Executive summary

The **UIA DIAMS project**, lead by the Aix Marseille Metropole, aims to engage the different parts of the society to improve the air quality problems in the region by means of an **open source data-exchange platform** focused on **service delivery**. This first zoom-in report focuses on the online platform, from its purpose and focus passing by its design process and by its future use.

The UIA DIAMS online platform originates from the idea the "air as a service" and it would be the platform for data and services exchange provided by different type of contributors. The platform is based on four main areas: sensor platform; territorial portal; innovation portal and services platform.

A design sprint was held for five days at the end of June 2020 that produced a prototype focused on the end-user. This type of methodology ensure that the proposed solution is aligned with the users' needs. It also contributes to overcome potential obstacles and resistances that might appear in the future.

The DIAMS digital platform
Report outline

- 1. Introduction to DIAMS
- 2. Data revolution in air quality governance
- 3. The DIAMS digital platform
- 4. The creative moment: the *sprintdesign*
- 5. Conclusions and recommendations

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1. Introduction to DIAMS

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 where 70,000 of its inhabitants are exposed to nitrogen dioxide (NO_2) levels exceeding the EU Limit Values

Air Quality (AQ) policies are designed following a **top-down approach**, from governments (at the European, national and regional and local levels) to industries and population. This creates a **lack of empowering** leading to a **lack of involvement of the general public but also from industries** in the fight to to combat poor urban air quality.

Nitrogen dioxide (NO_2) is a suffocating and irritating gas that comes mainly from combustion sources (diesel traffic and industrial emissions). Exposure to NO_2 is associated to bronchitis, asthma and other respiratory diseases.

Particulate Matter (PM) comprises small, solid particles that often come from traffic and combustion. These particles penetrate airways, lungs and even blood vessels. They are known to be responsible for cardiovascular and respiratory diseases, as well as lung cancer.
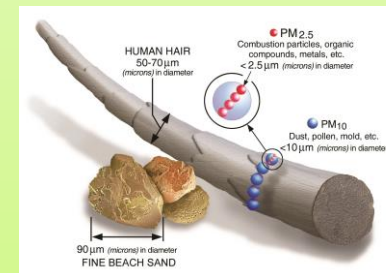
Source: www.epa.gov

The DIAMS project aims to tackle the **Aix Marseille Metropole's** air quality problem by establishing an alliance bringing together citizens, community leaders and private and public stakeholders.

The project have 5 main interconnected aims, which are:

1. To improve air quality information
2. To produce high quality, detailed and adaptive data by combining the power of IoT, citizens' science and experienced local actors.
3. To enable a fluid territorial air quality data exchange among urban, regional and national authorities to facilitate integrated planning.
4. To promote the co-design of innovative solutions to air pollution by citizens and private sector by means of the data collected.
5. 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 project will actively contribute to the creation of economic and social value for the Metropole's wide population.

One of the central activities of the UIA DIAMS project is to build an **open source data-exchange platform** focused on **service delivery.** This platform should be an area where:

▶ Air quality data from different sources (fixed monitoring sites from the regional environmental agency in charge of the air quality control; and that obtained from small sensors) should be embedded

▶ Services and apps

▶ Private and public stakeholders and also the general public interact in relation of the air quality problematic in the Aix Marseille Metropole

▶ A platform where policies to combat air quality are defined in a collaborative way

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2. Data revolution in air quality governance

The United Nations 2030 Agenda for Sustainable Development includes 17 Sustainable Development Goals (SDG) of which, goal #11, is **Sustainable cities and communities.** This goal envisages reducing the adverse per capita environmental impact of cities, by paying special attention to air quality and municipal and other waste management.

New technologies and the current data revolution could help achieving this goal.

The city of Marseille has a very dense urban centre as many other Mediterranean towns, with very little open green public spaces. Traffic emissions and the proximity to the port and other industrial emissions are the causes of high levels of pollution measured in the city.

