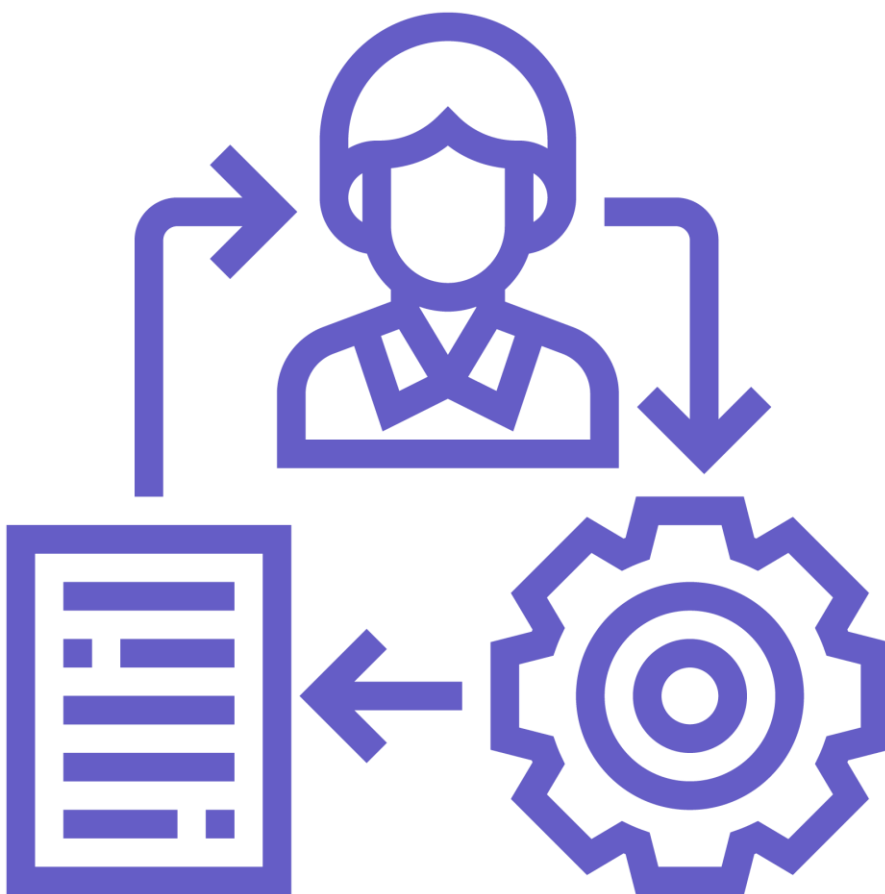# OPENAIR

Best Practice Guide

BP503 | Act on evidence

Engaging your community with air quality data

Introduction

Smart low-cost air quality monitoring projects create abundant new data that can be placed into the public domain for community members to access and use. Open air quality data has the potential to educate and empower people, supporting them to make changes to their lifestyle and habits in ways that can improve local air quality, while also reducing their own exposure to air pollution.

Making data open and accessible does not automatically translate into community engagement and impact. To achieve genuinely impactful engagement of community with air quality data, a more proactive approach is required. This involves leveraging new data resources through the active participation of community members in well-designed and well-resourced programs and activities. Local governments can design and deliver such activities, and this can form a major part of the impact created by an air quality sensing project.

Who is this resource for?

This chapter is intended to act as a guide for local governments tasked with designing and delivering a smart low-cost air quality monitoring project, and may be useful to staff in the following roles:

- people leading new air quality monitoring projects
- smart city professionals
- information, communication and technology professionals
- community engagement teams, or any other local government staff involved with the design and delivery of community programs and services
- planners
- environmental officers.

How to use this resource

This chapter explores the benefits of engaging your community with air quality data. It introduces several examples of data engagement activities and initiatives that can be adopted by local government. It also considers strategies for inclusion and diversity, and explores participatory approaches to the management and sharing of data. Finally, various risks of open data release are discussed, as well as ways to mitigate them.

This chapter is the third in a series of resources that explore community engagement and participation. It is recommended that you read the previous two OPENAIR Best Practice Guide chapters (*Participative design practice* and *Citizen sensing*) before engaging with this chapter.

The benefits of community data activation

Air quality is an issue that affects our everyday environment, at the local scales at which we live, work, and play, making it a relevant concern to the health and well-being of the entire community. This creates a strong incentive for personal engagement with air quality data, and a role for local government to proactively support that engagement.

Designing and delivering an effective program for community engagement with air quality data requires the allocation of time and resources. This investment must be justified in terms of the benefits that can be achieved, both for your organisation and for your community. Table 1 outlines the benefits of an effective community data activation program.

Table 1. The benefits of actively engaging your community with air quality data

Benefit	Explanation
Leverage more value from your data	The value of data lies in the way it can be used to support meaningful outcomes. If you are funding and resources the collection of data, then you will want to consider how you can most effectively leverage that data to create the greatest possible value. For many projects, this involves activation of data in your community. You should assign a good portion of project resources to community activation activities, because this is often key to achieving a return on investment, and justifying the longer-term business case for running a sensing network.
Support citizen empowerment through improved education and literacy	Education and literacy can include *digital literacy* (how to discover, access, and make use of data) and *environmental literacy* (how to interpret data, and extract insights from it about the links between air quality and how people respond to it. Improved knowledge and understanding, combined with practical skills, can empower people to make their voices heard and to take effective action on an issue that is important to them.
Improve accessibility and inclusion	A well-designed approach to community data activation can help to ensure inclusive engagement with people from diverse social, cultural, and economic groups. This ensures that harder-to-reach groups are not forgotten or excluded, and supports the needs of more vulnerable and disadvantaged people, aligning with your organisation's social impact policies.

