Public Stack Assessment of Hollandse Luchten

SHARED CITIES
SMART CITIZENS

waag futurelab

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The following analysis was conducted as part of the Shared Cities, Smart Citizens project's pilot in North Holland. This pilot utilised Hollandse Luchten as a case study. Hollandse Luchten is a community-based citizen sensing initiative that takes place in North Holland. The public stack is a framework for considering how the various layers of technology impact people and the planet. The questions below are drawn and iterated from the interactive page at https://publicstack.net/layers/. The analysis is one part of our broader research which develops key enabling methodologies to assess the governance of (in this case) data commons and (more broadly) technology around the public stack framework.

Foundation

Shared values

How do shared public values resonate in this initiative?

The shared values of health and wellbeing underpin Hollandse Luchten; people participate because they want the air quality to improve, and because they have a shared concern about the air quality currently.

Resources

What are the main resources to be governed?

Main resources include:

- **Physical infrastructure** like sensors and servers;
- **Data** including how that data is stored, shared, and utilised;
- **Internal communication**, for example the forum, as well as rules; and norms for communication which form governance processes;
- **External communication** such as the website and published resources;
- **Network of people** including roles, responsibilities, and mandate.

Are there any externalities?

- **Environmental externalities** include e-waste and energy consumption. For example, sensor production and replacement create waste; maintenance of the network and data infrastructures consumes energy. There will ideally be positive environmental externalities in the form of improved air quality in the region.
- **Cost:** The project is mainly funded by public taxes.
- **Community and social externalities** are a benefit in the region, as the project builds capacity and connectedness as a byproduct of HL.

Is the initiative in line with the sustainable development goals?

Yes, including:

- Good health and wellbeing
- Quality education
- Reduced inequalities
- Sustainable cities and communities

- Responsible consumption and production
- Climate action
- Life on land
- Peace, justice, and strong institutions.

Stakeholders

In what way is society represented?

- People who live in pilot areas are welcome to join Hollandse Luchten by attending a meeting, joining the mailing list, and/or building and using a sensor. People who do not take part in these activities are not formally connected to the project.
- People who are unrepresented in Hollandse Luchten via these formal processes have access to open data, visualisations, and other public outputs from the project.

Who does this initiative belong to and who are the other stakeholders?

- **Government:** Formally, Hollandse Luchten belongs to the *Province of Noord Holland*. They are 'where the buck stops' in terms of responsibility as the funder and final decision maker.
  - Hollandse Luchten faces the question of whether this position (top down, final control with the state) is compatible with the primary objectives and values of the 'citizen' (and non-citizen people) stakeholders.
  - Other governmental stakeholders include:
    - **Municipalities** are crucial stakeholders; municipal representatives are often involved, for example in joining co-creation sessions; some are in the process of becoming official partners in the project
    - Omgevingsdiensten (environmental services)
- **Organisational Stakeholders:** Organisational stakeholders include Waag, RIVM, GGD Amsterdam, TNO, Smart City Haarlem. These stakeholders are allocated a budget from the Province based on the project proposal, and have certain freedom and autonomy to do what they deem to be necessary and useful.
- **People:** People in sensing communities are an important stakeholder, but were not initially given the same role as other organisational stakeholders; for example, people who join Hollandse Luchten generally do not receive

compensation and are not included in the 'Regiegroep' decision-making body. Multiple people and stakeholders in the project have expressed a desire for the role and mandate of people in sensing communities to grow.

At the moment, people in sensing communities are represented through Hollandse Helden and working groups. People can participate if they live or work in one of the pilot areas:

- IJmond: Beverwijk, IJmuiden and Wijk aan Zee
- Zaanstad
- Buiksloterham (Amsterdam North)
- In development: Het Gooi: BEL-gemeente, Hilversum and Gooise Meer

The boundaries of participation are generally geographically limited to Noord Holland, the province which funds Hollandse Luchten (although interested people who are not in a pilot area are rarely but sometimes involved).

- **Business/industry/focuses of complaints:** People in Hollandse Luchten pilot areas sometimes focus their complaints around a single cause or stakeholder, who may also be included in a formal role in that pilot. This varies from pilot to pilot, but includes:
  - **Tata Steel**, a main concern in the IJmond region;
  - **The port area**, a main concern in Zaanstad and Buiksloterham;
  - **The highway**, a main concern in Het Gooi.
- **'External' stakeholders** face the risk of being unconsidered and/or underrepresented. These include but are not limited to:
  - Environment (flora and fauna)
  - Non-participating citizens, especially those who are unable to join due to physical, geographic, socio-economic, or other limitations.
  - Researchers and practitioners in fields related to citizen science. This includes citizen scientists in other areas who may replicate aspects of or draw inspiration from Hollandse Luchten.

Starting points and assumptions

What problem is Hollandes Luchten intended to solve?