In the era of the data revolution, **better data capture and a full combination of data sources** should be combined to achieve a better spatial coverage of air quality levels in cities and regions. Traditionally, **air quality data** has been collected **from stationary locations by environmental governmental agencies or universities**. Data from the existing fixed monitoring sites provide valuable information about the changes of concentrations through the day, seasons and years, linked to human activities such as emissions from road transport and industries emissions, among others. Concentrations of air pollutants also change due to the introduction of policies such as the revised emission standards on new vehicles through the Euro standards or the control of industrial emissions. Meteorological conditions such as wind or solar radiation conditions also have an influence on the levels of air pollutants. However, these monitoring sites offer limited information of the changes of concentrations in different areas.

In most cities there is **limited opportunity for citizens** to understand the **levels of pollution**

they are experiencing in their daily lives or for them **to avoid or reduce their risks** from being exposed to poor air quality. The information from fixed monitoring network is geographically sparse due to the high costs of the instruments and their maintenance.

In recent years, the development of small, portable and low-cost **sensors** have enabled to increase the spatial coverage of air quality measurements. Data from these sensors can help to **engage the different parts of the society** to combat poor urban air quality. By bringing a **personal meaning** to the **air quality data** that would help citizens (and others actors of the society) to see the need to **fight to improve the air** we breath in our cities.

Small and portable sensors are not aiming to replace established monitoring networks but to complement them. Small sensors provide additional benefits which include:

➤ enhanced visibility
➤ situational awareness and link personal activities
➤ identification of pollution hotspots

How the data revolution could help to fight against poor air quality?

▶ **New and innovative measurements** (for example, those from small portable sensors) and **statistical methods** (e.g. machine learning algorithms) should be developed to understand the causes of the variability of concentrations measured in the cities.

▶ **Accessible data formats (open data)** should be available for the public and also for private companies. **Open air quality data will enhance the creation of additional or improved applications** for the population in relation of the air in our cities.

▶ Data from the small sensors and the new services that might develop using this data **help cities to connect their infrastructure, regulatory stakeholders and citizens, to address the current air quality challenge**

How big data can help in the air quality governance?

▶ By **developing new ecosystems** between stakeholders in government, the private and public industries and the whole of the society

▶ By **empowering people**

▶ By **ensuring open data**

▶ By **making better policies and decisions based on the data**, increasing participation and accountability/open government for better outcomes for people and the environment

What are digital platforms?

Platforms are digital spaces where users can communicate and interact with one another (i.e. social digital platforms) and get access to products, services, or, resources on its broad sense, provided by peers, organisations or individuals. A key feature of digital platforms is their capacity, through digital means, to link different groups, individuals and organisations.

In the field of sustainability governance, digital platforms are reshaping the way sustainability information is collected, analysed, accessed, and used for decision making[1].

New technologies such as sensors enable the real-time and detailed monitoring of environmental conditions. In many of these monitoring platforms, algorithms operate on the data to analyse, predict, and forecast sustainability issues.

The UIA DIAMS platform?

The **UIA DIAMS** project is building an **online platform** where all data from the region (from fixed and mobile sensors; to emission data and air pollution numerical models) are going to be available to **facilitate the design of new apps and services.**

The **UIA DIAMS platform** aims also **to connect** the different parts of the **society** to **interact and find solutions** to fight against poor air quality in a collaborative way.