Benefit	Explanation
Target a specific audience for focused impact	A well-designed approach to community data activation can support a focus on engaging a specific target audience. There may be a particular group, defined by geography or socio-economic factors, that is either responsible for contributing to localised air pollution (e.g. through car use), or is at particular risk from exposure to poor air quality. In either case, active engagement with air quality data can support improved understanding of the issue, and may form part of a broader effort to create positive behaviour change. By allocating limited resources to strategically engage these groups, you can focus on creating change where it matters most.
Support innovation and the local knowledge economy	Open data can be used by a diverse range of people and organisations to support local innovation. This might include use of data by businesses and start-ups to provide new services, or improve customer experience (e.g. a gym might text members to recommend indoor exercise on a day with poor outdoor air quality). It might include use by community groups (e.g. a local soccer club might cancel a game due to poor air quality from a bushfire). Local governments can support a local knowledge economy by investing time and resources in data activation in the innovation space, such as through partnerships with co-working spaces, start-up incubators, and tertiary education partners.
Support citizen-led advocacy and environmental justice	Poor air quality disproportionately impacts lower-income and disadvantaged communities. Environmental justice is a type of social activism that responds to this type of disparity. Citizens who are educated and empowered to speak up on air quality issues can become advocates for change. Local governments may choose to directly support this, through proactive data activation and community engagement. Community advocacy can lead to legal victories (e.g. opposition to planning proposals), or even the establishment of new legislation.
Support future participative engagement with air quality	Your organisation's early forays into air quality monitoring (e.g. through a small pilot program) may have been limited in terms of participatory design and data collection. However, by actively including community members in discussion of local air quality and air quality data that you are collecting, you can establish a grassroots network that can form the foundation for more participative initiatives in the future.
Establish a social license to intervene on air quality	By proactively engaging your community with air quality data, you can support literacy and broad awareness of the topic. This creates a social licence for local government to intervene on air quality issues, such as by creating new policy or infrastructure that directly addresses air quality (e.g. the establishment of a low-emissions zone).

Before you begin

To ensure delivery of successful and high-impact community engagement activities, there are several things to consider early in your project planning.

Your data sharing plan

Be clear about your data sharing plan

Engaging your community with data is reliant upon data being shared. The decision to share data can be a complex one, with a great many considerations relating to precisely *what* data you will share (or not share), and whether you can do so appropriately and safely. Refer to the OPENAIR Best Practice Guide chapter *Sharing air quality data* for further guidance. It is recommended that you create a data sharing plan for your project, and obtain sign-off from senior management.

Who, why, and how

Target specific groups

'Community' is a broad term. To ensure meaningful engagement and impact creation, it is helpful to target specific groups. Groups might be identified by location (e.g. suburb), activity (e.g. cyclists), affiliation (e.g. parents of children at a particular school), or any number of demographic classifications. Consider what your target groups care about and why, and ensure that the issue (and data) that forms the focus of your planned engagement aligns with their interests and concerns.

Have clear engagement goals in mind

To ensure that engagement creates impact, it is important to have a clear goal in mind. Be clear about what it is that you want to achieve, and what you want people to learn or do. Are you aiming for some form of behaviour change? If so, how much do you really understand about your target group's current behaviour and motivations, and how do you know what is most likely to influence them? It can be helpful to conduct background research into community perspectives and attitudes before designing an engagement program, to ensure that you have a well-informed strategy.

Choose an appropriate mode of engagement

Consider the best ways to reach and engage your target group(s). Effective modes of engagement will vary by group, particularly where there are differences in age and cultural background. For example, digital modes of engagement may be more effective for younger people, while face-to-face engagements may be better for older citizens. The mode and design of engagement activities also matters a great deal in terms of inclusion and accessibility. Be mindful of including people who do not use English as a first language, for instance, or who are unable to attend planned engagement activities due to work hours or caring responsibilities.

Participative design

Incorporate participative design into your engagement approach

Participative design is an approach to project design that actively involves all stakeholders in the project design process, to ensure that the outcomes meet their needs. It is a critical foundation for effective

community engagement that works *with* people on their own terms, rather than talking *at* them. Refer to the OPENAIR Best Practice Guide chapter *Participative design practice* for practical guidance on this topic, and aim to incorporate it into your community engagement approach.

Spend time cultivating digital trust in your community

Effective engagement of your community with data relies upon a foundation of trust in digital infrastructure and data, how it is being used, and for whose benefit. To build this foundation of 'digital trust', allow plenty of time (particularly at the start of a project) for engaging your community around an issue, clearly explaining your organisation's aims in collecting this kind of data, listening to concerns and ideas, including people as active contributors, and establishing community leadership roles.

Capacity and constraints

Assign resources for community engagement from day one

It is important to consider community engagement activities as part of a complete air quality engagement project, right from the start. Anything added on as an afterthought will almost certainly struggle to succeed, due to under-resourcing. A well-designed, inclusive, and effective engagement initiative requires significant resourcing and capacity that can rival (or even exceed) that required for data collection activities.

Review existing internal skills, expertise, and capacity

Inclusive, appropriate, effective, and impactful community engagement requires dedicated skills and expertise. Consider the degree to which these are present within your team, or more widely within your organisation. If skills and expertise are present, do the people in question have the capacity to support your project? If these skills are not present, can you put aside funding to hire external contractors?

Reach out to foster new external partnerships

Consider local organisations that might make good engagement delivery partners, and reach out to them as early as possible to explore ideas and opportunities.

Review and connect with existing programs and facilities

Can any existing programs and facilities that are already run by your organisation be adapted to host or increase engagement with air quality data? Reach out to colleagues who run these programs and facilities, and get a sense of what might be possible.

Review policy alignment

A successful community engagement project should align with existing policy, potentially across a number of different areas (e.g. community engagement; inclusion and accessibility; data policy; health and well-being; transport; climate resilience). Conduct a review of your organisation's potentially relevant existing policy, as part of the early design thinking for a new engagement initiative.

