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# **Active citizenship in times of (post) covid-19**

Project report

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## Introduction

Citizen Science broadly refers to scientific projects that actively include non-scientists in different stages of research work. It is a way of collaborating between professional scientists and the general public or interested individuals. This cooperation enables researchers to, for instance, gather large-scale or hidden data, yet it also has an educational value – increasing knowledge and scientific interest among participants, improving their skills like responsibility, critical thinking, and problem-solving (Adam 2018). The term Citizen Science may also be understood as the participation of professionals with a tertiary education, from other disciplines in projects that are largely led by natural scientists or researchers from biomedicine (like in the case of COVID-19). This describes an interdisciplinary hybrid type of research where interested individuals with different backgrounds, expertise, and experience, including researchers and scientists, collaborate on accomplishing a common goal.

Citizen Science is a worldwide movement and includes the endeavors of multiple stakeholders and organizations. We can observe Citizen Science as an effort to strengthen social cohesion defined as the belief held by citizens of a given nation state that they share a moral community, which enables them to trust each other. According to the democratization view, on the other hand, Citizen Science allows citizens to shape the direction of research toward societal needs and to contribute knowledge that may be underappreciated by the scientific establishment. Citizen Science can also increase the transparency of science and enable citizens to learn about particular objects of research and the research process.

While in Slovenia Citizen Science is known only in some circles and its application is still rare, such projects are well known and supported in the United States, one of the leading countries in this area. It is the home of the Citizen Science organization which has over 10,000 members who actively design, manage, and study Citizen Science (Citizen Science Organization 2021). Further, the U.S. government has designed a specific website to accelerate the use of crowdsourcing and Citizen Science across the U.S. government, providing toolkits and resources to assist in designing such projects (Citizenscience.gov 2021). For example, at the moment in Slovenia such a website is implemented in the form of a pilot project of the Central Technical Library at the University of Ljubljana. It enables participants to present their Citizen Science project and Sledilnik is described among 8 projects. The website citizenscience.org in contrast counts 493 Citizen Science projects. Therefore, we find that more effort is needed to ensure the spread knowledge of citizen science in Slovenia.

The COVID-19 pandemic offers a great example of the importance and need for Citizen Science projects. It soon became visible that the pandemic was not simply a health crisis and that addressing it would require more interdisciplinary cooperation by different actors. This led to numerous new Citizen Science and crowdsourcing projects and initiatives. In the United States, one of the best ones is the Covid-19 Tracker which gathered data in all states of the U.S.A. However, such Citizen Science projects can now also be found in Slovenia, the best example being the famous Covid-19 Sledilnik, which is very similar to the American tracker and also run on a voluntary basis. Sledilnik is hence considered to be an important step in recognizing the importance of interdisciplinary and Citizen Science projects and their impact on science, the community, and individuals. This project aimed to analyze Sledilnik (using the case study method) to help develop a model for future Citizen Science projects aimed at benefiting wider society.

## **Project overview and activities**

The project's main purpose is to promote the Citizen Science approach in order to encourage interdisciplinarity, active citizenship, and humanitarianism, especially among young people. The main goal was to develop a model for Citizen Science projects based on the Slovenian and U.S. examples of good practices and present it to the broader and interested public with the core goal of promoting and encouraging such projects in the future. We primarily focused on the positive impact of Citizen Science projects on youth, notably students and younger researchers, and their role in such projects.

The main outcome of the project is the model of a Citizen Science project based on the knowledge from the U.S.A. and in-depth analysis of the Covid-19 Sledilnik as a Slovenian case study. The project activities occurred in three steps: literature analysis (including consultation with the American expert Dr Caren Cooper), a case study of Covid-19 Sledilnik based on a literature review and semi-structured interviews, and dissemination activities (including the co-organization of a roundtable featuring researchers and university students).

The main contributors to the project are Dr. Frane Adam, Maruša Gorišek, and Blaž Bajec.

## **Research plan: case study with qualitative analysis**

Upon reviewing the existing literature concerned with the concept of Citizen Science and the Sledilnik project, we conducted a series of interviews with the most active key members of the Sledilnik community. Our goal was to understand the creation, organizational structure, internal relationships, and evolution of the project in order to create a model and offer advice and encouragement for future projects. Bearing in mind the focus on youth engagement, increasing civic participation, and the nature of Citizen Science projects, we chose to sample three different profiles within Sledilnik:

- researchers and scientists;
- technical workers, experts in other fields (programmers, engineers, entrepreneurs); and
- students, doctoral researchers, young doctors.

In total, we conducted 13 interviews between April and June 2022<sup>1</sup>. The interviews were 30–45 minutes long and structured according to the developed questionnaire attached to this report. An overview of these interviews is also available in the attachment.

## **Theoretical background: Citizen Science projects in the United States**

The U.S.A. as one of the leading countries in this area has traditionally supported active citizenship *inter alia* through Citizen Science. The funding and support for such projects has been provided within the U.S. legal framework since the late 19th century, for example, the formal provisions in place since 1890 to support volunteers in the collection of observational meteorological data. EU countries have lately made provisions for supporting Citizen Science projects as well, albeit the considerable differences between Eastern and Western EU countries mirrored in the funding structure remain. Out of the 174 Citizen Science projects included in the European Citizen Science survey, 136 of them were from Central, Western, and Northern Europe, while just 32 (approximately 18%) were from Southern and Eastern Europe.

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<sup>1</sup> The project's duration was prolonged due to the COVID-related restrictions that influenced the implementation of the research and dissemination activities.

Citizen Science initiatives seem to be increasing, with the EU allocating about EUR 234 million to projects linked to Citizen Science since 2011. But almost one-third of the projects in Southern and Eastern Europe received no or very little funding (Vohland K., et al. 2021). However, many Citizen Science projects, such as Sledilnik Covid-19, start on a voluntary basis and still bring remarkable achievements and benefits for society. This makes it important to encourage the emergence of Citizen Science projects, not only through funding and tenders but also through the promotion of good practices, models, and tools for creating such projects.

### **Projects related to COVID-19**

One of the most comprehensive, although inconclusive presentations of Citizen Science COVID-19 projects is the Citizen Science resources associated with the COVID-19 pandemic. It contains links to citizen science and crowdsourcing projects that might be of interest to citizens wishing to help tackle the virus, researchers looking for support during interruptions to their fieldwork, parents looking for ideas to support children who are homeschooling, and anyone looking for useful ways to occupy their time while self-isolating. It presents initiatives ranging from web and mobile apps for tracking respiratory symptoms, contact tracking, questionnaires regarding mental health and resources for educators and researchers like the COVID-19 Social Science Research Tracker.

Despite the site being international with initiatives from the U.S.A., the U.K., Denmark, Canada, and Singapore, no project except for the mentioned U.S.-based Covid-19 Tracker, is as comprehensive and gathers the same quality and diversity of data as Sledilnik.

## **Developing a case-study-based model of Citizen Science projects: Sledilnik COVID-19**

### **Background**

Covid-19 Sledilnik (English translation: Covid-19 Tracker) is a volunteer crowdsourcing project that emerged early in the COVID-19 pandemic in Slovenia in response to the scarcity and inconsistency of data being reported by the health authorities. It started with a few interested individuals gathering data they found from various sources and presenting them in a database. At first, they collected the data for their own interest, but soon recognized the need for this data among general society. The community started growing, the data sources became better, and the spreadsheet grew to become the biggest and most comprehensive database on the pandemic in Slovenia. Throughout the 2 years of its existence, Sledilnik has developed into a large interdisciplinary community focused on promoting data excellence and availability as the key to managing the pandemic. This development enabled Sledilnik to not only concentrate on data gathering and presentation, but on data modelling, analysis, content creation, and communication.

### **The Sledilnik website**

Sledilnik is today the chief data source used by the media and interested actors. On its main data website, Sledilnik presents various data about the pandemic. Sledilnik does not create its own data and only presents data taken from other official sources. For much of the data, Sledilnik was the one to create the data flow (e.g., by directly contacting hospitals, intensive care units and schools that reported data directly to Sledilnik) and was thus the only or first place to make such data available. Members of Sledilnik also validate the data, check for mistakes and mismatches, and communicate them back to the original source. Data are

presented and visualized in many different graphs on the Sledilnik website that covers many aspects of the pandemic like the number of new cases, hospitalized, hospitalized in intensive care units, number of deaths per day (in hospitals and elderly care facilities), weekly death reports, days of the week comparisons of new cases, statistics on testing and positive test rates, the presence of the virus in wastewater, and data on vaccination uptake. Sledilnik also presented some more detailed data, for example, new COVID cases by age, region, new COVID cases in schools, hospitalizations by age and vaccination status, hospital capacities, and sources of infection.