- People who participate from local communities were the main focus of our research. As a shared goal, they want to improve air quality. Identifying the data use cases (or how people want to make use of Hollandse Luchten data) is the [subject of our research](#).

- As a facilitator, **Waag** wants to support the agency of citizens who are concerned about air quality through citizen sensing networks. We aim to democratise the process of air quality measurement, analysis, and response by enabling citizens to have a stronger position in public dialogue and decision making.

When will the problem be solved? Who defines success?

What is the problem?

- The problem is that stakeholders tend to refer to different data, accept different facts, and thus lack a common ground and shared reality from which to begin collaborating towards positive change. Most generally, the problem will be solved when all stakeholders – including people in the communities, governmental organisations, and Tata Steel – have a shared reality (in the form of data, analysis, and experience) to which they can refer. Success in this regard ought to be primarily defined by community participants.

Governance and oversight

What current mechanisms of governance are in place?

- The Regiegroep is the decision making group which develops high-level, long term strategy based on the advice of the working groups. The Regiegroep includes the Province of Noord Holland, Waag, and other institutional stakeholders. There are currently no official mechanisms for when a question moves out of the working groups and is elevated to the Regiegroep. There are similarly no defined processes for collaborative decision making – informal consensus is the norm.

- Working groups (advice organs composed of Hollandse Helden, topical experts, Province, and Waag) are limited to those who are highly involved in the topic or

in Hollandse Luchten. Any participant could potentially be in one of the three working groups: Hardware, Data Science, and Communication. There is currently no explicit process for joining or selecting members of a working group.

- Hollandse Helden is the group that represents participants in the working groups. So far, the process to join this group is informal and generally includes highly involved local residents.

Socio-economic considerations

Who finances the project?

- All project partners are paid by the province of Noord Holland.
- Citizens may be provided with a budget to organise sessions.
- There is currently a discussion on whether and how to provide Hollandse Helden with compensation, who want to be seen on equal terms as other partners.

How can society monitor the initiative?

- Project outputs are made publicly available through https://hollandse-luchten.org/
- People may join working groups and co-creation sessions to actively participate.
- The Province of North Holland reviews progress of paid partners.

Open Design Process

What methodologies are used?

- Hollandse Luchten utilises a public research methodology which prioritises co-creation. Co-creation sessions are the main avenue through which participation occurs in Hollandse Luchten.

Who facilitates co-creation? Who is included?

- Currently, sessions and meet-ups are co-organised by Waag and a measuring community. There is a standard format for setting up the community and organising (co-creation) meet-ups, which are then personalised for each community. Communities and local residents primarily lead the organisation effort locally (by involving local people, community groups, and organisations.) Waag plays a supporting role, but not a leading role in all organisation and facilitation.

What are we maximising through our design?

- Most generally, the design process prioritises participation with local communities, aiming to foster the conditions for people to have more agency over their own environment (in this case, to have more agency to improve air quality).
- In terms of technology, current designs for the sensor and visualisation balance a few considerations, including data quality, usability, a preference for sustainable and open source technology, and cost.

What mandate does the group have within official governing structures?

- There is a mandate (through funding) to build sensors and measure air quality. There seems to be interest among community participants and certain stakeholders (including Waag) to include Hollandse Luchten and other citizen initiatives more regularly as part of recurring policy cycles in the local, provincial, and national government.

How transparent is the process?

- The process is generally open and collaborative: For example, sensors are put together during co-creation sessions. However, there are also limits on transparency – for example, that certain parts of the sensor are proprietary, and that certain decision making processes are undefined.

- Strong attention is paid to making the design process open source and replicable.

Open Technology

What is the [application layer], and how is it in line or not in line with foundational values?

- Data analysis and visualisation are the main components of the application layer, and are very open. Co-creation sessions with citizens helped to develop the mapped visualisation; air quality experts have held sessions on how to interpret the data; an open process guided development, which included an open consideration of visual biases inherent in data visualisations; and the code itself is open and available on GitHub (https://gitlab.waag.org/code/hollandse-luchten-data-app).

- Nonetheless, we can ponder ways in which this would be even more open – by holding even further co-creation sessions; by having a forum akin to [MetaDecidim](https://metadecidim) where people can suggest changes to the technology; by developing multiple presentations of the data which consider different biases; or by having more conversations with more experts (perhaps with differing opinions) to help people to interpret the data they gather.

- The Hollandse Luchten website (https://hollandse-luchten.org/) could also be considered a part of the application layer, as it is a point of contact with the project for many people.

What is the <u>operating system</u>, and how is it in line or not in line with foundational values?

- There are multiple operating systems at work in Hollandse Luchten: the operating system of the servers (e.g. for running visualisation); the operating systems of RIVM (runs algorithm to correct data); the operating system of the network provider (which is controlled by an external party); and the operating system for programming the firmware. Where possible, these operating systems are as open as possible, though in some cases they are proprietary and/or not controlled by the project.

What are the <u>firmware and drivers</u>, and how are they in line or not in line with foundational values?

