



JRC TECHNICAL REPORTS

Impact Assessment and Recommendations

*Making Sense
H2020 CAPS Project*

Alexandre Pólvara
Susana Nascimento

2017



This publication is a Technical report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication.

Contact information

Alexandre Pólvara
alexandre.polvora@ec.europa.eu
+32 229 51013

Joint Research Centre
21 Rue du Champ de Mars B-1050 Bruxelles

JRC Science Hub

<https://ec.europa.eu/jrc>

JRC110754

EUR 29093 EN

PDF ISBN 978-92-79-79336-3 ISSN 1831-9424 doi:10.2760/395368

Luxembourg: Publications Office of the European Union, 2017

© European Union, 2017

Reuse is authorised provided the source is acknowledged. The reuse policy of European Commission documents is regulated by Decision 2011/833/EU (OJ L 330, 14.12.2011, p. 39).

For any use or reproduction of photos or other material that is not under the EU copyright, permission must be sought directly from the copyright holders.

How to cite this report:

Pólvara A., Nascimento S. *Impact Assessment and Recommendations*, EUR 29093 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-79336-3, doi:10.2760/395368, JRC110754

All images © European Union 2017

December 2017

DELIVERABLE

PROJECT ACRONYM	GRANT AGREEMENT #	PROJECT TITLE
Making Sense	688620	Making Sense

DELIVERABLE REFERENCE NUMBER AND TITLE

D4.4
Impact Assessment and Recommendations

Revision: <3.0>

AUTHORS

Alexandre Pólvora (JRC)	Susana Nascimento (JRC)
-----------------------------------	-----------------------------------



Project co-funded by the European Commission within the Call H2020
ICT2015 Research and Innovation action

DISSEMINATION LEVEL

✓ **P** **Public**

C Confidential, only for members of the consortium and the Commission Services

REVISION HISTORY

REVISION	DATE	AUTHOR	ORG	DESCRIPTION
v1.0	28.11.2017	Alexandre Pólvara	JRC	Initial draft and Contributions to Section 1
v1.1	8.12.2017	Susana Nascimento	JRC	Contributions to Sections 2 and 3
v1.2	17.11.2017	Alexandre Pólvara	JRC	Contributions to Sections 1, 2 and 3
v1.3	17.11.2017	Susana Nascimento	JRC	Contributions to Sections 1, 2, 3 and 4
v2.0	21.12.2017	Alexandre Pólvara	JRC	Contributions to Sections 1, 2, 3 and 4 and Final Editing
v2.5	23.12.2017	Frank Kresin	U. Twente	Final review
v3.0	27.12.2017	Alexandre Pólvara	JRC	Integration of Review Comments

STATEMENT OF ORIGINALITY

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

INDEX

Index	3
1. Introduction	4
2. Assessing What?	6
3. STEEP Framework	10
3.1 Social	11
Values, representations and practices	11
Community extension effects	11
Collective events as awareness raising	12
Internal communication	13
Inclusion and fairness	13
Exchanges and synergies with other organisations	14
3.2 Technoscientific	14
Open hardware, software and other open tools	14
Training and education	15
Materials and tools for local communities	16
Technical and scientific outputs	16
Open source platforms	17
3.3 Economic	18
New entrepreneurial initiatives	18
Alternative relationships with economic assets	18
Job creation	18
Direct exploitation and transfer	19
3.4 Environmental	19
Igniting environmental changes	20
Reducing environmental harm	20
Collective measuring and calibration events	21
Networking effects	21
Sustainability plan	22
3.5 Policy	22
New ways and channels of participation	22
Communities capacity to impact policy decisions	23
Organisational influence in political or power dynamics	24
4. Final Remarks and Recommendations	25
5. References	30

1

INTRODUCTION

The aim of this deliverable is to address the impact of Making Sense, considering not only citizens and communities involved on the ground level, but also the organizations behind it.

Making Sense is a peculiarly hybrid project by all possible accounts when we look into impact and above all to ways of assessing it. Depending on which side of it we might consider in our approach, the project will reveal itself as a distinct entity with often a rather different reach.

We may look at it as a maker driven project particularly aimed at changing social relations with technology. Or we may consider its impact from the perspective of a crowdsourcing venture, constantly fluctuating between traditional citizen science, based on common data collection activities, and new forms of environmental sensing designed around strong participatory and co-creation frameworks in all stages. And we may even observe it through several other lenses and discover a multitude of other aspects that emerged indirectly from our work.

But in between, we will most likely find out how the project never stopped crossing boundaries between research and practice at the top or between lay citizen concerns and more complex forms of activism at the bottom, and how much of this mix also allowed us to become united in our own multiplicity. All in all, what in fact ends up characterizing the impact of Making Sense on engaged citizens, communities and organizations is this precise indefinite fluidity. It allowed the project as a whole to touch a myriad of contexts which would not have been affected by it otherwise. And this is why we also chose a broad pathway to engage with its impact assessment, using a STEEP framework as the core of this report in Section 3, which we believe is capable of capturing key information going from Social to Policy dimensions, with Technoscientific, Economic and Environmental in between.

As a full fledged Collective Awareness Platform for Sustainability and Social Innovation, our project was always geared towards pioneering not only new models to create awareness on sustainability challenges, such as environmental pollution, but also new ways of tackling those challenges through participatory evidence gathering and collective action. We always thought first of developing the best possible actions, tools, concepts or pilots to pull up and infrastructure the citizens and communities which the project targeted, and only later about measuring and assessing its progress. In this emerging and experimental new space of Digital Social Innovation, our main concern was never to tick any impact boxes expecting to provide

any striking evidence of how amazingly well designed or deployed our tools, methods or pilots were, to justify any funding or institutional support attributed to the project.

Projects in these spaces need to avoid doing impact assessments merely for the bureaucratic demands to demonstrate their magnificent outputs, which are often attached to pressure from governments, funders, public officials and policymakers (Ógáin et al. 2012). The demand is obviously valid in order to provide full accountability and transparency, to define the present and future priorities for funding, or even to consider further investments towards medium to long term effects. But it could also be questioned if such metrics should even be used, taking into account that public and social values may be seen in a different logic or realm of action, or if they actually in the end influence decision or policy-makers when confronted with other political or economic circumstances, or not.

We strongly believe that there always should be dedicated efforts in a project such as Making Sense to hold it accountable for the resources made available during its activities, and also, that any impact assessment exercise should take place not merely attached to accountability commitments, but also to facilitate knowledge transfer. And we are now in a good position as a consortium to move forward in this direction by providing adequate data and overall documentation to execute such a process. But this will not only add to the answerability of the project, as it will also facilitate the understanding of others about the project's achievements and support an adaptation of its key outputs within the larger public realm of commons.

One of our main outputs at the end will be a Citizen Sensing Toolkit which we strongly hope will help others to effect positive change in their own contexts. But nearing Making Sense's completion, we also think it may be nearly impossible to help elevating any other community or citizen driven efforts to higher levels within this context, without us looking backwards and extracting information from our own project that will then help others beyond the lessons we could insert in such a toolkit. This task should always be included in the backbone of this kind of projects if we want to add up to and support the growth of a strong community of similar projects, and above all if we want it to be able to reach out beyond this still small circle.

Such type of exercise is not straightforward and more often than not needs to come attached with strong self reflexive explorations around its requirements, boundaries, and ultimately, its needs, as we will see and explore within the next Section. This is, however, also a goal of the current deliverable following an expectation it will help others to move in deeper and more thoughtful ways when thinking about impact in coordinating resources sustainably towards broader reach, identifying best practices to finetune their knowledge transfer frameworks, or devising better communication strategies on the trajectories from citizens to political agents.

2

ASSESSING WHAT?

In the initial proposal of Making Sense it was written that we were going to “show how open source software, open source hardware, digital maker practices and open design can be effectively used by local communities to appropriate their own technological sensing tools, make sense of their environments and address pressing environmental problems”.

Moreover, it was also stated that we would “*develop a conceptual and methodological framework for participatory environmental maker practices*”, and on top of it invest and deploy our resources to “*show how to provide citizens and communities with appropriate tools to enhance everyday environmental awareness, to enable active intervention in their surroundings, and change their individual and collective practices.*”

These initial goals are something that we always had in mind moving our activities forward. Looking at them nearly three years later we can proudly state they were all fulfilled and in some cases surpassed, even if often not via the pathways we early envisioned. Looking at them this will also be the focus of the present report even if not always in a straight route.

