Using data in parks

Rethinking Parks

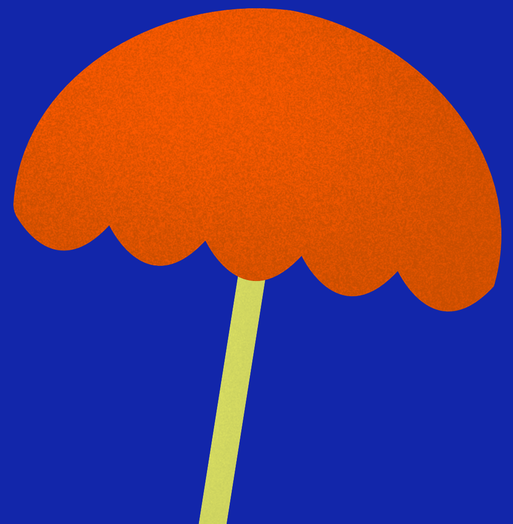
COMMUNITY FUND HERITAGE FUND nesta

Introduction

Public parks and greenspaces play an important role in people's lives. They are much loved assets, valued for many reasons, but also act as a useful barometer showing the livability of our communities.

Who visits, when and for what purposes is enormously rich information not only for better managing park's resources, but also for improving visitors' experience and monitoring the environment more widely.

To test the potential of sensor technologies in parks and greenspaces, two Rethinking Parks grantees developed pilot projects with the aim of providing replicable solutions and useful learnings for other parks.

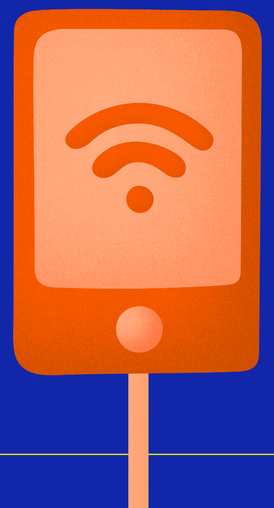


In this leaflet

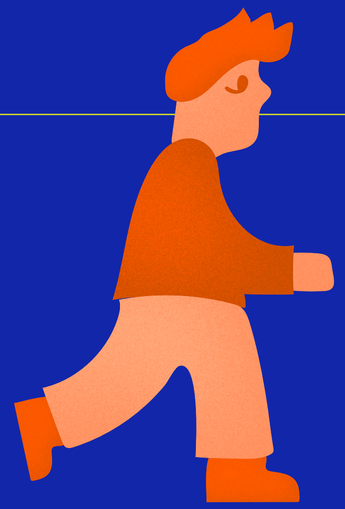
In this leaflet, we will draw on the experience of ParkLife and WiseParks, two projects supported by the Rethinking Parks programme to prototype, test and develop data solutions for parks.

Both projects were selected for their commitment to collaboration with local councils and co-production with communities, prototyping, open source technology development, and a strong data ethics framework.

Based on these two projects we will explore:

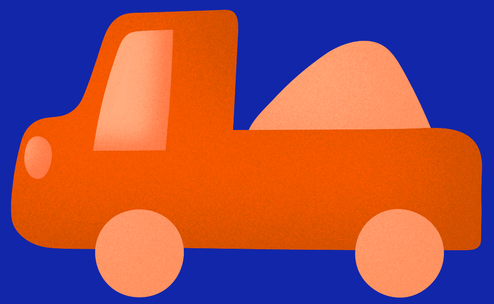


Data and technology used

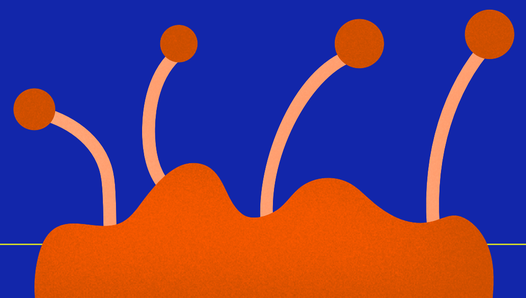


Public engagement activities undertaken

Resources needed to implement such projects



Key concepts for running a parks data project



Why gather data?

User-counting devices

WiFi user-counting devices offer park services real-time anonymised information on people's movement. By measuring the change in visitor numbers projects can:

Maximise investment opportunities by identifying areas of highest traffic

This, for instance, can inform where to place a new café or park attraction, but also determine when is best to carry out opportunistic basic maintenance on the park; for example, arranging litter collection and bin emptying to take place after peak visit times or ensuring that grass cutting isn't scheduled for when the park is at its busiest.

