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The Urban Lab of Europe !

The DIAMS project
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AIR QUALITY

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The DIAMS project

The **DIAMS** project aims to tackle the Metropole's air quality problems by establishing an alliance to bring together citizens, community leaders as well as private and public stakeholders. By building an open source data-exchange platform focused on service delivery, the project aims to achieve five strictly interrelated objectives. First it aims to improve air quality information and produce high quality, detailed and adaptive data by combining the power of IoT, citizens' science and experienced local actors. It will also enable a fluid territorial air quality data exchange among urban, regional and national authorities to facilitate integrated planning. The wealth of data collected will be designed as a source of inspiration for citizens and private sector creativity to co-design innovative solutions to air pollution. Last but not least the project aims to provide adaptive and personalised information on air quality and related measures to citizens. By shaping citizen-driven air policies and innovative business models the projects will actively contribute to the creation of economic and social value for the Metropole's large population.

Partnership

- Aix-Marseille Provence Metropole
- AirPACA
- ARIA Technologies
- Cooperative ALab in the Air
- Mobigreen – La Poste
- Matrice
- L'Air et Moi
- Groupe Tera
- AVITEM

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1. EXECUTIVE SUMMARY

This is the first journal dedicated to the DIAMS project (DIgital Alliance for Marseille Sustainability), funded by the Urban Innovative Actions. The project started in 2019 and by the date of the publication of this journal, it has completed its first year of implementation.

The Aix Marseille area is one of the fifteen areas in the French territory that exceeds the standards of good air quality conditions as set by the European Directives. The European and the French law and the local strategies aim to improve the air to eventually reduce population exposure to harmful pollutants.

The Aix Marseille Metropole (AMP) has decided to tackle the environmental problem of poor air quality by creating a digital platform where all parts of the society, including general public, policy makers, industries, associations, etc., collaborate and find solutions in a collective way. This is aimed to be achieved by the deployment of new air quality data obtained by small and portable sensors, integrated to the existing monitoring network, to increase the amount, both temporary and spatially, of air quality data; and by providing new numerical services (web and mobile applications).

In this first journal about the DIAMS project, a general overview of the European, French and local legislation regarding air quality is outlined in order to see how DIAMS fits within the existing legislation. Also, some of the challenges outlined by the Air Implementation Pilot project, led by the European Environmental Agency (EEA) and the European Commission undertook in 2012 and 2018, are also explained and helps to contextualize the important role that DIAMS play not just in the Aix Marseille Metropole, but also in a wider European scale.

More importantly, this first journal focuses on the main challenges that the implementation of the DIAMS project has faced and will be encountering in the coming years. Some of these are common to other environmental projects that aim to engage and communicate with all parts of the society including the most sceptical part and also economical actors. Other challenges are given by the local circumstances such as the coming local elections in March 2020 that have held up the leadership of the project at the political level until; and the strategic discrepancies between some of the partners of the project.

2. POOR AIR POLLUTION: REGULATING THE AIR TO IMPROVE PUBLIC HEALTH

Poor air quality is one of the most important challenging environmental issues that European cities are facing. According to the World Health Organization (WHO) poor outdoor air quality is associated with health effects ranging from increased hospital admissions and emergency room visits, to increased risk of premature death. In Europe (EU-28), fine particulate matter ($PM_{2.5}$) pollution was associated with 374,000 premature deaths in 2016 and around 68,000 and 14,000 premature deaths per year due to exposure to nitrogen dioxide (NO_2) and tropospheric ozone (O3)[1]. But poor air pollution also affects ecosystems and some air pollutants have a climate forcing effect too.

Air quality has improved substantially over the last years in city centres in most countries in the EU, with downward trends in concentrations of several major pollutants including $PM_{2.5}$ and NO_2, mostly due to introduction of emission standard regulations for road traffic[2,3]. However, $PM_{2.5}$ concentrations are above the WHO health limit and NO_2 exceed the European Limit Value in a large number of cities across Europe.

