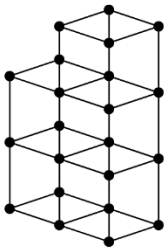


doing it together science

Grant agreement no. 709443

DITOs

Doing It Together science

Coordination & Support Action

D3.2 Innovation Hubs

Work Package: 3

Due date of deliverable: Month 15

Actual submission date: 31 / 08 / 2017

Start date of project: June 01 2016 Duration: 36 months

Lead beneficiary for this deliverable: Waag Society

Contributors: All partners of the DITOs Consortium

Reviewers: Katrin Voland & Veronica French (ECSA), Jesse Marsh (TCBL)

Project co-funded by the European Commission within the H2020 Programme (2014-2020)		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	
EU-RES	Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)	
EU-CON	Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)	
EU-SEC	EU-SEC Classified Information: SECRET UE (Commission Decision 2005/444/EC)	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 709443

Disclaimer

Copyright Notice

Acknowledgement

The DITOs project has received funding from the European Union Horizon 2020 programme under grant number 709443.

Reference

Please cite this work as:

DITOs Consortium, 2016. *Doing It Together science: D3.2 Innovation Hubs* UCL, London.

Document Identification Sheet

Project ref. no.	709443
Project acronym	DITOs
Project full title	Doing It Together Science
Document name	DITOs-D3.2-20170831.pdf
Security (distribution level)	PU
Contractual date of delivery	Month 15, 31.08.2017
Actual date of delivery	31.08.2017
Deliverable number	D3.2
Deliverable name	DITOs Innovation Hubs
Type	Report
Status & version	Version 1.0
Number of pages	67
WP / Task (responsible)	WP3 / T3 (Waag Society)
Author(s)	Waag Society: Pieter van Boheemen, Ista Boszhard, Lotte Kleijssen
Other contributors	UCL: Muki Haklay, Christian Nold, RBINS: Carole Paleco, UPD: Imane Baïz, ECSA: Gaia Agnello, MP: Chema Blanco Calvo, KERSNIKOVA: Simon Gmajner, MERITUM: Pawel Wyszomirski, UNIGE: Bruno Strasser, TEKIU: Aleksandra Berditchevskia
Project Officer	Colombe Warin
Abstract	Report on setting up of partner innovation hubs, facilities, multiplier arrangements with third parties such as science museums and centres, and future development plans
Keywords	Citizen Science, DITOs, Innovation Hubs
Sent to peer reviewer	31/07/2017
Peer review completed	10/08/2017
Supervisory Board approval	25/08/2017

Table of Contents

1 Version Log 6
2 Definitions and Acronyms 7
3 Executive Summary 8
4 Introduction 9
4.1 Scope and Objectives 9
4.1 The Context of Deliverable 3.2 10
5 Activities carried out and Results 10
5.1 Innovation and Innovators in the Context of DITOs 11
5.2 Development of the Innovation Hubs Conceptual Framework 11
5.2.1 Analysis of Existing Innovation Hub Networks 12
5.2.2 Innovation Hubs Shared principles 15
5.3 DITOs Innovation Hubs 16
5.4 Innovation Hub capacities of each DITOs Partner 16
5.4.1 UCL Extreme Citizen Science Group 17
5.4.2 Waag Society 21
5.4.3 The Royal Belgian Institute of Natural Sciences (RBINS) 27
5.4.4 Université Paris Descartes - Center for Research and Interdisciplinarity 33
5.4.5 European Citizen Science Association (ECSA) 39
5.4.6 Medialab-Prado 44
5.4.7 Kersnikova Institute 48
5.4.8 Meritum 52
5.4.9 UNIGE 54
5.4.10 Tekiu 57
5.5 Overall Analysis 61
6 Conclusions and Next Steps 64
6.1 Eight steps for DITOs Innovation Hubs 64
6.1.1 Fine-tune the Innovation Hub Concept and Principles 64
6.1.2 Enhance the Exchange of Best Practices 64
6.1.3 Increase the Functionalities of the Online platform 65
6.1.4 Outline a Legacy Plan for DITOs Innovation Hub Network integrating into ECSA 65
6.1.5 Key Performance Indicators for Innovation Hubs 65

6.1.6 Draft a DITOs Innovation Hub Manifesto 65
6.1.7 Present Value to External Stakeholders 65
6.1.8 Diversify Audiences 66
6.2 Conclusion 66
7 Bibliography / References 67