In addition to the *data* part of the website, Sledilnik has a few sub-sites such as a site with different models of the pandemic, a site with gathered current governmental measures in place, and a page on *Medium* where content articles are published. Articles on the *Medium* page are generally published during outbreaks of the pandemic and directed towards explaining science and statistics, debunking false information, and offering scientifically-based advice. Some of the most-read articles, for example, are: “*When effective vaccines encounter a statistical paradox*”, which explains the theory of Simpson’s paradox in vaccination statistics; “*How to spend holidays safely – and in good company?*”, which offered an explanation of bubbles and gave advice on how to spend time with the family safely during the pandemic; and “*PCR tests are reliable. How do we know this?*”, which explained the science behind PCR testing and debunked some myths related to the reliability of such testing.

Several members of Sledilnik were (or still are) active in the public discourse on the pandemic and the content they have created has gained considerable public attention. The media often turns to Sledilnik for explanations and comments on the pandemic.

### **Formalization and funding**

At the outset, the cost of maintaining and hosting the website was paid for by the members themselves. Since the community was informal and not organized in any way, it was impossible to officially receive any sorts of funding. This, and the desire for more formal cooperation, led to the registration of a formal Tracker Scientific Society (Znanstveno društvo Sledilnik). The Society's president is Luka Renko, the initiator of the Sledilnik project. At the end of 2021, the Society had 51 registered members of. This registration enabled Sledilnik to receive funding and donations and take part in official tenders. By that date, Sledilnik had not received any public funds, yet it had received more than EUR 20,000 in donations. Most of these donations were used to cover the costs of the project, charity projects (delivering water and food to COVID units at hospitals) and for a big meeting at which everyone met in person. All members continue to operate on a volunteer basis. The Sledilnik Society determined some possible projects for the future, but its proposals are generally in the form of brainstorming and not a precise plan. To our knowledge, no application has been made to a public tender (e.g., for a research project). Therefore, the community remains on a volunteer, self-initiative basis, which means its activity remains low when the pandemic indicators are lower.

### **Building (and maintaining) the community**

In the beginning, the community largely consisted of interested individuals and IT professionals who were creating codes for automatic data gathering and managing the data’s visual presentation. Soon, academics and researchers from different fields joined the community, along with other professionals and technicians. While the community consists of around 400 people, some 60 of them are more actively involved in the day-to-day work of Sledilnik. In their article, Slavec and Srakar (2020) analyzed the profiles of 47 of the most

active members. Most of these members hold a higher education degree, 12 hold a PhD, and 9 are included in the SICRIS national research database. The analysis shows that the fields most represented are information and communication technologies, natural sciences, mathematics and statistics followed by the social sciences and the humanistic and educational sciences (Slavec and Srakar 2020). Sledilnik offers a platform for the interdisciplinary connection of academic researchers from various fields, young researchers, professionals, and interested individuals. Mutual cooperation led to the creation of quality content regarding the pandemic as well as raising the importance of data excellence and availability through the media. Slavec and Srakar (2020) note that Sledilnik is an unprecedented interdisciplinary community in Slovenia given its size and the diversity of those involved; and is thus an interesting example of a Citizen Science initiative.

We now present deeper analysis of the community based on the interviews conducted with a view to developing a model applicable to future Citizen Science projects:

In general, we may observe the following profiles among members of Sledilnik:

- engineers, software developers, programmers, designers, and technical experts
- entrepreneurs
- researchers and academics from the natural sciences (physics, mathematics, biologists, microbiologists...)
- public relations and communication specialists, and journalists
- medical doctors and students of medicine
- researchers and academics from the social sciences
- students from various fields

It is important to note that several people fit into more than one profile mentioned above; for instance, a person can be a software developer and also work as an entrepreneur. The respondents' roles also changed during the pandemic, for example, one participating social scientist was also a high-ranking public servant at the start of the pandemic. Notably, some active Sledilnik members had either support from their working environment to work at Sledilnik for a few hours of their working week or they took a leave of absence from their work for a certain period to work on the Sledilnik project.

The community works completely online through the Slack platform, which is an online co-working application (or forum). This platform is further divided into thematical channels (e.g., development, PR and communication, surveys, myth-busting, content...). There are around 400 people on Slack, although the community was quite fluid throughout the time. As one founder of Sledilnik noted, some people only came for a short time, while others stayed longer but were never active. He estimates that approximately 30–40 people were very active in contributing to the project. Out of these most active people, another member estimates that some 40% are engineers and programmers, 40% scientists, and 20% other profiles, more focused on operative work.

#### *Motivation and reasons for joining the project*

There are two main reasons and motivations for joining the project that we observe among the members: the wish to help others and contribute to the common good; and the desire to ensure better data on the pandemic. The latter was the initial reason for creating of the project. Since there was no central point for data about the pandemic (number of new cases, hospitalized, dead), multiple people started to collect data from various sources (government press releases, media) by themselves and writing them down in tables. One of these efforts was published

online (in Google Docs form) and gathered the attention of other people who contributed data from their sources and pointed out potential mistakes and options for improving the data. This organically grown group then formed a Slack platform, created the website, and continued to attract new people with ideas for implementation.

While for some people the key motivation for joining was simply to obtain good data for their own research, most of them note that they felt good knowing they were contributing to wider society and wanted to help others. For some, helping the community was the main reason for joining the project. One of the most active members revealed that she thought highly of the project when it became known and wanted to join to be part of a project that was so beneficial for society. Another scientist noted he saw Sledilnik as a possibility for joining forces with other interdisciplinary researchers to find answers and contribute their knowledge to society.

However, many members of Sledilnik believe the situation at the start of the project was very peculiar – there was a clear and present danger and quick steps were needed. Therefore, many felt the desire to contribute to the greater good and help the community in crisis. Due to the lockdowns, many people also had more free time available than usual. Consequently, the motivation and activity of the community varied throughout the pandemic, being at its highest in outbreaks of the virus and its lowest in the calm periods.

### **Organizational structure and leadership**

All interviewees described Sledilnik's organizational structure in the same way – as an open community without a hierarchical structure, where the ideas and motivation of individuals are the main drivers. Still, they acknowledged the coordinating effort of the project's initiator (also the president of the mentioned society) which maintains the project's continuity but preserves an open attitude to all proposals of members/non-members. While the community is divided into different content-based channels, where some people act as coordinators (e.g., a coordinator for public relations), they do not act as leaders who divide up work and decide on content but are merely the people who have the greatest overall insight into that topic and can offer help to other members. The organization of the work is said to be very different from traditional company leadership.

Typically, a member proposes an idea on the Slack platform (e.g., a new visualization of data, fresh addition to the website, or even a new project) and other people give feedback, advice, and their opinion. Ideas recognized as good naturally attract other members who join in working on the project. Multiple members noted that it was important that the idea be accompanied by some initial work or a clear vision of implementation by the one who suggested it. Several members described this way of working as a typical meritocracy where everyone is free to suggest ideas, although the success of an idea depends on its recognition by the community and the hard work the initiator puts in, which attracts others to help them. Many ideas were thus proposed that did not get implemented because the initiator did not prepare the groundwork or a clear implementation plan. Similarly, work also entailed creating content. A member came up with an idea for a topic (mostly articles communicating science or debunking false information) and presented a draft. This attracted other members to join in to give comments and improvements until everyone involved was satisfied with the result. Also here, if the person presenting an idea for an article did not put in the groundwork to present a draft, it generally did not get implemented.

This kind of organizational structure depends heavily on the members' motivation and self-initiative. This is at once the greatest advantage and disadvantage of the community. When the

motivation and initiatives of the members are high, especially in outbreaks of COVID holding a '*clear and present*' danger felt by everyone, the community was able to be very efficient. On many occasions, they were able to introduce new content, data visualization, or a new addition to the website within less than 24 hours, even if it required the input of multiple people. Members regard such a structure of work as one of the biggest benefits of the community while many had previously doubted that such an organizational structure could be possible in practice. On the other hand, when the motivation of members is low, such as in times of low COVID-related numbers when the sense of urgency is reduced, the community is not very productive and innovative. The motivation drops further when the efforts are not acknowledged by the authorities like the National Institute of Public Health either due to the informal manner in which Sledilnik is based on personal or bureaucratic constraints of the public servant system.