Generally speaking, understanding and measuring impact requires a significant amount of resources, which needs to be considered simultaneously with developing an approach such as the one created within Making Sense, already highly intensive and time-consuming. Most of all, project such as ours need to consider quite carefully their impact assessment exercises in ways that are proportionate to and fit their main goals. At the closing stage of a project like this, there are other questions on the choices made along the way which surely ‘impacted its impact’ and now seem to fall beyond the scope of our own explorations here.

Before digging deeper into the final assessment we should maybe open up our black box and let a few of these same questions slide out. What were we really trying to achieve as a project beyond the initial funding proposal? How did this change? Was it to a great extent? And how often? Were such changes visible on day one of our collective work? Were they easy to spot at the first General Assembly? Did they become more pronounced it over the course of our first pilots or later? Was it after our first year review? Were these changes mostly good? How did they affected our expectations as a consortium? Were all partners aligned? Did our pilots run in totally different directions due to such changes? Did they have to compromise some of

our goals in any way? Did they become stronger and more entangled with the local communities at the core? And did the project surpass its envisioned goals in any way on this point and turn out to be a better experiment than any of us could have anticipated?

By the same token, we could keep asking even more specific questions at this time. We could interrogate ourselves about which are the real possibilities of measuring the overall impact of nine different pilots with diversified communities, contexts, human and technical resources, partners, and ultimately goals? Or even push it a bit more, and ask how could we ever be able to address such impact from the start of Making Sense with most pilots being designed and developed on the go while constantly iterating their operations to be truly successful?

The particular character of Digital Social Innovation (DSI), where Making Sense positions itself, makes it already quite hard to assess outcomes and gains without considering questions like this. As pointed out by Stokes et al. (2017), for example, we can find only a few projects within this field where we are capable to showcase impact at scale due to barriers at the system level and at the level of individual projects. So why even consider questions like these at this moment when others can be seen as more pressing? We can say that DSI develops new ways of dealing with complex problems and coming up with solutions that go not only beyond the traditional economic models but are also based on the multiplicity of actors' expectations and motivations. Projects in this field have often introduced new ways of thinking and addressing problems that represent discontinuities towards what is locally mainstream, with some cases where we are even talking about radical, bottom-up or community-driven innovation that is entirely dependent on these same actors and the choices they make. And this is why.

Never ignoring the need and usefulness of producing a comprehensive impact assessment that addresses the most traditional dimensions and questions, as a community of projects and organizations strongly invested in new approaches, we are still not capable to find satisfactory ways to assess the impact of many of the answers to questions such as those posed above, and how in fact they end up impacting traditional impact factors. But they seem to weigh quite heavily in what a project such as ours can achieve, and above all, given the highly intensive and time-consuming features of its processes, equally impact its operations in strong ways.

The alternative character of projects such as Making Sense accrues also to the inherent complexities of measuring how we can bring about societal change in general and this is not detached from deeper reflections on its internal or more malleable features. Ever changing dynamics of many different dimensions, coupled with competing and sometimes conflicting perceptions about what constitutes value or impact for different individual and collective actors make it certainly more difficult. Also monitoring benefits over a longer period of time, or estimating main advantages for future days is a hard task. Parts of our own project continue beyond its institutional closing for example, and if it's almost impossible to even observe in full scope what some of our latest pilots achieved on the ground, it's even a harder task to determine the impact of their deeds with such a short distance in time. For instance, the last pilot in Barcelona as well as the second and third pilots in Prishtina are still up and running on the ground, coordinated almost in its entirety by the local communities themselves. We will likely not only miss their feats here, but above all the majority of the

bigger impacts caused by what Making Sense just started to seed by still not knowing how to consider or measure these malleable factors.

In the end we agree as a consortium that Making Sense was slightly altered through multiple iterations regarding some of our initial assumptions. It largely outgrew initial crossings between open source, open hardware, open design and Fab Labs, for example, even if all these remain at its core. And one of our main focus rapidly moved from development and deployment of sensors into the challenges of using and improving technical resources that were already available, even if technical innovations at the sensing level still played a big part in some of our pilots. Such alterations ended up producing a better and more diverse project and we could not be prouder of this. Besides they even helped us reach places where we are more capable of thinking collectively how to reach a few definitive answers to many of the questions above. But no present indicator or analytical dimension will allow us to back-up our possible answers, however, with sufficient evidence to produce acceptable certainty in an assessment like this.

Such indicators or dimensions can only help us determine what happened on the first surface layers and luckily infer major changes that already happened or will soon take place. This is what we will do in the next Section. But due to both the lack of present adequate frameworks to capture more than what's often visible in projects such as ours, and the difference in goals and resources to enlarge and deepen the impact lenses considering other projects which are fully dedicated to devise novel impact assessment pathways, this is therefore one of the key limitations that exercises like this carry with them at a concluding stage where our reflections could be further expanded, even if it was never one of our intended goals at the beginning.

Apart from this, from day one we made multiple efforts to set out requirements, dimensions and quantitative and qualitative indicators for assessing and determining the impact of Making Sense until the end, as it is clearly visible in the ways we already addressed Making Sense KPI's in our mid-term review report, and will now address them again in the final review report. As a consortium, we co-created strategies to measure and assess the impact of our activities in all stages: scoping, community building, planning, sensing, awareness, action, reflection and legacy. And we considered not only the citizens and communities engaged through our nine pilots, but also main organizations behind it, alongside lateral institutional partners that collaborated with or supported these organizations in each pilot. We can surely revisit it all with another set of eyes in a scientific paper after Making Sense's end, aiming to include new ways to address impact as critically discussed before. But a different road lies ahead now.

We made use of multiple quantitative indicators traditionally employed to determine impact of projects like ours according to common benchmarking, such as in WP6 deliverables D6.4 and D6.5. Considering the initial proposal, some indicators were dropped after early developments as they would not be applicable, eg. number of SCKs, deployed since not all pilots used this resource. But statistics drawn from these reports show us for instance how since our website relaunch in August 2016, and until October 2017 measurements, we had around 2.008.540 Single Hits, 942.440 Page Views and 148.650 Visits with 5.8 Page Views per visit. They also show us how we currently have around 1390 likes in our main Facebook page, with a gender distribution of 58% female and 41% male which evidences gender

balance shift from traditional demographics in other technological projects. And above all, reading these WP6 reports, and going over indicators such as these, we can observe how Making Sense is in line not only with key goals stated in our proposal, but also with those in the early strategy defined in D6.1.

On top, additional impact assessment tools at the crossroads of quantitative and qualitative were also built throughout the project, as in WP5 Community Level Indicators which is presented and discussed in D5.4 and D5.5. These indicators were collaboratively created with participants of several of our pilots, in order to measure and determine whether changes have occurred as a result of the local activities, and were often used by these communities to create a feedback loop on the localized impacts of Making Sense to devise better action and campaigning strategies, by creating a baseline, identifying common goals, noting progress, and reporting on results. They showed us how the impact of Making Sense could also be assessed and measured at bottom layers and allowed us to capture key results for the overall project through citizen and community self assessments when generating and communicating general information, analysing and finding relevance in hard data; building their own communities around participatory sensing; or monitoring change and achieving policy impact at pilot level as envisioned in D5.1.

Moreover, in WP4 we turned our attention to a qualitative exploration of the impact that the participatory strategies in our nine pilots had on citizen engagement and community building for the whole project. This was explored within the joint D5.2+D4.3 deliverable and based on multiple ethnographic phenomenological incursions to the ground that were heavily tied to participant observation methods. Here we looked into key topics where it was possible to observe how the specific dimensions of citizen engagement or community building were addressed inside Making Sense considering several strategies defined in D4.2. And above all we looked into how the way these strategies were developed impacted each pilot, considering onboarding pathways, physical and online spaces and interactions, participant autonomies and upskilling, the role of experts and institutional partnerships, decision making and internal governance mechanisms, output ownership and appropriations, or diversity and social composition.

Now we will proceed into yet a new analytical level with another assessment exercise, where we draw from different sources to address the complexities and challenges of looking at the overall impact of Making Sense within its Social, Technoscientific, Economic, Environmental and Policy dimensions, composing a STEEP framework.

3

STEEP FRAMEWORK

In order to produce an encompassing but still agile assessment of Making Sense as a whole, we chose to aggregate, summarize and break down our review into five dimensions: Social, Technoscientific, Economic, Environmental and Policy (STEEP).