If in doubt, meet with senior management as early as possible

Open data release can have unintended political consequences. If there is any concern about potential sensitivities or political implications of releasing and promoting air quality data within your community, it is recommended that the topic is raised with senior management as early as possible, to weigh risks

against opportunities. Ideally, this results in high-level support for your engagement activities, which can be key to their success and longevity.

Community engagement activities and initiatives

There are a range of activities that local governments can support for proactively engaging your community with air quality data.

Data discovery workshops

A data discovery workshop is an event (or series of events) that teaches people where to discover data, how to filter out the data that is of particular interest to them, and how to download it for a variety of uses. There may also be a focus on interpreting the data (e.g. understanding the air quality impacts of personal actions and behaviour), and what the data might mean to people in terms of their day-to-day activities.

Workshops often target a specific group of prospective data users (e.g. parents and teachers at a primary school). A session generally focuses on the use of a particular online data discovery dashboard, or open data portal. It should aim to promote the existence of the resource, and build confidence and familiarity in using it. Feedback from these sessions can also be useful for adjusting the design and settings of dashboards, to more closely meet the needs of target users.
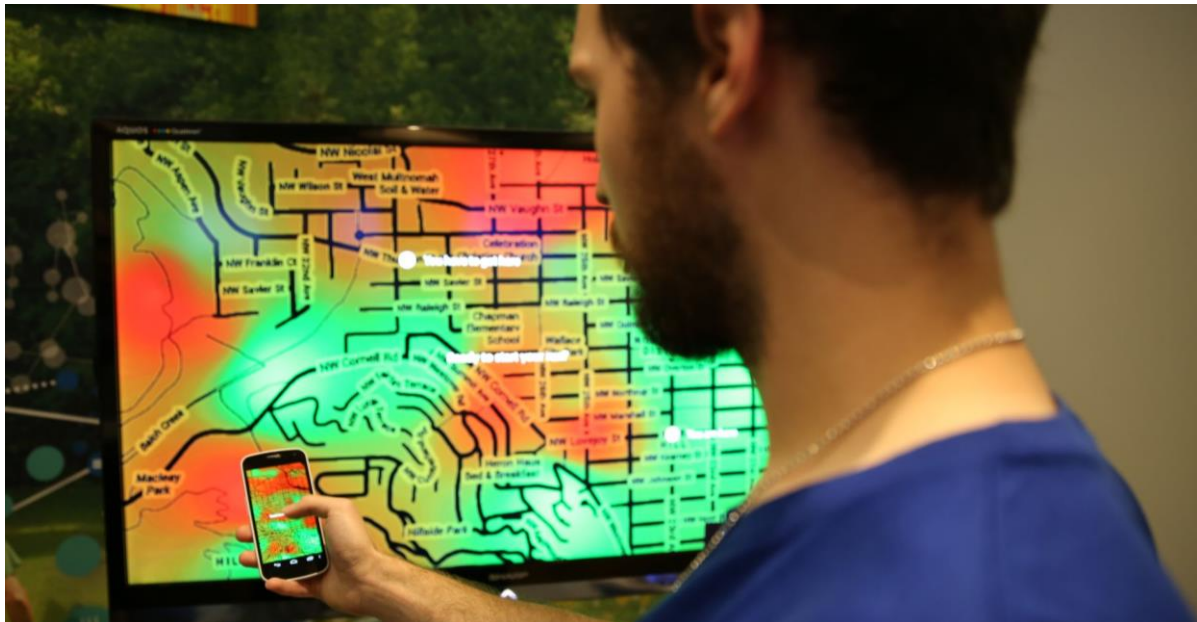
Demonstrating an air quality visualisation app that can be used by community members to support clean air wayfinding. Image source: Creative Commons

Data-actuated public art

Even though environmental data directly relates to public health and well-being, this kind of data can be complex and difficult to understand. Data-actuated public art uses live data to control the behaviour of an automated system, and create a dynamic experience for the viewer. Light, movement, sound, and

water may all be manipulated in real time to give 'concrete' form to abstract data. This type of engaging public art also helps to activate public spaces, and can play an important role in urban renewal projects. Where new developments include a requirement for public art, a focus on environmental data actuation can be prioritised.

CASE STUDY: *Antenna* sculpture by David Cianci (Charlestown, NSW)

Antenna sculpture (2018), Charlestown Skate Park, Charlestown, NSW. Image source: Lake Macquarie City Council

Lake Macquarie City Council installed a large piece of permanent public art called *Antenna* in a new skatepark facility in Charlestown. The work is constructed from Corten steel and glass, and is lit from within by programmable 'smart' LED strips. LEDs change colour according to temperature data from a nearby sensing device, and pulse rhythmically in response to live rainfall data from the Bureau of Meteorology.

Hackathons, datathons, and ideathons

In a hackathon or datathon[*], teams of programmers and developers compete to achieve the best application of open data to address specific challenges. This approach can work well with air quality data in a specific context. A simple example of a hackathon that uses air quality data might see teams developing an app for schoolchildren to understand air quality on their walk to school.

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[*] The term 'datathon' is increasingly used instead of 'hackathon', as there can be negative connotations to the term 'hack'.

Ideally, a hackathon should make use of a pre-existing data source (e.g. data resulting from a citizen sensing project) that is shared with participants (either openly or in a controlled fashion), rather than relying on the collection of new data using low-cost sensing devices. This is because collection of reliable and trusted data using citizen sensing approaches is a complex activity in its own right, and requires considerable additional planning and support that are generally beyond the scope of a hackathon.

An ideathon is an expansion of the hackathon concept, away from just coding and software development, making it open to people with a wider diversity of skills, knowledge, and expertise. An ideathon challenge might focus on a more complex issue (e.g. a new creative initiative to engage the community to reduce car use for short trips). While ideas might include development of new digital tools and services, they also require a more well-rounded, whole-of-project approach that accounts for factors like project design, governance, and communications and engagement strategy.

