WECOUNT

WeCount: Citizens Observing UrbaN Transport

Deliverable 5.4: Part A - Final Summative Monitoring & Evaluation Project Report

Report for:
European Commission
Research Executive Agency (**REA)**

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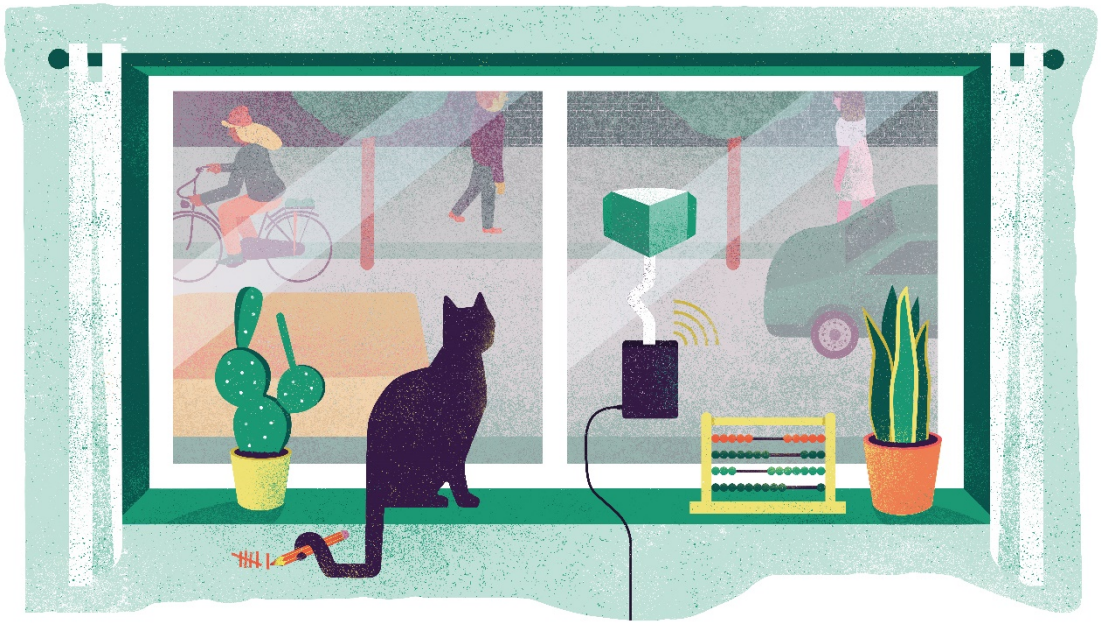

The WeCount Project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 872743

Document Details

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Description	This deliverable describes the process and results of monitoring and evaluating the engagement process in the five WeCount case studies. As a final deliverable, it outlines the evaluation rationale, describes the methodology in detail and provides a cross-comparison of all case studies. The full evaluation kit is included. The monitoring and evaluation have been led by Margarida Sardo (UWE), with contributions from Sophie Laggan (UWE), Laura Fogg Rogers (UWE), Elke Franchois (Mobiel21), Anke Bracke (Mobiel21) and Balázs Németh (POLIS). The monitoring and evaluation were done in collaboration with the Case Studies, who were responsible for applying the evaluation framework and collecting data.

Version History

Version	Updated By	Date	Changes / Comments
V1.0	M Sardo	01/09/2021	Deliverable draft
V2.0	All in WP5	01/10/2021	Sections added
V3.0	M Sardo	18/10/2021	Integration of different sections
V4.0	M Sardo	05/11/2021	Comments and changes addressed
V5.0	S Laggan	18/11/2021	Language check
V6.0	M Sardo	23/11/2021	Final editing.

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1 Executive Summary

WeCount was a Horizon 2020 project which aimed at quantifying local road transport, produce scientific knowledge in the field of mobility and environmental pollution and co-design informed solutions for several road transport challenges. Uniquely, this citizen science project empowered citizens to take a leading role in the production of data, evidence and knowledge around mobility in their local areas. Five case studies across Europe were involved in WeCount: Madrid and Barcelona in Spain, Leuven in Belgium, Ljubljana in Slovenia, Dublin in Ireland and Cardiff in the UK.

Citizens were given low-cost traffic sensors to install in their homes, enabling them to collect and analyse traffic data, as well as engage with key stakeholders throughout the process. Citizens took part in several workshops, from assembling the sensor to learn how to analyse the data.

The project has engaged **directly with more than 1,000 citizens and stakeholders** through workshops, seminars, mutual learning and science-policy dialogue workshops, as stipulated in the bid. A total of **368 citizen scientists** from WeCount case studies directly engaged with the project over its 24-month duration. An estimated 230,000 people were engaged indirectly through social media and the project website. There were **11,085 visitors** of the project website, and over **218,916 social media impressions**. There was a nearly perfect split of males (51%) and females (49%) participants in the project. WeCount was able to attract a **younger demographic than most citizen science projects with 29% of participants being younger than 16.** This skew towards younger audiences reflects the effort of staff in reaching them when possible. WeCount reached **16 schools** across Europe and engaged with **305 school children.** WeCount citizens were highly educated (82% had a degree or above) which maybe a reflection of the online and digital conduct of the project due to COVID-19 restrictions.

Across case studies a total of **52 events** and workshops took place, most of these were online. These events and workshops engaged a total of **843 citizens across Europe** (number is higher than WeCount members as some may have attended more than one workshop). Overall, citizens tended to enjoy the activities the project; 75% saw some improvement in their knowledge and almost half (48%) of citizens plan on using the data after the project ends.

At the time of writing, 10% of participants have so far taken action and policymakers see huge added value in the project. WeCount was able to reach and sustain engagement with a broad demographics in society, with Telraam acting as a constant reminder to citizens to look at the data and stay curious about what data others in the network were capturing. It was a talking point for families, another tool in the toolbox for activists and an opportunity to feel as though citizens were contributing to something bigger than themselves. The sensor is low cost and open access (as stipulated in the grant agreement), and is currently being refined, in response to citizens feedback to improve installation, design and accuracy. Alternatives have been explored for non-tech users (e.g., strawberry plants, facilitated discussions looking at the data, awareness-raising roles created for citizens) and will need greater attention in future iterations to allow for greater inclusion and participant diversity.

Running a large-scale Citizen Science project during a global pandemic was a challenge but one that the WeCount team have excelled at, by very quickly changing and adapting all plans from recruiting and engaging face-to-face, to recruiting and engaging citizens largely online. There is no question that the COVID-19 pandemic severed plans to build potential relationships with some citizens, especially those with a low-socioeconomic status, or intermediary organisations. Other impacts

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included slower deployment of sensors and reduced capacity for teams to build their own sense of community. Despite many setbacks, the case studies have persisted in completing their engagement cycle. They shifted to online and have done well in energising, encouraging, supporting and staying connected with citizens where possible, working collectively to co-design a truly participatory citizen science project. Clearly there is enthusiasm among some citizens to act, however some remain frustrated by what in their opinion is inadequate action from decision-makers, even after they do engage.

Moreover, the project provided cost-effective data for local authorities, at a far greater temporal and spatial scale than what would be possible in classic traffic counting campaigns, thereby creating new opportunities for transportation policymaking and research. The five WeCount case studies developed professional relationships with decisionmakers, which led to mutual benefits such as knowledge transfer, new contacts and access to widely subscribed communication channels to promote or further disseminate WeCount, and the possibility to use sensors to monitor the impact of sustainable mobility interventions.

This evaluation shows the importance of co-designing citizen science projects with citizens so that they are engaging, enjoyable and empowering. The more a citizen enjoyed their time in the project, the more likely they are to continue working with WeCount data after the project ends, which will eventually lead to taking more action. In addition, the greater the street-level knowledge improvement the more likely a participant is to act.

We hope this evaluation report proves useful to other researchers and practitioners working on mobility and citizen science projects.

Note: To provide appropriate framing and context on the WeCount project, sections 3 e and 4 of this report are largely identical to sections 3 and 4 in D 5.2 and D 5.3. By including all sections and background here, the report can stand alone without the reader needing to refer to D 5.2 and D 5.3.

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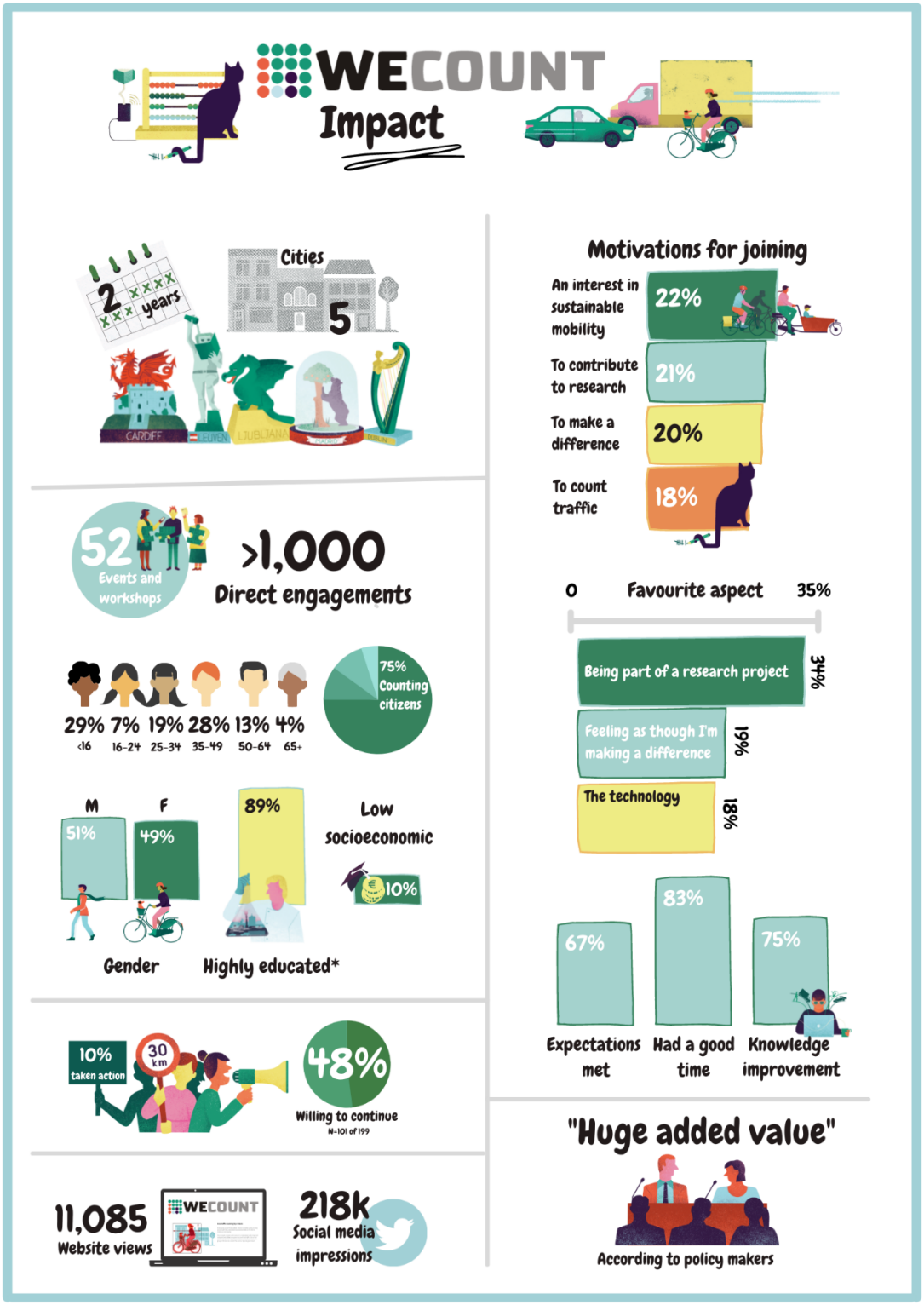

Figure 1 – Summary of the Impact of the WeCount project.

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2 Project Summary

2.1 The WeCount Project

WeCount, *Citizens Observing Urban Transport*, was a Horizon 2020 funded project, part of a Science with and for Society (SwafS) call (H2020-SwafS-2018-2020).

WeCount was a Citizen Science project working across five case studies in Europe to empower citizens to take a leading role in the production of data, evidence and knowledge around mobility in their own neighbourhoods, and at the street level. The project followed participatory citizen science methods to co-create and use innovative low cost, automated, road traffic counting sensors (i.e., Telraam) and multi-stakeholder engagement mechanisms across five case studies.

Citizen scientists in the five case studies were involved in collecting the data, analysing it and engage with key stakeholders throughout the process. WeCount aimed at quantifying local road transport (cars, large vehicles, active travel modes and speed), produce scientific knowledge in the field of mobility and environmental pollution, and co-design informed solutions to tackle a variety of road transport challenges.

2.1.1 WeCount objectives

The original WeCount objectives, as outlined in the project proposal:

- WeCount will advance citizens (and broader scientific) knowledge on traffic counting, transport management and related impacts.
- WeCount will establish a durable ecosystem for citizen science traffic counting and related impacts.
- WeCount will lower the technology threshold to reach a more diverse audience and ensure broader citizen inclusiveness.
- WeCount will demonstrate the diverse potential applications, in five use cases, to tackle five different societal issues related to local road traffic.
- WeCount will achieve meaningful research and local policy change, as a direct result of the evidence collected from the citizen science activities.

2.2 WeCount Case Studies

The project followed participatory citizen science methods across five case studies (Figure 2) in Madrid/Barcelona (Spain), Leuven (Belgium), Ljubljana (Slovenia), Dublin (Ireland) and Cardiff (UK). The five cases followed a similar execution pathway, Leuven & Madrid deploying first and serving as pilots for the remaining three case studies.

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Figure 2 - The five WeCount case studies.

2.2.1 Leuven

As one of the two pilot case studies in WeCount, the Belgian case in Leuven started in January 2020. Consistent with the citizen science approach in WeCount, participating citizens had a proactive role across all phases of the case study, from its problem formulation and co-design, through data collection and data analysis.

The community building process of WeCount in Leuven was based on previous participatory processes, initiated by the local government or by citizens themselves (e.g., the platform "Maak het mee" (Help us build Leuven together)). Steps were taken to gain a good understanding of the local mobility context and build on this process. Comprehensive stakeholder mapping was created for each city district. Stakeholders included city officials who supported these active citizens and citizen networks and were seen as critical players in the community building phase. In addition to a press release, more in-depth communication channels and materials were used to engage local communities (e.g., announcements on Telraam social media (Twitter & Facebook)). Reaching low socio-economic groups was an important focus in WeCount, especially in the scoping phase and in the data awareness and legacy phase of the project, with effort made to connect with organisations working with such groups.

The WeCount project did not start from scratch in Leuven since it had been the pilot site of the Telraam technology since Spring 2019. This meant there was already some public record of the Telraam devices and of the citizen engagement around it, both on the level of the public as well as at the city administration. WeCount Leuven used five different sub-networks, for the five different city sub-municipalities in Leuven.

Details and full monitoring and evaluation findings in Leuven can be found in *D 5.2 Summative Monitoring & Evaluation Pilot Report - Leuven & Madrid.*

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2.2.2 Madrid/Barcelona

The Spanish case study commenced in February 2020. Consistent with the citizen science approach adopted, participating citizens assumed a proactive role across all phases of the case study, from its problem formulation and co-design, through data collection and analysis, until planning and implementing the resulting actions informed by the case study's outcomes and experiences.

Although originally meant to focus on Madrid, due to issues with the sensor not working with Spanish street design, it was decided to expand the case study into Barcelona as well. Significant efforts were made to understand the stakeholder ecosystem of both cities, target relevant actors, and engage them at different levels. 66 community organizations in Madrid and Barcelona were identified and approached and public and private sectors were engaged. Schools and academic institutions (primary, secondary, university), for instance, were an important target group for the case study, with several school's lessons delivered to raise awareness of the wider issues covered by the project and encourage participation in WeCount. Three face-to-face interactions were also organized, when restrictions allowed, to further encourage participation. The core of the scoping and co-design process within the case study involved engaging citizens in participatory online workshops where participants gained an awareness of citizen science, urban (sustainable) mobility, as well as technical knowledge. A diverse community of citizens, stakeholders, and institutions was established, spanning different age groups, genders, interests, concerns, motivations, other demographic characteristics, as well as differing levels of digital skills and subject knowledge.

Details and full monitoring and evaluation findings in Madrid/Barcelona can be found in *D 5.2 Summative Monitoring & Evaluation Pilot Report - Leuven & Madrid.*

2.2.3 Cardiff

The Cardiff case study started in August 2020 and in keeping with the aims and ambitions of WeCount and the citizen science approach, participating citizens assumed a proactive role across all phases of the case study. From problem formulation and co-design, through to data collection and analysis, citizens were engaged deeply, with the intention that the data generated was used by them for communication campaigns and policy engagement.

The COVID-19 pandemic had a substantial impact on the Cardiff case study, for example, across the lifetime of the WeCount Cardiff network, the city has been in full or partial lockdown. To account for extensive lockdown restrictions, the WeCount Cardiff process was adapted from the original workplan to incorporate a phased approach: 1. Community building; 2. Data collection; 3. Data analysis and interpretation and 4. Communication and policy engagement.

Details and full monitoring and evaluation findings in Cardiff can be found in *D 5.3 Summative Monitoring & Evaluation Case Study Report – Cardiff, Dublin & Ljubljana.*

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2.2.4 Dublin

The Dublin case study started in May 2020. Consistent with the citizen science approach adopted, participating citizens have assumed a proactive role across all phases of the case study, from its problem formulation and co-design, through data collection and analysis. They also played a role in planning and implementing the resulting actions, which were informed by their data and personal experiences.

Traffic and transport infrastructure are well-known problems in Dublin. Prior to the pandemic, Dublin was reported to be the 6thmost congested city in Europe[1], with Dublin's Road users spending on average 213 hours sitting in rush hour traffic during 2019. This is related to the growth of the city since the 1990s and its insufficient public transport system.

Some transport-related stakeholders, e.g., Dublin City Council were involved in WeCount since the proposal stage; local community groups, meanwhile, were heavily involved since the start of the project and provided valuable support in terms of participant recruitment and traffic counter distribution and installation. In addition to the stakeholder engagement activities, Dublin held a series of introductory workshops, which helped the local team to co-design the next steps within the citizen science process.

Details and full monitoring and evaluation findings in Dublin can be found in *D 5.3 Summative Monitoring & Evaluation Case Study Report – Cardiff, Dublin & Ljubljana.*

2.2.5 Ljubljana

The first Slovenian sensor started counting in December 2019. Following the example of the pilot cases in Madrid/Barcelona and Leuven, Ljubljana adopted the citizen science, placing citizens in an active role. They were involved in most phases of the project, from problem identification, data collection and analysis of the results. In Ljubljana, the focus was on cycling and identifying cycling corridors. Therefore, in the first phase of identifying communities, we focused on finding associations and networks that are more sustainable, have green transport policies and of course concentrate most on cyclists.

A decision was made to expand the case study outside Ljubljana area to Novo mesto and the coastal part of Slovenia. This was done for two main reasons: first, a strong local champion activity in Novo mesto and in the Primorska region, and second the limitations faced by Ljubljana's Green City policy. The Green City policy led to the planting of 1,000s of trees across the city, including residential streets. Unfortunately, these very trees obstruct the view to the road.

Case study leaders in Ljubljana gained valuable insight into public engagement and citizen science during the project, such as on how to approach and interact with the public, and what engagement strategies work best in the Slovenian environment. As a result of these experiences, they have

[1] https://www.thejournal.ie/dublin-traffic-congestion-4985027-Jan2020/

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produced a guide on how to extend the case study to other neighbourhoods and cities in the state, an important legacy for the project in Slovenia.

Details and full monitoring and evaluation findings in Ljubljana can be found in *D 5.3 Summative Monitoring & Evaluation Case Study Report – Cardiff, Dublin & Ljubljana.*

2.3 COVID-19 pandemic

Just as the WeCount project started recruiting citizens and running workshops, the world was hit by the COVID-19 pandemic, which meant restrictions on who we could meet and where we could meet them. Eventually, all WeCount countries went into lockdown, which placed additional challenges on delivering the project as it was originally planned. WeCount was able to adapt quickly to the new restrictions and limitation, but nonetheless the project has been impacted by this global crisis. The impacts of the pandemic on WeCount were the subject of a small-scale research led by WP5 and are described in detail in the report "**Impact of the COVID-19 pandemic in delivering Citizen Science projects: Insights from the WeCount project"**.

The pandemic meant that there was slower deployment of sensors than had been hoped, it was harder to reach and engage low socioeconomic groups (for example, as some lacked Wi-Fi or technical skills), and engagement in general was affected. In-person events were replaced by online workshops and instruction videos, and considerable time was taken from the project in adapting to online delivery. To the disappointment of staff, the chance for citizens to chat and self-organise over coffee breaks was also removed in the transition to online. Moving online did mean more people could be reached geographically however, and evaluation became somewhat easier as all comments and feedback became digitised, saving the often-painstaking task of writing up hand-written notes. In summary, the main impacts on WeCount can be seen in Figure 3.

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Figure 3 – Impacts of the COVID-19 pandemic on the WeCount project.

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3 Evaluation Rationale

The Monitoring and Evaluation strategy was based on D5.*1 Monitoring and Evaluation Framework* and aims to examine whether the Objectives and Goals set out in D6.1 *WeCount Dissemination and Communication Strategy* and D6.4 *Overview of WeCount communication activities* have been achieved, referring to the Research Objectives listed above.

3.1 Researchers and public engagement with research

WeCount sits within a global context for public engagement with science and technology within the science communication field (Davies, 2013). Worldwide, there is continuing encouragement (funded and policy driven) for more researchers to engage with the public around their research (Poliakoff and Webb, 2007). The UK National Coordinating Centre for Public Engagement (NCCPE) defines public engagement thus:

> *Public engagement describes the myriad of ways in which the activity and benefits of higher education and research can be shared with the public. Engagement is by definition a two-way process, involving interaction and listening, with the goal of generating mutual benefit.*

WeCount has also been designed to fulfil the principles of upstream engagement, outlined in the EU 'Responsible, Research and Innovation' toolkit (RRI, online) as:

> *Doing science and innovation with society and for society, including the involvement of society 'very upstream' in the processes of research and innovation to align their outcomes with the values of society.*

As mentioned, five partner case studies were directly involved in shaping the project. Citizens could get involved through multiple workshops (educational and informative, co-creation workshops, etc.), data analysis and policy workshops and activities in local schools. In addition to these activities, citizens could get involved through other communication channels such as WeCount's website, LinkedIn group, newsletters, etc. This Evaluation deliverable explores how successfully WeCount has been in reaching out to a diverse audience, what changes or impacts can be detected in their knowledge on traffic counting, transport management and related impacts, as well as their sense of empowerment following involvement in the project.

This final deliverable focuses on an overview of the WeCount citizens' journey in the five case studies, as well as the WeCount team's journey throughout the project.

3.2 Learning about traffic counting and transport management

Raising awareness of transport management is a broad aim, and as such the Dissemination and Communication strategy (D6.1) outlines how 'learning' about traffic counting and transport management will be central to WeCount communications. Learning is a concept described in the Informal Science Learning literature and outlined in the 'Generic Learning Outcomes' (Arts Council, 2019), whereby learning may involve the development or deepening of skills, knowledge, understanding, values, ideas and feelings. These impacts are measured across five core domains: Attitudes and Values; Knowledge and Understanding; Enjoyment, Inspiration and Creativity; Skills; Behaviour and Progression. Evaluation of the WP activities attempts to measure the impacts of the WeCount project across these domains, for all identified audiences.

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3.3 WeCount participants

The WeCount project aimed to engage with a wide range of people. Below we outline the project's main audiences:

Counting Citizens

Citizens that were counting traffic or speeds in WeCount. They might have had a sensor at their window (Telraam or another sensor), a strawberry plant or do manual counts.

Involved Citizens

Citizens that were involved in WeCount but did not count. They may have taken part at WeCount events, subscribe to the newsletter or have applied for a sensor but were not selected.

Local champions

Citizens that supported their local network, hosting meetings, organising events, spreading the WeCount message etc., to build momentum in their communities. They may or may not be counting.

Local stakeholders

Policy makers, neighbourhood workers, 'techies', teachers, etc. Everyone that was identified in the local stakeholder mapping and was involved in WeCount in a more strategic capacity.

3.4 WeCount Events

The WeCount project organised different events and engagements with citizens, led by WP2. Below we outline the format of these events:

Co-design event: Co-design events aimed to work with citizens co-create a suitable data collection protocol and to co-design of the project governance structure relevant to that community. After this event, the data collection campaign was ready to start.

Kick-off recruitment event: Kick-off events happened after to the co-design event. The aim was to inform the target groups about the project and to recruit participants more broadly.

Kick-off Telraam workshop: The kick-off workshop was the event where all selected participants for a Telraam were invited to participate. During this workshop the participants received information about Telraam as a tool, the data, as well as how to install the Telraam at home.

Data analysis workshop: This was the final workshop in the WeCount process. All stakeholders (participating citizens, involved citizens, local champions, local policymakers & stakeholders, professionals, techies etc.) were invited to participate. The aim of this workshop was to analyse the data with the citizens, showcasing practical examples on how to use this data, and thus empowering them to interpret and use the data on their own in the future.

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4 Evaluation Strategy

4.1 Methodology

Evaluation is a process that takes place before, during and after an activity. Formative evaluation allowed our researchers to adapt to meet the needs of audiences, while summative evaluation assessed the quality of the activity being delivered, the delivery process itself and what impacts, if any, it had on the participants. Evaluation during engagements allowed citizens to contribute to the collective story of their network, stating their motivations for joining, shared issues of concern and ideas for collective/individual action. In this sense, engagement during activities helped with interactivity and community cohesion.

Monitoring and evaluation were crucial to understand if the WeCount aims and objectives were achieved and to critically reflect on the activities and delivery processes. Due to this thorough approach, **this report has the potential to be used to improve future activities, and events and to demonstrate achievements**.

4.1.1 Ethics Approval and Participant Consent

Ethics Approval was achieved through an application to the UWE Bristol Faculty Research Ethics Committee (FET 20.02.034). Informed Consent was achieved before taking part in all evaluation activities. All activities in this project have been determined as low risk to the researchers and participants. The main risks identified for participants are found in the time commitment involved, and in providing personal data. As such, all participants were warned about these commitments, with appropriate informed consent measures taken to ensure the participants were aware about their involvement before volunteering.

The Participant Information Sheets and Consent Forms used are included in Appendix 1. All documents were translated into the local languages. For children under the age of 18, class teacher consent was obtained, as required and in keeping with national law. A letter was also included for the parents/guardians of those pupils, again detailing the project and activity, asking them to inform the named teacher should they not wish their child to be involved. Consent by 'opt-out' is standard practice, especially when activities are relevant to the school curriculum, and when the individual children cannot be identified.

The WP leads were responsible for enacting the consent procedures outlined in this document. All personal data was managed in accordance with the **D1.2 *WeCount Data Management Plan***. Compliance with Article 39 of the Grant Agreement and the General Data Protection Regulation (GDPR) regarding the processing of personal data and on the free movement of such data will be guaranteed. We have ensured compliance with data protection frameworks in all countries in which we process data. If the data processing has taken place in non-EU countries, it has been compliant both with the National Law and GDPR. Data has been protected to ensure no sensitive data is released that can be linked to specific individuals or entities. Any data which can be identified to individuals or entities has been stored separately to their research responses to ensure confidentiality.

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4.1.2 Research Questions

A variety of methods were used to evaluate the individual events and activities and the project overall. The evaluation methodology was designed to collect high quality data in an easy and straightforward way that works for all partners and across case studies, focusing primarily on the partners and surveys for citizens. All evaluation methodologies attempted to answer the following research questions, which cut across all the WPs.

Objectives/Research questions:

- Are we engaging citizens who provide meaningful representation of local populations (gender, social deprivation, education, income etc.)?
- Are the tools/technology sufficiently robust, yet engaging and simple to use?
- Are the data generated and the engagement activities being used by citizens themselves?
- Are new WeCount communities emerging that are self-sustaining with minimal central support?
- How has developing and running a citizen science project impacted on the research team?
- How can we optimize recruitment, engagement, monitoring and evaluation of future citizen science mobility projects?

These objectives will be answered throughout this report.

4.1.3 Research Methods

A variety of methods were used to monitor and evaluate WeCount. Methods were selected based on how appropriate they were for the given audience and how practical they were to be used by case study leads, across five different countries and several different languages.

4.1.3.1 Online surveys

Online surveys are a convenient method to gather participants' views and thoughts about events and activities. By using online surveys, we would not take away the participants' attention from the activities they are engaging with. In addition, online surveys take away the pressure of being interviewed, making participants more comfortable (Couper et al., 2002) and eliminating interviewer-bias.

For WeCount participants, a final online survey was designed to be relatively short (around 10 minutes), quick and easy to complete, with both open and closed questions, to ensure a variety of data was collected. However, most questions were of a closed format, as this is more inclusive for a variety of different participants (De Vaus, 2002). Including more closed questions than open ones also assisted in making translation and data analysis straightforward. Open-ended questions, meanwhile, allow participants to provide answers in their own terms (Grand and Sardo, 2017) but were kept to a minimum, since they tend to have a lower response rate (Groves et al., 2004).

Online surveys were originally prepared in English and then translated by local case study teams. They were distributed to participants in their native languages at the start of the project to get a baseline on motivations and gather demographic information. A final, more in-depth survey was sent to all WeCount participants near the end of their project cycle, shortly after or just before their last workshop or interaction with the project/project team.

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All data from the surveys were translated to English by a translation and transcription company/ service. For the analysis of the final survey, six steps were taken for each case study. First, the raw data was cleaned, and closed questions coded in excel. Second, the open questions were given an initial review to identify and code themes (Braun and Clarke, 2006). Next, the quantitative data were transformed into graphs (in Excel) and the researcher began to write the emerging data story. Following this, the cleaned excel was imported into NVivo for a deeper analysis of content and themes. Themes were then condensed, and the dominant themes interpreted for meaning and added to the data story. The sixth step, relational statistics, was performed to see how certain themes relate, if at all, to demographic characteristics and other themes (e.g., knowledge gained and action took, for instance).

For statistical analysis, all survey data was coded and then imported into SPSS. Data was explored initially to test for normal distribution. As data is not normally distributed, nonparametric tests were run for each question asked. Two types of question were asked:

1. Does a certain participant characteristic (e.g., age) influence a certain participant ranking (e.g., motivation)?
2. Are there any relationships between different participant rankings?

Where relevant and possible, post-hoc testing was subsequently run to ascertain which groups were different from each other.

A copy of the final online survey is included in Appendix 11.6.