The area of Aix-Marseille in south of France is one of the 15 areas in the French national territory exceeding the air quality standards for Nitrogen Dioxide (NO_2) and Particulate Matter (PM). It is the biggest metropole in France with more 1.8 million inhabitants, grouping 92 municipalities, where 70,000 of its inhabitants are exposed to NO_2 levels exceeding the EU Limit Values. And this has an impact on human health. An epidemiological study linked exposure to particulates and increased risk of emergency asthma hospital visits in 3- to 18-year-old children in Bouches-du-Rhône[4].

Regulations of the air quality are implemented at various scales, ranging from the European level to the very local one. A description of the legislation framework relevant to the UIA DIAMS project can be found in the following subsections.

2.1 European level

In Europe, there are mainly two pieces of regulation to combat air quality. First, the **EU Ambient Air Quality Directives (2004/107/EC and 2008/50/EC)** set a series of Limit and Target values to protect human health and the environment. Also, they stablish the basis for the Member States to assess air quality in all their territories; to adopt and implement air quality plans to improve air quality in those places where standards are not met; and to maintain it where the air quality is good.

Second, in order to control the emissions of air pollutants, **the National Emission Ceilings (NEC) Directive (2016/2284/EU)** sets national emissions limit for nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO_2), ammonia (NH_3) and fine particulate matter ($PM_{2.5}$) for Member States and the EU.

2.2 National level

At the national level, France regulates the air pollution levels and its emissions in its territory following the EU legislation and it is complemented by three decrees:

1. the **decree of 7th April 2016 (DEVR1603792A)** that establishes a suite of measures to be implemented during pollution episodes;
2. the **decree of 19th April 2017 (DEVR1710772A)** that establishes the national plan of monitoring ambient air quality;
3. and the **decree PREPA of 10th May 2017 (DEVR1707177A)** that establishes the national plan to reduce the atmospheric emissions of pollutants

2.3 Local level

The Metropole Aix Marseille Provence (AMP) developed its Environmental Strategy which the aim of improving air quality in the Metropole. The list of actions is grouped in nine thematic areas:

1. Routinely air quality monitoring
2. Relieving dense urban areas
3. Cleaner transport
4. Promotion of the use of public transport
5. Reduce transport from heavy duty vehicles
6. Reduce the impact of maritime and port activities
7. Promote building energy efficiency
8. Efficient management of green waste
9. Reduction of industrial emissions

2.4 The accountability chain

The accountability chain was defined by the Health Effects Institute in the United States and tracks the effects of an air quality regulation from promulgation to final impacts on public health. Consideration of accountability starts with assessment of the effectiveness of regulations for reducing emissions and whether reductions have affected ambient concentrations as intended. Assessments must then evaluate whether adverse health effects of air pollution have been reduced[5]. The accountability chain is represented in Figure 1.