The **UIA DIAMS online platform is based on the idea** of the "air as a service".
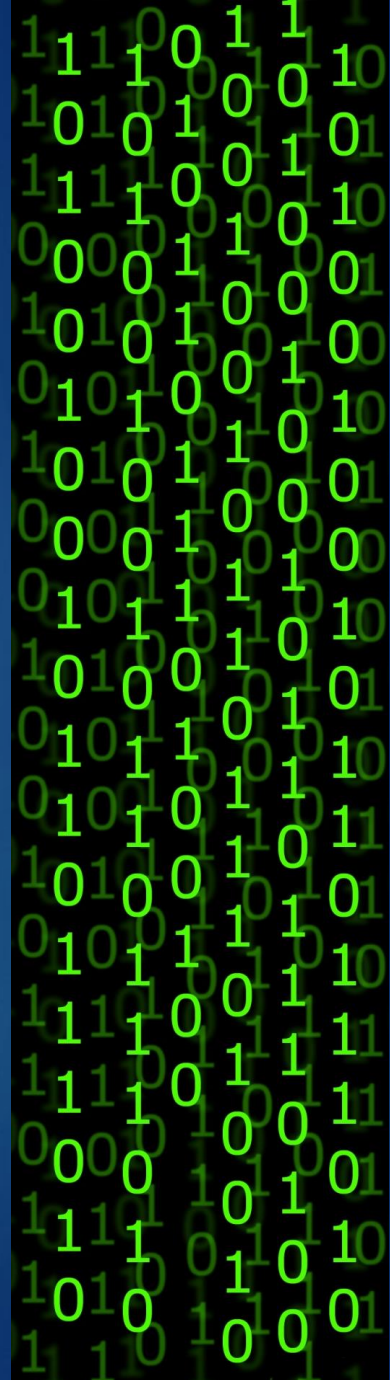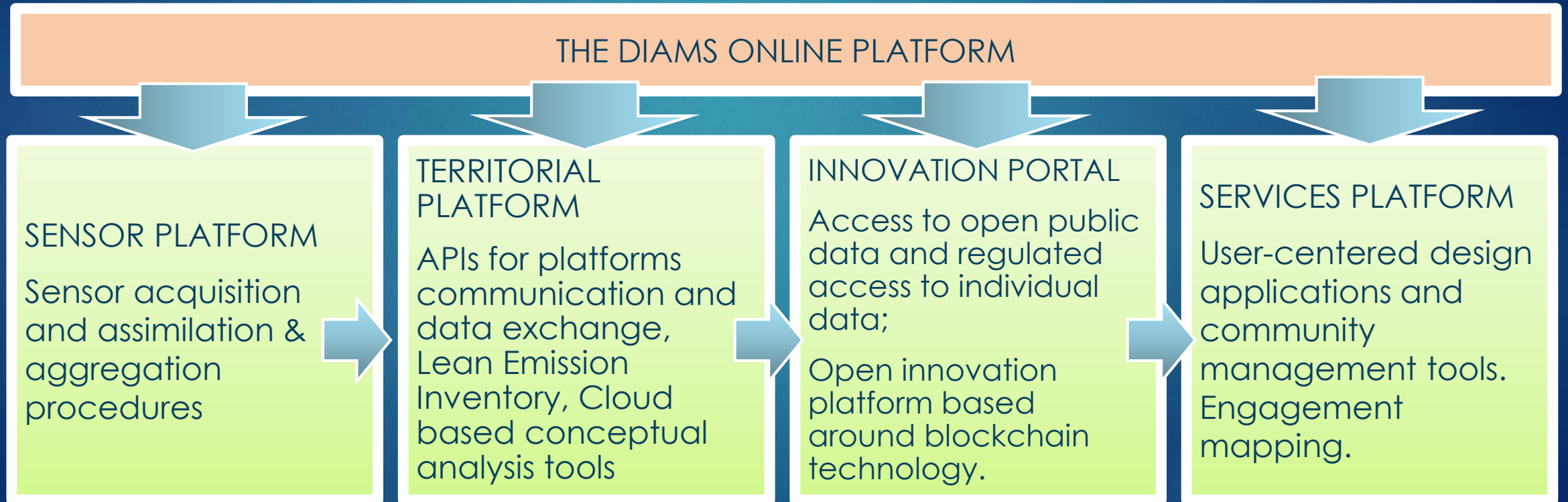
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3. The DIAMS digital platform

The **DIAMS platform** provides the **data and services** around the air quality in the Métropole provided by different **contributors**. It **facilitates transactions** between different types of individuals and organizations that would otherwise be difficult to connect between each other; and provides **technological building blocks** that are used as a foundation on top of which a large number of innovators can develop **complementary services and products**.

THE DIAMS ONLINE PLATFORM

SENSOR PLATFORM

Sensor acquisition and assimilation & aggregation procedures

TERRITORIAL PLATFORM

APIs for platforms communication and data exchange, Lean Emission Inventory, Cloud based conceptual analysis tools

INNOVATION PORTAL

Access to open public data and regulated access to individual data;

Open innovation platform based around blockchain technology.