4.1.3.2 Interviews

Individual interviews are described in the literature as a useful evaluation method as they directly access the observations, insights and the experiences of the participants (Tong et al., 2007). In this evaluation, interviews were used to further explore relevant topics, citizens' experiences and any issues. The individual interview was designed as semi-structured and the schedule included open-ended questions allowing participants to provide answers in their own terms (Groves et al., 2004). The interviews were used to evaluate citizen's thoughts, views and experiences on WeCount. The in-depth interviews occurred over phone or Skype/similar; in the local languages and were audio recorded, then 'intelligently transcribed' (e.g., removing 'ums' and 'ahs') by professional transcribers.

Interviews were also used to explore the experience of the WeCount team, using a similar method to the citizen interviews. Staff members were asked to reflect on the project process, their experiences (positive and negative) and the project's impact on themselves and the community. In addition to the qualitative interview questions, each interviewed WeCount team member was asked to quantitatively assess the expected impact of the WeCount project across several dimensions. To facilitate this, the Impact Assessment Framework from the H2020 ACTION[2] (*pArticipatory sCience Toolkit against pollutION*) project was slightly adapted and used. The ACTION framework considers five areas of impact: scientific, social, economic, political and environmental impact. Each dimension has been broken down into different sub-themes and thereby operationalised with different variables (Figure 4). The resulting 24 subthemes were used to assess the expected impact generated by the WeCount project. To complete this assessment exercise, a 1 to 5 Likert scale was

[2] https://zenodo.org/record/4432132#.YXmU2xpBxPa

used whereas 1 is not relevant (no expected impact) and 5 is very relevant (crucial expected impact area).

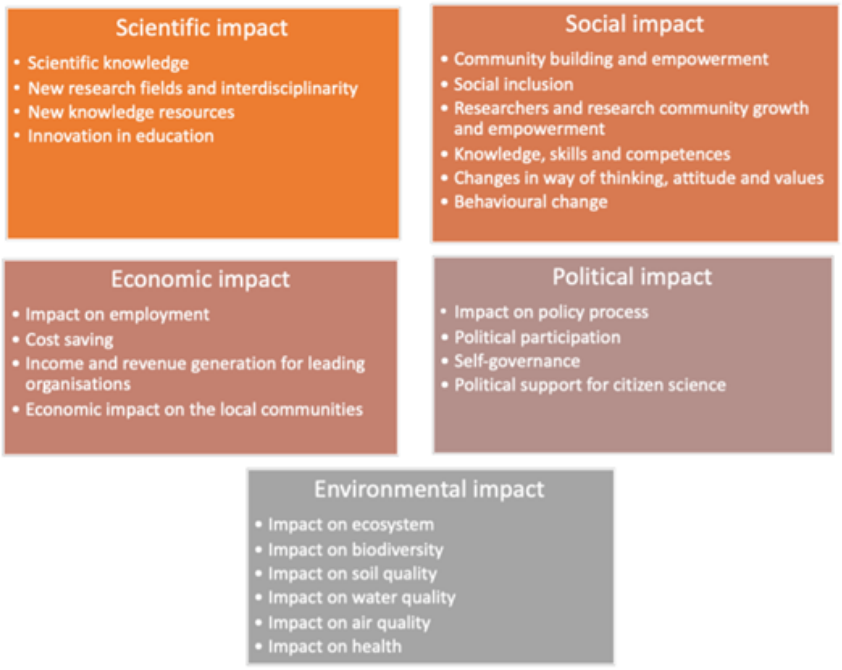

Figure 4 - Dimensions of impact as described in the ACTION impact assessment framework (source: ACTION project framework).

Each interview set – from citizens and from staff members – was analysed separately with different coding frames. The interview data was analysed in NVivo using the process of thematic analysis (Braun and Clarke, 2006), searching for themes that captured patterned meaning across the data. The codes were then refined and accumulated into themes that represented the semantic meaning across the dataset. Secondary analysis was performed with review by WP5 researchers to ensure the themes adequately represented the original data.

Copies of all interview schedules are included in the appendices (Appendix 11.3, 11.4 and 11.5).

4.1.3.3 Self-Reflective Logs

Staff running WeCount workshops were asked to keep a self-reflective log. Self-reflective logs are forms that staff running workshops are asked to complete soon after the event takes place. Having access to the thoughts, views, opinions and post-event reflections of WeCount staff enables triangulation with other evaluation data. A self-reflective log form and guidance to fill it out was provided in advance, with the aim of making it easy and straightforward to use. The self-reflective logs were interpreted in a qualitative way per type of event. Insights were gained into the 'do's and don'ts' of organising each type of event.

A copy of the reflective log template is included in Appendix 11.7.

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4.1.3.4 Feedback during workshops

A template was created for all case study teams to capture data from workshops. This data included demographics, efforts to target low-socioeconomic groups and participants motivations for being involved. Within the template there was also space for teams to make notes about the group interactions or results from any ice breaker activities conducted. Data was processed and analysed in Excel.

4.1.3.5 Demographic data

Demographic data was collected either during the workshops or while participants were registering for a Telraam or for an event (e.g., an online pre-registration form like Eventbrite). By collecting demographic data in advance of the workshops, the aim was to make the evaluation process manageable for the case studies, as well for participants, who would not have to dedicate as much time during the event(s) by completing long surveys. Demographic data from the registration stage (for Telraam and/or events) was either directly exported from the Telraam dashboard or downloaded by the case study leader. This data was analysed directly in Excel.

In addition to demographic data, information on number of citizens reached was also ascertained. General monitoring covered aspects such as recording:

- number of participants in all WeCount interventions.
- number of registrations on the Telraam website.
- number of "likes" on social media platforms.

We used Google Analytics as a passive monitoring tool for WeCount and Telraam website-traffic monitoring, with common indicators such as unique users per day/week/month, session duration, user acquire channels, user retention etc.

4.2 Evaluation implementation

A large-scale, international research project such as WeCount needs a monitoring and evaluation strategy and implementation plan that works across different cultures, levels of expertise and different experiences in evaluation methods. Here we describe how the WP5 team implemented the Monitoring and Evaluation framework.

4.2.1 Coordination across work packages

Several steps were taken to involve other consortium members, case study leads and other works packages in the development and implementation of the Monitoring and Evaluation framework:

- All case study leads were consulted and involved in developing demographic questions that were appropriate to their cities/regions.
- WP2 (WeCount Citizen Science Ecosystem) and WP3 (WeCount Platform and Sensors) were involved in developing the final citizen survey and its interview questions.
- During the review and development phases, WP5 has had continuous interactions with WP2 (WeCount Citizen Science Ecosystem) which included WP5 team members giving advice and obtaining Ethics Approval from the UWE Bristol's Research Ethics Committee. This resulted in Monitoring and Evaluation as an integral part of the WeCount Engagement Framework and Toolkit. The Toolkit embeds, in one single resource, data

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gathering requirements (and related templates) for evaluation purposes and delivery in line with the ethical approval. This coordination across work packages has been crucial in ensuring a coherent approach for informing and supporting the case studies' implementations.

4.2.2 Training

At several stages in the project, WP5 delivered training:

- **General training session on Monitoring and Evaluation**, delivered in M6, delivered by teleconference. The session was planned and delivered jointly by UWE Bristol and M21 and with all consortium members invited to attend. It provided an overview of the purpose of the evaluation, methods used and what each case-study was expected to contribute with.
- **Case Study-specific Monitoring and Evaluation training,** tailored to each case study's experience (if any) and focused on their monitoring and evaluation needs. These sessions provided an in-depth look at the monitoring and evaluation plans, including a detailed methodology and how and when to collect data. All sessions were delivered by teleconference.
- **Online survey guidance.** To support the local teams in disseminating the online survey and getting the best possible return rate, WP5 produced and distributed a detailed guide with instructions and set-by-step approach on how to distribute their survey to all WeCount participants.
- **Interviews with citizens.** Interviews with selected local citizens were conducted by the case study teams, in the local languages to allow participants to fully express their opinions and experiences. When needed, case study teams were offered an online training session on how to conduct research interviews. The case study teams were also given guidance and support on how to approach and recruit participants to take part in interviews, as well as how to get a diverse sample of participants.

4.2.3 Monitoring and Evaluation mentor

To ensure an effective implementation of the Monitoring and Evaluation framework, WP5 created the role of "Evaluation Mentor" role, who provided continuous support across case studies. This role became necessary as close cooperation with every case study is needed to guarantee the successful application of the framework. The mentor guided all local teams through the evaluation plan, following their own local monitoring and evaluation framework. Case studies were provided with the right information at the right time and supplied with the templates needed to collect evaluation data.

The Evaluation Mentor worked closely with all case study leads, organising regular meetings, answering questions, highlighting any monitoring and evaluation needs and sending reminders of data that needs to be collected and/or stored. This approach was quite successful, as all case-studies had access to a high level of support.

4.2.4 Ongoing support

Finally, like in other WPs, WP5 strengthened their relationship with case studies and other WP leads with one-to-one support, should the partners need any clarification, help during framework implementation, brainstorming solutions, or providing additional information.

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4.2.4.1 Impacts of the COVID-19 pandemic on the Monitoring and Evaluation Framework

When deliverable D5.1: *Monitoring and Evaluation Framework* was developed and submitted (February 2020) we could not imagine the world would be about to face a global pandemic. The original framework, which outlined the evaluation rationale and set out the evaluation plan and methodologies, was designed based on the planned face-to-face interaction and engagement with citizens in the five WeCount case studies. Just as the project started recruiting citizens and running workshops, the world was hit by the COVID-19 pandemic, which shortly led to local restrictions on who could meet who and where. Eventually, all WeCount countries went into lockdown, which placed additional challenges on delivering the project as it was originally planned.

Inevitably, the monitoring and evaluation plans had to be adapted to the new reality: the online recruitment of and engagement with citizens. Listed below are the deviations from the original D5.1 framework, considering the pandemic:

- The overall evaluation targeted a **smaller number of research questions** than initially planned, due to fewer opportunities to collect feedback from participants and due to online fatigue. During the pandemic and especially during lockdown, the WeCount team noted that people were seeing a huge increase in online events and online demands (as well as general life demands), leading to tiredness and eventually lower uptake and participation in the online world.
- **Snapshot interviews were not used** to evaluate workshops, in an effort not to overwhelm participants with more online demands.
- **Autonomous evaluation methods**: these were not used in their original form (i.e., feedback cards and feedback boards) but were adapted to the online world as much as possible. Online tools such as Miro and Mentimeter were used instead to collect additional feedback during workshops.
- **Scoping work**: planned scoping work with residents (e.g., organising events at neighbourhood centres to inform and involve difficult to reach) did not take place due to the COVID-19 pandemic. The local teams had to shift priorities and invest their time in looking for other recruitment methods and options, as well as setting up online workshops, which was not initially planned for. Additional time and effort had to be diverted into motivating participants to join the project, as the pandemic proved overwhelming for many people.

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5 Monitoring and Evaluation Framework – targets, objectives and execution

5.1 Project Communication and Dissemination

Dissemination of WeCount's five case studies was mainly organised around communicating local impact stories achieved by participating citizens. These impact stories (all available on the WeCount website) clearly show the local experiences and outcomes of the project through the eyes of active users and communities who have been shaping local policies with the help of WeCount data. Citizens have managed to collect and analyse valuable data about traffic, which has led to real change in some aspects of local traffic rules, from lowering speed limits and installing speed cameras or signs, to monitoring the impact of road changes, from road works to Low Traffic Neighbourhood trials. These stories manage to convey what WeCount all is about, especially when complemented with videos. Local case studies (Barcelona, Leuven, and Ljubljana at the time of writing) produced videos based on local impact studies which visually show the local context and achievements introduced by local users. Videos were mainly disseminated together with local impacts story articles to broaden their reach. These outputs were widely disseminated through European channels, including social media, newsletters and the POLIS Network.

In addition to local impact stories, more in-depth analysis of traffic data in case studies were communicated by articles complemented with graphs and metrics, such as those showing the impact of COVID-19 pandemic on traffic flows and modal split. An article on this has been included in Thinking Cities Magazine, through which hundreds of local decision and policymakers have been reached. WeCount was part of numerous EU transport and citizen science conferences (e.g., CIVITAS Forum, POLIS Conference, Citizen Science Conference, European Week of Regions and Cities etc.) with presentations given by local case study leaders and multiple webinars, including two organized by POLIS Network, where case studies had the chance to tell their stories to a wider European audience.

Impacts of local case studies were widely disseminated regionally and nationally as well. WeCount Barcelona was featured in the newspaper La Vanguardia and TVE Catalunya, the regional television channel among other platforms. WeCount also reached BBC England through the Cardiff case study and their local activities. WeCount Dublin peaked the interest of national and local media from Dublin's radio 98 FM to national television channel RTE. Leuven had similarly wide media coverage in Belgian media with local impact stories featured in RTBF, Het Laatste Niews and De Tijd online media channels. This wide coverage is testament to the 'newsworthiness' of WeCount, which co-developed unique techniques to detect and visualise mobility challenges and implement solutions. Figure 5 presents the main social media statistics for the WeCount project.

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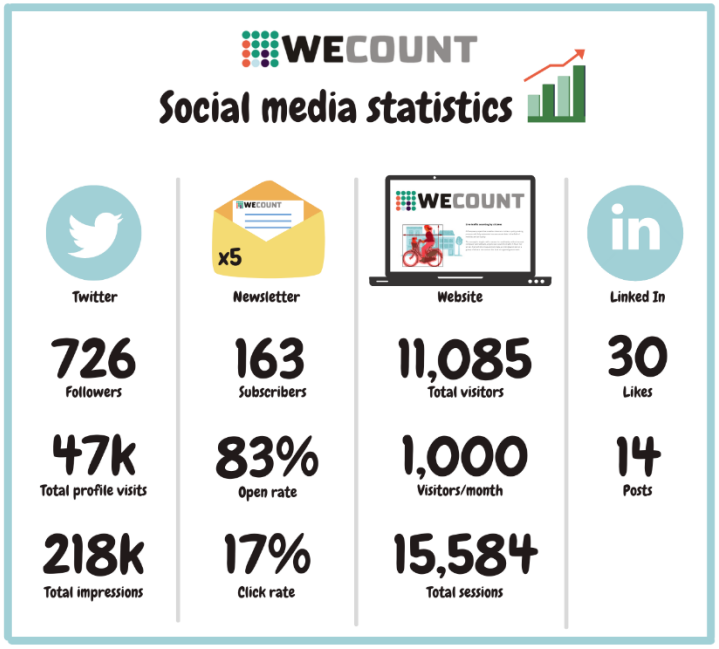

Figure 5 – Summary of the main social media statistics.

5.2 Evaluation Dissemination

The present in-depth D5.4 Final Evaluation Report will be shared at the end of the project. The Evaluation Report will be disseminated through WeCount's communication platforms and the WeCount Associates, as well as via the EU Commission. The report will be permanently stored and available on the WeCount website, the WeCount Zenodo archive and the UWE Bristol Research Repository.

Data emerging from the evaluation has been and will continue to be further disseminated in academic papers and conference presentations. The WP5 team is targeting both science communication and public engagement academic journals (e.g., Science Communication, JCOM – The Journal of Science Communication, Citizen Science: Theory and Practice) as well as mobility journals. The same strategy is being used for conferences. So far, the evaluation data has been disseminated in or is planned to be disseminated at:

Academic publications:

- Sardo, A.M. and Laggan, S., **submitted** (September 2021). "Impact of the COVID-19 pandemic in delivering Citizen Science projects: insights from the WeCount project". *Science Communication.*
- Sardo, A.M. Laggan, S., Fogg-Rogers, L. and Franchois, E., in preparation. "Involving citizens in more participatory ways, from evaluation to technological development – learnings from the WeCount project". *fteval Journal for Research and Technology Policy Evaluation*
- Ažman Momirski, L., Laggan, S, Hayes, E. and Sardo, A.M., in preparation. "The influence of culture on involvement in citizen science projects related to urban mobility". *Journal of Transport Reviews*

Other publications:

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- Ribeiro, C., Laggan, S. and Sardo, M. 2021, 'Moving Dialogue Online', *Thinking Cities: The Disrupted City?*, 9 June, 29/35.

Conference presentations:

- Upcoming: Annual POLIS Conference, December 2021. "WeCount empowered by Telraam: enabling citizens to initiate a policy-making process with fully automated traffic data collection." 1-2 December 2021, Gothenburg, Sweden.
- Fogg Rogers, L., Sardo, M., Laggan, S. and Salmon, R., 2021. "Act Now: Is the time for science communication about climate change over, or just beginning?" PCST 2020+1, 24-27 May 2021. Online.
- Sardo, M., Laggan, S., Fogg Rogers, L., Vleugels, I., Bracke, A. and Franchois, E., 2020. "Are we on the same page? Making project engagement and evaluation work across European cities and cultures ". Citizen Science SDG Conference, 14-15 October 2020, Berlin/online.
- Fogg-Rogers, L, Presented on behalf of the WeCount project. "Citizen science - tools to achieve real impact on policy making" European Week of the Regions and Cities, 11-14 October 2021.

Other presentations:

- Laggan, S., Fogg-Rogers, L., TAPAS lunchtime seminar. Involving young people in clean air research and decision making - lessons from three large-scale citizen engagement projects. Delivered online in February 2021. Available at: https://tapasnetwork.co.uk/lunchtime-seminars
- Laggan, S. and Sardo, M., Continuing Professional Development course. "Engaging Participants in Online and Blended Environments". Delivered online in April- May 2021.

5.3 Meeting WeCount objectives

Table 1 details how and where the original Monitoring and Evaluation objectives have been evidenced.

Table 1 – Monitoring and Evaluation objectives and execution.

Objectives	Research question/measure	Where and how this is evidenced
Overarching	Are we engaging citizens who provide meaningful representation of local populations regarding gender, social deprivation, education, income etc?	Demographic questions (registration form, final survey and before/during workshops) Education and occupation data used to estimate socioeconomic status. Postcode data (Dublin and Cardiff only) used to measure deprivation. **All presented in D5.4 - Part B**
	Are the tools/technology sufficiently robust, yet engaging and simple to use, in order to reach and sustain engagement with the broadest possible transect of society?	Final survey and interviews with citizens. Feedback from Zendesk.

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		Presented in D5.2 and D5.3, summarised in D5.4 - Part A
	Are the data generated and the engagement activities being used by citizens themselves, for instance by impacting local attitudes, increasing local advocacy, influencing citizen behaviour and increasing engagement with local policy making?	Final survey and interviews with citizens. **Presented in D5.2 and D5.3, summarised in D5.4 - Part A**
	Are new WeCount communities emerging that are self-sustaining with minimal central support in order to continue beyond the project end?	Interviews with staff. Interviews with citizens **Presented in D5.4 - Part A**
	How has developing and running a citizen science project impacted on the research team?	Interviews with staff. **Reported in D5.4 - Part A**
	How can we optimize recruitment, engagement, monitoring and evaluation of future citizen science mobility projects?	Lessons learnt from all case studies. Guidance for other citizen science projects. **All presented in D5.4 - Part B**
1. Advance citizens knowledge on transport & mobility	Examine and collect evidence of use of data by the citizens. Examine evidence of improved ability to autonomously deploy digital sensor technologies in their homes.	Final survey. Data analysis workshops and final actions. **Presented in D5.2 and D5.3 and summarised in D5.4 – Part A**
	Explore citizens' attitudes, values, knowledge and behaviour towards traffic counting, traffic management and travel behaviour and find out whether changes occur due to participation in the pilots.	Final survey. **Presented in D5.2 and D5.3 and summarised in D5.4 – Part A**
	Investigate citizens' participation at the various types of co-design workshops organised in the five pilots (e.g., hackathons, window chats).	Workshop evaluation form. **Presented in D5.2 and D5.3 and summarised in D5.4 – Part A**
	Measure user experience/ acceptance of the WeCount data platform, data dash boards, etc. Are the data generated at the pilots being understood by citizens?	Final survey. **Presented in D5.2 and D5.3 and summarised in D5.4 – Part A**
2. Establish a durable ecosystem for CITIZEN SCIENCE traffic counting & related impacts.	Record the percentage of the sensors installed without any hands-on support (by only using the manual, instructions video, step-by-step via the website). Do improvements in supporting materials made based on experiences in Leuven and Madrid give better results in Cardiff, Dublin and Ljubljana?	Data from the WeCount platform. Final survey. **Reported in D5.4 - Part A**
	What is the role of local champions (i.e., very engaged citizens)? What can we learn from their experience in the pilots in order to make the WeCount platform more durable?	Final survey. Interviews with local champions.

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		Reported in D5.4 - Part A
	What is the retention rate of citizens active on the WeCount platform after one year? What are reasons for drop-out and how can these be overcome?	Telraam platform. **Reported in D5.4 - Part A**
3. Lower the tech threshold to reach a more diverse audience & ensure broader citizen inclusiveness	Are we engaging citizens who provide meaningful representation of local populations regarding gender, social deprivation, education, etc. in the various activities (co-design workshops, live events, registrations at the platform, etc.)?	Demographic questions (registration form, final survey and before/during workshops) Education and occupation data used to estimate socioeconomic status. Postcode data (Dublin and Cardiff only) used to measure deprivation. **Summarised in D5.4 - Part A**
	A) Does WeCount succeed in also reaching the hard-to-reach target groups (e.g., lower income groups, ethnic minorities). B) Are different genders equally represented? C) What community building tools work well in this regard (real life events, social media, working with a local champion, etc.)?	Demographic questions (registration form, final survey and before/during workshops) Education and occupation data used to estimate socioeconomic status. Postcode data (Dublin and Cardiff only) used to measure deprivation. Staff self-reflective logs. Workshop evaluation form. **Question A) reported in D5.4 - Part A** **Question B) and C) reported in D5.4 - Part B**
	Has the project reached any other audiences?	Staff self-reflective logs. Workshop evaluation form. **Presented in D5.2 and D5.3 and summarised in D5.4 – Part A**
	Explore impacts on the WeCount team: challenges, learnings and any new skills. How has developing and running a citizen science project impacted on the research team?	Interviews with staff. **Reported in D5.4 - Part A**
4. Demonstrate the diverse potential applications, to tackle 5 different societal traffic-related issues	Did WeCount succeed in creating five local citizen science networks in different contexts? Has each case study managed 300 registrations? If not, why not?	Telraam platform. COVID-19 impact internal survey. **Reported in D5.4 - Part A**
	Are there differences in the success of applying WeCount to tackle different societal issues in different case studies (emission reduction, congestion, speed compliance, traffic management and rat running, environmental quality (air quality, noise), liveability, network of cycle tracks)?	Self-reflective logs. WeCount deliverables. **Reported in D5.4 - Part A**

	Measure attitudes, expectations and acceptance of local stakeholders before and during the pilot processes and outcomes.	Final survey. Interviews with staff. **Summarised in D5.4 - Part A**
5. Achieve meaningful research & local policy change	What is the impact of the WeCount community on decision-makers involved (such as local politicians, officials, etc.)?	Self-reflective logs. Final survey. Interviews with citizens. **Summarised in D5.4 - Part A**
	Collect evidence for policy changes (not per se implementation but public statements from policymakers, strategy/vision document).	**Reported in D4.1.** **Summarised in D5.4 - Part A**
	Is the quality of the data high enough to be used in scientific policy support research/consultancy?	**Summarised in D5.4 - Part A**

5.4 Meeting evaluation targets

The evaluation objectives and measures outlined in Table 2 provide us with an indication of the success of the evaluation sampling. Return rates for evaluation are based on the literature as well as on our vast experience using surveys. Recent return rates from the literature: Funkhouser et al. (2014) had between 2.5% and 26% return rate; Bulkley et al. (2016) had 25%.

Table 2 - Evaluation targets and measurements.

Objective	**Evaluation target**	**Evaluation reach**
Objective 1. WeCount will advance citizens (and broader scientific) knowledge on traffic counting, transport management and related impacts	Collect feedback from 20% of total number of participants, total across all case studies, using online surveys. Collect feedback from 20% of total number of participants, total across all case studies, using interviews and/or autonomous methods.	Collected: 235 surveys **(43%)** Collected: 37 interviews **The project evaluation targets were met.**
Objective 2. WeCount will establish a durable ecosystem for citizen science traffic counting and related impacts.	Collect feedback from 20% of total number of participants, total across all case studies, using online surveys. Complete one reflective log per workshop (for staff running the workshop).	See objective 1. Collected: 28 reflective logs (54% of total number of events) **The project evaluation targets were met.**

Objective	Evaluation target	Evaluation reach
Objective 3. WeCount will lower the technology threshold to reach a more diverse audience and ensure broader citizen inclusiveness.	Collect feedback from 20% of total number of participants, total across all case studies, using online surveys and/or interviews.	See objective 1. **The project evaluation targets were met.**
Objective 4. WeCount will demonstrate the diverse potential applications, in five use cases, to tackle five different societal issues related to local road traffic.	Achieve 20% completed online surveys. Complete one reflective log per workshop/event.	See objective 1. See objective 2. **The project evaluation targets were met.**
Objective 5. WeCount will achieve meaningful research and local policy change, as a direct result of the evidence collected from the citizen science activities.	Complete 3-4 in-depth interviews with key decisionmakers, per case study.	**Met partially**. Response from decisionmakers was low and in total 3 filled out the survey.
Dissemination & communication	Record all traditional media, social media and online coverage. Record participation in academic conferences, reports and journals.	**The project evaluation targets were met.**
Internal impacts	Complete 8-10 in-depth interviews with WeCount staff (two staff members per case study).	Collected: 10 interviews. **The project evaluation target was met.**

6 Evaluation Results and Discussion: The WeCount Citizen's Journey

6.1 Overview of WeCount citizens

6.1.1 Demographics and socioeconomic status

Research Question: *Does WeCount succeed in also reaching the hard-to-reach target groups (e.g., lower income groups, ethnic minorities)?*

Of those that responded to the demographic questions, 18% (N= 124) have low educational attainment, with 9% working in what is traditionally considered 'working class' jobs. 'Working class' is a socioeconomic term used to describe individuals in a social class marked by jobs that provide low pay, require limited skill, or physical labour. Typically, working-class jobs have reduced education requirements. Based on this information, we suggest that about 10% of WeCount citizens have a low socioeconomic status. Postcode data from Dublin and Cardiff indicate that 25% of the Telraams were distributed to deprived neighbourhoods, which is where we might expect higher levels of air, noise, and traffic pollution. Citizens that registered for WeCount had nationalities that largely matched the country they signed up to be a part of. Ethnicity was only captured for Cardiff. There is a **51:49 split between males and females,** which is **very close to WeCount's original aim of attracting an even number of men and women**. This ratio is largely due to the significantly more women in the Madrid/Barcelona case study, as there were more men than women in all the other case studies.

Educational attainment is exceptionally high – 81% (N=582) of participants have a degree or above**.** While it is common for more highly educated individuals to join citizen science projects, it was a hope of the project to break free from this pattern. As explained in section 2.3, the pandemic played a part in limiting the case studies from engaging such audiences.

Children (<16) could not apply to be a part of WeCount for ethical reasons, however they were engaged in educational activities, with many encouraged to ask their parents to set up a sensor or to take part in data collection, with a Telraam installed at their school whenever possible. As such, they have been included in the final figures, which show **29% of participants were <16, 28% were 35-49**; 19% were 25-34; 13% were 50-64; 7% were 16-24 and 4% were over 65. This means that, in general, **WeCount was able to attract a younger demographic than most citizen science projects**. We speculate that 16-24-year-olds were underrepresented in WeCount as 1) they had to contend with home schooling during the pandemic; 2) project staff had to focus on shifting the project online; and 3) the spaces in which they might be found in large numbers (youth centres/groups/clubs, parks, pubs, etc) were inaccessible during the pandemic. Table 3 summarises the known demographics of WeCount citizens.

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Figure 6 - Secondary school child at a WeCount workshop in Dublin.

Table 3 – Summary of the known demographics of WeCount citizens.

Demographics	Figures
Citizens registered	1,988
Male:Female	51:49 (N=664 vs 355)
Age	**29% (N=305) <16** (see D5.4 - Part B)
	7% (N=75) 16-24
	19% (N=203) 25-34
	28% (N=301) 35-49
	13% (N=138) 50-64
	4% (N=41) 65+
Educational attainment	5% (N=34) Lower secondary/ school leaver
	13% (N=90) Higher secondary/technical qual
	29% (N=208) postgrad/ doctorate
	27% (N=194) undergrad
	25% (N=180) masters
Occupation	4% (N=19) semi-skilled and unskilled
	5% (N=21) skilled manual
	23% (N=99) professional worker
	19% (N=85) Supervisory, clerical and junior managerial, professional
	31% (N=134) Higher & intermediate managerial, administrative, professional

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	0.5% (N=2) Unemployed 0.5% student or disabled 5% (N=21) Retired 3% (N=13) Self-employed
Nationality	(Not collected in Spain) 38% (N=266) Spanish 18% (N=126) Irish 17% (N=120), Belgian 12% (N=86) British 12% (N=86), Slovenian 2% (N=18), European (French, Italy, German, Portuguese, Dutch, Albania, Croatian, Finnish, Swedish; N=17) and American (N=1)

Socioeconomic status

Socioeconomic status (SES) is a measure of a person's combined individual/family income, employment and social position in relation to others. Traditionally SES is assessed by exploring income, education and occupation, either on an individual or household basis, with individuals/groups subsequently assigned 'low', 'medium' or 'high' SES.

Low socioeconomic groups have less income than the population average, which is often associated with lower paid jobs, and fewer higher education aspirations or opportunities. Likely because of the scientific nature/framing of citizen science projects combined with a lack of targeted engagement (Pandya 2012), low socioeconomic groups are often underrepresented in such projects. Yet these groups potentially have the most to gain from involvement. Often living in areas of multiple deprivation, low socioeconomic groups are typically the most impacted by interlinked environmental issues and poor health, such air pollution and lung problems (Yang and Liu 2018). The way people interact with transport also depends on SES. For example, those who depend more on the bus network to participate in the labour market tend to be lower paid, live in areas of deprivation, and are more likely to turn down employment due to transport limitations (Mackie et al., 2012). Aware of these issues, WeCount set an ambitious target of reaching 25% representation from low socioeconomic groups. The evaluation team requested all case studies collect data on occupation and employment to gather the data needed to determine SES, based on The European Socio-economic Classification (ESeC, Appendix 12)[3]. Aware that not all case studies would collect this data (e.g., because of preference or research culture) educational attainment and postcode data was also requested to act as proxies; education for the ESeC, and postcodes for calculating

[3] The European Socio-economic Classification categorise SES into 10 groups based on occupation and employment status. The ESEC was developed by the Institute for Social and Economic Research "to create a conceptually clear, validated and easily operationalized socio-economic classification for use in comparative European analyses of key policy and scientific issues of direct relevance to the evolving knowledge-based society". https://www.iser.essex.ac.uk/archives/esec/history-and-background/objectives

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deprivation score[4]. While all case studies collected information on education attainment, Leuven and Ljubljana did not collect postcode data, while Madrid/Barcelona chose not to capture neither postcode data nor data on employment. As such, we cannot say for sure whether WeCount has reached its target of 25% representation from low socioeconomic groups. However, we can draw the following conclusions:

- **18% of WeCount participants have a low level of educational attainment** (Figure 7). 10% of survey respondents stated they were either a school leaver or had a technical qualification, which supports our initial conclusion.
- **9% reported their occupation as skilled manual, semi-skilled or unskilled** (Figure 8). This is what is defined as 'working class' in the UK[5]. As each case study defined occupational categories differently, we may be under- or over reporting the number of low-paid workers.

