for all the core realms of the Air-Break project until October 2022.

Between October 2021 and October 2022, the Air-Break project entered in the core phase of its implementation and achieved significant progress and early results in most of its key strands. At the same time, however, some actions and investments faced additional challenges that have slowed their advancement.

EXECUTIVE SUMMARY

This second Journal focuses on the achievements of- and challenges for all the core realms of the Air-Break project until October 2022.
Reforestation activities have been completed with the plantation of ca. 2.000 trees and shrub in 5 locations. The innovative TalYa trays have been installed and the testing of their efficiency is in progress. An accidental damage to the monitoring sensors however slowed this testing phase.
Participatory Air-Quality Monitoring. All 14 second-level units have been installed and activated and started feeding data in the city's IoT server. The 50 low-cost sensors have also been built during learning workshops with high-schools and are now being distributed through schools and local stakeholders. A crucial data-validation challenge and potential inconsistencies with the official air-quality data have emerged, and this is currently slowing the public release of data collected through the new units.
Mobility. The study on commuting patterns has been completed, providing useful insights for policymaking. Three different gamification campaigns have been concluded, showing positive behavioural change especially when offering rewards. Infrastructural upgrades (Smart Hubs and Smart Bike Lane) however have been severely affected either by the supply chain shortages related to the COVID-19 pandemic, or by the energy crisis following the war in Ukraine. This forced the project to delay the delivery of the Smart Hubs, and to void the procurement procedure for the Smart Bike Lane and design a new solution in-house.
Citizens & Stakeholders Engagement activities have been extremely successful, with the active involvement of a large and diverse number of local stakeholders and citizens in a variety of project activities. The second Air Fest held in October 2022 crowned this success with the participation of over 400 people in a three-days of debates, roundtables, workshops, and site-visits.
With respect to the **UIA Seven Challenges for Implementation**, those most relevant and challenging for Air-Break are Public Procurement and Monitoring and Evaluation.

KEY ACTIVITIES AND INTERIM RESULTS

Between October 2021 and October 2022, the Air-Break project entered in the core phase of its implementation and achieved significant progress and early results in most of its key strands. At the same time, however, some actions and investments faced additional challenges that have slowed their advancement.

Reforestation and Nature-Based Solutions

In 2022, the project started the plantation of nearly two-thousands trees and shrubs and is growing a new urban forest in five selected areas of the city. This new vegetation is expected to contribute absorbing air pollutants, to mitigate heat-island phenomena, as well as to overall benefit urban drainage and to enhance the environmental and landscaping quality of the city. Furthermore, in this reforestation action, Air-Break is also testing the TalYa© Trays: an innovative technology that collects and conveys dew towards the root system of plants, thus allowing a more efficient watering of the vegetation.
All the ca. 2000 plants had successfully being planted in the selected locations by March 2022, and all details on the features of the 5 reforestation sites may be found in my recent web article "An Urban Forest is Growing in Ferrara".
As the plantation and the installation of the TalYa trays have been completed, in July 2022 the University of Ferrara could start monitoring the impact and effectiveness of the trays, by deploying temperature and humidity sensors and a solar-powered data logger in the testbed area of Via Eridano / Tosano. The experiment aims at comparing the soil characteristics as well as the health and growth performance of a set of plants equipped with the trays, against a set of plants planted in a traditional way over the course of four seasons. The results of the study were originally expected for the end of summer 2023; however, the monitoring system had accidentally been damaged forcing the research team to re-install the sensors and therefore causing a few months delay to the experiment.