SERVICES PLATFORM

User-centered design applications and community management tools. Engagement mapping.

The DIAMS digital platform

SENSOR PLATFORM

The **UIA DIAMS** is developing **2000 small sensors** associated to a **telephone app** to log and visualize the data. The sensors are going to be available to citizens through civil associations and also schools. Data from the sensors are going to be publicly available on the online platform. Data from these sensors aim to increase the spatial data coverage complementing that from fixed monitoring sites; and also engage with the citizens with the problematic of air quality.

Prototype of the DIAMS app linked to the use of sensors.

INTEGRATION OF DATA SOURCES

Territory data (from regional air quality surveillance service)

- ▶ On-line data at hourly resolution

- ▶ Fixed locations limited to one type of emission source (e.g. traffic, industrial, background)

- ▶ High-quality and accuracy of the data

- ▶ Data for EU compliance, evaluation of trends linked to changes in emission intensity

Sensor data (from small portable sensors)

- ▶ On-line data at second resolution

- ▶ Mobile locations encompassing multiple locations with different emission sources linked to personal exposure

- ▶ Lower-quality and accuracy of the data

- ▶ Citizen engagement programs, link to personal air pollution maps empowering behavioural change

Validation of data from sensors

Data from small sensors need to be validated to make sure that the measurements obtained are of good quality and comparable to those obtained from regional stations. One of the standards procedures is to collocate the sensor to one EN certified instrument and to compare measurements. Data precision, accuracy and drift are then evaluated and estimated. Possible correction algorithms can then be applied.

Validation of data apps

Apps to log and visualize the data from the sensors need to be operative. Logging the data along with the GPS data is essential to link concentrations to activities/emissions. Appropriate visualization tools need to be developed to ensure simplification of complex data but keeping their maximum accuracy.
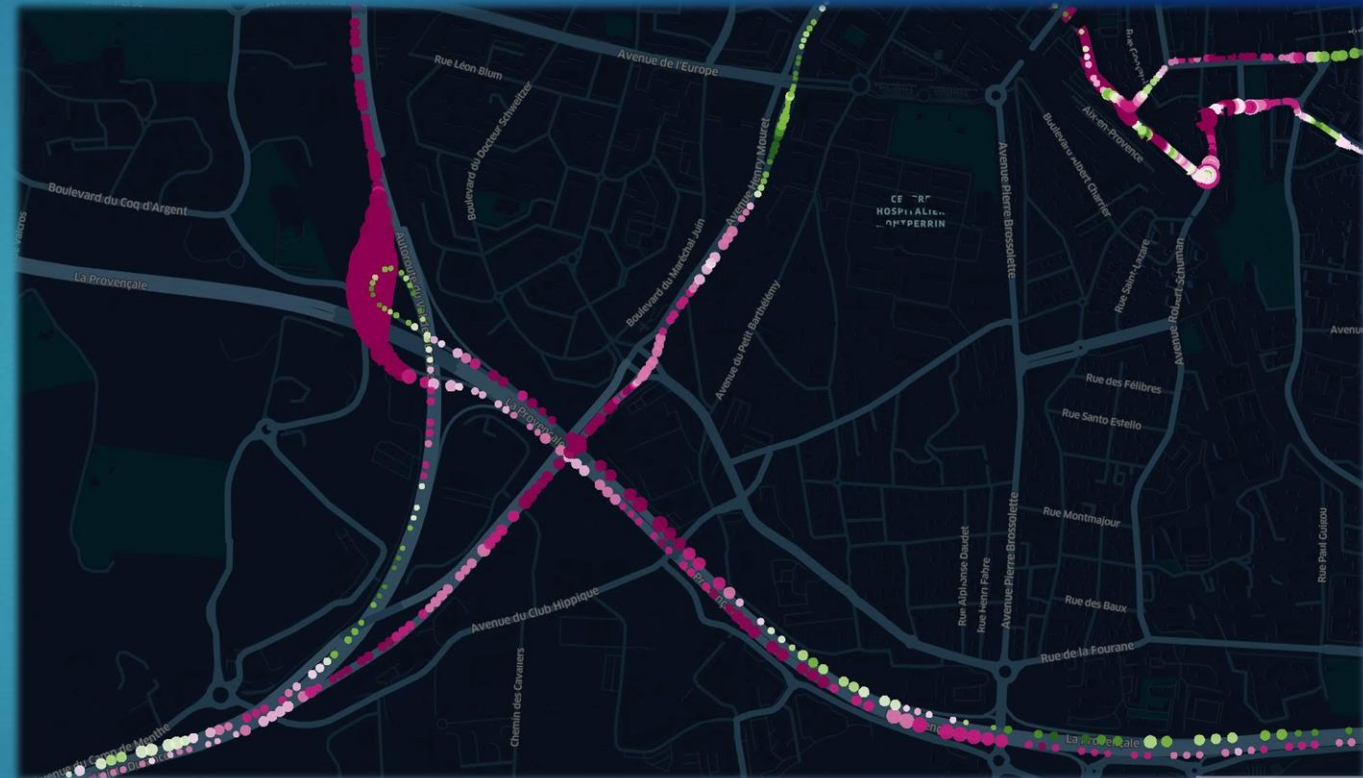