Figure 7 shows the educational attainment of all citizens who registered for a Telraam and declared this characteristic. 81% are highly educated, with either a bachelors (27%; N=194), masters (46%; 329) or doctorate (8%; N=59). 9% (N=40) of all registered citizens (who declared their employment status) would be considered as part of a low socioeconomic group. It is expected that 59% (N=262) are middle income and 31% (N=134) are high income earners.

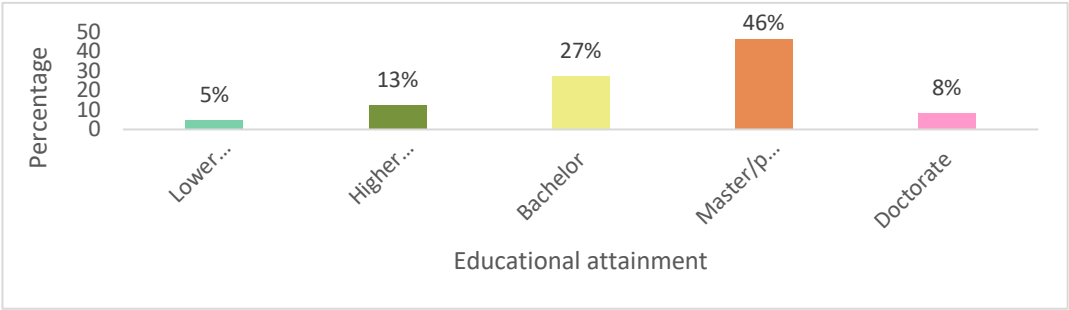

Figure 7 - Educational attainment of WeCount citizens.

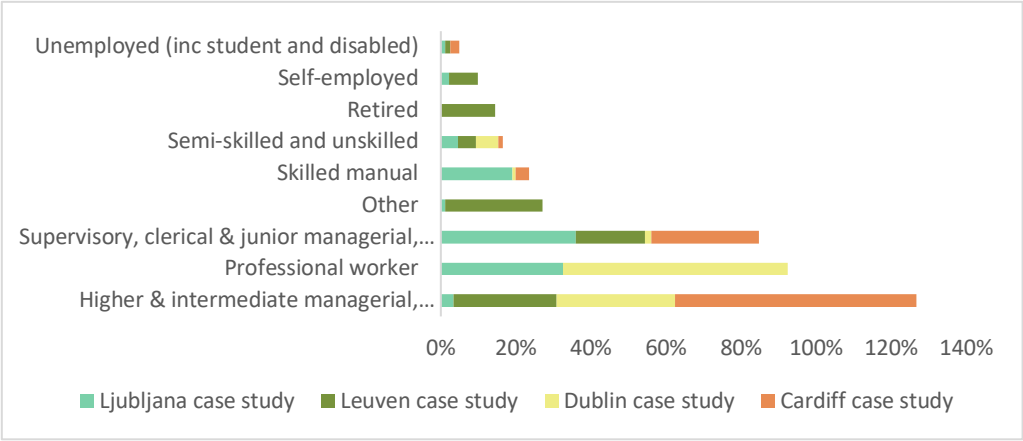

Figure 8 – Occupation of WeCount citizens.

[4] Employment and education make up two of a few factors attributed to deprivation. Deprivation rankings are calculated by some governments, often using census data, to work out which neighbourhoods require additional support.
[5] https://en.wikipedia.org/wiki/NRS_social_grade

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Table 4 – Summary of the occupation of WeCount citizens.

Occupation	Ljubljana	Leuven	Dublin	Cardiff	Percentage
Prefer not to say/no answer	25	142	12	5	Not included in calculation
Unemployed	NA	NA	NA	2	**0.5%**
Student and/or disabled	1	2	NA	NA	**0.5%**
Self-employed	2	11	NA	NA	**3%**
Semi-skilled and unskilled	4	7	7	1	**4%**
Skilled manual	17	0	1	3	**5%**
Retired	NA	21	NA	NA	**5%**
Other	1	38	0	0	**9%**
Supervisory, clerical & junior managerial, administrative, professional occupations	32	27	2	24	**19%**
Professional worker	29	NA	70	NA	**23%**
Higher & intermediate managerial, administrative, professional occupations	3	40	37	54	**31%**
Subtotal (- PNTS/no answer)	89	146	117	84	(T=436)

Deprived Neighbourhoods

Cardiff was able to attribute postcodes to deprivation, using the Welsh Index of Multiple Deprivation (WIMD) (Figure 9). WIMD ranks all small areas in Wales from 1 (most deprived) to 1,909 (least deprived). Based on this, we can say that **26% (N=22)** of all registered users that gave postcodes in the Cardiff case study (N=86 of 89) **are from areas considered the 10/10-20% most deprived within the country**. However, as it is estimated that only around 1 in 5 income deprived people live in the 10% most deprived areas[6], it is worth bearing in mind that gentrification and other factors may blur the lines between who we can consider deprived based on this information, and who we cannot.

[6] https://gov.wales/sites/default/files/statistics-and-research/2019-11/welsh-index-multiple-deprivation-guidance.pdf

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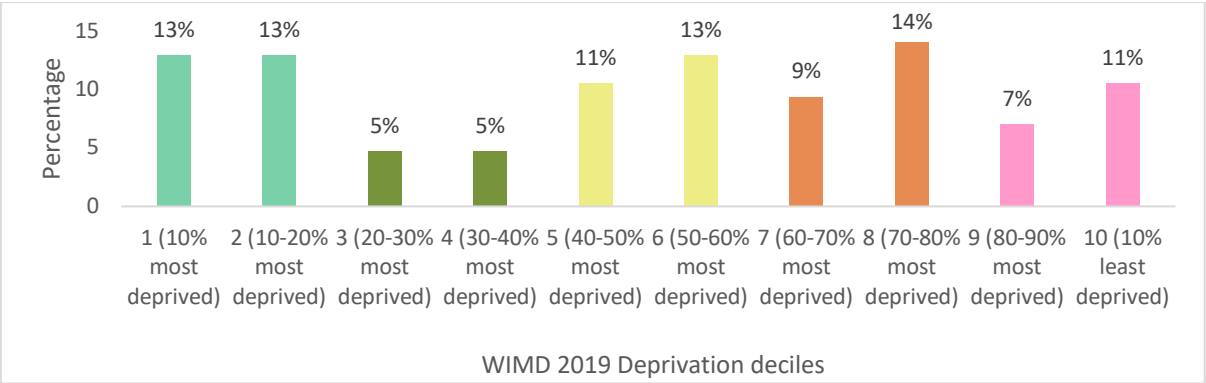

Figure 9 – Deprivation in the Cardiff case study.

The Dublin case study were also able to work out deprivation scores based on postcode data using equivalent data called *The Trinity National Deprivation Index for Health and Health Services Research 2016* (Figure 10). Based on this Index, **28% (N=49)** of all registered users in Dublin that gave postcodes (N=183 of 195) **are from areas considered the 10/10-20% most deprived within the country**.

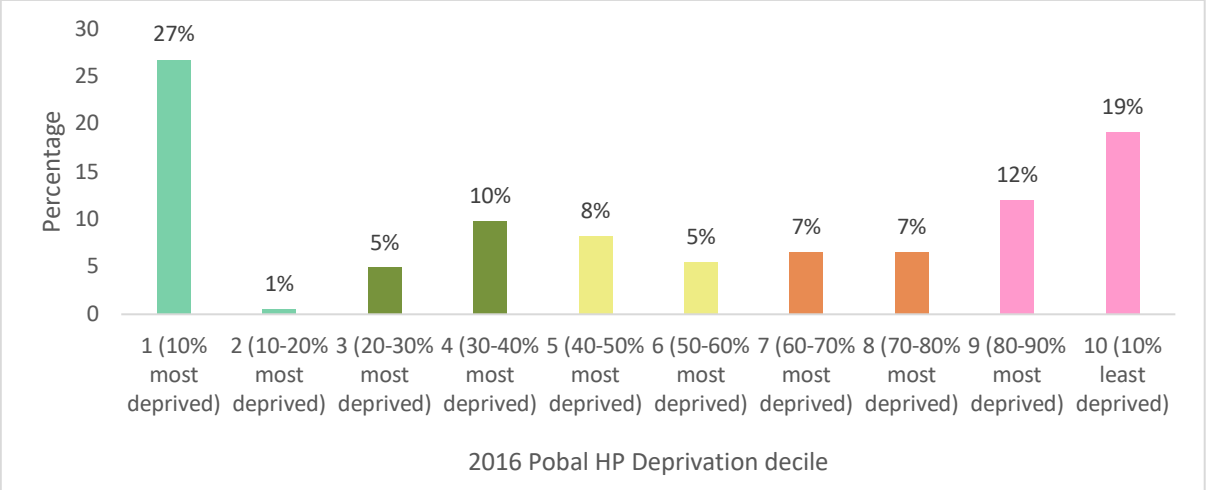

Figure 10 – Deprivation in the Dublin case study.

There were diverse reasons why case studies did not all collect this data. In Ljubljana, they were unable to attribute postcode information to socioeconomic status as postcodes do not relate to levels of deprivation. For instance, the whole of Ljubljana uses the same postcode, making it impossible to know in which neighbourhood a citizen resides. In the Madrid/Barcelona case study, postcodes are not necessarily related to socio-economic group and the local team opted for not collecting that information.

While the limited available data suggests WeCount has not reached its target for 25% representation from low socioeconomic groups, effort has clearly been made to target these communities. In the Dublin and Cardiff case studies, 25% of their sensors for example, were distributed to deprived neighbourhoods Based on the information available, we speculate **that at least 10% of WeCount participants are from low socioeconomic backgrounds**. It is important to have representation from this group, not only for the reasons mentioned above, but because, as we will mention later, the greater the local knowledge improvement the more likely a participant is to act. In other words, through engaging with these communities, through a two-way knowledge exchange, they may be

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supported to act on things that matter to them. Table 5 presents demographic data across the five European countries, as well as demographic data for WeCount citizens.

Table 5 - Demographic data across WeCount countries and WeCount citizens.

	Wales	Ireland	Spain	Slovenia	Belgium
National age	(England and Wales) 21% under 18 years, **29% 18-39s, 27% 40-59 years**, 22% 60+[1]	33.2% <25, **29.5% 25 - 44, 37.2% 45+**[5]	14.4% 0-14**, 65.62% 15-64**, 19.98% 65+[10]	15.14% 0-14, **64.13% 15-64**, 20.74% 65+[15]	In 2020, 20% <18, 19% 65 years+; **61% 18-64**[19]
WeCount age	**29% <16, 28% 35-49**, 19% 25-34, 13% 50-64, 7% 16-24 and 4% 65+.				
National gender	51% F: 49% M[1]	50% F, 50% M[6]	51% F, 49% M[11]	F 50%, M 50%[16]	51% F, 49% M[20]
WeCount gender	51% M:49% F				
National educational attainment	Almost 80% NQF level or above, almost 60% level 3 or above and **almost 40% level 4 or above**. >10% have no qualifications[2]	**47% of 25-64 year-olds have attained a tertiary education**, one of the largest shares across the OECD[7]	45% of adults do not have upper secondary education, 22% have this level of education, and **32% have tertiary education**[12]	**88% of adults aged 25-64 have completed upper secondary education**, higher than the OECD average of 78%[17]	**29.8% have upper secondary, post-secondary non-tertiary and tertiary** education in 2020[21]
WeCount education	5% (N=34) lower secondary/school leavers, 13% (N=90) higher secondary or technical qualifications. **81% tertiary**				
National employment status (of working age population, 16-64)	**73.5% employed**[3]	In 2019, around **47%** people were employed[8]	About **42%** employed in 2019[13]	**69%** employed (and paid)[17]	**70.5%** employed[22]
WeCount employment	Insufficient data				
National occupation split (active employees)	In 2019, **public services 29.5%**; wholesale, retail, transport, hotels and food 25.8%; private sector, 12%[4]	In 2019, 4.43% in the agricultural sector, 18.77% in industry and **76.8% in the service sector**[9]	2019, 4.03% in agriculture, 20.43% industry and **75.54% in the service sector**[14]	In 2019, 4.28% in the agricultural sector, 34.1% in industry and **61.61% in the service sector**[18]	**47% private services sector**, 31% public and subsidised services, 10% low-skilled (e.g., maintenance and cleaning)[23]

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WeCount employment	Higher & intermediate managerial, administrative, professional occupations (31%) Professional worker (23%)

See Appendix 13 for reference list.

6.2 Overview of active citizens per network

WeCount established a network of Telraam sensors in five different case studies across Europe (Figure 11). Each case study had their own mobility issues and stories, as well as citizen engagement activities. These stories can be found in the summative case study reports (D5.2 and D5.3).

Table 6 shows Telraam data for each case study. To understand the effectiveness of the organized kick-off workshops and the ongoing support to engage citizens to keep counting, the **retention rate of citizens active on the WeCount platform** has been calculated. This was done by dividing the current number of counting citizens (with an active Telraam) by the total number of counting citizens (with an active Telraam) at the beginning of each case study. Results show the highest retention rate for the citizens of Cardiff (72%) and the lowest for citizens in Madrid and Barcelona (22%). Dublin, Ljubljana and Leuven have similar retention rates.

Table 6 - Sensors initiated and still counting.

Network	Number of WeCount members	Number of Telraam owners	Number of Telraams that counted once	Number of Telraams still counting on 23/09/2021	Date first Telraam initialised in network	Retention rate (#Telraams counting once/ #telraams counting today)
Cardiff	70	82	74	53	21/11/2020	72%
Dublin	80	217	165	113	10/08/2020	68%
Leuven	86	293	216	121	21/09/2018	56%
Ljubljana	82	113	84	50	06/12/2019	60%
Madrid + Barcelona	50	90	59	13	17/03/2020	22%
Total	**368**	**795**	**598**	**350**	NA	59%

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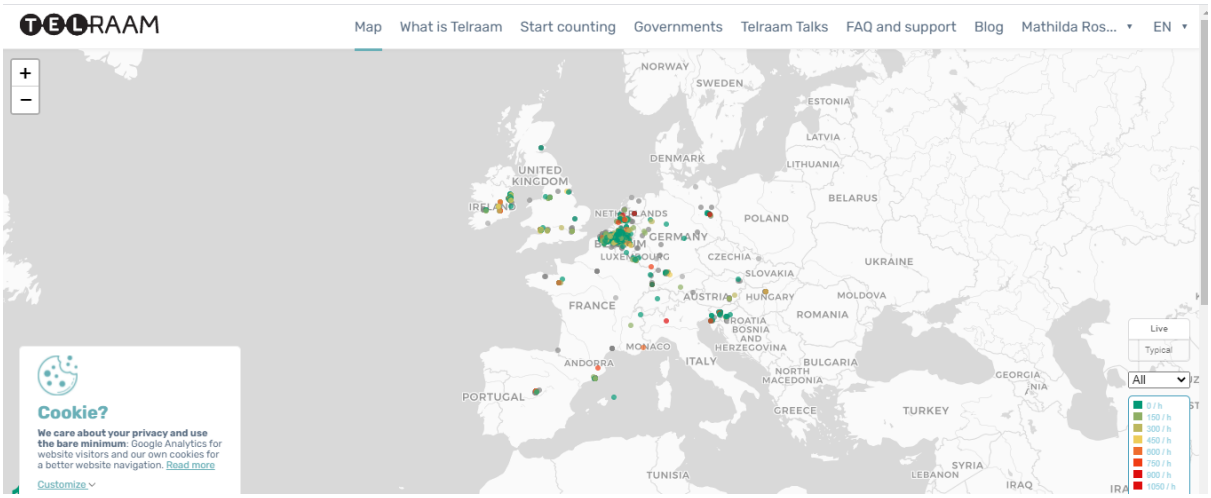

Figure 11 - Active or registered Telraam sensors across Europe.

1,988 citizens across the five case studies registered to be part of WeCount. After cleaning up the dashboard of inactive members, we can conclude that 19% of all registered citizens became members of one of the networks (N=368). There are more Telraam owners than registered participants because some joined prior to WeCount. All Kessel-lo pre pilot Telraam owners for example, are not an official member, and this is reflected in survey responses from people who have no clue what WeCount is. 40% of registered users went on to receive a Telraam (N=795), with 75% of owners able to get their sensor up and running (N=598). 59% of counters are still counting at the time of writing.

6.3 Overview of Helpdesk

In this section, information is shown for each case study, indicating how many members each network has, and how many citizens asked a question via the helpdesk (Zendesk). In addition, we detail the number of questions received over time.

Helpdesk usage was similar across case studies, with most helpdesk questions asked at the start of the engagement process, around the time of the installation workshop or after receiving the sensor. These questions are mainly about the installation of the sensor. A common question/problem is the connection between the sensor and the Wi-Fi. At the time of writing this report, questions are still frequent and arrive in quick succession. While questions generally tail off once most sensors are installed, there is a smaller spike in questions after a news item, a technical update, or a new activity. There are also questions, for example, in response to a data workshop, or about data analysis. For all case studies the number of questions declines towards the end of the engagement cycle. The technical adjustments to the robustness of the system have probably contributed to this decline (but this has not been evaluated). When looking at the number of questions asked to the helpdesk per cases, the users within the Leuven case used the helpdesk to ask questions more intense than any other case. Ljubljana, Barcelona & Madrid made the least use of the helpdesk via Zendesk. These case leaders indicated that users often e-mailed or called them directly with certain questions and problems. These questions are therefore not included in the helpdesk overview.

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Table 7 provides monitoring data the use of Zendesk helpdesk ticketing and FAQ system for all case studies. A participant becomes a user of Zendesk when they are logged in on the Telraam website as a Telraam user and use the FAQ pages there.

Table 7 – Zendesk monitoring.

	Leuven	Madrid / Barcelona	Dublin	Cardiff	Ljubljana
Number of users of Telraam Zendesk	314	93	233	102	100
Number of users with questions	125	10	42	28	3
Number of users without questions	189	83	91	74	97

6.3.1 Leuven

A mention of the sub-case or pre-pilot in Kessel-lo is appropriate here, as it started much earlier than any other cases, to test the sensor beforehand. Therefore, a much higher number of questions was noted at the start of the pilot (more than 20 per week). Related to the Leuven case study overall, a few peaks in the number of questions were also observed over time (up to 10 per week). The dates of peaks in numbers are linked to the start of a specific subcase in Leuven, and to other events, newsletters and updates. Between these peaks, the number of questions drop down to one or two per week. We also see a general decrease in the number of questions as the project moved forward.

6.3.2 Madrid and Barcelona

The Madrid and Barcelona case study started with a beta pilot. This beta pilot was a pre-pilot for the Madrid case, although smaller than the pre-pilot in Leuven. This links to the numbers of questions in the helpdesk. The highest number of questions can be seen during the beta pilot testing and then at the start of the official pilot in Madrid (up to 10 questions in one week). There is a similar picture to Leuven: with occasional peaks in questions over time (up to three per week). The use of the helpdesk in Madrid is in general much lower than in Leuven. There are mostly weeks with no questions.

6.3.3 Dublin

Dublin promoted the helpdesk system to WeCount citizens and, as a result, the number of questions and tickets within their case study is higher than Madrid and Barcelona. We observe a very similar picture to Leuven and Madrid: a peak in the number of questions (around 10 tickets in one week) at the start of the case study and occasional peaks in questions over time (up to five tickets per week).

6.3.4 Cardiff

The Cardiff case study lead went door to door delivering sensors. That face-to-face contact gave the citizens an opportunity to ask questions directly, instead of using the ticketing system. For the Cardiff case study, the same flow of the use of the helpdesk can be seen with a peak during installation time. Because the installation of sensors was more spread out over time, the peak in

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installation questions was also more spread out over time, with up to four questions per week. Next to that, Cardiff also had occasional peaks. Overall, the number of questions is much lower than in Leuven, because also the users with questions are much lower.

6.3.5 Ljubljana

The Ljubljana case study lead invested in direct contact with their citizens, by giving them a direct email address. The helpdesk system therefore was not used much (only three users with questions).

6.4 Workshops with Citizens

Task: *Investigate citizens' participation at the various types of co-design workshops organised in the five case studies.*

Since submitting D5.2 and D5.3, Cardiff, Dublin and Leuven have delivered data analysis workshops. Ljubljana's final data analysis and awareness raising workshop is scheduled for later in 2021, and Madrid and Barcelona held their workshop at the beginning of 2021.

6.4.1 Cardiff

In Cardiff, two data analysis workshops were delivered (the first reported in D5.3). For the second and final workshop, 27 citizens signed up, while 18 attended. For this event, there were three case studies from local champions, including one presented by a father and his daughter (<16 years old). In both data analysis workshops, it was clear that champions went to considerable effort to analyse their data and perform additional research. For the father-daughter team for instance, in addition to analysing sensor data they counted the number of cars parked on their street, finding that it would take one acre of land to store all these cars. With all these cars, "there is no space to store a bike, make a delivery, play, or take a street," said the daughter.

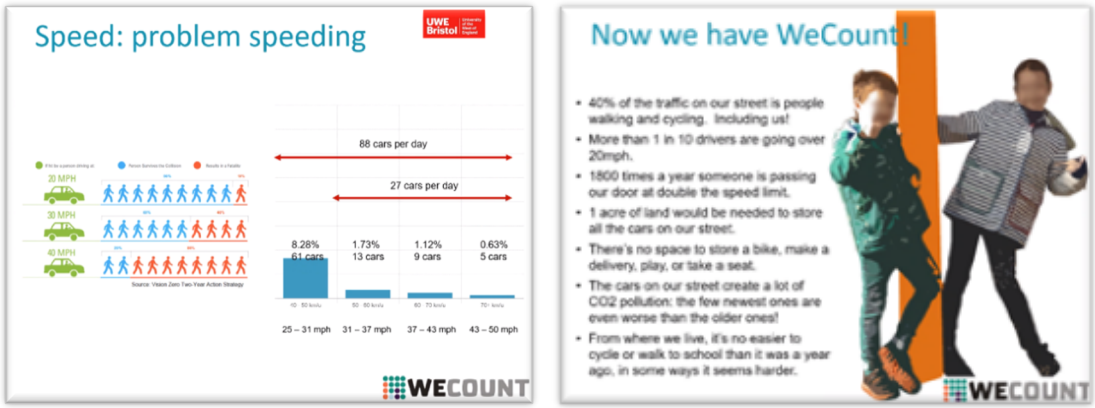

Figure 12 - Some of the slides presented during the Data Analysis Workshop in Cardiff.

At the end of the workshop, participants were asked if they felt better able to act with their data. The response was an overall yes. They were **more aware** of problems facing other streets, of what they have available to them on the platform and **able to speak up**:

> *"Yes, better understanding of what's there. We hadn't explored it so much before and seeing the other street share theirs really helped"* (Cardiff Data Analysis participant 03)

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6.4.2 Dublin

Dublin's data analysis workshop consisted of a brief introduction (how does Telraam measure, strengths and weaknesses), followed by hands-on analysis using a Google Collaboratory, a platform that allows you to write and execute Python in your browser. Attendees could access Colab notebooks in Playground mode and work alongside, while the host presented the notebooks. 23 participants signed up and 15 attended. Nine were male and six were female, representing a full spectrum of ages from 16-65+, with the majority (N=7), aged 35-49. Over half (54%) of attendees stated they were beginners when it comes to data analysis; 15% said they were intermediate and 31% thought they were advanced. The attendees really enjoyed the workshop and were very impressed with the data analysis tools that they were shown. One attendant commented "there's a lot more, you can do with the data than I had initially seen from the dashboard so [I will] definitely be playing around with [it]." Unfortunately, two attendees struggled to enter data into the notebook, so decided to just watch instead. As noted below (Table 10), all attendees felt they were able to understand the data coming from the sensor at the end of the session (5 out of 5). All said they were inspired to act and felt able to act to some extent (both 4.4 out of 5), following the workshop, with some attendees stating they would show the graphs they had produced to their councillors.

6.4.3 Leuven

Leuven data analysis workshop took place in June 2021. The aim of the interactive evening was to analyse and interpret the collected traffic counts from citizens. 20 counters attended. Participants decided upon four case studies to explore: road works and its impact on neighbouring roads, speeding, traffic filters and high traffic volumes. Citizens were able to deep-dive into this data, looking at the influence of times of day, school holidays and lockdown restrictions on the figures. From here, the citizens could model and visualise potential scenarios, pose questions that allowed participants to understand how unsafe it may feel for people to use roads in certain areas, and debate possible solutions. The approach taken here is an example of **real co-creation**, putting the data in citizens hands and supporting them to analyse it and draw their own conclusions.

Figure 13 – Workshop in Leuven.

6.4.4 Youth-specific workshops

As detailed throughout this report, it was a key priority for the case studies to engage young people and children in the process. So far, 305 young people (under 16) have been engaged on issues relating to WeCount through presentations and school lessons, and **it is predicted that around 831 young people will have been engaged by next summer**. Schools work will continue beyond

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the life of the project due to a collaboration with the initiative for Digital Engineering Technology and Innovation (DETI) in the West of England. See the *Table* 8 and D5.4 - Part B for more detail.

Table 8 - Number of schools engaged and number of children (potentially) reached, across the case study cities.

	Madrid/ Barcelona	Ljubljana	Cardiff	Dublin	Leuven	Total
Number of schools engaged	3 (co-design events)	2 (WeCount presentations)	8 delivered, 12 planned	2 (kick-off engagements) + at least 2 more schools	1, with seven resident sensors (Flanders)	37
Number of children reached (+ potential*)	102	60	100 (+ 460)	43 (+ 48)	(+ c. 18)	**831**
*** based on average class size for that country times by number of schools planned**						

Adding the numbers from the workshops and current engagement with schools, a total of 843 citizens have been engaged directly so far through online or in-person events (Table 9). This is an underestimation as events were also held at public events (e.g., in Madrid/Barcelona) but numbers were not captured. As such, we believe **the project has engaged more than "1,000 citizens and stakeholders through workshops, seminars, mutual learning and science-policy dialogue workshops", as stipulated in the bid**. The aim was for 200 per case study region. While there is not an even split across the case study cities (see D5.2 and D5.3), as explained previously, it is harder culturally to engage people in say former-Soviet Ljubljana which is unfamiliar with public engagement compared to cities like Barcelona where it is part of the fabric of life.

Table 9 – Details on WeCount workshops.

	Co-design	Kick-off events	Data analysis	Youth engagement	Total
Cardiff	NA	48	45	100	193
Dublin	NA	31	15	43	89
Madrid/ Barcelona	196	16	51	102	365
Leuven	4	72	20	NA	96
Ljubljana	NA	12	28	60	100
Total	**200**	**305**	**179**	**159**	**843**

6.4.5 Reflections

As is clear from these three workshops, the case studies took unique approaches to their workshops, adapting to suit both their skillset and the local needs and interests of the citizens.

A total of **843 participants attended workshops** across the five case studies (Table 10). Along with **9 co-design workshops**, **21 kick-off sessions** were held to introduce the project and set

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citizens up with sensors. **9 data analysis workshops took place** and an additional 13 youth events (note that this is lower than the number in the above table as some youth events are captured in the above-mentioned engagements). That makes **52 events and workshops** in total. **189% (N=684) of all WeCount members (N=368) participated in one of the adult workshops**, which suggests that some participants went to several, or that events were attended by unofficial members (see page 37).

Feedback on (mostly adult) citizens' experiences was sometimes, but not always, gathered during these workshops. Table 10 shows the results for each case study, with feedback averages weighted to give an overall score (out of 5). Across all case studies (Figure 14), citizens enjoyed the workshops (4.5), felt their input was valued (4.6); largely feel capable of installing a Telraam after the relevant session (4.25); feel capable of understanding the Telraam data (4.6) and generally strengthened in knowledge (4.6). The majority of participants feel better able to act based on the data (4.4) or believe their input will be used to influence urban transport and mobility (4.4). Clearly participation was high and feedback overwhelmingly positive.

Table 10 – Workshops details and feedback.