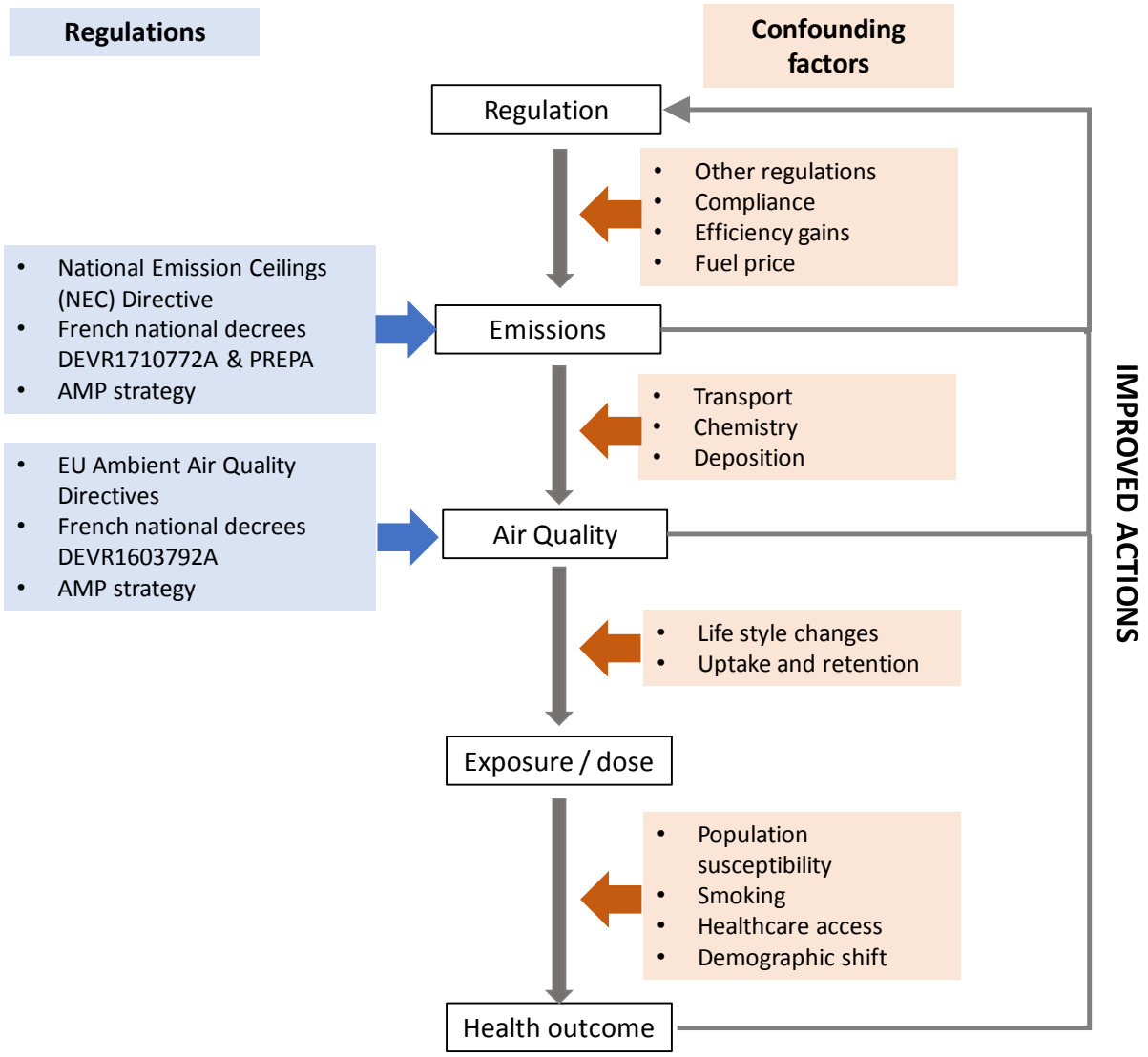

Figure 1. Accountability chain in air quality projects aiming to improve public health. Pieces of legislation at the European, national and regional levels regulating each of the steps are indicated. Adopted from 5.

The UIA DIAMS project follows nicely this accountability chain. It aims to reduce the emissions of air pollutants in the Aix Marseille Metropole by engaging different actors of the society, including industries and citizens; that in turns, aims to reduce the air quality levels measured in the area; to reduce the exposure of harmful pollutants to the population to improve public health standards.

3. THE EUROPEAN PILOT PROJECT TO COMBAT URBAN AIR POLLUTION

In 2012, the European Environmental Agency (EEA) in agreement with the European Commission, implemented an Air Implementation Pilot project to understand what cities need to better implement EU air quality legislation and also to set a platform where cities share their experiences[6]. The Air Implementation Pilot had five workstreams which included emissions inventories, modelling, monitoring networks, management practices and public information. A total of 12 European cities in different countries were chosen to participate. Relevant to the UIA DIAMS project, one of the challenges that were identified in the Air Implementation Pilot project was that, in general, the cities underuse mass media, social media websites, and new technologies like smartphone applications. In return, most of the participating cities highlighted the lack of feedback on the interest of their citizens in air quality issues.

In a follow-up project in 2018, cities reported that a number of important challenges still remain, including communicating and engaging with the public on air quality issues and making the case for new air quality measures. Achieving policy coherence across administrative and governance levels, as well as generating political and public support for improving air quality beyond the minimum EU standards, was still challenging[1].

The UIA DIAMS project is actually working towards overcoming the challenges identified by the Air Implementation Pilot project, especially in the engagement of the different actors of the society.