Evaluate impact of investment by comparing before and after traffic

At Highfields Park in Nottingham, for example, manual visitor counts were carried out before and after a £4.8m National Lottery-funded restoration project completed in 2018. A project planned for 2020 will create a new memorial garden at the less visited Western end of the site to draw more visitors there. WiseParks monitoring will allow them to establish whether the plan is actually successful.

Sensor technology

Combined with openly available datasets and increased internet access, sensors are devices that sense, measure and collect data about the environment around us. When multiple devices are connected to the internet at a large scale, they are referred to as the Internet of Things (IoT), or more generally as "smart technology". Most commonly used sensors detect temperature, humidity, proximity and pressure, but can also include more complex inputs such as sound or video.

If developed responsibly, the use of smart technology and IoT sensing in public green spaces can help:

Support parks maintenance
Detecting important data on temperature, humidity, bins load, or energy usage, sensors can provide real-time data to park managers, contributing to service efficiency and ultimately improving visitor experience.

Provide useful data to tackle pollution and wider environmental challenges
Particularly relevant for cities tackling the climate crisis on multiple levels, sensors can provide useful data on air quality, noise and biodiversity.

What did the ParkLife project test?

Data and technology

The ParkLife project, delivered by the University of Edinburgh in partnership with the City of Edinburgh Council, took place in five parks in Edinburgh and focused on gathering sensor data to measure biodiversity levels, build a picture of the total number of park visitors, and the way they engaged with parks. To do this they developed:

Solar-powered sensor noticeboards

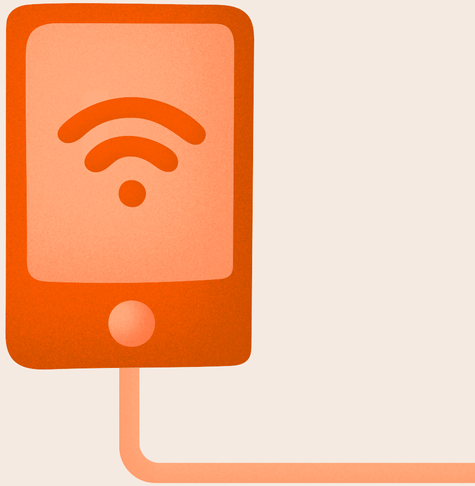
These are physical noticeboards with a lockable front screen and an access panel on the back, hosting all the sensor components.

Sensors installed include:

- Infrared-based distance ranging or LiDAR, which enables precise detection and counting of people (and bicycles) passing within the bounds of a close by pathway.
- Ultrasonic microphones for bat detection, which is a strong indicator of healthy biodiversity.

The chatbox

A chatbox is a computer programme that simulates a conversation through voice commands or text messages. Because LiDAR technology only provides counts of people passing, this technology was selected to allow park visitors to engage directly with park managers, providing them with more qualitative data about individual and collective experiences.



Data gathered through solar-powered sensor noticeboards will be soon available on a dashboard on the park's website, together with the chatbox.

Key findings

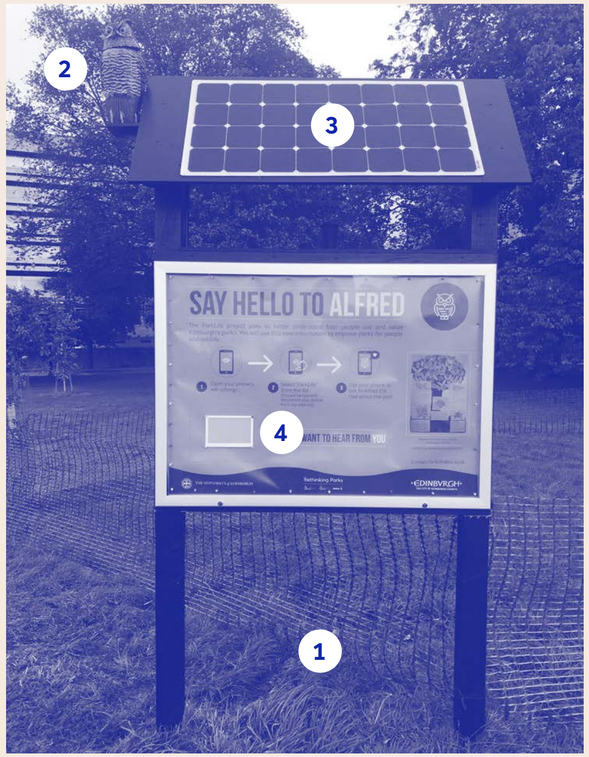
Accessing existing data proved to be difficult during the project due to both a lack of available data and sharing constraints on behalf of data owners. To respond to ethical and privacy concerns, ParkLife's approach focused on direct sensing to capture data that was less privacy-invasive with broad applicability to all parks and greenspaces.