Table of Figures

Figure 1: DITOs time scale 10
Figure 2: Principles of innovation hubs. 15
Figure 3: Participatory Process for Community Mapping (source: Haklay & Francis 2017) 18
Figure 4: Open source lab centrifuge replications around the world. 23
Figure 5: Some Open Wetlab equipment 24
Figure 6: Workshop in the Textile Lab Amsterdam 2017. 25
Figure 7: Small touring exhibition developed in collaboration with a citizen association & RBINS 29
Figure 8: RBINS organisation chart 30
Figure 9: Organisational chart CRI Paris. 34
Figure 10: From idea to impact in 4 steps. 36
Figure 11: Multi-purpose places of convergence, privileged spaces for encounters. 37
Figure 12: CRI Impact assessment framework 39
Figure 13: ECSA working groups. 40
Figure 14: Collaboration and knowledge exchange among ECSA WG, COST Action for Citizen Science and International group on interoperability. 41
Figure 15: Mapping of DITOs partners according to environmental sustainability and biodesign topics and the public and policy audiences 63

1 Version Log

Version	Date	Released by	Nature of Change
DRAFT/v0.1	06/07/2017	Pieter van Boheemen (Waag Society)	Initial version
DRAFT/v0.2	28/07/2017	Pieter van Boheemen (Waag Society)	Draft analysis and conclusions
DRAFT/v0.3	31/07/2017	Pieter van Boheemen (Waag Society)	Draft for peer review
DRAFT/v0.4	14/08/2017	Pieter van Boheemen (Waag Society)	Draft for consortium review
FINAL/v1.0	22/08/2017	Pieter van Boheemen (Waag Society)	Final for Supervisory Board approval

2 Definitions and Acronyms

Acronyms	Definitions
BIFI	Institute for Biocomputation and Physics of Complex Systems
CBA	Center for Bits and Atoms
CNC	Computerised Numerical Control
COST	Cooperation in Science & Technology
CRI	Centre de Recherches Interdisciplinaires
CS	Citizen Science
CSA	Coordination and Support Action
DITOs	Doing It Together science
DIY	Do It Yourself
DoA	Description of Action (Annex 1 of Grant Agreement 709443)
DT	Discovery Trip
EC	European Commission
ECSA	European Citizen Science Association
EPFL	Ecole Polytechnique Fédérale de Lausanne
EQF	European Qualification Framework
EU	European Union
eutema	EUTEMA GMBH
ExCiteS	Extreme Citizen Science
GNU	GNU's Not Unix!
H2020	Horizon 2020 Programme
ICT	Information & Communication Technology
KI	Kersnikova Institute
KPI	Key Performance Indicator
Meritum	Centrum Szkolen I Rozwoju Osobistego Meritum
MIT	Massachusetts Institute of Technology
MOOC	Massive Open Online Course
MP	Medialab Prado, Madrid
NGO	Non Governmental Organisation
OPAL	Open Air Laboratories
RBINS	Institut Royal des Sciences Naturelles de Belgique
RRI	Responsible Research & Innovation
TCBL	Textile Clothing Business Labs
Tekiu	Tekiu Limited
UCL	University College London
UK	United Kingdom
UNIGE	Université de Genève
UPD	Université Paris Descartes
USA	United States of America
WG	Working Group
WP	Work Package
WS	Waag Society
WWF	World Wildlife Fund

3 Executive Summary

This deliverable constitutes the concept of innovation hubs in the context of DITOs and describes the status quo from which the partners are moving to building a sustainable network beyond the duration on the project.

Here we articulate key innovation hub principles and practical insights on how organisations can support the implementation of new ideas and concepts that stem from citizen science. These principles are derived from existing innovation hub networks and informed by the Responsible Research and Innovation (RRI) toolkit. An analysis of these hubs has led to the conclusion that innovation hubs focus on **communal** activities providing room for **self-organising and adaptive** initiatives, that promote **interdisciplinary knowledge transfer** targeted towards **enabling innovators** with the aim for **global impact**. Next, these principles are used as a lens through which the practices and capabilities are analysed of each of the DITOs partners UCL, RBINS, UPD, WS, ECSA, MP, KI, Meritum, UNIGE and Tekiu.