This poses a problem and a challenge for other projects that could derive from the community, especially members who point the project Podnebnik out. This project was supposed to be a spin-off one dedicated to the climate change data; however, it is developing at a completely different tempo. The sense of urgency and danger is much less, the climate is not changing daily, and the motivation for urgent actions is lower<sup>2</sup>. The project is thus taking much longer to implement and it is harder to attract people to work on it.

### **Knowledge transfer and youth engagement**

Most of the interviewees reported they have gained new knowledge during their work for Sledilnik, and acquired valuable experience. Some examples of new knowledge obtained is a new programming language they learned and other similar technical knowledge, knowledge of how to communicate with different actors, organizational and other skills. For most interviewed members, while their work at Sledilnik was not directly connected to their jobs they did use the knowledge they had gained during their education or career and applied it to Sledilnik. The work at Sledilnik did not directly influence their careers, yet many stated that they had included it on their CV and that the public in general sees it as a really good professional reference.

The type of organizational structure and way of work in the Sledilnik community enabled people to communicate fast, join in shared topics of interest, and quickly find people with skills and knowledge needed to implement ideas. However, this type of structure also highly preferred people with self-initiative already possessing considerable knowledge and skills. This might have created a problem with attracting members who are younger, not yet independent in their work, and require more mentorship and guidance. One interviewee admitted that the community had troubles attracting young people willing to commit self-initiatively. Still, there are cases of good practice within Sledilnik as well. One interviewee was a student of medicine who joined Sledilnik in order to work with people on an university course assignment about intentions regarding vaccinations. He was working under mentorship from the university and cooperating with members of Sledilnik. This cooperation later led to the publication of academic article, with the student continuing to collaborate on other Sledilnik projects and becoming the coordinator of a small project (available family doctor tracker).

### **Future of the community and limitations**

Practically every interviewed member stated that community's potential to create new projects and features is high, but depends greatly on the motivation and time of individuals given that

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<sup>2</sup> As stated in some interviews, Podnebnik entails much more complex data on climate changes concerning societal changes over a longer period of time, for example, the average 10-year temperature since 1961 (for more, see: <https://n1.info.si/poglobljeno/dr-ziga-zaplotnik-slovenijo-caka-veliko-vec-neurij-z-mocnim-vetrom-in-toco/>).

volunteering has its limits. As seen during the pandemic, the community's activity varied based on the sense of urgency of the situation, which influenced the members' motivation. One member noted that the community proved to be able to implement projects overnight when that was needed to respond promptly to the needs of society. Another member added that the community works best when under time pressure. Some members therefore believe that similar, equally successful projects are unlikely to come from the same community while acknowledging the unprecedented platform of informed and expert individuals from a variety of disciplines that Sledilnik created in Slovenia.

Apart from the urgency of the situation, other factors influenced some members' lack of motivation and willingness to cooperate in future projects to the same extent. Particular members have less free time available to dedicate to the project. Others reveal their disappointment with Sledilnik's effectiveness in terms of systematic changes in the area of data availability, not to mention the response of the authorities to their efforts. Last but not least, pandemic fatigue can also be seen among the Sledilnik community.

Within the community, there is an interest in developing new projects on topics other than COVID. A few of these have already been realized, such as an online platform that enables citizens to search for the closest family doctor<sup>3</sup> who is available to accept new patients, or a brief a webpage containing important information for Ukrainian refugees entering Slovenia<sup>4</sup>. The biggest project in the making is Podnebnik, a website dedicated to tracking data and sharing content concerning global climate changes. The initiative to develop Podnebnik started quite soon after the success enjoyed by Sledilnik by some members of the community who professionally deal with climate change modeling. The idea underlying Podnebnik is to collect, analyze, and publish data revealing the impact and dimensions of climate change (e.g., the rise in sea levels, gas emissions in different sectors, and data on energetics) to permit the general public to have a better understanding of climate change. Although a large group gathered around the project (over 90 people joined the Slack channels related to Podnebnik), the project has been developing at a much slower rate due to a combination of the above-mentioned reasons. The website has yet to be finished and go live.

### **Importance and implications of the project**

When members were asked what they consider to be Sledilnik's biggest value during the pandemic, they mostly highlighted two aspects – becoming a central data point for informing the general public, media and other interested actors about the state of the pandemic, and its important role in science communication through the content and articles they have created. During the time of Sledilnik, the website was developed in response to a need – there was no place where the media or general public could obtain all of the relevant data about the pandemic (like the number of cases, deaths, hospitalized, weekly averages, incidence numbers etc.). For instance, the National Institute of Public Health (NIJZ) created its data point more than 1 year after the pandemic started.

The many awards received by the community (including the “Apple of inspiration” from the President of the Republic) and the high number of website users (among the most visited sites in Slovenia) prove that Sledilnik was recognized as an important project holding clear benefits for broader society.

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<sup>3</sup> <https://zdravniki.sledilnik.org>

<sup>4</sup> <https://slovenia-ukraine.info/en/>

However, several members of the community complained that Sledilnik's cooperation with other governmental bodies (Ministry of Health, Health Institute...) was only successful on the operational level, with individuals providing data. There was little cooperation on the organizational level, thereby raising doubt that the government saw Sledilnik as an important actor in the pandemic. Members especially note that there was almost no cooperation with NIJZ. As they mentioned, NIJZ replied to their emails in the same way as they do to the general public, often with a considerable delay, and not showing much willingness to cooperate with Sledilnik. One indicator of this lack of cooperation is the difference in the sum of COVID-related deaths in various international databases. The ECDC database shows the data from NIJZ (gathered weekly) and reveals that every individual that died within 28 days of a being declared positive. Those figures are available with a delay. Sledilnik presents this data in some tables but prioritizes the number of deaths each day reported by the hospitals and elderly care facilities. The sum of those deaths is nowadays more than 1,000 people lower than the NIJZ figure. The fact that many international databases take the number from Sledilnik means the total number of COVID-related deaths varies a lot in different databases. Members of Sledilnik are quite unanimous in explaining that the discrepancy is due to the difference in the counting methodology and mainly support the existence of the two numbers (as they could not methodologically support any sort of combination of two different time series). Yet, there was no communication between Sledilnik and NIJZ (nor the government) regarding those differences and the implications they might hold in international comparisons.

## **Conclusions – lessons of Sledilnik for future Citizen Science projects**

There is no doubt that Sledilnik is an extraordinary example of a self-grown community of academics, experts, and interested individuals from different disciplines, which managed to respond to the needs of society in times of crisis and in many ways proved to be more efficient than the state. We may point to several factors that added to the efficiency of the community and its success:

- Openness and flexibility of the community: in terms of a variety of people, knowledge and skills and an organizational structure in which where everyone was free to share ideas, start new projects, and join/leave the community.
- Motivation and self-initiative as the main drivers: this led to people being personally invested in projects and being willing to put in more time and effort into them than had someone ordered them to do the same.
- Interdisciplinarity: enabled the community to engage in a broad range of products or projects (from content-related to vaccines, mathematical modelling through to surveying).
- Online-based cooperation and communication: use of the online platform enabled quicker communication and an organic thematic division of work. It also lowered costs and made it easy and fast for members to join initiatives and offer their expertise.

However, many of those factors emerged due to the specificity of the situation – responding to a crisis and working under the urgent pressure of clear and present danger. This means it is impossible to use it as a model for other Citizen Science projects that start in different circumstances. Evidence for this is the Sledilnik community's lack of activity when pandemic indicators are low, along with the problems the same community has with starting new, bigger projects not related to COVID. Therefore, choosing the same organizational structure and way of working might not be appropriate for other Citizen Science projects. Without an acute crisis that the community is trying to address, it is hard to expect the same level of motivation and self-initiative from community members. Further, the described way of work proved not to be

very successful for attracting young people or people who need more mentorship and guidance in their work.

In any event, the case of Sledilnik can offer some important points for other Citizen Science projects in the future:

- It is important for participants to feel personally involved in the project. This increases their motivation and productivity. Instead of a clear delegation of tasks, self-initiative is important. For example, involving different participants in the early stages of the project and allowing them to co-create the project on all levels might prove more efficient than creating clear rules which they should follow.
- Interdisciplinarity benefits everyone. Creating a project with people from different disciplines can improve knowledge transfer and creation. Not only lay people and students but also experts can learn many new things via such cooperation.
- It is important to understand possible structural obstacles in advance. If the project depends on the cooperation or input from other organizations, it is important to anticipate problems that might arise from this in order to avoid any halting of the project or the loss of members' motivation.