Collocation of the small sensors in one of the AtmoSud monitoring stations in Marseille. FIDAS is one of the EN approved instrument to measure particulate matter in the EU.

Territory data
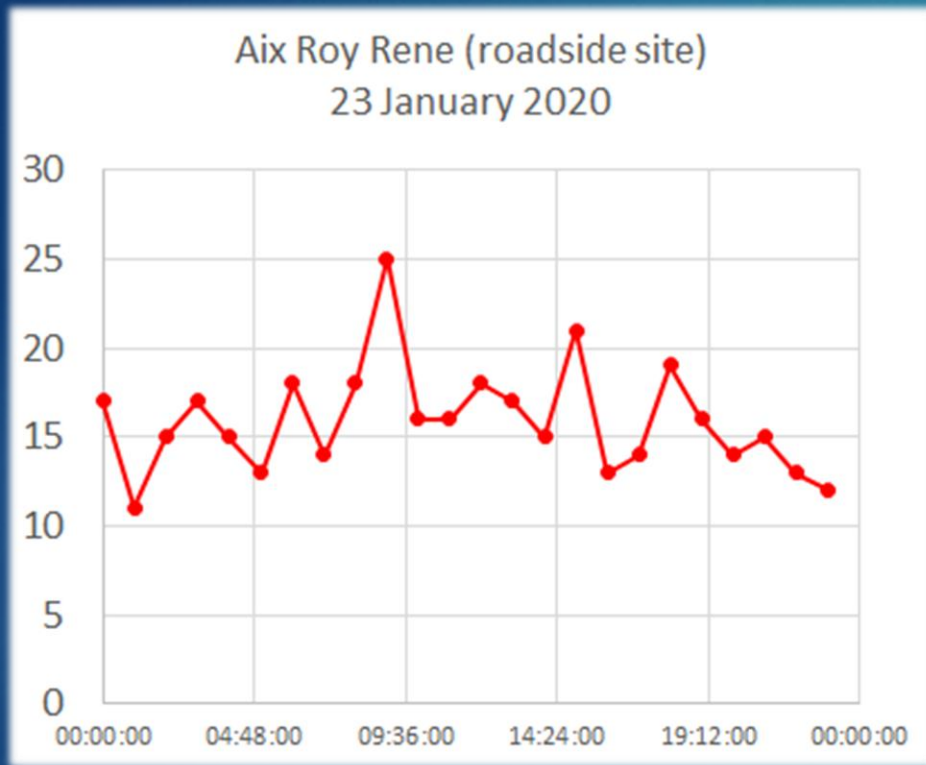
Sensor data

PM10 concentrations measured in the fixed station of Aix Roy Rene in Aix-en-Marseille. The concentrations of PM10 ranged between 10 and 25 μg m^{-3} on 23rd January 2020.