A physical noticeboard was preferred over a digital one because it would make data gathering functional in the short-term (providing a standalone power supply to enable continuous sensing and remote monitoring). Physical notice boards also guarantee more transparency, becoming a visible interaction point to display information about the sensing taking place.

An important success factor is the location of the noticeboard:

- Ideally, this should be installed beside a popular walking/cycling path to ensure that the sensors for people and cycle detection can be utilised effectively.

Noticeboard front panel



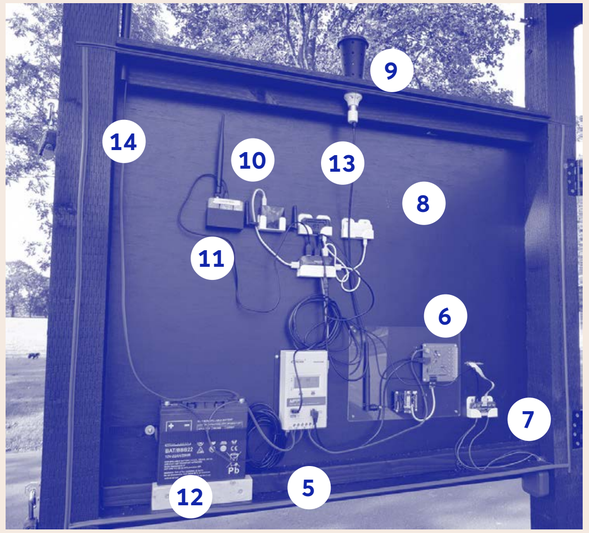
1 – Outdoor wall-mountable noticeboard; 2 – Alfred; 3 – 100W solar panel; 4 – Epaper display

- It is best installed facing due north or due south and not obscured by trees, for maximum solar gain.
- It should remain close to insect-friendly habitat as this will increase the likelihood of bat detection.

After testing the first chatbox iteration with potential users, it became immediately clear that a chatbox needs to provide data in a form that park managers or non technical staff could process and analyse. For the second iteration of the chatbox, a list of criteria was developed to ensure they would be adequate to the technical expertise of users.

After a careful review of off-the-shelf chatbots available on the market, the open source bots development platform Botpress was selected.

Noticeboard back panel



5 – Charge controller; 6 – LoRaWAN board controller; 7 – Raspberry Pi MQTT server; 8 – Raspberry Pi chatbot; 9 – Ultrasonic microphone; 10 – Board WiFi; 11 – LoRaWAN sensor relay; 12 – 20AH battery; 13 – Raspberry Pi bat detector

Public engagement

In addition to a data discovery process to identify what data was already being collected in parks, ParkLife engaged different groups of park stakeholders including park managers, Friends of Parks groups and regular park visitors to gauge their interest in the project. To do so, they used different methods for different audiences, including individual site visits to the four parks with park managers, in-depth workshops with each park's community groups and more than 200 surveys with park visitors.

Key findings

- Many people in community groups were familiar with some sensors (like cycle and people counters) but are not necessarily aware of all the possible alternatives that exist.
- The numbers of people engaging with the noticeboard compared to those passing was relatively small.

Both findings indicate the need to design sessions to inform visitors about sensing opportunities and challenges before involving them in co-production activities, to ensure they can make informed decisions. After the first phase of consultation, ParkLife rapidly prototyped and tested with groups the visual representations and messaging on noticeboards, which showed the data being collected. They also tested different ways of visualising and presenting the data on the online dashboard to determine which visualisation method was most easily understood.