Figure 1 - Damages to the soil's monitoring system. Source: UniFE

Participatory Air-Quality Monitoring

Participatory air-quality monitoring in Air-Break revolves around the installation of 14 second-level units and 50 first-level low-cost sensors. The formers are intended to provide an additional, more capillary layer of air-quality measurements, feed the city's IoT server and ultimately contribute informing policy decisions. Additionally, the values gathered with these 14 units are also meant to be publicly shared through a dashboard currently under development. The latter, instead, are mostly conceived as an awareness-raising and educational tool for schools and volunteering citizens and stakeholders.
All details of this monitoring system are discussed in depth in my Zoom-In Nr. 1, while in this Journal I will focus on the status of- and challenges to implementation of this core component of the Air-Break project.
At the time of my writing (November 2022), Air-Break has managed significant progress in the first stage of this

activity. The project completed the installation and activation of the 14 second-level units (LSA Units) which already started gathering data, as well as the participatory workshops for the assembly of the 50 low-cost sensors. On the one hand, LSA Units have already started feeding data into the Municipality's IoT Server and information are therefore already available and visible to the local administration on the city's GIS platform. Nonetheless, these units adopt a different technology from the official monitoring stations by the regional environmental agency (ARPAE). LSA Units thus still need to be calibrated in order to ensure that their measurements are coherent with the official ones. To this extent, two LSA Units have been installed in the same location of two ARPAE official stations in order to allow the comparison and alignment of their measurements over the next months.

Figure 2 - LSA Unit and ARPAE Official Monitoring Station. Source: the Author

On the other hand, all the 50 low-cost sensors have been assembled during a series of learning-by-doing workshops carried out with high-schools between fall 2021 and summer 2022.

Figure 3 - Learning-by-doing workshop. Source: the Author

Twenty of these sensors have been allocated to local schools as a support tool for their educational activities. For the time being, and while awaiting the finalisation of the bureaucratic procedures for their installation on the schools' outdoor premises, the sensors are being used indoors for testing and scientific experiments within the schools' regular curriculum (biology, science). Additional 24 sensors will be distributed to local citizens, business owners, and associations that will be selected by means of an open call to become an Air Sentinel and adopt a sensor. These sensors will be installed outside (in the garden or courtyard, at about 1-2 meters in height from the ground) and they will automatically send the single measurements to the server of the Participatory Environmental Monitoring Network (RMAP) and from there the hourly averages will be transmitted to the servers of the Municipality of Ferrara. Lastly, 6 sensors are being kept for back up in case of need.
The second stage of this activity entails the public visualisation of the data gathered through the LSA Units. This will be done through an open dashboard geared to provide hourly updates on Ferrara's air quality conditions on the basis of the newly created Air-Break Index. This new index is set to rank air-quality on a qualitative scale – from very-poor to very-good – by averaging the values of PM2.5, PM10, NO2, O3, CO.
From a technical point of view, the dashboard has been ready for several months already; however, its public deployment is still on hold due to a number of core challenges.
Air-quality monitoring methodologies, threshold values, and mandatory mitigation measures are regulated and managed at European and national, and regional levels. Such countermeasures often involve limitations to motorized traffic and buildings' heating and are therefore a matter of high public sensitivity.
For this reason, it is crucial that there are no asymmetries between the official data gathered and published by the regional environmental agency (ARPAE), and those generated by Air-Break. In this respect, ARPAE raised concerns that mis-aligned data might generate confusion among the population and possibly delegitimize the official sources. Thereby, Air-Break is currently undergoing a thorough review process in order to validate the reliability of the data collected and the scientific soundness of the index, as well as to identify a suitable and unambiguous way to visualize air-quality data publicly. Accordingly, on the one hand the National Research Council (CNR) has been contracted to assess and validate the data collected by the LSA Units, while on the other hand, project partners are working on fine-tuning the way the Air-Break Index is calculated as well as on a new layout for the public dashboard, in order to avoid any possible ambiguity with official, city-level data by ARPAE. Progress in this sense is expected in early 2023.

Mobility

Air-Break tackles mobility from two core standpoints. On the one hand, with a continued effort in monitoring commuting patterns and developing playful digital tools to trigger and reward more sustainable mobility behaviours. On the other hand, with the provision of innovative infrastructural upgrades to support green/light mobility.

