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PREFACE

It is a great pleasure for me and the Ministry of Economic Development to present the finalisation of this European Project, CIVIC EPISTEMOLOGIES - Development of a Roadmap for Citizen Researchers in the age of Digital Culture.

The area of communications, an important part of the Ministry of Economic Development, is responsible for a wide variety of policies for the development of telecommunications infrastructures and of information and communication technology (ICT) smart services and applications that constitute key factors for economic development.

Major actions undertaken by the Ministry also include: supporting research and innovation activities, encompassing different sectors of the information and communication technologies, in partnership with Universities and Research Institutions – that is why the aspect of culture, as an essential element for the economic and social development, is a focal point in our ministerial policies.

The cultural and creative sectors represent an example of what can be achieved by combining resources and professionalism in order to overcome the transnational problems and to take every opportunity to expand the footprint of European culture worldwide. Cultural heritage provides a crucial component of economic growth, as well as in European innovation processes, competitiveness and welfare.

These initiatives would benefit from stronger international cooperation in all sectors of ICT at the European level, therefore, we will continue to contribute and enforce the Italian participation in the Digital Agenda for Europe.

Mauro Fazio

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Writing a handbook on citizen science for digital cultural heritage and humanities is in itself a challenge. The fact that its focus is a Roadmap for synergies between citizen science and e-Infrastructure makes the challenge even more ambitious.

The branch of knowledge connected with this area of research is still at the beginning of being explored, and good examples to follow on are few and not easily found. Luckily, representatives of targeted stakeholder groups such as policymakers, cultural heritage institutions, academic institutions, citizen science activist's organisations, researchers, and e-Infrastructures have provided us with invaluable inputs, which have been the keystone for the outcomes of the CIVIC EPISTEMOLOGIES project. Many thanks for that.

We would also like to express our gratitude to all partners in the project, who have shared their great knowledge with us and also produced most of the basic information for the Roadmap and this handbook.

A special thanks goes to the European Commission that made this project possible and also to reviewers who, with their advice and recommendations, contributed to improve the quality of this Roadmap.

Antonella Fresa and Börje Justrell

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FOREWORD

This handbook is a product of the CIVIC EPISTEMOLOGIES project, a coordination and support action funded by the European Commission (EC) in the Seventh Framework Programme for the Research and Technological Development. The term ‘civic epistemologies’ is taken from a study by Sheila Jasanoff in *Designs on Nature* (2007) in which she defines civic epistemologies as

“the institutionalized practices by which members of a given society test knowledge claims used as a basis for making collective choices”.

CIVIC EPISTEMOLOGIES is about the participation of citizens in research on digital Cultural Heritage (CH) and humanities, and its main outcome is this Roadmap.

The engagement of Europe’s citizens in scientific research has just started to be exploited, thus representing an important opportunity for improving European competitiveness. The case of digital CH and humanities is particularly relevant because:

- Humanities play a major cross-cutting role in the evolvment of European research and innovation – as it is acknowledged also in the Horizon 2020 Programme of the EC
- CH as such is an area in which citizens are particularly active (recording, cataloguing, and discussing things on an individual, group/voluntary/amateur basis)
- The potential of broadening e-Infrastructure deployment to support the participation of citizens in research activities is not yet fully explored, although holding a potentially strong impact on social cohesion and job development, both aspects being important drivers in the European policy context

The project started with an analysis of the requirements and needs that existing experiences of citizen science demonstrated. This activity was carried out through a rich programme of focus group meetings, whose results were discussed in the international workshop held in Valletta in November 2014.

A Registry of Resources was developed gathering information about existing initiatives in the domain of citizen science, which can be used as reference and inspiration for new projects and which remain as a legacy of the CIVIC EPISTEMOLOGIES project after the end of the EC funding period.

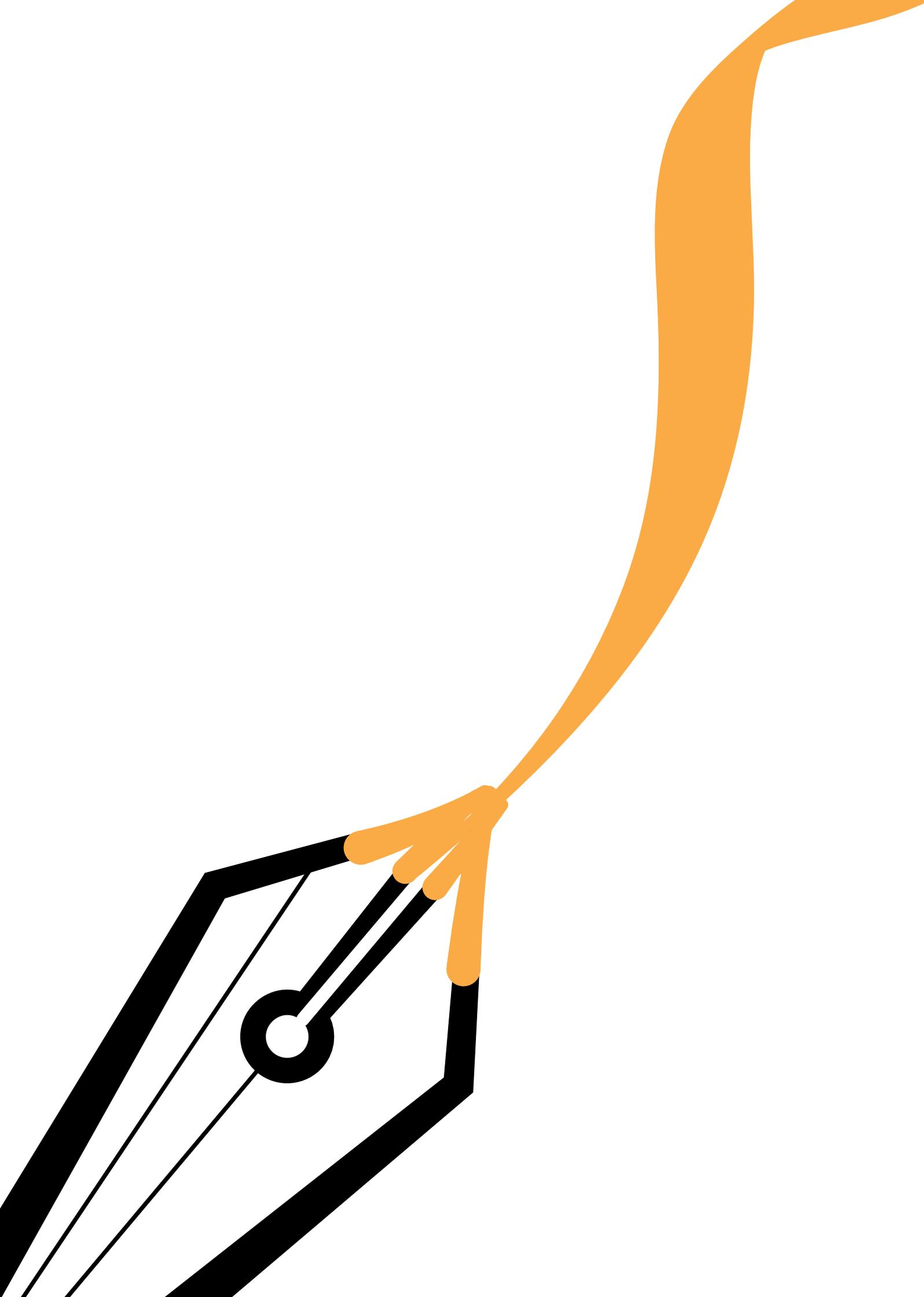
A study about a shared multidisciplinary Strategic Research Agenda has been conducted in order to correlate scientific objectives with the steps indicated in the Roadmap.

In parallel, the CIVIC EPISTEMOLOGIES website was launched, complemented by a showcase on *digitalmeetsculture* magazine and a channel on the social networks; many cooperation agreements were also established with relevant stakeholders and projects.

An iterative process started then for the production of the Roadmap. A first draft was prepared on the basis of the requirement analysis of the previous phase; this draft was discussed in the second international workshop held in Leuven in February 2015. The outcomes of the discussion informed the second release of the Roadmap, which integrated also comments and feedbacks gathered through the online activity of the project and direct exchanges with stakeholders. This second release was discussed at the third international workshop held in Budapest in July 2015.

The Roadmap is intended to be a living document, open to contributions from researchers, e-Infrastructure providers, cultural managers, artists, students, teachers, and citizens interested in the matter. An online version of the document is published on the website where visitors can deliver their comments to improve and ameliorate; it is in other words an instrument offered to the community for free use and re-use.

The aim of this Roadmap is to illustrate a path towards the engagement of citizens in the research and valorisation of CH, by using distributed services like digital tools and online communication offered by the e-Infrastructures. However, these services are meant not only for the participation of citizens - together with cultural and academic institutions - in the research processes. They shall also support the participation of creative industries in the exploitation of digital cultural content and, furthermore, artists in their role of mediator between sectors not used to working together, and providers of added value services for the benefit of the society at large.



1. INTRODUCTION

1.1. Document overview

This Handbook presents the CIVIC EPISTEMOLOGIES Roadmap, which is the main outcome of the project. It builds upon the results of activities carried out by all the partners and aims to provide recommendations and examples of best practice for citizen science initiatives in the digital CH and humanities sector.

The handbook consists of five chapters:

Introduction – This chapter introduces the concept of citizen science in the domain of digital CH and humanities and provides relevant links and references to connected areas of work. It also introduces to the relationships between arts, creativity and technology and the role that artists and creativity can play in the context of citizen science initiatives.

Our vision – This chapter presents the vision of the CIVIC EPISTEMOLOGIES partners.

The Roadmap – This chapter focuses on the Roadmap and its different parts. The Roadmap itself consists of five parts, each of them set out in separate sections presenting:

- A short review of what the Roadmap stands for
- The presentation of the targeted groups of stakeholder and their requirements
- The lessons learned during the implementation of the project activities and identified gaps
- The main components of the Roadmap, namely timeframe and areas of action
- A web space dedicated to the Roadmap

A proposed action plan – This chapter points out the most important actions to take in the major areas of the Roadmap and provides a list of recommended actions to be taken by the targeted stakeholder groups when they want to initiate a citizen science project.

Conclusions – This chapter summarises on a general level the discussion of the previous chapters. The handbook also provides two complementary annexes: **Glossary** and **Abbreviations**.

1.2. Main challenges

1.2.1. Turning the wheel of citizen engagement

The participation of Europe's citizens in scientific research represents an important opportunity for improving European competitiveness, because of the value that citizens can add in specific areas of research. Further, the use of e-Infrastructures could provide relevant support to the participation of citizens. In particular, the participation of citizens in the research on CH and humanities has the potential to play an important role in the development of the European Research Area, and can

take the lead in the discovery of new directions of cross-disciplinary research; but this opportunity has not yet been fully developed.

In this framework, CIVIC EPISTEMOLOGIES targets use and usefulness of citizens' engagement in CH practices and humanities research, where such engagement has a twofold benefit for culture:

- To be enriched by the citizens' contributions
- To become more widely used and exploited (also, for example, with the participation of creative industries)

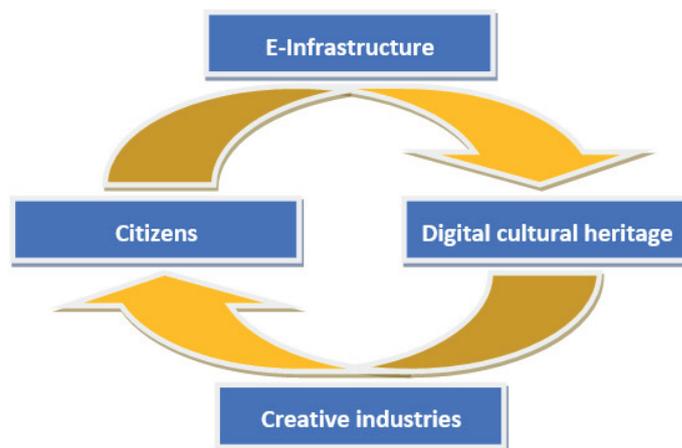


Figure 1: The 'wheel' of citizen engagement

The solution endorsed by CIVIC EPISTEMOLOGIES in order to get this 'wheel' turning, is to empower the existing e-Infrastructures with new services, targeted to the needs of specific research domains. The aim is that it should be possible in the future to tailor these new services to the requirements of each research community. In this light, it is necessary to identify common layers, tools and standards that can be shared among different communities and domains. This scalable and modular approach to the e-Infrastructures deployment will allow to serve better the research and to reduce costs of development.

It goes without saying, that this approach would need new deployment – i.e. new distribution of forces - carefully planned and indicating actions that each stakeholder has to take. The stakeholder groups targeted by CIVIC EPISTEMOLOGIES are presented in section 3.2 below.

Actions needed are described in a proposed action plan presented in chapter 4. These actions can, generally speaking, be divided into three main stages applicable on a citizen science project:

- Preparatory stage
- Deployment stage
- Monitoring stage

The recommendations given in section 4.2 are adapted to these stages and also aggregated around each stakeholder group.

1.2.2. Co-producing and co-creating knowledge

There is, in general, a considerable interest among the public in exploring, recording and cataloguing their own CH or that of their community or locality and to contribute with personal stories to enrich this heritage.

Further, digital cultural content is massively increasing. These digital assets include both digitised and born digital material. This data may be held within a dedicated online archive or it may be collected and form a contribution to an aggregated database or archive.

At the same time, an increasing number of citizens are engaged in and with online discussion fora and social networking platforms. However, the outcomes are not always easy to predict and could also sometimes be negative and undesirable. The danger is that, without the establishment of a civic epistemology, separate communities develop as exclusive and even elitist and, as a consequence, the range and scope of a common set of civic values and understandings related to CH is diminished.

CIVIC EPISTEMOLOGIES aims to investigate how the phenomenon of citizen science can be encouraged and facilitated in a way that a shared or common CH discourse develops, knowledge is advanced and the exchange of ideas remains open and participatory. CH institutions and academies should welcome and embrace the opportunities implied in citizen science, as it offers occasions to be closer to citizens who are actually their audience. Next to this, a participatory and co-creative approach is positive and benefitting for CH institutions as it adds to the knowledge base of their collections, and opens up new ways for their collections to be used. However, it does also create challenges for institutions, raising issues about curatorial authority over interpretation and on skill development to empower citizens to satisfactorily participate in research. First, the citizen who is a culture consumer has to realize that he or she can become a producer, taking a more active role. This calls for a broad awareness campaign, where CH institutions as well as platforms such as *Europeana*¹ and specialised research infrastructures can make users aware of their shared responsibility to become caretakers of the cultural practices they engage in. Being conscious that one is a stakeholder in what happens is a first requirement in order to feel the need to intervene, to contribute, and to have a responsible voice. This is of the utmost importance, since in many instances of CH data part of the knowledge is not with the institutions but with the general public, in the stakeholder communities that have a relation to the subject matter (as it is the case, for example in the context of orphan works).