This analysis yields a mapping of the current position and eight useful steps that will guide the developmental trajectory of the DITOs innovation hub network into the future by:

- Starting with furthering the understanding of the innovation hub principles by the partners and collaborators and
- continuing the exchange of best practices.
- extending the online project space in support of that, and
- exploring the possibility of measuring the progress of the network with that platform.
- improving the hubs capabilities to diversify audiences and promote inclusion. Attract external collaborators by
    - drafting a manifesto and
    - a clearer value proposition to business and policy stakeholders.
- finally, ensuring all participants commitment by 8) outlining a legacy strategy beyond the lifetime of DITOs. By doing so, the DITOs innovation hubs aim to facilitate innovations that address the grand challenges facing today’s society.

4 Introduction

DITOs Innovation Hubs is Deliverable 3.2 (D3.2) and marks the start of a journey of the project partners towards becoming a network of 'innovation hubs'.

DITOs promotes the development and establishment of citizen science. One of the expected benefits of these activities is finding solution for the grand challenges facing today's society, and the implementation of such solutions. Nutrition, health, climate and many of the grand challenges relate to the two overall topics addressed in DITOs: biodesign and environmental sustainability. Paradoxically the scientific understanding of human and non-human life on the planet has expanded vastly over the course of the past decades, while the public opinion on topics such as climate change are polarising, even questioning the validity of science itself. Now more than ever science and society need to join hands and drive responsible transformation into a sustainable future. Informed by the EC agenda on Open Innovation, Open Science and Open to the World[i] it has become clear that there is a need for hot spots of inspiration and successful collaborations. This is why the DITOs partners aim to facilitate innovation processes by transforming themselves and other organisations into innovation hubs.

This deliverable reports on the establishment of the overall concept of innovation hubs, how the consortium partners activities are forming the basis for local innovation hubs, how these are linked to ECSA's network and how these are serving as demonstrators to other centres and groups across Europe. Through this task and deliverable, the partners initiated a reflective and capacity building process to move forward with the aim of becoming innovation hubs. The report concludes with expected next steps and recommendations for this trajectory. The information presented in this report is based on a survey among the partners, theoretical desk research on innovation hubs and an assessment of how DITOs innovation hubs tie into the existing ECSA network and its future ambitions.

4.1 Scope and Objectives

In the DITOs Description of Action (DoA) a number of aims for the overall project are mentioned that are relevant to D3.2:

- the strengthening **of European cooperation** through capacity building of the European Citizen Science Association;
- participatory activities, with a strong focus on **cross-European fertilisation and knowledge sharing** between hubs and activity centres.

Additionally, the DoA describes mechanisms to maximise impact. The Expected Impact section states that on completion of the DITOs project, the local science and innovation hubs created by the partners, with ECSA as a coordinating institution, will **form an enduring network** for policy and decision-making support for citizen science.

This deliverable is closely connected to Objective 3.3 'Establishing ECSA as a pan-European knowledge and resource centre for RRI-driven citizen science to provide a streamlined interface for stakeholder capacity building'. Therefore, the current innovation structures in ECSA serve as one of the case studies for establishing the concept of DITOs innovation hubs, and the conclusions of this deliverable intends to fill the gap between the present DITOs activities and continuation of the project's legacy by ECSA by the end of the project. The DoA provides an important starting point for this

process. It is expected that each partner will function as a **technological and social innovation hub**, reaching beyond the traditional audience for institutional science communication centres, to marry scientific excellence with local grassroots activities and establish online and offline collectives.

4.1 The Context of Deliverable 3.2

The DITOs project is on a mission to push the boundaries of participation in science and technology. In two research areas (WP1 biodesign and WP2 environmental sustainability) the project engages citizens, scientists and policy makers by employing a wide range of formats and techniques, including spaces of observation (exhibitions), interaction (workshops) and discussion (science cafe's). These two topics represent two scientific areas with emerging societal challenges, which have to be dealt with through the innovation processes that result from scientific advancements. Since DITOs establishes new relations between citizens and these developments, the project has the potential to offer a clear value proposition to Innovators that are in need of societal involvement, guidance and reflections.