		Cardiff	Dublin	Ljubljana	Madrid/ Barcelona	Leuven
Total attendees		93	89	40	265	126
WORKSHOP	Policy (in the pipeline)	1	NA	NA	NA	NA
	Data analysis	2	1	1	4	1
	Kick-off workshops	4	7	3	3	4
	Co-design	NA	NA	NA	8	1
CITIZEN FEEDBACK	Enjoyment	4.6	4.9	4.3	4.6	NA
	Understanding of Telraam Data	4.7	5.0	4.3	NA	NA
	Ability to act based on the data	4.7	4.4	4.1	NA	NA
	Inspired to act	NA	4.4	NA	NA	NA
	Input valued	4.4	4.9	4.8	4.5	4.8
	Capable of installing a Telraam	NA	3.8	NA	NA	4.7
	Strengthened in knowledge	NA	4	NA	5	4.3
	Belief input will be used	NA	NA	4.4	NA	NA

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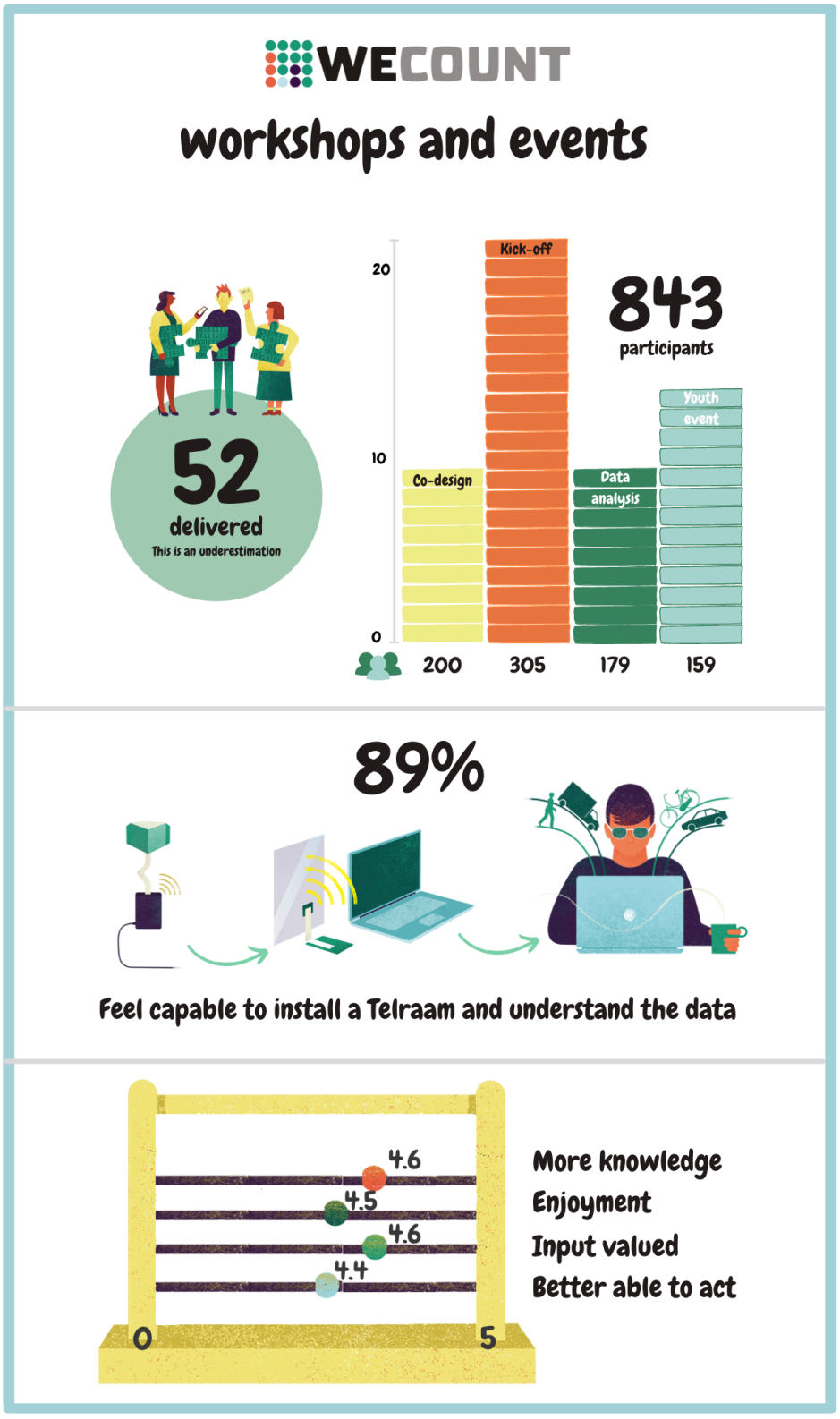

Figure 14 – Summary of WeCount events and workshops.

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6.5 Citizen Experience across all case studies

This chapter details the overall results from the citizen survey and the citizen interviews, combining answers from respondents across all case studies.

In total, **236 participants completed the final survey** – 32 (14%) from Cardiff, 53 (22%) from Dublin, 9 (4%) from Madrid/Barcelona, 92 (39%) from Leuven and 50 (21%) from Ljubljana. **This represents 43% of all WeCount members** who are part of a case study network, well above the ambition of collecting feedback from 20% of WeCount citizens. **37 of the survey respondents also took part in the citizen interviews.**

It should be noted that respondents' demographics and overall experiences are likely unrepresentative of all participants that took part in WeCount as a whole. This is because survey and interview response rates are low for some case studies relative to the number of registered users on the Telraam platform. We can only make inferences to trends and outcomes in our reporting, triangulating data to the best of our ability with supplementary data from staff and citizen interviews, staff self-reflective logs and other feedback (e.g., Zendesk). Statistical analysis presented here provides greater certainty about differences between groups and assesses the strength of relationships.

6.5.1 Participant types

The majority of survey respondents identified as **counting citizens with a Telraam** (75%; N=178), while 18% identified as involved (N=43), and 3% (N=7) identified as local champions (Figure 15). This is the expected distribution for this project. There was no target set for active champions although it was hoped that there would be a slightly bigger uptake of this participant type. As explained in D5.2 and D5.3, lockdown restrictions limited the potential of active champions within the WeCount project.

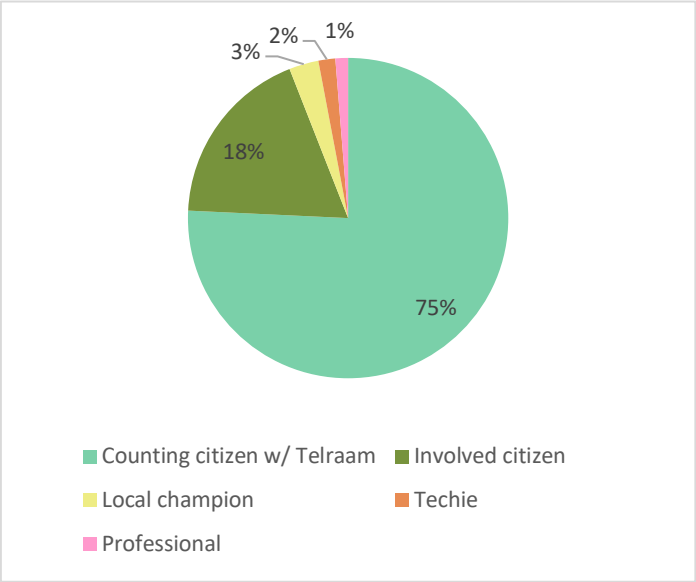

Figure 15 - Types of WeCount citizens.

Fewer than half (N=17 of 43; 40%) of the **involved citizens** explained how they were involved in the project, however those that did listed they either attended a workshop (N=7; 16%), counted manually (N=2; 5%), volunteered in some capacity (N=1; 2%) or monitored the project via the

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website (N=1; 2%). Six stated they were 'never involved'. The explanation for this was that they did not qualify for a Telraam – either their window was not suitable or there were enough volunteers in the neighbourhood.

6.5.1.1 Demographics: survey respondents

More **males** (N=127; 61%) than females (N=80; 38%) took part in WeCount, with negligible representation from other genders (N=2; 1%) (Figure 16). Note that 'prefer not to say/did not say' was excluded when calculating percentages in this section, unless stated otherwise.

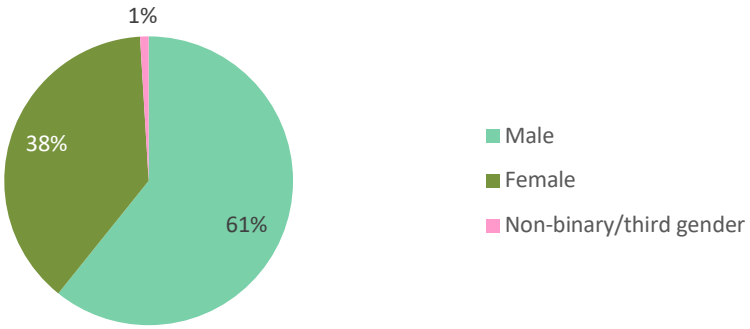

Figure 16 - Gender of survey respondents.

Survey respondents were **largely middle-aged or older** (Figure 17). 46% (N=97) were aged 35-49, with 24% (N=52) aged 50-64. 16% (N=34) of survey respondents were aged 25-34. 23 respondents did not answer this question. Excluding under 16s, this pattern is not too dissimilar from registration form data, although there is a skew towards older people (35+), suggesting older people are more likely to prefer taking online surveys than young people. Also, this spread of ages may in part be an artefact of the online survey itself, which may not appeal or be accessible to younger participants.

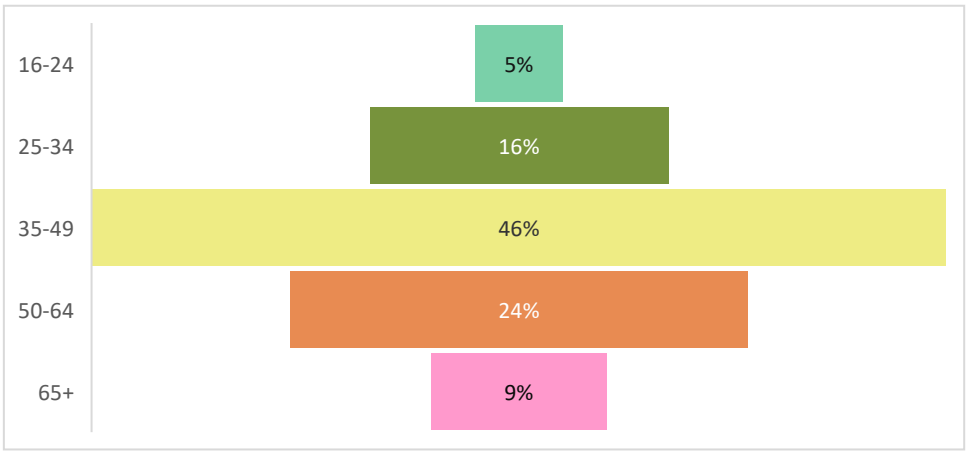

Figure 17 - Age of survey respondents.

The majority of survey respondents were **highly educated**, with an undergraduate degree or above (89%; N=186 of 209) (Figure 18). This does not match up with the overall education levels reported in the registration form (see Demographics and socioeconomic status 30section). Namely, it appears that if you are more educated you are more likely to fill out the survey (89% vs 81% on the registration form), or put another way, people with fewer qualifications are less likely to respond

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to the survey (11% vs 18%). Note, 'prefer not to/did not say' was excluded from the calculation of percentages here.

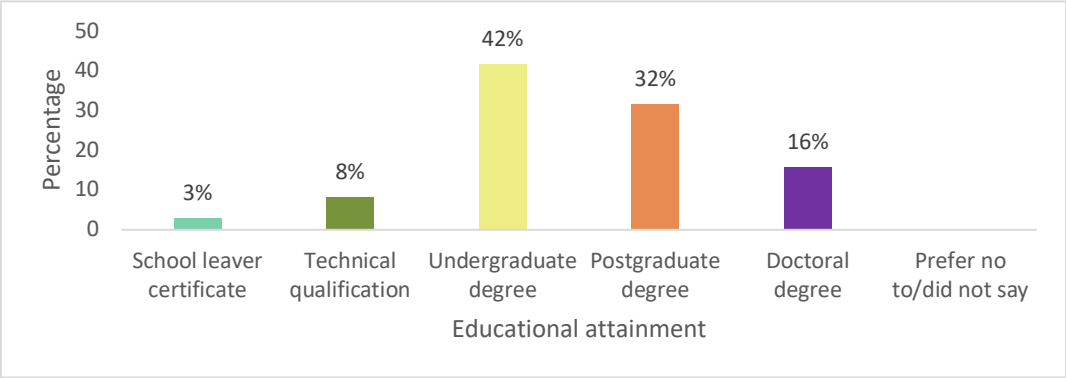

Figure 18 - Educational attainment of survey respondents.

6.5.1.2 Citizen Interview Demographics

***Task:** explore citizens' attitudes, values, knowledge and behaviour towards traffic counting, traffic management and travel behaviour and find out whether changes occur due to participation in the pilots.*

37 citizens responded to the request for interviews. Only 38% (N=14) of the interviewed citizens identified as female. All of the interviewees held an undergraduate degree or above and were therefore highly educated respondents. The modal age category (for those who gave their age) was 35-49 years old.

6.5.2 The citizen experiences of WeCount

The citizen interviews were analysed using one coding frame, which resulted in six themes. Two of the themes relate to motivations for joining the project, Traffic Evidence and Data Lovers. Four of the themes relate to the citizen experience on the project; Car-free Campaigning, Creating Community, Project Operation, and Using the Telraam. The interview qualitative data were triangulated with quantitative data from the survey and will be integrated together throughout the next section.

6.5.2.1 Motivations

Motivations for joining WeCount varied across case studies, although **overall the main motivations from the survey were as follows: an interest in sustainable mobility (N=100; 22%), to contribute to research (N=94; 21%), to make a difference (N=89; 20%) and to count traffic (N=81; 18%)** (Figure 19). An interest in science/citizen science or technology was less of a motivation for joining, which is understandable given the project's empowering research design – the project was promoted to and attracted citizens who wanted to make a difference in the urban transport and mobility space.

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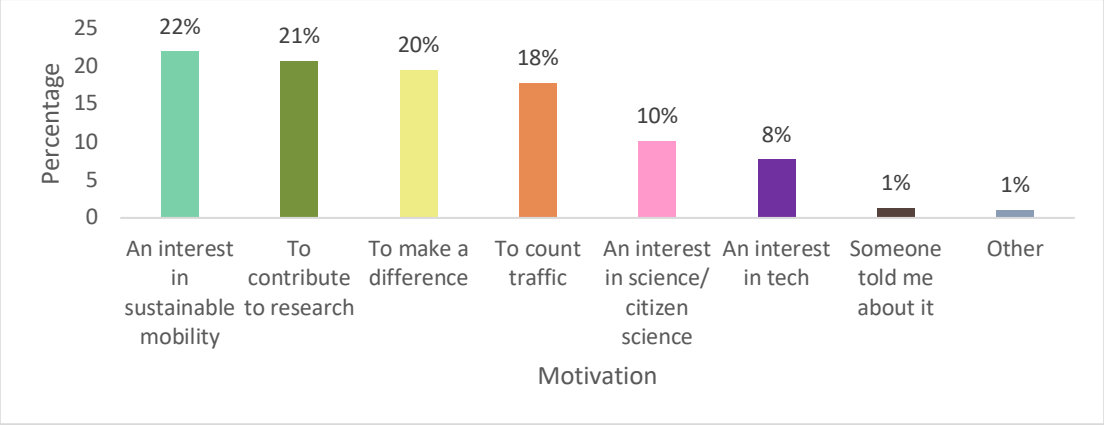

Figure 19 - Motivations for joining WeCount.

Perhaps rather unsurprisingly, there is a highly significant difference between gender and an original motivation to join due to an interest in technology (Mann-Whitney U= 4150.5; n_1=n_2=236; P <.005 two-tailed). **Men were significantly more likely than women to join WeCount out of an interest in technology**.

According to the Kruskal Wallis test, there is a **significant difference between higher educational attainment and more science-related motivations**. These motivations were "to count traffic" (H (4) = 13.22; P = .01), "to contribute to research" (H (4) = 10.26; P = .03) and "an interest in science/citizen science" (H (4) = 10.26; P = .01). In other words, highly educated people are more likely to choose these motivations. There is no significant difference between age and motivation.

6.5.2.2 Traffic Evidence

Citizens self-described their motivations for joining the project and tended to describe one of two reasons – being a data lover or wanting to gather evidence about traffic issues. Most of the interviewees said that they wanted to take part in WeCount and have a Telraam because they wanted to gather objective evidence about the traffic on their street. Many told stories about discussing the traffic levels, speed, noise, and air pollution with policymakers, but being previously unable to prove it.

> *It's an additional motivation to have the data...You can't ignore it anymore. If you say: At certain times it's too crowded here. They can send over a police officer and they say there's no problem. They can't deny certain things anymore. That gives you, as a civilian, a weapon in your hands – although that might be somewhat aggressive wording. An additional instrument, something you can use.* (LeuvenCitizen Interview04)

Some described how they had reported this to authorities but had previously been dismissed as emotional or exaggerating. Others described how the authorities had monitored the street but during quiet periods, so they could then dismiss the claims. The continuous data from a Telraam meant they felt they could no longer be dismissed.

> *I think the situation is actually worse than we thought it was, so it's been eye-opening really. It is a busy road, there's no denying that, but it's actually busier than we thought it was because the data actually shows us that it's busier, so yes, it's really revealing and hopefully, it can be building and used for some kind of constructive change, yes, that's what we're hoping.* (CardiffCitizen Interview07)

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6.5.2.3 Data Lovers

Some of the interviewees said that they had chosen to take part in the project due the ability to collect and analyse data. They described how they had been involved in other data projects, or how they really wanted to analyse data from the city. Many described regularly checking the website to visualise patterns across the city, or to monitor travel at certain times of the day.

> *I like data so, it's interesting because you're part of a larger project. There's data from everywhere... If you simply look at the website you see all your numbers per users and you can click on. I think there already are some layers there.* (LeuvenCitizen Interview01)

> *I thought it was very interesting, actually, when I first looked into Barcelona map and learned where traffic measuring devices, that is, the device that counts all the different vehicles, I thought it was very interesting because that way we can characterise the area somehow. Moreover, having citizens involved make it very modern, in my view, and actually it reports directly to the citizens, that is its function, right? And for those reasons it is very interesting.* (BarcelonaCitizen Interview01)

6.5.2.4 Project experience and feedback

Survey respondents' **expectations were largely met**, with 67% (N=157) saying they were met 'extremely' or 'very' well (Figure 20). 28% (N=66) stated their expectations were moderately met, with 5% (N=11) believing their expectations to be met unsatisfactorily.

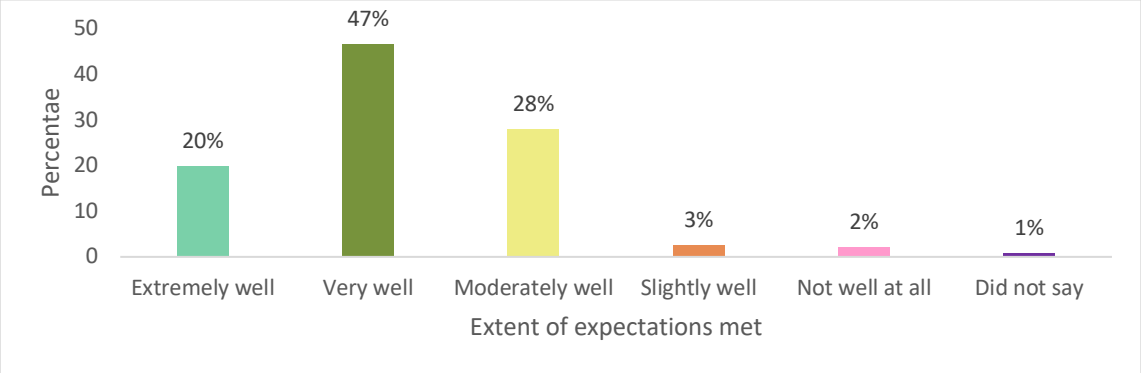

Figure 20 – Meeting citizens' expectations.

Overall, survey respondents had a positive experience, with 83% (N=197) rating their time as either excellent or good (Figure 21). 13% (N=31) had an 'average' time, while just 3% (N=7) had a 'poor' time on the project. The technology was the main reason as to why participants expressed negative experiences. All comments, from this survey and the Helpdesk, have been taken onboard by the technical team and they plan to make the necessary improvements over the coming months.

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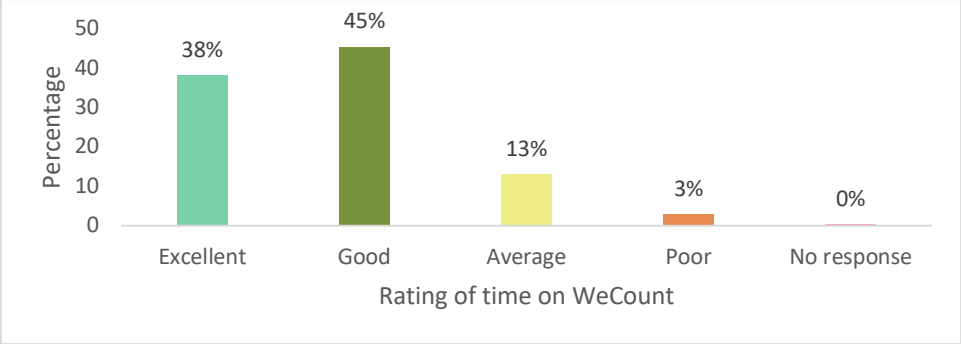

Figure 21 – Rating time on WeCount.

6.5.2.5 Favourite aspect of being involved

For survey respondents, **'being part of a research project' was their favourite part of being involved (N=144; 34%)** (Figure 22). Largely reflecting original motivations for joining, this was followed by a **feeling that they were making a difference (N=80; 19%).** Interestingly, **the technology (N=75; 18%) came third**, even though it was ranked 6th for motivation to join, which suggests that value may have been added from using Telraam and associated tools and platforms during the project. Gathering evidence to support a campaign (N=65; 15%) came fourth, which likely relates to respondents' pre-existing interest in sustainable mobility – i.e., they may already be active in this space and thus been motivated to join to further their campaigning. (See Action section for further information.)

There is no statistical difference between age or educational attainment and favourite aspect, however there is for gender. Kruskal Wallis testing found that **working collectively to solve problems was highly significant between genders** (H (1) = 9.76; P = .003). Post-hoc Mann Whitney testing found that the mean score for this favourite aspect reported by men is on average -.209 points less than for them mean score reported by women. This mean difference is significant at the 0.05 level (P = .013). In other words, **women were statistically more likely to consider collective problem solving to be their favourite aspect of WeCount**, more so than men.

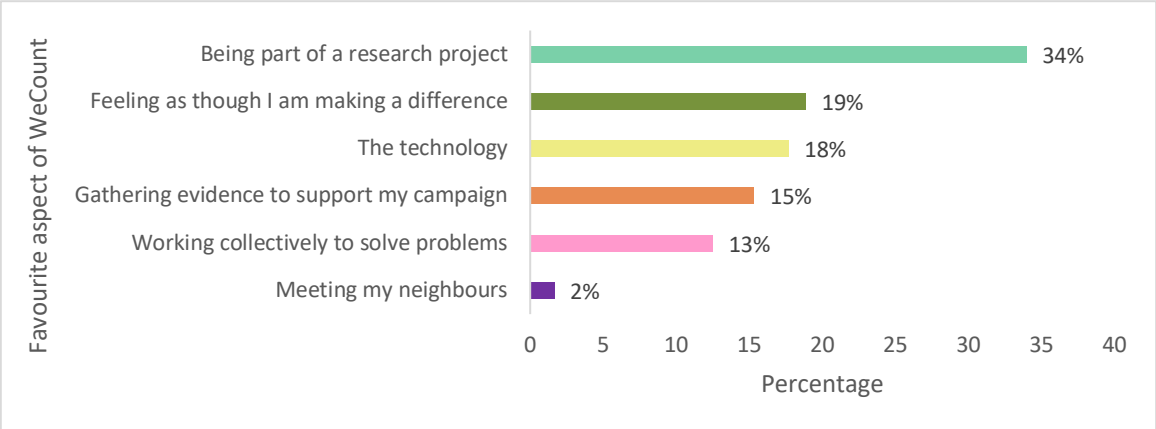

Figure 22 – Favourite aspect of WeCount.

The interview themes reinforced the survey data, with most participants stating that they had enjoyed being part of the project. They felt that the project had operated smoothly, with good communication between case study staff and participants. Many participants described the data from the project as an excellent legacy.

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All I can say, I think it's a wonderful project. I think it's fantastic. I would love to see it maybe happen again and maybe greater outreach into other areas particularly. It was very well done, very user-friendly. The information is great, even if you weren't going to use it. It's a very interesting - some people go and watch trains. I can imagine some people would be into counting traffic - I really do! ... I'll keep that Telraam going for months to come. (DublinCitizen Interview07)

I think that the project is beautifully set, the involvement of the public in transport policy is desirable in my opinion, the only way we can come up with solutions that will suit everyone, or at least most people. (LjubljanaCitizen Interview04)

However, as noted in the survey and in the Staff Interviews, many participants did experience difficulties setting up the Telraam to count traffic and to maintain its operation over several weeks. As noted from the survey, all comments have been taken into the development of the sensor to improve it for future projects.

I had a problem with my device because of issues with my Wi-Fi connection – it kept dropping all the time. The device also dropped and I had to attach it back into place. I also noticed that it doesn't stay in place; it slides down and doesn't record what it should. Otherwise, I really like the website but not everything is in Slovenian, so that could be improved. (LjubljanaCitizen Interview02)

6.5.2.6 Knowledge improvement

"Knowledge is power". Knowledge is a pre-cursor for action; once we know about an issue, we can become more willing to act upon it (Funke 2017). For WeCount, it was important to see whether citizens gained greater knowledge about the main relevant issues and to see whether it had a bearing on action taken. Excluding participants that did not respond to this question, overall **75% (N=144) saw at least some improvement in their knowledge**, with 52% (N=74) of these respondents seeing a drastic improvement (Figure 23). Breaking this down, general knowledge and locally specific knowledge on traffic and mobility saw the greatest improvement among survey respondents, with 85% (N=176 of 208) and 83% (N=171 of 205), respectively seeing respondents gain at least some knowledge. 70% (N=117 of 168) saw an equivalent improvement in knowledge on air quality and traffic safety, with 63% (N=110 of 176) stating the same for knowledge on how to act.

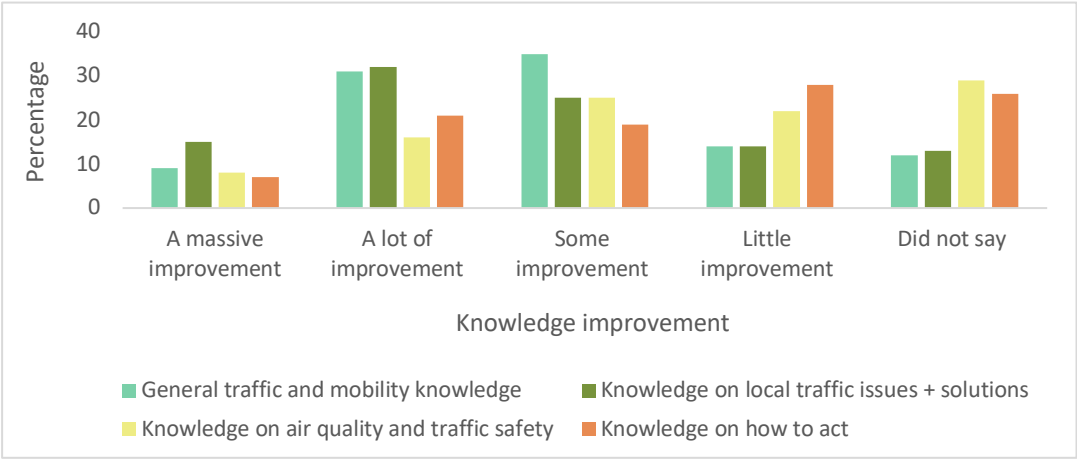

Figure 23 – Knowledge improvement across WeCount case studies.

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Kruskal Wallis testing found that neither age, gender, educational attainment or case study had a bearing on knowledge improvement. Interestingly, a relationship has been found between knowledge and action taken**: there is a statistical difference between knowledge on local traffic issues and solutions and action taken** (*H* (2) = 6.71 = *P* .035). Further analysis revealed that **the greater the street-level knowledge improvement the more likely a participant is to act** (Figure 24). There was no statistical difference for any of the over knowledge categories. Note that we did not ascertain baseline knowledge, so are unaware if citizens already had some degree of knowledge on these issues.

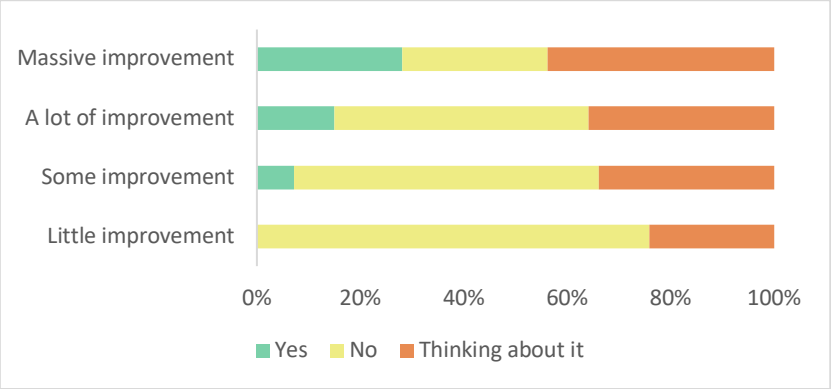

Figure 24 – Knowledge improvement across case studies.

6.5.2.7 Change in opinions

Over half of respondents (M= 55%; N=115 of 209) did not have a change of opinion about traffic-related issues following involvement in WeCount (Figure 25). It is likely this is largely explained by the fact that for over a third of participants (35%) stated the data coming from WeCount validated their existing beliefs (see Technical section). On the other hand, on average, 45% of respondents to this question saw **a change in opinion to some degree (N=94 of 209)** with marginally more change noted at the street level compared to neighbourhood level (48%; N=101 vs 42%; N=87).

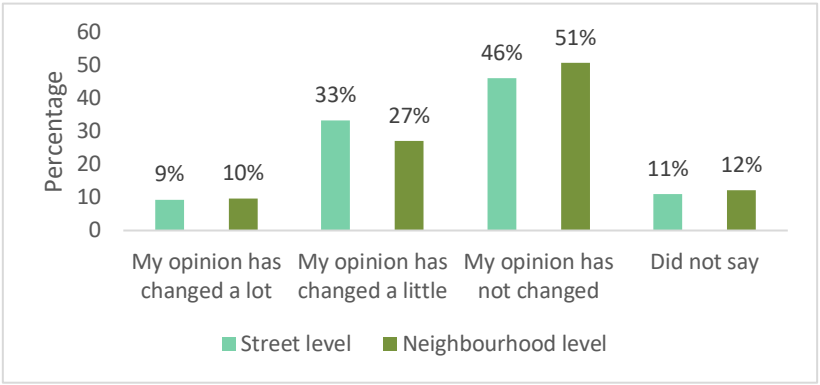

Figure 25 – Change in opinions.

While the number of actions taken was low (N= 24 across case studies), there was still a slight significant difference between the extent of opinion change at street according to Kruskal Wallis testing- (*H* (2) = 6.92 = *P* .031) or neighbourhood-level (*H* (2) = 6.93 = *P* .031) and action taken. Ultimately, **the more someone's opinion changed about street-level traffic issues the more likely it was they were to take action**.

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6.5.2.8 Current levels of activism

There was an even split between participants regarding current levels of local activity on traffic-related issues. 50% (N=117) were active to some degree when they completed the survey, and 50% (N=117) were not (Figure 26).

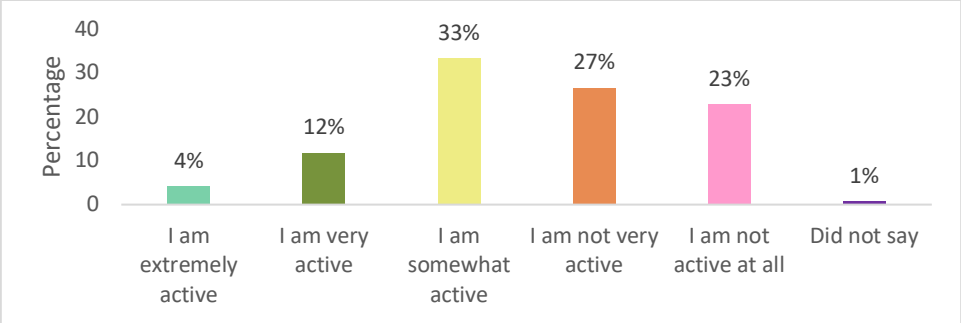

Figure 26 - Level of traffic-related activity.