Our assessment is simultaneously based on data collected by WP1, WP3 and WP6, coupled with ground level qualitative research conducted within the scope of WP4 and WP5. In each of the chosen analytical dimensions we interpret and combine these outputs to specifically consider and discuss direct and indirect impacts of the project on citizens and communities involved, together with impacts on the pilot coordinator and partner organizations. To do so, for each of these five dimensions we chose to observe subcategories relevant to our project, and are in line with previous impact assessment frameworks and exercises developed or carried out by previous leading CAPS projects such as IA4SI (Impact Assessment for Social Innovation) or D-CENT (Decentralised Citizens Engagement Technologies).

Given the broad characteristics of the project, and the heterogeneity of our nine pilots, not all dimensions or subcategories offered comparable empirical evidence on the project's impact. For instance, the Social dimension stands out right at the start, both in size and in categories considered, as it was in fact a main focus for us. But other dimensions also encompass highly positive factors of impact for the project, and we need to make clear that all were considered on an equal footing at the analytical onset of this assessment exercise, with an additional effort to showcase positive examples in each to illustrate the wide inprint of Making Sense.

In order to facilitate the readability of this Section, we chose to number the pilots in all cities as 1, 2 and 3 accordingly to their chronological order. As such, instead of Urban AirQ we have Amsterdam Pilot 1, instead of Green School Community we have Prishtina Pilot 2, instead of Gracia Sound we have Barcelona Pilot 3, and so forth. Summarized descriptions of pilots with correspondent names can be found in the previous WP5 and WP4 deliverable D5.2+D4.3 "Making Sense Framework and Assessment of Participatory Strategies".

3.1 Social

Considering the impact of Making Sense at the social level we will first focus on its relationship with the citizens involved in the project, namely in regard to how it operated changes in **values, representations and practices**. Overall, we were able to observe significant impacts at this level in the citizen participants of nearly all pilots with the following clear examples:

All Pilots conducted in Prishtina were successful in enabling new practices and subsequently new values and representations. These Pilots gave decision-making powers and a central role to 26 citizen participants through the creation of three committees dedicated to monitoring and research; education; and campaigning and mobilization. Moreover, from the actions of these members, more than 170 participants were also impacted by the project in Prishtina. Committees provided new perspectives on nearly every issue in the Pilots by mentoring, training and guiding these participants, helping them developing and conducting measurements, or engaging them in co-organizing and co-coordinating campaign actions.

Changes in values, representations and practices were also at the core of the project's impact of the Barcelona Pilot 1 through a strong participatory involvement and empowerment of citizens. 25 community champions became highly engaged in the running of this Pilot. They reported obtaining new knowledge not only about technology, including sensing practices and the sensors themselves, but also on the value of citizen participation and collaborative methodologies, in particular when campaigning to help address environmental problems.

The feedback from participants of Amsterdam Pilots 1 and 2 was also positive concerning perceived changes in their values, practices and representations. This was often expressed by the willingness of Pilot 1 participants to engage in further initiatives, either to continue measurements of air quality or noise, or engage in research about air pollution and diseases. In Pilot 2, qualitative data gathered with students and teachers showed an overall change in their values and representations about the environment, and also a knowledge increase coupled with positive attitudes towards more hands-on learning experiences.

In the social dimension, we choose in second place to dwell into the community level of the project. We start here by looking at how strong citizen engagement in some Making Sense Pilots resulted in high impact through **community extension effects** as follows:

A key example here is related to Barcelona Pilot 1 participants and their involvement in subsequent Pilots and even other Fab Lab Barcelona projects. In acquiring knowledge and experience from Pilot 1, they were later able to take ownership and leading roles, including designing, planning and delivery of activities; and helping the core team with the organisation and teaching new participants about sensors and data collection for instance.

Another key example on this point pertains to Prishtina, also with Pilot 1. Several participants from this first Pilot quickly moved into the support team of Pilot 2, mentoring children, parents, carers and teachers in the school where Pilot 1 took place. They further developed competences to work with partners, and became both a reference and guiding point to new participants.

In third place we keep on putting the social dimension spotlight on the community aspects of the project, now turning our attention to the type and number of **collective events as awareness raising** moments organised for the local communities or by the communities themselves. There is also a clearly positive output at this level, which can be showcased by the following indicators:

Amsterdam Pilot 1 targeted and engaged 25 local residents who participated in 3 citizen meetings, 1 workshop and 1 meetup. The high number of participants in one part of Pilot 2, namely 1200 kids in Dutch Cinekid Festival 2016 during 10 days, corresponds to a peak in the impact of the project. Pilot 2 also included activities in 3 schools with around 120 students participating through an after school programme. Amsterdam Pilot 3 was also successful in bringing together around 100 participants in 3 measurement workshops on location and 1 developer meetup.

Prishtina Pilot 1 had in total around 170 participants in all the project's activities, including participants in 1 topical carcamp, 3 impact calibration sprints, 162 air pollution measurement sessions and 1 placement of diffusion tubes. This high level of participation was further enhanced by 4 general assemblies when the project team met with the 26 committee members, and 1 digital bootcamp with 28 participants but over 100 applications. Prishtina Pilot 2 also showed impact in the type and number of participants and events, including 1 digital bootcamp with 19 parents and teachers, plus 20 children in the school, 3 general assemblies, 4 impact calibration sessions, and 89 measurement sessions. In Pilot 3 we continued to observe the involvement of the committee members in 2 general assemblies, 89 air pollution measurement sessions, 1 placement of diffusion tubes, and 1 air quality and data collection training for 6 more participants.

Barcelona Pilot 1 brought together 25 community champions who were engaged in a high number of events throughout the duration of the Pilot, including 2 onboarding workshops, 1 data ownership workshop, 1 data visualisation workshop, 1 action workshop (to design the public action in Plaça del Sol), several planning, designing and test sessions for the Noisebox, and 1 reflection workshop to share their views. To be noted is also the organisation of 1 launch event with around 85 participants. Pilot 2 had a more limited impact when considering the short period of time (4 full days) and number of participants (15 students). Pilot 3 built on the impact of the previous work and engaged around 14 community champions through continued workshops over time, also reaching out to 35-40 participants in its first workshop, 11 local residents for another workshop, and around 1000 citizens in 3 workshops organised at Plaça del Sol.

In fourth place within the social dimension and again at the community level we focus on the **internal communication** between the project team and participants as a potential positive impact when it comes to improving overall collaboration and creating strong communities around the project. A few good practices established or stimulated by the project team stand out in the Pilots, which point towards a positive impact in this regard:

Prishtina Pilot 1 put in place several channels of communication to enable a good communication with committee members. It included sending weekly notifications with updates on work done and upcoming tasks, and setting up Google Forms and Google Calendar in order to make decisions collectively. This had a positive impact on the access to relevant and timely information about the project, and on the capacity for committee members to mobilize and engage in a participatory way. Pilot 3 had an additional impact through the creation of a lively WhatsApp group, coupled for instance with “measurement selfies” and real-time reporting when measurements were being made.

Another example came from Amsterdam Pilot 1 that attests to the positive impact of keeping a good communication between all involved. In this case the different participants, including researchers, the project’s team and the local residents, continued their exchanges not only through public meetings but also through a weekly newsletter, personal contacts and direct mailing.

Barcelona Pilot 1 was another example which successfully managed to establish different channels of communication with participants through a number of different workshops but also through social media, thus allowing the community champions to build closer relationships between each other. In addition, setting up a private Facebook group page proved to have a positive impact for participants to report their technical difficulties quickly to the Making Sense team who then managed to give them back useful feedback.

Still at the community level we address in the fifth place the crucial issue of **inclusion and fairness** regarding overall efforts to empower citizens and communities with careful attention to potential disparities, for example in terms of gender, ethnicity, age, location or socioeconomic status. Making Sense managed to have a positive impact whenever possible which is shown in the following instances:

In Amsterdam Pilot 2 the project’s team chose to select three schools in Amsterdam which had different geographical and socio-demographic contexts, which ensured a diverse composition of the students and teachers involved.

Prishtina Pilots had at their core a diverse group of committee members, with ages between 17 and 30 and with backgrounds ranging from students at different levels and from different areas, to part-time or full-time workers. Pilot 3 had a strong emphasis on the impact it could provide for populations living close to power plants and coal mines, and also for the Roma minority in Plementina by including them in the activities of the Pilot.