4. THE UIA DIAMS PROJECT IN THE AIR QUALITY CONTEXT

The UIA funded **DIAMS project** (Digital Alliance for Marseille Sustainability), led by AMP, aims to **create an innovative information system on air quality** which on itself aims:

1. To promote a fluid transmission of territorial data and air quality data between urban, regional and national platforms; and ensure their consistency
2. To produce and deliver high-time and spatial-resolve air quality data in the area
3. To increase the awareness and the level of engagement of both citizens and policy makers through personalized and adaptable information
4. To promote behavioural change in citizens and private sector industries in order to find innovative solutions to improve air quality

In concrete terms, the **DIAMS project aims** to deploy **a platform to exchange data on air quality and digital services** (e.g. apps, on-line services) so all parts of the society (comprising decision-makers, experts, citizens and economic actors) commit to develop coordinated action plans at all territorial levels (individual, local, urban, regional, national and European-wide) to combat air pollution.

Therefore, the DIAMS project fits within the frame of the Environmental Strategy of the AMP in six of their nine thematic areas (1, 3, 4, 5, 6 and 9).

5. OVERVIEW OF THE OPERATIONAL CHALLENGES DURING THE DIAMS IMPLEMENTATION

In the following section a description and analysis of each of the challenges that the implementation of the UIA DIAMS project have faced in the first year of life and faces in the forthcoming years are described below.

5.1 Leadership

The leadership challenge for the DIAMS project is moderate. In terms of the leadership, we have to distinguish two domains. The first one, the management team for the project at the Metropole, working in close collaboration with other departments within the local authority (EU department, Digital Strategy, Communication, Smart Tech and Smart City Unit), is efficient and engaged in the delivery of the project.

The second, it is the political leadership which has been lacking during the first year of the implementation of the project. The main reason for this is the upcoming municipal elections in the AMP marked for March 2020. However, recently, the political leadership has started to change, and it is showing signs of engagement.

One of the most significant signs of the lack of engagement at the political level was the non-existence of an official launch of the project until January 2020. By that time, DIAMS already started its second year of implementation. This was shown to be problematic given that the project aims to create a community working together to raise awareness of the air quality problems in the urban area among the general public but also across different economic actors; and to find solutions in a collective way. The project had a website in the public domain and the different partners were already working towards involving citizens, schools and also the private sector.

However, the management team at the metropole level and also the different partners worked towards changing this. For instance, the elected representative of the Environmental Strategy department went the inauguration of the *Living Lab* (see section 5.6) in October 2019 and showed a high level of interest about the place and the activities planned. Also, DIAMS had several lobbying meetings with external actors (GPMM, industries, associations, etc.) and by a process of word of mouth, the elected representatives started hearing more and more about the DIAMS project. And most importantly, the municipal campaign put on the spotlight the air quality problems in the region and therefore politicians started to gain interest about DIAMS and also used it in their campaign.

Therefore, the leadership challenge for the DIAMS project is moderate but with clear signs to be low in the near future.

5.2 Public procurement

The procurement challenge is limited for DIAMS. During the implementation of the project only two public procurement processes are expected and therefore the impact of those is expected to be low. However, the criteria used in the public procurement process in the AMP is based on 30% technical and 70% on the economic cost and this distribution on percentages risk to grant less expensive services but less innovative ones.

5.3 Cross-department working

DIAMS, conversely to most of other UIA projects where projects are led by one single municipality, is led by the Aix Marseille Metropole comprising a total of 92 municipalities.

The members of staff at the AMP involved in the DIAMS project comprise different departments at the local authority: EU Service, Digital Strategy Direction, Communication Direction, Smart City Service and the Environmental Strategy Direction. All these departments are geographically separated in the Metropole, in different cities. Despite, the different members of staff showed a good level of participation, involvement and engagement with a constant communication flow through phone calls and email exchanges; and bi-monthly meetings. In some of the strategic meetings all services and departments are also called. Some of the subjects and aspects of the project are led by a single department.

The fact that the project is lead by a Metropole and not a single municipality, acting as a supra-local actor, might be beneficial to attain the main objectives of the project. First, it might have a greater capacity to reach more agents of the society (citizen, industrial partners, policy makers, etc.) than a single municipality and engage them in the project. Second, air quality policies might benefit of the supra-local dimension of the Metropole, ensuring consistency across a set of cities that are clearly interlinked.

Therefore, the cross-department working setting at the local authority level is not going to pose a challenge in the implementation of the DIAMS project.