CASE STUDY: iSCAPE's *Lego Serious Play* workshops for creative problem-solving

Lego Serious Play workshop. Image source: Creative Commons

Lego Serious Play is an open-source facilitation methodology designed to support creative thinking, problem-solving, and collaboration. Lego blocks are used as a medium for people to express their ideas and concerns, articulate problems, and co-create imaginative solutions through metaphors and storytelling.

iSCAPE (*Improving the Smart Control of Air Pollution in Europe*) was a Europe-wide program of Living Labs focused on monitoring urban air quality using low-cost sensing devices, which ran from 2016 to 2019. iSCAPE held its midterm gathering of Living Lab partners in Bologna (Italy), and the Lego Serious Play method was used to explore challenges and solutions relating to citizen engagement with air quality data. This proved to be so successful that iSCAPE took the method to

the annual gathering of the European Living Lab community in Geneva (Switzerland) in 2018, exploring 'why' and 'how' to build air quality Living Labs.

School programs

School programs can be developed to engage students of all ages on the topics of air quality and smart sensing technology. Local air quality data that is collected using low-cost sensing devices can be particularly relevant in this regard, as a sensing device might even be deployed on (or near) school grounds to provide students with real-time data.

School programs should be curriculum-matched, and may cover a wide variety of topics, including digital literacy and IT, environmental sustainability, science and geography, health and well-being, and civic responsibility. School programs should be developed in collaboration with educational content developers. It is also critical to engage with target schools as early as possible, to ensure that a program fits into their schedules, and meets their needs.

CASE STUDY: CleanAir Schools 2021-2024 (NSW)

Image source: CleanAir Schools

The CleanAir Schools program is a collaboration between the University of NSW and the NSW Government to install up to 100 smart low-cost air quality sensing devices in schools across New South Wales. The collection of air quality data inside and outside of classrooms should help to improve understanding of how air quality impacts children's health, with the potential to influence policy.

CleanAir Schools features 'Energy Transformers', a curriculum-matched educational program that teaches primary school students how air quality data connects to local and global energy and environment issues, such as energy choices, climate change, air pollution, and human health.

Integrate data engagement activities with existing public programs

Most local governments have existing capacity in the form of current public programs and initiatives (or facilities or resources) that can be leveraged to help support data engagement activities. Examples include library events programs, makers' spaces, co-working spaces, start-up incubators, special community events and festivals, and active transport programs.

Libraries are ideal for hosting data discovery or digital literacy workshops. They may have existing programs that can be adapted to work with an air quality topic. Image source: Creative Commons

The benefits include:

- By reaching out to colleagues who are running existing public programs, you can combine efforts and resources, and ensure that you are not duplicating efforts.

- The cost of data engagement activities may be covered using existing budget allocations for other programs, increasing your options for impact.

- You can access existing expertise through community engagement, by seeking out direct working knowledge of local communities, and making the most of pre-existing relationships with key community members.

- Air quality as a topic can tick many boxes in terms of community interest, social inclusion, health and well-being, sustainability and liveability, and digital literacy. This makes it an ideal focus of collaboration with existing public programs, and the original content provided by an air quality monitoring project may be welcomed by colleagues leading those programs.

Reaching everyone

In every community engagement activity, there will be certain groups that are easier to reach than others. It is important to keep in mind that standard events and workshops might only engage a small subset of your community, who may not be the group that is most impacted or disadvantaged by poor air quality. Unfortunately, the most disadvantaged people in a community tend to be the most vulnerable, and also the hardest to reach through traditional modes of community engagement.

To reach out to a more diverse audience, a much broader range of engagement strategies and out-of-the-box thinking may be required. Although this tends to require more time and effort, the pay-off can be significant. Not only can you ensure that you create meaningful targeted impact (which is the best way of justifying ongoing support for your sensing activities), but inclusion of diverse participants can also lead to more unique and innovative outcomes.

Engagement approaches that explicitly consider inclusivity and accessibility are also needed to reach a wide range of people from different cultural and linguistic backgrounds, age groups, genders, sexual orientations, abilities and socio-economic groups.

Melanie Meade of the Pittsburgh Breathe project speaks at a rally in Pittsburgh in 2019. Industrial air pollution disproportionately impacts working class neighbourhoods and people of colour. Image source: Creative Commons

The same strategic approach to engagement extends to specific groups of people that you may want to include (e.g. pregnant women; carers on parental leave; tradespeople; university students; cyclists). For each group of people, there will be certain more effective ways of attracting attention, securing participation, and building trust.

Key recommendations for reaching diverse groups in your community

- Consider all your stakeholders at the start of your project, and allocate a generous amount of time and resources to initial outreach, aiming to understand what their concerns are.

- If you identify certain disadvantaged groups with a stake in your project, reach out to colleagues within your organisation who have expertise working with them (e.g. your organisation's Indigenous cultural engagement or disability inclusion teams). Base your engagement strategy around their advice and knowledge.

- For each group you identify, consider exploring and listing their concerns and motivations; barriers or challenges to effective recruitment and sustained engagement; and unique opportunities that arise from engaging with that group.

- Bring a diversity of core project stakeholders together, and collectively brainstorm ideas for communication and engagement. Get creative with medium, format, location, and delivery style

Participatory data stewardship for digital trust and social impact

What is participatory data stewardship – and why is it helpful?

Digital trust is defined as "individuals' expectation that digital technologies and services – and the organizations providing them – will protect all stakeholders' interests and uphold societal expectations and values" (World Economic Forum, n.d.). A lack of digital trust is a challenge facing local governments wishing to engage communities with data, as it significantly reduces the potential for data to support positive social impact. However, some emerging and innovative approaches to the sharing and management of data may help to build greater digital trust in communities, and improve overall outcomes.

Data stewardship involves the responsible and effective management of data resources, to ensure that they are accessible, usable, safe, and trusted. Participatory data stewardship[2] is an emerging set of approaches that shift the responsibility for data stewardship beyond the lead organisation, and into a shared participatory space that may include a variety of stakeholders (including individual community members), to support improved digital trust. See Figure 1 to understand the aims of participatory data stewardship.