The social impact of Making Sense should also be explored through the effects it had on each consortium partner organisation that led the Making Sense Pilots in their city, alongside other organisations that supported, contributed to, benefited from, or ultimately emerged within these Pilots. Here we will focus on the positive impact derived from the **exchanges and synergies with other organisations** as a result of the activities of the Pilots, which is present as follows:

Amsterdam Pilot 1 had a strong community of practice from the beginning, also building on its previous and still ongoing work in the Amsterdam Smart Citizens Lab. This community included other organisations such as University of Wageningen and the Amsterdam Institute of Advanced Metropolitan Solutions, local and national official measurement organisations such as GGD Amsterdam and KNMI Royal Netherlands Meteorological Institute) and the Dutch National Lung Foundation. This Pilot also engaged with existing community neighborhood groups highly invested in the topic of air quality.

As a positive impact from Barcelona Pilot 1 activities, 4 universities and research centers approached Making Sense with an interest to conduct research about the successful engagement of community champions and new co-design practices for smart systems. Pilot 3 also counted on continued and strong support of Kubik, a coworking space, through the activities. Importantly, Pilot 3 had a visible effect on the efforts of the local communities to self-organise (for instance through a joint Twitter account) around the issue of noise pollution in the Plaça del Sol.

The impact of Barcelona Pilots is further expanded through its evolution into Pilot 4 beyond the end of Making sense. This will be an additional Pilot combined with D-CODE project, another CAPS project, and it will further explore how citizens can use data on noise pollution through the Smart Citizen Kit to make their own decisions and engage in new actions and campaigns.

3.2 Technoscientific

Taking into consideration the technoscientific impact of Making Sense, we will first focus on the relevant effects of our activities at the citizen level. As one of the first indicators, the number and type of **open hardware, software and other open tools** used by participants stands as a visible impact of Making Sense as a maker driven project aimed at changing citizens' relationships with technology. In this regard, participants in all Pilots made extensive use of a diversity of open tools described as follows:

In Barcelona Pilot 1 community champions employed 25 Smart Citizen Kits. In Pilot 2 Smart Citizen Kits were used together with homemade sensors made with cabbage (the same that were used in Amsterdam Pilot 2) and with juice cartons and vaseline. The

positive impact of Pilot 3 was showcased through the adaptation of the Smart Citizen Kit into the Noisebox with the purpose of public sensing and display.

Participants in Amsterdam Pilot 1 had the opportunity to use 16 Lora Bora open source sensors for their measuring activities, which were developed in the context of the Waag's Amsterdam Smart Citizens Lab together with RIVM and researchers from the University of Wageningen, and then extended, networked and multiplied in this Pilot. For Pilot 2 students experimented with Smart Citizen Kits, Lora Bora sensors and homemade sensors (e.g. acidity meters made with cabbage, and UV meters made with sunscreen). The use of open tools was further expanded in Amsterdam Pilot 3 through the creation of an open source software/webpage by the project's team which was used by participants coupled with laptop and smartphone webcams to measure gamma radiation.

In Prishtina Pilots the focus on air pollution led to the use of more targeted open tools such as Airbeam, diffusion tubes to measure nitrogen dioxide (NO₂) and sulphate dioxide (SO₂), or NO₂ rapid air monitors. For instance in Pilot 3 participants used Bora devices, 40 NO₂ and SO₂ diffusion tubes for bioindicators, 74 NO₂ and SO₂ diffusion tubes for recording lichen prevalence, and 1 WeatherHawk WM-200 Anemometer to measure wind speed and direction.

Technoscientific impact at citizen level is closely related in Making Sense to **training and education** developed by the project with the purpose of improving or developing digital skills. We observed a positive impact in the project's capacity to support the acquisition of skills and competences by participants through a number of relevant events and materials designed specifically for Making Sense environmental monitoring:

Barcelona Pilot 1 planned and organised weekly workshops for community champions to learn to use a full range of technologies, not only the sensors for the measurements but also data sensemaking techniques, and digital fabrication and other DIY tools in Fab Lab Barcelona, coupled with a swap shop in those same workshops to replace faulty devices. The positive impact of Pilot 3 was also showcased in the number of workshops and meetups for local residents dedicated to how to employ sensors in their surroundings. Data visualisation, art and design workshops conducted by invited organisations 300.000km/s and Domestic Data Streamers also expanded the range of participants' communication skills.

In the Prishtina Pilots there was a clear effort to organise air quality and data collection trainings for all committee members in order to enable them to conduct the measurements with open tools or to upload the data themselves. This also proved beneficial for the recruitment of members in different time periods and had a positive impact on their autonomy when making hands-on calibration and measuring activities throughout the Pilots.

In Amsterdam Pilot 2 the design of easy-to-use sensors coupled with instructions and pictures for homemade sensors had a positive impact in their use by young students

both in the Cinekid Festival and at schools. The project's team also introduced some flexibility in the making of the sensors, for instance at the school settings where students could solder the connections. Still teachers suggested for future iterations more background information, Youtube videos, tutorials connected with school curricula, and more activities for students to be as independent as possible.

When it comes to the community level, the Making Sense technoscientific impact is more oriented towards **materials and tools for local communities** which were used or could be used for their own benefit in future occasions for environmental monitoring, sensemaking and action. In this regard the project had a positive impact through the production of such materials and tools to be appropriated by communities as follows:

In Prishtina Pilot 1 the project's team developed a guide on "Participatory Youth-Driven Campaign Development" which evolved into a Campaign Plan through a first iteration in the digital bootcamp and was divided in three main issues: online campaigning, physical campaigning and campaigning with data. A document on "Talking Points" was also developed which had a positive impact on participants and activities in general to put in place a unified set of positions, arguments and data for media and public debates. In Prishtina Pilot 3 a new measurement activity based on bio-indicators was devised by one of the Committee members for systematic measurements, which also included the distribution of 40 SO₂ and NO₂ diffusion tubes. As a major legacy for the communities in Prishtina, Making Sense launched a platform (<http://ajripishtines.info>) in December 2017 which provides data visualisations from the Pilots, together with additional info about health issues and air pollution, as well as data from real-time sensors from the US Embassy. As part of the platform, the winning team of the hackathon organized in the summer also developed an android app AJRIPRISHTINES.

Amsterdam Pilot 3 developed a web based and open tool (<https://gammasure.org/>) to be used by large audiences or populations in the vicinity of nuclear installations and in future situations of radioactive emergencies. This tool enables them to quickly generate and share accurate data with their own laptops, smartphones or tablets just by covering the cameras with black tape.

As we are looking into the same dimension for impact of the Making Sense, we now focus on what it means for coordinating or partner organisations engaged in the project. In this specific aspect the project had considerable impact throughout its duration in the transfer of its **technical and scientific outputs** in the format of papers, articles, publications and presentations in events, conferences or workshops. To be noted though is that the indicators bellow cover the period until November 2017, which leaves out outputs in 2018 to be expected to present the Making Sense final results:

Regarding talks and presentations, the Making Sense team counts with a total number of 45 with a total outreach of 5514 people in 24 cities. We also delivered presentations at 7 academic conferences attended by over 800 peers and experts.

As for workshops organised within the project (including all events with participants in the Pilots) or in external events, or organised by other partner initiatives, Making Sense counts 32 attended by 1419 participants in over 15 cities, with an additional event (CineKid Festival) attended by over 5000 people. The workshops had a total outreach of 6419 people.

In terms of popular articles, Making Sense had 30 articles published or broadcast in news portals, magazines and TV stations that presented news about the project. TV channels such as in the case of Kosovapress, RTKnews and the Dutch National Television, have broadcasted our activities and/or interviewed members from the project.

As for scientific publications, so far 1 article has been published, 1 article has been submitted and is waiting for publication, and 3 workshop papers were accepted. As final results are now fully available, including all the data from the Pilots, we will submit more articles to peer-reviewed journals or publications in 2018.

At the same level addressing coordinating or partner organisations engaged in Making Sense, the technoscientific impact is mostly connected to the project's goal from the start to **open source platforms** in order to disseminate as much as possible its outcomes to others and stimulate adoption in other contexts and places. Although the impact of this widespread adoption would need to be monitored over time after the completion of Making Sense, the impact of this strategy is already visible in the following:

In general, by using Fab Labs.io, the technical and design innovations produced during the Making Sense project become embedded in the larger ecosystem of the Fab Lab network, which is an open, creative community of fabricators, artists, scientists, engineers, educators, students, amateurs, and professionals located in more than 75 countries.

In all Pilots the measurement data is made available either through open tools such as Smart Citizen Platform or GitHub, which has enabled local communities, citizens and other organisations to freely access the project's outputs and activities. Moreover in Amsterdam Pilot 2 the instructions, worksheets and materials of the Smart Kids Lab activities are available online (smartkidslab.nl). They were already used in Barcelona and Pristina, and can be expected to be used in future iterations in school settings. Also in Amsterdam Pilot 3 all information about setting up a measuring network for gamma radiation is available on Github, and the website / tool will be maintained online as an additional resource for data platforms such as the AMS Datahub.