Workshops carried out throughout the project

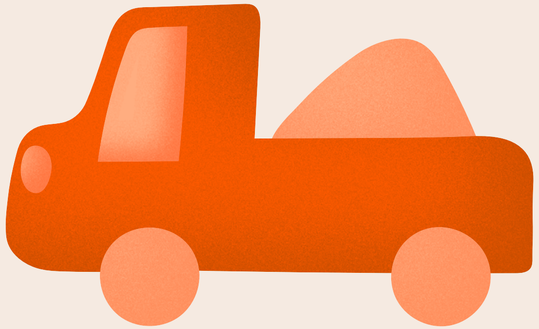
Resources

The approximate cost of production and materials for each sensor noticeboard was £1,000.

While the up-front raw material costs are low, final pricing is likely to be a key factor in adoption if products are developed for the local authority market and need to factor in a modest investment of money especially in response to maintenance issues and time to set-up.

Given that sensors are located outdoors and in public spaces, rather than being added as external elements, they should be built-in to park infrastructure, such as gates or noticeboards to provide a more robust and sustainable option and avoid environmental damage and vandalisation.

Illustrations prototyped to inform about data collection activities in the park



What did the WiseParks project test?

Data and technology

The WiseParks project, delivered by the University of Nottingham in partnership with Nottingham City Council, took place in two large parks of the city and focused on ways to assess the busyness of an area by using WiFi user-counting devices.

To do this, the team developed sensor technology based on the Raspberry Pi single board computer. Each sensor (shown on the next page) includes:

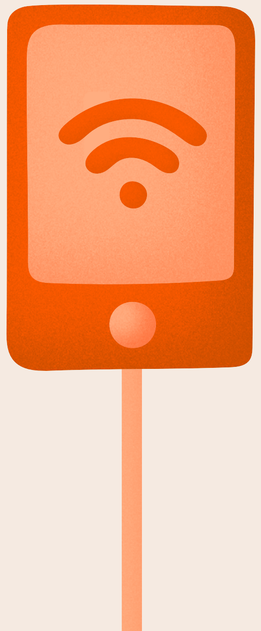
- Micro SD card (to store data).
- 4G dongle and a data SIM card (to transmit the data).
- Battery.

This receives signals routinely sent from WiFi-enabled devices, including smartphones, tablets, laptops and some wearable technology.

Once the data was received, it was anonymised as soon as possible, by removing all identifiable data.

Key findings

Anonymising the data limits the breadth of questions which can be asked of the system, as they cannot say anything about repeat visitors, visit duration or the path taken between devices. This approach was taken to address privacy



concerns expressed by park visitors. Public signage was also developed to inform people about data collection activities.

Deciding the location of the sensors is of utmost importance when using data devices. Potential locations may be limited by practical issues like security and power supply.

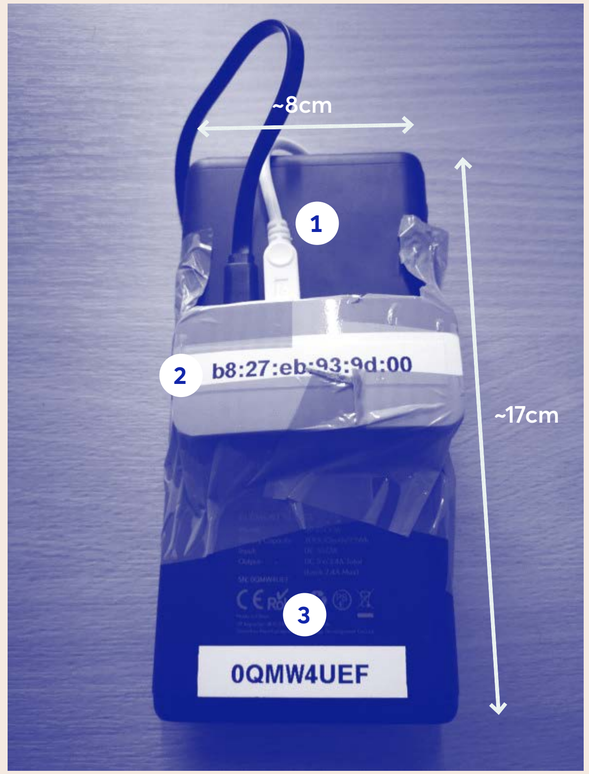
The ideal placement may be in the middle of an open space, away from non-park visitors, with a mains power supply and on a path which every park visitor must traverse. It can be surprisingly difficult to find places like this and compromise is often required to find a suitable location.