Finally, the influence of Sledilnik and experiences from the U.S.A. show that it is important to encourage such projects on different levels. It is necessary to also promote self-initiative projects on the state level and offer different incentives to increase the number of Citizen Science projects. In this respect, much can be learned from the U.S.A. and its platforms for promoting Citizen Science projects.

## **Dissemination activities and promotion**

As envisioned in the project proposal, the promotion of findings and presentation of Citizen Science projects is a principal goal of this project. In this regard, we have created a small, informative brochure describing Citizen Science that can be shared online or in printed form. The brochure's contents are based on the toolkit for Citizen Science projects published at the United States Government portal for Citizen Science. Topics related to this project are also published on our website ([www.institut-irsa.si](http://www.institut-irsa.si)).

We have continued to keep in contact with Dr Caren Cooper, an American professor from North Carolina State University, a leading expert on the topic of Citizen Science in the U.S. Already before the project had started, she supported the application. We also sent her the results of our project and the final report.

Moreover, we have been actively engaging with individuals and groups that we recognized as being most likely to develop such projects.

### **Workshop in cooperation with SASS (FUDŠ)**

Upon completing the research part of the project, our Institute in collaboration with the School of Advanced Social Studies (FUDŠ) organized the roundtable: "*Selected Challenges of Public Health in a European Context: Experiences of the Covid-19 Pandemic*". Part of this roundtable was devoted to presenting the findings of our research and explaining the importance of interdisciplinary cooperation and such projects for the wider benefit of society. The roundtable was attended by researchers, academic professors and students, which are among the profiles

most likely to engage in such projects and develop them in the future. An invitation to the roundtable is available here: <https://institut-irsa.si/vabilo-na-okroglo-mizo/>.

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## Websites:

<https://www.citizenscience.org>

<https://www.citizenscience.gov>

<https://covidtracking.com/about-data/state-reporting-assessments>

## **Attachments: Abstracts of the interviews**

### **ABSTRACT 1 – PhD (Sociology), professor at a university, female**

**Interview conducted: 16. 5. 2022 at 15.15**

#### **1. Personal profile and cooperation in the Sledilnik project**

She holds a doctorate degree in science, lectures at the university, and has cooperated with Sledilnik since June 2020 when she was still serving as secretary general for higher education at a ministry. At the beginning, she contributed by searching data since the lack of it was critical. Then she moderated a channel regarding employment and others. After leaving the ministry, she took up other roles and also contributed to the content. She needed a conversational partner for exchanging ideas, to debate aspects of pandemics, and obtain feedback on possible solutions.

#### **2. Sledilnik as a Citizen Science project**

At the beginning, the skills most needed came from people with knowledge of software, then came other disciplines like economists, psychologists, PR managers, yet few were representing the social sciences. Sledilnik is run by volunteers. Anyone wishing to make presentation of their idea can have it implemented if it attracts support. This is uncommon in the theory of management since there usually are rules and you need to abide by them to become an insider of an institutionalized organization while the members also need to know their tasks; for example, in research projects with predefined concepts and assumptions. While Sledilnik works in open communication and also with a high level of academic discussion but involves a wide pool of competent people on a hop-on, hop-off principle even when they do not know have the general framework and shared knowledge. The initial intention was to become a platform for data on COVID, but it turned out there is no data so they had to mine it by themselves and even digitize it. Sometimes, it leads members to the end of their thinking capacity, although there were always others willing to take over and share the burden when someone lacked the time. The downside of this kind of organization of work is exhaustion and that expectations of the environment grew bigger to exceed the available capacities.

#### **3. Sledilnik and knowledge transfer**

Her position was always focused on the problem at hand while searching for solutions to the difficulty of the pandemic in her network and involved her as a whole. As the communication with Sledilnik went on around the clock, this made it hard to differentiate EU state secretaries and other colleagues at meetings when everyone was searching for data. She views Sledilnik as an interesting research community for finding other perspectives to problems. Further, she works in one UK team where they adopt different computer methods than they would without such an exchange of knowledge provided on this platform. Sledilnik was also her private sounding board group regarding her own experience with long COVID. The communication that was primarily online improved after they met in vivo since it is sometimes hard to understand the meaning of written words from people with different characters and professional backgrounds, but ultimately all members were searching for communication during the time of the crisis.

#### **4. The role of Sledilnik in an epidemic**

The important role played by Sledilnik entailed forcing the established institutional structures to reflect on their unpreparedness, where the only body capable of responding with protocols for the crisis was the civil protection unit. Sledilnik provided services to a state that is illiterate

when it comes to data, particularly big data. Moreover, policymakers are not used to dealing with going beyond anecdotes and group interests to include evidence as the basis of decisions while during a crisis one needs data analysis, to choose a strategy and then make a decision. The role of Sledilnik is also namely to put forward the agenda of digitalization and informatization, even though at the time of the pandemic its services were not acknowledged by the institutions and it had a luke-warm relationship with resisting individuals who sensed their institutionalized authority was being challenged. Due to the lack of knowledge, they were unable to define their needs at a time of crisis while Sledilnik was able to identify them.

## **5. The future of Sledilnik**

During the process of crystallizing the future purpose of Sledilnik, Sledilnik was found able to provide a virtual community with the social capital of volunteers who are prepared to share ideas and work. Perhaps there will be a reduced presence in the media, there is no sense of crisis at the moment, yet there are still the projects on climate change and others. Still, to share data one needs to have some key persons to meet, to establish trust. One also needs to maintain and take care of the virtual space to reach this level of openness where there are no inflated egos as are sometimes present for example in research projects. The humility of volunteers jointly contributing their time is something to learn from and to regard Sledilnik as a model of practice for organizing work in the future.

## **ABSTRACT 2 – Development engineer, working as a manager coach, and in start-up investing, male**

**Interview conducted: 17. 5. 2022 at 10.00**

### **1. Personal profile and cooperation in the Sledilnik project**

The interviewee is a computer technician with a career as a development engineer and manager, currently working as a manager coach and start-up investing. He was the first person to begin collecting data on COVID infections and deaths in his own spreadsheet (based on information from the media), which he later shared with other people who contributed and formed the Sledilnik community. He was in charge of data input, validation, visualization, coordination, and helping new members. In October 2021, he wanted to shut the webpage down and archive it since there had been no progress with data availability on the national level. The community decided to take over some of his work and keep the webpage alive.

### **2. Sledilnik as a Citizen Science project**

He reports there are various profiles of people involved in Sledilnik: scientists, programmers, entrepreneurs. Together, over 300 people joined the Slack platform on which they communicate, albeit the community was quite fluid, some only came for a short time. He assesses that around 30–40 people were very active in contributing to the site. The organization of work is very different from traditional company leadership. There are some coordinators for specific fields (communication, data, development) but mostly in the sense of someone who has a general overview, not someone who delegates tasks. Work is based on the motivation and goals of individuals who come up with an idea, obtain support for that idea, and make it happen. Therefore, the dynamics and work changed throughout the pandemic depending on people's motivation, which was highest in the first wave and in the autumn of 2020. The positive and negative aspects of such organization are the same – everything depends on the personal responsibility of people and their free time. This is a bigger challenge in projects such as Podnebnik where there is no clear and present danger.

### **3. Sledilnik and knowledge transfer**

The work on Sledilnik was different to the work he was doing in his job. He reactivated some of his old knowledge and learned a new programming language during his work at Sledilnik. However, while Sledilnik did not have a direct impact on his career, it was a valuable experience. In Sledilnik, he worked with people he would not have otherwise (especially scientists), which was a good experience, but notes that the scientists who joined Sledilnik were more open-minded and collaborative than some other scientists from different institutions he had encountered at some Sledilnik-related meetings. He added that Sledilnik is based on a meritocracy, and what counts more than someone's credentials are their ideas and work in the community (being able to implement good ideas).

### **4. The role of Sledilnik in an epidemic**

He believes Sledilnik's biggest contribution was in being the central data point for everyone to access and become informed about the epidemic situation in Slovenia. As a second point, he noted their work on the content they produced – debunking some myths and answering questions from the media and the public. The communication with NIJZ was very formal (NIJZ sees Sledilnik like anyone else from the public, often it does not reply) despite trying to establish more regular communication. He noted very good working relationships with people from the Ministry of Health who provide data. Overall, communication was good on the operative level, but scarcer on a higher level.