3.3 Economic

Aiming now at an exploration of what was the impact of Making Sense at the economic level we will start by addressing here the citizen layer. This project never proposed to have any strong business or financial models targeted at **new entrepreneurial initiatives** promoted by project's participants, or even the establishment of **alternative relationships with economic assets** deriving from its activities. However, we were still able to observe a few good examples in Making Sense that can be reported:

In Amsterdam Pilot 1, one participant devised a new entrepreneurial activity benefiting from the technical support and community environment provided in our activities to kickstart his own spin-off named TreeWiFi (<http://treewifi.org/>). This is now on the route to become a commercial project inspired by the Making Sense efforts to tackle air pollution. It chooses to explore a different approach on top of our sensor network, creating bird houses which contain their own sensors to measure air quality, and are able to provide free wifi if determining the air quality to be good.

On the other hand, in all of Prishtina Pilots we saw a transformation of committee members relationship with economic assets through the deliberate choice to grant them decision making powers regarding the project's internal budget, allocating it to certain activities instead of others. These participants often stated this was an interesting feature of Making Sense in comparison to other projects they worked in or had knowledge of. They also claimed that it often allowed them to deliver better results through the ability of just making simpler choices, as to whether or not to take a taxi instead of walking to measuring places thus enlarging measuring times.

In this same dimension, and now considering the Making Sense communities and how they might have been impacted economically, again it was never one of our key direct goals to produce results at this level. Furthermore, given not only such scarcity of objectives in this particular topic, but the short time still occurred between the pilots end and this assessment exercise, it's also quite difficult to verify if Making Sense has produced any direct economic impacts in the local communities involved or targeted by the project at this stage, whether we search for positive or negative ones. On a positive note, indirect impacts were observed however through limited **job creation** benefiting some participants in Making Sense communities, even if still within the circle of organizations already involved with the project:

Three community Champions from Barcelona Pilot 1 that entered the project as citizen participants were later co-opted to work with the Pilot coordinators either in Fab Lab Barcelona initiatives, or in projects from partner organizations, and still continue to be employed in these same places.

In similar fashion, at least two committee members from Prishtina Pilots were invited to join PEN and take over jobs that involved communication activities for the whole organization. One of these participants still works in the same role at the moment of writing.

As for coordinating or partner organisations engaged in the project, no relevant increase in formal and informal collaborations with business or industry partners may be singled out as an impact factor of Making Sense for example. But the economical impact of our activities, albeit limited, was still a bit broader, considering the project was attached from the start to the development of sensing tools with potential for **direct exploitation and transfer**:

Fab Lab Barcelona's Smart Citizen Kit (SCK) (<https://smartcitizen.me/#sck>) used in all Barcelona's Pilots precedes this project and its commercial and noncommercial uses in other ventures and contexts can even be framed as a main trigger for the existence of Making Sense. Since 2013 it presented itself in v1.1 as an open source toolset including an Arduino-based sensing board, an online platform and a mobile application. The SCK v1.5 came out in early 2017 partially supported by Making Sense, specially regarding the validation, integration, and onboarding phases, and is currently retailing commercially for approximately € 150. Its new hardware and firmware design and features were the conclusion of more than 2 years of development and the experience acquired after more than 1000 people who used the device within and outside Making Sense.

In Amsterdam Pilot 3, we saw the development of other new sensing tool that could measure gamma radiation, Gammasure, through a specifically designed software coupled with computer or mobile webcams. Waag Society is presently establishing a partnership with WISE International and at least one major European EPA towards the development of a v2.0 of this tool. Current plans point first to its free distribution under open source licensing, but there are also conversations to explore it commercially as EPA's will be able to expand their measurements on a low cost basis, with indication that just the Dutch official radiation sensing network could double for around € 5000 only.

And on a smaller and even lateral scale, Barcelona's Pilot 1 adopted an open collaborative tool from the Knowle West Media Centre in order to better proceed with their initial citizen mapping of issues, resources and needs based on community inputs, and this adaptation has already demonstrated a commercial potential. It is in fact now being used in other projects by one of Barcelona's Making Sense partners, Ideas for Change, which is an SME offering commercial based solutions at the crossroads of social innovation and technology impact and currently working on data commons.

3.4 Environmental

Making Sense being a project aimed at tackling environmental challenges, and in particular problems such as air or noise pollution, is supposed to be specifically suited to demonstrate impact on the environmental front. And as such a project it was indeed able to offer several tools for environmental awareness raising, measurement and subsequent action taking, to its engaged citizens and communities, and the organizations involved with it. Unfortunately, observable changes within this environmental dimension are often slow due to natural and

built ecosystem characteristics, and only one of our Pilots was capable to impart measurable and concrete short term impact on their community within the timespan of Making Sense.

In this context, our analysis will mainly point towards what was put in place throughout the pilots with the goal of **igniting environmental changes** on mid and long term futures. This mainly corresponds to specific tools or activities often also entangled with the Social or Policy dimensions. But we may start here by singling out some good cases of how they were able to trigger potential spaces for environmental impact at the citizen level:

Amsterdam Pilot 3 is a good example of this catalyst approach targeted at citizens, with the creation of Awareness Sheets based on the notion that to act on environmental information and impart change in a specific field, citizens need to be able to understand it. The strategy for impact here was making the invisible visible, transforming abstract data and concepts in the field of gamma radiation into actions participants could take on their own or demand from others, such as stop eating lettuce from nearby gardens if high radiation levels were detected, or request iodine pills from public organizations if higher levels were achieved. This awareness tool was tested throughout three workshops and is still being iterated with feedback denoting changes in values, representations and practices in line with those already explored before in the Social dimension, although with no further research conducted yet on their superficiality or permanence.

Other example within a parallel spectrum can be drawn from Prishtina Pilot 3, with the impact of the previous Pilots in citizens perceptions and values being felt in ways that made the committee members opt to expand their measurement radius into surrounding areas and communities. The concept of environmental justice offered by the project coordinators in Prishtina took a central role here, and the learnings obtained in earlier sensing and campaigning activities helped the participants to connect issues such as air pollution with social or ethnic marginalization that were detached from each other until then within their own communities. Moreover, such learnings also supported some committee members to change their familiar and own lifestyles. One participant even reported through an open ended interview how he persuaded his parents to change their heating system from coal to electric after obtaining a better understanding through Making Sense about the effects of air pollution on the health of all Prishtina inhabitants.

On the community level of Making Sense within this environmental dimension we can look first into signs of impact achieved through the pilot that produced the most concrete changes in terms of **reducing environmental harm** within the scope and timeframe of Making Sense. This pilot benefited clearly from the lower permanence time in average of its environmental 'bad', which was noise, compared to others equally tackled by Making Sense, such as air pollution, or worse, gamma radiation. But it is even so a major impact feat within the context and goals of our project:

Barcelona Pilot 3 followed the environmental challenge addressed in Pilot 1 which was noise pollution. It was focused on particular neighborhood and square where a citizen community came together around this issue with many participants not even knowing each other before. After collectively capturing data, collectively making sense of the

gathered information, and collectively creating and testing several practical solutions to make a positive change to their living conditions, the citizens of this community were able to see by themselves a few changes that resulted in a reduction of noise levels. The city council launched an awareness campaign to make people who use the square conscious of the impact of night-time noise on local residents, and following demands from the same residents it has also initiated refurbishment works to deter revellers from congregating in some areas of the square. Most notably, the council and local residents are now engaged to achieve more permanent solutions. The citizen community is still active with a strong online presence and monthly physical meetups, and several members repeatedly stating in our research that they now “feel empowered”.

On the same community level, we may still point in the second place to the intensive organization of **collective measuring and calibration events** as awareness raising activities. These activities were often capable to produce impact here by turning what are traditionally considered exclusively technical events into social instances filled with both reflection and change making moments.

All cities and pilots excelled in this particular field, with both Amsterdam Pilot 1 and Barcelona Pilots 1 and 3 especially able to show how social gathering for sensing can be strongly geared towards high level impacts in terms of potential environmental change.