Participation however also means having the skills to do so:

- On one hand, this requires partly a rediscovery of skill considered dormant or forgotten by the large society (such as painting, drawing, creative writing) and activation of consumer-oriented skills (such as using a smartphone) into more active forms of creativity (such as making street photography). This is also about citizens perceiving that they have 'permission' to be an active stakeholder. Especially on this level, artists and creative people could have a

1 Europeana is the flagship project of the European Commission to provide access to the European digital CH content. www.europeana.eu

facilitating role since they can trigger these forgotten skills and show the citizen on how to use modern technologies in a creative way

- On the other hand, specific training is needed on the technical and digital skills involved to participate in online culture. For example: understanding the web language, having notions of metadata, ontologies and controlled terminology lists, learning about digital formats and documents, and learning how to code small apps

Finally, citizen authorship skills need to get the right visibility and recognition. By stimulating knowledge and use of licensing models for open source and a deeper understanding of Intellectual Property Rights (IPR) issues, it is possible to tap the hidden economic power of citizen cultural activities.

1.2.3. Ethical and social issues

Citizen science offers important benefits to science and society. Citizens can help scientists with data collection and provide advice on research design and implementation; citizens' participation in the research can also offer an opportunity for CH institutions and people to recalibrate their relationships.

However, citizen science demands a thorough awareness of the roles of each actor in the research and a clear allocation of responsibilities. And in the case of CH and humanities, this is even more complex, considering that several players are involved: in addition to academies and citizens, also CH institutions. The dialogue between these groups is not always simple, because they use different specialist languages and jargons. Also, the interests of each group are different: academies look for improving their knowledge through experiences that could also be disruptive with regard to the past knowledge, CH institutions aim to preserve the knowledge of the past, and citizens look for a deeper involvement in interpretation of their culture, and exciting experiences, gaining a better understanding of scientific concepts and practices.

Furthermore, the personal integrity of citizens should be protected, even in the condition of large groups of participants; communication with participants should be effective; appropriate publication practices and authorship should be put in place.

Developing sound terms of reference of citizen science projects is an important challenge to be faced by the concerned stakeholders (e.g. www.rri-tools.eu/about-rri).

1.3. Work done to benefit from

1.3.1. CH institutions using e-Infrastructures

CIVIC EPISTEMOLOGIES has looked into other domains, to find out if there are experiences of distributed services that are transferrable to the field of citizen science. Apparently, very little has been done so far, but digital preservation seems to be the domain in which distributed services offered by e-Infrastructure for the digital CH sector has been mostly explored. The underlying approach in preservation is very clear and easy to conceive: the CH sector produces large volumes

of digital content that needs to be safely stored, kept permanently accessible and easily re-useable over time by different end-user groups. This is a main challenge in the first place for the CH sector, as a content provider, but to some regards also for end-users like researchers in citizen science.

The former *DC-NET* project² explored how e-Infrastructure can add value to research in the digital CH sector. Number one on the project's top-seven list of important new and improved services for this sector, which can benefit from e-Infrastructure support, was long-term preservation³. A 'sister' project of *DC-NET*, the *INDICATE* project⁴, also identified the need to address the current situation in digital preservation and to offer concrete and robust support to CH institutions. As a follow-up of these two projects, a succeeding project, *DCH-RP*⁵, was given the task to develop a Roadmap for preservation of digital CH content, mainly by using distributed services (e-Infrastructure). The *Europeana Cloud* project⁶ also addresses the problem of storage and permanent accessibility of cultural data records. *Europeana Cloud* is planning to be a service-oriented infrastructure with instances coming from a number of network services. The project is looking for a twofold solution where the private, community based cloud will consist of hardware resources provided by several technically advanced institution users, and a public part based on resources leased from commercial providers⁷. Challenges for *Europeana Cloud* are no less than big commercial providers such as *Amazon* and *Google Cultural Institute* offering a wide number of high-end services. Moreover, CH institutions might not be ready to adopt cloud solutions due to a lack of familiarity with advanced cloud solutions, and a sense that their introduction might lead to a loss of control of cultural resources for cultural guardians.

An initiative with the aim to facilitate long-term access and use of digital data related to European arts and humanities is the *Digital Research Infrastructure for the Arts and Humanities DARIAH*. Its focus is on enhancing and supporting digitally-enabled research and teaching across the humanities and arts. In August 2014, *DARIAH* was established as a European Research Infrastructure Consortium (ERIC) and became a formal Competence Centre within *EGI-Engage* project (March 2015)⁸.

DARIAH-DE, which is partially funded by the German Federal Ministry of Education and Research (BMBF), has supported a study that takes the use of distributed services and addresses sharing software in a distributed infrastructure a step ahead. This new approach is based on the fact that research infrastructures have become an everyday tool for doing science, but so far the focus has been mainly on sharing resources (especially data) and on offering services for processing and accessing the resources. However, there is a demand from the users to share not only the data they have gathered or created but also the software they implemented. Such sharing has the potential to speed-up the scientific discovery - but only if the software can be applied by other

2 www.dc-net.org; DC-NET is an ERA-NET project that run from December 2009 until March 2012, funded by the European Commission under FP7-e-Infrastructures.

3 See Service Priorities and Best Practices for Digital Culture Heritage p. 32

4 www.indicate-project.eu/; see also Digital Preservation Services: State of the Art Analysis by Raivo Ruusalepp and Milena Dobрева (for the DC-NET project) at www.dc-net.eu

5 www.dch-rp.eu; Digital Cultural Heritage – Roadmap for Preservation

6 pro.europeana.eu/project/europeana-cloud

7 See Design of Europeana Cloud Technical Infrastructure, project.core.ac.uk/files/dl20140_submission_258.pdf

8 wiki.egi.eu/wiki/Competence_centre_DARIAH

researchers to address new problems. The situation today is, according to this study, that software implemented in a project is often understandable and deployable only by the authors⁹.

Digital Preservation Coalition (DPC) has listed a number of issues and potential advantages and disadvantages of using distributed services in digital preservation activities¹⁰. This list can, to some extent, be applied also to services supporting citizen science.

1.3.2. Citizen science and e-Infrastructures

The advancement of Information and Communication Technologies (ICT), the Internet and mobile technologies opens a new perspective for bringing together different communities unified by their interest to contribute to research. This has resulted in a rapid growth of the citizen science initiatives around the globe.

The interest for such projects has grown to the extent that specialised platforms which allow defining research tasks and involving users have been created; e.g. *Zooniverse* and *CrowdCrafting* developed in collaboration between the *Citizen Cyberscience Centre* and the *Open Knowledge Foundation*. These platforms are used for research in different domains, but mostly in the sciences with few implementations in the CH and the humanities¹¹. However, the spread of citizen science across domains is uneven. For example, when checking the numbers of projects offered on *CrowdCrafting* at the end of 2014 and three months later, it is noticeable that there is a very fast growth of projects in the social science domain. Humanities show growth, but the number of such projects is considerably smaller than traditional 'hard science' and arts projects.

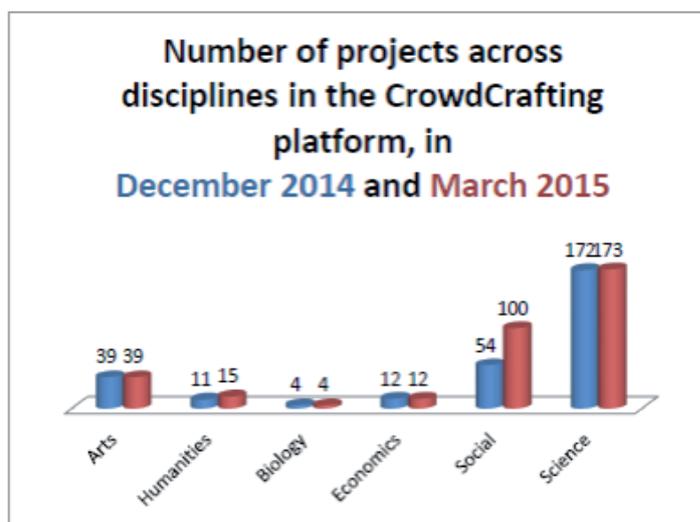


Figure 2: Dynamics of numbers of citizen projects

9 www.bmbf.de/pub/roadmap_research_infrastructures.pdf,d.d24

10 See Preservation Management of Digital Materials: The Handbook www.dpconline.org/advice/preservationhandbook

11 Smith A.M., Lynn, S., Lintott, C.J. (2013) An Introduction to the Zooniverse. Crowdsourcing: Works in Progress and Demonstration Abstracts. AAAI Technical Report CR-13-01. CrowdCrafting. (2013) Online: blog.okfn.org/2013/09/17/crowdcrafting-putting-citizens-in-control-of-citizen-science

Digital CH is closely connected to humanities and a logical question is, therefore, why humanities are not using citizen science more actively? This is a complex question to answer, and one possible approach could be to better understand the expectations and requirements of various stakeholders and users. A possible reason by many for the lack of uptake in humanities is the limited technical skills and experiences in using online collaboration environments. This was demonstrated in a recent case at the faculty of economy and business at KU Leuven where the library tried to organise the transcription work of handwritten population and industrial censuses using *CrowdCrafting* platform so the raw data could be made accessible and reusable for research. The barrier to start up a project appeared too high, and help was requested from the local library ICT department to explore solutions and other tools that could be more easily implemented¹².

The *Socientize* project (Society as e-Infrastructure through technology, innovation and creativity) has as its task to:

“coordinate all agents involved in the citizen science process, setting the basis for this new open science paradigm. The project will promote the usage of science infrastructures composed of dedicated and external resources, including professional and amateur scientists. Socientize will set-up a network where infrastructure providers and researchers will recruit volunteers from a general public to perform science at home.”¹³

The project published a Green Paper in 2013 aimed as a consultation document to encourage interested parties to submit their experiences in citizen engagement¹⁴. Based on the results, a White Paper on citizen science was published in September 2014.

The *Socientize* project has identified in these documents a number of drivers and barriers for citizen science, some of them with bearing on the use of e-Infrastructure.

One main driver is that the use of e-Infrastructures enables citizen science by providing storage and accessibility, but also computing power managing the data. Especially if citizen-based resources like networks of desktop computers, mobile phones and other private devices are to be used in a project.

Examples of barriers are access and interoperability of the citizen science data sets need – generally speaking - to be improved. When data sets based on citizen science data have been created by scientists for their own needs, these data are sometimes difficult to use for other groups, like citizens or researchers. However, opening up for wider use of data sets, immediately raises the question of ownership and IPR issues. Scientists who work in citizen science projects will sometimes not share and provide access to the collected data. The reasons behind differ, and it can be a serious hindrance if too few projects have a clear policy about the ownership of the results.

*Citizen Cyberlab*¹⁵ is an EU ICT project funded under the EC FP7 Programme, belonging to the *Citizen Cyberscience Centre*¹⁶, with its central focus of research on creativity and learning in on-line citizen science. Beyond helping scientists execute laborious tasks, the projects of the *Citizen Cyberscience*

12 Internal KU Leuven case June 2015

13 See: www.socientize.eu/?q=eu

14 The Socientize project: “Green Paper on citizen science. citizen science for Europe. Towards a better society of empowered citizens an enhanced research”, p. 29-30

15 www.citizencyberscience.net/the-lab

16 www.citizencyberscience.net

Centre enable citizens to learn about science and take part in the more creative aspects of research. Little is known about the learning and creativity processes stimulated by such projects, even though millions of volunteers participate. Even less is known about how to optimise those processes. To explore these aspects of citizen science, *Citizen Cyberlab* is evaluating existing on-line collaborative environments and software tools to assess their role in supporting and stimulating creative learning, as well as examining the best practices of current citizen science projects. New platforms and tools for citizen science to address the gaps are also considered to be created. *CitizenGrid* is the mission control centre for all the applications in *Citizen Cyberlab*. The aim of *CitizenGrid* is to get everyone involved in citizen science by providing a place where scientists can host their applications easily, and in whatever way they want to. They also want people to be able to find the right type of project to get involved in¹⁷.

1.3.3. Examples of Citizen Science in a European context

Citizen science has gained substantial popularity and is becoming a new outlet for people who are not professionally trained to be researchers but have the possibility to contribute to a wide range of research. As a concept it refers to the engagement of the general public in scientific research activities when citizens actively contribute to science either with intellectual efforts, surrounding knowledge, or with their tools and other resources.

As said in Haklay's Report:

"The past decade has witnessed a sustained growth in the scope and scale of participation of people from outside established research organizations, in all aspects of scientific research. This includes forming research questions, recording observations, analyzing data, and using the resulting knowledge. This phenomenon has come to be known as citizen science."¹⁸

'Citizen science' is often used as a synonym for 'crowd sourcing', and there are significant similarities. However, we consider that the use of the term 'citizen science' is justified when the involvement of citizens is aiming at research project guided by an academic and generating genuine new knowledge. In this light, when considering digital CH and humanities, 'crowd sourcing' is still more popular.

There are several societal and technological trends that explain the emergence of citizen science today. Concerning the technological trends:

"we should pay attention to the growth of the Web and mobile communication, and the ubiquitous connectivity that they offer."¹⁹

On the societal changes generated by the technology, we can mention:

- The rapid growth in education (especially higher) during the second part of the 20th century
- Increased leisure time, especially in middle and high income countries
- Growth in educated and able retirees

¹⁷ citizencyberlab.eu/

¹⁸ Haklay, M. (2009), "Citizen Science and Policy: A European Perspective", Wilson Center, Case Studies Series Vol. 4. Muki Haklay is Professor of Geographic Information Science at University College London (UCL) and the Co-director of the UCL Extreme citizen science Group

¹⁹ ibidem

Citizen science is well established in European funding programmes. In FP7, the EU has supported several citizen science initiatives, including the *Socientize* project mentioned earlier. Many of these projects are concentrated on environmental issues, but some that are shaped at very specific tasks²⁰.

Other examples specifically active in the domain of the e-Infrastructures deployment are:

- The *IDGF-SP* project²¹ with the main objective to involve and engage (in long-term) significantly more citizens and new communities in the volunteer and private (campus-wide or enterprise) Distributed Computing Infrastructures
- The *CHAIN-RED* project²² aiming at promoting and supporting technological and scientific collaboration across different e-Infrastructures established and operated in various continents, in order to define a path towards a global e-Infrastructure ecosystem that will allow Virtual Research Communities (VRCs), research groups and even single researchers to access and efficiently use worldwide distributed resources (i.e., computing, storage, data, services, tools, applications)

Examples of European initiatives built on citizen engagement are:

- *Europeana* and the collection of users-content from the First World War
- *EuropeanaPhotography* and the collection of pictures from the visitors of *All Our Yesterdays*. The exhibition showcases masterpieces from the first 100 years of photography (1839-1939) from the most famous European collections of in total 19 partner institutions: photo-archives, photo-agencies, and museums²³ and complemented these masterpieces with private collections gathered by scanning the pictures provided directly by the visitors of the exhibition
- The artistic experiment that is creating a statue made of building blocks provided by researchers from all over Europe on show in Lisbon in the occasion of ICT 2015. This initiative was presented at Net Futures 2015, an event organised in Brussels by the European Commission²⁴

CIVIC EPISTEMOLOGIES is in line with the Horizon2020 strategy, in which the research on CH and on social sciences and humanities is embedded in cross-cutting initiatives.

1.4. The inter-relation between arts, creativity and technologies

Initiatives highlighting the value of artistic approaches for participatory science have the potential to bring a wider public into the process and encouraging creativity. The number of shared spaces

20 See for example GAP2 (gap2.eu) about stakeholder driven science within the context of fisheries governance.

21 idgf-sp.eu

22 www.chain-project.eu

23 See www.europeana-photography.eu/index.php?en/91/events-archive/57/all-our-yesterdays

24 See ec.europa.eu/digital-agenda/en/news/net-futures-2015

of conceptualization, observation and interaction between science-technology-arts is growing and complementing established meeting places like science museums. Participatory experiments are gaining wider acceptance as the impact of scientific advances and awareness among researchers grow.