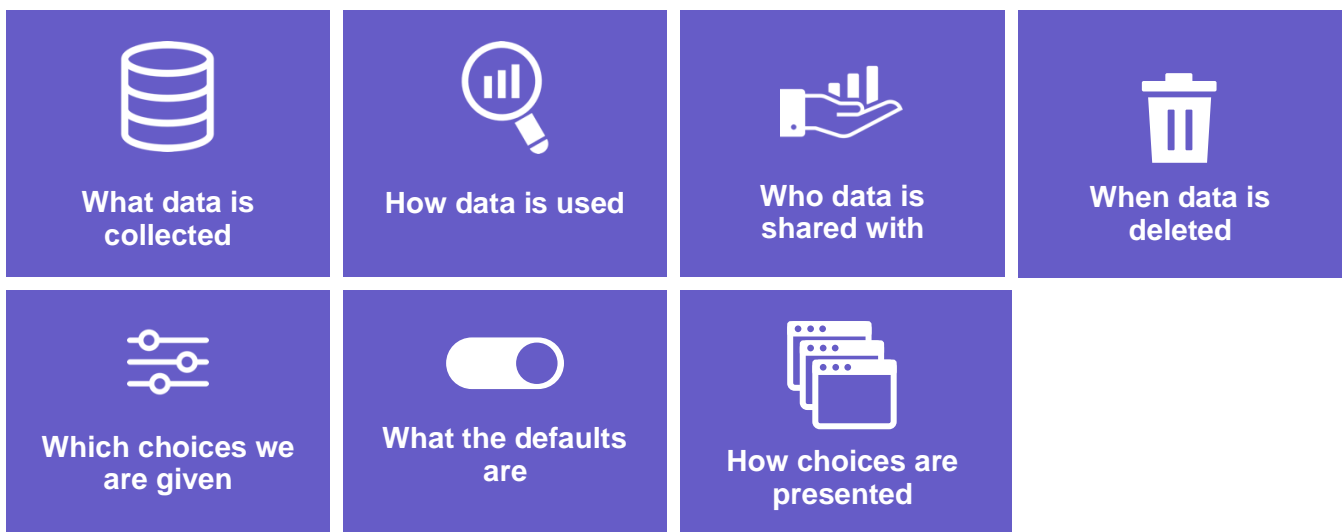| What data is collected	How data is used	Who data is shared with	When data is deleted
Which choices we are given	What the defaults are	How choices are presented	

Figure 1. The aims of participatory data stewardship as developed by Connected by Data, a UK-based campaign to give communities a powerful say in decisions about data, so that it is used to create a just, equitable, and sustainable world (Connected by Data, n.d.)

A report on participatory data stewardship by the Ada Lovelace Institute presents a scale of increasingly collaborative and empowering mechanisms for participatory data stewardship. This culminates in approaches such as data cooperatives, where citizens collectively design, implement, and manage all aspects of data governance, while the lead organisation adopts a support role (providing resources,

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[2] See also: Collective data governance (another term for the same set of concepts).

expertise, and facilitation) (Ada Lovelace Institute, 2021). See Figure 2 for the positive outcomes that participatory data stewardship can support.
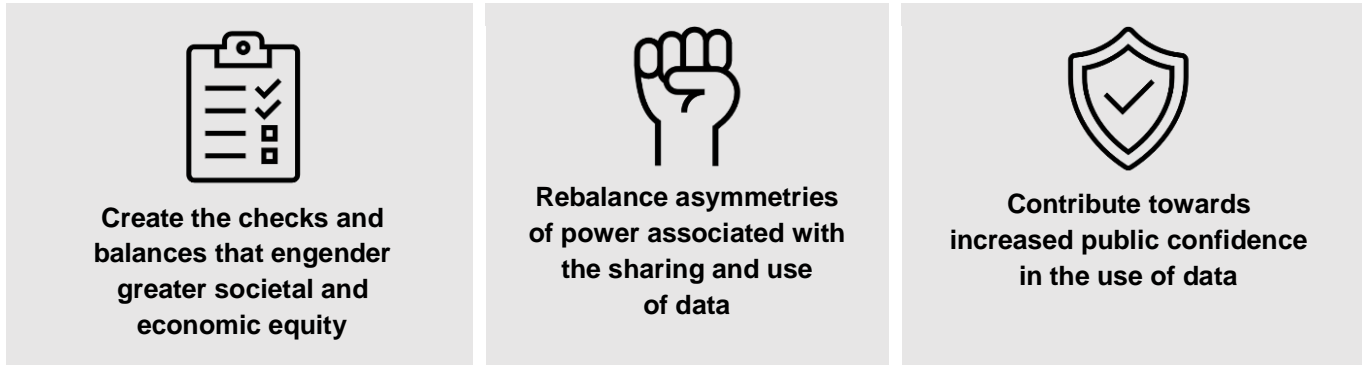

| Create the checks and balances that engender greater societal and economic equity | Rebalance asymmetries of power associated with the sharing and use of data | Contribute towards increased public confidence in the use of data |

Figure 2. Positive outcomes of participatory data stewardship (Ada Lovelace Institute, 2021)

In the context of environmental data, participatory stewardship may be a critical approach for supporting environmental justice and grassroots responses to the climate crisis (Nanda & Mohamed, 2021).

Types of participatory data stewardship

This section introduces four possible approaches to participatory data stewardship that a local government might consider using when engaging community with air quality data (summarised in Table 2). This is not intended as an exhaustive list, as there are many emerging variations to these approaches.

Table 2. Four types of participatory data stewardship

Participatory stewardship type	Explanation
Community data ambassadors	The training of individual leaders to support the sharing and activation of data within community.
Data commons	The collective management of a shared data resource using a shared set of rules, supported by data infrastructure.
Data trusts	A third-party legal entity, based upon the rules and structure of a financial trust, that governs data on behalf of beneficiaries.
Community data hubs	A network of autonomous participatory stewardship hubs that enable data sharing between multiple institutions and community.