PM10 concentrations measured in Aix-en-Marseille using one of the sensors developed for the UIA DIAMS project. The maximum concentration was 223 μg m^{-3} as marked by the intense magenta colours.

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4. The creative moment: the *design sprint*

The ***design sprint*** is a five-day process for validating new ideas and solving big challenges through prototyping and testing new ideas. The process boosters creativity and creates an environment for precise and quick problem-solving.

This innovative method is centred in the **end-user**. This is of particular interest for the UIA DIAMS project that aims to test and find new ways to **involve citizens in environmental governmental decision-making processes**.
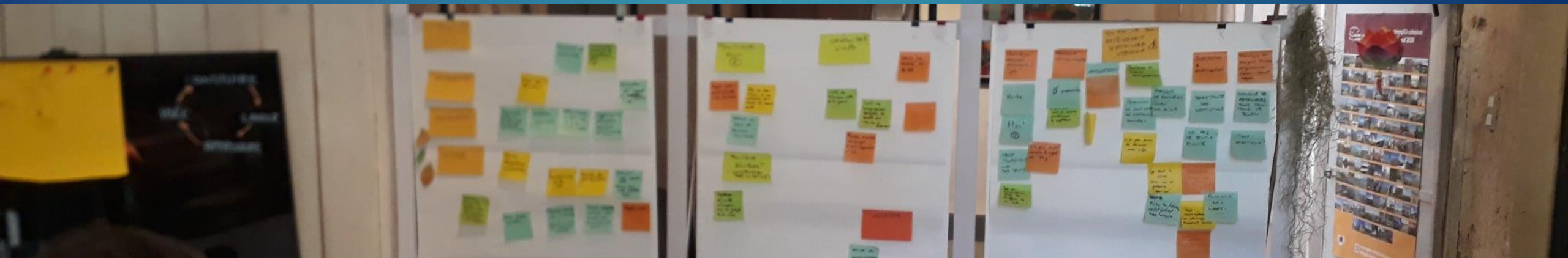
A **design sprint** was set to create and test the **online DIAMS platform** with members of three partners of the UIA DIAMS project: the Aix Marseille Metropole (the lead of the project); AtmoSud; and A Lab in the Air.

That took place in the Living Lab (Aix-en-Provence) between 22 and 26 June 2020.

Day 1	Day 2	Day 3	Day 4	Day 5
Map	**Sketch**	**Decide**	**Prototype**	**Test**
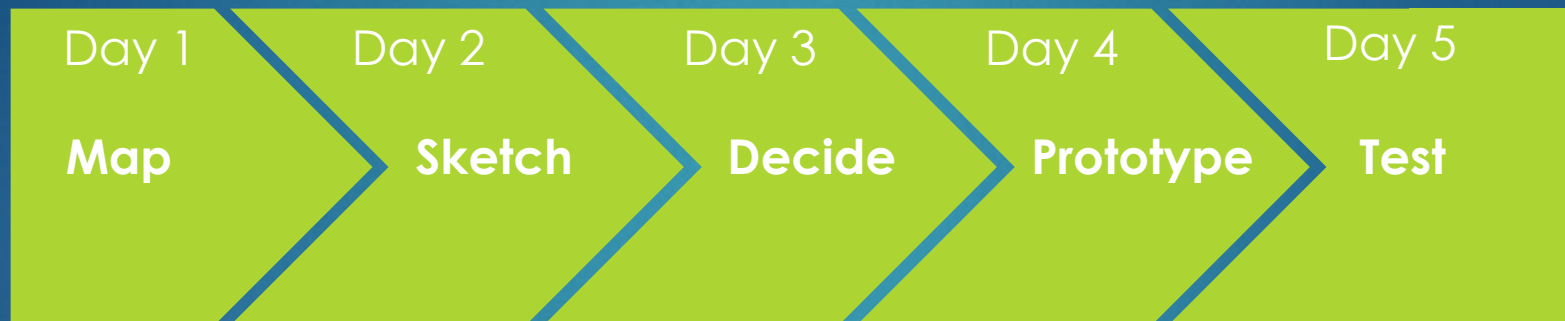
Sketch of the *design sprint* process.
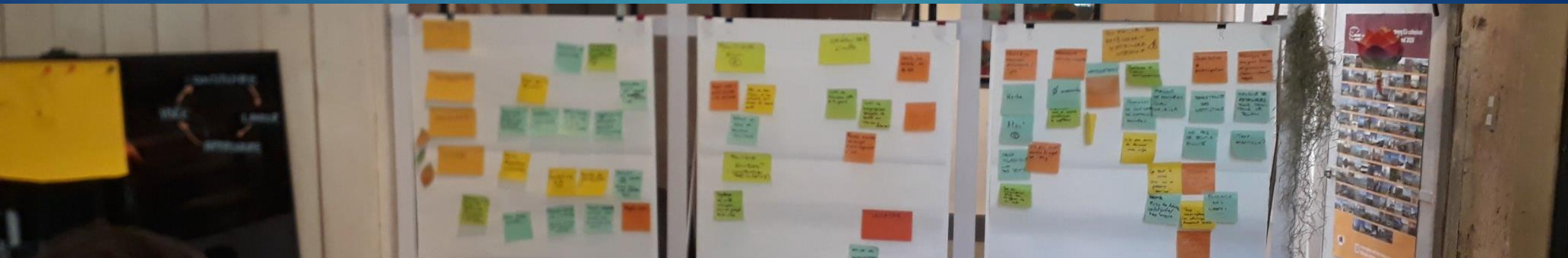
First day. *Map phase*. The challenge that the design sprint aims to solve is defined. The team defines an user map and interviews with the experts in the field. All members of the team share their vision how the DIAMS online platform should be designed.