5.4 Participative approach for co-implementation

The participative approach designed by the DIAMS project is well organized and have fortnightly scheduled meetings with the different actors and partners. A full work-package of the project is dedicated to this. There are three fortnightly meetings which involve different actors and partners:

- *Steering Committee*: This committee is composed by senior members of staff and the project management team at the AMP and other two partners of DIAMS (Atmosud and LAB in the air). The aim of the Steering committee is to make strategic decisions and provide an oversight of the project. These meetings are held quarterly.

- *Leaders Committee*: This committee is composed by the DIAMS project management at the AMP, Atmosud and Lab in the air. It decides on the general activities of the project and the general budget of the project and the meetings are held every two weeks. Depending on the topics discussed, appropriate directions are solicited to participate.

- *Partners Committee:* This committee is made up of the project managers of each partner

and takes place once a month. Each partner gives an update about the progress of the project for those work-packages they are involved in, they communicate about the activities and the project results.

All meetings have an agenda which is circulated in advance; and minutes are taken and shared to all through an on-line exchange platform.

Despite the good organization and the regularity of the meetings for each of the committees, there are clear discrepancies between some of the partners. At the strategic level, there are different visions in how to engage parts of the society such as the economic actors of the area and the procedures to follow. Also, the definition and the design of the on-line platform to exchange air quality data, also is proven to have different opinions from the major partners of the project. This is proven to be the largest challenge that DIAMS is facing.

5.5 Monitoring, evaluation and measurement

Monitoring, evaluating and measuring the impact of the project might pose a medium challenge for DIAMS. The innovative nature of the project makes it very difficult to quantify the results of the project as it evolves around the creation of the DIAMS community. The proposal of the project outlined the targets that the project is willing to achieve and as well the methodology how to quantify them.

There are few metrics that might result appropriate to quantify the success of the project such as the compatibilization of the number of start-ups and services around the air quality domain. However, evaluate the level of awareness of the air quality problems in the local area among the population and quantify the effect of the DIAMS project may be challenging. Metrics such as the number of engaged contributors or the percentage of people in the target groups that have been reached might not be enough to capture the degree of engagement from the potential beneficiaries. In general, environmental projects face the big challenge of reaching the sceptical part of the society: for instance, those not willing to change from the use of private car to public modes of transport.

Also, the project is aiming to reduce the population exposure to fine particulate matter. However, it is unclear how this goal is going to be evaluated and isolated from other possible policies taking place at the local, regional and European level, that might be also contributing to the reduction of ambient levels. Also, air quality levels are also confounded by other factors as shown in Figure 1 (atmospheric transport mechanism, chemistry, etc.). The methodology how this is going to be quantified is still unclear at this level of implementation.

5.6 Communication with target beneficiaries

The communication with the beneficiaries is a key part of the implementation of the DIAMS project.

The communication strategy of DIAMS is organized around three main aims:

1. To formalize and give value to the engagement of the local authority to the innovative approach to combat environmental issues
2. To mobilize the population and increase the level of engagement with the project

3. To capitalize the innovative approach

The parts of the society that DIAMS is aiming to reach are:

1. Institutions: The Aix Marseille Metropole, the Department of national education, Europe, The Region, The Department 13, ARS (Regional Health Agency), ADEME (The Agency for the Environment and Energy Management), etc.
2. Private companies such as Siemens, local start-ups, etc.
3. Associations: environmental associations, PIICTO, etc
4. Industries
5. Citizens

One of the key actors that DIAMS is aiming to reach and involve in tackle the air quality problems of the AMP are the industries. About one third of the air pollutants emissions to the air are estimated to be released from industrial sources. However, industries are facing the challenge to be competitive in global markets and improve environmental standards might not be a priority once complying with the law. As partners and active actors within the DIAMS community, there are some ways that industrial actors might be engaging: by improving the transmission and the dissemination of real-time emission data; by improving the management of air quality crisis; by restoring the confidence in standard events; among other examples. The way how to engage industrial partners in the DIAMS community is still under discussion between project partners. Some of the partners envisage to engage industrial actors by providing a set of examples and practical cases (*case studies)*; others, by applying more state-of-the-art methods such as *DPSIR +C* (Driver, Pressure, State, Impact and Response) methods.

