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In-situ assessment report of citizen local interactions and self-reporting GEAR cycle 3

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Crowd4SDG

Citizen Science for the Sustainable Development Goals

Deliverable 4.5

In-situ assessment report of citizen local interactions and self-reporting GEAR cycle 3

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Abstract:

In this report, we present a data-driven approach leveraging digital traces to monitor metrics pertaining to the diversity, collaboration and activity of teams in the context of the GEAR cycle 3. We collected compositional and organizational data from 11 participating teams from different sources: communication data from public Slack channels, surveys, and self-reported activity data from CoSo (Collaborative Sonar), a digital platform for monitoring team collaborations and task management. Using social network analyses, we show how the relations between team members evolve both at the level of the team (intra), across boundaries with other teams (inter) and with the organizing team. Finally, we highlight how these measures can be useful for monitoring performance, a question we explore further in deliverable D4.7. We conclude that measures of team composition, activity and collaborations can be leveraged to monitor the collaborative processes during the GEAR cycle 3, highlighting their usefulness in the context of the Crowd4SDG project and similar initiatives leveraging Citizen Science to address the SDGs.

For more information on Crowd4SDG, please check: <http://www.crowd4sdg.eu/>





Document history

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Project Partners

	Partner name	Acronym	Country
1	Université de Genève	UNIGE	CH
2	European Organization for Nuclear Research	CERN	CH
3	Agencia Estatal Consejo Superior de Investigaciones Científicas	CSIC	ES
4	Politecnico di Milano	POLIMI	IT
5	United Nations Institute for Training and Research	UNITAR	CH
6	Université Paris Cité	UPC	FR



Crowd4SDG in brief

The 17 Sustainable Development Goals (SDGs), launched by the UN in 2015, are underpinned by 169 concrete targets and [231 unique measurable indicators](#). Some of these indicators initially had no established measurement methodology. For others, many countries do not have the data collection capacity. Measuring progress towards the SDGs is thus a challenge for most National Statistical Offices.

The goal of the Crowd4SDG project is to research the extent to which Citizen Science (CS) can provide an essential source of non-traditional data for tracking progress towards the SDGs, as well as the ability of CS to generate social innovations that enable such progress. Based on shared expertise in crowdsourcing for disaster response, the transdisciplinary Crowd4SDG consortium of six partners is focusing on SDG 13, Climate Action, to explore new ways of applying CS for monitoring the impacts of extreme climate events and strengthening the resilience of communities to climate related disasters.

To achieve this goal, Crowd4SDG is initiating research on the applications of artificial intelligence and machine learning to enhance CS and explore the use of social media and other non-traditional data sources for more effective monitoring of SDGs by citizens. Crowd4SDG is using direct channels through consortium partner UNITAR to provide National Statistical Offices (NSOs) with recommendations on best practices for generating and exploiting CS data for tracking the SDGs.

To this end, Crowd4SDG rigorously assesses the quality of the scientific knowledge and usefulness of practical innovations occurring when teams develop new CS projects focusing on climate action. This occurs through three annual challenge based innovation events, involving online and in-person coaching. A wide range of stakeholders, from the UN, governments, the private sector, NGOs, academia, innovation incubators, and maker spaces are involved in advising the project and exploiting the scientific knowledge and technical innovations that it generates.

Crowd4SDG has six work packages. Besides Project Management (UNIGE) and Dissemination & Outreach (CERN), the project features work packages on: Enhancing CS Tools (CSIC, POLIMI) with AI and social media analysis features, to improve data quality and deliberation processes in CS; New Metrics for CS (UP), to track and improve innovation in CS project coaching events; Impact Assessment of CS (UNITAR) with a focus on the requirements of NSOs as end-users of CS data for SDG monitoring. At the core of the project is Project Deployment (UNIGE) based on a novel innovation cycle called GEAR (Gather, Evaluate, Accelerate, Refine), which runs once a year.

The GEAR cycles involve online selection and coaching of citizen-generated ideas for climate action, using the UNIGE Open Seventeen Challenge (O17) coaching programme. The most promising projects are accelerated during a two-week in-person Challenge-Based Innovation (CBI) course. Top projects receive further support at annual SDG conferences hosted at partner sites. GEAR cycles focus on specific aspects of Climate Action connected with other SDGs like Gender Equality.

Grant Agreement description of the deliverable

The focus of Work Package 4 (WP4), led by the University of Paris, is to conduct research on Citizen Science. This encompasses the establishment of methods and the collection of data to inform the development of effective, high-quality citizen science projects. To that aim, this work package develops metrics and statistical models in order to assess the many-faceted outcomes of the citizen science projects developed within the Crowd4SDG consortium.

By leveraging the digital traces from online tools that document project progress and citizen engagement, it is possible to quantitatively monitor and analyse i) the activity of teams working within the GEAR collaborative framework, and ii) the activity and engagement patterns of citizen science participants. As such, we propose to frame the participants' behaviour, their interactions and engagement with tools used during the GEAR cycles.

We highlight in bold what this deliverable addresses among the tasks of WP4.

T4.2: Measuring analytics of citizen collaborations using new metrics/descriptors on digital traces (UP, UNIGE)

The epistemological analysis performed in Task 4.1 provides the conceptual foundation for specific new metrics and descriptors for Citizen Science. While individual learning progress can be monitored in a straightforward manner by the increase in relative level of expertise on specific keywords/topics (see, for example, the iLearn project at CRI), it remains unclear how such insights can be generalised to assess overall learning progress achieved in specific challenges/projects and the entire scope of projects initiated within the scope of Crowd4SDG. For this reason, this Task will **develop and implement new metrics and descriptors that not only measure productivity and output, but also assess the overall learning and research dynamics as well as the diversity, originality, relevance, robustness, and adaptiveness of the knowledge produced in the context of each individual citizen-innovation team as well as the entire group of citizen-participants across all CS projects within Crowd4SDG**. The work involves the development of specific algorithms based on a fundamental discussion of the kind of knowledge Citizen Science is expected to produce and whether/how it differs from knowledge produced by conventional scientific approaches (see Task 4.1). In the proposed project, participants will have access to and assess—in a distributed, large-scale manner—the local impact of the Crowd4SDG programme. By **monitoring the activity patterns of participants** when they use the Citizen Science Solution Kit (examples: project documentations of SDG in Progress or the community management solutions of CrowdBuilder) to **conduct real time analyses of the collaboration within the teams, we can frame the participants' behaviour, their interactions and engagement within the O17 Challenges that form part of the project**.

