

# Crowdsourcing and the impact of citizen science technologies on environmental monitoring



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## Key Points

- By working with professionals as part of a community, citizens play an essential role in genuine scientific discovery, experiments, data collection, and analysis that promotes the protection and understanding of the natural world.
- Citizen science has evolved from a niche interest to a powerful force that has a tangible impact on environmental stewardship and public policy advocacy.
- When combined with crowdsourcing (obtaining vast amounts of data from a large number of participants, typically via the Internet), the collective voice of citizens is amplified - resulting in an immediate real-time response to urgent issues such as pollution and natural disasters.
- The Internet of Things (IoT) and sensors are at the forefront of citizen science technologies. These devices enable individuals to monitor and collect precise data on environmental parameters such as air quality in urban areas or soil conditions in local parks.
- Additional technologies include machine learning and artificial intelligence, blockchain for data integrity, drone technology, augmented and virtual reality, mobile apps and gamification strategies.
- As we unite to pursue a healthier and more resilient planet, innovation and collaboration between technology and citizen scientists are set to shape a world where environmental monitoring is a shared responsibility and a collective triumph.

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[Citizen science](#) (data for research/analysis collected by non-professional participants) has undergone a transformative journey, evolving from a niche interest to a powerful force. In an age of digital connectivity and technological advancement, crowdsourcing and citizen science technologies are emerging as potent tools, empowering individuals to actively participate in protecting and understanding our planet – resulting in a paradigm shift in environmental monitoring.

Indeed, when it comes to [our work in environmental monitoring](#), our client diversity highlights how the paradigm has shifted to encompass a range of activities across different sectors. While we're still tasked with developing 'big' solutions for [monitoring glacial melting](#) or enabling [deep sea exploration](#), we're also being asked to create smaller – but equally significant – solutions for [smart homes](#) and [energy-efficient workspaces](#). This shows that it's not only researchers and climate analysts who require bespoke environmental monitoring solutions but also everyday people in their daily lives.

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The future of citizen science technologies promises unprecedented advancements in terms of their capabilities, benefits, and impact on environmental conservation and climate action. In this blog post, we'll delve into the innovative technologies shaping the landscape of environmental monitoring, driven by the collaborative efforts of engaged communities worldwide.

# The increasing impact of crowdsourcing on environmental monitoring.

[Crowdsourcing](#) is the practice of obtaining large amounts of information or input by enlisting the services of a large number of people, typically via the Internet. It amplifies the collective voice of citizens, turning everyday individuals into contributors to a global symphony of environmental observations. Through mobile applications, online platforms, and social media, people can now report and share real-time data on various environmental parameters, from air and water quality to wildlife observations.

A notable example is the [Plastic Tide Project](#) – an initiative that uses crowdsourced data to map and address the problem of plastic pollution in oceans.

- **Crowdsourcing approach:** The project utilises machine learning and crowdsourcing to analyse satellite imagery of coastlines and water bodies to identify and map the presence of plastic waste.
- **Citizen involvement:** Volunteers, including individuals from the general public, are

encouraged to contribute by annotating and categorising images through an online platform. This collective effort aids in training machine learning algorithms to recognise and distinguish plastic waste from other objects in the images.

- **Real-time monitoring:** The real-time nature of the crowdsourced data allows for a more dynamic and responsive approach to monitoring plastic pollution. As the dataset grows, it contributes to a better understanding of the distribution and movement of plastic debris in marine environments.
- **Impact:** The Plastic Tide project demonstrates how the collaboration between technology and citizen scientists can provide valuable insights into the extent of plastic pollution. By engaging a global community, the project aims to raise awareness, inform policy decisions, and contribute to developing effective strategies for mitigating plastic pollution in oceans.

The immediacy of crowdsourced data provides a crucial advantage in environmental monitoring. Volunteers equipped with smartphones or specialised sensors can capture and share data instantaneously, enabling rapid response to environmental changes. This real-time capability is particularly valuable in addressing urgent issues such as pollution incidents or natural disasters.

# How do citizen science technologies transform individuals into scientists?

## Internet of Things (IoT) devices and smart sensors

[IoT and sensors](#) are at the forefront of citizen science technologies. These tools empower individuals to monitor and collect precise data on environmental parameters. Integrating IoT in citizen science projects enhances the granularity and accuracy of the information collected, from tracking air quality in urban areas to monitoring soil conditions in local parks.

## Machine Learning and Artificial Intelligence (AI)

Capitalising on the information citizens gather relies on the swift and intelligent analysis of vast datasets – machine learning and AI are central to this process. These technologies can identify patterns, anomalies, and correlations within complex environmental datasets, enhancing the efficiency and accuracy of data interpretation. Citizen scientists will benefit from AI-driven insights, making their contributions more impactful in addressing environmental challenges.