Sensors may be run with mains or battery power supplies. For ease of maintenance, mains power is preferable. If a battery is to be used, the sensor must be readily accessible to staff trained to maintain it.

Access to a cellular data signal is essential. If this is not possible at a desired sensor location then some other arrangement must be made, for example a clock add-on or a bespoke wireless data connection.

The sensor built for this project was not inherently weatherproof, therefore it had to be provided with some casing. It is important to highlight, however, that any housing will reduce the strength of the signal received by the sensor. For example, completely enclosing the sensor in a metal case may result in no signals reaching the sensor.

Sensor



1 – Connection to a 4G dongle for data transfer
2 – Raspberry Pi Zero W single board computer
3 – LiPo battery (~5 days)

Public engagement

Public engagement activities were organised to inform visitors that signals from their devices may be used, but that they could opt out by disabling WiFi or turning off devices.

A pilot survey was undertaken to gather further information about park use and signage used to inform park visitors of the data collection activities. The survey included questions related to the frequency and length of visits, purpose or activities usually undertaken in the park, number of people in a group, the number of WiFi-enabled devices they carry. It also asked them for their views on the signage itself as well as their understanding of and views about the poster sign.

Key findings

While it is legal to collect signals from WiFi-enabled devices, there are still public concerns with these activities and a high level of responsibility and duty of care are needed when dealing with this sort of data. Making this approach acceptable requires that:

- Data collected is kept safe and in accordance with local data protection arrangements.
- Data is anonymised, with WiFi-derived and manual-count transformed to 'counts' and stripped of any identifyable elements.

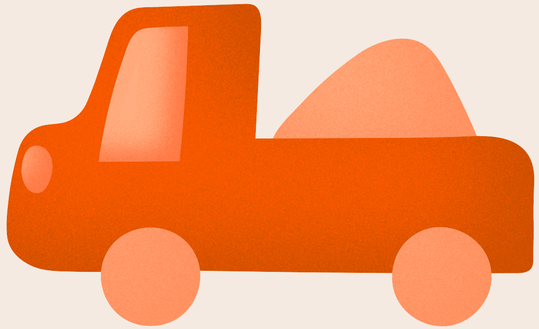
Even if non-personal data is collected, it is always appropriate to reassure park visitors of the nature and intent of any study.

Acceptability of the research will be somewhat dependent upon how it is understood by others. Clear explanations are required for staff working in the area and information for visitors also needs to be available and understandable. If properly understood, individuals will be better informed, and hopefully more willing to support and participate in the project.

Resources

A ‘Raspberry Pi Zero’ uses sensor devices that are relatively inexpensive, costing around £100 each to build, including a battery.

For this project, the smallest version of the Raspberry Pi was used, designed for applications where low power consumption and small size is more important than processing power or connectivity. This technology is widely available and requires limited technical knowledge to access. WiFi dongles come with 3G connection which allows them to access to a time server. For this project, WiseParks used a pay-as-you-go connection (£5 per month).



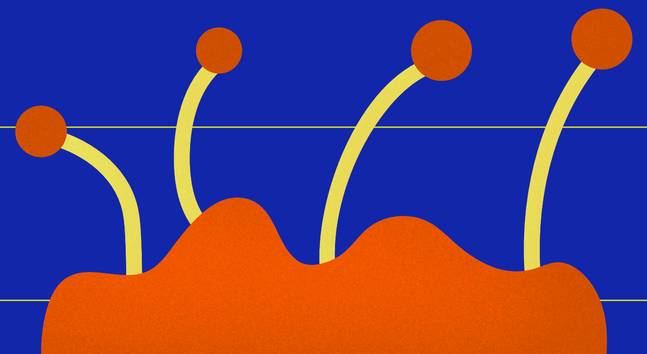
Key concepts for collecting parks data

Co-production

When innovating in the public realm, it is vital to ensure that public goods and services produced are safe and useful to users.

To understand users exact needs and expectations, traditional public consultation through surveys or focus groups at the onset of the project is often not enough. Instead, you will need to directly involve developers, professionals, direct users of the services, and their families and neighbours throughout the entire process of design and delivery. When public services are co-produced in an equal and reciprocal relationship, the services themselves and the people who use them, become effective agents of change.

Consult Nesta's Co-Production Catalogue to find out do's and don'ts in co-production approaches.