Commuting Analysis & Behavioural Change Initiatives

In order to better understand the commuting practices, habits, and trends of Ferrara's citizens and city-users, and

ultimately to inform policy decisions, the project conducted a thorough analysis of mobile phone data provided by Vodafone. The analysis has been carried comparing data from four specific weeks in 2021 with the same 4 weeks in 2019 (pre pandemic):

- End July early August
- September, start of schools
- October, attractive events in town
- November, business as usual, no extra or peculiar activities or peaks

Overall, what emerged is that tourist flows have been rather unchanged in the two periods, while workers' commuting patterns have been significantly altered, most likely by the new remote practices emerged during the pandemic. In more detail, the study allowed to identify the location and causes of traffic peaks throughout the day/week; to highlight workers' top commuting axis and destinations in town; as well as the main origins of commuting flows and means of transportations. With these information, then, the project may assess the efficiency of road axis and the suitability of the public transportation offer in comparison with the actual demand and need of citizens and city-users, and ultimately orient the city's policy decisions and objectives. In this sense, indeed, the city is set to open a set of working tables with companies' mobility managers, as well as with local and regional-level mobility agencies to co-design more sustainable and demand-oriented public transit offers.

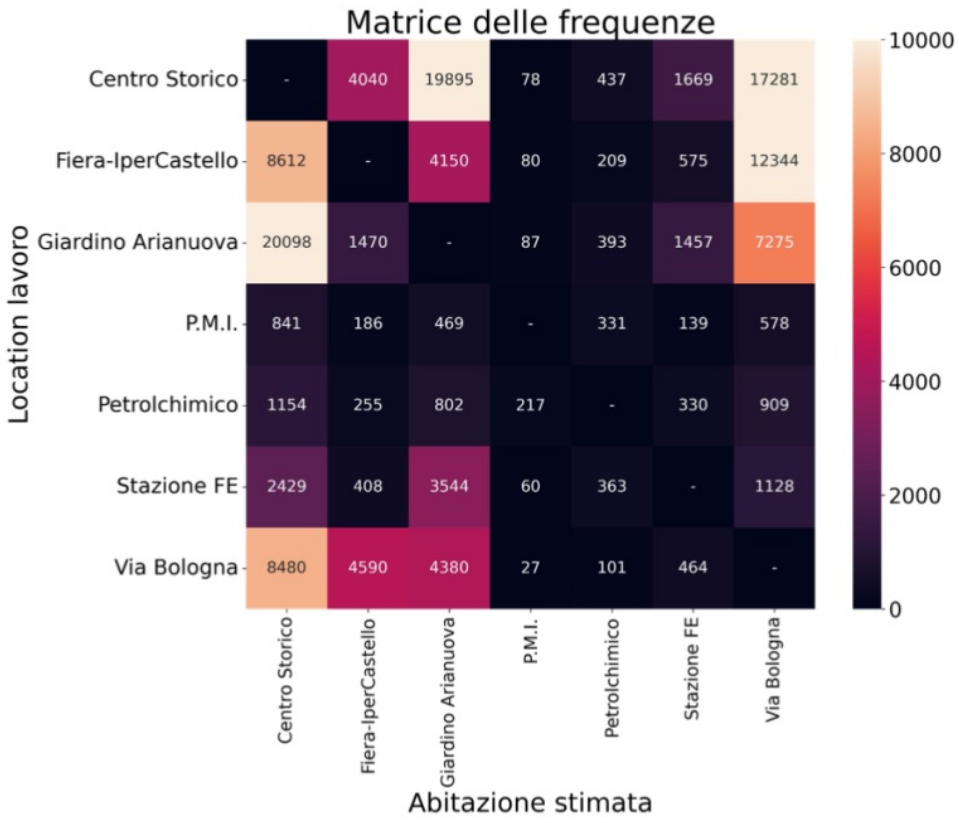

Figure 4 - Origin-Destination Matrix. Source: SIPRO

Beyond analysing commuting patterns, Air-Break also deployed a set of behavioural change initiatives and campaigns towards more sustainable individual mobility choices: BIKE2WORK; Ferrara Play&Go; and Kids Go Green.