As pointed out above, the 'rediscovery' of dormant and creative skills, and the 'reorientation' of consumer-oriented skills into more active forms of creativity play an important role in triggering citizen science projects. Especially on this level, artists and creative people could have a facilitating role since they can trigger these dormant skills and show the citizen on how to use modern technologies in a creative way.

Regarding contributions of artistic practices to innovative ICT developments, communities of hybrid researchers have already started to develop new technological applications responding to specificities of their artistic creativity. This has led to the EC launching of the *ICT ART CONNECT* study, in order to characterize and connect artistic communities of ICT researchers at all levels, including institutions, companies and individuals. The study is creating a map of individuals and institutions engaged in artistic practices within ICT research projects in Europe and world-wide. It analyses best practices to enhance interaction between artists-researchers and other IT experts and to increase the impact of these interactions on innovation and creativity in Europe. It does not only analyse success stories but also it aims to identify the main needs and demands in order to draw recommendations for a strategy of the EC Directorate General DG CONNECT, to engage more broadly with the arts in the Horizon 2020 Programme²⁵.

25 See www.icstartconnect.eu

2. OUR VISION

New skills are needed in our changing society. Underinvestment in skills renewal and knowledge/technology transfer and the loss of traditional skills leads to the risk of innovation deficit and of a general lack of diversity and choice across design, production and markets, resulting in missed employment and commercial opportunities. A Roadmap that offers new understandings and ways of grasping opportunity can, therefore, lead to economic as well as social benefits. CIVIC EPISTEMOLOGIES is a project that shares its commitment to the values of openness, collaboration and wide participation.

One important project over-riding strategic objective is to support the development of a policy regarding the role e-Infrastructures can play in encouraging and facilitating the mediation process of citizen science in the area of digital CH and humanities, contributing also to a closer alignment between the private and public spheres. Within this scope, CIVIC EPISTEMOLOGIES seeks to identify and deploy new services and protocols enabled by e-Infrastructures, which will in turn support Europe's citizens, its creative enterprises and its wider cultural industries to enter into productive technology-enabled dialogue with CH institutions and humanities research.

CIVIC EPISTEMOLOGIES is engendering dialogue, which is still relatively infrequent, between research bodies (creativity, digital humanities, and digital libraries), e-Infrastructure providers, citizens' associations, and the artistic sector who seldom share their specialist knowledge outside their immediate groupings, whether professional or interest-based. Larger bodies in the cultural sector, including the owners of industry archives as well as national public heritage bodies, will be encouraged to open up their innovation potential through informal dialogue with interested volunteer users and experts.

CIVIC EPISTEMOLOGIES is informed by the consortium's awareness that new technologies are very powerful tools in the processes of creativity, co-creation and innovation. However the creative and cultural sectors are both highly segmented and small-scale (many SMEs, micro-enterprises) and are lacking often in technical know-how. Further, much humanities-based scholarship is both mistrustful of new technologies (e.g. much scholarship is still highly traditional in terms of the means of publication and dissemination of written outputs) and faces difficulties in engaging with wider audiences. The notion of the 'prosumer' – the enthusiastic reader of published research with special interest in the area who also contributes interactively with that research via new technologies – has not yet fully penetrated either the academy or the CH sector.

Finally, the consortium considers it vital to address the following questions: How can humanities-based research, in which the citizen is invited to play an active role, support re-conceptualization of the ways in which CH reflects, constructs and enriches individual and collective identities, and represents these increasingly fluid identities more fully, within a context of continuing social change? Which are the ethical issues that are raised when citizens participate in the research? For example who 'owns' the results and who decides on their access, use and re-use? How should political, social, gender, religious, cultural related aspects be taken into account when launching a citizen science initiative?



3. THE ROADMAP

3.1. The Roadmap as an instrument

The Roadmap aims to support the implementation of e-Infrastructure powered services in order to:

- Enable creation, access, use and re-use of digital CH content
- Provide learning and training resources
- Provide communication services to multidisciplinary research teams located in different geographic places
- Enable citizens to participate in a range of research goals established at a European level together with CH and academic institutions

The ultimate aim is to address the scientific processes in CH and humanities, in order to bring citizens, possibly through their associations, into the process of planning research.

The 'map' in the Roadmap draws the landscape of citizen science for the digital CH and humanities based on the current situation, but also taking into account that the situation may change in the future. Much depends on the maturity of the scientific processes and on the flexibility and usefulness of the services provided by e-Infrastructures. The overall context is also changing at different levels: technical, political and legal. Distributed solutions like government clouds are becoming increasingly prevalent and some CH and academic institutions may be obliged to make use of them. New data infrastructures with a portfolio of services are constantly being built. Societal changes have also to be taken into consideration.

The 'road' in the Roadmap points to an action plan, considering that actions are needed in a number of areas: tools, services, authentication, trust, governance models, user requirements, funding and business models, skills / training, etc.

The CIVIC EPISTEMOLOGIES Roadmap integrates three domains of necessary intervention (business change, policy framework and better tools) with the major PEST factors (political, economic, scientific, and technological).

The Roadmap is built on two implicit assumptions:

- Existing e-Infrastructures for research and academia are efficient channels also for the delivery of services to be used by CH institutions for supporting citizen science
- It would be possible to establish common policies, processes and protocols which allow the CH domain to access e-Infrastructures at EU level, despite the fact that e-Infrastructures often are national entities, sometimes with different policies and procedures for access and usage

Many CH and academic institutions have in-house solutions for processing their digital collections and holdings but also their research applications. When comparing in-house solutions with e-Infrastructure services, it is inevitable that some discrepancies appear, such as incompatibility of

purposes or scope, lack of technical or semantic interoperability, reliance on different standards, and jurisdictional and legal barriers, etc. The Roadmap has, therefore, the ambition to serve as a 'pilot' in overcoming differences between conflicting claims or opinions.

3.2. Identifying stakeholders and their requirements

3.2.1. Defining who are the stakeholders

In this section the targeted groups of stakeholder are identified and characterised, who they are and which benefit they can expect from implementing the Roadmap.

The following groups of stakeholders are the key ones, all with different roles to play:

- CH institutions and academic institutions (e.g. the research communities) - to identify clear protocols of interaction with citizen scientists and internally, as programme owners and decision makers on different levels, allocate budgets and implement good governance
- E-Infrastructure providers - to plan for future deployments
- Citizen organisations - to associate and organise activists into representative bodies
- Policymakers - to support institutional conditions and make necessary financial resources available

An important aspect is that the academic institutions, in their role to identify the protocols for citizens' engagement, not only will enhance the citizens' roles within communities of interest at local, national and potentially global levels, but also increase the reach and impact of their research. Similarly, the role of CH institutions should enter into a phase of change: from being traditionally just content providers to becoming also service providers. In their cooperation with e-Infrastructures, CH institutions will offer an opportunity to explore new audiences and markets.

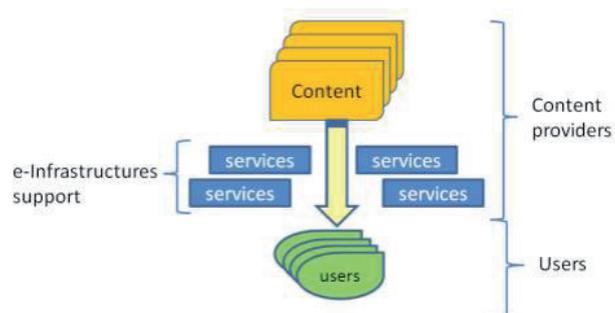


Figure 3: DCH institutions becoming providers of both content and services

There are also other identified complementary stakeholder groups. For them citizen science is not expected to be considered as a core activity, even if their contributions to the success of CIVIC EPISTEMOLOGIES Roadmap can be relevant and sometimes vital. They are:

- Artists and the creative sector in general
- Schools and the education sector in general

Artistic and creative practices contribute to the establishment of engagement processes. Artists can act as mediators between the cultural institutions and citizens, inspiring co-creation initiatives which can take place both online and in the physical premises of museums, libraries and archives. Schools and educational practices can successfully host citizen science initiatives, contributing to attracting youngsters' interests and creating new liaisons between the schools and the society.

The fact that the stakeholders are of very different kinds with disparate needs and requirements makes the question of dialogue and establishing a common framework particularly important. A valuable reference is the *RICHES Taxonomy*²⁶. This has been developed in the frame of *RICHES – Renewal, Innovation and Change: Heritage and European Society*, which is a project funded by EC in the FP7. The taxonomy is a theoretical framework of interrelated terms and definitions, referring to the new emerging meanings of the digital era (such as 'preservation', 'digital library', 'virtual performance' and 'co-creation'), aimed at outlining the conceptual field of digital technologies applied to CH. It can be used as a basis to be extended with more terms specifically related to the themes of civic epistemologies. In this light, a Memorandum of Understanding has been established between RICHES and CIVIC EPISTEMOLOGIES.

3.2.2. Applied methods

CIVIC EPISTEMOLOGIES applies a mixed method approach to understand stakeholders' different demands and expectations in citizen science, involving policymakers, CH and academic institutions, citizen organisations, e-Infrastructure providers, artists, teachers and students.

The project has explored the existing body of knowledge featuring general examples of citizen science work as well as examples of citizen science integrated in the CH and humanities context. These examples have been gathered and commented on within the online CIVIC EPISTEMOLOGIES **Registry of Resource**²⁷.

Specifically designed **user studies** were also carried out, aimed at investigating similarities and differences in requirements of various stakeholders. Web surveys were combined with expert consultations within the project consortium, and with a programme of focus groups that captured the opinions of different stakeholders (policy makers with a focus group held in Malta, citizen organisations with a focus group held in Sweden, and citizen scholars with a focus group held in Spain)²⁸. Specific workshops were also held in Malta in November 2014 (on requirements), in Leuven in February 2015 (on the Roadmap), and in Budapest in July 2015 (on CH institutions innovation).

Through an analysis carried out with experts from academies, research goals with a potential to be carried out in cooperation with citizens have been identified, and gathered in a draft for a **Strategic Research Agenda**. The Agenda covers digital humanities research and ICT applied to CH, the

26 See www.riches-project.eu/riches-taxonomy.html

27 www.civic-epistemologies.eu/registry-of-resources

28 The initial analysis of these user studies is presented in Dobрева, M., D. Azzopardi (2014) citizen science in the humanities: A Promise for Creativity. In: G.. Papadopoulos (ed.) Proceedings of the 9th International Conference on Knowledge, Information and Creativity Support Systems, Limassol, Cyprus, November 6-8, 2014, ISBN: 978-9963-700-84-4, pp. 446-451. To appear as well in Springer series. Dobрева, M. (2015) Collective Knowledge and Creativity: The Future of citizen science in the humanities. In: KICSS 2014 (Post-)Proceedings, Springer AISS, ISSN 2194-5357 (in print)

evolution of e-Infrastructures and digital libraries, and how they may better serve the involvement of citizens in the research. The engagement with creative enterprises and CH institutions in the development of common research has been investigated, with a particular attention to the role of artists in conjugating technology, science and society.

A **pilot** was organised in real-life conditions engaging students, teachers and elderly people in exploring place-names evolution in South East Ireland. Two **case studies** were conducted in the UK to explore how to motivate and to involve citizens groups active in the performing arts and individual citizens using a city-app, in CH research, under the lead of dedicated scientific coordinators.

3.2.3. Understanding stakeholders requirements

CH INSTITUTIONS

Different parts of the CH domain have different needs, depending on the size of the institutions, the typology of heritage they preserve, if they have exhibition vocation, the kind of projects they have, etc. The conditions (e.g. technical and financial resources) for managing these projects differ also quite much. Therefore, services for supporting citizen research need to be not only flexible and scalable, but also easy to adapt and utilise. Representatives of CH institutions have also underlined that the technical perspective (i.e. hardware) is not the highest priority for those institutions, at least not for now. What is needed are different kinds of easy to use applications like automatic control systems for data checking, data format checking etc., but also applications tailored for crowd sourcing.

An overview of available tools/services is of importance for CH institutions, and the CIVIC EPISTEMOLOGIES Registry of Resources will be very useful in this regard. Staff training is recognised by representatives of CH institutions as crucial for success. An increasing number of institutions realise they may run the risk of losing the initiative in citizen science, which can negatively affect their traditional role in making collections and holdings available for research and the public. Behind this anxiety lies an insight need in mentality shift. Whilst CH institutions traditionally had a monopoly on providing guidance to CH content, today increasingly, that body of knowledge is directly accessible to external users via the Internet. This has to be accepted by the CH institutions and also integrated in their strategies for disseminating digital CH resources. However, to get public engagement to flourish, the culture of the CH institutions needs to support it.

ACADEMIC INSTITUTIONS

The CIVIC EPISTEMOLOGIES study on a shared Strategic Research Agenda indicated that, in the last decade, a dramatic paradigm shift has taken place: the so-called 'socialization of knowledge'. This has deeply affected scientific practice, not just by the introduction of new theoretical insights, but also by the technological evolutions that profoundly impacted epistemic practices.

The extensively networked society we have created through technology makes researchers more interdependent even for the most basic of judgements. This means that besides the fact that much of the scientific knowledge has become indirect, mediated by communication tools such as the web, apps and social networks, the average academic researcher is seldom alone in making judgements. Instead, the researcher is surrounded by experts – professionals and/or semi-

professionals – whose knowledge he or she is depending on. In fact, in most cases, researchers are no longer able to make a full knowledgeable judgement – to the classic standard of justified true belief – without deferring part to a network of others. This means that social organisation of knowledge domains has become of crucial importance. This is often realised through transparent, open standards and procedures which codify what is considered as socially acceptable knowledge. Open Access, Open Content, Open Data, and Open Source: these are elements of the same desire to create a common reference framework that enables us to fit our insights together.

When asking representatives of scientific research which kinds of infrastructures are needed to support citizen science and collaborative approaches to culture and arts research, the answer is often simplistic: connect to existing e-Infrastructures and use tools and services that people are already familiar with!

On the other hand, there are requirements that cannot be served by the existing services provided by e-Infrastructures; for example, possibilities to add different layers to data and to separate user input from validated and curated data.

New services that are both desirable and possible to develop for digital heritage and citizen engagement, could, according to scientific researcher, be: best practices lists, show-cases, role models and methods and means for peer reviewing.

E-INFRASTRUCTURE PROVIDERS

One of the basic assumptions of CIVIC EPISTEMOLOGIES is that distributed storage and computing, grid and clouds approaches (e-Infrastructures) and virtualisation models can offer a reliable technical platform to the research in digital CH and humanities.

An important potential value is the possibility for e-Infrastructure providers to deliver services that can be used by several digital CH and humanities research projects, communities or bodies, so called common services. A common service is a facility that has the potential to be useful to several independent projects or initiatives. The common service is delivered over the Internet, has clearly defined inputs and outputs and provides a distinct set of services. The concept of common services relies on the availability of storage, computing power and high-speed data networks, which are precisely the facilities that e-Infrastructures can offer.

When representatives of the e-Infrastructure community express their view on requirements on distributed services for citizen science, they highlight the following priorities²⁹.

Firstly, citizen scientists' basic needs of ICT-services are normally very 'hands on'. Important services are:

- Fast and reliable public Internet access
- Adequate 'portals' to access and deposit data
- Adequate 'portals' to access data analysis tools
- Clear and understandable documentation

²⁹ Based on a presentation by Rosette Vandenbroucke, Vrije Universiteit Brussels at the work shop in Leuven on the Roadmap.