Regarding the discrepancies in the total number of deaths, he emphasized that these are two different methodologies which both have their strengths and weaknesses. The NIJZ figures are probably more accurate, especially for general and international comparisons, but are not available daily, making it impossible to use for modelling and daily monitoring of the epidemic. He noted that they put a lot of work into explaining those differences, particular to the media. Communication regarding the mortality data happened only with UKOM, which combined both data together and formed a third version that was methodologically incorrect and they did not agree with it.

As Slovenia's greatest problem while dealing with the epidemic, he noted the problem of communication, which was not harmonized among the key figures (politicians and experts) and often included the wrong emphasis (reading daily numbers instead of explaining trends and the situation). He also expressed his disappointment with the under-preparedness of institutions (especially NIJZ) for this pandemic (epidemiological tracing with paper and pencil at the beginning, no model of an epidemic).

### **5. The future of Sledilnik**

It depends solely on members of the community, their motivation and time. Sledilnik, along with the formed association, offers some basics for support, yet the projects depend on the activation of members themselves. There are some institutional problems with cooperation (e.g., when the Zdravniki project was launched and received media attention, ZZZS was happy about the project and promised to cooperate, but that did not happen at the end).

## **ABSTRACT 3 – Final-year student (medicine), male**

**Interview conducted: 16. 5. 2022 at 19.00**

### **1. Personal profile and cooperation in the Sledilnik project**

As a final-year student of medicine, he joined Sledilnik coincidentally. Their team in the course examining intentions for vaccination was conducting interviews and expanded their work under the supervision of Dr. Zwitter and wrote an article with the help of experts from Sledilnik. He knows that interdisciplinarity gave the article a result that could not have been achieved on their own. He was the communication link between the team, Sledilnik and their mentors. He is now leading members at Sledilnik in the project [zdravniki.sledilnik](https://zdravniki.sledilnik).

### **2. Sledilnik as a Citizen Science project**

He finds that a project needs some interested individuals to reach its goals, even though in the situation of a pandemic they generally did not know how to get there. The participation was democratic and organically developed after the proposals of a member who had presented an idea, then others joined in. Still, it is crucial that people respect other peoples' opinions and are willing to share knowledge. On the other hand, there is no directive and deadline like usual projects, the production is based on the interest of the members. Now among the 400 users of Sledilnik Slack, the group around [zdravniki.sledilnik](https://zdravniki.sledilnik) has expanded to 50 members.

### **3. Sledilnik and knowledge transfer**

He is involved in a project outside Sledilnik for implementing technological solutions to register heart failures. He learned much from Sledilnik with respect to soft skill organizing of people, and also gaining an insight into actual processes on site, while the media gave conclusions that were unsupported or the lectures at the faculty conveyed the ideal version of doing science and medicine. He acknowledges that the results of his projects are better because of the support of the Sledilnik community.

### **4. The role of Sledilnik in an epidemic**

He is unsure about the role of Sledilnik since the members with different expert backgrounds were not really taken into account by the authorities. Sledilnik gathered the data and was responsive to the situation and advanced parallel to the course of events compared to the institutional response. The communication of the measures was also not done properly and now under the stress of medical staff overload the pandemic was a missed opportunity to strengthen trust in the medical system.

### **5. The future of Sledilnik**

Now Sledilnik is a platform that gives opportunities for people who seek to do some good for society using technological means. The future depends on the activity of its members, particularly maintaining the motivation that can drop when the solutions proposed are ignored by the authorities.

## **ABSTRACT 4 – PhD (Economics), working at a research institute, male**

**Interview conducted: 17. 5. 2022 at 16.00**

### **1. Personal profile and cooperation in the Sledilnik project**

He holds a PhD in economics and is finishing his second doctorate in mathematics, namely mathematical statistics. He works at a research institute and lectures at a faculty. He joined Sledilnik at the beginning in April 2020 in the framework of the Young Statisticians section at the Statistical Society of Slovenia that organized a roundtable which led to the temporary modeling expert group on COVID that ceased to work in September 2020. He is also one of the cofounders of the Sledilnik Association established in December 2020. He joined because of his interest to find information and data modeling and is still active on the channels of Slack as well as in the formal roles of the Association.

### **2. Sledilnik as a Citizen Science project**

He recounts an interesting blend of different groups that contributed to the Sledilnik project: software developers, physics, statisticians, mathematicians, biologists and, notably, PR managers, entrepreneurs, and artists. He views Sledilnik as an open platform with volunteers' engagement in three main fields: modeling, data management, and contents. One particular change in operations was formally establishing Sledilnik as an association that provides a platform for very diverse professionals and experts so far unseen in Slovenia.

### **3. Sledilnik and knowledge transfer**

At the beginning of the epidemic, along with his colleagues he applied for research grant on COVID, meaning that his engagement is connected to the research interest that was then the top concern in general. Engagements with Sledilnik supported his professional work. That is also the case with some other colleagues, but it depends on the individual how one is able to transfer the knowledge since Sledilnik is a particular setting. Due to his background in the social sciences and also in the natural sciences, he was able to communicate to all groups involved and had no issues with such communication, even though there are particular characteristics in every professional discipline.

### **4. The role of Sledilnik in an epidemic**

Sledilnik's role in the pandemic is evident from its presence in the media. The cooperation with NIJZ was troublesome, even though both actors in their own way were crucial for dealing with the pandemic and could have cooperated with each other with greater ease. The communication was sometimes intense in the daily communication regarding the data. Another role of Sledilnik is as a platform of different profiles to exchange information and cooperate, which was not established at the start when the pandemic first hit. Sledilnik provided the data, but the authorities seemed not to be aware of evidence-based decision-making with a model and a stronger connection between data and policy is needed in Slovenia.

### **5. The future of Sledilnik**

Sledilnik holds great potential, it has moved past its disappointment with the authorities and has many ideas. There is a sense of fatigue after 2 years of activity on the other hand since the people on the platform are volunteers and the engagement depends on their motivation. Still, ordinary people approach it because they want to contribute solutions based on the data and also because the new Slovenian resolution on information and research activity includes citizen science as one of the fields to be supported. There is in addition the association that works

openly with members and beyond and is receptive to new ideas. It all now depends on activating the volunteers to participate, share ideas and do the work required for the projects.

**ABSTRACT 5 – PhD (Computer science), owner of a company (technologies of the future), male**

**Interview conducted: 17. 5. 2022 at 19.30**

## **6. Personal profile and cooperation in the Sledilnik project**

A doctor of computer science with his own company that deals with developing technologies of the future. He was one of the first people at Sledilnik to start gathering data in order to understand the situation. He tried to bring scientists from different backgrounds together to contribute to the general understanding of the pandemic. The main motivation for his work at Sledilnik was his wish to understand what was happening and his desire to help those around him. Lately, he has been less involved with the project than at the beginning because of his other occupations.

## **7. Sledilnik as a Citizen Science project**

He noted that Sledilnik had several functions – engineering, data, science, communication, media – in which different profiles of people are working. The aim was for everyone possessing relevant skills and knowledge to cooperate since the pandemic is a complex phenomenon and it is not appropriate that each field only does its own thing. He describes the organization of work as a community of interested citizens working together. In his opinion, no other organization structure was possible for Sledilnik and it did the most it could have.

## **8. Sledilnik and knowledge transfer**

The work at Sledilnik was completely separated from his professional work and was a way of helping the community. Except for working with interesting people and establishing some new friendships, it did not hold any other implications on his life and career.

## **9. The role of Sledilnik in an epidemic**

In his view, Sledilnik had multiple contributions during the epidemic. It showed how data-oriented thinking can work and how people can organize themselves and work if needed and possible. It also showed how this can be alien among existing structures. He noted that the communication with other institutions seemed to be more one-way than two-way, with some exceptions. Many actors took Sledilnik for granted and only thought about what they could obtain from it, not how they could help it. He noticed a mindset whereby everyone first took care of themselves and then others, while Sledilnik was working the other way around, first making something for others.

Regarding the discrepancy in the number of deaths, he pointed out the difference between databases such as John Hopkins and Worldometer, where volunteers often work, and the ECDC, which is an official institution and working through official administrative channels. He added that the data are based on indicators and measures that can differ, and it is impossible to expect everyone to work in the same way.