All these approaches are relatively new. However, as organisations mature in the production, management, and use of data in the coming years – and as public concern about data privacy and responsibility continues to rise – we can expect these ideas to become increasingly well-developed.

Community data ambassadors

Community data ambassadors are community members who are trained and mentored in skills relating to the stewardship, interpretation, and activation of data. Ambassadors are often positioned as community leaders, with a focus on advocacy and campaign leadership. Their role is to engage their wider community with an issue, and act as a bridge between community interests and experts in a field. The Open Data Ambassadors is an example of this, as is the Clean Air Ambassador Program (see case study below).

CASE STUDY: Clean Air Ambassador Program (Vallejo, California)

The Phillips 66 refinery near Vallejo is the focus of sustained environmental justice campaigns relating to air quality, which are strengthened by the Clean Air Ambassador Program. Image source: Creative Commons

The Vallejo Citizen Air Monitoring Network (CAMN) is an initiative in the San Francisco Bay Area that connects residents, community groups, and experts to build knowledge and understanding of air quality from a community perspective. This empowers community members to fight for cleaner air, and to contribute to positive local solutions.

In 2022, CAMN launched the *Clean Air Ambassador Program*, which trains residents, educators, and youth leaders (16+) to understand, improve, and effectively communicate about air pollution in their community. The science-based program, combined with data from the local Purple Air monitoring network, supports informed advocacy and engagement by environmental justice communities in Vallejo. Ambassador training covers health and personal exposure management, air quality science, the use of low-cost sensing devices and interpretation of their data, and outreach, advocacy, and campaigning skills.

In the first year, 15 Ambassadors were each awarded a $500 stipend for completing an extensive train-the-trainer program, and a further $500 'mini-grant' to develop their own project designed to drive change within Vallejo and beyond. Funding is provided by the Bay Area Air Quality Management District, a public agency that regulates air pollution.

Data commons

A data commons is "any system where people can freely contribute information or data while, at the same time, retaining effective collective sovereignty over it" page 3, paragraph 2 of (Sagarra et al., 2020). It borrows ideas from the more established field of 'natural commons management', and tends to comprise four key elements:

- a data resource

- a community that gathers around that resource

- a set of rules, agreements, and terminologies used to manage and share the data resource

- data infrastructure (a platform or integrated collection of systems) that provides functionality.

CASE STUDY: The DECODE project and Citizen Science Data Governance (Barcelona, Spain)

Smart Citizen sensing devices were deployed by citizens in Barcelona. Their data was uploaded to the DECODE platform, allowing citizens to manage how they shared the data. Image source: Creative Commons

DECODE (DEcentralized Citizens-owned Data Ecosystem) was a multidisciplinary EU project (2018-2019) that responded to people's concerns about a loss of control over their personal information on the internet. The project created a decentralised, privacy-enhancing, rights-preserving platform designed to give data sovereignty back to people, and enable citizens' digital rights. The platform is an example of a data commons, and was trialled in four pilot projects, one of which involved the use of smart low-cost sensing device data.

DECODE ran the Citizen Science Data Governance pilot project in Barcelona in 2018, in collaboration with Fab Lab Barcelona. Citizens collected environmental data using smart low-cost sensing devices deployed in their neighbourhoods. Data from these devices was uploaded to the DECODE platform, which encrypted it to enable anonymous data sharing within the community. Participants used a smartphone app that provided granular control over what information they shared, with whom, and under what conditions, underpinned by smart contracts and blockchain.

Data trusts

Data trusts have emerged within the smart cities space as a response to growing concerns about the responsible and transparent sharing and use of public data. A data trust is a legal entity for data stewardship, based on the rules of legal and financial trusts. It features a formal governance structure comprising a local government of people who have a 'fiduciary' responsibility to manage the data entrusted to them, on behalf of a defined set of beneficiaries.

Civic data trusts go a step further, combining the data trust model with participatory governance approaches that allow citizens (the beneficiaries) to engage in a deliberative process to make decisions about how the trust manages and shares data. Unlike with data commons, there are no specialist tools, technologies, or platforms associated with data trusts. Instead, a data trust is more focused on process and governance, and can use a variety of different technologies to support data access and trust creation (Open Data Institute, 2019).

Data trusts can be a useful way of increasing public access to data, while retaining digital trust. However, they are currently a new and emerging concept, and due to their more formal nature, there tend to be multiple legal and bureaucratic challenges that can complicate their creation. Nevertheless, data trusts may well mature in the coming years, supported by a more general maturation of data standards and policy. As this occurs, we may expect to see them adopted by local governments.

CASE STUDY: Borough of Greenwich (UK) data trust feasibility study

Romney Road, Greenwich, UK. A feasibility project in the Borough of Greenwich explored the potential of a data trust to manage the sharing and use of parking data generated by IoT sensors. Image source: Creative Commons

The Open Data Institute (2019) delivered four pilots that explored the feasibility of data trusts in various public contexts. One of these involved the London borough of Greenwich and the Greater London Authority, and related to the management and sharing of real-time data from an IoT sensing device network that monitors car parking spaces and energy use.

The study engaged extensively with prospective data users, trustees, and a wide variety of legal experts, and while it stopped short of actually implementing a working data trust, the comprehensive project report is still a useful reference for any local government considering establishing a data trust in a smart city context.

Community data hubs

Community data hubs are an idea developed by the Open Environmental Data Project, combining elements of the various participatory data stewardship approaches described previously, with the concept of data collaboratives (which are more concerned with data sharing between institutions, and less with community). Community data hubs are a model for managing the complexities of data sharing between multiple institutions (e.g. government, civil society, universities) and the broader community, in a way that maintains participative democratic principles. See Figure 3 for an example of a community data hub.