But the Prishtina Pilots should be definitely singled out as a gold standard for Making Sense here, with Pilot 1 encompassing 3 collective Impact Calibration sprints, 162 collective Air Pollution Measurement Sessions, and collective 1 Placement Diffusion Tubes; Pilot 2 including 4 collective Impact Calibration sessions and more than 90 different collective measurement sessions; or Pilot 3 with 89 collective Air Pollution Measurement Sessions covering mornings, afternoons, evenings and multiple after hour periods. In particular, the Impact Calibration sprints aimed to calibrate their measuring devices were crucial to establish the connection between these technical actions and the desirable environmental outcomes often helping participants to understand the long and complex road from awareness to sensing to action.

As for the impact of Making Sense in this dimension considering the organizations behind it, we can react first to how the project's own kinship with the environmental field helped it to broaden up its reach by triggering a **networking effect** with partner organisations. More often than not, projects such as Making Sense are still poorly connected to others, but multiple efforts were made in all nine pilots to establish strong networks within and across cities in order to boost our impact through knowledge-sharing on environmental issues:

Amsterdam Pilots 1 and 3 were crucial for Making Sense strategies in enlarging its impact at environmental level by ensuring strong connections not only with existing networks in the field, such as those were Waag Society was already active with their previous Smart Citizens Lab, but also with traditional research and expert based organizations. Partnerships established with RVIM, WISE International, University of Wageningen, GGD Amsterdam, AMS, ECN, Lung Fund, and several Dutch municipalities,

were key for cementing Making Sense's impact at the environmental level through knowledge and data transfer. By encouraging and enabling the creation of bottom-up sensor networks, and sharing the resulting citizen sensing outputs, we add to available institutional data and understanding thus contributing to a healthier and cleaner environment.

No carbon compensation activities were planned or developed over the course of Making Sense, and the project partners can't detail any positive net impact at this level. Nonetheless, after the first year review the consortium collectively detailed several strategies to ensure a better **sustainability plan** considering the material impact of our main sensors:

The Bora sensor used in Amsterdam Pilots 1 and 2 was designed as a modular system using off-the-shelf boards and three customized pcbs. The choice to adopt a modular system was made as maximum flexibility was required in the development process to reduce e-waste as much as possible during new hardware implementation. This also enabled reuse of all the single parts, to improve the actual version, or to use its components in similar applications, aiming to postpone as much as possible the hardware components' end of life. Moreover, the customized boards were produced with a CNC milling machine in Fab Lab Amsterdam, keeping the fabrication chain under control and not commissioning the production to external industrial outlets that could have used chemical products for etching and/or masking.

Regarding the SCKs deployed in Barcelona Pilots 1, 2 and 3, the enclosure is mainly built of ABS plastic, a highly durable polymer, and the boards and all other electronic and computational elements were designed and produced from the beginning to become a robust and user friendly tool which most citizens can keep using after the Pilots, thus extending the sensors' life cycle. Both the software and hardware architecture allow for new versions to be uploaded on the device to expand and improve the current functionalities, also providing an extended duration and reducing its wastefulness. Furthermore, the Open Source nature of SCK allows citizens to repurpose the sensing device as an Arduino compatible board, and its 3D printed components open up space for quick replacement of parts through printing in local Fab Labs or other facilities. And in case SCKs gets damaged, a replacement strategy is often provided, with the damaged one later fixed if possible or sent to a local E-Waste Recycling Plant.

3.5 Policy

Making Sense aimed from the beginning to empower citizens and communities to tackle local issues which stands at the core of any policy impact we achieved throughout the project. We will start at the citizen level and how Making Sense has offered **new ways and channels of participation**, for example through campaigns and other means with the ultimate goal of influencing policies and political decisions, and in the following instances:

As stated before, all Prishtina Pilots empowered young people to become active participants through the establishment of committees in charge of many tasks throughout the Pilots. Particularly when it came to public interventions or campaigns, these committee members developed skills and competences to decide and put forward civic actions, while learning how to build and defend arguments in the setting of the general assemblies, and define their own political processes and strategies.

In Amsterdam Pilot 1 one of the participants used sensor data generated during the Pilot as a basis for the request of a meeting with the municipality to discuss the perceived problem of air quality in the area. From the beginning the Making Sense team managed expectations from the participants by clearly stating that data from measurements would most probably not be accepted in legal actions. Still it's a positive sign that participants could still use data to compose their stories about air pollution and as a means to engage in direct interactions with policy makers. Still, qualitative data gathered after the Pilot have pointed to the hypothesis that the presence of experts might have hindered a more activist role of involved citizens and perhaps placed them as more passive receivers of knowledge from these same experts.

Based on the notion that citizen sensing has the potential to enable new forms of civic and scientific action, when looking into the same policy impact but at the level of communities, here we address how Making Sense affected change in its **communities capacity to impact policy decisions**, which can be considered in the following instances:

In Amsterdam Pilot 1 two community groups engaged in more activist activities after the official end of Pilot, which have included a legal suit against the Dutch state over the high levels of air pollution, a petition, their own pilot about noise pollution, and the organisation of a public event targeted at politicians and citizens. The involved communities also petitioned to stop the building of a parking lot using the data collected in the Pilot, but their impact was limited due to the refusal of councillors to accept the data as reliable.

In Barcelona Pilot 3 the final action in Plaça del Sol was joined by around 1000 citizens which discussed and deliberated in a citizens' assembly and in activity tables about how to collaboratively address the problem of noise pollution as a community, and how to set up well-argued alternative proposals to the city council.

When it comes to public manifestations or campaigns, several of the Making Sense Pilots successfully provided new ways for communities to put forward their views, although the impacts in policy are not immediately visible. For instance, the communities engaged in Amsterdam Pilot 3 joined an international manifestation of around 60.000 people about the dangers of gamma radiation across regions and countries.

The same policy impact is to be taken into account regarding the coordinating and other organisations involved in Making Sense. Future activities such as a Making Sense dedicated policy paper and the launch of a World Sensing Day are already planned for 2018 as ways of

further exploiting the project in the Policy dimension. But in this respect we already observed ways how the project's activities and campaigns managed to increase our **organisational influence in political or power dynamics**, as it is shown below:

One of the most impactful effects of Making Sense happened in Prishtina Pilot 1 following its campaign actions. The project managed successfully to introduce the issues of air pollution into the public discourse of major media outlets, which in turn may have pushed for a raise of awareness about the government's accountability. Immediately after the news about the lack of data since 2013 from the authorities, the Kosovo Environmental Protection Agency disclosed missing data and restarted its regular publication.

In Prishtina Pilot 2 the Making Sense team had a policy impact when it was invited to participate in the civil society consultation in preparation for the first SAA Subcommittee on Transport, Environment, Energy and Regional development. The purpose of the consultation was to provide inputs and share information for ongoing dialogue between the European Union and the Kosovo government.

Finally Prishtina Pilot 3 also organised a concerted advocacy effort during the election period through street interventions designed to pressure candidates of political parties to address the issue of air pollution in their campaign programmes. The influence over the public discourse was visible in its nation-wide media coverage, although their invitation for a public debate on air pollution addressed to representatives of all political parties was unfortunately not accepted.

Through all these Pilots, Making Sense in Kosovo was able to become a player in the environmental political arena with its efforts counting heavily on efforts by the Ministry of Environment to recently push for a new law aimed at suspending the use of coal / wood for heating, namely in primary and high schools. The impact of the Pilots was nonetheless hindered by a series of limitations acknowledged by the Making Sense team. The scope of campaigning activities was negatively limited by the slow pace of municipality's bureaucratic procedures. Collaboration with governmental bodies and agencies was difficult at several stages of the project. And at times activities might have had a negative impact taking into account the draft of another new potential law on air quality that can establish state institutions as the only ones authorised to undertake air monitoring measuring.

4

FINAL REMARKS AND RECOMMENDATIONS

Our final remarks will now build upon the impact assessment of Making Sense on citizens, communities and organisations involved throughout the project, and also present a number of recommendations targeted at related and similar projects.

The effects and challenges identified in the previous sections attest to Making Sense's hybrid position at the intersection between a maker driven project, a crowd sensing venture, and a research and practice-oriented effort. In sum, it stands out as a citizen sensing project, or an environmental sensing project with a strong participatory and co-creation approach from the beginning.

As part of the community and underlying rationale of the Collective Awareness Platforms for Sustainability and Social Innovation, Making Sense was geared towards the deployment of digital tools for creating awareness on sustainability issues and the support of new forms of participatory practices and collective action.