As the biggest problem of Slovenia while dealing with the epidemic, he pointed out the lack of interdisciplinarity and the politization of the pandemic.

## **10. The future of Sledilnik**

The future largely depends on people's time. He personally feels somewhat burned out. Regarding other possible such projects in Slovenia, he noted that the country needs to ask itself if it wants people's initiatives, or expensive and rigid bureaucratic systems.

### **ABSTRACT 6 – PhD (Population studies), chief data officer, female**

**Interview conducted: 18. 5. 2022 at 18.00**

#### **1. Personal profile and cooperation in the Sledilnik project**

Holds a PhD in population studies, currently working as chief data officer. From the summer of 2020 until March 2021, she was unemployed and worked full time at Sledilnik in the area of data, answering e-mails from the media and the public, and helped with content creation. In autumn 2021, she took over the daily work of data input, validation, and coordination from Luka Renko. She joined Sledilnik when invited by a friend. Her main motivation was to be useful and be able to contribute to a project she thought highly of.

#### **2. Sledilnik as a Citizen Science project**

She observed very different profiles of people working at Sledilnik, but sees a common point in that they are all *generalists* (curious, knowledgeable in more than their professional field, interested in cooperation). She describes the organization of work as based on the self-initiative of the members, where an idea itself is not enough, but a plan for implementation and willingness to work on it are also necessary. She points out that the community is extremely meritocratic – no one delegates tasks and all opinions are worth the same. Ideas that the community sees as good and useful, and which can be implemented, are those that succeed. She thinks that this is the only possible organization of work for Sledilnik to exist in such a form and be so successful because people are driven by their motivation and interests. The downside is that such an organization depends on people's availability, time, and motivation, and when there is less of that there is less work done.

#### **3. Sledilnik and knowledge transfer**

The work at Sledilnik is connected to her professional work, technical- and content-wise. The work at Sledilnik, and things she learned there, gave her a lot of motivation and confidence for the work she does at her job. She also notes that Sledilnik was a good reference to have on her CV while searching for employment. She was in contact with different profiles of people than she would otherwise have been, but is used to working in interdisciplinary groups. However, she gained new knowledge in communication with the official institutions, public, and media.

#### **4. The role of Sledilnik in an epidemic**

She sees Sledilnik as a website at which people could obtain information about the epidemic situation in Slovenia, which they used as a basis for risk assessment and adapting their behaviors accordingly. She also noted the importance of the models and the predictions researchers made while using this data.

Sledilnik cooperated very productively with the Ministry of Health, especially on the level of direct communication with the people who provide data. The communication ran both ways, Sledilnik often did some favors for them as well (a different data format, correcting mistakes in the data). With NIJZ, the cooperation was really cold and one-way. Sledilnik often contacted it with questions, suggestions, notices about mistakes, but often it did not reply, or it replied

after 30 days with a very official response that did not address the topic. She pointed out that Sledilnik sees NIJZ as someone on the same side as them, but it does not seem to think the same about Sledilnik.

Regarding the discrepancy in the number of deaths, she believes it is very good that we have different ways of measuring and different sources based on various definitions. The different data each have their pros and cons. The only thing she wishes is for the explanations of these differences to be more visible and easily accessible at the Sledilnik website. She also stated the only problematic source was the combination of both sources, which was methodologically questionable, that the government had used for some time, regarding which they held (unproductive) meetings with UKOM. The foreign databases that use Sledilnik as their source usually do not have any contact with Sledilnik and take from the website the data they want (from API server). They only had contact with Our World in Data.

As the biggest problem of Slovenia while dealing with the pandemic, she noted the problem of communication (too patronizing, never admitting mistakes, too little rationality and explanation behind the decisions).

### **5. The future of Sledilnik**

She sees the potential of the community as very big, yet it depends on outside factors. She stated that the community works best when under some time pressure, which is why some other projects are not starting so efficiently. She does not see herself cooperating in any other similar project because she is afraid that she would be disappointed since she doubts it is possible for other communities to be this effective and work in the same way. She sees possible obstacles for new projects if they depend on cooperation with formal institutions (as Sledilnik does to obtain data). Public administration works on different principles, the institutions are more rigid, and cooperation is harder to ensure. Sledilnik benefited from its recognition, which made it easier, yet they still encountered difficulties.

**ABSTRACT 7 – A programmer, founder and technical director of a company (information systems for geography), male**

**Interview conducted: 19. 5. 2022 at 11.00**

**1. Personal profile and cooperation in the Sledilnik project**

He holds a high school degree, studied physics, has been programming since he was a student. Currently, he is the co-founder and technical director of Sinergize, dealing with geographical data and data visualization. At Sledilnik, he was involved in modeling discussions for data presentation to the public. He joined the project because he knew that collectively joined efforts bring results and the spreadsheet of Luka Renko gave the most insight so they decided that they needed to organize over the Slack platform and after that things organically continued to grow. He is presently only actively updating the data once per week that remained unautomated from the public institutions and comments on the ideas on the channels of Slack.

**2. Sledilnik as a Citizen Science project**

He identifies the main groups that contributed as technicians and program developers supplemented by the people who managed the communications. Sledilnik is self-organized, he recalled only two instances when someone organized the excess of people who wanted to contribute and they did not know how. Otherwise, the projects are made by motivated people who are interested in an issue and individuals take responsibility for carrying out their ideas and then ask others to help. He acknowledged the role of Luka Renko in maintaining the continuity of daily operations, before others joined in. The community is extremely open to the presentation of different ideas where people are given quick feedback and advice, which is an asset. Still, one downside is that the people work as volunteers and sometimes there is not enough energy for bigger projects.

**3. Sledilnik and knowledge transfer**

During his engagement with Sledilnik he learned certain new software programs and languages that he now uses in his work, but he mostly appreciates the awareness of how people stand together with a dedication to share knowledge and contribute with their capabilities towards the common goal. That is something to learn from in the professional sphere. He found many open-minded people with a high level of competencies that put their differences and ego behind them to share ideas in argued discussions and he values their opinion.

**4. The role of Sledilnik in an epidemic**

He had hoped that Slovenia would have been more successful at dealing with the pandemic and is unsure how to quantify the contribution made by Sledilnik. Perhaps the project was an excuse for the institutions not to take over the responsibilities they hold and perhaps people would have demanded more from the government. Sledilnik mostly had a psychological impact, people trusted its posts, and the media obtained information it needed. Mostly in the institutional framework, Sledilnik was not taken into account, only given some advisory role at the Ministry of Health. The communication of the reasons explaining the measures could generally have been better.

**5. The future of Sledilnik**

Sledilnik has potential, it became a gathering point of motivated knowledgeable people that lack time and that is the challenge for the future. Sledilnik is not transferable to the corporate environment in the way Sledilnik spontaneously works. He would contribute to Sledilnik in

hourly tasks and not use his vacation days like he did at the beginning of the pandemic because he now dedicates more of his time to his family.

**ABSTRACT 8 – BA in computer science, MA in business administration, engineer of communication technologies, male**

**Interview conducted: 19. 5. 2022 at 17.00**

### **1. Personal profile and cooperation in the Sledilnik project**

Bachelor of computer science and a master's in business administration, currently working as an engineer of communication technologies (system integration). At Sledilnik, he cooperated in data models and visualization. For a few years, he has been interested in the problem of vaccination in Slovenia and so cooperated in debunking myths about vaccination. He also developed a Macedonian version of Sledilnik, where he is the main coordinator. At the start of the pandemic, he began preparing his own graphs of the epidemic and later learned about Sledilnik through social media and joined it. Currently, he is mainly taking part in debates and has little other work.

### **2. Sledilnik as a Citizen Science project**

He sees the Sledilnik community as a big mix of scientists and technicians that is very flatly organized. The main principle is "*if you know something, do it*", there is no overriding philosophy, people who want to help, join, cooperate, and start working. The only difference through time is the change in the people's motivation. As long as there is motivation, he sees no cons in such organization of work. The new project, Podnebnik, shows, that where motivation is a bit lower, it is harder to perform and takes longer to make things work.

### **3. Sledilnik and knowledge transfer**

His work is flexible enough to allow him to use some time during his work for Sledilnik as well, but the work type is not connected. He already sees himself as someone who has fulfilled his career, so his work at Sledilnik had no impact on it. The work at Sledilnik allowed him to meet and interact with types of people he would otherwise not have (especially scientists), which enabled him to learn a lot of things. He noted some difficulties with communication due to semantical differences between various fields, but overall the communication was always respectful and good.