"BIKE2WORK provides incentives for sustainable mobility through an economic contribution for workers committed to using bicycles for home-to-work trips. Employees of participating companies are rewarded for their home-to-work trips by bike with economic incentives in their pay checks (0.20 C per Km, max 50 C per month, max 20 km per day). Mobility managers and employees are supported by a software platform and a mobile app, and the overall campaign participation is supported by a specific life–cycle" (Bucchiarone et.al, 2022) as shown in Figure 4.

In terms of achievements, since May 2021, BIKE2WORK managed to involve 584 employees from 58 companies, which completed 42.973 bike journeys for a total of 160.160 kilometers.

Figure 5 - Bike 2 Work participation lifecycle. Source: Bucchiarone et.al (2022)

"Ferrara Play&Go2 is a long-running gamified urban mobility campaign promoting voluntary travel behaviour change. In Play&Go, players exploit a mobile app to track their sustainable journeys, which are subjected to an automatic validation procedure and are rewarded with virtual points and allows the player to proceed in the competition. Play&Go combines standard game elements (e.g., points, badges, leader boards, real prizes) with personalized game content (i.e., single and multi-player, competitive and collaborative weekly challenges) that is tailored to the player's profile and is specifically focused on encouraging and rewarding a positive change in the player behaviour" (Bucchiarone, Bassanelli, Marconi, 2022).
This campaign run between December 2021 and June 2022, counting 675 active players that travelled 160.000 kilometers over 38.310 trips.

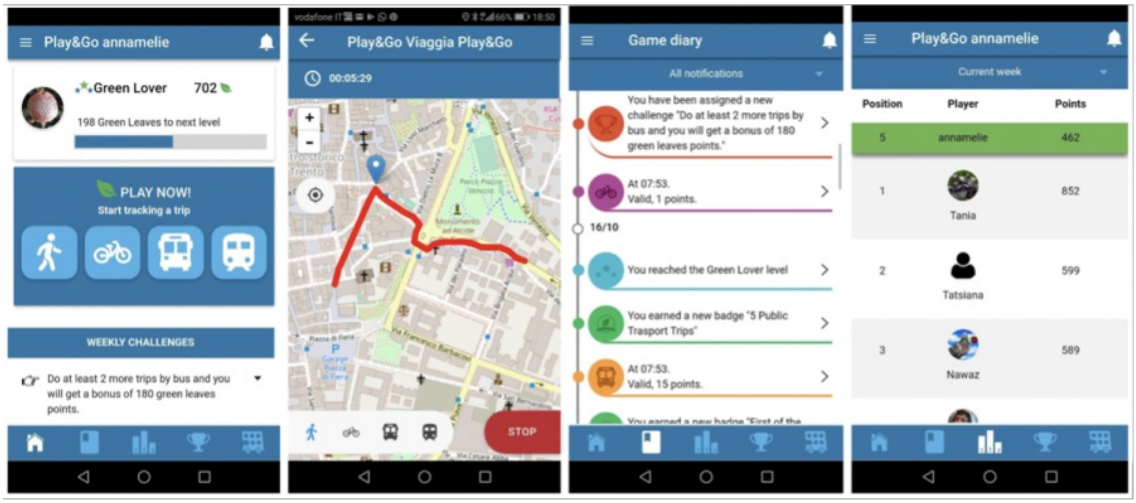

Figure SEQ Figure * ARABIC 6 - Home page and main functionalities of the Ferrara Play&Go App. Source: Bucchiarone, Bassanelli, Marconi (2022)

"Kids Go Green involves the entire school community (children, teachers, and families) in a gameful educational journey to promote sustainable and active home-to-school mobility for primary and middle school age children. In Kids Go Green, the sustainable kilometres made by each child on their trips from home to school (e.g., on foot, by walking bus, by bike, with the school bus) contribute to the progress of the whole group of children on a virtual educational journey to places in the real world that is personalized according to the group interests and capabilities" (Bucchiarone, Bassanelli, Marconi, 2022).
In terms of result, during schoolyear 2021-2022, 185 pupils from 10 classes and 4 different schools participated in Kids Go Green and totalled 18.389 km, corresponding to a total of 7 virtual trips.