These digital traces will be used to explore the previously defined metrics of citizen science quality. The work in this task will build upon previous work by the partners. Using data from the various tools offered by the CS Solution Kit (see section 1.3.4.2), namely SDG in Progress and Pybossa, we will, in a similar manner, quantify team diversity (skills and backgrounds), dynamics (bursts of activity), organisational structure (core-periphery network structure and leadership dynamics), as well as the influence of physical meetups on team activity.

T4.3: In-situ assessment of citizen local interactions and self-reporting (UPD, UNIGE)

In this Task a self-report smartphone application will be developed in order to be able to **establish deeper insights into collaboration dynamics**. The app will be able to assess social proximity through smartphone sensors (Bluetooth, Wi-Fi and GPS) and trigger context-based

notifications. We intend to use this app to provide fine-grained measurements of citizen collaborative dynamics, both in terms of social network dynamics and in terms of learning experience through the self-reporting contextualisation it offers. The application will be based on an open-source platform developed by researchers at the Child Mind Institute in New York in the context of a large-scale mental health study. Their platform, Mindlogger, is a general-purpose open source data collection platform that can be used by anyone to administer surveys, quizzes or different types of tasks. Proximity-based notifications will be implemented to trigger "Ecological Momentary Assessments" asking individuals to **document the type of interaction they are currently part of, so that we obtain an augmented understanding of the social context. Lastly, we will provide reports that provide insights into network structure and summary statistics.** The reports will be in the form of a dashboard tool based on open source software MITeams. The results of this task will be used for assessing participant interactions during the different phases of the GEAR methodology cycle and thus feed back into WP3. **The self-reporting phone app will be used for the in-person events to be carried out in the Accelerate Phase carried out (see Task 3.2).**

1. Introduction

1.1. Context

WP4 aims to develop and monitor new metrics and develop statistical models of team engagement and collaboration that contribute to the many-faceted outcomes of the citizen science projects developed within the Crowd4SDG consortium over the 3-years course of the project.

The WP4 has two specific objectives:

- Develop **new standardised metrics and descriptors** for measuring the diversity, originality, effectiveness, sustainability/robustness and adaptation/appropriateness of solutions and insights gained from Citizen Science projects.
- Implement the metrics and descriptors as tools to **analyse the digitised records** of Citizen Science collaborations and the solutions and insights they produce.

By doing so, WP4 contributes to the following specific objectives of the Crowd4SDG project:

- SO1.2: “Create CS projects and study the mechanisms that lead to improved citizen science skills and high-quality scientific outcomes”, and
- SO2.2 “Produce economic and social outputs relevant to achieving SDGs through challenge-based CS events, with a special focus on climate change resilience”

In this report, we provide a quantitative assessment of the participant interactions and self-reports during GEAR cycle 3. This report follows in the line of (and completes) previous reports for GEAR 1 ([D4.3](#)) and GEAR 2 ([D4.4](#)). We use digital traces from the Slack workspace, demographic data and self-report surveys to study the communication activity and collaboration of participants, to later examine their impact on the success and quality of citizen science projects. We leverage, in particular, social network analyses to examine centrality measures in communication processes and informal advice networks. We present an integrated statistical modelling framework in the companion deliverable D4.7.

1.2. Changes made compared to the GEAR cycle 1 and GEAR cycle 2

Noticeable differences with the GEAR cycles 1 and 2 had to be taken into account when looking at team diversity, activity, and collaboration in GEAR cycle 3. These differences were the following:

- During GEAR 2, a teaming algorithm was used to form teams among participants who joined as individuals, while some teams came pre-formed (see Deliverable 3.4). In GEAR 3, all teams were formed by the teaming algorithm.
- The Accelerate phase changed its format from a 2-week intensive workshop with daily sessions in GEAR 2 to a 1-day per week workshop during 5 weeks between December and February in GEAR 3.
- The Slack channel of the Accelerate phase was made private during GEAR 2, which did not allow its analysis. It remained public in GEAR 3.

2. Methods

In this section, we describe our data collection strategy for the digital traces (Slack workspace) and self-reports (surveys) that are used to monitor the diversity, collaboration and activity of participants.

2.1. Slack data: team communication

A Slack workspace was used by the teams during the different phases of the GEAR cycles as a means to communicate with other teams and with the organising team. This data source was shown to provide insights on team interactions during GEAR Cycles 1 and 2. Here, we study the “Evaluate” phase, consisting of coaching events and providing the largest team base (11 teams), as well as the “Accelerate” phase, which lasted for 5 weeks and involved 5 teams.

The extracted data consists of:

- User Metadata: This includes data from the workspace members profiles, such as the Slack ID, user name, profile description, timezone, status (admin, bot or others).
- Channel Metadata: This includes the Channel ID, description, creators, members, attributes (is private, is shared) and pinned messages.
- Messages: Each message has an ID, timestamp, sender, text, reactions (users who reacted to the message with an emoticon), and a reference ID to a parent message if it is a part of a thread.

2.2. CoSo data: team activity and collaboration

While Slack allows us to gather information on communication between participating teams and the organising team, it does not encompass the totality of direct information about team activity (division of labour) or collaborations (both formal and informal, such as advice seeking). As in our previous reports for GEAR 1 and 2, we leveraged the newly developed CoSo platform ([Tackx et al., 2021](#)) to disseminate a total of 10 surveys on a weekly basis through Slack and during weekly sessions, with a single sign-in system allowing for seamless data integration (Figure 1). A summary of survey engagement is provided in Table 1. The full surveys were filled in online and can be found in Annex 2.

On CoSo, participants were asked to answer the following questions at the end of each week:

- Who did you collaborate with last week?
- Who did you seek advice from last week?
- How helpful did you find [name of the session]? This question was used for evaluation of the GEAR cycle which results are presented in the D3.4.

In parallel, consortium partners joined forces to co-design a registration survey and a final survey for each phase. These were collected via Google Forms. Results of those forms are presented in the [D3.5 “GEAR report cycle 3”](#).

Reminders were sent on Slack for weekly surveys and via email for the final ones. With the exception of two surveys, the response rate increased since Gear cycle 2 (Table 1), which

confirms the efficacy of our data collection strategy. The results are presented in the [D3.5 "GEAR report cycle 3"](#)

The surveys and research questions received the ethical approval of the Inserm committee attached to the University of Paris team (IRB00003888), in charge of collecting the data. Participants gave their consent to the collection of data as they registered to the Evaluate phase (See Annex 2. Registration Form). Data was pseudonymized by our team before the analysis.