### **4. The role of Sledilnik in an epidemic**

He sees Sledilnik as a service that filled a gap that emerged, especially with data visualization and communicating that data. It was a project that benefited society overall. He was not intensively included in communication with other institutions and organizations, but thinks that the attitude of other organizations towards Sledilnik was always respectful.

He sees the discrepancy in the total number of deaths as a challenge, particularly for those that use such numbers. The discrepancy is due to a different source and different methodology.

Regarding management of the pandemic, he believes Slovenia made a few small mistakes that formed a bigger problem, but overall the response of the government was good. He advocates public measures in order to save lives. He also noted that as a society we are lacking some perspective and literacy about public health, science, and the media.

### **5. The future of Sledilnik**

He believes the potential of the community is considerable, but the second products are always harder to make. However, new ideas will emerge, he is especially optimistic about Podnebnik, which is taking a little longer because the environmental crisis is more long-term. He will not lose his motivation for working at Sledilnik and is open to working on new ideas.

**ABSTRACT 9 – BA in organization and management, a programmer in his free time, employed at a digital marketing company, male**

**Interview conducted: 25. 5. 2022 at 13.00**

### **1. Personal profile and cooperation in the Sledilnik project**

Bachelor degree in organization and management of information systems, working as a product leader of new online products, currently working at a platform for digital marketing. He does programming in his free time. At the beginning of the pandemic, he had a similar idea to gather data and saw that Sledilnik already existed. He joined it after being invited by a friend to help with organization and coordination. He worked on data visualization, coordination, programming, Excel formulas, and arranging data sources. Later, he was active in creating the association (administration), funding, and in the project for Ukraine.

### **2. Sledilnik as a Citizen Science project**

He estimates that among the most active people 40% are engineers and programmers, 40% scientists, and 20% operative people. He noted that Sledilnik always had a problem with getting younger people to join them. He describes the organization of work at Sledilnik as the perfect meritocracy, that never works, yet here it did. Each opinion counts and those projects and ideas that win support from others and convince them that it is good to work on it then get implemented. Ideas themselves are good, but without implementation are worthless. There can be problems with such organization, sometimes there were hours wasted on discussions on how Sledilnik should position itself regarding political decisions and some opportunities might have been lost. Further, some people who only had ideas and did not put any ground work to support their ideas were not compatible with this way of work and left Sledilnik.

### **3. Sledilnik and knowledge transfer**

When he started working for Sledilnik, he had time off work and could work 8–10 hours per day for Sledilnik. Later, his boss was very understanding and he was able to combine his work at Sledilnik with work for his job. He considers Sledilnik as a good reference on his CV, but it did not influence his career. During his time at Sledilnik he worked with many different people with whom he would not have otherwise, especially scientists and medical doctors. He does not remember any problems communicating with other profiles of people, but thinks that the communication needs to be more careful and on point to avoid any misunderstandings. He thinks that the people in Sledilnik usually stayed more in their own topics and were aware of the things they knew and the things they did not.

### **4. The role of Sledilnik in an epidemic**

He considers the role of Sledilnik as fulfilling some public need in presenting data on an epidemic. The initial graphs started from egoistic motives because people wanted to know the numbers themselves, but soon became obvious that there was a more general need for such data.

Regarding communication with other organizations and institutions, he was not at the forefront of it, he mainly had contact with the people who provided data. His impression is that once the two parties got to know each other, the communication was good, but it mostly depended on

people's willingness. Not everyone was willing to cooperate, but they developed really good relationships with some.

With respect to the difference in the number of deaths, he believes that this is an extremely good example of why evidence should be gathered at one central point, that should be thoughtfully led in the most professional way, open to everyone, including machine reading. If international databases then presented that data differently, that would be their own problem. He noted that for every change in the data there was a discussion on the Sledilnik Slack channels where they decided in which way to present some data.

He thinks the greatest problem of Slovenia while dealing with the epidemic was the lack of a systemic approach and a broad overall attitude against the pandemic (the media should have reported more objectively, the government should have made better decisions).

## **5. The future of Sledilnik**

He sees two options for the future of Sledilnik – that it is closed down or finds new challenges. The community which was established because of the pandemic will not make any other project in the same way because it is impossible to find a problem that everyone would care for equally to the same extent as they initially did about the pandemic. The problems concerning continuation are especially connected to motivation. Obstacles for future projects might lie in difficult access to data from international institutions if projects wish to work on that basis.

He sees the role of the community as a platform where people can come and join with ideas and use the resources to make new projects. He would like to continue working on such a platform and views the activity in such projects as a way of giving back to community and society.

## **ABSTRACT 10 – PhD (Science studies), development and research associate, female**

**Interview conducted: 25. 5. 2022 at 14.30**

### **1. Personal profile and cooperation in the Sledilnik project**

She works as a development and research associate. She holds a doctoral degree in Science studies with a background in methodology and communication studies. She joined Sledilnik on the invitation of her sister, she contributed some comments and in one period transcribed data from printed materials when nobody else was available to do the work. The project was interesting and she wanted to know how this kind of project works. Now she follows the discussions but does not have a full view of all of the themes in the channels of Slack.

### **2. Sledilnik as a Citizen Science project**

She finds in Sledilnik highly professional individuals, there are fewer lay people, which is a characteristic of citizen science in her view. Organizationally, it worked with volunteering for a project that someone proposed and was also ready to take responsibility for. There were some managerial tasks taken by Luka Renko and Maja Založnik that had some overview, but in general the proposed ideas were discussed, adopted, or left out without many tensions or hurt egos that otherwise are present in activist endeavors in her experience. Sometimes, there is a sense of a lack of someone to direct efforts to reach for bigger projects. Now she observes this has become a pleasant community in a formal association that is open to all suggestions and ideas.

### **3. Sledilnik and knowledge transfer**

She did not connect her professional work with Sledilnik, only contributing insights about the organizational facts in the healthcare system. She had worked previously with mathematicians and technicians so she had good communication, even though she sometimes felt unappreciation of the social sciences for being a politically motivated discipline. The social sciences were underrepresented in Sledilnik and she sometimes explained the views and sometimes this led to the point where it was not worth continuing the explanation.

### **4. The role of Sledilnik in an epidemic**

Sledilnik's main role was providing the media with consistent data and gathering the data which is now also available to analyze. It was available to every citizen and also to the policymakers that should have done the job themselves.

### **5. The future of Sledilnik**

She finds Sledilnik to be a diverse group of splendid people, but the problem is the time since people put off their work to make the community during the early phases of the pandemic. She is waiting for the right opportunity or idea to join in where she can contribute.

## **ABSTRACT 11 – BA in marketing, MA in cultural management, a producer**

**Interview conducted: 26. 5. 2022 at 12.00**

### **6. Personal profile and cooperation in the Sledilnik project**

Bachelor's degree in marketing and a postgraduate diploma in cultural management, currently employed as a producer. At Sledilnik, he was in charge of production and the coordination of communication, website editing, communication through social networks and other PR activities. When Sledilnik emerged in social media, he had ideas for how to improve the communication and Luka Renko invited him to join. His activity at Sledilnik depended on the need of people to receive information, which meant he was more active during outbreak waves and less active in summers as well as recently.

### **7. Sledilnik as a Citizen Science project**

He noted many different profiles of the people working at Sledilnik, yet he mostly cooperated with people who work in PR, journalism, but also with scientists (physics, mathematics), medical doctors, and programmers. He describes the community as multidisciplinary with a special emphasis on *multi*, where members have in common a willingness to use their time and interests for the benefit of society. He sees the organization of the community as a very flat organization where a 'can-do' attitude is very important and things happen naturally – the community detects a problem or a new idea, people debate on it on Slack, there is an initiative that starts the ground work, and other people join to help. This structure changed a little over time as people became more focused on specific topics in Sledilnik. Further, the intensity of the cooperation changed through time because of individuals' fatigue and lack of time.

He describes the way of working at Sledilnik as a very meritocratic principle based on self-imposed responsibilities. He notes that before joining Sledilnik, this way of working seemed to be an ideal type that could not exist in reality. As a negative side of this kind of organization, he noticed that some people who did not like such a way of working could not join and left. Further, this way of working would have been impossible if Sledilnik had to take some more formal responsibility that required professionalization.

### **8. Sledilnik and knowledge transfer**

His job is not connected to the work he does at Sledilnik, but he can combine both in his time. In the lockdown, his work responsibilities were reduced and he had more time available for Sledilnik. He cooperated with many different profiles of people.