6.5.2.9 WeCount-related action and behaviour change

Research Question: *Are the data generated and the engagement activities being used by citizens themselves, for instance by impacting local attitudes, increasing local advocacy, influencing citizen behaviour and increasing engagement with local policy making?*

The interview and survey data indicated that many citizens joined the project to gather evidence for to further their vision of safer communities, and that the project fulfilled these aims. Citizens described many reasons for taking action, from cars speeding on their streets, noise pollution, concern for air pollution, and unsafe walking and cycling routes. They planned to use the data from the Telraam to engage other citizens and local policymakers.

> *I believe we should make this problem known and start delivering solutions so I believe this is a step forward. The first step is to get to know the scope of the problem and then starting to find solutions. I would hope for some changes. This is a way to document what is going on, but this is the beginning, so I would like to extend my contribution or see actual changes.* (MadridCitizen Interview07)

> *In my estate I'd be very conscious, just the speed of the cars coming in and things. I guess I felt there wasn't a lot I could do about it, but now I think those data can show… Obviously there's information there that I can do something about this; that's actually great, it empowers me a little bit. Especially in the school it's going to be very valuable to change behaviour at the school and that's because I have kids there and it is good. I am very thankful for that opportunity to contribute in that way.* (DublinCitizen Interview05)

Survey respondents reported **24 individual actions**, which emerged after seeing their data. This equates to **10% of respondents** (Figure 27) and to **24 individual actions**. While this may appear low, several reasons may explain this:

1) it is believed that some actions may not have been reported to the case study leaders
2) some will happen after this report is published, after the final data analysis/policy workshops or the project's end.

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With most COVID-19 restrictions lifted and the summer holidays out of the way, citizens may have had renewed energy to act. However, based on the diffusion of innovation theory (beginning in 1957, see Rogers 2003 and Anderson 1957) and zipf curve theory (Zipf 1949), it is unlikely that actions taken will exceed a small percentage of the engaged population. See the *Main findings and Discussion* for more information. It is also unknown how many people were involved in these actions, e.g., if the action was taken with a campaign group, community group or colleagues – this information would be useful in understanding how far WeCount data is spreading, although it is typically hard to capture.

The top five actions taken with WeCount data were:

1. Notified local government/responded to a consultation (N=9)
2. Shared knowledge among the community (N=7)
3. Applied for a neighbourhood action grant (N=2)
4. Notified the police, business, or other (N=2)
5. Shared on social media (N=1)

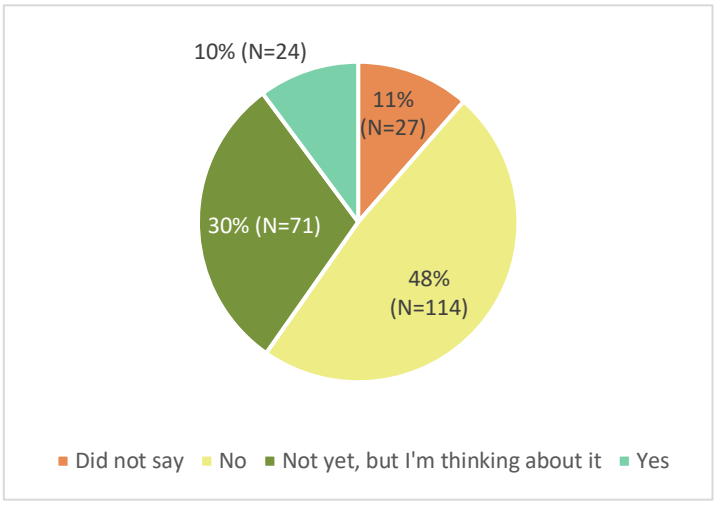

Figure 27 – Action taken after seeing Telraam data.

Kruskal Wallis testing found there to be a statistical difference between likelihood of action taken and two favourite aspects: the technology (H (1) = 4.30; P = .03) and "gathering evidence to support my campaign" (H (1) = 13.78; P = <.005). In other words, **those who preferred gathering evidence to support their [transport/mobility] campaign) or preferred the technological aspects of WeCount the most were more likely to act than those that did not prefer these aspects**. Both these aspects were rated highly for survey respondents (third and fourth favourite aspects, respectively) and align with the project goals of using technology for citizen-led sustainable mobility. Thus, it makes sense that as project and community goals align, citizens become more likely to take forward an action. As there is no significant difference between the top two favourite aspects ("being part of a research project" and "feeling as though I am making a difference") and action taken, it is suggestive that these respondents assume that other people, namely researchers, will do the action. This is reflected in some of the survey and interview responses reported in D5.2 and D5.3.

Survey respondent's motivation for joining also had a bearing on subsequent action taken. A Kruskall Wallis test revealed a statistical difference between the motivations to count traffic (H (2) = 8.05; P = 0.01) and to make a difference and subsequent action taken (H (2) = 24.72; P = .005). This means that **motivations "to count traffic" or "to make a difference" were significantly**

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more likely to lead to subsequent action than general interest in the issues or passive motivations (to contribute to research) (Figure 28). In sum, action or technology-based drivers had a significant bearing on action taking. No correlation was found between demographic characteristics and action taken, although we expect this is an artefact of a low sample size (i.e., 24 actions).

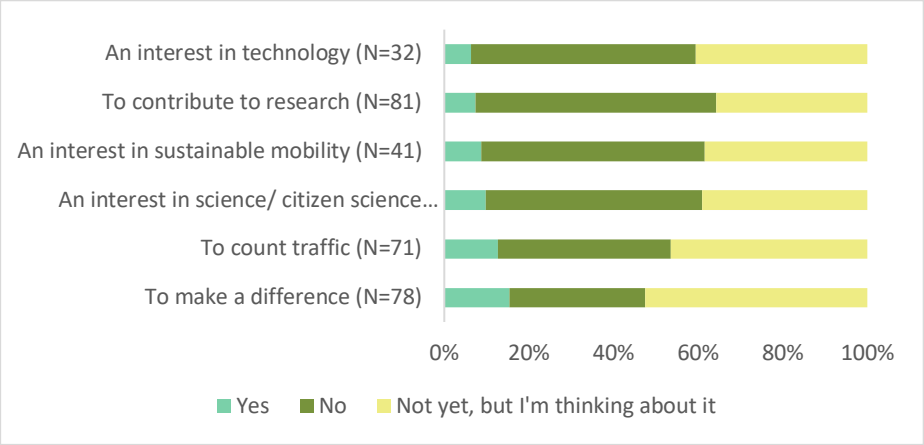

Figure 28 – Relationship between motivations to join the project and actions taken.

Enjoyment, meanwhile, did not have a bearing on action taken, nor did the type of motivation selected and subsequent enjoyment. It did, however, have a bearing on willingness to continue (see Future activism section).

As reported in D5.3, several citizens felt a renewed sense of agency from participating in WeCount. This is a clear example of a change in behaviour as a result of WeCount:

> *… I used to be really active until my life took a different turn, and so not active at all, and then* ***this project kind of reminded me that that's my nature, I want to go back to being more proactive about sustainable travel****, promoting this, so yes, thanks for the reminder… We bought a bike for our toddler, so that we can connect it to our old bikes, and I'm already thinking about changing my car to an electric car, if we can afford it, so actively looking, not sitting back, and waiting for things to happen, but let's make things happen.* (CardiffCitizen Interview05)

These indirect actions may not have been reported in the survey, but we expect other citizens also felt inclined to modify their travel behaviours to play their part. Actions have also been taken by staff, or in collaboration with the community. Since the publication of D5.2 (in June) the Spanish case study for instance has carried out final actions; one in Madrid and one in Barcelona. These actions consisted of pop-up creative engagements using analogue visualisations of the data coming from the sensors (Figure 29). These were placed in streets with active Telraams and led by citizens. All key stakeholders involved in the project were invited.

The action was fully co-created with the participating citizens as they: (1) co-created three options for the final action and event; (2) democratically chose the one to implement; (3) actively participated in the co-design of the materials (i.e., magnetic boards, pins, graphics, locations etc.); and (4) in some cases assembled the kits (see examples in figure below) and led the action itself.

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Figure 29 - WeCount final action in Madrid and Barcelona.

Thus, upon analysis, we believe that **citizens are using WeCount data and activities themselves** in all manner of ways. Citizens have shared their data with neighbours, encouraged other residents to join, shared their findings at workshops and on the street, and been in contact with local government on multiple occasions. In addition to the actions formally documented in the survey (N=24), there have been two co-actions (as mentioned above), engagement by citizens with schools (e.g. installing sensors in at least two schools, with one school aiming to use the data to pedestrianize their school street), five new analyses conducted and shared (e.g. on pavement parking or air quality, in Cardiff), a plan to report speeds to the estate management company to lobby for speed bumps, and a success story in reducing speeds by reporting data to the authorities, all this in addition to some feeling that their activism has been reactivated after a hiatus. Together, this takes the actions to 34 (36 if the school act and the speed is reported).

> *Suddenly when I learned about this dimension I met with my neighbours in the vicinity and reported it to those people responsible in the district where we live because there had been a district traffic re-organising plan that led to the sudden presence of many vehicles going through right in front of here. Thanks to this, I was able to provide all the data/information to the public authorities which I believe it is very interesting.* (MadridCitizen Interview04)

6.5.2.10 Future activism

Almost half (48%, N=101) of citizens plan on using the data after the project ends (Figure 30). This can be considered as successful due to the delivery of the project during COVID-19. Having been delivered almost entirely online, a place which is notorious for attention loss and high-dropout rates, there was a sense among the team that people may not be willing to continue. However, this outcome shows the potential a simple device can prove for community action, even after the facilitators have gone away. If other ways to be involved were available (e.g., as local champions, or with other digital and analogue sensors) there is a chance this figure could be much higher. However, time will tell whether citizens continue counting after project communications and engagement end.

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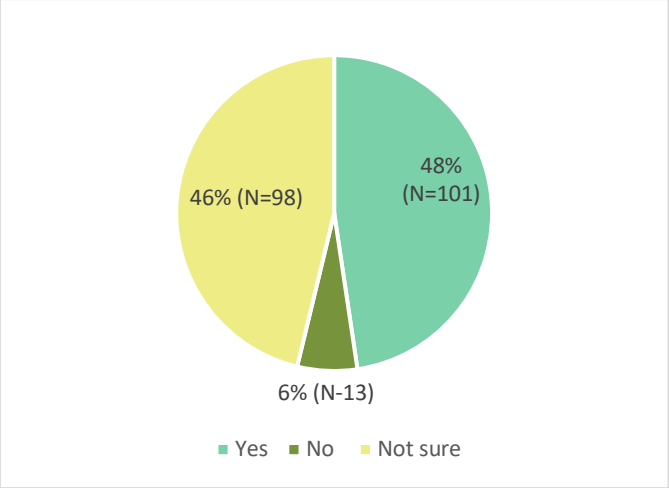

Figure 30 – Plans for using WeCount data.

Statistically speaking, action taken did not have a bearing on whether or not a respondent is likely to continue using the data, nor did the majority of the characteristics under investigation (age, gender, education). However, a Kruskall Wallis test revealed that our categorisation of **participant type (*H* (1) = 12.88 = *P* = <0.005) did have an influence on willingness to continue**.

85 Counting citizens (48% of total =177) are willing to continue after the project ends, compared to 10 involved citizens (23% of total = 43) and 4 (66% of total = 6) local champions (Table 11). This suggests that the degree of involvement in citizen science influences willingness to continue. In other words, **participants who see themselves as local champions,** professionally or as a more active member of the project, **were more likely to say they would continue than if they were a counting citizen**, and even more so than if they were an involved citizen.

Table 11 – Use of data after WeCount ends.

		Will continue to use the data after project ends			
		Yes	No	Not sure	Total
City	Cardiff	12 (41%)	0	17	29
	Dublin	31 (67%)	1	14	46
	Madrid/Barcelona	2 (22%)	1	6	9
	Leuven	38 (45%)	6	40	84
	Ljubljana	18 (41%)	5	21	44
Total		**101 (43%)**	13	98	235

Respondents' rating of their enjoyment while taking part in WeCount showed highly significant differences in whether or not they were likely to continue, according to Kruskal Wallis (*H* (1) = 18.45 = *P* = <0.005). Post-hoc Mann Whitney testing found that the mean score for "Yes, I will continue" is on average 1.158 points more than the mean score for "No, I won't" depending on the individual's subjective measure of enjoyment on the project. 74% of participants who rated their time as excellent said yes, they would continue (N=53 of 80) compared to 1% who said no (N=1) and 33% who said they were not sure. Respondents become less certain as their enjoyment rating decreases. Just 43% (N= 43 of 99) of those that rated their time as "good" said they will continue,

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5% will not and 52% unsure. 17% of those who rated their time as "average" will continue, 17% will not, and 70% are unsure. In other words, **the more a participant enjoyed their time, the more likely they were to say they will continue working with WeCount data after the project ends** (Figure 31).

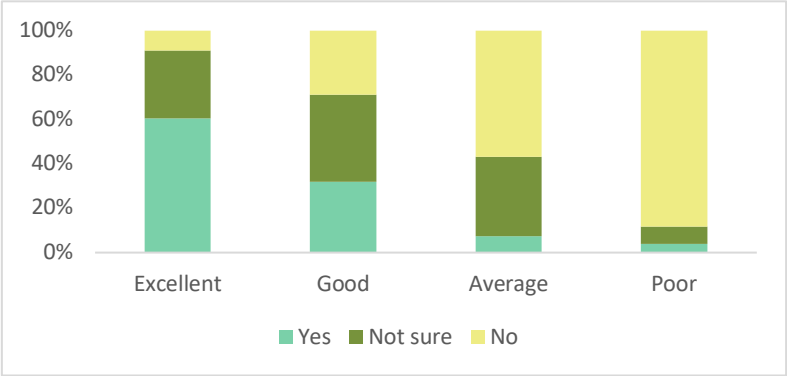

Figure 31 – Perception of time spent on WeCount and willingness to continue.

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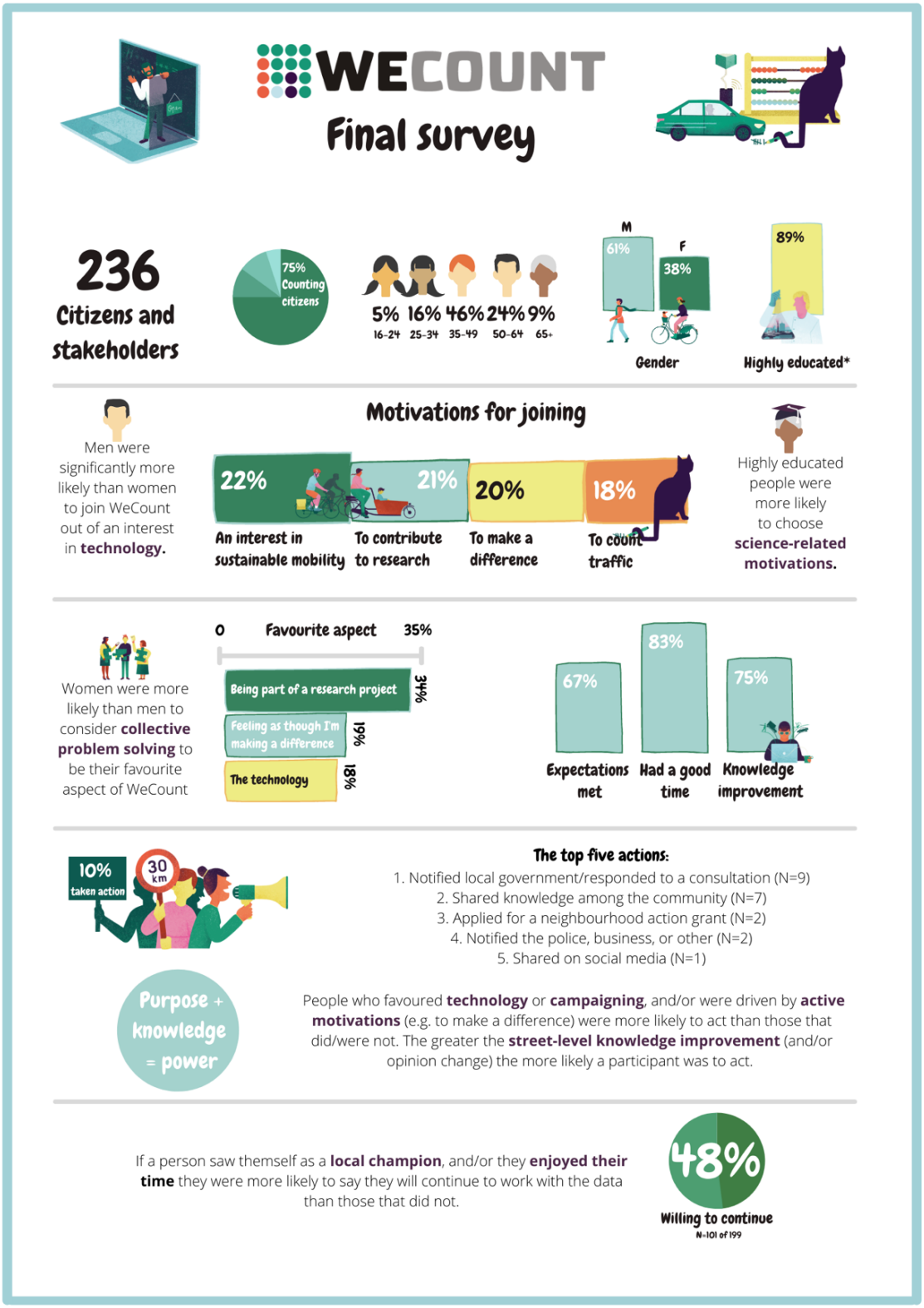
6.5.2.11 Survey findings summary



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6.6 Self-sustaining networks?

Research Question/Task: *Did WeCount succeed in creating five local citizen science networks in different contexts? Has each city managed 300 registrations? If not, why not?*
Task: *Examine evidence of improved ability to autonomously deploy digital sensor technologies in their homes.*
Research Question/Task: *Are new WeCount communities emerging that are self-sustaining with minimal central support in order to continue beyond the project end?*

WeCount partly succeeded in registering over 300 citizens in each of the five case studies - indeed 1,988 citizens registered in total. However, the registrations varied in each city; Ljubljana reached significantly less than this target (N= 202) and Cardiff and Leuven were just shy of 300 (Cardiff N=267, Leuven = 290). Dublin and Madrid/Barcelona however, far exceeded 300 (Dublin N=457, M/B N=750).

There are signs there is an improved ability to autonomously deploy the sensors. In Dublin, for instance, they distributed multiple sensors to individuals, with the aim of them spreading them around their community. In their interview, an Irish citizen said they set up one sensor and another in their child's school. Other examples include setting up sensors in nearby community spaces, or in places of employment (e.g., an office in Ljubljana). In Cardiff, one local champion has convinced a neighbour to take part and is currently working on convincing a third. This citizen's overall aim is to have enough sensors to cover all four segments of their road.

It is too early to tell whether the networks formed during WeCount are self-sustaining, or the degree to which they are 'connected'. It is also hard to evidence. To document this type of emergence, further interviews would need to be conducted with multiple individuals within each sub-network to assess the strength of connections (at the end of the project and one year later). Some citizens connected with 'nodes' in their network through door-to-door engagement, while others promoted WeCount through neighbourhood committees/action groups or street WhatsApp groups. These types of informal exchanges cannot be observed at a distance. It would be encouraging to see this type of interaction continue, however now that society has emerged from lockdown restrictions and now that WeCount communications and workshops have ceased, it may be harder for those not already active in this space to prioritise transport and mobility activism or to have the motivation to continue.

There is appetite among some citizens to expand the networks. Citizens in Dublin, Leuven, Madrid/Barcelona and Ljubljana commented on the untapped potential for the project to reach other (priority) streets and wanted to see the project team find ways to recruit citizens unaware of WeCount (e.g., through door knocking). Promisingly, **the majority of citizens, local champions and government representatives expressed a willingness to continue after WeCount officially ends** (48%/N=101 yes; 46%/N=98 not sure).

Several comments were made in the interviews that citizens heard about WeCount via partner newsletters, social media or communications from their respective local council. It is promising to see that online-only recruitment still proved useful; and shows the need to **make use of existing facilitator networks within the project** to spread the message too.

An interesting example of where this networked approach might prove particularly effective is in the newly established series of eight sensors in and around a school in Leuven. Set up by the case study's project team, there is a central hub (the school), with subsequent sensors in the surrounding environment. The school is a relatively permanent entity with a captive audience (say

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compared to say a renter or an individual houseowner who's motivation may wane). The school children will learn subject content through WeCount, while seeing how they are part of a bigger picture. The neighbouring counters are motivated by the fact that they are supporting the school and the community in monitoring infrastructural and behavioural changes over time, which could in the long-term lead to a reduction in air pollutants and greenhouse gases, and an improvement in citizens health and quality of life. As the host, the school takes away the need for too much external support. It is worth cautioning that this is no solution – community and school settings are often overstretched as it is and need proper resources (e.g., time, staff) for this hub model to work.

6.7 Community Building

Research Question/Task: *What community building tools work well in [terms of reaching diverse audiences] (real life events, social media, working with a local champion, etc.)?*

Community building is a pre-requisite for self-sustaining networks. This is because without neighbourly connections, and community organising skills such as an understanding of how to shift power (i.e., who to contact and how on traffic and transport-related issues), it is unlikely citizen networks will get off the ground. For many well-off communities, they already have these requirements. It is less likely to be the case in poorer communities, who may not know an organiser, or have experience engaging with decisionmakers. Even if they do, these issues may not be at the forefront of their mind, as issues such as housing or employment may take precedent. However, this is a generalisation, and, in both cases, active citizens can be found. See

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Discussion for evidence to support this.

As early as the bid proposal stage, case study leaders have worked with community centres (for proposal advice, recruitment, in setting up a sensor in the vicinity etc). Leaders used a variety of forms of online communication (social media, emails, website, teleconference) to reach and engage audiences, and this worked particularly well for members of the public who use these platforms, or indeed have a preference to engaging online. The teams were aware that they do not work for those with less formal education and/or on lower incomes (which often means, among other things, fewer opportunities to readily access a computer or Wi-Fi – see Impact on local champions section), however due to the COVID-19 pandemic they had little choice. Different types of engagement tools were used to overcome access barriers when allowed (e.g., stalls at public events, analogue data visualisations, in-person workshops), however demographic data was seldom recorded to evidence if these were successful strategies.

Broad brush approaches to engagement can capture the attention of the general public, consisting of a diversity of people, although it can be hit or miss. Ljubljana's advertising campaign on buses to present WeCount data during a 10-day period is one such example. Despite promoting the campaign among participants and on social media, no one has yet to scan the QR code and comment on the data. This is borne out across the other cities, with low engagement from groups who were not already interested in taking action on traffic. Once reached, low socioeconomic groups typically need to be engaged differently, such as with analogue sensors or facilitated workshops and events in community spaces. In Bristol, for example, they have been running afterschool STEM clubs in the community centres of target areas, with advertising through local printed newsletters, word of mouth, or digital equivalents, with some lessons specific to WeCount and the sensor. This was made possible due to existing connections with these centres and several discussions on how this could work in their context. Once such communities are engaged, updates on the project may need to be in the form of posted letters, face-to-face engagements with the project team and training if and when there is interest (see Impact on local champions section).

Interview data from the citizens indicated that the Involved Citizens also wanted to build more community engagement and connections. In Leuven, the project commenced before COVID-19 and so the interviewees there discussed how the Telraam sensors and data enabled many community conversations.

> *My husband has become a big fan as well too. He creates a graph with an overview per hour for each month. We always hang it up. Every month we add to it. There're conversations about that. That's interesting because then you hear about things. Like the idea about the residential area, you think about it yourself, but you don't know if there are other people thinking about it too, but because people pass by and start talking about these numbers, you notice that maybe the neighbour also wants it. ...This wouldn't be happening if we didn't make these numbers visible. It's interesting to hear all these people's ideas.* (LeuvenCitizen Interview01)

However, most citizens engaged with the project online only due to COVID-19. They expressed disappointment that they were not able to extend their community networks and activism, due to the nature of online meetings. They indicated that they would like social and moral support from other participants, which future projects could try to stimulate.

> *One of the things for me that feels like it's missing is I don't really feel like part of a community. Maybe there's a Twitter page or maybe there's a Facebook group or whatever where people are talking*

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about their data and I missed that, but at the moment I don't feel like part of a community of people in and around Cardiff who have sensors... (CardiffCitizen Interview01)

It's a lot more difficult to do everything online. I think, if corona hadn't been a thing, we ourselves, from the service, would have been a lot more present in the area. You pay someone a visit. Physical meetings, where people get to know each other, where you have constructive dialogue, discussions, you cannot really do that online. (LeuvenCitizen Interview06)

The impacts of COVID-19 on project delivery and on the staff, collaboration is also echoed in the Staff Interviews section. WeCount staff were fully aware that community building would not succeed given the circumstances. When they have been able to engage with diverse audiences in-person, there has been a degree of success in building the knowledge base of participants. Offering skills in community organising to grow social participation in decision making, was not on the agenda however, and according to our researcher who is trained in this area, training interested groups would take several weeks (based on a full-time commitment). The project simply did not have enough time to build this into their design, but could pay dividends for future Citizen Science projects. Several suggestions on how to improve engagement, e.g., with printed communication materials, and meet-a-scientist opportunities, are not exclusive to low socio-economic groups. As science communication tells us, a diversity of communication channels, old and new, are necessary if we are to build community across the board.

Research Question/Task: *Are the tools/technology sufficiently robust, yet engaging and simple to use, in order to reach and sustain engagement with the broadest possible transect of society?*
Research Question/Task: *Measure user experience/ acceptance of the WeCount data platform, data dash boards, etc. Are the data generated at the pilots being understood by citizens?*
Research Question/Task: *Record the percentage of the sensors installed without any hands-on support (by only using the manual, instructions video, step-by-step via the website). Do improvements in supporting materials made based on experiences in Leuven and Madrid give better results in Cardiff, Dublin and Ljubljana?*
Research Question/Task: *What is the retention rate of citizens active on the WeCount platform after one year? What are reasons for drop-out and how can these be overcome?*

6.8 Tools and technology

To summarise D5.2 and D5.3, **the technology is engaging for those that did participate**, with the majority of survey respondents' participants regularly checking the platform (N=110; 62%), their data and the data of others. Only a small percentage (7%; N=13) stopped looking, while a negligible amount never looked (1%; N=2). Some citizens are concerned about the accuracy of the data, although this is healthy scepticism – i.e., choosing not to have blind faith in the technology. TML, the developers believe the degree of error to be +/- 10% and this largely reflects citizens' manual checks. While cosmetically the sensor needs some tweaking (i.e., wireless, a better way to secure it to the window so it does not fall down, etc.), and alternatives to wi-fi need to be sought, once it is installed and fixed to the window the sensor largely needs to be left alone. However, prevailing environmental conditions (sunshine, darkness, rain) may decrease accuracy. Due to the machine learning capabilities of the sensor, its accuracy should in theory improve over time. Due to

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this mixed review, **the technology is on its way to being robust**. D6.3 provides more details about the ongoing actions to address the technology challenges.

However, **75% of all Telraam owners were able to install their sensor successfully** (Table 12). This is a good outcome, showing that the technology threshold was not too high for those that were able to have a sensor. However, this still means **25% were unable** to install, or did not want a Telraam. The reasons why people were unable to install included faulty devices and multiple technical issues that led to a loss of motivation. This may have something to do with a **gap in technical knowledge**, in addition to the newness of the technology.

Dublin and Leuven posed the question on 'do you feel capable of installing a Telraam' after their kick-off sensor workshops. Responses teetered on the more confident side with Dublin's citizens giving a 3.8 out of 5 (N=47) on average, with Leuven's citizens giving a score of 4.7 (N=72). Comments in the survey varied from "really straightforward" and "easy" once time could be dedicated to it to "very difficult". It is also possible that techno-phobic or unskilled (technologically speaking) citizens may have not participated because technology was involved. Inability to install may also relate to confidence: "I'm not sure I would have been able to sort it out without having him," said one participant about the doorstep support provided by a member of the Cardiff team. Handholding is often required for citizens who sign up to citizen-sensing/participatory research projects. **The WeCount technology is not always easy to use**. We did not document how many citizens installed their sensor without hands-on support. However, multiple remarks were left about the need to email the case study team with questions, suggesting there remains a degree of external support needed.

Table 12 – Telraam usage across WeCount.

	Cardiff	Dublin	Leuven	Ljubljana	Madrid/ Barcelona	TOTAL
Telraam owner	74	143	154	106	64	537
Active Telraam	65	132	119	84	60	460
Percentage able to activate sensor	88%	92%	77%	79%	94%	**86%**

Each case study was able to modify what materials they put in the welcome pack to citizens. They could also have modified the content of the installation instructions if they wished, although they chose not to (beyond small tweaks). 68% (N=118 of 173) of respondents found these packs useful. Along the way, new pages were added to the Telraam website to help with installation when gaps in information were identified by citizens. Feedback from Leuven's co-design event on the data platform also led to improvements in its usability, and citizens' appreciation for this tool are apparent in the final surveys. Thus, **the lessons learnt from the pilots, and each case study thereafter, contributed to improvements in the material available**.

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Figure 32 - WeCount Packs (Cardiff).

Of the various **online information** provided to help citizens (instructions during registration; FAQ articles to troubleshoot during Telraam set up and use, and an online helpdesk to ask staff about issues) on average, **83% (ave. N=126 of 155) of survey respondents were satisfied by these resources**[7].

Once set up with their Telraam, participants could make use of their own map, excel (raw) data, in addition to existing data of other users on the map, an API and background information on how to use these tools. **The majority of survey respondents considered the first three tools to be good/very good** (**90%; 78% and 88%, respectively**, or N=154 of 172; N=91 of 116; N=138 of 157). Note that there are fewer responses to the excel data as around 1/3 did not use it (35%; N=63 of 179). The map data is readily available via a weblink, with easy to interpret graphs. Only if you were keen to do in depth analyse would you go on to explore the raw data. **Around 2/3 of counting citizens did not use the API data (64%; N=113 of 177)**, presumably because it is a very technical tool that requires prior knowledge on how to use it. **However, those that did use it rated it highly (73% good/very good; N=47).** Background information on how to use all these tools was available on Telraam's website, however 45% of respondents (N=81 of 178) did not use these. This may be because the information available was sufficient. Those that did access this resource ranked the information highly (80%, N=77, good/very good; 20%, N=19, neutral).