Who are we ?

At Crowd4SDG, we are using surveys for two purposes: improving your experience with the programme, and exploring how activity, interactions, and diversity of teams impact their success. Thank you for helping us to do so! You can find more about it in this [information form](#).

To access the survey, please login using your email and select Participants as a team name.

Team

Select your team

Email (the mail email you gave in the registration form)

Enter your email

Submit

How helpful did you find the session on [name of the session] ?

Did not attend & did not watch the Zoom recording
 Very unhelpful
 Unhelpful
 Neither unhelpful nor helpful
 Helpful
 Very helpful

Who did you seek advice from during the previous block?
Select the persons by name from the list below. You may need to scroll down to see all of them.

Search the participants

Who did you work with since the previous block?
Select collaborators within your team or from other teams. You may need to scroll down to see all of them.

Search the participants

Which task(s) did you perform since the previous block?

- Brainstorming / ideation
- Planning tasks
- Developing protocols / methods
- Reading papers / documents
- Attending meetups with other teams
- Collaborating with other teams
- Interpreting results
- Preparing other documents/materials to share outside the team
- Preparing graphics / videos
- Writing / preparing a pitch
- Project administration
- Software development
- Hardware development
- Data analysis / modelling / visualization
- Meeting with people affected by the problem you are trying to solve
- Meeting with actors of the field of your solution
- Team Building activities
- Documentation of your project
- Use of CS project builder
- Use of CS logger
- Use of Decidim
- Use of Visual Cit
- Use of SDG in progress

Figure 1: Screenshots of the CoSo survey platform. We show elements of the CoSo surveys on participant interactions disseminated weekly.

Survey	Data collection platform	GEAR 3 respondents (% of responses)	GEAR 2 respondents (% of responses)
Evaluate registration Form	Google Form	44 (96%)	38 (100%)
Evaluate weekly 1	CoSo	33 (72%)	26 (68%)
Evaluate weekly 2	CoSo	33 (72%)	26 (68%)
Evaluate weekly 3	CoSo	30 (65%)	20 (53%)
Evaluate weekly 4	CoSo	29 (63%)	22 (58%)
Evaluate Final Form	Google Form	29 (73%)	22 (58%)
Accelerate initial Form and bloc 1	CoSo	11 (80%)	11 (79%)
Accelerate block 2	CoSo	12 (80%)	12 (86%)
Accelerate block 3	CoSo	12 (80%)	11 (79%)
Accelerate block 4	CoSo	10 (67%)	6 (43%)

Table 1. List of surveys and their response rate of GEAR cycles 2 and 3.

2.3. Network construction

We used the number of posts and number of reactions of a user in the available Slack data as a marker of individual engagement, or team engagement when aggregated over team members. The Slack mention (resp. reaction) network links a user A to a user B if A mentions (resp. reacts to) B, with a weight corresponding to the number of times A has mentioned (resp. reacted to) B. When aggregating at the team level, intra-team mentions are encoded as self-loops, and the weights of the intra-team links are summed.

CoSo was used to collect interactions between participants. This information was aggregated over all timepoints collected, yielding weighted interaction networks where edge weights correspond to the number of times the interaction was reported. For CoSo network representations, we aggregated the networks over all timepoints collected, yielding weighted interaction networks where edge weights correspond to the number of times an interaction was reported. For Slack networks representations we further aggregated the individual networks at the team level.

All data were analysed using the R software.

3. Results

In this report, we provide a quantitative assessment of the participant interactions and self-reports during GEAR cycle 3. We use digital traces from the Slack workspace, and self-report survey data to build metrics of communication activity and collaboration of participants. We examine their impact on the success and quality of citizen science projects in the companion deliverable D4.7.

3.1. Cohort description

During the Evaluate phase, 42 participants were grouped into 11 teams. Out of those, 20 participants composing 5 teams moved to the Accelerate phase. The team name, number of members, and furthest stage of the GEAR reached are described in the Table 2 below. A detailed description of team diversity is provided in the [Deliverable 3.5 “GEAR report cycle 3”](#)

In contrast with GEAR cycle 2, in this cycle all teams were formed using a teaming algorithm described in the above-mentioned report.

Team number	Team full name	Number of participants	Furthest phase reached
Team 1	Bumi Team	4	evaluate
Team 2	Aqua Teach	4	refine
Team 3	The Vibrant Network of Climate Enthusiasts	3	evaluate
Team 4	Learning for future	4	evaluate
Team 5	Food For All	4	evaluate
Team 6	Earthling wishes	3	evaluate
Team 7	Share & Change	4	accelerate
Team 8	Team Dr. World	4	accelerate
Team 9	Naughty Leaders	4	accelerate
Team 10	Indigenous	4	evaluate
Team 11	Let's clean up!	4	refine

Table 2. Name, number of participants, and furthest stage reached by teams.

3.2. Team communication

During both Evaluate and Accelerate phases, teams used a Slack workspace in order to discuss with other team members from their own or from another team, as well as with the organising team. Since the challenge was fully conducted online, this workspace was a central repository for communications at the cohort level. We analysed the data from the public channels of the Slack workspace to study the patterns of engagement of participants within and across teams, as well as with organisers.

3.2.1. Evaluate phase

We observe bursts of activity on Slack during the weeks 2 and 3 of the Evaluate phase (Figure 2a), highlighting an intensification of the Slack use during the programme. The overall activity was strong among teams that would later on be selected to move to the next phase of the cycle, such as “Let’s Clean Up” and “Aqua Tech” (Figure 2b).

Beyond individual post information, Slack offers the opportunity to identify interactions between individuals, through their reaction to posts of other members. This allows us to

gather insights on the quantity of interactions at the intra-team, inter-team, as well as mentors/organiser team levels. To examine the interaction dynamics, we use a network approach, with nodes representing individuals (designated by their role or the name of their team) or teams (aggregated data across team members) linked by their interactions. In the following figures, node size and link thickness are proportional to the number of interactions (at the individual or pair level). The network approach allows us to gather insights on i) who the most central individuals are in the information flow and ii) how much horizontal communication across the community is observed.

In order to reconstruct interaction networks from the Slack data, we need to define a unit of interaction. This is challenging, since text-based interactions differ from traditional face-to-face interactions or friendship networks used in social network studies (Poquet et al., 2020). Here, we combined two approaches. First, we reconstructed a “direct interaction network” utilising user mentions. These correspond to explicit mentions of a user by another user, using an “@” tag, and represent specific calls for help/action (as such mentions notify another user). In addition, we reconstructed a (denser) network of reactions to posts using emoji reactions. These represent more discreet interactions that signify quick approval (similar to nodding to signal understanding). The aggregation of both networks was used for subsequent analyses.