Secondly, most of the citizen science projects have some ordinary basic underlying needs. Therefore, CH organisations must have a robust technical platform in place, supported by a data management policy and a data management plan. This platform can be a mix of private and public e-Infrastructures and corresponding services offered by a mix of providers.

To summarise, it seems that e-Infrastructures first priority, when it comes to citizen science activities, is to give the customer a flexible, but at the same time, a stable basic technical environment. In order to do that, at least two main approaches to distributed services supporting citizen science projects are in place among e-Infrastructure providers. We can refer to them as the 'kiosk model' and the 'turn-key model' respectively.

This 'kiosk model' could contain supplementary services like federated authentication, audit and certification, persistent identifiers distribution, which are typical network services that would make work easier for institutions or networks of institutions that manage computer maintenance 'on their own'.

The 'turn key' model could contain cloud or grid based services that offer the entire process, covering all the phases and functions needed in citizen science activity models, eventually with a particular focus on storage, curation services and other organisational aspects like trust and IPR.

CITIZEN ORGANISATIONS

There was a unanimous agreement among stakeholders from the citizen organisations side that semi-professionals and non-professional citizens should be incorporated into the work carried out in CH institutions. The use of citizen engagement enhances the work and the quality of data collection, leading to a more advanced outcome that responds to the shifts taking place in our 'technology obsessed' society. The best way to include the voices of non-professional researchers is simply to ask them to get involved.

The drivers behind private persons taking part in citizen science projects are, according to the activists' organisations:

- Reward of some kind (could be small, symbolic and of less monetary value)
- Personal interest
- Idealism (helping the local society in some way, religious duty, etc.)
- The expectation that the results of the research could be in some way used or re-used in personal private research studies

The general pattern is that citizens often participate in research activities through their local or regional societies. The CH institutions are seldom first on stage in these topics. On the other hand, it is also evident that local museums and other CH institutions in the local areas play a key role in shaping the citizens personal activities that are directly linked with an activist's role and work.

There must be a balanced approach to digital technologies. Digital tools and services can help and allow many people from various backgrounds, even those that are often excluded and marginalised, to get involved and offer an opinion or contribute to the investigation(s). The digital tools cannot be the central point. There has also to be a balanced approach to gathering data as it can either isolate or create communities.

Digital technology tools that can be used are often found in the activists' private technical environment, i.e. personal computers with CD and/or DVD, Internet with YouTube, Skype and social media installed.

Policy-makers highlighted that the involvement of volunteers in projects undertaken by CH and academic institutions helps to establish a long lasting relationship which is a powerful way of engagement with the general public. Satisfied citizen scientists can help in future projects and might also serve as an effective 'word-of-mouth' advertising, which would in turn bring more people to the CH institutions. This could also help create dialogue with the community in terms of shared memories. In the domain of CH and the arts, citizens' contribution can help foster a sense of appropriation by the stakeholder communities. Knowledge development in this case involves a framework for co-creation, as detailed for example in the *RICHERS* Policy Brief "Co-creation strategies: from incidental to transformative"³⁰.

POLICYMAKERS

Citizen science has grown in scale and scope, and is, not surprisingly, receiving increased attention from policymakers at local, national, and international levels. A general positive attitude towards citizen science was also strongly felt in the focus group with policymakers and managers of CH institutions organised by CIVIC EPISTEMOLOGIES.

It is obvious, that policies can play an important role in stimulating engagement and vice-versa. If the people care, so will the governments. In this way, a virtuous circle can be triggered between citizens and policy level.

Political awareness might give the CH institutions more help from the governments who are expected to dedicate more time and resources to issues related to DCHH research.

The general feeling that seemed to stem from the discussions with policymakers was that citizen science is a highly valued method, which could be an immense source of data, but at that point was not necessarily accessible for the institutions to make use of. While it seemed easier to use citizens in a scientific research, it is still hard to clearly see a path to make use of such an encompassing resource in the CH setting.

THE ARTISTIC AND CREATIVE SECTOR

"Hidden Cultural Heritage: Inclusion, Access and Citizenship" is one of the case studies carried out by CIVIC EPISTEMOLOGIES, focused on people, including a group of vulnerable people, who volunteer to participate in cultural activities, whether theatre, dance, music, art, film making, photography and so on, as part of their own cultural enrichment and journey towards a sense of citizenship. These groups were drawn from a UK arts project: *Arts at the Old Fire Station in Oxford* - a charity and social enterprise that brings together arts workers and homeless people for professional development.

30 RICHERS Project, www.digitalmeetsculture.net/wp-content/uploads/2015/09/EUROPEAN-POLICY-BRIEF_Co-creation_final.pdf

The targeted citizens participated in a variety of activities to create and share cultural activities, including digitally enabled cultural activity, but as homeless or vulnerably housed people they do not tend to identify as 'citizens'. However, the activities that were the subject of the case study demonstrate the value of this work in transitioning its participants to citizenship, gaining skills that enhance their employability and contribution to society more generally. This activity, often hidden from regular surveys of citizen engagement with digital CH is powerful in understanding better about how digital technology can contribute to transformative experiences for citizens.

Interesting is also that homeless or vulnerably housed people do have both the knowledge and access to technical facilities for using digital technology tools, including social media. But it obviously needs instruments like artistic and creative practices to unlock the door of engagement.

THE EDUCATIONAL SECTOR

Citizen science activities have in the last year become a popular instrument in learning situations. The educational possibilities are many, especially when it comes to inquiry-based learning and to minimising the boundaries between schools and the world outside. Large community geography projects are in work, involving thousands of pupils. One is the National Geographic's *FieldScope* programme³¹.

Voices are heard, that

"The rise of citizen science in education is turning classrooms into labs and pupils into pioneers, with projects investigating humanity's impact on the planet among the most accessible for schools."³²

However, the CIVIC EPISTEMOLOGIES pilot study on place names in Ireland showed that it is important to have in mind that activities involved in citizen science project are novel to young students and despite their familiarity with digital applications and devices for their own social activities, the learning curve is steep. The students do not have experience in acting as professionals and it is, therefore necessary to set up ground rules, discuss expectations and practices before letting them into live situations.

The requirements when working with schools and the education sector are quite different compared with collaborating with other sectors of society. The training element is more in focus and also to set up the right environment adapted to the age and educational level of the students.

FUNDING BODIES

No specific activities were carried out during the CIVIC EPISTEMOLOGIES project to gather information about the requirements of funding bodies. However, these organisations are important to be taken into account because it is from the availability of initial public and/or private funding that often citizen science projects are triggered.

31 See natgeoed.org/fieldscope.

32 www.theguardian.com/teacher-network/teacher-blog/2014/jul/29/citizen-science-school-pupil-engagement-environment

A quotation from M. Haklay is reported here as a useful information. He summarises some findings concerning policy support for citizen science and citizen science support in policy formation and operation³³. These findings can to some extent also serve as a check list for bodies (public or private) investing monetary resources in the use of citizen science:

- Citizen science activities vary in their organizational settings: from ad hoc community groups to national NGOs or leading research institutes. Policies should be in place to support citizen science at different levels and organisations.
- Creating a successful citizen science project requires multiple skills – from good understanding of the scientific issue, to science community and ICT development. This requires ensuring the suitable investment is provided before starting a given project, and that the multidisciplinary nature of the field should be taken into account.
- Government officials and policy actors at different levels should be made aware of citizen science, so they can use it as part of policy implementation, as well as supporting existing activities.
- Citizen science can yield high quality, policy relevant information. Analysts who work with policy makers should be aware of the specific characteristics of such data, and use it appropriately.
- Support for information management and data quality procedures is needed for citizen science activities, especially when the activities are run by small organizations.
- The costs of information sharing and technical infrastructure need to be taken into account in citizen science projects, and be funded accordingly.
- Open access to academic publication is important for citizen science for two reasons: to allow participants to see the end result of their contribution and to support the learning process of citizen scientists.

Last but not least: funders of citizen science projects will probably ask for information how public engagement work is evaluated, and used correctly. Evaluation is a valuable tool that enables learning from experiences and to assess the impact of a project.

3.3. Lessons learned and identified gaps

3.3.1. Lessons Learned

This section discusses some important lessons learned during the requirements analysis, the pilot and the case studies carried out during the CIVIC EPISTEMOLOGIES project.

INTELLECTUAL PROPERTY RIGHTS

Most content providers would like to see their content being made widely available and reused, but sometimes only in manners that comply with their own legitimate interests and policies. These interests and policies vary from one content provider to another, reflecting different missions and tasks, but they all require that access to their content is controlled, recorded and acknowledged.

Technology is sometimes emphasised as a way to solve IPR and rights management issues but it is only part of the solution. The legal basis and the agreements between content owners and those who enable access to the content, as well as end users, are the most important parts. From discussions with different stakeholder groups it is obvious that coordinators and organisers

33 Haklay, M. (2009) "Citizen science and Policy: A European Perspective", Wilson Center, Case Studies Report 4, p.53

of citizen science projects need to be more aware of IPR because of their potential to lead to unanticipated consequences; some may even hinder the dissemination or use of the research produced by these projects.

Teresa Scassa and Haewon Chung have outlined a typology of citizen science projects based upon intellectual property issues. They are focusing largely on issues that may arise from contributions to the research project by the public and/or from project output³⁴.

Their typology classifies citizen science projects according to four broad categories, which are defined based on the nature of participants' contributions:

- Classification or transcription of data
- Data gathering
- Participation as a research subject
- Solution of problems, sharing of ideas, manipulation of data

According to their findings, some forms of participation are less likely to involve intellectual property considerations than others.

In the first three categories, IPR largely depend on the form in which contributions are made. Photographs, videos, and written observations may all raise questions about copyright. On the other hand, help with transcriptions or entering data into online forms is unlikely to give rise to any IPR issues. Cases where the participant is also a research subject could spark ethical concerns, but the intellectual property analysis likely does not change.

In the fourth category it is possible that the contributions of particular participants may rise to the level of inventorship or authorship, and thereby raising intellectual property questions.

Beyond the organisers, participants in citizen science projects may also seek to understand how issues of authorship, inventorship, and ownership may arise in relation both to their contributions and to the overall output of the project.

AUTHORISATION AND AUTHENTICATION

The needs to access networked applications and remote/distributed data is evolving dramatically in society. When it comes to citizen science and crowd sourcing activities, the results of these activities can only become science when they are shared, and sharing possibilities is, therefore, of crucial importance. This requires authentication services.

User authentication is a basic requirement for community related services and for controlling access to restricted resources not available to the public. User authentication and authorisation to access controlled resources are high-priority services because of their central role in the digital rights management and the enforcements of IPR. User authentication and access control are services, which are useful to both content providers and to content users.

34 Teresa Scassa and Haewon Chung: "Typology of citizen science Projects from an Intellectual Property Perspective. Invention and Authorship Between Researchers and Participants", Wilson Center, Policy memo series 5. February 2015 wilsoncenter.org/sites/default/files/Typology_of_Citizen_Science_IP_Rights_Scassa.pdf

Authentication and authorisation are often separated from the application and the data themselves: authentication of the users is done by the users Identity Providers (IdP) while the authorisation is done by the services based on the information received by IdPs.

Access that follows this model is known as federated access and it has brought several advantages both for users, who can benefit from a better user experience (fewer credentials to remember, log in once and access multiple applications, lower risk of forgetting their credentials) and for the service operators, who in practice outsource the user management life-cycle and can focus on authorisation. Federated access also increases security, by using a trusted connection between the IdP and the service provider; this trust connection is built by using standard protocols, legal framework and policies that are shared by the participating entities.

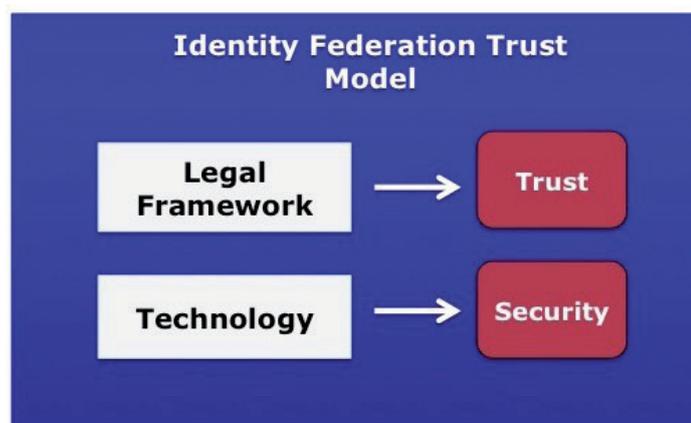


Figure 4: Trust model in Federated Access

For CIVIC EPISTEMOLOGIES, federated access is a key element, both in terms of using federated storage to handle data distributed all over Europe and in terms of user management. Federated access is in fact particularly desirable in a situation where services are offered across institutions and to users that do not belong to the institution that offers the service or technical facilities.

Federated access provides the technical and policy framework to allow for services to be shared in a trustworthy fashion across borders. How authentication is carried out by the institutions and how rights management is carried out by the service provider is left up to the respective parties.

When deciding whether to offer federated access, e-Infrastructures offering services should assess their potential user-base: whether they expect many local users or many users coming from different institutions. Federated access caters for the latter use-case and brings the following benefits:

- Users will be able to log in once (single sign-in) using their institutional credentials and access multiple services (sign on), Single Sign-On, whilst having the assurance that their personal data will not be disclosed to third parties
- CH and academic institutions participating will be free of the burden of user name and password administration, and will have access to more tools for managing data. On a large scale of users this means reduced administration and service provisioning costs; and it avoids duplications of identity stores
- Collaboration among different parties becomes easier

The first step to join a federation is to talk to the federation operator in a specific country. The list of existing federations is available online at: refeds.org/resources/resources_list.html.

There is an ongoing effort through an EC funded project within the Horizon 2020 funding programme called AARC, that brings together 20 different partners from among National Research and Education Networks (NRENs) organisations, e-Infrastructures service providers (including EGI) and libraries. AARC aims to develop and pilot an integrated cross-discipline authentication and authorisation framework, built on existing Authentication and Authorisation Infrastructures (AAls) and on production federated infrastructures³⁵. Outcomes will ultimately support a number of research communities needs for federated access, including CH.

THE ROLE OF CITIZEN ORGANISATIONS

It is also obvious from discussions with activist organisations that they often see themselves as an important part of the knowledge society with an ability to participate in citizen research projects, mainly crowd sourcing initiatives. In a country like Sweden, with a strong organisational tradition, they have the strength to organise and run some of these projects themselves using CH institutions as a source for crowding, if there are no CH institutions in place (or not willing) to support them. It was not possible during the CIVIC EPISTEMOLOGIES project to determine if this is the case also in other Member States as well or in other countries around the world. More research would be needed in this domain.

The case of activist societies in Sweden has been studied in the project. These organisations represent a strong movement that is using different strategies for reaching their goals and particularly by organising themselves in nation-wide federations strong enough at political level to be recognised as an important partner to cooperate with or to listen to. It has been observed that in some other countries sister organisations are using media or are connecting themselves to research projects or programmes at universities with high level of awareness.