Second day. *Sketch phase*. The members of the team looks for existent examples and solutions and present them to the others members. Creation of a storyboard to be reviewed on day 3.

Third day. *Decision phase*. Revision of the different ideas presented the previous day and selection of a prototype via « secret » vote.

Fourth day. *Prototype phase*. Creation of a prototype: list the base functionalities, graphics, navigation schema and formulations of the DIAMS online platform.

Fifth day. *Testing phase*. The team tests the prototype with different type of end-users. Interviews with end-users to annotate comments and suggestions. In this case, five end-users tested the prototype.
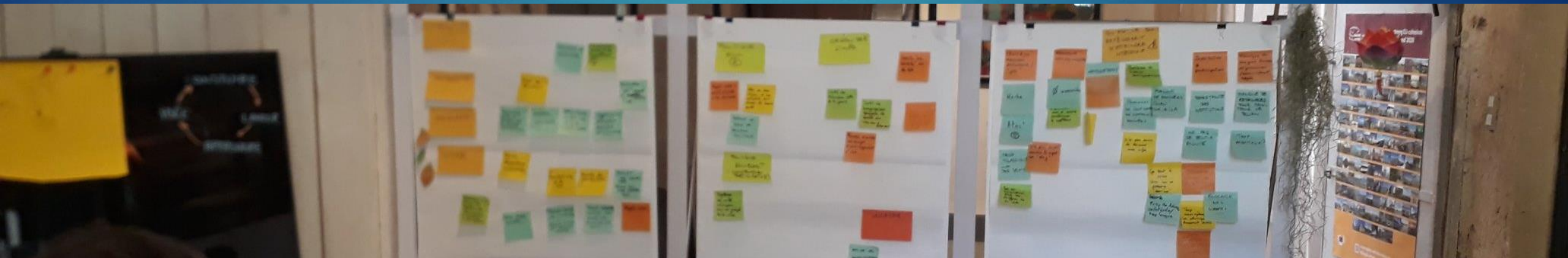
The participant

1. What is your name and what is your role in the UIA DIAMS project?

My name is Anne BERLANCOURT and I am the founder and manager of a lab in the AIR, one the main partner of the UIA DIAMS project.

2. Have you ever been involved in the design of another online data/service platform?

Yes. I contributed to the development of several BIM/CIM based platforms, including a site based multi-analysis tool for Renault, and a simulation tool used over a Berlin neighbourhood. I also designed the functional architecture of environmental management platforms for several clients, including the Normandy Air Basin.