### **9. The role of Sledilnik in an epidemic**

The biggest contribution made by Sledilnik, in his opinion, is the data excellence that Sledilnik provided – all data were checked and validated, the methodologies were understood, and that was then presented in a way accessible to everyone. Moreover, he points out the importance of the communication Sledilnik engaged in, especially for debunking myths, offering explanations, producing some videos, supporting science communicators, conversations with the media, and giving answers based on science.

He was not one of the main actors in communicating with other institutions, yet his experience with it shows that informal ties were easier to establish than formal ones. Sledilnik encountered many people who understood the importance of open data and were willing to help them in acquiring it. They formed two-way relationships where they provide data and Sledilnik validates and checks it for mistakes or inconsistencies. Those relationships work well. Regarding formal relationships, those often took the appearance of empty talks. He notes the

conversations with UKOM, MZ, ZZZS and other institutions where they tried to find ways to cooperate, but it never happened. He stated that those organizations work on different principles and are too bureaucratic and too stiff for such cooperation.

As concerns the discrepancy in the number of deaths, he believes this is a good illustration of the importance of data. Each of those figures is legitimate and makes sense for certain uses, each has its own qualities and faults and we must understand them.

He believes the biggest problem of Slovenia while dealing with the pandemic was the understanding of the role of communication, which is very important for ensuring that people respect the measures. He states that the basis of crisis communication has been known for a long time, but was not applied by the government or the key actors. He is also critical of NIJZ, which was unprepared for the pandemic despite being evaluated by the WHO a few years ago, and despite knowing that a certain part of the population is skeptical of vaccines.

### **10. The future of Sledilnik**

The future of Sledilnik depends on the epidemiological situation, if it will still be needed in such form. The community has already detected the next important topic, environmental changes, but the dynamics of the urgency are different here, which is why things are evolving slower. He will continue to cooperate in projects if he feels interested in them. He sees the future of Sledilnik as an open one – anything can happen. He believes that it is very important for such projects to have open data and to not close ourselves off in small areas and structures, but to support interdisciplinarity and cooperation.

**ABSTRACT 12 – PhD (biostatistics), employed at a company developing cancer medicine and diagnostical tests, male**

**Interview conducted: 26. 5. 2022 at 16.00**

**1. Personal profile and cooperation in the Sledilnik project**

Doctoral degree from biostatistics tackling issues of natural phenomena from agronomy to medicine from a statistical point of view. For the last 4 years employed at a company developing cancer medicine and diagnostical tests. Joined Sledilnik at the very beginning and followed and contributed to the modelling channel. Joined as motivated by his own motto of active engagement for the common good of society: »lead or follow or get out of the way«. At the moment not actively engaged in Sledilnik's activities, only following the posts on the Slack channels.

**2. Sledilnik as a Citizen Science project**

He found Sledilnik as a gathering of different exceptionally competent profiles. Not sure about the variety, guesses mostly engineers, but also social scientists that contribute and share their point of view on the common solution. He compares Sledilnik to village cooperation where communal effort leads to synergetic solutions to problems, when everybody knows some bits of information or someone who can contribute. At the moment, the most propulsive project seems to be the tracker of available family doctors. They are self-organized as Sledilnik is as a whole generally. With the core group that takes on the majority of responsibilities eager to do something good and solve problems in society. The downside of such projects is that when the solutions are not acknowledged by the authorities, he feels the motivation recedes.

**3. Sledilnik and knowledge transfer**

His employer encouraged his dedication of some of his working time to Sledilnik. His career might be changed in the future due to the connections he gained in the Sledilnik community network, but there is currently no direct impact. The community includes people of different backgrounds which makes for endless possibilities of project creation in a tolerant environment with high work ethics. There were seldom instances of an individual insisting on their views.

**4. The role of Sledilnik in epidemic**

He cannot quantify the impact of Sledilnik, but it was present in the media, won some awards, and individuals from Sledilnik gave a lot of their time for journalists' questions. Sledilnik was the active party vis-à-vis the institutions where it wanted to obtain data, get things done. That led to some heated communication, particularly with NIJZ, since its capacities were not sufficient and Sledilnik was not taken seriously. Slovenia with its low trust in government has its own issues but he finds that the expert group that led the epidemic measures was in the role of whitewashing the government's decisions, they constantly explained to the public the reasons behind the measures on a daily basis. On the other hand, at the beginning of the pandemic Slovenia held real potential to spearhead the world fight against the virus.

**5. The future of Sledilnik**

Sledilnik to be able to implement projects overnight and consists of people who have the potential to swiftly respond to the needs of society. One example is the tracker of available family doctors. He sees Sledilnik as exceptional and fascinating with regard to the opinions of his friends and colleagues who are not concerned with the future and only look at their own gains, but Sledilnik has the human capital and contributing to the common good like that is necessary for the future of everyone's grandchildren. Even companies acknowledge that people

are harder to find than finance. The motivation is crucial and it is a shame that the country does not acknowledge such activities of its citizens volunteering in a project like Sledilnik.

## **ABSTRACT 13 – PhD student (Physics), young researcher, male**

**Interview conducted: 10. 6. 2022 at 12.00**

### **1. Personal profile and cooperation in the Sledilnik project**

When he started working at Sledilnik, he was finishing his master's studies in Physics. In autumn 2022, he took on a Young Researcher position in the area of theoretical physics. Before joining Sledilnik, he used his modeling knowledge that he had gained at university and developed the first, simplified model of the epidemic. He later joined Sledilnik, largely due to selfish interests of getting better data for his model, but then cooperated in other areas as well. He did not have a permanent task, he cooperated in writing articles, creating visualizations, discussions about data, and so on. He was very active from March 2020 to February 2021, and since then a lot less. Now he is actively following the Slack forum and uses it as a source of information.

### **2. Sledilnik as a Citizen Science project**

He points out two big groups of profiles at Sledilnik, a large group of programmers and a group of people working in science and academia. Many joined on the invitation of acquaintances already involved with Sledilnik, which meant similar profiles. However, there were also many other profiles, people from the social sciences and so on.

In his words, the organization of work had no hierarchy, there was no one responsible for determining the content and work, which was all based on self-initiative. Someone found something interesting and shared it, and if other people recognized it as interesting, they joined in and started working on it. When creating content, there were often multiple people working on a shared Google Document. The principle based on self-initiative has its pros and cons, especially if there is a lack of self-initiative, when little gets done.

### **3. Sledilnik and knowledge transfer**

He could not connect the work at Sledilnik with his studies since he is dealing with theoretical physics, but he says he could use the knowledge he gained during studies for Sledilnik (namely work in modeling). He learned a lot and cooperated with a broader spectrum of profiles than he would otherwise, and it broadened his general knowledge. He was interested in pursuing an academic career already before joining Sledilnik.

### **4. The role of Sledilnik in an epidemic**

As the biggest contribution of Sledilnik, he refers to the website, which was a source of information for the general public, the media and often also decision-makers. It was a comprehensive and interactive data collection. He also stressed the importance of the content and the communication of science as Sledilnik did.

He did not cooperate in the communication of Sledilnik with other actors, and is unaware of possible problems with it.

Regarding the discrepancy in data, he agrees that at first sight it is absurd that we do not have a unified number of deaths because it should be objectively known who died from what. However, we do not perform autopsies on every person so the count remains a matter of

definition. He does not see the discrepancy due to a different methodology as a big problem so long as we know why those differences arise and what are the differences in counting.

As the biggest problem of Slovenia's management of the pandemic, he sees the problems with communication by the government. He stresses the regular change in narrative (from the end of the pandemic and an army plane flight, to scaring people), which resulted in a loss of trust in some parts of society, which then stopped complying with the measures. He admits that it was a very hard task, perhaps impossible, but the way communication was managed did not improve the situation, but probably made it worse.

## **5. The future of Sledilnik**

He believes it will be hard to make another project similar to the COVID one because the topic was urgent and acute. Other projects, such as Podnebnik, have different dynamics, the data there is not daily, but yearly. He views Sledilnik and the community on the Slack forum as an information channel where you can connect with other active and self-initiative citizens, where some small collaborations can happen, but does not have a clear task for the future. He is willing to join more of such projects if he is interested in the topic. He pointed out how easy it is to join such platform if all the work is done online. For now, his role remains one of a reader and follower of the Slack forum. Future challenges for Sledilnik might arise but cannot be predicted.