The conditions for organising citizens' research activities (becoming obstacles if they are not fulfilled) are mainly:

- The results of the activities have to be open for all to use ('open source')
- The technical facilities have to be in place from the beginning and also easy to use
- The planning of the activities has to be made in cooperation with citizens research representatives, in order to incorporate their knowledge right from the beginning

In earlier days most of the knowledge and expertise connected to the CH institutions holdings and collections were held by the institutions' own staff members. Today, with more and more of these institutions' data and metadata available on the Internet, important parts of this knowledge and expertise are located outside the institutions, in the hands of users who also advance it by using different kinds of ICT tools. An important issue for the CH institutions therefore is how to harvest this increasing external knowledge and expertise and make use of it in their internal work. The organisations of citizen activists see themselves as a fundamental part in this process.

³⁵ aarc-project.eu

THE VALUE OF AN OPEN PLATFORM

Openness is normally considered as high priority by most stakeholders. In computing, an open platform describes a software system which is based on open standards, such as published and fully documented external Application Programming Interfaces (API) that allow the software to function in other ways than the original programmer intended, without requiring modification of the source code. The opposite is a closed platform.

An open platform does not mean per se that it is open source, however most open platforms have multiple implementations of APIs. An open platform can consist of software components or modules that are either commercial or open source or both. It can also exist as a part of closed platform. An open platform implies that the vendor allows, and perhaps supports, the ability to do this. By using an open platform, a developer could add features or functionality that the platform vendor had not completed or had not conceived of. An open platform allows the developer to change existing functionality, as the specifications are publicly available open standards.

In a citizen science context, openness relates both to the software used and to the data that has been gathered (data sets), allowing researchers and the general public faster access to the information. But openness also raises the question of authenticity of data, and there is also an ongoing debate today about data reliability. Although there are many successful experiences using different techniques to ensure the quality and accuracy of data, it is still a common issue in many scientific fields. Current projects on citizen science are normally based on a mix of proprietary software and open source software. But the trend is clearly towards openness. It improves speed and efficiency as well as efficacy of science policy measures. There is also a legal claim that public authorities provide open access to their data in order to be used by the public or by scholar in research.

Opening up for wider use of data-sets, raises the question of ownership and IPR, a reoccurring theme. Scientists who work in citizen science projects will sometimes not share and provide access to the collected data. The reasons behind differs, and it can be a serious hindrance if too few projects have a clear policy about the ownership of the results. There are also a number of unknown cases when volunteers are not informed about the IPR of projects they have been involved in. With an increasing number of funders requiring that data gathered during funded projects should be accessible for reuse by other scientists, issues on data quality, data standardisation, ownership and IPR are getting more and more urgent to solve.

The point of view taken by most stakeholders in CIVIC EPISTEMOLOGIES can be summarised as:

- Real accessibility needs to be available, not a theoretical one. The findings and results need to be shared with the community
- Citizen science platforms and software should be free to use and preferably open source, in order to support the basic ideas in citizen science: voluntariness, openness, and collaboration
- Artefacts or data which embody a community's CH need to be equally accessible to everyone. No curators or directors should deem themselves the exclusive owners of such a collection

INTERGENERATIONAL EXCHANGES

A pilot was developed in CIVIC EPISTEMOLOGIES when teenage citizen volunteers' recorded data related to Irish place names and place-based heritage research, through conducting interviews

with senior citizens who outlined both cultural and historical perspectives of place-names in an Irish context, on the basis of their direct memories.

As stated in the pilot report³⁶, the ‘intergenerational background’ for the study is as follows:

“Current generation of senior citizens - people from the age of 50 and over - has spent most (or at least much) of their lives in the pre-digital world before the Internet and social networking global communication revolution, whereas the teenagers of today are digital native - born in the late 1980’s or early 1990’s - have spent most of their lives immersed in the ever pervasive plethora of digital services, communications and entertainment. Whilst older people can remember life during the rationing of the Second World War and before electricity, and have witnessed and experienced dramatic political and cultural changes, which teenagers of today may only have read partially about in history books; young European people face current and future challenges unknown to earlier generations such as cyber bullying, cybercrime, climate change, global financial and ecological crises. Yet both these current generations have encountered common challenges too in emigration and austerity. Sharing lived experiences of seniors may also give younger generations faith in their ability to overcome challenges and build social resilience in communities. Doing this via a citizen-led approach democratizes the means of local place-based cultural production and consumption, empowering those who participate. Intergenerational heritage recording matches latent social and cultural resources for the benefit of society. Socio-cultural records of ordinary life in previous generations are thin - haphazard often scarce, reliant on official newspaper accounts, archives, and occasional family photographs; senior citizens personal recollections are a valuable cultural resource. In contrast, many teenagers of 2015 make thick cultural records - recording and sharing countless moments through photos, video, text on their phones, tablets or computers everyday; teenagers’ digital skills are a valuable culture-recording resource in society. Place-based intangible CH, as evident in place names, oral history and stories of place, is a significant factor common across all generations, and this is one reason why it has been selected as a literally common ground on which to centre intergenerational cultural exchanges in our CIVIC EPISTEMOLOGIES pilot study. Participating in cultural history recording projects such as this assists seniors to appreciate the value and worth of their own personal recollections. Learning about how previous generations lived in ones local area directly through listening and conversations is a way to bring history alive, make it immediately relevant and enable young people to see their own position and potential in a longer view. Sharing stories and knowledge about place and language through research in place names, gives participants access to the wider historical networks of memory; deepening cultural connections to the natural and built landscape, whilst also building social capital within communities.”

The volunteer students, and senior citizens involved in the pilot study reported that they found the experience enjoyable, indicating also the possibility for extending this type of approach to future projects. However, this type of project is high risk and challenging. It does not guarantee production of quality CH archives. Its foremost value may be in the creation of opportunities for meaningful intergenerational interactions and otherwise unlikely recordings to be made.

The stakeholder group with policymakers also very explicitly said that to create a better communication with the communities, one must get to the source of it – children. These young members of our societies are often not aware of what is going on in their own communities, let alone on a national level. By creating a better bridge between the community and the children, this would help nurture individuals who would grow up showing more interest in the CH domain and thus be more willing to volunteer their help and services in the future.

CITIZEN’S ENGAGEMENT IN DIGITAL CH FOR SOCIAL INNOVATION AND COHESION

Two case studies were conducted by the CIVIC EPISTEMOLOGIES project to examine two very different contexts in which citizens engage with digital CH to evidence how citizens participate in

36 The pilot report is available as deliverable D4.1 Ethnographic Pilot report and can be downloaded from the project’s website in the ‘Project page’: www.civic-epistemologies.eu/project

the construction and sharing of digital CH, and its potential for increasing skills, jobs and social cohesion³⁷.

The first case study ('Hidden' CH – inclusion, access and citizenship), focuses on citizens who participate in a variety of activities to create and share cultural activities, including digitally enabled cultural activity. As homeless or vulnerably housed people they do not tend to identify as 'citizens', but the activities that are the subject of the case study demonstrate the value of this work in transitioning its participants to citizenship, gaining skills that enhance their employability and contribution to society more generally. This activity, often hidden from regular surveys of citizen engagement with digital CH is powerful in understanding better about how digital technology can contribute to transformative experiences for citizens.

The second case study (Local CH – inclusion, access and economic development) examines how a city can utilise digital technologies in creative ways to engage its visitors to enhance the economic health of the city while encouraging users to recognise how digital technologies can enhance their experience of and relationship with a city.

A variety of forms of interactions took place within the case studies. In the first study human interaction, digital technologies and CH were more distanced and perhaps less 'hands on'. In the second study the opposite occurred; the participants directly interacted with the digital tool, but were less impacted by the process.

This leads to the conclusion that access to digital technologies is not the most important thing rather the nature of the interaction and the quality of that interaction leads to a more transformative experience. The number of new technologies has made our time the age of information and processes allowing individuals and groups of people to engage with CH in a variety of ways. Infrastructures that address the changing landscape of information, allowed us to familiarise ourselves with the needs of the various groups, their access to digital tools, and the CH they engage with.

In summary, there are a variety of uses for digital technologies that are invaluable to the CH sector. Institutions and other key stakeholders should actively invest in digital technologies as they are an integral part of modern society. This can enhance the user experience as well as the local, national and international community. The wider context and varied uses highlight that digital technologies and CH stakeholders need to be further investigated. The two case studies allowed us to infer that citizen engagement with digital technologies can enhance the CH sector. Strategies need to be in place that allow for improvements and discussions to occur.

3.3.2. Gaps

This section highlights some of the gaps that are expected to be filled when implementing the Roadmap.

³⁷ The results of the case studies are available as deliverable D4.2 Case Studies Report and can be downloaded from the project's website in the 'Project page': www.civic-epistemologies.eu/project

THE LAST MILE – AN OVERVIEW

Lack of know-how

ICT is a powerful driver of creativity, but specific technical know-how is still generally lacking in the CH and humanities sector:

- In the creative industries sectors to make digital CH more widely used and exploited
- In the humanities, where scholarships are not yet taking full advantage of ICT in their research and to engage with wider audiences
- In the CH sector where new skills are needed to enable CH institutions to grasp employment and business opportunities

European e-Infrastructures have been built over the last decade with support from the European Commission. These e-Infrastructures are able to support the participation of European citizens in research on CH and humanities. This capability – when being used - will ultimately improve social cohesion arising from the sharing of knowledge and understanding of European citizens' common and individual cultures (see also section 5.6).

Better uptake of intangible CH

There is a variety of tangible and intangible CH of importance that exists and need to be accessible. The tangible one, like buildings, monuments, artefacts and other landscapes are important to bear in mind. However, the intangible resources need to be better considered and integrated into digital research frameworks and platforms. The research on intangible CH (languages, music, ideas, oral histories, dance and performing arts, etc.) is often missing to be part of the technological advancements. Individuals and local communities have a role in this research (including those vulnerable groups highlighted in one of the case studies carried out by the CIVIC EPISTEMOLOGIES project). Intangible CH needs to be considered in a technology framework, it needs to be embraced into research and CH institutions strategies.

Better focus on business value

There is great value in including local communities and citizens in any CH research and production of applications. Without the perspective from the citizen scientist, there is a risk of not matching the needs of the target group. Without clear strategies and frameworks in place to support the business initiative, including both projects and products, there can be delays and/ or missing opportunities.

Working with citizens from different areas better ensures that key outcomes are met from the consumers' point of view and that new business models are implemented in an effective and efficient way that effectively caters target groups.

The need for apps, interactive online services and other applications powered by digital technologies are clear and could harness an economic growth that directly impacts a community and its CH sector.

Need for enhancing cohesion and inclusion

Through involving local communities and citizen scientists, digital technology development can better cope also with the demands of the CH sector and the development of the target audiences. Citizen engagement and community cohesion is enhanced by involving these various communities and voices. Several stakeholder groups give evidence of that.

CH and the use of digital technologies have the potential to foster inclusion by providing critical platforms to share ideas, which need to be better exploited.

Need for new opportunities of funding

Ground-breaking research or arts-based organisations run easily into the difficulty of securing funding. Through the inclusion of citizen scientists, including vulnerable groups and marginalized communities, information and CH content, both tangible and intangible, can be sourced. This encourages crowd-sourced information which has many positive effects on research and key stakeholders. Citizen science engagement is offering new ways of looking at funding and other business models, such as the promising crowd funding movement.

Need for digital tools and technical platforms for including the public

Digital tools and technical platforms, including social media portals, allow non-professionals from various communities with varying levels of education to contribute to scientific studies. The public can be a powerful resource, but it risks not being harnessed. These tools and platforms should enable non-professionals to easily share information with researchers, and should be used to invite individuals from local, national and international communities to offer their expertise. This enhances the scope of a project and also increases the number of individuals who participate, and contribute knowledge about the research. The digital tools can also serve as a quick and inexpensive way of disseminating project objectives and conclusions.

E-INFRASTRUCTURE SERVICES FOR CITIZEN SCIENCE

Supporting Services

E-Infrastructure services for citizen science, including crowd sourcing, are normally structured around development of tools, but also need to involve policy instruments necessary to achieve efficient intervention in the digital CH and humanities.

A ground breaking part of the concept that CIVIC EPISTEMOLOGIES is aiming to introduce, concerns the possibility to customise the citizen science focused services provided by e-Infrastructures, by tailoring service portfolio and characteristics to the actual tasks and requirements of each project. However, even if the e-Infrastructure resources seem to be allocated in ways that could support citizen science activities quite well, and this area of research is developing quite rapidly, nevertheless the market for those customisable services is still in its infancy and this could distract the attention of e-Infrastructure managers from developing such services.

One aspect that may contribute to this weakness is the level of maturity in the digital CH and humanities to handle distributed services for citizen science. E-Infrastructures can reach their maximum potential in serving the CH in practice only if the domain is prepared to exploit the

opportunities offered by using e-Infrastructures. From contacts with different stakeholders it is clear that parts of the CH and humanities sector is not yet taking full advantage of e-Infrastructure because of a general lack of knowledge and expertise in the use of these technologies.

Citizen scientist's basic needs of IT-services seem to be normally very 'hands on', and the technical perspective (i.e. need of hardware) is easily over-estimated. For example, in the pilot study conducted by CIVIC EPISTEMOLOGIES, the use of default audio recorders on smart phones, or tablets devices was perfectly adequate for the task. What is needed is mostly a different range of applications, such as automatic control systems (data checking, data format checking, authentication services etc.). The three basic requirements for e-Infrastructure services are obviously: independence of e-Infrastructure technologies (to avoid lock-in situations), usability from 'anywhere', and ease of use.

Many stakeholders underline that simple interfaces are crucial for the use of distributed services for citizen science or crowd sourcing offered by e-Infrastructures. Some take a step further and prefer the use of existing platforms rather than engaging with the use of new infrastructures which would allow specialised expertise to be used. To conclude, there seems to be a need for a basic framework that can then be adapted and reworked depending on the nature of the citizen science project that is being undertaken. While there are definitely some good examples of citizen science projects in the digital CH and humanities, this domain is, as been stated earlier, less advanced than the domain of, for example, natural sciences. Creating specific toolkits focussing on the case of CH, with practical guidance on how to plan, manage and engage with citizen scientist, could be of great help.

In addition, the creation of CH networks with an interest in citizen science could help bring together researchers, technology providers and large networks of volunteers, which is a basic pre-requisite for citizen science projects.

Non-functional requirements for e-Infrastructures to focus on, mentioned by most stakeholders, are: availability, reliability, security, regulating investigations, data integrity and usability.

The service architecture

The reference architecture is illustrated in *Riding the Wave: How Europe can gain from the rising tide of scientific data*³⁸, the report dated October 2010 produced by the High-Level Group on Scientific Data appointed by the EC, which describes long term scenarios and associated challenges regarding scientific data access, curation and preservation.