Prototyping

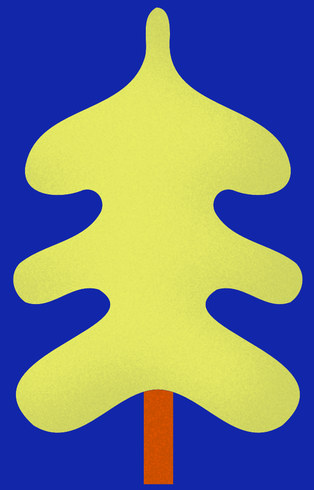
When developing data products, it is much easier to collect feedback and make changes at an early stage than when the product is near ready. To utilise time and money and to ensure the most effective use of data, it is always advisable to start by creating a mock-up, or in technical language, a Minimum Viable Product, MVP. This is an early version, an almost-working model of what will be tested with prospective users and stakeholders. A prototyping approach will allow you to steer the project in the right direction, get it approved by stakeholders, collect feedback from users and collaborators, make changes and then iterate the process until you have a clear visualisation of what is needed to build the final product.

Consult Nesta's Prototyping Framework to find out more.

Open source software and code sharing

To guarantee transparency and accountability, it is always helpful to share work and contribute to the wider innovation community as you can often achieve more collectively than individually. Open code sharing platforms, such as GitHub, help creators of digital innovations share their work.

Tools like Raspberry Pi, makes computing and digital making accessible to all through providing low-cost, high-performance single-board computers and free software.



An ethical and sustainable approach to technology and data

Defining the answers to these questions is a precondition to a project's success.

Consult Nesta's data sharing toolkit to find out more, especially if the project will be delivered in partnership with multiple stakeholders.

Rather than being seen as the single solution for all problems, technology should be one of many tools used in conjunction with other forms of public service innovation and techniques that can drive social change. Similarly, everything about data – from the decision to collect it to the way it is used – has a societal impact and therefore requires careful consideration.

Before starting a data project, consider the following questions (adapted from NOLAlytics new project criteria checklist):

Objective

- Has a problem statement been defined?
- What is the deliverable for this project? How will the deliverable be used – i.e., who will do what differently?

Project sustainability

- Does the project align with the organisation's priorities and is there support at the executive level?
- Is there capacity to implement and who is responsible for the delivery of the project?

Impact on people

- Who can collect, access and use the data and who decides over future collection, access and use?
- What is the positive/negative effect of the project on people?
- Have adverse risks been evaluated and mitigated?

Types of data

- Is data available for this project?
- Is the data collected personal?
- If so, is it possible for people to opt-out?

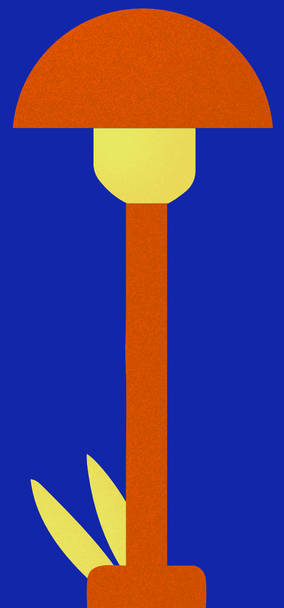
Evaluation

- Does the project include a short and middle-term evaluation?
- Is the project producing the intended outcomes?
- Is there a communication strategy to inform the public about the project?

Tools and resources

Project resources

- ParkLife's Data Toolkit provides a guide for others who would like to experiment with the methods and the open and re-usable technology the project developed. Technical info can be found on GitHub.
- WiseParks's programme page provides additional information about the project. The team is also finalising a report and technical information, which will be freely available, alongside videos explaining the WiFi sensing technology.



Useful toolkits and resources to innovate with data

- Nesta's Public Sector Data Analytics Guide can help your data intervention by making sure that any data analytics activity will lead to an actionable insight.
- Nesta's Data Sharing Toolkit will take you through all the steps of a data partnership.
- DECODE's final report "Common Knowledge: Citizen-led data governance for better cities" gives an overview of how privacy-enhanced sharing of data for public value and data commons principles can help address the issues of personal data under- and over-use in the public realm.
- ODI's Data Ethics Canvas can help you identify and manage ethical issues – at the start of a project that uses data, and throughout.

Rethinking Parks is funded by The National Lottery Community Fund, The National Lottery Heritage Fund and Nesta. It supports innovative ways of managing and financing the UK's public parks to make sure they are sustainable and are run more impactfully for their local communities.