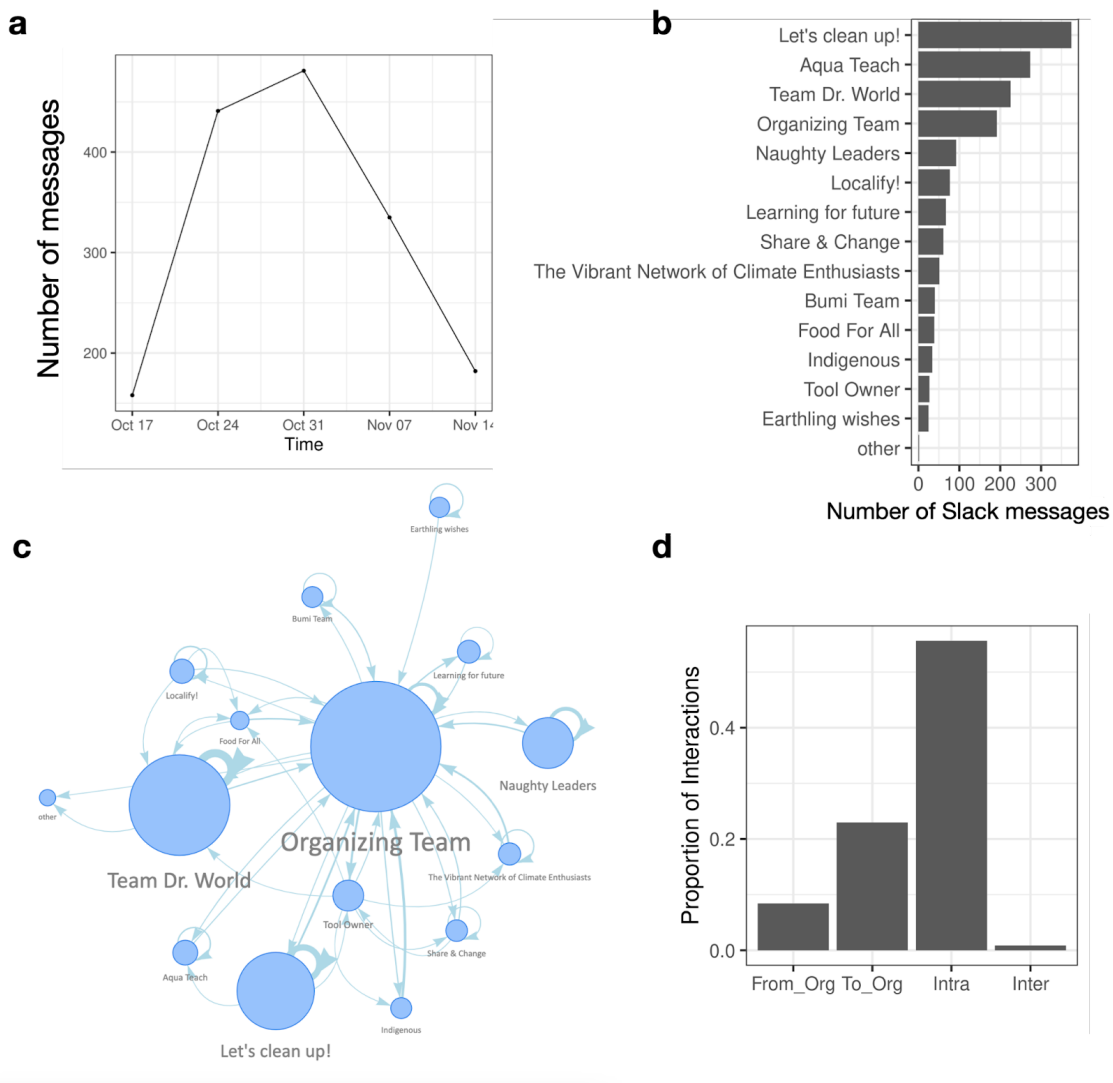


Figure 2: Slack analysis during the Evaluate Phase. **a.** Total number of Slack posts per week. **b.** Number of Slack messages per team. **c.** Communication network constructed from mentions and reactions. Nodes represent aggregated data at the team level. Teams are linked by weighted edges quantifying the number of times an individual from one team reacts to a post from another team. The size of the nodes correspond to the weighted degree, that is the number of times the team mentioned or has been mentioned by a participant from another team. Note that this is different from the raw number of messages, as messages do not have to contain any mention of another team. **d.** Proportion of interactions that are from the organising team, to the organising team, within a team (intra) or between two teams (inter).

We show the Slack network aggregated at the team level in Figure 2c. Links between two nodes indicate the number of interactions between team members of two teams, and self-loops indicate interactions within teams. Links are directed from sender to receiver. We find that the network has a strong “star-shape” centred around the organisation team. This indicates the centrality of the organisation team, with very few “horizontal” interactions between teams. In addition, we find that the workspace was mostly used for intra-team communication (Fig 2d). With regards to interactions with the organisers, we find that the interactions are bidirectional, meaning that teams both ask for and receive help from the coaching team, with overall more interactions going from teams to organisers than the opposite (Fig 2d), suggesting that the communication is top-down: the organisers provide information in a post and team members approve it.

3.2.2. Accelerate phase

The Accelerate phase lasted for 5 weeks, with 5 teams selected for the program. Overall, the results of this phase are consistent with what we found for the Evaluate phase (Fig 2). First, the activity on Slack grew during the phase, following an intensification as previously noted (Fig 3a). Engagement and centrality in the network varies between teams, with the two winners “Let’s Clean up” and “Aqua Tech” in leading positions (Fig 3b). Finally, the workspace was again used principally for intra-team communication, yet with a larger number of interactions with the Organizing team (Fig 3c,d). Overall, these results are consistent with the previous observations in the Evaluate phase, which also comforts the generalizability of our previous studies in GEAR 2.