38 ec.europa.eu/information_society/newsroom/cf/itemlongdetail.cfm?item_id=6204

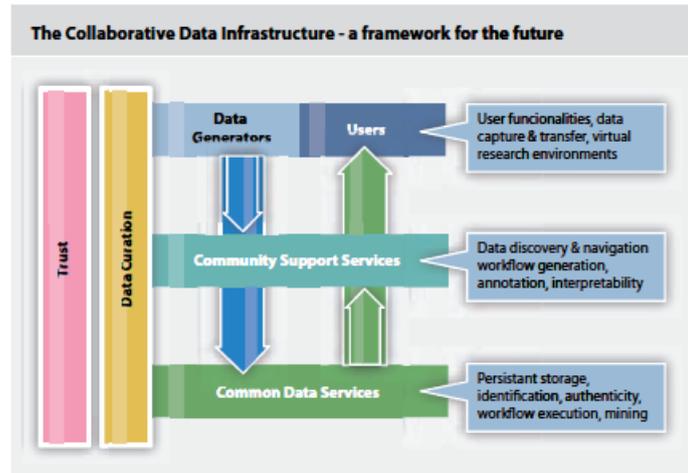


Figure 5: The collaborative data infrastructure - a framework for the future (from “Riding the Wave”, p. 31)

On this basis, the *EUDAT*³⁹ project presented the architecture of a conceptual model that integrates various infrastructures with vast amounts of research data, and adds services for curation and trust in addition to the interface to users. As it stands, this model represents basic stakeholder needs in the research area: ensure the trustworthiness of data, provide for its curation, and permit an easy interchange among the generators and users of data. These needs could also be said to be basic ones in the digital CH and humanities, and the *EUDAT* projects conceptual model can, therefore, serve as a base for further development.

Improvements and adjustments of the model have already been made in the area of research data. The Data Archiving and Networking Services (DANS) in the Netherlands has developed, based on the *EUDAT* conceptual model, a federated data infrastructure with three layers of roles and responsibilities for the various stakeholders (*Front office – Back office* model)⁴⁰.

CH institutions as well as research centres of different kinds have sometimes built up their own infrastructure to manage their digital resources. But it is undoubtedly true, that continuing investment in in-house solutions, particularly in the case of citizen science, risks perpetuating lack of interoperability and fragmentation of resources into ‘digital silos’, which are very dangerous conditions. Stand-alone solutions that are not transferrable and interchangeable lead to fragmentation and do not offer economies of scale. Instead, shared solutions for creation, storage and use of digital resources, including the e-Infrastructures, will become the major component of the future knowledge economy.

In order to move ahead from the current state into shared, decentralised solutions, it is important to define key institutional requirements in a standardised way. Researchers and research institutes, projects, and communities turn to clouds more and more often when they need a platform to store, share, process or archive large research data in a reliable and user-friendly way. Given its

39 *EUDAT* is a project funded by the EC under FP7 and further extended under H2020. Further information on the project’s website at eudat.eu

40 See www.dans.knaw.nl

long-running experience in federating IT services for research and education, the European Grid Initiative Foundation (EGI), one of the CIVIC EPISTEMOLOGIES' partners, is in a position to help create a federation of CH institutions and research centres' computing infrastructures as a cloud federation. This cloud federation can provide a distributed hosting environment for community-specific services that can be instantiated, scaled and migrated across the federation to provide resiliency and portability, and most importantly, cloud compute services can be offered where data resides, without the need of moving research data out of the institute premises. The EGI *Cloud Marketplace* provides a community platform for sharing tools and applications as virtual appliances that can be reused and executed on those cloud federations. The "Open Science Cloud to Realise the Data Commons" document describes the EGI vision to provide the possibility to share data, the processing services and the applications, virtual laboratories and tools, relying on existing federated data and storage facilities⁴¹.

NEED FOR A NEW MIND-SET

Defining drivers for making a shift in institutional practices in the CH research

In addition to the technological challenges, innovations around the internal workflows of the organisations operating in the CH domain is of great importance for the achievement of the vision of CIVIC EPISTEMOLOGIES. Internal workflows currently encountered among CH players imply that a number of actions need to be taken by many institutions that are engaged in citizen science, in order to make their digital resources more usable. Firstly, roles inside the organisation have to be redefined to guarantee that citizen science is accepted as a method of work. Secondly, in order to create new skills and competences, practitioners have to be trained in both understanding and the handling of the new conditions associated with citizen science in a digital context i.e. the changing forms of artefacts and metadata, the changing methods of work, and the rapid changes in technology itself. Furthermore, decisions have to be taken about the procurement of services related to citizen science and computing resources. All these actions require time to be performed and financially resourced. Advocacy of the need for citizen science is, therefore, another important action in order to create the conditions required for understanding, acceptance, and endorsement by decision makers.

Engagement processes

How to successfully attract volunteers in citizen science activities are broadly debated by the stakeholder groups that CIVIC EPISTEMOLOGIES is targeting. However, there seems to be a lack of research on the motivations that need to be offered to the citizens in order to take part in research projects as volunteers.

Motivation is sometimes described as being either intrinsic (i.e. improvement of skills) or extrinsic (i.e. fun and intellectual stimulation) and also specific to the type of project⁴². Other factors like

41 documents.egi.eu/public/RetrieveFile?docid=2575&version=5&filename=OpenScienceCloud-EGI-v1.pdf

42 No, O., Arazy, O., and Anderson, D. (2011) "Technology-Mediated citizen science Participation: A Motivational Model". Proceedings of the Fifth International AAAI Conference on Weblogs and Social media (CWSM 2011), July 2011, Barcelona, Spain www.faculty.poly.edu/~onov/Nov_Arazy_Anderson_Citizen_Science_ICWSM_2011.pdf

social network effects and feedback to participants can, of course, also have an influence. Citizen activist organisations point, when asked, to three main drivers behind private person's engagement in science projects: reward of some kind (symbolic and of less monetary value), personal interest, idealism, the results could be used in the person's private research (see section 3.2.1).

The National Co-ordination Centre for Public Engagement in UK has an eleven point long on-line list on engaging the public as researchers - from how to get started to available resources (case studies and guides and articles)⁴³.

Training

The quality of the data gathered or created by citizen volunteers is one of the main concerns expressed by researchers and CH professionals.

There are some interesting practical experiences to be drawn from of the *Dutch Many Hands (VeleHanden)* crowd sourcing service. *VeleHanden* was established some years ago for 'crowd sourcing' information from archive documents. Any archive service in The Netherlands is able to make scanned documents available on *VeleHanden* and ask for volunteers (the 'crowd') to help with indexing these documents, or transcribing them, or tagging photographs, or matching up data to scans - or any kind of task that the archive service thinks people might be interested in doing online.

However, the uptake by archival institutes had less success than anticipated even though there was immense interest from motivated volunteers. Doubts concerning data quality by professionals manifest in several ways, it can be a personal worry about the data quality, but just as well concerns about possible reactions they might receive from their peers reviewing their work. In the case of the *VeleHanden* project, it was suggested by Fleurbaay & Eveleigh⁴⁴ that there were some fears from the archival organisations in losing their specialist position by allowing citizens to uptake a part of the archivist's work. The authors advocate that CH professionals should accept their changing role from gatekeeper towards facilitators, providing users with the professional expertise to navigate, filter and interpret the abundance of data.

Training of the staff of CH institutions is of course crucial for success when engaging citizen volunteers. If CH institutions fail in changing their professional role and remain being gatekeepers, part of these institutions work in reaching out to the public will be taken up by others.

Issues and concerns towards the quality of data gathered or created by citizens can be minimised by providing extensive training, supervision and support to volunteers. This can happen through individual training, online tutorials, trial versions and examples, and discussion fora. Of course this kind of guidance takes up a lot of time and resources, but the effort pays back both in quality and quantity.

43 www.publicengagement.ac.uk/how/methods/engaging-public-researchers

44 Fleurbaay E., Eveleigh A. (2012). Crowdsourcing: Prone to Error? Retrieved from ica2012.ica.org/files/pdf/Full%20papers%20upload/ica12Final00271.pdf

Ethical issues

More effort should be spent in defining and promoting guidelines and best practices related to citizen science with particular regard to the questions that raise when carrying out projects in the CH domain. These issues are linked also to the Responsible Research and Innovation (RRI) approach for ICT in Horizon 2020, which covers many ethics in relation to digital privacy and security issues but also real world matters of respect and dignity in interactions, events, and research practices in general.

3.4. The main components of the Roadmap

The Roadmap is made of a list of selected areas for action laid out on a defined range of time. The articulation of timeframe and areas of action constitute then the action plan, which is described in the following chapter 4.

3.4.1. Timeframe

The CIVIC EPISTEMOLOGIES Roadmap should make it possible for each institution in the CH and humanities domain to define its own practical action plan with a realistic timeframe for the implementation of its stages.

In this light, three time frames have been considered:

- **Short-term (2016- 2017).** The purpose of proposing a short-term action plan (2016) is to initiate the development of e-Infrastructure services on a level that will be self-sustainable and continue to progress on its own.
- **Medium-term (2018-2019).** The medium-term action plan covers the two years after the end of the CIVIC EPISTEMOLOGIES project and it concerns the production phase, when the developments initiated during the short-term action plan are deployed.
- **Long-term (2020 and beyond)** for the logical continuation of the work and full implementation of the citizen science initiative.

3.4.2. Selected areas for actions

Based on an analysis of the state of the art and the requirements expressed by different stakeholder groups, seven main areas have been selected for actions:

1. **Empowering existing e-Infrastructures with new services.** This action aims to develop and make available the specific new services that can satisfy the needs of digital CH and humanities research communities.
2. **Tailoring new services to the requirements of each research community.** This action aims to customise the new services on the basis of the individual specifications of the research project where the services are going to be used. Terms of reference, definition of roles and responsibilities, and guidelines will be important components.

3. **Improving interoperability and re-use.** This action concerns the implementation of a better integration of internal and external digital resources within the overall workflows for handling research data. This action is important in order to put in place a set of measures to avoid building 'digital silos' within the organisations participating in the research.
4. **Establishing the conditions for cross-sector integration.** Cross-sector integration is a key condition for maximising the efficiency of successful solutions, transferring knowledge and know-how between different sectors. A scalable and modular approach to the e-Infrastructures deployment is needed that will allow serving research better and reduce costs of development.
5. **Developing governance models for infrastructure integration.** The agreement on governance modules is a necessary condition for successful institutional participation in larger e-Infrastructure initiatives. This includes also aggregation and re-use of digital resources.
6. **Exploring artistic and creative practices as an instrument for engagement.** This is an area which still requires to be valorised and exploited in terms of its potential for social innovation and cohesion.
7. **Developing ad-hoc training and awareness opportunities for targeted users.** Training and awareness of target users is a key pre-condition for the successful implementation of a citizen science initiative. The actors involved come from different background and have different experiences, therefore they should reach a compatible level of knowledge that can allow sharing information and understanding instructions from the project leaders.

For each area a set of prioritised actions are suggested in an action plan (see chapter 4).

3.5. A web space dedicated to the Roadmap

This Roadmap represents the main outcome of the CIVIC EPISTEMOLOGIES project.

By definition, a Roadmap is not useful if it is not widely disseminated, validated and endorsed by the user groups it aims to target. The CIVIC EPISTEMOLOGIES project contributed substantially to the creation of a wide community of people coming from different sectors (policymakers, CH institutions, humanities researchers, citizen scientists, activists, e-Infrastructure providers, artists and professionals from the creative sector, etc.) who demonstrated interest in the work done for the development of the Roadmap. Now it is important to keep alive and to continue to nurture this community, creating awareness about the final version of the Roadmap and fostering its diffusion and implementation in Europe and worldwide.

Furthermore, a Roadmap, for its on nature, cannot be considered as a final step. It has on the contrary to be considered as a living document that needs to be continuously maintained, updated and improved as time passes, technology changes, new requirements have to be taken into account, and so on.

For these reasons, CIVIC EPISTEMOLOGIES created a dedicated web-space where it is possible to download the last version of the Roadmap, but also where it is possible for everyone to provide

feedback and comments, a kind of forum dedicated to the use of e-Infrastructure services and facilities for citizen science and crowd sourcing in the CH domain.

Apart from presenting and discussing the Roadmap, this web-space will link also to other relevant material, information and services that are relevant for the implementation of the Roadmap itself and that contribute to supplement it.

In particular, a section is dedicated to the CIVIC EPISTEMOLOGIES Registry of Resources, conceived as a practical instrument to help different stakeholders in the implementation of their own citizen science initiatives.

By the end of the project, the web-space will continue to be hosted in a dedicated section of digitalmeetsculture accessible at civic-epistemologies.eu/roadmap.

A long-lasting network of common interest has been created during the CIVIC EPISTEMOLOGIES project, connecting, in addition to the partners, CH institutions, research bodies, creative industries, e-Infrastructures, and citizen associations. The participation in the focus groups, workshops, surveys, and pilot and use case studies contributed to establish such network on very concrete basis. Similarly, the online debate about the Roadmap, has contributed to the enlargement of the network of common interest. This network will continue to exist, as a group of people, interested on the use of the citizen science paradigm for CH research projects, and aggregated around the ideas represented in this Roadmap.

4. A PROPOSED ACTION PLAN

This proposed action plan consists of two parts:

- A list of proposed actions, following the timeframe and the selected areas for actions, as identified in the previous section 3.5
- A list of recommendations aggregated around each targeted stakeholder group

4.1. Proposed actions

4.1.1. Short-term (2016- 2017)

STEP 1: TO START UP

Before starting planning for the use of distributed e-Infrastructure services for citizen science activities, there are some basic considerations to be taken into account:

- Project management, participants engagement and data management are three ground pillars that need to be addressed in setting up a citizen science project. This will include establishing a community management charter (which will address also how to manage 'rogue' users falsifying or disrupting data collection)
- Procedures for establishing goals and for planning how to achieve them are needed
- Objectives of the project must be clearly defined and they should be SMART: S(pecific) M(easurable) A(chievable) R(elevant) and T(ime limited)
- Plans are required for recruitment of the necessary scientific and human resources, funding, and communication and marketing

In this preparatory phase important activities are also:

- Establishing key partnerships with relevant e-Infrastructures
- Establishing key partnerships with citizen science networks
- Analysing innovation drivers (economic, technical, other drivers)

STEP 2: TAKE ACTIONS IN IDENTIFIED AREAS OF THE ROADMAP

The following actions correspond to the selected areas for actions listed in section 3.5.2.

1. Empowering existing e-Infrastructures with new services

The implementation of new services should refer to the 'three linked S': Setup services (needed to simplify the construction of online digital CH resources), Stable platforms (needed for hosting, backup, preservation, etc.), Scalability (needed when the amount of material grows and the levels of usage increase).

The following areas of services should be considered:

- Services for content providers (i.e. services related to the creation of online data resources for research in CH). A recommended list of priority services follows:
 - › Interoperation (required to simplify the interoperation of online digital CH resources)
 - › Aggregation (can harvest and combine material from several digital CH resources and therefore needed to enable delivering multisource facilities to users)
 - › Cross-search (needed to enable searching across multiple online digital CH resources)
 - › Semantic search (needed to take advantage of semantic web technologies such as linked data and ontologies)
 - › Persistent identification (needed to simplify or automate the maintenance of persistent identifier and their mapping to specific locations within digital CH resources)
 - › IPR and Digital Rights Management
- Services for adding value to the content (i.e. services focusing on ways to enhance data, to make it more accessible, user-friendly and attractive in order to facilitate re-use of data in different contexts). A recommended list of priority services follows:
 - › Geo-referencing (needed to enable an item to be shown on a map to illustrate its relationship to other items and to other geo-referenced information)
 - › 3D visualisation and manipulation of complex digital items (needed to build up virtual reality scenarios to provide unique and immersed experiences, sometimes useful in projects with an artistic component)
 - › Linked data (needed to enable linking of multiple data resources in combined or linked searches)
 - › Advanced search support (e.g. search by image, shape, colour, etc.)
 - › Annotations and citation (needed to enable researchers to add their own contributions to DCH materials to enrich the content)
- Services for user management (i.e. services that support virtual research communities and activities of content consumers; the latter are those who consume content for research like academic and citizen researcher and staff members at DCH institutions). A recommended list of priority services follows:
 - › User authentication (needed for authentication; Single Sign-on simplify the use of several resources in a seamless way, removing requirements to remember and administrate several logins and passwords)
 - › Group-based access control (needed to enable a user to access several different data resources; offers also possibilities for providing access to new resources without the request of new authentications each time a new resource is accessed)
 - › Collaborative environments (needed to make it possible to work together on the same data and to offer features to researchers and other users of content to collaborate on their research); these environments can be restricted to pre-defined groups and/or individuals
- Before entering in the development of new services, first explore the catalogues of existing services provided by relevant e-Infrastructures; if the required service already exists, take no action; if not, define the technical specifications of the new service in cooperation with the e-Infrastructures; try in the first place to fill the gaps identified in section 3.4.2 above.
- The design of these new services needs to be planned and developed based on practical case studies and pilots that, if possible, should include proof-of-concepts.