Nearly all counters across who responded to the citizen survey were **still counting** at the time they took the survey (N=156 of 172; **91%**). 10 of the 16 no longer counting explained why they stopped, with 60% saying they did so because of unresolvable technical issues. As of September 2020, 59% are still counting. Workshop attendees in Cardiff, Dublin and Ljubljana were asked to what degree they understood the Telraam data. **On average, respondents really understand the data (4.8 out of 5; N=70**). While this level of comprehension is impressive its worth a reminder that this is a highly educated cohort.

6.8.1 Traffic data and data accuracy

89% (N=138) of counters believe the data coming out of Telraam to be accurate/mostly accurate. Only 8% (N=12) think no/mostly no, and 3% (N=5) are not sure. **65% (N=122) of**

[7] Participants were also able to interact with the project through social media. Only 64 respondents fed back on this aspect of communication, suggesting it was not as widely used, however they were largely satisfied (55%, N=35) or neutral (45%, N=29) about the help provided.

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counters were surprised a little or a lot by Telraam data (either their own or data from their area) and 35% (N=65) thought it was as they expected (e.g., because it validated existing beliefs).

According to Kruskal Wallis, data accuracy had a bearing on their rating of enjoyment on the project with significant differences between ratings of enjoyment and subsequent perceptions of accuracy on the project (H (4) = 12.16 = P = .016). (Figure 33). 32% (N=21 of total 66) of those that thought yes, data was accurate had an "excellent" time. More people rated the project as 'good' (N=75), with fewer believing the data to be accurate (12%, N=9), with mostly accurate (75%; N=57) and mostly inaccurate (4%; N=3) selected more often. A similar trend is seen for average ratings.

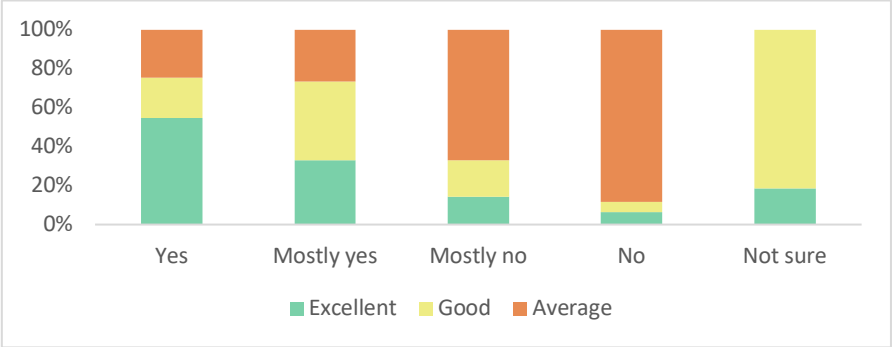

Figure 33 – Relationship between perception of data accuracy and enjoyment of WeCount.

Below is a summary of the key statistics for Telraam's tools and technology (Table 13). A detailed explanation of suggested technical improvements has been extensively covered in D5.2 and D5.3.

Table 13 - Summary of the key statistics for Telraam's tools and technology.

Technical element	Survey outcome
Still counting	91% (N=156)
Usefulness of Welcome Pack	68% (N=118 of 173)
Dashboard usage	62% (N=101) viewed it often
Rating online information available for registration	83% (ave. N=126 of 155) satisfied
Rating of data outputs available as good/very good	Own map 90% (N=154 of 172) Excel (raw) data 78% (N=91 of 116) Existing data on others' maps 88% (N=138 of 157) API 73% (N=47 of 64 – 113 did not use the API)
Reaction to data	65% (N=122) 'surprised' 35% (N=65) 'as expected'

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Belief in data accuracy	89% (N=138) accurate/mostly accurate

6.9 COVID-19 pandemic impact

While an investigation into the impact of the COVID-19 pandemic on staff and citizens was not planned initially, it seemed appropriate given that the pandemic undoubtedly affected all aspects of the project. Thus, to understand the extent of the problem we interviewed staff on this matter as well as asking survey respondents. **80% (N=197 of 245) of survey respondents time on WeCount was in some way impacted by the COVID-19 pandemic** (Figure 34). Interestingly, **there was an almost equal split between those with a preference to engage face-to-face with participants and staff (24%; N=58) and a preference to engage online (22%; N=55).** This is understandable given different personalities (introverts, extroverts, etc.). A lot of participants had more time to spend on the project (19%; N=47), presumably as some of their social or work-related activities were put on hold during lockdown, while for others they had less time, likely because of additional caring responsibilities or work.

As mentioned in D5.2 and D5.3, it was harder to reach people without computers/low socioeconomic groups. Community workers that case study leads contacted to facilitate these engagements did their best, but it was not the same. As one mentioned, it would have been easier to meet users of the centre, over a cup of coffee and "it would have been easier if I had seen [members of the WeCount team] more often or if there was a problem, that you could instantly come over" (LeuvenCitizen Interview05).

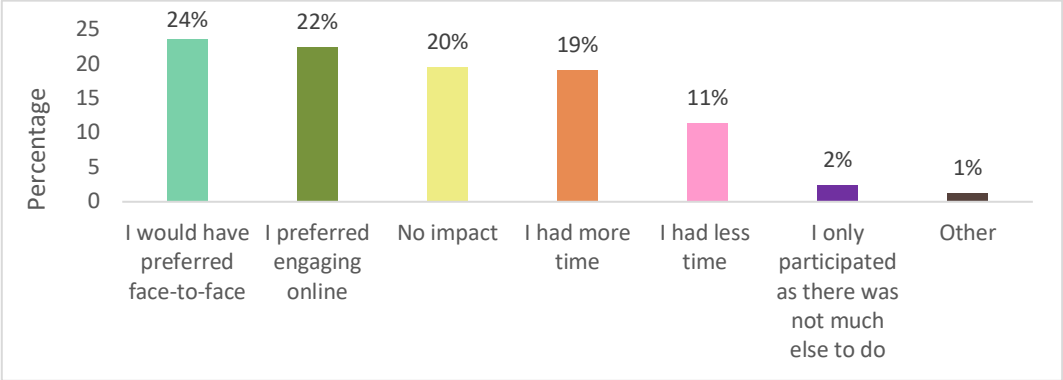

Figure 34 – Impact of the COVID-19 pandemic on the citizens' experience.

6.10 Improvements

While citizens were largely happy with their time on WeCount, they did put forward some ideas for how to improve the project, which have since been taken on board by the project team. The most voted for improvements concern a need for:

1) **a mechanism to show if efforts are impactful/successful (33%; N=99);**
2) **more ways to get involved (15%; N=46);**
3) improvements to the technology (13%; N=41);
4) support in making it easier to understand the data (13%; N=39).

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Based on the responses to the "please explain" section of this question, the reason why the success/impact mechanism is so high is because a high proportion of survey respondents were hoping for reports that could be used to influence policy makers. Most of these respondents also thought that the project team should be the ones responsible for creating and sharing these reports.

> *I'm not sure if the aim is to kind of submit results to the council, because I know there are measures taking place now on this road in particular by the council to try and reduce speed, but not necessarily reduce traffic volume, so I guess you would want the council to have access to the data ultimately, I guess, in order for them to see how heavy traffic is at certain times of the day, and then issues then that arise from the data perhaps.* (CardiffCitizen Interview04)

6.11 Impact on local champions

Research Question: *What is the role of local champions? What can we learn from their experience in order to make the WeCount platform more durable?*

Local champions already exist within communities – they just need seeking out. Many are a part of campaign or community groups, or act as them professionally, e.g., as community workers. While not always useful giving them this title formally, knowing who the project's local champions were helped when the team needed to see how things were doing on the ground. Several local champions evolved organically over the course of the project, or if they were given opportunity to take on additional responsibility (e.g., hand out more sensors), while others were specifically asked to step up (e.g., in Cardiff, which recruited 13, thanks in part to the team in actively encouraging enthusiastic participants early in the project). Some citizens, however, did not want the additional responsibility (for example, in Ljubljana).

Figure 35 – Case study leader in Cardiff delivering sensors on his bike.

3% (N=7) of survey respondents identified as local champions. Local champions were largely responsible for spreading awareness about the project (N=4; 57%), encouraging others to have a Telraam (N=1) and providing technical assistance to those with a Telraam (N=1). The percentage share among responsibilities may have been different if face-to-face interactions were possible. Of those that answer the question, three will continue to use the data after the project ends (60%), and two are unsure (40%).

> *I guess one recommendation for involving communities, in a lot of communities there are already community-wide groups, like Tidy Towns or environmental groups, and approaching them, because*

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these people are going to be active and interested in their own local environment in general. (DublinCitizen Interview06)

Most of the local champions interviewed thought the sensor was easy to install, although the community worker said it was not, and it was a challenge for their centre to get up and running.

The local champions put forward suggestions to improve the project going forward. Below we detail all the non-technical recommendations:

- Take the researchers/project team into the community to meet the people behind the project.
- Send a letter to counters every now and then saying, "In the past month, we counted these many cars, these many of this," etc. It will be beneficial for those interested but without a computer, and for those with a computer but need some extra nudging. It can also feel a bit more special than an email.
- Correlate the data (e.g., peak traffic and pollution levels, traffic numbers and liveability, etc) to make more valuable.
- Run the project over a long period of time to support citizens to use data once they start to observe trends.
- Increase the number of sensors in order to obtain more data. "The largest possible number of sensors spread out, the better… [with] Town Council involvement to run it in a more municipal way".

Some suggestions have already been trailed in some cities, like "tap into communities through community groups", "spread out more sensors" by citizens looking to take a more active role, "make [the project] broader than just the counters" and "asking people what kind of story they want to tell, what their objectives are, and then trying to facilitate that as much as possible".

Finally, students also became temporary 'local champions' in Ljubljana. Through a role-playing exercise, students put together a pitch to persuade residents to join the project. This could be useful for future projects to support citizens to become more active in their community.

6.12 Impact on decisionmakers and other audiences

Research Question: *Is the quality of the data high enough to be used in scientific policy support research/consultancy?*
Research Question: *What is the impact of the WeCount community on decisionmakers involved?*
Research Question: *Has the project reached any other audiences?*
Task: *measure attitudes, expectations and acceptance of local stakeholders before and during the pilot processes and outcomes.*
Task: *collect evidence for policy changes (not per se implementation but public statements from policymakers, strategy/vision document).*

In their report on citizen science for environmental monitoring, Roy et al. 2012 found that "there is evidence to suggest that the value of citizen science for monitoring the environment and providing evidence to underpin policy has been underestimated […yet there is a] tendency to perceive the quality of citizen science collated information as low" (p7). This, they argue, could undermine the potential for policy change.

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The margin of error for a typical air quality/speed/traffic counting sensor varies with the technology used. With respect to traffic counting, the closest substitute for Telraam are pneumatic tubes. The accuracy of pneumatic tubes is unclear. From TML's experience with pneumatic tubes, the accuracy level is similar. Therefore, with a the 10% +/- margin of error for data collection by an average Telraam, WeCount data could well be of **sufficient quality for policy support research/consultancy**, especially if combined with other datasets, as many citizens suggest. However, the question remains, will policymakers use them?

We already have evidence of WeCount data being used in research and consultancy:

- A PhD student at the University of Brussels (VUB) has used the API to test whether mobility based on Telraam data can be used as a predictor to estimate COVID-19 hospitalizations. The analysis was published online as part of the Mistic research project: https://elucidata.be/mistic/blog/Is-traffic-volume-correlated-to-Covid-19-infections
- A team at VITO (a Belgian semi-public research institute) working on air quality modelling (https://vito.be/nl/luchtkwaliteit) has used the Telraam API to estimate changes to traffic volumes as an input for air quality models. The teams used a variety of sources for this, from the official counting data on the highway network (MOW) to a Google Traffic API [8] report and complemented with Telraam data for a finer spatial and temporal resolution.

All case studies developed professional relationships with decisionmakers, often involving them as early as the proposal stage. Subsequently this has led **to mutual benefits**. Among other things, there has been **knowledge transfer** (e.g., with the Citizen Science Office within Barcelona City Council and MediaLab Prado in Madrid), **new contacts** and **access to widely subscribed communication channels** to promote or further disseminate WeCount (e.g., to schools, as is the case in Dublin), and the possibility to use sensors to monitor the impact of **sustainable mobility interventions** (like Low Traffic Neighbourhoods being introduced by Cardiff Council). Clearly, a good impression has been made and there is a **willingness from the Councils in the case studies to find synergies**. However, according to a local official interviewed in Leuven, time, resources and communications remain barriers to fruitful city-citizen-researcher relationships. There is a sense that they feel this was a missed opportunity:

> *"I have this frustration [that the data is] not being put to use [by us], no time, etc. It's important. I feel these are valuable, engaged citizens that we have to cherish. They are involved in quality of life in [the neighbourhood]. We're also involved in [that] quality of life… but we're on our own track."* (Leuven Citizen Interview 06)

This is an important finding, as it is this knowledge-action gap that can lead to frictions between decision makers and citizens, as articulated by this citizen:

> *" I think it's very important that [the data from the project is] used for something [and communicated in a transparent way] to keep the motivation of many people up. Else they will feel like: I've collected data for two years and now the mobility plan shows they don't use it at all... I assume that if it's not put to any use, then a lot of people will give their Telraam back, because then it becomes an empty box that's not used for anything."* (LeuvenCitizen Interview 4)

8 https://developers.google.com/maps/documentation/javascript/examples/layer-traffic

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While discouraging, the local official does see "**huge added value**" in the project as it is participatory in nature and provides objective data to the subjective experience of citizens. "What's interesting, can the counters tell us more than the agency? …the feeling is different if a counter says it rather than an agency," (ibid).

The Head of the Safe Mobility Department in Ljubljana, meanwhile, installed a sensor in what seemed like an attempt to understand the back-end of the project. They were interested by the capabilities of the sensor and are interested in having more numbers (e.g., passenger volumes) that they can use for their work. This value is echoed by Leuven's Vice Mayor for mobility. They attended the city's data analysis workshop, listened to the suggestions of the citizens and said:

> *"These 200 sensors provide us as a city with a wealth of information; information that we use when making all kinds of mobility decisions.* ***We will certainly include these analyses in our mobility plans for the boroughs****", said the alderman. "As a city, we are also pleased that so many people from Leuven have committed themselves to mapping out the traffic and then thinking about solutions together. Thanks to the project, residents are involved in our plans for sustainable mobility and the liveable and safe city we strive for. It's also great that this tool, which was developed in Leuven, is gradually conquering Europe".*

Attitudes, expectations and acceptance of decision makers were not captured at the start of the project; however, it is clear from the above that they are in support of the project and impressed by its potential. The final survey provides further insight into their attitudes, expectations and acceptance during WeCount. Three professional stakeholders responded to the survey, two from Leuven and one from Madrid. They were motivated to join out of professional interests, an interest in science/citizen science, or to contribute to research. They had a good (N=2) or average time (N=1). For this group, **being part of the research project was their favourite aspect (N=2), although they also enjoyed gathering evidence to support their campaign, the technology, working collectively to solve problems and the bottom-up approach (all N=1).** According to this group, a better coordination of the activities or less work commitment would improve the project. **There expectations have been moderately met, or been exceeded, although one reflected that it is too early to really know**. Two of the three will continue to use the data after the project ends.

Figure 36 – Schools were one of the WeCount audiences. Here, a workshop at a school in Dublin.

Among the **other audiences reached** are schools, charities (campaigning for cycling, car-free cities, 'living streets', 'play streets', etc.) and community groups, in addition to people who may shy

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away from or be unable to make face-to-face meetings. In Cardiff, for instance, they have connected with Possible, a UK climate action charity, that is launching a car-free city project in four English cities. They have given them their spare sensors and trained them in how to install the sensors and engage diverse audiences (based on WeCount's learnings), hoping to give them the best chances of success with their campaign. There has been a new network set up on Telraam's website and will be launched first in Bristol.

Throughout the project, each case study has been finding ways to influence decisionmakers, be that through citizens presenting their data to them, or through strategic opportunities crafted together with members of the WeCount project team. Collecting evidence for policy change is not linear in WeCount, as the aspiration was that citizens would do this independently.

Nevertheless, we summarise the evidence for policy change that WeCount are aware of:

Case study	Evidence
Madrid/Barcelona	The case study worked on transferring the knowledge and findings to the local Citizen Science Office (at city council level) and led a Policy Masterclass with the projects' results. In addition, independent initiatives from citizens have taken place. For example, a local community in Barcelona, through showcasing the evidence collected in their street from the WeCount Telraam sensors, managed to change the speed limit for this street, which was decreased to 10km/h. Other local citizens and WeCount participants reported data from their Telraam sensors in local media to reach the public authority in a more (informed) protest-oriented manner. Finally, from dissemination related activities, several councils in Catalonia manifested their interest in adopting the Telraam sensor and replicating the WeCount citizen science interventions in their own contexts.
Dublin	Dublin City Council asked WeCount to install traffic and air quality monitors in schools selected for their School Zone initiative, as this will provide them with an objective measure of the effectiveness of this initiative. This initiative aims to reduce congestion, increase safety at the school gate, and encourage active travel to and from school. School Zones will receive colourful circles on the road demarcating the school area, and pencil-shaped bollards on the footpath to prevent illegal parking.
Cardiff	The case study has not resulted in any physical interventions being implemented because of the project to date. However, the Cardiff citizen scientists have reported the value that the data and project

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	provided in amplifying their voices and empowering them to move the conversation beyond subjective concerns to more quantified and targeted communication. Subsequently, the citizens are eager to continue traffic monitoring beyond the project lifetime to utilise the data to explore the impact of local transport decisions such as the reopening of Castle Street to private car use (Nov 2021) and future exploration of the impact of proposed Healthy Community Neighbourhoods across Cardiff.
Leuven	As a result of the activism of the local citizen group, the city authorities have introduced two interventions to improve speed limit compliance: first, in May 2020, the installation of a digital sign indicating speed to vehicles and second, in November, the installation of a temporary speed bump. As the Telraam device has been collecting data continuously, the impact of both interventions on speed limit compliance can be isolated.
Ljubljana	The Slovenian government is currently preparing an amendment to the Transport Act, looking at increasing use of electric scooters in transport. The city administration hoped the Telraam would provide statistics about electric scooters, but unfortunately the sensor does not yet count scooters. The local team were contacted by a concerned citizen of Spodnji Stari grad in the municipality of Krško. They were very concerned about local traffic, as workers in the surrounding businesses use the road as a shortcut. The citizen installed a Telraam and the data formed the basis for numerous requests for improvement in traffic issues addressed to the Municipality and the Mayor of Krško, the Krško Police Station and the Krško Intermunicipal Inspectorate.

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7 Evaluation Results and Discussion: The WeCount Team's journey

7.1 Staff Interviews

Ten staff interviews were conducted in total, with two staff members per case study city being consulted. The interviews were analysed using one coding frame to bring the themes together. The discussion about the Impact scores is dealt with in the Impact Scores section. The resulting interview themes were Process Feedback, Sensor Troubles, Impact of COVID-19 on delivery, Impact of COVID-19 on collaboration, and Working with Citizens.

7.1.1 Process Feedback

Overall, the staff members felt that the project had gone well and achieved its aims given the changes necessitated by the COVID-19 pandemic. The Engagement framework was praised for guiding people through the delivery process, whilst also offering flexibility to adapt for city and national differences.

> *I really like the citizens-side framework that we've been working within. I think that's really good... It's the building a community, sensor deployment, data workshops, community workshops. I really like that kind of onboarding framework of bringing citizens involved, or getting citizens involved and work their way through. I think that's probably been the strongest aspect of the project for me overall.* (WeCountStaffInterview09)

Especially for those less experienced in citizen engagement, having tools that could be "cherry picked" proved useful beyond the project

> *I think that at some point when you are not a citizen engagement expert, you find it very lost in how to, you are kind of afraid of people. One thing that I think was good is to have a guideline, not like a step-by-step, but a guideline to cherry pick some of the tools and adapt it.* (WeCountStaffInterview04)

The Evaluation Framework was praised for being very comprehensive, alongside a helpful evaluation mentor. Some staff members thought that the framework was too rigid, and that they would have benefitted from more training or face-to-face support (although they noted this was difficult due to COVID-19).

> *I support the framework as it is and I really think that it can be a good framework, or it is a good framework. There are a lot of tools offered/suggested, ways to monitor and evaluate every event that has taken place. If we could have that evaluation training physically with all the partners, oh, that would be so much better.* (WeCountStaffInterview01)

> *One important thing was to be clear at the very beginning of what the effort would have been and receive the training to be able to meet our requirements, I suppose.* (WeCountStaffInterview03)

The overall impact of the COVID-19 pandemic on delivery and collaboration is discussed in later themes.

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7.1.2 Sensor Troubles

All staff members mentioned experiencing difficulties setting up the sensors to operate in citizens' windows. As an experimental technology in a research project, this is to be expected, and the comments below provide opportunities to improve the Telraam technology. Several staff members noted that the design of their city and the housing style meant that the Telraam could be difficult to locate with a clear view of the road. Barcelona and Madrid both have high rise apartment buildings, while Ljubljana has many street trees which block the view of the road. This means the requirements to locate the sensor in a window will be problematic in some countries.

> *Well, obviously, the biggest challenge that we've faced is in relation to the sensor. Not the sensor itself, but really the suitability of the sensor to this environment, I suppose, and specifically to the urban design of cities like Barcelona. They're not always facing the street like a 90-degree view on the street. It's different and that has caused us many challenges.* (WeCountStaffInterview03)

> *This technology wasn't prepared for Barcelona Madrid infrastructure. We had lots of limitations in order to give this technology, or these sensors, to the people to have it to collect data. It was frustrating for them not to have all the requirements to be involved.*
> (WeCountStaffInterview04)

As the project developed, it also became apparent that the sensor technology had several problems with registration, finding and maintaining a Wi-Fi network, and machine learning to recognise pedestrians, heavy vehicles and cycles.

> *The Wi-Fi and how we have to connect the sensor to the network was really hard. For example, we have a lot of schools and city council buildings or public buildings that want to be involved, but they can't because the Wi-Fi wasn't the one that should have this sensor. It was a real barrier because we could have a lot of, for example, a network of schools that were really interested in this.*
> (WeCountStaffInterview04)

> *I think it's the sensor [that] needs to be improved, but I think we all know that. The sensor needs to be easier to set up with the whole set up process. It needs to be able to count at night; that's a big issue here… the whole architecture of how the data is, how the registration works, I would change that to make it easier, because it was just too complex for us.*
> (WeCountStaffInterview07)

The WeCount staff team were not initially aware of these issues, and so felt they had to maintain and repair their reputation of trust with their citizen science community.

> *The people were disappointed, we were also a bit disappointed because, okay, it is clear that always with this kind of measurements, you have a mistake, there is a mistake always, but I think and also the team thinks that the mistake is too big. So then of course this is putting us in an uncomfortable position towards the people.* (WeCountStaffInterview05)

It was also a lesson for some staff in how to better manage expectations:

> *...I should have investigated more what is, and what isn't possible to do before promising people. That's something I've learnt. I've learned that it's better to do a lot of simple things as opposed to do one thing that's very complex because that can make people just getting away from it because they would perceive it as something that they cannot achieve.* (WeCountStaffInterview03)

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7.1.3 Impact of COVID-19 on Delivery

All staff members highlighted how the COVID-19 pandemic meant that they had to completely change their recruitment, delivery, and evaluation plans. Given the unprecedented nature of national lockdowns, many staff thought that the project had done extremely well to continue to deliver at all. However, they noted that online delivery mechanisms were not as they would have hoped for or would have operated in normal times.

> *I was really looking forward to the development and the bringing into practice of the citizen's engagement framework with a strong focus on the difficult-to-reach people. We had some very good ideas and tools developed on how to get involved with the difficult-to-reach. Then there was something coming up that was called COVID-19 which made it very, very difficult to have all these tools implemented and to reach that very important call.* (WeCountStaffInterview01)

> *At a project level, I think [online delivery] affected very much our ability to really undertake co-design of some of the technologies which, in my opinion, has had several consequences into the final results of the project. If people are more involved into planning the experiment, into designing it, I think that at the end of the day, it's a better way to manage expectations for them.* (WeCountStaffInterview03)

This meant that the project was unable to engage with people who were not already digitally literate, or who already had an interest in mobility and the environment. This resulted in the WeCount participants being highly educated and from higher socioeconomic status groups.

> *Of course, targeting vulnerable groups was, I would say, impossible. Well, impossible to create the impact we wanted. We did start with some small things and some interviews, but we didn't achieve in involving them in a digital, in this digital story.* (WeCountStaffInterview02)

> *I think the pandemic has been a challenge, so it's broken those traditional links that you'd normally have. The way we build relationships and projects is through that face-to-face communication, and you lose that immediately with the pandemic when you've got to stay at home, so that makes it a little bit more challenging. Again, same with the workshops, with citizens is you'd want that to be face-to-face, but they couldn't be.* (WeCountStaffInterview10)

However, some staff members noted that they will maintain some of the learnings from the pandemic for future projects. Online meetings proved useful for busy community members and helped to maintain connections between staff and communities. There was also a sense among staff that they adapted well to the change of circumstances.

> *For some people it actually helped because not everybody can just go somewhere in the evening and leave everything at home. I think for some people that was better, that they could just join from home. I don't think we would have had that option if we weren't forced to do everything online. I don't think we would have had a blended approach. So that actually worked quite well.* (WeCountStaffInterview07)

7.1.4 Impact of COVID-19 on Collaboration

The staff members recognised that the same issues they worked through in their case study cities were also present between international staff members in the consortium. Again, the ability of the consortium to adapt to online working and still deliver the project was praised by many.

I think that the consortium's ability to be resilient to this situation was probably my highlight. There're several others, of course, but if I have to say one, I think that this is the one. (WeCountStaffInterview03)

I think some parts have been a challenge, obviously because the pandemic you can't communicate directly with people, you can't sit in the office with people and have a chat with people, so that's been a bit challenging. I think the relationship between various partners of us and colleagues, that's been really good. If there was an issue I couldn't resolve by troubleshooting, I could easily get in touch with them, for example. (WeCountStaffInterview10)

However, as the consortium only met once physically at the start of the project, most staff members discussed how they felt the potential for exchanging and sharing knowledge and skills between partners was not fulfilled. They discussed how they had been excited to begin the project, but that this personal learning and development through the international consortium had not been realised.

I think that we have lost a lot of exchange, first of all, but also experience that we could not share with each other. We could not learn from each other. Things went wrong because we did not have enough exchange between each other. That's something that made me a bit unhappy. (WeCountStaffInterview01)

No, to be honest with you I was so happy at the beginning because I was just like, 'Ah, this is the first project that I'm actually going to work with people that I like', and I wanted to work with you guys so it's sad that it ended up like that. (WeCountStaffInterview08)

7.1.5 Learning from Working with Citizens

The staff members were asked what they had learnt from the project, and skills to work with citizens was their main cited impact. Staff members discussed how much they enjoyed working with citizens and communities, and how important it was for the project to give back to communities.

We loved it. People rock, right?! The thing that we have a really diverse group. Not socio-economically speaking, but from different ages and with different technical skills. This was very good because the thing is that we could achieve an on-boarding that makes sense for everyone and we could also, with these people that had more technical skills, we also had a lot of feedback regarding the technology and what could be better. (WeCountStaffInterview04)

Some staff members discussed how creating community was a very important aspect for citizen science projects. Sharing learning between peers in the community, and between researchers, was vital to develop and maintain project momentum. The staff discussed how they had improved their skills to enable and empower these interactions, and to allow time and space for them to develop between community members.

Maybe what I've learnt there is that the [Telraam] pickup was not only important for us but also for the ones that get their Telraam at that moment, because they always wanted to share a bit - why I want to have a Telraam? Just talk a bit, chit-chatting about mobility and data, and problems, and issues. (WeCountStaffInterview01)

I would say generally speaking it was really good, and it was really nice to work with the citizens. In the workshops they told us that they really appreciate what we're doing, and that was really good feedback and it makes you feel really good when people actually appreciate what you do. I think

maybe my email etiquette has become a bit better and a bit more positive, because I had to write so many. (WeCountStaffInterview07)

The staff also learnt a great deal about the challenges that people face in cities with mobility, which will inform their research in future projects. As noted in the literature on citizen science, researchers learn as much from listening and engaging to citizens, as citizens do from working with scientists.

Did I enjoy working with the citizens…?! Yes, course I did. I wouldn't describe myself as a people person, but inevitably I had to become a people person! … The bit I really, really enjoyed was actually those doorstep conversations, where you actually take the time to stop and listen to the challenges that people are facing. What I got out of those engagements that I did have was the value of listening, and the value of actually not only listening, but hearing the challenges that people had. (WeCountStaffInterview09)

Citizens are often excluded from the science and just get the numbers at the end, but to allow citizens to be part of the process to generate those numbers, to understand their local context, I think that is incredibly valuable. That's what I like doing, is helping people do that, so from that perspective I absolutely loved that, yes. I think I've learned a lot, to be honest. There are so many different perspectives that people bring, so many different angles that people think about. (WeCountStaffInterview10)

7.2 Impact Scores

All ten staff members also completed the ACTION framework impact scoring (quantitative) and discussed this qualitatively in the interviews. The results are discussed here.

7.2.1 Scientific impact

As a citizen science project, it should come as no surprise that **scientific impact** (Figure 37) is an important and inherent part of any other citizen science project. This scientific dimension aims to understand to what extent the WeCount project has produced "new (scientific) knowledge", "resources" or "research fields" and is therefore able to influence future "innovative research(ers)", whether in the form of citizen science or not.

Overall, this was the domain the WeCount team scored most highly, with an expected scientific impact receiving an overall average score of 3.5 (0 being the lowest score and 5 the highest). Broken down to each sub-dimension, scientific knowledge and new research fields and interdisciplinarity received average scores of 3.1 and 3 respectively, while innovation in education and new knowledge resources scored slightly better with average scores of 3.7 and 4.1 respectively.

While the project staff and research community gained new knowledge about citizen engagement and practices (resources), staff members also thought the citizens themselves gained new knowledge and awareness.

Our scope was for people to learn and to participate in an informed way, so there's several elements from technology, open source, sustainable mobility that we've transferred to them. I think that was an important element. Changes in way of thinking, attitudes and value. (WeCountStaffInterview03)

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The WeCount staff felt that this new knowledge and data had empowered the citizens to act and further disseminate their understanding with other citizens.