Here we can recall once more the main intended impacts as established at the beginning of the project (http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=13797), divided in societal objectives (*“Make visible and tangible the invisible”*; *“Understand their environment”*; *“Turn data and insight into compelling stories & action”*; *“Using public networks of low cost, open source sensors”*) and desired results (*“Better informed, more engaged citizens”*; *“Impactful dialogues between citizens and governments”*; *“More data, more insight, better policies”*; *“More enjoyable, social, inclusive, healthy & livable cities”*). Through our collective strategies to measure and assess impact, we can state once more that our initial goals were clearly fulfilled.

Still the project went into new and sometimes different paths than we initially envisioned, also as a result of multiple iterations compared to the initial assumptions. But we can state with confidence that such alterations ended up producing a better project and in end, and celebrate our overall impact of nine pilots with a diversity of communities, local contexts, human and technical resources, partnerships and political buy-ins.

The time is now to pass on our learnings coming from these activities and processes as a project, and to point towards future directions and ways forward for similar projects. The following recommendations are aligned with the previous STEEP framework and try to extract its analytical strong points and complement a few gaps detected. Moreover, they also emerge in the sequence of the more centred and restricted "Recommendations for Community Driven or Participatory Sensing Projects" offered in the joint D5.2 + D4.3 report, and due to their main goals, end up transpiring into the Key Learnings of the final Making Sense toolkit.

Give extensive autonomy to citizens and communities in the day-to-day operations. A strong participatory involvement can lead to more empowerment of citizens and communities if they are entrusted with tasks and extended responsibilities. This will build not only their sense of ownership but also improve their skills and competences when it comes to the use of technologies, designing strategies for action, collaborating with others, taking control of their data, or intervening in the public and civic space. Citizens and communities can then replicate, reuse and transmit to others what they learned, or even take on mentoring or guiding roles

Invest as much time and resources as possible in your engagement strategies. Engaging with citizens and communities should be seen as the main priority. It means adequate material and human resources over extended periods of time, so excellent planning is essential with the understanding that constant reworkings or adaptations will be part of it. Take time to know very well your social contexts, with attention to issues of inclusion and fairness when involving citizens and communities. Be careful not to perpetuate or aggravate existing disparities or ongoing divisions in terms of gender, ethnicity, age, location or socioeconomic status.

Diversify the type and number of events and activities. They should be organised as much as possible by the project team together with the citizens and communities, or by themselves with just a supporting role by the project team. Take or encourage citizens to go through all types of activities to empower them every step of the process, for instance trainings, calibration sprints, general assemblies, iteration workshops, data interpretation, visualisation and ownership workshops, campaign preparations, and public interventions.

Communication is key to sustain collaboration with and between citizens, communities, and other organisations. Diversify channels of internal communication to keep everybody updated and ready to make decisions quickly, using for example newsletters, email, social media and direct messaging. Prepare carefully what you want to communicate, to which external audiences and when you want to do it. Make use of different means that can deliver your messages quickly, efficiently and in an engaging way through blogs, visualisations and graphics, documentaries, and overall storytelling that can reach diverse groups.

Promote exchanges and synergies as much as possible with other organisations. Such organisations should be already rooted in the local context, with a sound understanding of the issues at hand and able to make a meaningful contribution. Don't underestimate the amount

of work that is necessary to win over or to build good relationships with external organisations, especially in the policy arena and/or in sensitive issues. Connect with projects close to your domain of intervention, taking the example of networks and coordination actions like DSI4EU (<https://digitalsocial.eu/>). This European hub brings together practitioners, organisations, policy makers and many other stakeholders across countries and regions to build capacity, and stimulate collaboration and knowledge sharing between peers and similar projects.

Choose as much as possible the use of open hardware, software and other open tools. At the same time participatory or community-oriented projects need to be flexible towards other technologies if they fit the purpose of the work in question, or if they are more available or even more easy-to-use for citizens and communities. When coupled with an effective dissemination strategy, open source technologies are excellent ways to pass on know-how and increase the use in other contexts and by diverse groups. For small scale projects and pilots they can be the best route to boost the number of users and size of communities, while also ensuring the sustainability of the produced knowledge, results and learnings.

Invest time and resources to diversify training and education for citizens and communities. The main purpose is to improve their skills and competences, but don't stop at digital literacy, that is, the mere ability to understand and use technologies. Also consider other crucial skills when it comes to collaboration, like data analysis, visualisation techniques, data control and ownership, campaigning, or internal and external communication. Empowering citizens and communities through such skills and competences could be one of the more long standing and compelling effects of your project or pilot.

Develop materials, guidelines and toolkits targeted to both expert and non-expert audiences. This could greatly extend the outreach, the impact and also the sustainability of any project, especially when coupled with open source technologies. From here comes the importance of one of the last Making Sense outputs, “Citizen Sensing: A Toolkit”, which we envision will help others to effect positive change in their own contexts. Also engage as much as possible in other knowledge transfer efforts through papers, articles, publications and presentations in events, conferences and workshops, and connect to other networks and partners in sectors which deal with similar concerns as in our case digital social innovation, maker cultures or citizen science.

Explore the development of new products and services beyond traditional models. Exploitation and transfer of technologies such as the Smart Citizen Kit, spin-offs and affiliated projects, or new entrepreneurial efforts can be derived from a project's activities and promoted by citizens and communities. New business models, market and non-market based, can promote alternative economic relationships, going beyond the established, traditional growth and commercial models. Tap into emerging discussions and networks aiming to support the sustainable scalability of projects initiated by citizens, communities, and organisations within the social innovation ecosystem.

Strive for more research and assessment of viable business or financial models. Despite encouraging efforts, most projects are still in embryonic stages, operate at a small scale, or

simply don't fit into conventional organisational models. There needs to be more research and actual experimentation into how such projects can be further developed in more and more contexts, and demonstrate at the end their value and impact. New criteria need to be in place to assess and promote the sustainability of initiatives not oriented towards pure technological development and maximization of profit, but instead towards improvement of well-being, quality of life, openness, transparency and empowerment.

If possible, diversify sources of funding through public or private endeavours. The difficulty of growing and increasing the impact of citizen or community-oriented projects makes it necessary to search for widely varying sources of investment and support. Options include crowdfunding, donations, volunteer work, membership fees, pay-by-use, selling of services or expertise, consultancy to other organisations, or establishing partnerships with research centers, securing public funding at the local, regional, national and European levels, corporate sponsorships, philanthropic funding, and collaborations with private foundations. There are no one-size-fits-all models and not a lot of successful stories out there.

Select the best options for data collection and analysis according to your purposes. Providing real-time data and ensuring rapid feedback to citizens, communities and other stakeholders involved is extremely resource intensive, and might not be your main goal in the end. Producing robust evidence requires mid and long term commitment adjusted realistically for small changes accumulated and prolonged over time. Have a close look at ongoing efforts in citizen science working on data quality, comparability and interoperability. Successful initiatives are introducing or revising data protocols, operate in different organizational settings beyond more traditionally scientific ones, and tackle issues of long term storage, curation and archiving.

Support positive change in citizens' perceptions, values and practices. Take into careful consideration that any changes at this level in the environmental field can often be superficial, and require more time than the actual duration of a given project or initiative. More research is needed to understand such changes in citizens and communities, which in turn could impact attempts to address challenges in their neighborhoods, cities or regions. At their own appropriate scale, projects can work on concepts as environmental justice, or empowerment through sensing as Making Sense did, being more oriented to social and collective calibration and measuring events that could add to awareness raising as campaigning interventions in the civic space often do when possible.

Offer new ways and channels of participation for citizens and communities. This may include for instance campaigns, public interventions and other means with the ultimate goal of influencing policies and political decisions. Such narratives, strategies and actions should be co-created or defined by citizens and communities themselves, as they become proficient in deciding and putting forward civic and political actions. Still take into account that policy impact is difficult to guarantee for many reasons, ranging from sensitive topics not easy to be fully supported by public authorities or politicians, to complex and bureaucratic processes that take considerable willingness and time to change, or unstable or biased political contexts.

Engage in concerted efforts targeted at policy makers, politicians and political actors.

Create channels of communication with relevant policy actors or media to get your message across, and plan carefully to work with and influence other organisations to help shape policy or power dynamics at the appropriate level for your project. While the current political context in Europe increasingly calls for civic involvement, formal and effective mechanisms are still lacking for citizens to impact more directly policy-making in multiple stages. Despite some encouraging signs, for instance on the growing influence of citizen science in policy and decision-making, there is still a noted need in scientific literature for a strategic approach able to continue over time and argue for the value of citizens and communities' inputs. These efforts would ultimately lead to a redistribution of power in which participatory exercises could be truly unrestrained by top down frameworks and have substantial consequences in policy.