- Develop an evaluation plan for each new service; it helps focusing on what is meant to be achieved with this service, how it is planned to be achieved and how to know when it is achieved.

2. Tailoring new services to the requirements of each research community

The following action should be considered:

- Define the purpose of the targeted research community. Public engagement cover a range of approaches that be categorised in three often overlapping purposes:
 - › Informing: make the work of higher education more accessible to the public
 - › Consulting: listening to the public's views, concerns and insights in order to better understand complex situations, coherencies, etc.
 - › Collaborating: establish partnership with the public to solve problems together, drawing on each other's expertise
- On the basis of the identified purpose(s):
 - › Identify the specific relevant new services in the applicable areas of services identified above
 - › Ensure that these identified new services are appropriate and relevant to the target audiences and can effectively contribute to planned research activities
 - › Discuss with e-Infrastructure how to tailor the identified new services in accordance with requirements of the targeted research community
- Identify ethical or social issues that may arise from engaging the public with the research of the targeted research community:
 - › Which kind of the application(s) can the research have in the society and which kind of societal changes might result from these applications?
 - › Are there positive and/or negative impacts on certain members of society or groups?
 - › Are there any associated religious, political, cultural, gender-based or social class related issues?
- Check if identified ethical and social issues can affect the way in which the identified new services are tailored.

3. Improving interoperability and re-use

The following action should be considered:

- Analyse aspects of internal interoperability within the CH institutions and research organisations, in order to avoid building 'digital silos'. The following aspects need to be considered:
 - › Technical aspects: hardware and software solutions should use available standards
 - › Semantic aspects: many vocabulary sources are already available; check if any of these can be used before creating a new one
 - › Organisational and inter-community issues: it is important that citizen science projects are supported by organisational commitments between the concerned institutions, both among the institutions involved in the project and internally in the institutions themselves
 - › Privacy issues: the treatment of personal data should be in line with European directives on data protection and their implementation in national legislation

- › Legal issues: harmonisation of legal frameworks in general should be addressed, for example concerning the issue of cross border storage and differences in legal positions regarding preservation of master files within a project

4. Establishing conditions for cross-sector integration

The following action should be considered:

- Decide about standards to use: extensive use of relevant and open standards is vital when promoting interoperability and encouraging widespread access to support openness and collaboration, and make voluntariness possible.
- Use the CIVIC EPISTEMOLOGIES Registry of Resources: the development of the Registry is an important step in the construction of the Roadmap. Further development, updating and maintenance of the Registry will help establishing profitable collaborations between different research sectors.

5. Developing governance models for infrastructure integration

Actions should be taken to decide on high-level models for:

- Project management, to maintain a good quality project. Three key constraints, often referred to as the 'Project Management Triangle', need to be constantly managed:
 - › Cost - the budgeted amount available to run the project
 - › Time - the amount of time available to complete the project
 - › Scope - what must be done to achieve the desired end result(s) of the project

Each side of the triangle represents one of these three constraints, which are often in competition with each other; e.g. if the scope of the project is increased, this often results in an increase in the time and funds required to run the project. Balancing these constraints usually requires care and attention at the various stages of a project.

- General governance, to implement a model based on three levels:
 - › Strategic level: aiming at securing the long-term perspective; this is done from internal and external perspectives. Actions should be taken to follow up and manage a consolidated service provider portfolio, and to establish a forward-looking relation between client and service-provider (i.e. the e-Infrastructure)
 - › Tactical level: securing updated services and agreements as requested by the citizen science project, within a mid-term perspective
 - › Operative level: securing the follow up of the daily work and that problem and incidents that arise are handled in a proper way
- IPR: Ideally, IPR issues should be addressed when drafting the terms of participation ('terms of use') in a project. When addressing intellectual property issues at this stage two main questions should be considered:
 - › Is any right associated to the contributions provided to the project by the public participants?
 - › Is the public participation generating any IPR in the research output?
- Data management: Normally, both a policy and a plan are needed. The Data management policy should address:
 - › Access rights and restrictions

- › Long term usability
- › Data formats
- › Metadata structures
- › Interoperability with existing frameworks
- › Open access approach

The data management plan should cover how data will be handled both during the research phase and after the completion of the research project. This plan can also include data services, plans for collaboration at the data level, and reference procedures and resources needed for long-term preservation of data.

6. Exploring artistic and creative practices as an instrument for engagement

The new *STARTS* initiative⁴⁵ of the EC and its integration in the Work Programme 2016-2017 of Horizon 2020 is indicating an interesting way to connect artistic and creative practices with science and technology:

“... the Arts are gaining prominence as catalysts in an efficient conversion of Science and Technology knowledge into novel products, services, and processes and a drivers of open and participatory processes.”

The following actions are suggested to be taken into account:

- Triggering participatory processes is exactly the focus of citizen science initiatives and in this light the involvement of artists and creative people in these projects should be encouraged.
- Create communities that join citizens with artists together with research and cultural institutions.
- Integrate arts as a component of the research, fostering the engagement of citizens in creative activities as part of the citizen science initiatives.

7. Developing ad-hoc training and awareness opportunities for targeted users

The following action should be considered:

- Use the answers to the following questions as the basis for defining a training and awareness programme:
 - › Is the staff familiar to act as the experts and coordinators of projects?
 - › Do the targeted users already know the expertise of the coordinators and acknowledge their expert knowledge?
 - › Are the contacted individuals and/or organisations of citizens aware of the CH institution goals for public engagement?
 - › Are there clear ways to seek feedback from targeted user on aspects of your public engagement activity?
 - › Is this feedback or evaluation used to inform the planning process of public engagement and relevant strategy development?

45 ec.europa.eu/digital-agenda/en/news/starts-ict-2015-when-arts-innovate-connect-and-transform

- Identify a body of knowledge needed by the actors involved; it could be based for example on the depth of scientist-volunteer collaboration proposed by the Center for Advancement of Informal Science Education (CAISE)⁴⁶:
 - › Contributory projects, which limit citizen scientists to more passive roles in data collection and identification; this represents the majority of projects available today
 - › Collaborative and co-created projects, which allow for autonomous roles for volunteers to define hypotheses, set research protocols, interpret findings, disseminate conclusions, etc.

STEP 3: CHOOSE SERVICES TO ADDRESS

The outcome of step 2 should be a number of identified new services and services already available, tailored to the requirements of the specific research community. In order to choose services to address, the following aspects should be considered:

- Prioritise: which ones of the listed services are the most needed?
- Check if those prioritised are so called common services already delivered from a common technical platform provided by e-Infrastructures and used by other projects with citizen engagement)
- Evaluate how the e-Infrastructures are able to handle the requested services in a context of citizen science. What are the constraints? For example: beware of extending e-Infrastructures for research to the citizen environment, it can be too expensive. Some concepts like the federated identity (see section 3.4.1) are not possible when extending to any citizen.
- Set up an agreement to be shared by all parties: the acting CH institution(s), involved research institution(s) and the e-Infrastructure(s) providing the necessary services. Such an agreement could cover:
 - › Functionality
 - › Service types
 - › Type of architecture
 - › Outsourcing aspects like cost reduction, increased effectiveness and quality, level of resources to be used (technical and human), and minimising of risks
 - › Standards to be in place that covers identified services
 - › Responsibilities
 - › License conditions

4.1.2. Medium-term (2018-2019)

STEP 1: WHERE ARE WE NOW AND WHICH ARE THE NEXT STEPS

Summarise priorities, decisions and other actions made during the short-term stage and adjust to conditions at hand in the project.

⁴⁶ informal.science.org

STEP 2: TAKE FURTHER ACTIONS IN THE MAJOR AREAS OF THE ROADMAP

The areas of implementation, which are identified a priority area for the specific citizen science project, should be further developed.

1. Empowering existing e-Infrastructures with new services

The main activity in this stage is to transform the adjusted priorities, decisions and actions made during the short-term phase into solid technical solutions.

2. Tailoring new services to the requirements of each research community

The main focus in this stage should be to:

- Test and scientifically evaluate how the tailored new services fulfil the requirements of the targeted research community
- Make an implementation plan based on the outcome of the evaluation
- Make guidelines to address social and ethical issues
- Define roles and responsibilities of the different actors

3. Improving interoperability and re-use

Being an area of actions that focus mainly on the internal conditions of CH and academic institutions, the most important action in this stage is to develop and test that chosen services and tools facilitate internal interoperability and re-use of data and results. Both technical and semantic aspects are important to be addressed.

4. Establishing conditions for cross-sector integration

The main focus in this stage should be to fill in gaps in cross-sector integration. Examples of that could be to:

- Investigate the possibilities for sharing services that are not so called common services with other initiative in citizen engagement
- Take action in both reaching new audiences and broaden the impact of the research; complementary to the CIVIC EPISTEMOLOGIES Register of Resources, there are a number of initiative on the Internet, that offer customised services in this field⁴⁷ (wich are also indexed in the Registry)

5. Developing governance models for infrastructure integration

The main focus on this stage should be to

- Carry out solid analyses of needs for re-design of existing internal infrastructure to get it effectively integrated with chosen services provided by e-Infrastructure
- Define a set of governance principles for your citizen engagement activity to support this integration

47 See for example SciStarter (scistarter.com)

6. Exploring connection between artists, scientists and citizens

The main focus should be on continuing the initial experiences carried out during the previous period:

- Engaging artists in the project from the outset, with clear tasks and timeframes
- Providing laboratories (physical and digital) to experience artistic practices
- Demonstrating the artistic dimension of the research in dissemination events

7. Developing ad-hoc training and awareness opportunities for targeted users

The main focus is:

- All guidance and training materials used for citizen science programs should be pilot tested before they are sent out to ensure that the material clearly communicate protocols or the purpose of the study to volunteers
- This is particularly important when the target groups are students and teachers

STEP 3: PLAN FOR ACTIONS DURING THE LONG-TERM STAGE

The main focus in this stage should be to

- Identify areas of action that need more time to be implemented
- Make a plan for the actions to be carried out in the long-term stage
- Check if your project is in line with the established principles of citizen science that underlie best practices in this field; there are for example the “Ten principles of Citizen Science” developed by the European Citizen Science Association (ECSA)⁴⁸

4.1.3. Long-term (2020 and beyond)

The focus of the long-term action plan should be to

- Review the plan established in the previous phase
- Implement services and tools identified and developed in earlier stages
- Fill in remaining gaps in cross-sector interaction
- Offer a mature business model for the use of chosen services provided by e-Infrastructure

4.2. Recommendations

This section provides a list of recommendations aggregated around targeted stakeholder groups. The recommendations can be seen as general requirements for fulfilling a citizen science project and are based on the results of the user studies conducted during the CIVIC EPISTEMOLOGIES project.

48 hecsa.biodiv.naturkundemuseum-berlin.de

For each group the recommendations are connected to the three stages of a generic citizen science project, as indicated in section 1.3.1 above, namely: preparatory, deployment, and monitoring stages.

4.2.1. CH Institutions

PROJECT STAGES AND REQUIREMENTS

Preparatory stage

CH institutions should:

- Gather sufficient experience to advice on the tasks within their citizen science initiative and be able to resolve concerns related to scientific questions that should arise
- Have a clear value proposition for the types of citizens they seek to engage in their citizen science initiative; they also need to implement suitable incentives to create long-term relationships with engaged public members
- Define the desired quality of volunteers' contributions and make sure the volunteers understand what the citizen science concept entails when recruiting novices
- Identify the goals they aim to achieve and plan their citizen science activities accordingly, making regular audits of the tools and services that are used in the project in order to ensure that they are properly serving the requirements of the running citizen science initiative
- Have a responsibility for 'technology watch', monitoring the technology evolution
- Liaise with e-Infrastructure providers to guarantee that the facilities are actually full available for the project
- Select appropriate communication channels to reach volunteers, and maintain contacts with other stakeholders, including academics
- Define policies, job assignments and terms of reference regulating their citizen science activities and, more important, choose and implement a strategy for training their staff
- Choose and implement a dissemination strategy, taking in particular account also any relevant dissemination requirements of funders, and monitor the extension of the network
- Encourage, via suitable incentives, new volunteers to join the network. Volunteers whose inputs meet or even exceed the established quality standards could be considered potential champions of the citizen science initiative and be promoted in the network for their results. CH institutions should create a culture of appreciation of different personal motivations and introduce suitable rewarding mechanisms
- Decide early on the granularity of tasks where citizen's contribution is expected and together with intermediaries (e.g. associations of citizens) become familiar with main attractors and factors helping engagement

Deployment stage

CH institutions should:

- Be able to train the citizen-members of the project on their specific tasks, have the capacity to attract new citizens, and, as a result of that, be able to sustain the citizen community involved in the project
- Jointly with the e-Infrastructure providers, identify the most useful workflow, monitor quality issues and revise accordingly workflows adopted within particular projects
- Have a clear business model for the citizen science project

Monitoring stage

CH institutions should:

- Provide feedback on the workflow to their e-Infrastructure provider(s)
- Monitor citizen science experiences, evaluate the experiences of using technological tools within this context, and plan for any necessary future change either of the tools, or of other aspects such as training

All stages

CH institutions should:

- Be able to plan, obtain and maintain the budget necessary for the citizen science project
- Be familiar with the characteristics of the targeted crowd
- Identify and apply quantitative and qualitative evaluation metrics to follow the development of the project
- Incorporate the project outcomes into their own collections or their digital presentation, depending on the nature of the project
- Pay attention to the dynamics of satisfaction of volunteers

4.2.2. E-Infrastructure Providers

PROJECT STAGES AND REQUIREMENTS

Preparatory stage

E-Infrastructure providers should:

- Define how the task(s) of the citizen science project can be broken down into simpler components
- Reflect scaffolding of user interface
- Offer the best solution in terms of generic platform and design of specific services
- Be familiar with the policies in place
- Pay special attention to solutions which help engagement (or at least do not contribute to disengagement, e.g. too complicated or confusing interfaces)

- Contribute to address technological aspects of the training
- Contribute with appropriate dissemination infrastructure
- Contribute to the network extension with tools which maximise the use of personal social media networks of the volunteers

E-Infrastructure providers may introduce various gamification-style rewards (levels, badges, points, etc.) to meet popular personal motivation styles

Deployment and monitoring stages

CH institutions and e-Infrastructure providers should identify jointly the most useful workflow. The outcomes of identical or similar e-Infrastructures in different cultural settings (e.g. countries) can result in different scales of uptake.