## **Blockchain for Data Integrity**

Ensuring the integrity and transparency of data is crucial. [Blockchain technology](#) secures data in a tamper-proof manner. As contributors supply valuable information, blockchain establishes a decentralised and trustworthy ledger, enhancing the reliability of environmental monitoring data. This not only safeguards the integrity of the data but also reinforces the credibility of participants' efforts.

## **Augmented Reality (AR) and Virtual Reality (VR)**

The immersive experiences offered by AR and VR technologies enrich engagement. These technologies can provide virtual fieldwork experiences, allowing participants to explore ecosystems and gather data in a simulated environment. AR and VR also offer powerful educational tools, enabling citizen scientists to deepen their understanding of environmental processes and share their experiences with a broader audience.

## **Drone Technology**

Drones have proven invaluable in environmental monitoring, providing aerial views and collecting data from hard-to-reach areas. In the future, citizen scientists may have access to user-friendly drone technology, allowing them to conduct high-resolution surveys and contribute to monitoring efforts in diverse landscapes. This democratisation of drone technology could lead to more inclusive and widespread participation in environmental research.

## **Citizen Science Apps and Gamification**

Mobile applications and gamification strategies will continue to play a pivotal role in engaging participants. User-friendly apps facilitate data collection and submission, making it accessible to individuals with varying technical expertise. Gamification elements, such as rewards and challenges, motivate participants and foster a sense of community, turning environmental monitoring into an interactive and enjoyable experience.

The future of citizen science technologies for environmental monitoring is a landscape brimming with possibilities. As these innovations continue to unfold, citizen scientists will be equipped with powerful tools that empower them to contribute meaningfully to our understanding of the natural world. The collaborative synergy between technology and community engagement holds the key to addressing pressing environmental challenges, ushering in an era where every citizen can actively participate in pursuing a sustainable future.

# **What tangible impact can citizen**

# science projects have?

The impact of empowered communities on the environment is two-fold: Environmental stewardship and policy advocacy.

Firstly, crowdsourcing and citizen science technologies foster a sense of community engagement and environmental stewardship. Participants become active contributors to understanding their local ecosystems, cultivating a deeper connection with nature. The democratisation of science empowers individuals of all backgrounds to make meaningful contributions to environmental research.

A case in point is the [City Nature Challenge](#) (CNC). Launched in 2016 as a competition between Los Angeles and San Francisco, the CNC has grown into an international event, motivating people worldwide to find and document wildlife in their cities.

- **Participation:** Residents of different cities are invited to use the [iNaturalist app](#) to document and share observations of plants, animals, fungi, and other living organisms in their urban environments.
- **Competition:** The challenge is structured as a friendly competition between cities to see which can observe and document the most species, engage the most participants, and make the most observations.
- **Collaboration:** While there is an element of competition, the overall emphasis is on global partnership. Participants collectively contribute to a growing dataset that scientists and researchers can use to understand urban biodiversity better.

In addition, the data generated through crowdsourcing and citizen science initiatives carries significant weight in policy circles. Policymakers benefit from the wealth of information engaged citizens provide, influencing decisions related to environmental regulations, land use planning, and conservation efforts. The bottom-up approach ensures that local knowledge and concerns are integral to policy discussions.

A notable example is [Mapping for Change](#), a social enterprise that collaborated with communities in London to monitor air quality through the London Air Quality Network (LAQN).

- **Citizen Involvement:** Residents, schools, and community groups were provided with air quality monitoring kits, enabling them to collect data on pollution levels in their neighbourhoods.
- **Public Awareness:** The initiative increased public awareness of air pollution issues, emphasising the potential health impacts and linking poor air quality to specific locations.
- **Government Recognition:** The data collected by citizen scientists contributed to a growing body of evidence on air quality issues in London.

- **Policy Changes:** The findings influenced the formulation and revision of local and national policies related to air quality management.
- **Low Emission Zones:** In response to concerns raised by citizen science initiatives and other stakeholders, measures such as Low Emission Zones were implemented in certain areas, restricting high-emission vehicles and promoting cleaner transport options.

## Final thoughts on a future where everyone is a scientist

The power of crowdsourcing and citizen science technologies lies in data collection and fostering a global community committed to environmental sustainability. As we unite to pursue a healthier and more resilient planet, the collective impact of our efforts can drive positive change on a global scale.

As we navigate the future, the collaboration between technology and citizen scientists is set to shape a world where environmental monitoring is a shared responsibility and a collective triumph.

If you want to develop technologies that can enhance people's power to positively impact the planet, [get in touch](#). Our wealth and depth of experience make us perfectly positioned to co-develop solutions that are practical, accessible, and versatile.

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## **FAQ's**

### **Why is citizen science important for environmental monitoring?**

Citizen science is crucial for environmental monitoring as it engages individuals in collecting valuable data, expanding coverage, and providing real-time insights into local ecosystems. This collaborative approach enhances scientific understanding and empowers communities to participate in environmental stewardship actively.

### **How does IoT contribute to citizen science technologies for environmental monitoring?**

The integration of Internet of Things (IoT) devices in citizen science technologies allows for real-time data collection, enabling individuals to monitor environmental parameters such as air and water quality. This enhances the accuracy and granularity of the data collected, providing a more comprehensive view of the ecosystem.