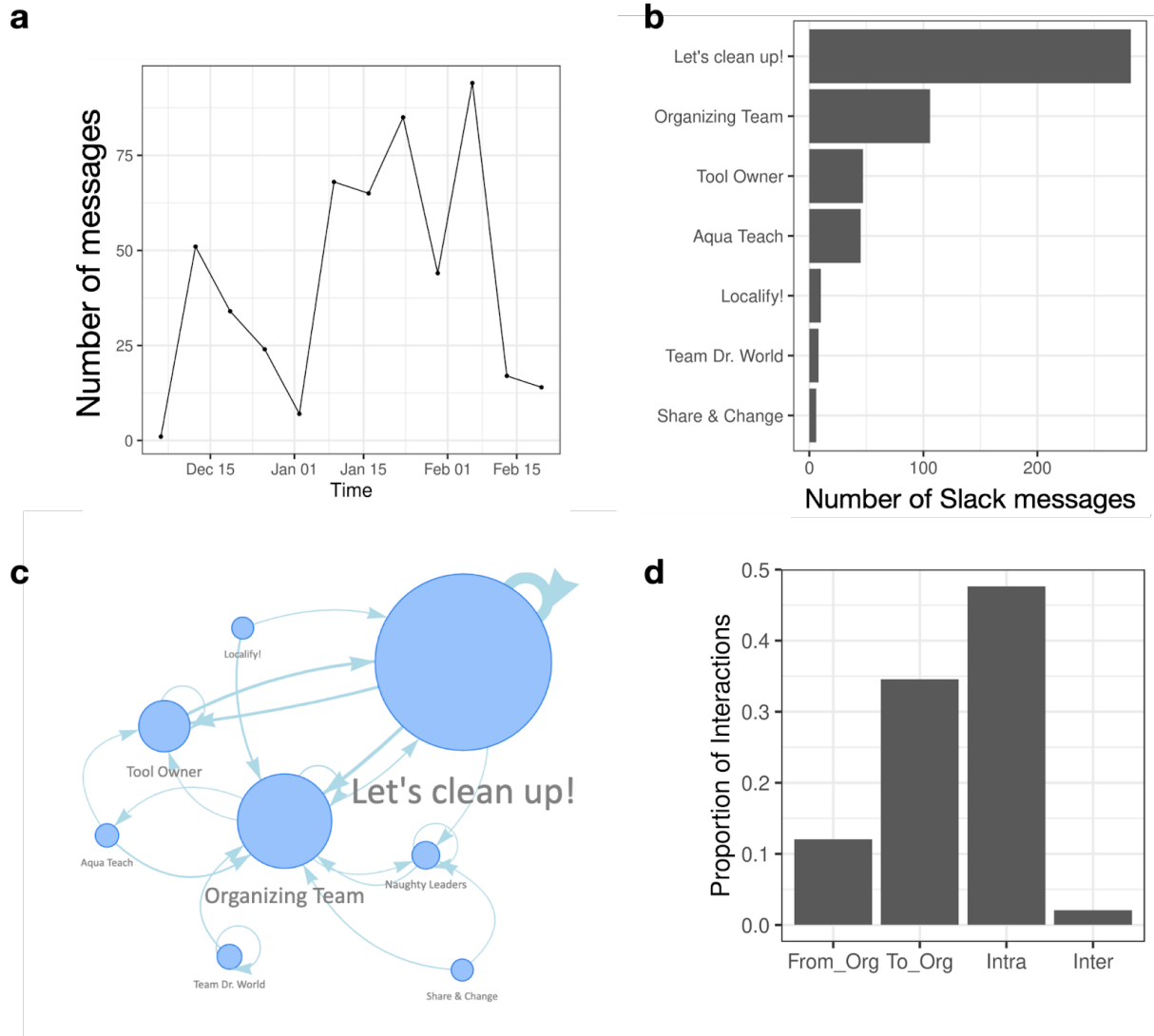


Figure 3: Same as Figure 2, for the Accelerate phase.

3.3. Activities performed

While Slack informs on participant engagement and their interactions with organisers, it does not provide information on what activities teams perform, or what type of (informal and formal) interactions occur. Such information can help guide coordinators in managing citizen science communities. In order to gather deeper insights into team dynamics, we performed weekly surveys on activities performed and on collaborations during the four weeks of the Evaluate phase and the 5 weeks of the Accelerate phase that were preceding the presentations to the jury.

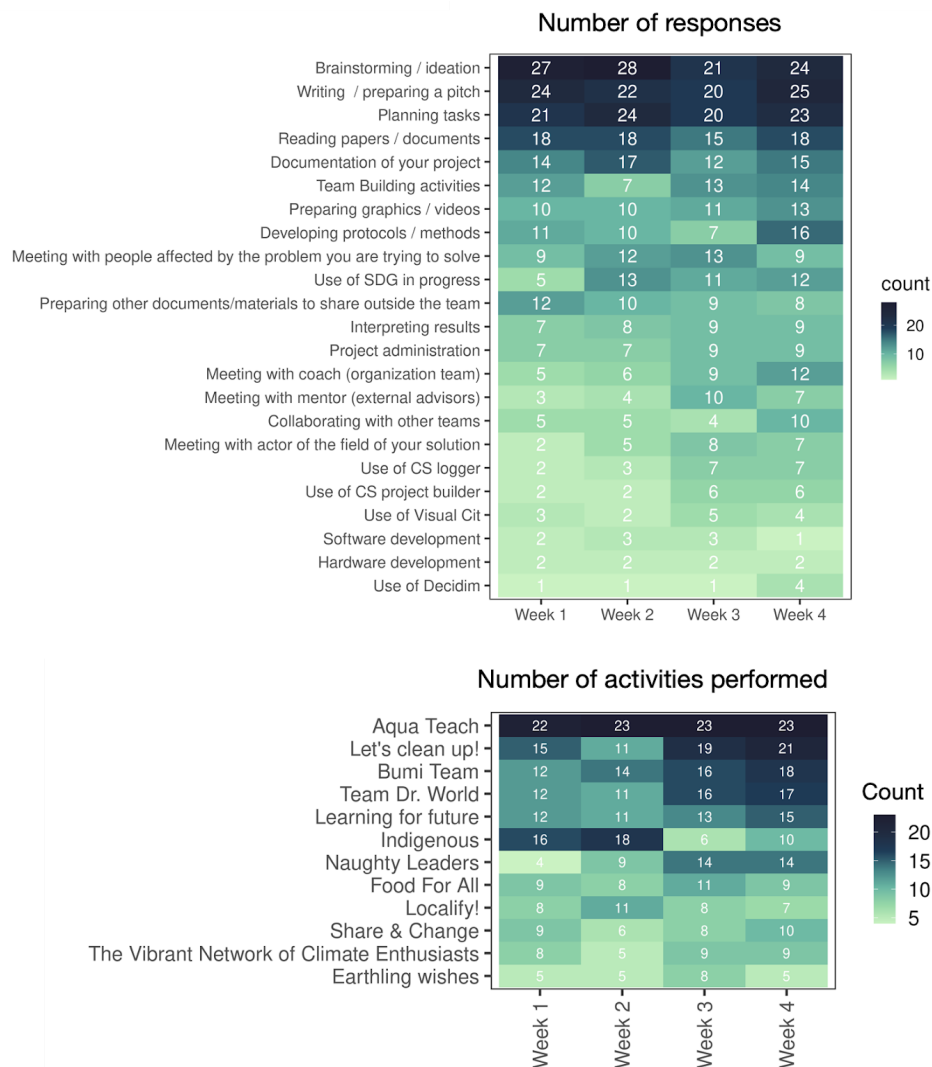


Figure 4. Number of participants reporting an activity over time during the Evaluate phase (top). Number of activities self-reported by participants of each team (bottom)