The concept involves a network of independent (but interconnected) community data hubs. Each hub within a network shares the following features:

- it comprises multiple community members, who work together as a collective

- it tends to be focused on a specific community issue or need, which determines the rules and governance approach of that hub

- it can make autonomous decisions about how data within that hub can be used or shared

- it connects to any number of other community data hubs, and/or to government agencies, civil society partners, or research institutions

- it sets its own rules about data governance and exchange with external organisations.

Each individual hub is decentralised, with its own control and governance of data and information contributed by the group.

Groups can talk to each other and share data.

Hubs can also provide information external to the Community Data Hub ecosystem.

Sharing can be 1) group-specific, or 2) group-integrated data with external entities (government agencies, requests for information about government policy, etc.).
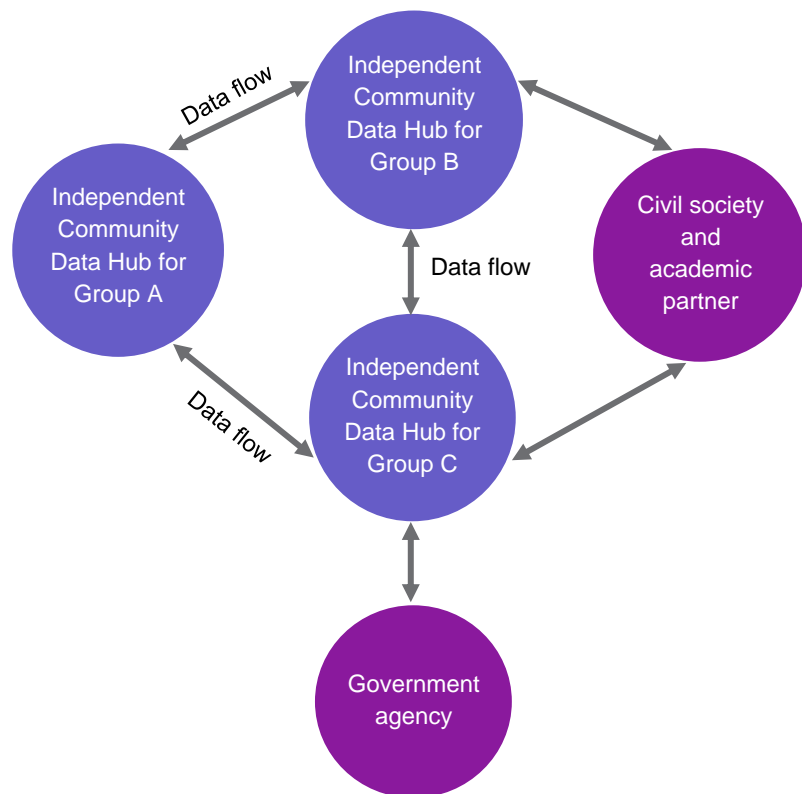

Figure 3. An example of a community data hub, produced by the Open Environmental Data Project. Figure source: Creative Commons (replicated with colour change to match document style and resolution requirements)

Risks associated with data release and community engagement with data

Engaging your community with air quality data can be a hugely beneficial activity, with the potential to support significant positive impact. However, there are certain risks associated with data release, and with community engagement with data. By understanding these risks, you can mitigate them through good planning. Table 3 provides an overview of key risks, as well as guidance on how to mitigate them.

Table 3. Risks associated with the engagement of community with air quality data, and suggested risk mitigation strategies

Risk	Description	Suggested mitigation
Poor quality data	Data is of poor or questionable quality (relative to the phenomenon it describes), and may be inappropriate for supporting a particular data use case. This may cause confusion, and erode community trust in data and technology.	Data quality is always relative to its intended use, so it is vital that you understand the proposed uses of your data, and the limits to those uses. If you are the provider of open data, it is your responsibility to communicate this, as part of the information that accompanies the data release. The amount of information required will vary by data use application. Refer to the OPENAIR supplementary resource *A framework for categorising air quality sensing devices* for more detailed guidance on this topic.
Poorly understood data	Data can be of good general quality, but poorly understood without proper data analysis, resulting in a couple of issues: 1. Third-party data users might interpret and extract insights from data that are not understood by your organisation, creating a liability. 2. Open data release always runs the risk of community members raising any concerns publicly, requiring organisations to be fully equipped to respond to such a scenario in an authoritative way.	Allow a reasonable period of data collection and analysis prior to open data release and community engagement with data. Invest time and resources in analysing data, and ensure that your own internal data users have time and support to become familiar with the data (and confident about what it says). Note: this is what might be thought of as a cautious or more conservative approach. It tends not to be compatible with more deeply participative projects, where community is involved at all stages of project design and delivery, and data is more transparently available from day one. In these cases, the approach should lean more towards expectation management (e.g. the addition of a caveat to open data sets), but a degree of risk is unavoidable.

Risk	Description	Suggested mitigation
Poorly formatted and labelled data	Data may be of good quality and well-understood, but it might be poorly formatted and labelled, making it difficult for people to use and interpret. This can lead to confusion, incorrect analysis, erosion of trust, or simply a reduction of potential impact that the data might support.	There are two notable best practice standards that relate to the formatting and labelling of data for open release: 1. The FAIR data principles provide a framework for making data findable, accessible, interoperable, and reusable. Find out more, and access some practical tools based on FAIR data, at ardc.edu.au/resource/fair-data. 2. The Linked Data Rating (a globally recognised 5-star rating system) provides guidance on the formatting and labelling of open data. Find out more at 5stardata.info.
Unintended political consequences of data release	Data can be of high quality, well-understood, and well-formatted and labelled, but still lead to unintended political consequences for your organisation. Examples: - Sensing device data shows that a new local government-approved development is a localised source of air pollution, inviting difficult questions in the media and from the community about why the approval was awarded. - Sensing device data increases community concern about a specific air quality issue where local government lacks any real agency. Public pressure may mount on local government to act, creating a difficult political bind.	1. Engage internally to explore possible consequences of the data insights you have generated or discovered. 2. Arrange meetings with your planning department and environmental enforcement team, and present your findings to senior executives. Check for any possible negative outcomes that might arise from data release. Note: gaining approval for open data release by internal stakeholders to tell you what concerns them about it may be a recipe for inaction. It is important to approach this type of process pragmatically, and find a balance between due diligence and impact creation.
Inappropriate engagement attempts	Appropriate and effective engagement of minority or special interest groups may call for expert knowledge and sensitivity. If this is missing,	Reach out to colleagues or experts with professional training and direct experience with