E-Infrastructure providers should:

- Integrate tools which help to filter or correct erroneous inputs by volunteers
- Form a key partnership with CH institutions providing technological services and expertise
- Not rely on complete familiarity of citizens with the use of the technological tools; this requires efficient help; possibly user training, as well as potentially some resources for user support
- Implement suitable tools supporting volunteers; it could be expected that these will be cross-fertilised with personalisation technologies; e-Infrastructure providers will adjust their services to the characteristics and requirements of the project; e.g. the design of services aimed at supporting artistic use would differ from the design of services for professional researchers

All stages

E-Infrastructure providers who aim to serve citizen science initiatives should be able to support CH institution in the implementation of suitable evaluation metrics.

E-Infrastructure providers should:

- Implement analytics which could help to analyse the causes in case volunteers stop their contribution (complexity of tasks, repetitiveness, or other factors)
- Make available tools to monitor data provenance in citizen science projects;
- Develop, assess, and integrate emerging (and open) services and tools, and support modernisation of workflows according to CH institution needs and joint evaluation
- Gather feedback from CH institutions on various aspects of use of tools/services they are providing and plan for improvements accordingly; this should be supported by tools to evaluate the performance of the e-Infrastructure in the citizen science project, in order to provide inputs for planning future improvement of the services and tools
- Provide easy real time help on the most popular communication channels preferred by the volunteers

4.2.3. Academic Institutions

PROJECT STAGES AND REQUIREMENTS

Preparatory stage

Academic institutions should:

- Boost the development of citizen science initiatives by investigating the effectiveness of citizens' tasks and the feasibility of their use in the CH domain
- Extend the understanding of longer-term engagement of different profiles of volunteers
- Provide more extensive motivational studies of volunteers in CH initiatives, including modelling behavioural norms for various types of volunteer contributions; inputs are expected to be provided especially by information behaviour scientists

All stages

Academic institutions should develop their competences related to citizen science initiatives implemented by CH institutions.

4.2.4. Citizen Organisations

Citizen organisations should consolidate their competences related to citizen science initiatives implemented by CH institutions.

Citizens associations can:

- Provide support to the creation of the citizens team by aggregating individuals, when useful
- Offer physical spaces where volunteers can meet and exchange their ideas
- Offer physical and/or digital spaces for training activities
- If applicable, provide a 'help desk' function

In general, the citizens' associations can have a mediation role, between institutions, research and citizens.

4.2.5. Policymakers

M. Haklay (2009) sketches three aspects of the intersection of citizen science and policy that policymakers need to consider⁴⁹.

Firstly,

"the level of geography - from very local community (e.g. neighborhood scale), where local issues are frequently providing the motivation for citizen science activities, through city level, where activities are driven by coordination and collaboration between different groups, to regional level, where coordination effort becomes more formalised, then, to state/country level, and finally to continental scale."

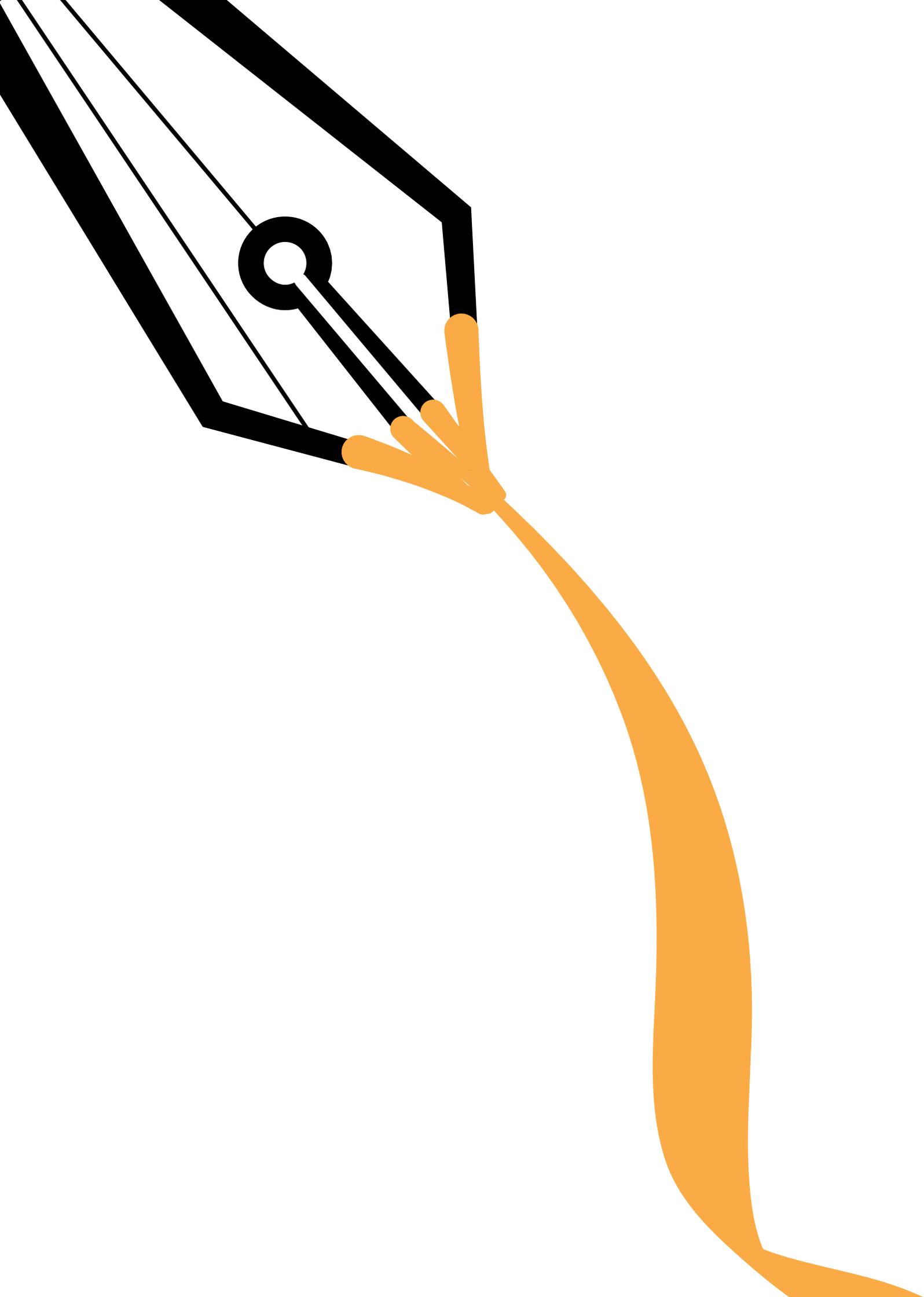
49 Haklay, M. (2009) "Citizen science and Policy: A European Perspective", Wilson Center, Case Studies Report 4, p.4 -5

Secondly, the awareness of different policy application areas – Within this context, Haklay differentiates between “citizen science used in support of public policies and policies that facilitate citizen science”.

Thirdly,

“the level of engagement and the type of citizen science activity – from passive sensing, where participants use available sensors...; volunteer computing...; volunteer thinking, in which participants engage in cognitive tasks to assist scientists; to full-scale environmental and ecological observations, participatory sensing, and civic/community science, which include active engagement in building and deploying scientific tools and methods”.

Geography, application areas, and activity types become in this way cornerstones for advocate policymakers in developing support policies for citizen science in the digital CH and humanities research.



5. CONCLUSIONS

This handbook is the main product of the CIVIC EPISTEMOLOGIES project, and it is built on coalescence of an extensive set of information and knowledge developed and gathered throughout the project.

Key actions in constructing the Roadmap have been to

- Analyse the needs of key stakeholder groups, foremost CH institutions, e-infrastructures, academic institutions, citizen organisations, and policymakers
- Based on key findings, develop the Roadmap itself and the complementary action plan and recommendations
- Validate the Roadmap through one pilot in Ireland and two case studies in the UK
- Develop a web space which provides access to the Roadmap but also to supporting services like the Registry of Resources and the Strategic Research Agenda

Other key actions have been to

- Encourage research institutions to establish clear protocols for citizen engagement and shared research goals where achievable
- Ensure widespread impact of the CIVIC EPISTEMOLOGIES findings through a strong communication and dissemination plan

Over the past decades we have witnessed a sustained growth in the scope and scale of participation of people from outside established research organisations in all aspects of scientific research. CH and humanities are not an exception, although the number of projects is not as high as in other domains of science.

One of the most important lessons learned, which the Roadmap tries to disseminate, is the necessity to consider a shift in mentality in both the CH and the academic sector. The participation of non-professional curators in the development of new knowledge has to be fully accepted and appropriate procedures and guidelines have to be designed and applied in line with that. Otherwise, there is a risk in missing a big opportunity in mobilise additional non-conventional resources for the research on CH and humanities.

Finally, the exploration of how artistic and creative practices can support the research on CH and humanities has also started. It is a process that will require time to become actually a standard approach, but its potential, also in the domain of the citizen science in digital CH is high and very worthwhile to be pursued.

GLOSSARY

Specific terms and the definitions used in the Roadmap⁵⁰.

Born Digital – Digital materials that are not intended to have an analogue equivalent.

Cloud computing – a phrase used to describe a variety of computing concepts involving a large number of computers connected through a real-time communication network such as the Internet.

Co-Creation – joint or partnership-oriented creative approaches between two or more parties, especially between an institution and its stakeholders, towards achieving a desired outcome.

Crowd funding – the process of raising money to fund a project through many donors using an online platform.

Crowd sourcing – the process of gathering contributions, services, ideas, content, or data, by soliciting contributions from large groups of people, and in particular from online communities.

Digital asset – the material produced as a result of digitisation or digital photography; the term includes also more complex accumulations such as online learning resources, web pages, virtual reality tours and digital/visual files.

Digital curation – has wider coverage than digital preservation and involves maintaining, preserving and adding value to digital data throughout its life-cycle.

Digital library – a collection of digital objects with a focus. The collection can include text, visual material, audio material, video material, and is stored electronically, using preferably standard formats. It includes also the software instruments to store and access the files contained in the collection.

Digital preservation – a set of activities required to make sure digital objects can be located, rendered, used and understood in the future.

Digital record – any information that is recorded in a form that only a computer can process and that satisfies the definition of a record as stated in the formal regulation and/or the policy for the cultural institution in mind.

Digital resources – encompasses both digital records and digital assets.

Digital silos, data silos – a repository of data that is under the control of one single organisation (or department) and is isolated from the rest of the community of common interest, because of technical or cultural reasons.

Digitisation – the process of converting analogue data carriers (parchment and paper records, microforms, photos, film and audio and video tapes) into digital form using scanning, digital photography, or other conversion methods.

E-Infrastructure – the term used for the technology and organisations that support research undertaken through distributed regional, national and global collaborations enabled by the Internet. It embraces networks, grids, data centres, and collaborative environments; it can also

⁵⁰ Some of the definitions are taken from the RICHES Taxonomy.

include supporting operations centres, service registries, single sign-on, certificate authorities, training, and help-desk services.

European Research Area – the system of the European research initiated with the Communication of the EC in January 2000 (ec.europa.eu/research/era/index_en.htm).

Green Paper – a report and consultation document of policy proposals for debate and discussion.

Grid computing – the collection of computer resources from multiple locations to reach a common goal.

Memorandum of Understanding – an agreement between two or more parties indicating the common interest and a joint programme of actions.

Memory institutions – a metaphor used about a repository of public knowledge; a generic term used about institutions such as libraries, archives, museums, clearinghouses, electronic databases, and data archives, which serve as memories for given societies or mankind as a whole.

Metadata – information about data required to manage, search, understand, use, and preserve digital content.

Ontology – a structural framework for organising information; used in artificial intelligence, the Semantic Web, systems engineering, library science, information architecture etc. as a form of knowledge representation about the world or some part of it.

Open source (software) – software developed, produced and distributed under a free license, including all necessary technical documentation, in order to allow free distribution, use, and its subsequent development and improvements by anybody.

Persistent identifier – a long-lasting unique reference to a digital object, which could be a single file or set of files.

Portal, web portal – a web site designed to display aggregated information from different sources in a unified way.

Prosumer – a person who is both, a consumer and producer of content and data.

Technology watch – assessment of new technologies emerging in the research and industrial sectors, with the aim to identify their innovation potential in the targeted domain of activity.

Virtualisation – refers in computing to the act of creating a virtual (rather than actual) version of something, including a virtual computer hardware platform, operating system (OS), storage device, or computer network resources.

Virtual performance – performing arts productions in which interactive technology and virtual spaces are used to mediate or augment interactions among performers, between performers and the performing space, or between performers and the audience.

Visualisation – any technique for creating images, diagrams, or animations to communicate a message. Visualisation today has ever-expanding applications in science, education, engineering (e.g., product visualisation), interactive multimedia, medicine, etc.

ABBREVIATIONS

Acronyms used in the Roadmap.

3D	Three-dimensional	EUDAT	European Data Infrastructure project, an FP7 project supported by EU
AAI	Authentication and Authorization Infrastructure	FP7	Seventh Framework Programme of the EU for research and technological development
API	Application Programming Interface	GRID	(See Grid computing in the Glossary)
AARC	Authentication and Authorisation for Research Collaboration, an H2020 project supported by EU	ICT	Information and Communication Technologies
BMBF	The German Federal Ministry of Education and Research	IDGF-SP	International Desktop Grid Federation Support Project, an FP7 project supported by EU
CAISE	Center for Advancement of Informal Science Education in Washington, D.C. (USA)	IdP	Identity Provider
CH	Cultural Heritage	INDICATE	International Network for a digital cultural heritage e-Infrastructure, an FP7 project supported by EU
CHAIN-RED	Coordination and Harmonisation of Advanced e-Infrastructures for Research and Education Data Sharing, an FP7 project supported by EU	IPR	Intellectual Property Rights
DANS	Data Archiving and Networking Services in the Netherlands	NGO	Non Governmental Organisation
DARIAH	Digital Research Infrastructure for the Arts and humanities	PEST	Political, Economic, Scientific, Technological
DCH-RP	Digital cultural heritage – Roadmap for Preservation, an FP7 project supported by EU	RICHES	Renewal, Innovation and Change: Heritage and European Society, an FP7 project supported by EU
DC-NET	Digital Culture Heritage Network, an FP7 project supported by EU	RRI	Responsible Research and Innovation
DPC	Digital Preservation Coalition	SMART	S(pecific) M(easurable) A(chievable) R(elevant) and T(ime limited)
EC	European Commission	SOCIENTIZE	Society as e-Infrastructure through technology, innovation and creativity, an FP7 project supported by EU
ECSA	European Citizen Science Association	SSH	Social Science and Humanities
EGI	European Grid Initiative	STARTS	S(science)&T(echnology)&ARTS
ERA	European Research Area	UCL	University College London
ERIC	European Research Infrastructure Consortium	VRC	Virtual Research Communities
EU	European Union		

CIVIC EPISTEMOLOGIES Consortium



Ministero dello Sviluppo Economico, Project Coordinator, www.sviluppoeconomico.gov.it



Promoter SRL, Technical Coordinator, www.promoter.it



Riksarkivet, www.riksarkivet.se



Prussian Culture Foundation, hv.spk-berlin.de/english/



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UNIVERSITY OF MALTA
L-Università ta' Malta



Instytut Chemii Bioorganicznej PAN, www.man.poznan.pl/online/en



Waterford Institute of Technology, www.wit.ie

Waterford Institute of Technology



ARCTUR d.o.o., www.arctur.si

ARCTUR
universe



European Grid Initiative, www.egi.eu

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