Road traffic emissions in the AMP region are estimated to contribute another third to the total emissions. Traffic emissions can be associated to industrial processes (for instance, traffic of heavy duty vehicles in and out of industrial premises, transport of raw materials and gods, etc.) but also associated to private drivers using their vehicles for transport. In this second case, drivers might see their contribution as insignificant in comparison with other big emitters (e.g. industries) and therefore not aiming to change. This behaviour has been observed in a previous study where car users did not make links between their own behaviour and air pollution. This highlights the difficulty in reducing air pollution through vehicular reduction or behavioural changes[7]. Reaching this part of the population might be challenging during the implementation of the DIAMS project accompanied with a lack of powerful public transport policies associated with the DIAMS project itself.

Overall, reaching to all parts of the society might represent a challenge when configuring the DIAMS network. Most of the people who are mobilized and engaged in environmental projects usually show a high degree of involvement in different environmental initiatives before the development of a new project. Reaching to the sceptical part of the society might be difficult and this might be exacerbated if the political leadership, that has started to engage during the second year of the project, falls to engage fully during the rest of the implementation years.

The mechanism that DIAMS is aiming to reach the wider public is through active workshops where citizens collect their own data by means of portable sensors and visualizing the data. These activities are going to be run in a new created space, the *Living Lab*. Similar type of activities with small and portable sensors will be

undertaken in schools with young students. All these activities are scheduled to launch the first term of 2020. Visualization of air quality data from sensors has been agreed to be one way to draw public attention to imperceptible hazards such as air quality[8]. However, other studies have indicated that the use of maps of air pollution levels explained the causes and the extent of air pollution, but not why people should be concerned, and therefore the use of pollution maps might be difficult for public participation on local air quality policy making.

5.7 Upscaling

DIAMS already included an upscaling project on its proposal. During the first year of the implementation of the project, DIAMS aims to set up the communication plan and the set of activities to engage the different key beneficiaries. The second year is set to test them; and the third year to scale it up. Therefore, this challenge might not pose an impediment for DIAMS.

One aspect that partners might want to consider in the upscaling process, is to define the mechanisms how to keep the DIAMS community alive and active once the project is finished. For instance, how to maintain the digital platform; the availability of the sensors for the use of schools, citizens, etc.; how to ensure the long-term engagement of the population for air quality problems, etc.

6. CONCLUSIONS

Overall, the implementation of the UIA DIAMS project is facing two big challenges: adopting a participative approach between all the partners of the project; and the communication with key beneficiaries (Table 1).

The first challenge is due mainly to differences in strategic views between the two main partners of the project. However, through the scheduled meetings and the participation of all partners of the project, under the direction of the AMP, this might be overcome over time. The second, responds to the nature of environmental projects and not only to the DIAMS project. Environmental projects face the difficulty how they can engage with the wider public and the different actors of the society.

There are other two aspects that pose a medium challenge for the implementation of the DIAMS project: the leadership, related to the delay of the political engagement at the local level; and monitoring, evaluation and measurement. The latter is also general in most air quality projects.

The other aspects are expected to be low for DIAMS.

Table 1. The challenge traffic light for the UIA DIAMS project.

Challenge	Level	Keywords
1. Leadership	Medium	Delay in the political leadership
2. Public procurement	Low	Low number of public procurements for the implementation of the project
3. Integrated cross-departmental working	Low	Good inter-department network
4. Participative approach	High	Confrontational views and perspectives between partners
5. Monitoring, evaluation and measurement	Medium	In the process for the right definition of the quantitative and qualitive parameters
6. Communication with target beneficiaries	High	Good communication plan but challenging to reach all parts of the society, specially the most sceptics.
7. Upscaling	Low	Planned in the proposal

The next steps foreseen by the project are the launch of the citizen engagement activities through the workshops and *ateliers* in the new created space *'The Living lab'* and also the school activities. New portable sensors to measure exposure to air pollution will be finished to be manufactured and distributed to citizens and also used in the workshops and the scholar activities.

The architecture of the online platform will be also discussed and designed in the coming months, integrating regional air quality measurements with those obtained from the sensors and integrating data services that might be developed integrating all these data sources.

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