Overall, in the last assessment of the three campaigns conducted in 2022 by Bruno Kessler Foundation "data show that each campaign reached the aim to change users' behaviour and that the rewarding systems implemented played a crucial role in the realization of this goal" (Bucchiarone, Bassanelli, Marconi, 2022). These results suggest that awareness-raising alone might not be sufficient to determine substantial behavioural change. Hence, in the perspective of upscaling and mainstreaming the solution, it will be key to identify a rewarding strategy that is sustainable in the long run.

Bucchiarone, A., et. al, An End-to-End Solution for Enabling Urban Cyclability: The BIKE2WORK Experience. IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, 2022

Bucchiarone, A.; Bassanelli, S.; Marconi, A. How to Foster Eco-Sustainable Behaviors through Multi-Campaigns Rewarding Mechanisms: The Air Break Experience. Sustainability 2022

Infrastructural Upgrades

In terms of infrastructural upgrades, Air-Break is set to deploy four Smart-Hubs and do realise a new Smart Bike Lane connecting the Technological-Scientific Pole in the West of the city to Via Cavour through Via Mulinetto and Corso Isonzo. While all executive designs have been completed and approved, both investments have been severely affected either by the supply chain shortages related to the COVID-19 pandemic, or by the energy crisis following the war in Ukraine.
The Smart-Hubs suffered delays in the supply of raw materials, especially for their electronic components (i.e., router; antennas; access points; photovoltaic panels), which have only been delivered in the last quarter of 2022. Project Partners are currently undergoing bureaucratic procedures before being able to proceed with the installation and activation of the hubs, tentatively in the first quarter of 2023.
The Smart Bike Lane, instead, suffered a sudden halt during summer 2022 in the wake of the energy crisis. While the executive designs were ready, and the procurement procedures completed, at the time of the contract signature, the selected supplier and owner of the patent for the mOOve® Modules, due to a dramatic increase in production costs – combined with a shortage in the supply of steel – acknowledged the impossibility to deliver the product within the timeframe and at price defined in the procurement procedure. Therefore, the procurement of the mOOve® Modules has been cancelled and the MUA and Project Partners had to find an alternative solution and to design in-house a new bike lane. At the time of my writing, the project is considering replacing the modular flooring with a more standard carpet made of recycled materials but directly deployed on the ground. Moreover, the bike counters and adaptive lightening systems originally foreseen to be embedded in the modular flooring will be replaced by smart cameras capable of providing the same functionalities. Due to this contingency, we report the missed opportunity of testing for the first time ever the mOOve® Modules in an urban context. Nevertheless, the fast reaction of the Project Partners to identify an alternative solution shows a remarkable capacity of resilience, creativity and innovation of the MUA and its project partners.

Overall, with the cease of the main restrictions to public gatherings previously imposed by the COVID-19 pandemic, Air-Break seized the opportunity to accomplish major achievements in the engagement of citizens and stakeholders at all levels, registering high level of participation in all activities organized with schools as well as in the gamification campaigns and in the roundtables and working groups on commuting. The second Air Fest (Festa dell'Aria) held in October 2022 crowned this success with the participation of over 400 people in a three-days of debates, roundtables, workshops, and site-visits.
Reforestation activities and the installation of the new air-quality monitoring units have been completed successfully. Challenges instead emerged on the one hand in the validation of the air-quality data gathered and elaborated by the project; and on the other hand, in the procurement and deployment of mobility infrastructural upgrades.