3. Which was the methodology used to design these platforms? How did it differ from the design sprint?

The methodology used for the technical platforms was more of the "*waterfall*" type. We focused on technical challenges and we were insufficiently focused on the users needs !

The functional analyses I conducted were much more focused on the users needs, but we did not go as far as design a prototype, which would have helped to explain and "sell" the platform to politics and citizens.

I did learn from these previous experiences and this is why we proposed to develop the DIAMS platform in an agile mode, with a preliminary "design sprint" to address users needs.

4. Which are the main advantages of a design sprint in an innovative project such as DIAMS?

DIAMS uses innovative experimental processes to ensure that the resulting program will be fully "citizen-driven", such as design thinking, agile methods, prototyping and testing. The Design sprint is integrated within the Agile approach. Design sprints are five-day processes for answering critical business questions through design, prototyping and testing ideas with customers. The output of the design sprints is a prototype that has been tested with at least 5 target users. A "product roadmap" expands the design sprint prototype to flesh out the remaining, prioritized features / screens / user flows. These priorities becomes entries in of the product backlog, which can then be fed into the agile dev sprints.

The design sprints ensure that the proposed solution is aligned with the users' needs. It also contributes to overcome potential obstacles and resistances to the project. DIAMS embodies a cultural shift within the air sector: from centric approaches to stakeholders-driven approaches, from strict plans to experimentation. The political system does not easily allow for a change, and resistance is expected to arise. The design sprints help foster co-elaboration and exchanges between experts, policy makers, stakeholders and citizens. It also reinforce the "project based" approach of DIAMS and the publication of visible interim results (prototypes). By allowing stakeholders to be a part of the design process, they become part of the project and more than just the recipient of it.

The design sprints also contribute to the development of skills new to the Metropole such as digital and designing skills. They enable civil servants to learn those skills and practice them on live projects, together with external partners that share their experience.

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5. Conclusions and recommendations

The **big data** era with **more accessible open data** about **air quality** (and other surrogate data such as emissions from traffic and industries, meteorology, etc.) might enhance the **fight against poor urban air quality** and other sustainable challenges that affects most dense cities. Combining data from different sources (from governmental sources and those from citizen-driven science programs), by creating new statistical algorithms and by creating online platforms based on the delivery of services provide a way forward to **empower society** to face the challenge of poor air quality and find solutions in a collaborative way .

The **UIA DIAMS project** aims to empower the different parts of the society to the air quality problem by making **more accessible all** the available **data** in the Aix Marseille Metropole through an online platform based on the delivery of services and territorial data.

Further to the **existing regional sites** measuring concentrations of air pollutants from AtmosSud, **UIA DIAMS** will be deploying **two thousand small monitors** measuring particulate matter that will be available to measure the concentrations that **individuals are exposed on their daily lives, on their daily activities**. Bringing personal meaning to air quality levels will foster their engagement to fight against poor air quality in their cities.

5. Conclusions and recommendations

Creating a **unified platform** where regional and individual sensor data are available with an unified format will facilitate the creation of **data services** (e.g. apps) available for the general society and also for business and for decision-makers. **Making data and apps available for the whole society** will help finding ways to combat air pollution in a collaborative way.

The **DIAMS online platform** was prototyped using the **design sprint** methodology. Such approach is starting from a **definition of a challenge and ends up with a prototype design** which is tested and commented by the targeted end-users. As such, this approach ensures that the final product (i.e. the online platform) is designed thinking about them. In this way, such type of projects foster **the communication with target beneficiaries**, a challenge that most projects in the environmental field face.

References

[1] M. Lamers, S. Kloppenburg, A. Dewulf and K. Arts: Digital platforms for sustainability governance, Wageningen Centre of Sustainability Governance report.

To know more

The use of low-cost and portable sensors in air quality monitoring programs:
https://youtu.be/1JgL7y2Elz8?list=PLO7GJ8zJouJ2ouJn_PsIyDcJL772U0py8

About the UIA DIAMS project: https://www.air-diams.org/

About the UIA initiatives: https://www.uia-initiative.eu/