Risk	Description	Suggested mitigation
	engagement efforts may fail to connect and resonate with a target group, or worse, may cause offence and harm.	those groups, and who ideally have strong working relationships with community leaders. Examples in a local government setting might include Indigenous cultural liaison, disability inclusion, LGBTQI+ representation, and staff trained to work with CALD (culturally and linguistically diverse) communities.
Failure to allocate adequate time and resources	The greatest risk to strong positive outcomes is a failure to allocate adequate time and resources to well-planned and well-delivered engagement activities.	Plan your project to allow for deep community engagement with data, with significant budget and time allocation to enable this. The most successful efforts to engage community with data tend to follow a more complete process that starts with participatory design, and may include supporting citizen sensing projects. This approach requires more effort and resourcing, but may yield the strongest social impact.

References

Ada Lovelace Institute. (2021). *Participatory data stewardship*. https://www.adalovelaceinstitute.org/wp-content/uploads/2021/11/ADA_Participatory-Data-Stewardship.pdf

Connected by Data. (n.d.). *Communities should be involved in making decisions about data*. https://connectedbydata.org/solutions/participation

Nanda, A., & Mohamed, S. (2021). *Environmental Data is Critical to Fighting the Climate Crisis: Data Stewardship Can Put It In the Right Hands*. The Bastion. https://thebastion.co.in/politics-and/environmental-data-is-critical-to-fighting-the-climate-crisis-data-stewardship-can-put-it-in-the-right-hands/

Open Data Institute. (2019). *Greater London Authority and Royal Borough of Greenwich Data Trust Pilot report*. https://docs.google.com/document/d/1QT1sA9LFDJZBChfEPdZE4ZENManoMaOsJx1A-gq30d0/edit?usp=sharing

Sagarra, O., Hoffmann, X., Clotet, X., Espelt, R., Calleja-López, A., Rodríguez, J., Balcells, P., Bria, F., Aragón, P., Kumar, R., Marras, M., & Laniado, D. (2020). *Final report on the Barcelona pilots, evaluations of BarcelonaNow and sustainability plans*. https://decodeproject.eu/publications/final-report-barcelona-pilots-evaluations-barcelonanow-and-sustainability-plans.html

World Economic Forum. (n.d.). *Digital Trust*. https://initiatives.weforum.org/digital-trust/about

Additional resources

World Economic Forum | [World Economic Forum Digital Trust Initiative](#)

A definitive and globally recognised guide to the concept of 'digital trust' that can be used to form a foundation for any institutional engagement.

Ada Lovelace Institute | [Participatory data stewardship](#)

This one of the most comprehensive and widely cited reports on participative data stewardship. The report outlines a scale of increasingly participative practice, illustrated with multiple case studies. Information is easy to follow, and is presented with practical applications in mind.

DECODE | [Common Knowledge: Citizen-led data governance for better cities](#)

A comprehensive resource on data commons and the work of the DECODE project, including a report on three European pilot projects and a roadmap for future policy development.

Open Data Institute | [Data Trusts Summary Report](#)

An informative guide to data trusts that can be referenced by local government.

Smart Cities Council Australia New Zealand | [Smart Cities Week 2020: Data Dialogues - Let's Talk Civic Data Trusts](#)

Organised by Smart Cities Council Australia and New Zealand, this recorded conference session explores issues relating to data stewardship, and expands on the concept of 'civic data trusts' as they might be applied in the smart cities space in Australia and New Zealand.

Associated OPENAIR resources

Best Practice Guide chapters

Participative design practice

This Best Practice Guide chapter provides guidance for inclusion of participatory design approaches in a smart air quality monitoring project. The chapter explores the benefits of participatory design for local government in this context, practical approaches for implementing it, and common challenges that arise.

Citizen sensing

This Best Practice Guide chapter provides guidance relating to a type of citizen science known as 'citizen sensing'. This is where citizens play an active role in the collection of air quality data using low-cost sensing devices. Benefits of the approach, practical considerations, and common challenges are explored.

Data policy for local government air quality monitoring

This Best Practice Guide chapter explores how local government data policy can support the effective, responsible, and strategic management and sharing of data associated with air quality monitoring. It addresses critical considerations, and provides practical advice relating to the design and development of appropriate data policy.

Sharing air quality data

This Best Practice Guide chapter provides guidance on the sharing of air quality data. It explores the process by which a local government might assess data to determine its shareability, and presents a series of practical options for implementing data sharing.

Activities for impact

This Best Practice Guide chapter introduces a range of activities that can be undertaken by a local government to create impact relating to an air quality issue. Activities are categorised into four impact areas: transport; built environment; green infrastructure; and community engagement.

User interfaces and data stories

This Best Practice Guide chapter introduces some of the key tools and strategies that can be used to communicate air quality data to stakeholders and collaborators in meaningful and useful ways. The chapter focuses on the design and functionality of user interfaces, including dashboards, data portals, and a variety of live data integrations. It also explores communication strategies and the use of 'data stories' for effective engagement.

Supplementary resources

A framework for categorising air quality sensing devices

This resource presents a new framework for categorising air quality sensing devices in an Australian context. It identifies four tiers of device types, separated in terms of functionality, and the quality and usability of their data output. It is designed to assist with the selection of devices that are appropriate to meeting the needs of a project and an intended data use case.

Further information

For more information about this project, please contact:

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