5

REFERENCES

Balestrini, M., Seiz, G. (2016) *Dissemination & Communications Plan (Deliverable 6.1)*. Project Making Sense. European Commission.

http://making-sense.eu/wp-content/uploads/2016/11/MS_D6.1-Dissemination-and-communications-plan.pdf [accessed December 14 2017]

Balestrini, M., Verderau, M., Dall'Olio, C. (forthcoming) *Communications Impact (Deliverable 6.4)*. Project Making Sense. European Commission.

Balestrini, M., Verderau, M., Dall'Olio, C. (forthcoming) *Documentation on Project Presence at Conferences, Workshops and Hackathons (Deliverable 6.5)*. Project Making Sense. European Commission.

Bastin, L., Schade, S., Schill, S. (2017) "Data and Metadata Management for Better VGI Reusability". In: *Mapping and the Citizen Sensor*, edited by G. Foody, L. See, S. Fritz, P. Mooney, A. Olteanu-Raimond, C. Costa Fonte, V. Antoniou. London: Ubiquity Press.

Becker, M., Hughes, J., Campos, A., Belmonte, E., Lakey, T., Sloan, H., Franquesa, D., Nunziatti, W., Eve, G. (2016) *Monitoring and Impact Analysis (Deliverable 2.3)*. Project CHEST / Collective enHanced Environment for Social Tasks. European Commission.

<http://www.chest-project.eu/wp-content/uploads/2015/10/D2.3-Monitoring-and-Impact-Analysis-v2.pdf> [accessed December 14 2017]

Bria, F., Lucarelli, S. (2016) *Impact and Sustainability Model (Deliverable 1.3) and Planning for the Next Period (Deliverable 7.5)*. Project D-CENT / Decentralised Citizens ENGagement Technologies. European Commission.

https://dcentproject.eu/wp-content/uploads/2016/06/D7.5_-D1.3.pdf [accessed December 14 2017]

Cangiano, S., Romano, Z. (2017) *Digital Social Innovation Toolkit*. Project DSI4EU / Digital Social Innovation for Europe. European Commission.

<https://digitalsocial.eu/uploads/digital-social-toolkit.pdf> [accessed December 14 2017]

Coulson, S., Woods, M., Hemmet, D., Scott, M. (2017) *Report and Assessment of Impact and Policy Outcomes Using Community Level Indicators (Deliverable 5.5)*. Project Making Sense. European Commission.

<http://making-sense.eu/wp-content/uploads/2017/09/Making-Sense-D5.5-Report-and-Assessment-of-Impact-and-Policy-Outcomes-Using-Community-Level-Indicators.pdf> [accessed December 14 2017]

Haklay, M. (2017) “Volunteered Geographic Information, Quality Assurance”. In: *The International Encyclopedia of Geography: People, the Earth, Environment, and Technology*, edited by D. Richardson, N. Castree, M.F. Goodchild, A. Kobayashi, W. Liu, R.A. Marston. Hoboken: Wiley/AAG.

Manzini, E. (2015) *Design, When Everybody Designs: An Introduction to Design for Social Innovation*. Cambridge: MIT University Press.

Mulgan, G. (2010) “Measuring Social Value”. *Stanford Social Innovation Review* 8(3), 38–43. https://ssir.org/articles/entry/measuring_social_value# [accessed December 14 2017]

Nascimento, S., Pólvara, A. (2013) “Opening Up Technologies to the Social: Between Interdisciplinarity and Citizen Participation”. *Design Issues* 29(4), 31-40.

Nascimento, S., Pólvara, A. (2015) “Maker Cultures and the Prospects for Technological Action”. *Science and Engineering Ethics*. doi:10.1007/s11948-016-9796-8

Nascimento, S., Pólvara, A., Paio, A., Oliveira, S., Rato, V., Oliveira, M.J., Varela, B., Sousa, J.P. (2016) “Sustainable Technologies and Transdisciplinary Futures: From Collaborative Design to Digital Fabrication”. *Science as Culture* 25(4), 520-537.

Nascimento, S., Rubio-Iglesias, J.M., Owen, R., Schade, S., Shanley, L. (forthcoming) “Citizen Science for Better Policy Formulation and Implementation”. In: *Citizen Science Innovation in Open Science, Society and Policy* edited by M. Haklay, A. Bonn, S. Hecker, A. Bowser, Z. Mazuch, J. Vogel. London: UCL Press.

Ógáin, E.N., Lumley, T., Pritchard, D. (2012) *Making an Impact: Impact Measurement Among Charities and Social Enterprises in the UK*. London: New Philanthropy Capital. www.thinknpc.org/publications/making-an-impact/making-an-impact/ [accessed December 14 2017]

Passani, A., Bellini, F., Prampolini, A., Vanobberghen, W., Firus, K., Dulckaia, I. (2016) *IA4SI Methodological Framework (Deliverable 2.2)*. Project IA4SI / Impact Assessment for Social Innovation. European Commission. https://ia4si.eu/wp-content/uploads/2016/07/D2.2_final.pdf [accessed December 14 2017]

Pólvara, A., Nascimento, S., Sanders, E.B.-N, Grael, M. (2016) *Co-Designing Participatory Approaches for Communities (Deliverable 4.2)*. Project Making Sense. European Commission. <http://making-sense.eu/wp-content/uploads/2016/08/Making-Sense-D42-CoDesigning-Participatory-Approaches.pdf> [accessed December 14 2017]

Scott, M., Woods, M., Hemmet, D., Coulson, S., Pólvara, A., Nascimento, S. (2017) *Making Sense Framework & Assessment of Participatory Strategies (Deliverables 5.2 + 4.3)*. Project Making Sense. European Commission.

<http://making-sense.eu/wp-content/uploads/2017/11/MAKING-SENSE-DELIVERABLE-D5.2-and-D4.3.pdf> [accessed December 14 2017]

Stepenuck, K.F., Green, L.T. (2015) “Individual- and Community-Level Impacts of Volunteer Environmental Monitoring: A Synthesis of Peer-Reviewed Literature”. *Ecology and Society* 20(3).

Stokes, M., Baeck, P., Baker, T. (2017) *What Next for Digital Social Innovation? Realising the Potential of People and Technology to Tackle Social Challenges*. Project DSI4EU / Digital Social Innovation for Europe. European Commission.

https://www.nesta.org.uk/sites/default/files/dsi_report.pdf [accessed December 14 2017]

Wiggins, A., Newman, G., Stevenson, R.D., Crowston, K. (2011) “Mechanisms for Data Quality and Validation in Citizen Science”. In: *Proceedings of the 2011 IEEE Seventh International Conference on e-Science Workshops*. IEEE Computer Society Washington, DC, USA.

Woods, M., Fazey, I., Hemmet, D. (2016) *Recommendations & Guidelines for Powerful Deliberate Practices (Deliverable 5.1)*. Project Making Sense. European Commission.

<http://making-sense.eu/wp-content/uploads/2016/08/Making-Sense-D51-Recommendations-and-Guidelines-for-Powerful-and-Deliberate-Practices.pdf> [accessed December 14 2017]

Woods, M., Hemmet, D., Bui, L. (2016) *Community Level Indicators (Deliverable 5.4)*. Project Making Sense. European Commission.

<http://making-sense.eu/wp-content/uploads/2016/09/D5.4-COMMUNITY-LEVEL-INDICATORS.pdf> [accessed December 14 2017]

***Europe Direct is a service to help you find answers
to your questions about the European Union.***

Freephone number (*):

00 800 6 7 8 9 10 11

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

More information on the European Union is available on the internet (<http://europa.eu>).

HOW TO OBTAIN EU PUBLICATIONS

Free publications:

- one copy:
via EU Bookshop (<http://bookshop.europa.eu>);
- more than one copy or posters/maps:
from the European Union's representations (http://ec.europa.eu/represent_en.htm);
from the delegations in non-EU countries (http://eeas.europa.eu/delegations/index_en.htm);
by contacting the Europe Direct service (http://europa.eu/eurodirect/index_en.htm) or
calling 00 800 6 7 8 9 10 11 (freephone number from anywhere in the EU) (*).

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

Priced publications:

- via EU Bookshop (<http://bookshop.europa.eu>).

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.



EU Science Hub
ec.europa.eu/jrc



@EU_ScienceHub



EU Science Hub - Joint Research Centre



Joint Research Centre



EU Science Hub



Publications Office

doi:10.2760/395368

ISBN 978-92-79-79336-3