The activities most performed were consistent with the purpose of the Evaluate phase: coaching teams into generating a feasible, novel citizen science project. As such, the main activities performed across the 4 weeks were the brainstorming and ideation of the project, the planning of tasks and the preparation of the final pitch (Figure 4a). As the phase progressed, teams increased their use of tools, and their collaborations with other teams or with mentors, suggesting the constitution of an identified ecosystem for teams to navigate. This increase in activity is reflected when considering individual teams, with the number of activities performed generally increasing across weeks (Fig 4b). Moreover, we found that

teams “Aquatech” and “Let’s clean Up!”, the eventual winners of the cycle, performed the largest number of activities, consistent with the independent observation of their high activity and engagement in Slack networks. Finally, as for the case of Slack network, we find consistent results when considering the Accelerate phase (Fig 5),

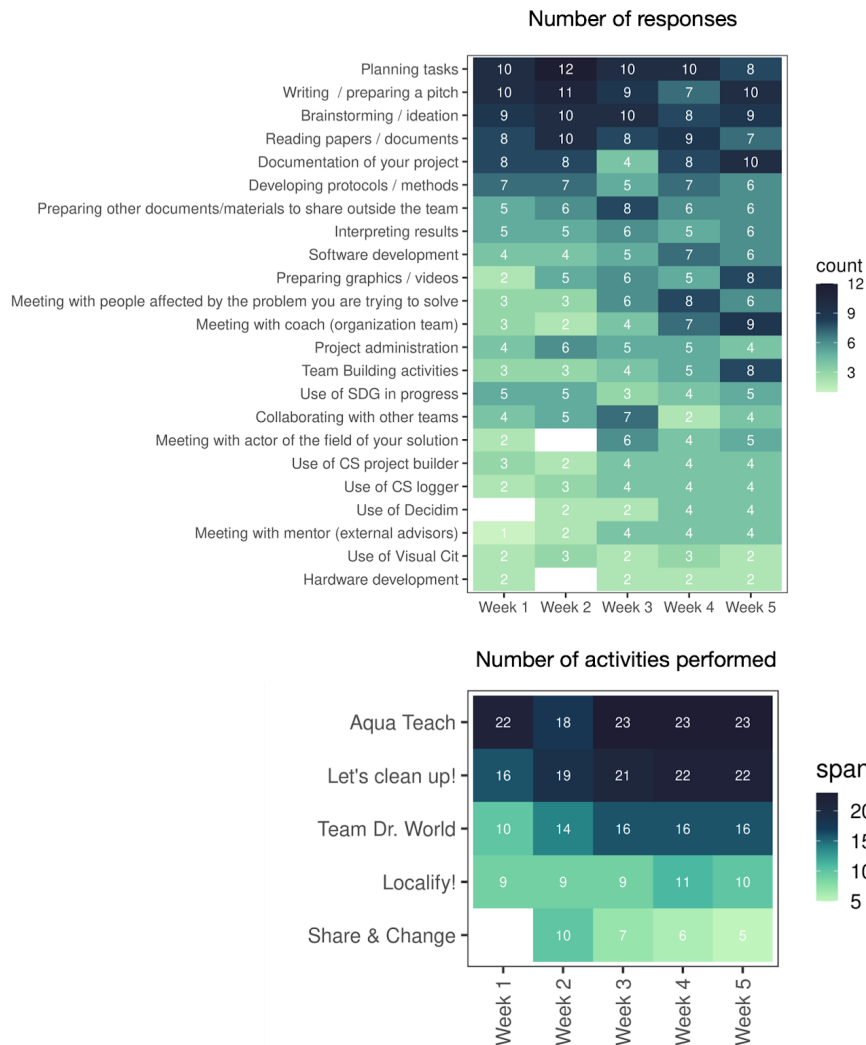


Figure 5. Same as Figure 3, for the Accelerate phase

3.4. Participant interaction networks

Beyond activities performed, we used CoSo surveys to enquire about formal (“Who did you work with?”) and informal (“Who did you know before?” and “Who did you seek advice from?”) interactions (Figure 6-7). These surveys were aimed at investigating the collaborative dynamics during the GEAR Cycle, quantifying the social capital and embeddedness of the teams in the ecosystem, and measuring their evolution and eventual impact on team performance.

We observe that contrary to GEAR 2, here there were virtually no participants who knew each other before. Work collaborations occurred mostly within teams, as well as with organisers (Figure 6d,e and 7c,d), while only few inter-team interactions were observed. In both Evaluate and Accelerate, we find that while participants sought primarily advice within their own team in the first weeks, they gradually increased their outreach to the organisers, eventually the latter constituting a majority of their interactions.

In the Evaluate phase, organisers occupied the most central position, acting as bridges between teams. During the Accelerate phase, we observe that the two winning teams Let's Clean Up! and AquaTech became the most central participants, with organisers in the periphery acting as contact points. This centrality confirms previous patterns from Slack and from activity engagement, showing again that the eventual performances of the two teams that made it to the Refine stage are apparent in the network patterns analysed with surveys.