### **What role does machine learning play in citizen science technologies?**

Machine learning in citizen science technologies aids in the analysis of large datasets, identifying patterns and correlations within environmental observations. This advanced technology enhances the efficiency and accuracy of data interpretation, making citizen-contributed data more insightful and actionable for environmental monitoring.

### **How can citizen science influence environmental policies?**

Citizen science can influence environmental policies by providing policymakers with valuable data on local environmental conditions. This bottom-up approach ensures that community perspectives and

concerns are considered in decision-making processes, leading to more informed and effective environmental policies.

## **Which technologies are emerging in citizen science for environmental monitoring?**

Emerging technologies in citizen science include augmented reality, virtual reality, and blockchain, which hold promise for enhancing the scope, accuracy, and security of citizen-collected data. These innovations are set to make environmental monitoring more accessible and engaging for individuals worldwide.

## **Why is real-time data collection significant in citizen science technologies?**

Real-time data collection in citizen science technologies allows for immediate responses to environmental changes, facilitating early detection of issues such as pollution incidents or shifts in weather patterns. This timely information is crucial for effective environmental monitoring and management.

## **What impact does citizen science have on community engagement?**

Citizen science fosters community engagement by encouraging individuals to actively participate in environmental monitoring. This shared experience creates a sense of community and environmental stewardship, enhancing public awareness and involvement in local ecosystems.

## **How can citizen science contribute to global collaboration for a sustainable future?**

Citizen science fosters global collaboration by connecting individuals worldwide in the pursuit of environmental sustainability. Through shared data and experiences, citizens contribute to a collective effort that transcends borders, driving positive change and shaping a more sustainable future.

## **What educational benefits are associated with citizen science initiatives?**

Engaging in citizen science projects provides educational benefits by offering participants the opportunity to develop scientific literacy, research skills, and a greater appreciation for the natural world. These initiatives serve as interactive learning experiences, especially in school and community settings.

## **How do citizen science apps and gamification enhance participation?**

Citizen science apps and gamification elements, such as rewards and challenges, enhance participation by making data collection more accessible and enjoyable. These user-friendly tools encourage a broader audience to contribute to environmental monitoring efforts and actively participate in scientific research.

## **Why is crowdsourcing valuable for environmental monitoring initiatives?**

Crowdsourcing is valuable for environmental monitoring as it harnesses the collective power of individuals to gather data over large geographic areas. This approach increases data volume, providing a more comprehensive understanding of environmental conditions and contributing to scientific research.

## **What is the impact of citizen science on public awareness of environmental issues?**

Citizen science initiatives have a significant impact on public awareness by involving individuals in environmental monitoring. This hands-on involvement raises awareness of environmental issues, promoting a sense of responsibility and encouraging informed decision-making for a sustainable future.

## **How do citizen science initiatives address the challenge of monitoring remote areas?**

Citizen science initiatives address the challenge of monitoring remote areas by leveraging the contributions of volunteers who can access and monitor hard-to-reach locations. This distributed approach expands the coverage of environmental monitoring efforts, providing insights into areas that may be overlooked by traditional methods.

## **What is the role of blockchain in ensuring data integrity in citizen science?**

Blockchain technology plays a role in ensuring data integrity in citizen science by providing a secure and tamper-proof method of recording and verifying information. This enhances the transparency and reliability of citizen-collected data, reinforcing the credibility of environmental monitoring efforts.

## **When can citizen science make a difference in policy discussions?**

Citizen science can make a difference in policy discussions when the data collected by participants is presented to policymakers. This evidence-based approach highlights community perspectives and concerns, influencing decisions related to environmental regulations, conservation, and land use planning.

## **How does the City Nature Challenge engage citizens in environmental monitoring?**

The City Nature Challenge engages citizens in environmental monitoring by encouraging them to observe and document biodiversity in their urban areas. This initiative promotes a sense of community and environmental stewardship, empowering individuals to actively contribute to the understanding of local ecosystems.

## **What impact does citizen science have on air quality monitoring in urban areas?**

Citizen science has a significant impact on air quality monitoring in urban areas by providing real-time

data and localised information. This grassroots approach raises public awareness of air pollution issues, influencing policy changes and driving initiatives such as Low Emission Zones to improve urban air quality.

## **Why is inclusivity crucial in citizen science initiatives?**

Inclusivity is crucial in citizen science initiatives to ensure a diverse range of participants and voices contribute to environmental monitoring. This approach fosters a sense of community, empowering individuals from various backgrounds to actively engage in scientific research and environmental conservation.

## **How can citizen science empower communities to advocate for environmental issues?**

Citizen science empowers communities to advocate for environmental issues by providing them with data and insights into local environmental conditions. Armed with this information, citizens can engage with local authorities, participate in policy discussions, and advocate for positive changes in environmental management and conservation.

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