> *I think we really put a lot of effort in empowering them, and I think we did succeed. If you look at the engagement and the way people are engaged and the, yes, the commitment to share ideas, to think, to co-create, I think that's a really nice impact.* (WeCountStaffInterview02)

> *For those who are able to get it to work and able to generate data... they were able to generate really good, local data that were valuable to people. The citizens were really clear that it was valuable for them. It wasn't just a case of, 'I've generated some data, cheers, bye.' It was, 'Oh my God, look what I can do with this.' That came through in the workshops really clearly, so from that perspective, absolutely.* (WeCountStaffInterview10)

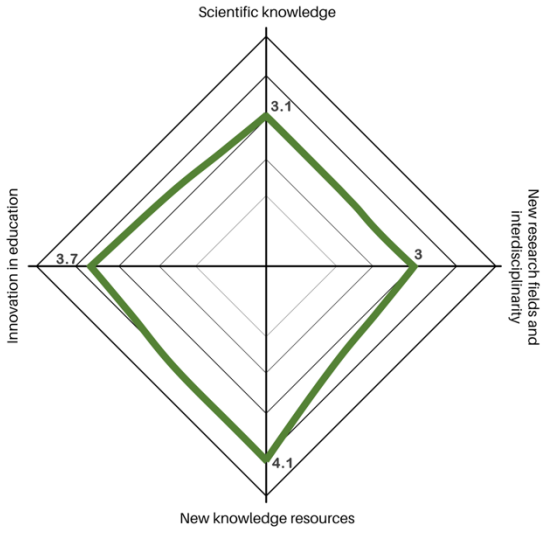

Figure 37 – Scientific impact.

7.2.2 Social impact

When conducting research in close collaboration with citizens, social impact (Figure 38) is a crucial aspect to examine, monitor and evaluate as it has the potential to influence society. Citizen research and science thus acquire a dual purpose. On the one hand, it strives for valuable research results in sufficiently large numbers, and on the other hand, it works to empower citizens and create a community that stands on its own. This social dimension aims to understand how the WeCount project can support "community building and empowerment", "social inclusion", the "skills and competences of participants", "behavioural change" and the ability to influence the "way of thinking, attitudes and values" amongst participants.

This domain was ranked almost as highly as scientific impact by the WeCount team with an average of 3.4. Broken down by sub-dimension, the average scores show substantial differences (see chart B). Social inclusion and behavioural change received the lowest average impact scores (2.7 and 2.9 respectively); while researchers and research community's growth and empowerment and changes in way of thinking, attitudes and values are believed to have a moderate impact (average score of 3.4 for both). Community building and empowerment and knowledge, skills and competences were given the highest average impact scores (4.1 and 4.0 respectively).

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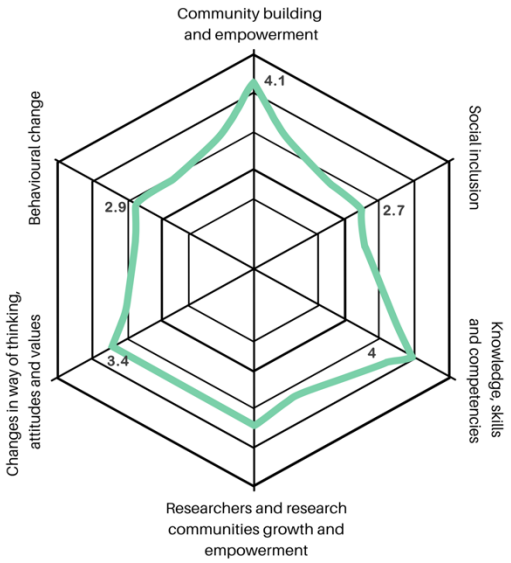

Figure 38 - Social impact.

This was the domain which most staff participants chose to talk about in the interviews. The extent to which the citizen scientists were empowered by the data surprised the WeCount staff. The citizens analysed and discussed the data in ways which were new to the scientific community, such as exploring how much space would be required to park all the passing cars.

> *There are so many different perspectives that people bring, so many different angles that people think about. Some of our citizens were talking about the really local context, doing their own sums to compare the data... Others were taking the data and almost, from my mind, taking it out of context...and then presenting the data back into the traditional box in a completely different way... That was really interesting, so it's different ways of presenting the data has been fascinating to see.* (WeCountStaffInterview10)

The WeCount staff noted how sharing the data and aims of the project enabled the citizen scientists to develop as a community – bridging existing networks and developing new ones.

> *I guess community building and empowerment, I gave it a four because I do believe that we were able, to some extent, to join individuals that were interested of different kinds and even different communities... Trust me, given the situation here and the tensions that exist, that I think was a big achievement.* (WeCountStaffInterview03)

It was noted that in some cities social inclusion was limited by the COVID-19 pandemic and the digital nature of engagement. The WeCount team noted that they were not able to reach all sectors of the community and were limited to people who were already concerned about the environment or were digitally aware.

> *You put 20 people in a room for an hour or two with teas and coffees, you're going to get a lot of secondary conversations that happen, that help build that community. That didn't happen. Because of that…in terms of our case study, I think it has struggled a little bit, because of the fact that… I don't think we created any new communities. What I think we did is add value to existing communities* (WeCountStaffInterview09)

Similarly to the citizen interviews, WeCount staff noted how the quantitative and scientific nature of numerical traffic evidence, meant that many citizen scientists were empowered to take action

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with their data. They felt the project had enabled people to start to make a difference in their community.

> *I think that [people] are very concerned regarding how the traffic impacts in their lives. I think that this one, it was a citizens' lives project. I think that makes a lot of sense how it was structured or the dynamics.* (WeCountStaffInterview04)

> *It's given citizens data that they can use. It enabled and empowered citizens to think about the data that they have and what to do with the data. From that perspective, I think the social impact has been, for me, the greatest out of all of those.* (WeCountStaffInterview10)

7.2.3 Political impact

Doing science in a participatory manner affects the political realm in several ways. This makes evaluating and assessing the generated political impact quite complex. Not only has the generated data the potential to support or evaluate (new) policies; conducting citizen science can also ensure a better acceptance of the concept of bottom-up or grassroots development in general, which can increase the use and acceptance of this method in political debates and decision-making processes. In addition, political impact can unfold and therefore differ at various geographical levels, increasing the complexity of assessing it (source: D6.2). The political dimension of the ACTION methodology aims to understand how citizen science results are being transferred and used to support "political processes", how projects are impacting citizens ability to "participate" and "self-govern", and how much "political support" or acceptance there is for citizen science in general.

The expected political impact by the team resulting from the WeCount project is rather moderate, with an overall average score on this dimension of 3 (Figure 39). Impact scores by subdimension show that the greatest impact is expected by the WeCount team on the political support for citizen science (average score of 3.4), followed by the impact on policy processes (average score of 3.2), political participation (average score of 2.9) and self-governance (average score of 2.7). In general, the impact at the political level was not as highly assessed as at the scientific and social level.

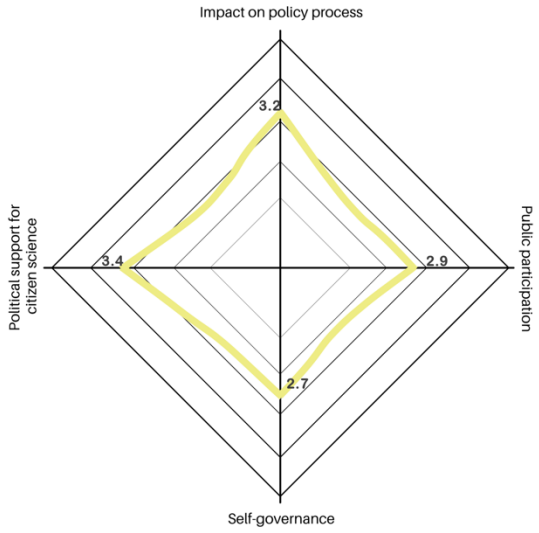

Figure 39 – Political impact.

In the interviews, WeCount staff noted that political impact was a difficult domain in which to see change. While citizen scientists wanted to make a difference in their community, they did not

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always know how to engage with political processes to bring about change. This was corroborated in the citizen interviews, with many stating that they needed more training to engage with councils and local policymakers. This was also true for many of the WeCount staff.

> *I think this is a gap that we have in the project, that we didn't have any training, or at least support in this sense, because we are very good in engaging people and to on-board with the technology and to have results of this. The link from the results to the real change, or the link with the policy, it's more at advocacy level. I think that this is a thing that more or less is missing in the whole project, in my opinion.* (WeCountStaffInterview04)

While staff and citizens were keen to engage with politics to make changes locally, the policymakers were not always so transparent or willing to listen.

> *The contact with the local government was a tough one. It really went up and down, but with a lot of up and downs. We did a lot of meetings and at many points we had the feeling that we were responsible for communication in-between departments of the city instead of them as one, as a whole, talking to us, so that was really a challenge.* (WeCountStaffInterview02)

> *We have found one department, which is not directly involved with traffic, but they said, 'Well, no, we think that's interesting, but we have to get the approval of the mayor,' and then the approval of the mayor came, and we got a greenlight after about six or seven months. The policy obviously is to show a nice face. Yes, yes, we think that's nice, but on the second level, which no one tells, they are blocking it. That's why it doesn't work.* (WeCountStaffInterview05)

However, staff members felt that the project and Telraam data opened doors for changes to be made. Many were expecting political and city changes to come after the lifetime of the project.

> *With those we have reached digitally, we have given them the opportunity to have more impact on local policy based on the Telraam data and the tools that we offered them. I really think that we offered them some tools and ideas to be empowered and go to their local policies/policymakers and take some actions. That's with the target group that is called, not the difficult to reach.*
> (WeCountStaffInterview01)

> *I think Telraam really was a good catalyst for engaging in policymaking, because you're objectifying the gut feeling, and you're all sharing results, you're all talking to each other. People are trying to understand each other, so I really believe, I strongly believe that being engaged in the data collection or in other ways would, really being engaged instead of just being asked a question makes people better participators. They are more enthusiastic or more skilled as well.* (WeCountStaffInterview02)

Plans are also in place to train citizen scientists and WeCount staff in working with policymakers and presenting data from the project.

> *I think something we're going to do in the next couple of months is to hold a policy workshop, so we can discuss with people how that data feeds into policy. I think we need to support them in making sure they understand the quality of the data and how robust the data are. If they're challenging people with data, they need to be able to understand that these aren't absolutely spot on, that there are margins of error that they need to work with. I think those are the things that can really help citizens as well.*
> (WeCountStaffInterview10).

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7.2.4 Environmental impact

As a citizen science project linked to environmental pollution caused by local road transport, the environmental impact generated by WeCount is very relevant. It should be noted that this dimension is closely related to both the social and political dimension, as they work together to inspire local actions and therefore foster pro-environmental changes. This impact is therefore an indirect result from citizen science projects like WeCount. To fully fit the project goals of the WeCount project and better align with the Sustainable Development Goals, the subdimensions as developed within the ACTION impact assessment framework were altered to use within WeCount. The environmental impact was assessed using the following subdimensions: "responsible consumption and production", "sustainable cities and communities", "pollution reduction", "conservation of resources", "restoration of ecosystems and environments" and "climate action".

In general, the WeCount team expected a rather low environmental impact from the WeCount project as air quality or noise quality sensors were not the foci – and citizens could gather/analyse data that fitted with their agenda or interests. On average, this dimension was assessed with an impact score of a 2.7. The scores on each sub-dimension reveal more information (Figure 40). The highest impact on this dimension is expected on the development of sustainable cities and communities and climate action (average scores of 3.5 and 3.4 respectively). On the other hand, only a small impact is expected on the reduction of pollution (average score of 2.8). Considering the objectives of the WeCount project, this number is very low. This may indicate that most WeCount staff participate in the project to bring about changes at the social and political level as an important first step towards sustainability, rather than at the environmental level per se. Finally, responsible consumption and production, conservation of resources and restoration of ecosystems and environments received the lowest impact scores (average scores of 2.3; 2.2 and 2.2 respectively).

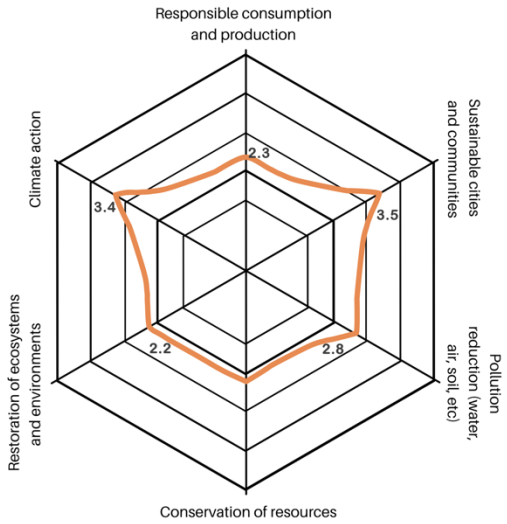

Figure 40 – Environmental impact.

WeCount staff thought that the social impact was much greater than environmental impact but noted that the environmental issues were directly related to people's quality of life in cities. Improving the urban environment therefore directly impacts on social wellbeing and cohesiveness, and there is much potential for future project development

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When it comes to counting traffic, this has a lot of impacts. ... It's a very multifaceted and very complex concept. You could talk about urban design, space. You could talk about road safety. You could talk about road and transport management, as in transport system behaviour. (WeCountStaffInterview03)

People are so concerned… Traffic is such a big mess [here] and people are very concerned about it and they had a lot of questions about the air quality as well, so that's going to come in soon hopefully. (WeCountStaffInterview07)

7.2.5 Economic impact

The generation of economic impact is not directly linked to the objectives of WeCount nor citizen science projects in general. For this reason, the economic dimension is rather difficult to assess. Nevertheless, considering the need to foster the sustainability of new initiatives resulting from citizen science projects in general, this dimension was added to the ACTION impact assessment framework (source: D6.2). More specifically, the economic dimension aims to understand to what extent citizen science can have an impact on both participating organisations and participants itself in terms of "employment", "cost saving", "income and revenue generation for leading organisations" and "economic impact on local communities".

The economic impact was very low according to the WeCount team, with an average score of 1.6 (Figure 41). Both the impact on employment, cost-saving and local communities received an average score of 1.5; while the impact on income and revenue generation for leading organisations received an average score of 1.8.

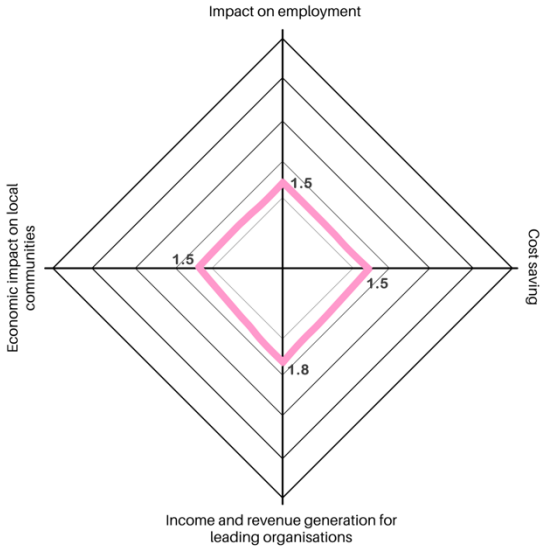

Figure 41 – Economic impact.

The WeCount staff also stated in interviews that economic impact is a much longer-term process and had not been realised during the life of the project.

I think we got impact - well, in all the spheres except for the economic impact, so I didn't see any impacts in that, but I guess that will be more long-term. (WeCountStaffInterview07)

However, the WeCount staff thought there was potential for the project and the Telraam device to impact on all domains in future.

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I think this tool and this sensor has the potential to be really powerful for democratising data. I think it opens eyes, opens doors, and it opens conversations. I think if the sensor's challenges can be overcome, … then everyone would want one. It really opens up local data collection. If you can resolve those, then it's absolutely on to an enormous winner. (WeCountStaffInterview10)

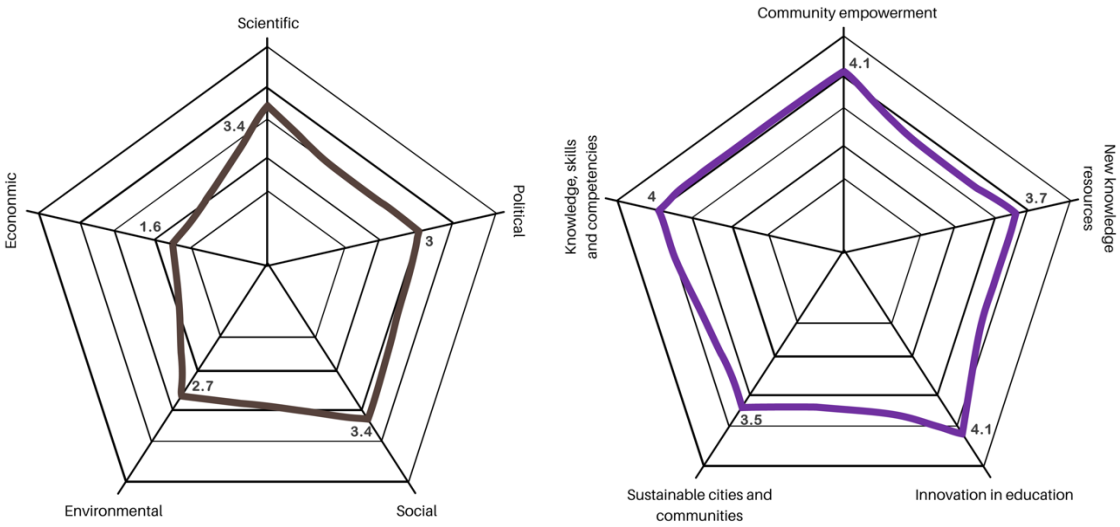

Figure 42 – Overall impact of the WeCount project.

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8 Main findings and Discussion

8.1 WeCount's main findings

- **Gender: near 50:50 split** (51male:49female).
- **29% of participants were younger than 16**, 28% were 35-49 years old, 19% were 25-34, 13% were 50-64, 7% were 16-24 and 4% were over 65. In general**, WeCount was able to attract a younger demographic than most citizen science projects** (Pateman et al. 2021).
- **82% (N=582) are highly educated** (degree or above), 18% (N=124) have low levels of education. This puts WeCount among the most highly educated citizen science projects (91% is currently the highest documented; Haklay 2008).
- **25% representation from low socioeconomic groups was not met (more likely it is about 10%)**; however, there are reasons to explain this. Lockdown restrictions limited the potential to involve these groups, as well as time constraints due to the global pandemic.
- **9% reported their occupation as skilled manual, semi-skilled or unskilled.**
- **1,988 registered.** 19% (N=368) of all those that registered became a 'member' of a network and 40% (N=795) of all registered users received a Telraam. 75% of Telraam owners were able to get their sensor up and running (N=598). 59% of counters are still counting.
- WeCount partly succeeded in registering over 300 citizens in each of the five case studies. Ljubljana were significantly less than this target (N= 202) and Cardiff and Leuven were just shy of 300 (Cardiff N=267; Leuven = 290). Dublin and Madrid/Barcelona however, far exceeded 300 (Dublin N=457; M/B N=750).
- **The technology is engaging for those that did participate and is on its way to being robust**.
- The technology is not always easy to use, especially for those with fewer technical skills or less confidence, and handholding is often required, even for those who may see themselves as having a baseline level of experience.
- On average, respondents understand the data well (4.8 out of 5; N=70).
- 89% (N=138) of counters from the survey believe the **data coming out of Telraam to be accurate/mostly accurate**.
- **The more citizens perceived the data to accurate the more likely they were to have a good time**
- **There are signs there is an improved ability to autonomously deploy the sensors**. It is too early to tell whether the networks formed during WeCount are self-sustaining, or the degree to which they are 'connected'.
- It is estimated that over 1,000 citizens and stakeholders were engaged across 52 workshops, schools' activities and other public events.

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- An estimated 230,000 people were engaged indirectly through social media and the project website.
- **Citizens are using the data**: it is leading to policy and behaviour change and greater awareness.
- **The more involved you are, the more likely you are to act.**
- There are signs that **some communities are self-sustaining around hubs** (e.g., community centres and schools) but support may be required periodically (e.g., training, facilitated workshops to analyse the data if not led by support worker or teacher).
- **236 participants completed the final survey (43% of all WeCount members), 75% of which were counting citizens**. Although respondents are older and more often male than the WeCount population, results can give some insight into attitudes, values, knowledge and behaviour:
    - Main motivations for joining WeCount**: an interest in sustainable mobility (N=100; 22%),** to contribute to research (N=94; 21%), to make a difference (N=89; 20%) and to count traffic (N=81; 18%).
    - **Men are significantly more likely than women to join WeCount out of an interest in technology**.
    - **There is a significant difference between educational attainment and more science-related motivations**.
    - **Expectations were largely met**, with 67% (N=157) saying they were met 'extremely' or 'very' well.
    - Overall, **survey respondents had a positive experience, rating their time as either excellent (38%; N=90) or good (45%; N=107).**
    - **'Being part of a research project' was their favourite part of being involved (N=144; 34%)** and feeling that they were making a difference (N=80; 19%) came second.
    - **Women were statistically more likely to consider collective problem solving to be their favourite aspect of WeCount, more so than men**.
    - **75% (ave. N=144) saw some improvement in their knowledge, or above**, with 52% (ave. N=74) of these respondents seeing a drastic improvement.
    - 45% of respondents to this question saw **a change in opinion to some degree (N=94 of 209)**
        - **the greater the street-level knowledge improvement the more likely a participant is to act.**
        - **the more someone's opinion changed about street-level traffic issues the more likely it was they were to take action.**
    - Survey respondents reported **24 individual actions**, which emerged after seeing their data. This equates to 10% of respondents.

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- **Almost half (48%; N=101) of citizens plan on using the data after the project ends**.
- **Participants who see themselves as local champions, professionally or as a more active member of the project, are more likely to continue than if they are a counting citizen, and even more so than if they are an involved citizen** (sign of self-sustaining)**.**
- **The more a participant enjoyed their time, the more likely they are to continue working with WeCount data after the project ends.**

- **Local champions** can be anyone of several things. They can: work with hubs (schools/community centres) to build local networks; act as community organisers, going door-to-door, to spread awareness, rally support and membership and reach diverse audiences; apply their enthusiasm to local, place-based issues that needs solving; be heavily involved in local groups; offer technical assistance; or be a professional LC for targeted engagements with marginalised communities. All these roles are essential for the project to work, and for it to keep expanding. They also provide crucial, strategic feedback for improving project design.
- **We believe data is of sufficient quality for policy support research/consultancy.** Case study leaders have developed professional relationships with decisionmakers for knowledge transfer, contacts, communication channels and strategic opportunities. time, resources and communications remain barriers to fruitful city-citizen-researcher relationships (and keep up motivation).
- Among the other audiences reached are **schools, charities and community groups**, in addition to people who may shy away from or be unable to make face-to-face meetings.
- **Impact on the project team:**
  - The Engagement and Evaluation Frameworks were sufficiently adaptable for different skillsets and different case study environments. The lessons learnt from the pilots, and each case study, contributed to improvements in the material available.
  - The project team enjoyed working with citizens and improved their engagement skills and indicate they will continue working with citizens in future projects.
  - However, while the project was still delivered despite COVID-19 lockdowns, the project team felt they missed out on sharing knowledge and skills, and truly impactful collaborations.

WeCount is unlike most citizen science projects to date, which are designed to crowdsource or distribute intelligence (Sardo and Laggan, 2021). Through a process of co-design, asking citizens what matters to them and working with them where needed to analyse and act upon the data, WeCount adds to the small but growing number of projects that **democratise the production of knowledge and make space for citizen-led policy change**. It is clear from the project evaluation that this approach works in **making people feel empowered**.

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8.2 Discussion

8.2.1 Keys to success

Collaboration is key to the success of these types of democratic citizen science projects, with research indicating their ingredients are **time, space and facilitation** (Nowak 2006; Nowak and Highfield 2011). For instance, where case studies have worked closely with more active citizens over the course of the project it has led to new avenues for exploration (e.g., air pollution monitoring) and greater opportunity to expand the network (including to poorer communities). **Supporting people who feel less confident**, with tailored training or doorstep assistance was also well received. **Word of mouth** has also been useful, with more active citizens or professional local champions encouraging others to join. **Culture** undeniably influences support of these types of citizen science projects, as has been shown in Ljubljana. As Braun (2010) states, "**education, self-organization and knowledge of civil rights are crucial for an effective social participation process**" (p777). If levels of education are low, there is an underdeveloped civil rights movement and people are not familiar with self-organising for policy change, the sparks needed to light the flame of community activism may fail to materialise. Writing on community-led approaches to reducing poverty in neighbourhoods, Crisp et al. (2016) report that in low-income communities with a poorly developed local voluntary and community sector, community organising may not work. Self-organising needs to be visible as a normal part of people's lives for others to think they can be a part of it. As such, we recommend future projects embed '**community organiser training**' in their design**, targeting areas with an established voluntary and community sector**. We also urge projects to commit to **the long haul** - at least three years, preferably five, to deliver their project, with an explicit aim of making their work self-sustaining after they leave/find ways to keep engaging on the issue and supporting communities to self-organise. One way this could work is using schools and **community spaces** as hubs for further sensor deployment, with training attached to these spaces. Trusted institutions with connections to carers/parents and low socio-economic groups, they are ideal candidates, although this needs to be supported with **finances to fund facilitation staff** (as these organisations are already overstretched). In non-pandemic times, and in addition to pre-planned online **recruitment**, strategic partnerships and TV/Radio, project teams had planned to recruit individuals in **non-conventional spaces** (e.g., pubs, cafes, places of worship and on the street, etc), and to spend more time developing in-person opportunities with marginalised communities through community workers. However, it is unlikely to have diversified the audience due to lack of time, space and facilitation. Given the nature of this project, one more condition would be needed for a democratic process - **technology-free opportunities for involvement**, should technology have been an insurmountable barrier. On a related point, to further the advancement of citizen science *with the people*, **it is imperative that discomfort is surmounted by project staff to capture demographic data**; otherwise, how will we ever know whether we are supporting those most impacted by and vulnerable to air pollution and traffic issues.

After communication channels have been exhausted, the key is to **make the project ""sticky**" enough to elicit and sustain significant effort over the long term" (Kobori et al. 2016, p13). While hypothesised in 1949, the idea still holds that participation consists of a small share of citizens contributing the most, while many contribute little (Zipf, 1949). Luckily in an age where data points can be connected and knowledge shared freely over the internet, those little contributions end up supporting the whole with far greater efficiency. Having **a tangible hook, that was relevant to people's everyday lives with opportunity for periodic workshops, kept people motivated** in between times when people cannot meet. Although '**reward**' was not openly expressed by more

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active citizens as something they needed, staff found ways to **thank all citizens** (e.g., beer, cake, an end-of-project celebration). In Cardiff, they will also be sharing a booklet with each counter, detailing what their individual sensor collected and how that contributed to the project. Both reward and **feedback** are seen by Kobori et al. (2016) to sustain engagement of more active citizens. Considering counter retention was high, when typically, dropout rates in online education projects are high (Gregori et al. 2018), it appears that WeCount has created the conditions to make it stick.

8.2.2 Accuracy, agency, power

What is less well documented in the citizen science research is the role **trust** and **responsibility** as the locus of power starts to shift towards citizens. When they are the ones generating data and getting to know the technology, trust starts to be questioned, perhaps more critically. This is a very interesting avenue for further research, and one seen positively as citizens are showing signs they do not have blind faith. While we have found that enjoyment is correlated to trust in data accuracy, having citizens that are not 100% positive is not necessarily a bad thing – the best scientists after all are often those with a healthy dose of scepticism. Meanwhile, individual and collective responsibility starts to be debated. For those used to the older model of citizen science, where citizens collect data for scientists, the idea of taking action seemed preposterous. It should be the role of the scientists to do this, they claim. Even if they were to act, they say, they would not know where to start. Ultimately, we all have a role to play, however for some they may not have realised their potential. Thus, alongside all the planned activities for participatory co-designed citizen science projects, **training and debate around data accuracy, agency and power** (the latter two themes are covered in community organiser training) **is required to equip citizens with the skills and knowledge they need to self-organise**. This echoes the National Academies report (2018) that suggests learning is more likely to take place when projects are designed with learning outcomes in mind – if you want greater scientific literacy and more local champions in the population, you need to consider the training required to allow these to flourish. Lastly, while of course some actions are more effective, and need to be communicated as such, **scientists and practitioners need to value all contributions equally**, as it may not be possible for some citizens to step up into the leadership roles we are describing. Activism takes many forms and we should honour each effort that is made. And given that co-designed citizen science places each person on an equal footing, equal attention also needs to be given to the **cultural education of participating scientists** (Riggs 2005). For example, communities not exposed to higher education will not be used to PowerPoints, online meetings or technical language. According to Kawagley et al. (1998) indigenous (aka people not exposed to science but are intimately connected to the landscape) education requires employing "modelling and guided practice, and that cooperative learning, peer tutoring, and hands-on learning are essential strategies," (p137). Examples throughout the WeCount case studies highlight this approach, although these strategies may have been more prominent if there was not a global Pandemic to contend with.

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Keys to success in participatory citizen science processes

Phase 1: Foundations

Commit to the long haul: at least three years, preferably longer.

Aim to make efforts self-sustaining: once project ends/find ways to continue.

Collaborate: its ingredients being time, space and facilitation. Work closely with more active citizens and stakeholders for new avenues of exploration and greater opportunity to expand the network (including to poorer communities).

Recruit broad and narrow: make use of conventional media and social media, strategic partnerships with local government and community workers, and unconventional spaces (pubs, cafes, places of worship, the street, etc). Work with local active individuals/groups to spread the message of the project.

Provide technology-free opportunities for involvement: should technology have been an insurmountable barrier. I.e. analogue sensing.

Develop hubs within the network: by working with schools and community spaces for further sensor deployment and training. Support with finances to fund facilitation staff and cover expenses.

Phase 2: Train citizens and scientists

In community organising: to explore issues around power, agency, civil rights and collective action with citizens and scientists. Target areas with an established voluntary and community sector.

In technicalities, with doorstep assistance: to support those less confident with technology. Where possible, encourage peer tutoring.

In scientific literacy: for citizens on data accuracy and topical knowledge, as well as for project team in terms of the need to capture demographic data, and how to capture it. Involve citizens in evaluation.

In cultural awareness: of participating scientists and citizens to understand how to engage different audiences. For example, communities not exposed to higher education will not be used to PowerPoints, online meetings or technical language.

Phase 3: Make the project sticky

Hook people in with something tangible: that is relevant to their everyday lives.

Celebrate contributions: individual and collective, big or small, communicating achievements and failures back to communities so they can be inspired by role models.

Reward: with beer, cake, impact booklets or whatever is most relevant to the audience.

Blend: offer periodic online workshops together with in-person kick-off and wrap up events.

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9 Conclusions

> *The most effective programs will engage community members as active participants in every aspect of the scientific process: defining the research questions, collecting and analysing the data, and translating scientific insights into policy decisions and actions. Such programs will also connect scientific questions and practices to community priorities, values, and norms*
> (p312, Pandya, 2012)

A total of **1,988 people** registered interest across the five case studies. After a selection process, 27% of all registered citizens became members of one of the networks. They were mainly <16 (29% of participants) and 35-49 years old (28%) which shows WeCount was able to attract a **younger demographic than most citizen science projects**. WeCount citizen scientists were **highly educated** (82%) and there was a **nearly perfect split of males (51%) and females (49%)** participants in the project.