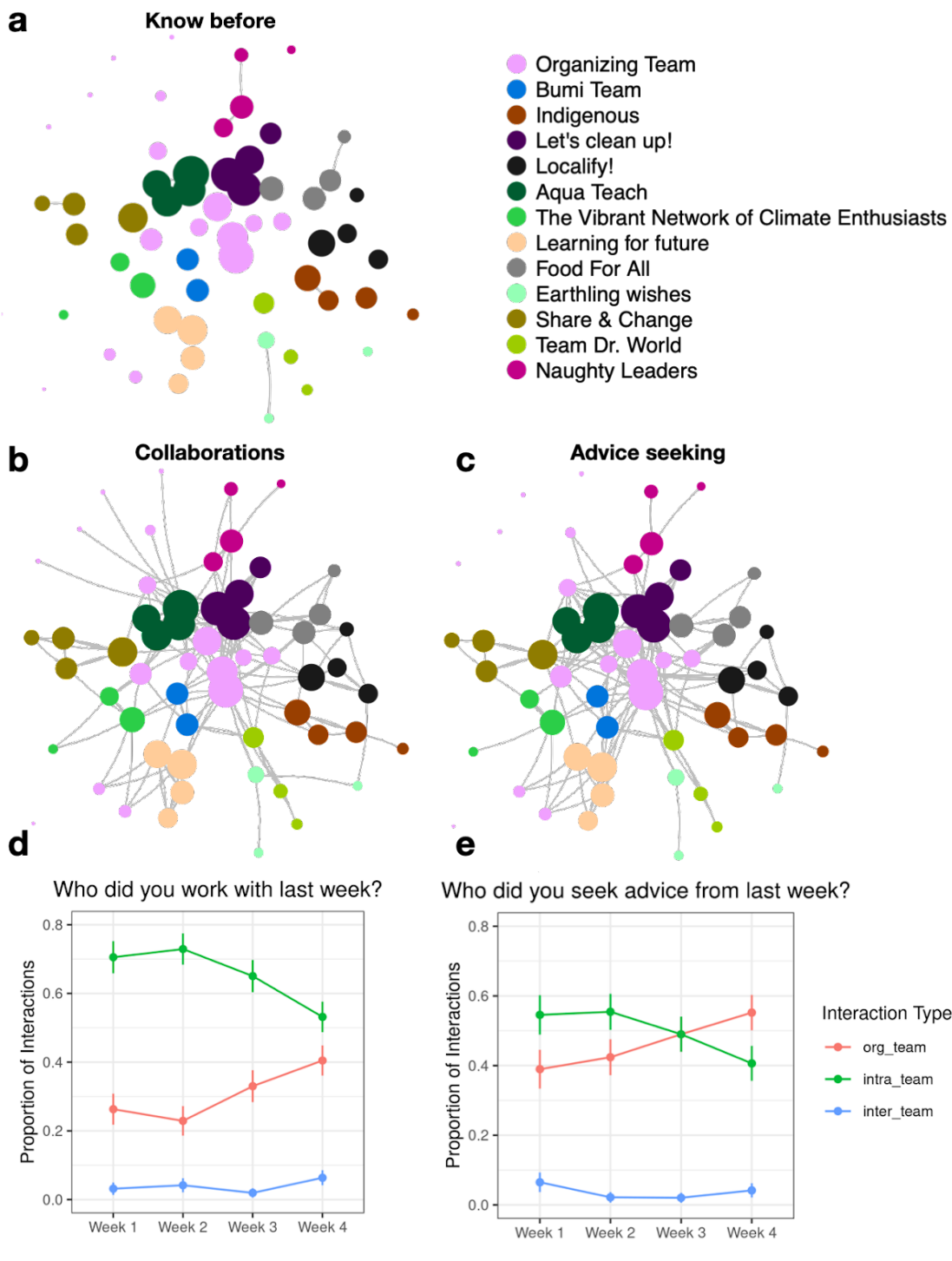


Figure 6: a-c. Participant networks constructed from self-report data from CoSo, using prompts: “Which of these people did you know personally before?” (a), “Who did you work with last week?” (b), and “Who did you seek advice from last week?” (c). Node size is proportional to the degree (number of



links) in the overall network. **D-e.** Proportion of interactions where one of the nodes is from the organising team (red), where the two nodes are from the same team (green) or from different teams (blue), for the advice seeking and the collaboration networks. We show average values and error bars denote standard error.