CHALLENGES FOR IMPLEMENTATION

Challenge		Observation
Leadership Challenge level	●	From Journal #1, the assessment of this challenge is unchanged. The MUA is strongly committed to the project both at political and technical level. On the one hand, Air-Break is a priority for the city's administration, and this ensures the full support and the direct, active involvement of political authorities in the project activities and public events. On the other hand, all senior managers from the different departments involved are engaged in- and stimulated towards the development and successful and timely implementation of project activities.

Public Procurement

Challenge level

The worldwide supply-chain bottlenecks stemmed out of the COVID-19 pandemic combined with the energy crisis developed as a consequence of the Russian-Ukrainian conflict, resulted in a dramatic increase of inflation at global level. This had a strong impact also at project level, forcing the company selected for the delivery of the Smart Bike Lane (SBL) to withdraw from the procurement procedure, as no longer able to offer the product at the conditions set in the tender. Under these conditions the MUA had to change plans and design alternative solutions to deliver the SBL. While the design and construction will be performed within the partnership, the MUA still needs to procure the different components to realise the new solution, and it is expected that the SBL could be deployed towards the end of the first quarter of 2023.

Cross-Department Working

Challenge level

From Journal #1, the assessment of this challenge is unchanged. The MUA established two bodies to ensure a smooth cross-department harmonisation:
A core Project Management Unit (PMU) composed by senior managers and senior staff from both the General Directorate / International Relations and the Environmental Quality Service, which is in charge for the overall coordination of the project.
The Operational Team (OT), composed by the managers of all departments involved in the project, which regularly meet and align their activities.
Traditionally rooted silo-mentality within the administration is still a challenge, yet the regular meetings of the PMU and OT sensibly contribute mitigating this.

Participative Approach

Challenge level

From Journal #1, the assessment of this challenge is unchanged. All Project Partners are strongly invested and engaged in the project and in the successful implementation of its activities. There is a very good degree of interaction among project partners, local stakeholders, and the civil society in the co-implementation of the different actions/activities related to the air-quality monitoring network. In particular, the larger group of stakeholders has been very active and engaged, with the prominent participation of local high-schools, the regional environmental agency - ARPAE, as well as of a number of national-level associations and interest groups (e.g., Legambiente, FIAB)
However, many elements of the project are still not fully integrated among themselves and are hardly conceived as components of the same unique system, with a still persisting silo-thinking attitude.

Monitoring and Evaluation

Challenge level

At this stage of the project, monitoring and evaluation is the most challenging aspect for Air-Break on two main levels. On the one hand the delays in the deployment of the Smart Hubs and Smart Bike Lane will allow only a few-months window to assess the impact of these investments.
On the other hand, the still-pending validation of the measurements of the newly installed second-level air-quality monitoring units, risks to delay and/or limit the assessment of the efficiency of this core component of the project. Moreover, in this context also the participatory dimension of the activity, with the release of the open air-quality monitoring dashboard has been put on hold.

Communication

Challenge level

With the cease of the limitations to public gatherings and an enhanced social-media presence, the Air-Break project sensibly improved its outreach, visibility, and communication capacity, being able to disseminate effectively the main achievements accomplished.

Upscaling

Challenge level

As illustrated in Journal#1, Air-Break has a manyfold upscaling potential:

- At the end of the project, and on the basis of the results achieved during implementation, the MUA intends to extend and mainstream Air-Break's experimental approach to the whole city's integrated sustainable urban planning policy.
- Thanks to the active involvement of ARPAE in the larger group of stakeholders, Air-Break's approach to AQ participatory monitoring has the potential to be scaled-up at the regional level.
- The products and technological solutions tested within Air-Break also have the potential to be adopted and replicated elsewhere

In addition to this:

- The early findings of the project (e.g., commuting patterns, outcomes of participatory workshops and consultations, insights from gamification campaigns, etc...) are currently being processed by the MUA's technical departments and will inform the development of the new General Urban Plan (PUG, Piano Urbanistico Generale).
- The large network of stakeholders activated within Air-Break constitutes a major asset for the MUA and the project partnership for the development of new synergies, projects, and collaboration pathways.

Air quality

See on UIA website