- The firmware is software that runs on the sensors. It is documented on GitHub and can be shared with and developed by anyone.

What is the <u>equipment</u>, and how is it in line or not in line with foundational values?

- The line where 'equipment' ends and 'infrastructure' begins is not so clear, but here we can take equipment to refer to the physical sensor and its locally associated parts. In this case, the main equipment is hardware, most specifically the HL sensor box. Equipment also includes the antenna, the servers that store data, and more.
- In this sense, HL equipment is partially open – the completed sensor can be opened, and instructions to build it are available on GitHub. However, components of the sensor kit are provided by companies and built with proprietary technology.

What is the <u>infrastructure</u>, and how is it in line or not in line with foundational values?

- The network infrastructure acts as a transmitter. Sensors send data they have collected every six minutes to a server from the network provider. In this sense, the network is a 'highway' that transmits data onto a server. Hollandse Luchten technology currently runs on Lora, chosen in part because it is free.
- The data infrastructure includes servers and code. It reads the data and prepares it to be read by other machines and humans (for example, processing

the data to correct misreadings due to humidity, salt in the air, etc.). Following this process, the calibrated data is sent to the Waag website for visualisation. In this way, the data infrastructure is the collection of digital pipelines and servers to collect, process, correct, and make data available for analysis.

- The infrastructure functions to make HL possible. While much of the infrastructure is outside of the project's direction control, project facilitators have paid close attention to ensuring that those parts which can be controlled (like ensuring the calibration process is open) adhere to foundational values within the limits of feasibility.

People

What is the role of <u>involved participants</u> or 'users' of the technology?

- People in the designated sensing communities are able to participate by hosting a sensor, by signing up to the mailing list, and/or by attending events. It is possible to participate in events even as a non-resident of these sensing communities.
- Many participants involved would like to be able to draw definitive conclusions from the data.
- Participants and other stakeholders (including Waag) would like to see the role of participants (citizens, community members, etc.) grow in terms of directing the project and influencing policy change at the level of the Province.

What is the role of <u>uninvolved people</u>? How might they be affected by or (unintentionally) interact with the technology?

- The role of uninvolved people is difficult to define – uninvolved citizens are, by definition, not involved. They thus do not have a role or formal representation.
- There is a geographical limit to who can be involved – people working or living in sensing communities can certainly be involved. There is a loose process for communities and towns to join, but it remains informal and undefined.

- Those without a sensor or who do not attend meetups and co-creation sessions may nonetheless interact with the website or visualisation. Ideally, people who are not involved may eventually benefit from positive political change or change in local practices and, ultimately, better air quality.

What is the position of people in the general public with regard to other stakeholders (especially government and industry) in relation to this technology?

- Hollandse Luchten grew out of a desire to place local people on a more equal playing field along with those in government and industry. It has been successful in this regard to an extent – for example, local community members now have lines of communication with people in these other stakeholder groups, and collaborate with them in co-creation sessions.
- Nonetheless, the position of the general public is still relatively weak compared to their counterparts in industry and government. Industry and government have relatively more mandate, financial leverage, and established organisation than local individuals and community groups.

What is the position of people in the general public with regard to this technology's development process?

- People in the general public are welcome to join and collaborate in the development process, but are typically not involved in the most high-level planning and decision-making processes. Ideally, high-level involvement from community members will increase.

What expertise and perspectives are involved in building, using, and maintaining this technology? What expertise and perspectives are missing?

- Primarily, people living in sensing communities are the experts in their own lives. They are in the best position to benefit from better air quality as a result of this project.
- RIVM provides institutional knowledge of air quality and data calibration; the Province of North Holland has mandate and expertise in governance; Waag brings expertise in technology and facilitation of participatory processes; Tata Steel has participated, offering the perspective of industry. While this is not an

exhaustive overview of the stakeholders and their capacities, it does indicate that there are a wide range of diverse stakeholders involved who represent different areas of the 'quadrupal helix'.

- Further technical expertise is always welcome, especially in terms of maintenance of the sensors and networks.
- Additional expertise in policy cycles would be a benefit; specifically, someone with knowledge of the nuances involved with political responsibilities that overlap between the local, regional, and national levels.

What mandate do people have to change this technology (with regard to steering, decision-making, and internal governance)? What mandate do people have to use this technology?

- People have a mandate to build sensors if they live, work, or are otherwise involved in one of the project's local sensing communities. Anyone has a mandate to download and analyse Hollandse Luchten, and to view documentation of the technology itself on Github. People in pilot areas also have a mandate to host a sensor at their own home.
- Often to the frustration of participants, they generally do not have a strong mandate to refer Hollandse Luchten data as 'official'. This is an area the project aims to address with its plans to update the sensors; however, there is likely to be a continuing dynamic in which participants would like to draw definitive conclusions based on the data, while experts in other stakeholder groups emphasise the uncertainties and vagueness inherent to this and other data analysis.