Across Madrid/Barcelona, Leuven, Cardiff, Dublin and Ljubljana a total of **52 events** and workshops took place, most of these were online. These events and workshops engaged a total of **843 citizens across Europe**. Overall, the workshops were well received and well rated by the citizens scientists, who found their input was valued and largely felt capable of installing a Telraam after the relevant session. Citizens also felt capable of understanding the Telraam data and reported strengthened in knowledge. The majority of workshop participants felt better able to act based on the data.

Overall, the main motivations for citizens to get involved in WeCount were **an interest in sustainable mobility** (22%) and to **contribute to research** (21%). **Expectations of the project were largely met**, with 67% saying they were met 'extremely' or 'very' well. Overall, 75% saw some **improvement in their knowledge** and 10% of WeCount participants acted after seeing traffic sensor data. This means participating in WeCount has generated **24 individual actions**. Almost half (48%) of citizens plan on using the data after the project ends.

WeCount was able to reach and sustain engagement with a broad transect of society, with Telraam acting as a constant reminder to citizens to look at the data and stay curious about what data others in the network were capturing. It was a talking point for families, another tool in the toolbox for activists and an opportunity to feel as though citizens were contributing to something bigger than themselves. The sensor is low cost and open access (like stipulated in the grant agreement), and is being refined, in response to citizens feedback to improve installation, design and accuracy. Alternatives have been explored for non-tech users (e.g., strawberry plants, facilitated discussions looking at the data, awareness-raising roles create for citizens) and will need greater attention in future iterations.

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11 Evaluation Toolkit

11.1 Information Sheet (project)

Case Study Lead Contact details

e.g., Professor Enda Hayes
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WeCount: Citizens Observing Urban Transport

You are being invited to take part in this project and research study as a resident of Cardiff. Please do ask us if there is anything that is not clear or if you would like more information, using the details above.

WeCount is a citizen science project, providing citizens with the tools to measure traffic and footfall on your street.

You will be asked to install a Telraam device on your window, which will count traffic passing by your house/workplace. The Telraam device data is compiled from five cities across Europe: Cardiff, Dublin, Leuven, Ljubljana, and Madrid. Data from the device does not store any visual information on your street or specific location and will be stored on a secure server meeting EU General Data Protection Regulation (GDPR) conditions. We do not foresee any risks from participating in this project.

Each city will then use this data to discuss traffic issues relevant to each city. This may include car vs bike traffic, traffic speed, air pollution, and road improvements for active mobility.

You will be asked to take part in up to three (online) workshops discussing with other participants about your experience and opinions on traffic on your street, as well as how you found using the Telraam device. The workshops will take 1-2 hours and will be 6 months apart; the workshops will be audio recorded. You will also be asked to give your opinions on participation in the project through online surveys.

All personal details will be stored securely and separately to your opinions according to the GDPR code. Your personal comments will not be identifiable to you and will be grouped thematically with other participants for reporting. Overall outcomes from the project will be published in reports to the European Commission, on the WeCount website, in academic journals and conferences, and through wider media.

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and asked to give your consent regarding the use of the information that you provide. If you decide to take part, you are still free to withdraw up until the city case study closes.

Thank you for your time.

This study was given ethics consent by the Faculty Research Ethics Committee of the University of the West of England, UK, on behalf of the European Commission: researchethics@uwe.ac.uk

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11.2 Information Sheet (Interviews)

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WeCount: Citizens Observing Urban Transport

You are being invited to take part in this research interview as a community member. Please do ask us if there is anything that is not clear or if you would like more information, using the details above.

WeCount is a citizen science project, providing citizens with the tools to measure traffic and footfall on your street.

You will be asked to take part in up to two interviews and possibly complete a reflective log about your experience and opinions on running the Telraam devices and city case study. The interviews will take half an hour and will be 6 months apart; the interviews will be audio recorded. Reflective logs will be sent to you via email.

Your personal comments will not be identifiable to you and will be grouped thematically with other participants for reporting. All personal details will be stored securely and separately to your opinions according to the GDPR code. Overall outcomes from the project will be published in reports to the European Commission, on the WeCount website, in academic journals and conferences, and through wider media.

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and asked to sign a consent form regarding the use of the information that you provide. If you decide to take part, you are still free to withdraw up until May 2021 when we start report writing.

Thank you for your time.

This study was given ethics consent by the Faculty Research Ethics Committee of the University of the West of England, UK, on behalf of the EU Commission: researchethics@uwe.ac.uk

The WeCount Project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 872743

11.3 Interview schedule (citizens)

Thank you very much for agreeing to participate in this interview. It won't take very long, and I'd appreciate it if you could be as honest as possible regarding your views and thoughts about the WeCount project. There are no right, or wrong answers and we are really interested in capturing your thoughts and views.

Let's start by thinking about your involvement in the WeCount project. Which of the following best describes your involvement?

→ I am counting traffic with a Telraam (go to section A)

→ I am counting traffic/collecting data without a Telraam (go to section B)

→ I am a local champion (go to section C)

→ I took part in an event but don't have a Telraam (go to section D)

→ I am involved as a professional stakeholder (go to section E)

--- SECTION A ---

For counting citizens (with a Telraam/manual counting)

1. Can you please explain how you originally got involved in the WeCount project? What motivated you to be a part of WeCount?

2. Overall, how have you found it being involved? Has it lived up to your expectations?

3. And what have been some of your highlights? The most positive aspects of being involved?

4. From your experience, what aspects of the project do you think could be improved? (e.g., technology, communication)

5. What has been your experience been of using the digital technology? (e.g., the Telraam devise, website and dashboard)

6. What did you think of the data you found?

   Do you hope to do anything with the data? (Please explain)

7. How active around traffic-related issues in your street/neighbourhood would you say you were before WeCount?

8. Has your involvement in WeCount changed your level of activity?

   In what way?

9. Has your opinion changed about traffic related-issues in your street or neighbourhood? (please explain)

10. Do you have plans to continue using the Telraam now that the project has ended? (Please explain)

--- GO TO SECTION E ---

--- SECTION B ---

For involved citizens (without a Telraam)

1. Can you please explain how you originally got involved in the WeCount project? What motivated you to be a part of WeCount?

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2. In what ways were you involved in the project?

3. Overall, how have you found it being involved? Has the project lived up to those expectations?

4. And what have been some of your highlights? The most positive aspects of being involved?

5. From your experience, what aspects of the project do you think could be improved?

6. Can you explain why you didn't have a Telraam?

7. Did you find out about the data collected from your area?

(If yes,) …What did you think?

Do you hope to do anything with the data? (Please explain answer)

8. How active around traffic-related issues in your street/neighbourhood would you say you were before WeCount?

9. Has your involvement in WeCount changed your level of activity?

In what way?

10. Has your opinion changed about traffic related-issues in your street or neighbourhood? (Please explain)

11. Do you plan to remain involved in local action on traffic-related issues (or similar) now that the project has ended? (Please explain)

--- GO TO SECTION E ---

--- SECTION C ---

Questions for local champions

1. Can you please explain how you originally got involved in the WeCount project? What motivated you to be a part a local champion?

2. In what ways were you involved in the project (what were your main responsibilities)?

3. Overall, how have you found it being involved? Has the project lived up to those expectations?

4. And what have been some of your highlights? The most positive aspects of being involved?

5. From your experience, what aspects of the project do you think could be improved?

6. What has been your experience been of using the digital technology? (e.g., the Telraam devise, website and dashboard)

7. Did you find out about the data collected from your area?

(If yes,) …What did you think?

Do you hope to do anything with the data? (Please explain answer)

8. How active around traffic-related issues in your street/neighbourhood would you say you were before WeCount?

9. Has your involvement in WeCount changed your level of activity?

In what way?

10. Has your opinion changed about traffic related-issues in your street or neighbourhood? (Please explain)

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11. Do you plan to remain involved in local action on traffic-related issues (or similar) now that the project has ended? (Please explain)

--- GO TO SECTION E ---

--- SECTION D ---

Questions for local policymakers and stakeholders

1. Can you please explain how you originally got involved in the WeCount project? What motivated you to be a part of WeCount?

2. In what ways were you involved in the project?

3. Overall, how have you found it being involved? Has the project lived up to those expectations?

4. And what have been some of your highlights? The most positive aspects of being involved?

5. From your experience, what aspects of the project do you think could be improved?

6. Did you have a Telraam? If no,

    Can you explain why you didn't have one?

    Would you have liked to have had one if you could?

7. Did you find out about the data collected from residents?/what did you find out from your dataset?

    (If yes,) …What did you think?

    Do you hope to do anything with the data? (Please explain answer)

8. How active around traffic-related issues in your street/neighbourhood would you say you were before WeCount?

9. Has your involvement in WeCount changed your level of activity?

    In what way?

10. Has the project influenced your work in any way? (e.g., provided evidence, enhanced community connections, improved understanding, etc)

11. Has your opinion changed about traffic related-issues in your city? (Please explain)

12. Do you plan to remain involved with WeCount (staff, technology) or the citizens involved now that the project has ended? (Please explain)

--- GO TO SECTION E ---

--- SECTION E ---

1. We are almost done, only a few more questions to go.
2. What is your age (in years): 16-24; 25-34; 35-49; 50-64; 65+; Prefer not to say
3. What is your gender: Male; Female; Other; Prefer not to say
4. What is your highest level of education? School leaver certificate; Technical qualifications; Undergraduate degree; Postgraduate degree; Doctoral degree; Prefer not to say
5. Is there anything else you would like to add about the WeCount Project?

Thank you very much for your time and feedback, it's very much appreciated. Have a good day.

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11.4 Interview schedule (WeCount team)

Assign a value from 1 to 5 to each area of impact and to the related dimensions of the WeCount project

(1 is not relevant/we do not expect impact in this area – 5 this is very relevant/was a crucial impact area)

Scientific impact	**Value**
Scientific knowledge	
New research fields and interdisciplinarity	
New knowledge resources	
Innovation in education	

Social impact	**Value**
Community building and empowerment	
Social inclusion	
Researchers and research community's growth and empowerment	
Knowledge, skills and competencies	
Changes in way of thinking, attitudes and values	
Behavioural change	

Political impact	**Value**
Impact on policy process	
Political participation	
Self-governance	
Political support for citizen science	

Economic impact	**Value**
Impact on employment	
Cost saving	
Income and revenue generation for leading organisations	
Economic impact on local communities	

Environmental impact	**Value**
Responsible consumption and production	
Sustainable Cities and Communities	

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Pollution reduction (water, air, soil, etc)	
Conservation of resources	
Restoration of ecosystems and environments	
Climate action	

Interview day

Let's start with a very general question about your involvement in WeCount:

1. Could you please briefly describe your role within WeCount?

Thinking about the project overall:

2. In your opinion, what has worked well?
3. And what didn't work so well?
4. Please would you describe the sort of challenges that you and the local team faced over the past 18 months?
5. Thinking about the impact questions you have filled in: (Read their scores if they need to be reminded)

   A) Which aspect do you think has had the most impact in your city?

   B) And which aspect didn't make a difference?

Moving on, thinking about citizens' engagement:

6. Did you enjoy working with citizens? Why? Why not?
7. Have you learnt anything from engaging with citizens in WeCount?
8. Thinking about citizen's engagement, do you think you have any new skills from being involved in WeCount?

Thinking about monitoring and evaluation:

9. Overall, how do you feel about the evaluation framework and methods? This includes the evaluation templates provided, the online survey, interviews etc.
   a. Based on your experience in WeCount, do you have any suggestions to improve the evaluation framework?
10. Did you enjoy having an Evaluation Mentor? Was this helpful?
11. Did the evaluation framework meet the expectations/objectives of your local situation?

Thinking about the WP2 engagement toolkit:

12. Did you find the engagement toolkit from WP2 useful? Why or why not?
13. What tools did you use, if any?

Thank you for your time.

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11.5 COVID-19 Pandemic – Interview Schedule

Impact of the COVID-19 pandemic in delivering Citizen Science

Please try to capture how you have adapted your plans for WeCount so far. We will get in touch later in the project to capture any additional changes. Be as honest and detailed as possible.

Start by thinking about recruiting participants:

1. Please describe the impacts of the pandemic in recruiting participants for the WeCount project:
2. What did you have to change in terms of your original recruitment strategy?
3. What sorts of approaches have been helpful?
4. What approaches have not been so helpful?
5. What has been your biggest challenge so far?

Thinking about delivering workshops/events:

6. Please describe the impacts of the pandemic in delivering workshops/events:
7. What did you have to change in terms of your original strategy?
8. What sorts of approaches have been helpful?
9. What approaches have not been so helpful?
10. What has been your biggest challenge so far?

Overall and final thoughts in relation to WeCount:

11. Has the pandemic made anything at all easier/simpler?
12. Please add here anything else you think might be relevant.

Thank you for your time!

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11.6 Online survey (citizens)

Note: Online surveys were set up online using Qualtrics. The template shared here showcases the content of the surveys, not the style and formatting.

We would like to evaluate your recent experience with the WeCount project through a few questions, which will take no longer than 15 minutes to complete and will help us improve future projects. We will hold your data securely and confidentially. If you have a Telraam, your views will be linked to your original Telraam information, however all comments will be anonymised and grouped together for reporting so you are not identifiable. Completing this survey indicates that you give consent for this data to be used in this research study.

Thank you for your time.

This study was given ethics consent by the Research Ethics Committee of the University of the West of England, UK. For information on the research please contact margarida.sardo@uwe.ac.uk

Section A: Your involvement

Choose the option that best describe your involvement in WeCount: (L)

I have a Telraam (Counting Citizen) -> go to Questions for counting citizens)

Please provide your Telraam number:

I live in a neighbourhood where traffic counting took place but I don't have a Telraam myself -> go to Questions for involved citizens

I have been facilitating community conversations and championing the project (with or without a Telraam) -> go to questions for local champions

Please provide your Telraam number:

I took part in an event but I don't have a Telraam

I am not involved as a citizen but as a professional stakeholder (researcher, member of the Council, etc) and took part in some events -> go to questions for 'stakeholders' (local policy makers and stakeholders, techies and local geeks)

Section B: questions for different participant groups

Questions for Counting Citizens

About the WeCount project:

What motivated you originally to participate in the WeCount project? (L)

I wanted to count traffic

I wanted to contribute to research

I want to make a difference in my local area

I am interested in sustainable mobility in general

I am interested in technology for good

I am interested in the science/citizen science

My neighbour/family asked me personally/told me about it

Other. Please specify:_____

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Overall, how would you rate your experience in the WeCount project: (L)

Excellent (5); Very Good (4); Good (3); Not good (2); Not good at all (1)

What was your favourite aspect about being involved in the WeCount project? (Tick all that apply) (L)

Meeting my neighbours

Working collectively to solve problems

Being part of a research project

Feeling as though I am making a difference

Using technology for good

Gathering evidence to support my campaigning

Not applicable

Other (please state)

What aspect about being involved in the WeCount project would you improve? (L)

Communication with project team

Coordination of the activities

Reduce the amount of work required

Provide more ways to be involved

Make it easier to understand the data

A mechanism to show if our efforts were successful/impactful

Other (please state):

_____

How well would you say were your expectations met? (L)

Very well (5); Quite well (4); Okay (3); Not well (2); Not at all (1)

Please explain your answer: _____

In your opinion, has participating in WeCount improved your knowledge about: (L)

	No improvement at all (1)	**Little improvement (2)**	**Some improvement (3)**	**A lot of improvement (4)**	**Extreme improvement at all (5)**

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Traffic and mobility in general					
Traffic in your street/neighbourhood: where problems are, where are bottlenecks, where can we find good examples, etc.					
The impact of traffic on air quality and traffic safety					
How you can take action about traffic in your area					

How much action would you say you are currently taking with regards to traffic issues in your local area? (This can include talking about the issues to friends or Councillors, campaigning, distributing flyers, hosting events, or other activities) (L)

Extremely active (5); A lot of action (4); Some action (3); A little action (2); No action (1)

Please add your Telraam number here:_____ (L)

Is your Telraam currently still counting? (L)

1 Yes; 2 No; 3 I don't know

If not, why did you stop counting? (L)

1 Technical issues that I could not solve myself

2 I didn't want to be involved anymore (please explain)_____

Other reasons _____

Do you think the Telraam sensor is accurately capturing traffic numbers in your street?

Yes; Mostly; Mostly not; No; Don't know

Please explain:

In general, how satisfied are you with: (L)

	Did not make use of it (0)	**Not satisfied at all (1)**	**Not very satisfied (3)**	**Satisfied (3)**	**Very satisfied (4)**	**Extremely satisfied (5)**
The instructions on the Telraam website during registration						
The online support by the Telraam-team: FAQ-articles						
The online support by the Telraam-team: helpdesk						

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Help from a neighbour, friend, family						
Help on social media (Facebook, Twitter)						

How often do you look at the Telraam dashboard with the traffic data of your and other Telraams? (L)

I look at the data more than once a week

I look at the data only a few times a month

I look at the data only now and then

I looked at first but then stopped looking after some time

I have never looked at the data

In the Telraam toolkit you may have received printed materials in addition to your Telraam. How useful were these add-ons for you?

- Letter worth explanation about the project and tips to take action

Very useful; Somewhat useful; Not really useful; Not useful at all; Did not use; NA

- Flyers for your neighbours

Very useful; Somewhat useful; Not really useful; Not useful at all; Did not use; NA

- Poster 'here I count' to put at your window

Very useful; Somewhat useful; Not really useful; Not useful at all; Did not use; NA

Do you have any suggestion to make this toolkit better? --------

How do you rate the following data sources? (L)

	Rating scale (1-5) 0 Did not use **1 very poor; 2 poor, 3 ok; 4 good; 5 very good**
Own data on the map on www.telraam.net	
Own data in the excel on my dashboard	
All data on the map on www.telraam.net	
The Telraam Api: https://telraam-api.net/	
Background information on the FAQ (e.g., how the classification work): https://telraam.zendesk.com/hc/nl	

Thinking about the WeCount/Telraam data for your street or area: (L)

It surprised me a lot; It surprised me a little; It was what I expected; Not applicable/ didn't look at the data

Please explain your choice:_____

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Has WeCount changed your overall opinions about traffic-related issues?

	No (1)	My opinion changed a little (2)	My opinion changed a lot (3)
In your street			
In your neighbourhood			

Has your involvement in WeCount changed how you feel about where you live?

Yes/No

Please explain...

Did you take any action based on Telraam data?

Yes; No; Not yet, but I am thinking about it.

If yes, please state what action:

Now that the project has ended, will you continue to work with the WeCount data and/or research team:

Yes; No; Not sure yet

If you have anything to add about the WeCount project please add your comments here:

Thank you.

Questions for Involved Citizens

About the WeCount project:

What motivated you originally to participate in the WeCount project? (L)

I wanted to count traffic

I wanted to contribute to research

I want to make a difference in my local area

I am interested in sustainable mobility in general

I am interested in technology for good

I am interested in the science/citizen science

My neighbour/family asked me personally/told me about it

Other. Please specify:_____

Overall, how would you rate your experience in the WeCount project: (L)

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Excellent (5); Very Good (4); Good (3); Not good (2); Not good at all (1)

What was your favourite aspect about being involved in the WeCount project? (Tick all that apply) (L)

Meeting my neighbours

Working collectively to solve problems

Being part of a research project

Feeling as though I am making a difference

Using technology for good

Gathering evidence to support my campaigning

Not applicable

Other (please state)

What aspect about being involved in the WeCount project would you improve? (L)

Communication with project team

Coordination of the activities

Reduce the amount of work required

Provide more ways to be involved

Make it easier to understand the data

A mechanism to show if our efforts were successful/impactful

Other (please state):

_____

How well would you say were your expectations met? (L)

Very well (5); Quite well (4); Okay (3); Not well (2); Not at all (1)

Please explain your answer: _____

In your opinion, has participating in WeCount improved your knowledge about: (L)

	No improvement at all (1)	**Little improvement (2)**	**Some improvement (3)**	**A lot of improvement (4)**	**Extreme improvement at all (5)**
Traffic and mobility in general					
Traffic in your street/neighbourhood: where					

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problems are, where are bottlenecks, where can we find good examples, etc.					
The impact of traffic on air quality and traffic safety					
How you can take action about traffic in your area					

How much action would you say you are currently taking with regards to traffic issues in your local area? (This can include talking about the issues to friends or Councillors, campaigning, flyering, hosting events, or other activities) (L)

Extremely active (5); A lot of action (4); Some action (3); A little action (2); No action (1)

How were you involved in the WeCount project?

I counted manually; I attended a workshop or event; Other, please state

Why did you not have a Telraam?

Window not suitable

Not interested in the technology

Data privacy concerns

I don't think I would be able to install it / I'm no good with technology

There is no Telraam network active in the place where I live

Other, please state

Did you find out about the data collected from your area?

Yes/No

(If yes) What did you think about the findings?

It surprised me a lot

It surprised me a little

It was what I expected

Not applicable/ didn't look at the data

(If yes to above) Did you take any action based on Telraam data?

Yes; No; Not yet, but I am thinking about it.

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If yes, please state what action:

Has WeCount changed your overall opinions about traffic-related issues?

	No (1)	**My opinion changed a little (2)**	**My opinion changed a lot (3)**
In your street			
In your neighbourhood			

Has your involvement in WeCount changed how you feel about where you live?

Yes/No

Please explain...

Now that the project has ended, will you continue to work with the WeCount data and/or research team:

Yes; No; Not sure yet

If you have anything to add about the WeCount project please add your comments here:

Thank you!

Questions for Local Champions

What motivated you originally to participate in the WeCount project? (L)

I wanted to count traffic

I wanted to contribute to research

I want to make a difference in my local area

I am interested in sustainable mobility in general

I am interested in technology for good

I am interested in the science/citizen science

My neighbour/family asked me personally/told me about it

Other. Please specify:_____

Overall, how would you rate your experience in the WeCount project: (L)

Excellent (5); Very Good (4); Good (3); Not good (2); Not good at all (1)

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What was your favourite aspect about being involved in the WeCount project? (Tick all that apply) (L)

Meeting my neighbours

Working collectively to solve problems

Being part of a research project

Feeling as though I am making a difference

Using technology for good

Gathering evidence to support my campaigning

Not applicable

Other (please state)

What aspect about being involved in the WeCount project would you improve? (L)

Communication with project team

Coordination of the activities

Reduce the amount of work required

Provide more ways to be involved

Make it easier to understand the data

A mechanism to show if our efforts were successful/impactful

Other (please state): _____

How well would you say were your expectations met? (L)

Very well (5); Quite well (4); Okay (3); Not well (2); Not at all (1)

Please explain your answer: _____

In your opinion, has participating in WeCount improved your knowledge about: (L)

	No improvement at all (1)	**Little improvement (2)**	**Some improvement (3)**	**A lot of improvement (4)**	**Extreme improvement at all (5)**
Traffic and mobility in general					
Traffic in your street/neighbourhood: where problems are, where are bottlenecks, where can we find good examples, etc.					
The impact of traffic on air quality and traffic safety					

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How you can take action about traffic in your area					

How much action would you say you are currently taking with regards to traffic issues in your local area? (This can include talking about the issues to friends or Councillors, campaigning, flyering, hosting events, or other activities) (L)

Extremely active (5); A lot of action (4); Some action (3); A little action (2); No action (1)

What is your Telraam number?

…

I didn't have a Telraam

How did you become a local champion for WeCount? (L)

It emerged organically during the project

I put my name forward

A friend put my name forward

I was approached by a member of the project team

Other (please explain)

What were your main responsibilities? (L)

Spreading awareness

Encouraging others to have a Telraam

Organising local events

Providing technical assistance to people with a Telraam

Other (please explain)

Do you plan to continue as a local champion now that the project is over?

Yes; No; Not sure

Please explain

Thinking about the WeCount/Telraam data for your street or area:

It surprised me a lot

It surprised me a little

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It was what I expected

Not applicable/ didn't look at the data

Please explain your choice:_____

Has WeCount changed your overall opinions about traffic-related issues?

	No (1)	**My opinion changed a little (2)**	**My opinion changed a lot (3)**
In your street			
In your neighbourhood			

Has your involvement in WeCount changed how you feel about where you live?

Yes/No

Please explain...

Did you take any action based on Telraam data?

Yes; No; Not yet, but I am thinking about it.

If yes, please state what action:

Now that the project has ended, will you continue to work with the WeCount data and/or project team:

Yes; No; Not sure yet

If you have anything to add about the WeCount project please add your comments here:

Thank you.

Questions for Local policymakers & stakeholders

What is your area of work?

Policy

Planning

Research

Business

Other (please explain) ….....

In what ways did you interact with the WeCount project?

I attended public events/workshops

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I attended consortium/project meetings

I connected with local participants for my own research/professional interests

I connected the team with local contacts

Other (please explain)

How has the project influenced your work?

Greater community connections

Greater professional connections

It has provided me with evidence to support my work

It has improved my understanding of traffic-related issues

I have shared the projects findings with colleagues

Anything else, please add here:

Now that the project has ended, will you continue to work with the WeCount data and/or project team:

Yes; No; Not sure yet

Did you take any action based on the WeCount findings?

Yes/no

Please explain ….

If you have anything to add about the WeCount project please add your comments here:

Thank you.

Questions for Professionals, Techies & local geeks

What motivated you originally to participate in the WeCount project? (L)

I wanted to count traffic

I wanted to contribute to research

I want to make a difference in my local area

I am interested in sustainable mobility in general

I am interested in technology for good

I am interested in the science/citizen science

My neighbour/family asked me personally/told me about it

Other. Please specify:_____

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Overall, how would you rate your experience in the WeCount project: (L)

Excellent (5); Very Good (4); Good (3); Not good (2); Not good at all (1)

What was your favourite aspect about being involved in the WeCount project? (Tick all that apply) (L)

Meeting my neighbours

Working collectively to solve problems

Being part of a research project

Feeling as though I am making a difference

Using technology for good

Gathering evidence to support my campaigning

Not applicable

Other (please state)

What aspect about being involved in the WeCount project would you improve? (L)

Communication with project team

Coordination of the activities

Reduce the amount of work required

Provide more ways to be involved

Make it easier to understand the data

A mechanism to show if our efforts were successful/impactful

Other (please state):

_____

How well would you say were your expectations met? (L)

Very well (5); Quite well (4); Okay (3); Not well (2); Not at all (1)

Please explain your answer: _____

In your opinion, has participating in WeCount improved your knowledge about: (L)

	No improvement at all (1)	**Little improvement (2)**	**Some improvement (3)**	**A lot of improvement (4)**	**Extreme improvement at all (5)**
Traffic and mobility in general					

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Traffic in your street/neighbourhood: where problems are, where are bottlenecks, where can we find good examples, etc.					
The impact of traffic on air quality and traffic safety					
How you can take action about traffic in your area					

How much action would you say you are currently taking with regards to traffic issues in your local area? (This can include talking about the issues to friends or Councillors, campaigning, flyering, hosting events, or other activities) (L)

Extremely active(5); A lot of action (4); Some action (3); A little action (2); No action (1)

In what ways did you interact with the WeCount project (tick all that apply)?

I offered technical support

I attended a WeCount event

I helped to hack the data

I provided industry connections

I used Telraam data (api) to create an application (or something else?)

Other (please state):

Has WeCount changed your overall opinions about traffic-related issues?

	No (1)	**My opinion changed a little (2)**	**My opinion changed a lot (3)**
In your street			
In your neighbourhood			

Now that the project has ended, will you continue to work with the WeCount data and/or research team:

Yes; No; Not sure yet

If you have anything to add about the WeCount project please add your comments here:

FOR ALL SURVEYS: Section C: About you

Age (year): (L)

1 16-24

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2 25-34

3 35-49

4 50-64

5 65+

6 Prefer not to say

Gender: (L)

1 Male; 2 Female; 3 Other; 4 Prefer not to say

What is your highest level of education? (L)

1 School leaver certificate; 2 Technical qualifications; 3 Undergraduate degree; 4 Postgraduate degree; 5 Doctoral degree; 6 Prefer not to say

We might be conducting additional telephone/online interviews to collect feedback from participants. If you're interested in being interviewed, please leave your email address below:

Thank you for your time and feedback.

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11.7 Self-Reflective log template

Guidance:

1. Take a look at this reflective log **ahead** of your workshop/event.

2. **After you finish** your workshop or event (after participants leave), take 15 min to reflect on how it went. Please log in to your email account or laptop, etc. and complete the self-reflective log.

3. Send your reflections via email to your WP5 Mentor. You will receive a reminder if you forget, don't worry.

4. Please complete the template in English.

5. Please avoid printing the log and filling it in by hand, as it's much harder to extract data from it.

Template:

<table>
<tr><td colspan="5"><u>General information</u></td></tr>
<tr><td colspan="5">Event name:

Location:

Date:

Time:

Brief event description (type of workshop/event, duration, online or face-to-face, etc.):

Communication channel(s) used to reach participants:

If face-to-face: Brief description of your venue (venue type, atmosphere, etc.):</td></tr>
<tr><td colspan="5">Why did people want a Telraam?</td></tr>
<tr><td>People use my area as a rat run</td><td>Our community is not safe</td><td>I want to monitor cars speeding</td><td>I want to get an idea of local air quality</td><td>I love tech</td></tr>
<tr><td>I want to encourage cyclists</td><td>I want to encourage walkers</td><td>I will use the data to lobby local policymakers</td><td>I will use the data for my school or group</td><td></td></tr>
<tr><td colspan="5"><u>Strengths - What went well?</u></td></tr>
<tr><td colspan="5"><u>Weaknesses - What didn't go so well?</u></td></tr>
</table>

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Improvements - In your opinion how could the event be improved? What could you have done differently?
Engagement - How easy or difficult was it to engage with the participants? (Reflect only on those that apply to your activity) 1. Talk to your participants 2. Get the participants to talk to you 3. To get participants to do the activity
Were the participants knowledgeable? What kinds of knowledge or understanding of the topic did they have?
Please add any other thoughts, comments or reflections about the event.

12 ESeC class

ESeC Class	Common Term	Employment regulation
1	Large employers, higher grade professional, administrative and managerial occupations	Higher salariat
2	Lower grade professional, administrative and managerial occupations and higher-grade technician and supervisory occupations	Lower salariat
3	Intermediate occupations	Higher-grade white-collar workers
4	Small employer and self-employed occupations (exc agriculture etc.)	Petit bourgeoisie or independents
5	Self-employed occupations (agriculture etc.)	Petit bourgeoisie or independents
6	Lower supervisory and lower technician occupations	Higher-grade blue-collar workers
7	Lower services, sales and clerical occupations	Lower-grade white-collar workers
8	Lower technical occupations	Skilled workers
9	Routine occupations	Semi- and non-skilled workers
10	Never worked and long-term unemployed	Unemployed

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13 Reference list for Table 5

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