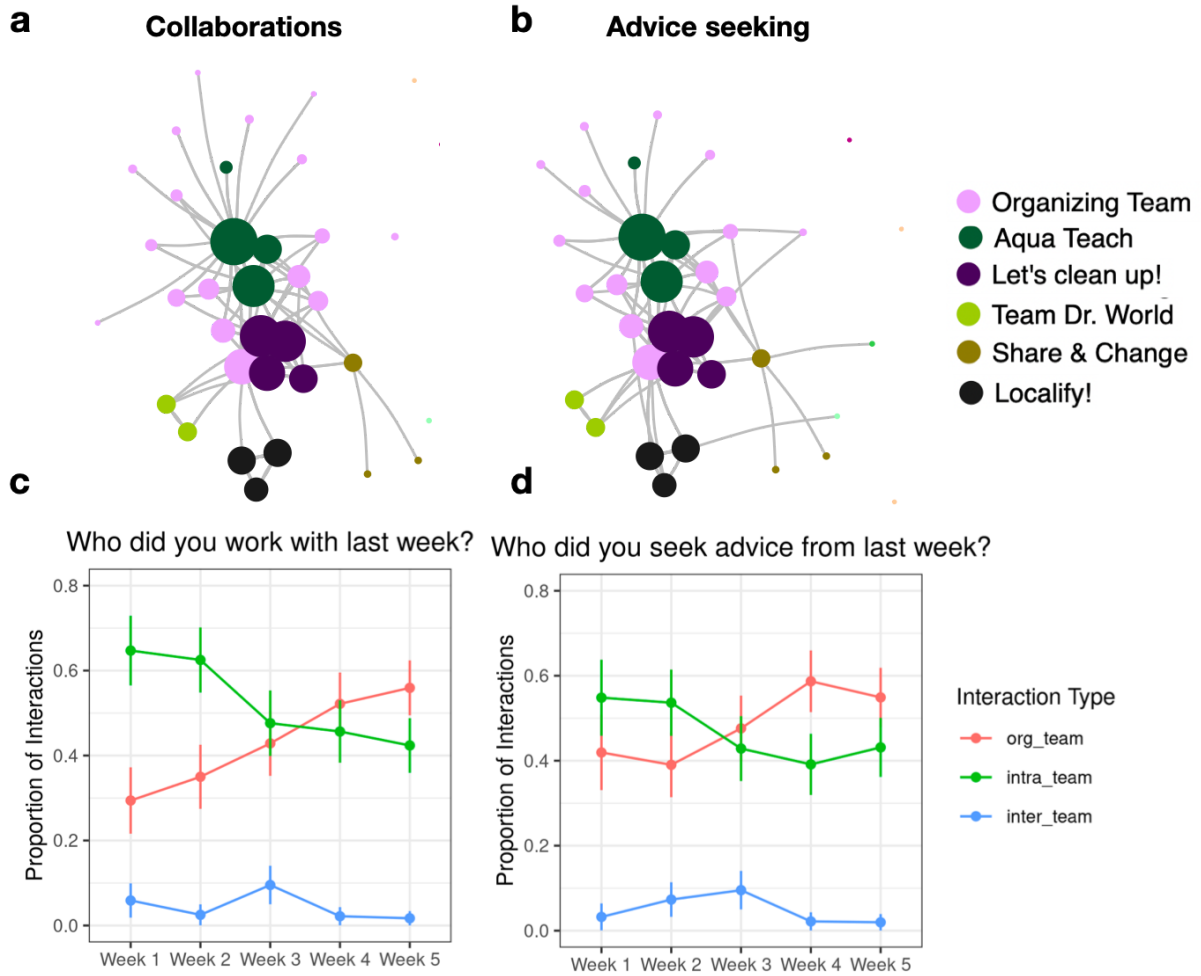


Figure 7: Same as Figure 6, for the Accelerate phase. (note: the network of prior ties is the same between the two conditions and is not shown here).

4. Conclusion

Work Package 4 aims to develop and monitor new metrics and develop statistical models of team engagement and collaboration that contribute to the many-faceted outcomes of the citizen science projects developed within the Crowd4SDG consortium.

In this report, we presented a data-driven approach to describe the GEAR cycle 3 through team composition, activity and interaction dynamics. In particular, we leveraged the CoSo platform for collecting self-reported data on collaborations and task allocation structure of participating teams. We note an improved engagement to surveys compared with the previous GEAR cycle, which might be due to unifying the survey instrument with CoSo. We show how different data sources on teamwork, effort, communication and collaborations act as independent and complementary measures that can be related to team performance. In addition, we show that the results gained from Accelerate and Evaluate phases are similar, suggesting that the insights from previous cycles (only Evaluate phase) can generalise. These findings serve as a basis for i) exhibiting the potential of using digital traces to derive measures related to team process, ii) highlighting perspectives for monitoring metrics in the next GEAR cycle. Hence, this work results from the efforts put into the Task 4.2 and 4.3 and is complemented by the Deliverables 4.2 and 4.4.

While our initial hope was to follow the in-situ dynamics of teams participating in the program, the unexpected shift to a fully online program led us to shift gears, focusing on digital traces from the team coordination tools, as well as building a smartphone application to facilitate the reporting of collaborative activities. By leveraging a single sign-in system and the ability to run all future surveys in one place using the CoSo app, we were able to collect comprehensive profile information about participants along with temporal insights on their collaborative activities, avoiding extensive manual curation from the organising team and ensuring analysis-ready data.

Overall, the quantitative description of the composition of participants and teams, and the monitoring of their activity via the use of digital traces and self-reports provide the ground for future programs to take evidence-based decisions for similar innovation cycles and frame the improvement of citizen science skills and outcomes of the developed projects. The self-reported and surveyed data offer an opportunity to operationalise metrics and descriptors underlying the quality and novelty of citizen science projects. Our contribution extends beyond the Crowd4SDG project to the general evaluation of citizen science by informing project leaders, citizen scientists and decision makers on what can be assessed online to perform high-quality citizen science based on the criteria provided in D4.2 and operationalised in this report.

5. References

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Annex 1: list of abbreviations

Abbreviation	Description
AI	Artificial Intelligence
CBI	Challenge-based Innovation (in-person coaching)
CoSo	Collaborative Sonar
CS	Citizen Science
GEAR	Gather, Evaluate, Accelerate, Refine
NSO	National Statistical Office
O17	Open Seventeen Challenge (online coaching)
SDG	Sustainable Development Goal
WP	Work Package



Annex 2: surveys

[Registration Form](#)

Evaluate weekly 1, 2, 3 and Accelerate

Which task(s) did you perform since the previous block?

- Brainstorming / ideation
- Planning tasks
- Developing protocols / methods
- Reading papers / documents
- Attending meetups with other teams
- Collaborating with other teams
- Interpreting results
- Preparing other documents/materials to share outside the team
- Preparing graphics / videos
- Writing / preparing a pitch
- Project administration
- Software development
- Hardware development
- Data analysis / modeling / visualization
- Meeting with people affected by the problem you are trying to solve
- Meeting with actors of the field of your solution
- Team Building activities
- Documentation of your project
- Use of CS project builder
- Use of CS logger
- Use of Decidim
- Use of Visual Cit
- Use of SDG in progress

0%

Who did you work with since the previous block?
Select collaborators within your team or from other teams. You may need to scroll down to see all of them.

Participants



Who did you seek advice from during the previous block?

Select the persons by name from the list below. You may need to scroll down to see all of them.

Search the participants

Participants

How helpful did you find the session on [Name of the session]?

- Did not attend & did not watch the Zoom recording
- Very unhelpful
- Unhelpful
- Neither unhelpful nor helpful
- Helpful
- Very helpful



Back

Next

What went especially well, or what could have gone better and how? Any other comments welcome too.

Text input area for comments.



Back

Next



[Final form - Evaluate](#)

Accelerate initial Form and bloc 1

Teamwork / collaboration
I am able to efficiently collaborate in a team.
Please rate accordingly.

- Strongly disagree
- Disagree
- Neither disagree or agree
- Agree
- Strongly agree

0%

Back Next

Communication
I am able to communicate my ideas or projects clearly and concisely.
Please rate accordingly.

- Strongly disagree
- Disagree
- Neither disagree or agree
- Agree
- Strongly agree

13%

Back Next

Problem solving
I am able to find solutions to challenges my problem is facing through brainstorming, prototyping, and / or engaging with stakeholders.
Please rate accordingly.

- Strongly disagree
- Disagree
- Neither disagree or agree
- Agree
- Strongly agree

25%

Back Next



Leadership / self-confidence
I feel confident in being able to launch my project.
Please rate accordingly.

- Strongly disagree
- Disagree
- Neither disagree or agree
- Agree
- Strongly agree

38%

Back Next

How helpful did you find the session on [Name of the session]?

- Did not attend & did not watch the Zoom recording
- Very unhelpful
- Unhelpful
- Neither unhelpful nor helpful
- Helpful
- Very helpful

38%

Back Next

What went especially well, or what could have gone better and how? Any other comments welcome too.

88%

Back Next

[Accelerate Final Form](#)