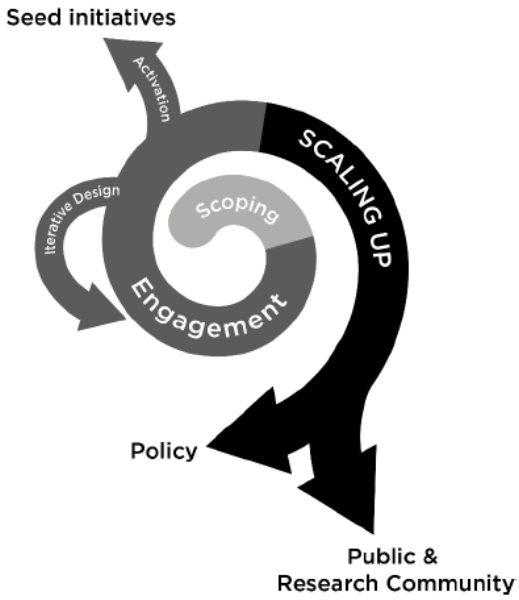


Figure 1: DITOs time scale

After a first phase of Scoping and Piloting (M1-6) the project has now arrived in Phase 2 Engagement and Networking (M7-24), while the final phase will focus on Scaling and Legacy (M24-36). This Deliverable resides in WP3, which primarily focuses on Public Engagement and Capacity Building; this means utilising impact maximisation mechanisms to build capacity such as establishing networks to reach a target audience of 290,000 offline and 1.3 million online. The DITOs partners have already conducted a substantial number of the 500 activities in WP1 and WP2 that form the basis, starting from their own methods and gradually coinciding with each other. Most notable collaborative activities have been joined Roundtables and Conferences as well as the DITOs Science Bus that is currently travelling between partners and external parties across Europe. Now is the right time to bring the partners even closer together, draw learning from the achievements thus far and take the necessary steps to transform the partners into hubs and become a stronger network. In the forthcoming D3.3 Sustainable support for citizen and DIY science (M36), the consortium will reflect on the extent to which this goal has been achieved.

5 Activities carried out and Results

The establishment of this deliverable started with the development of a conceptual framework for innovation hubs. Next, a survey was conducted among the DITOs partners to establish an overview of the status-quo and gather input for next steps.

5.1 Innovation and Innovators in the Context of DITOs

The term 'innovation' is frequently misunderstood and used only to describe invention. In fact, the word innovation[ii] should be used to describe the translation of ideas or inventions into practice, such as the development of goods, services, methodologies or even philosophical frameworks. Innovation spans across the whole process of idea generation up to actual implementation. Science, the creation of knowledge by application of the scientific method, can serve any aspect of that process, although it is mostly observed in the ideation stage. Therefore, within the context of DITOs, 'innovation' must be understood as the process of translating knowledge acquired through the practice of citizen science. And 'innovators' as the stakeholders that drive or are involved in this process.

Two major types of innovation can be distinguished. On the one hand, business innovation, which describes the process of developing and implementing new goods or services that fit the needs of a customer[iii]. On the other hand, social innovation, which refers to the process of implementing ideas or invention that serve a social need[iv]. Both types of innovation are promoted by DITOs, although there is clear orientation towards the latter, as both the biodesign (WP1) and environmental sustainability (WP2) activities address primarily social needs.

5.2 Development of the Innovation Hubs Conceptual Framework

There is no single definition for the complex concept of innovation hubs as pointed out by Gryszkiewicz & Friedrici[v]. The best way to understand innovation hubs is to define them as virtual or physical places that supports innovation. However, this definition is not precise enough for the context of DITOs. This is why this deliverable starts with a definition, based on an analysis of similar hubs around the world. The innovation hub networks that were selected for this analysis have in common that they consist of individuals or groups that self-organise in collaborative communities to produce knowledge, insights or information as well as tangible goods. These hubs also employ a practice of sharing knowledge and skills, enabling peer learning and peer production. This enables individual participants to build upon the knowledge and experience gained by other members of the hub or connected hubs within a particular network. The hubs gain knowledge and experience from practical hands-on activities, and from physical prototypes or experiments that are conducted.

Importantly, as innovation is a process rather than a product, in innovation hubs it is not just the end result, but also the process that counts and is publicly discussed. This means these hubs create an atmosphere of experimentation, an environment that enables failure without serious consequences and promotes an attitude in which testing and failure are publicly shared for others to learn from. The most famous commons-based peer learning hubs are in the field of software development. Some of these have sprouted to become more related to the physical world and move from an engineering motive to a science approach. In present day often referred to examples are FabLabs, TCBL Labs, Hackerspaces, Living Knowledge Network and ECSA Innovation Hubs.

These existing networks will be analysed in the following sections with special focus on the notion of RRI[vi], in particular in terms of 'diversion & inclusiveness', 'anticipation & reflection', 'openness & transparency' and 'responsiveness & adaptive Change'.

5.2.1 Analysis of Existing Innovation Hub Networks

In order to draw on the expertise of grassroots and DIY groups and organisations, a number of networks of existing innovation hubs have been analysed including FabLabs, TCBL Textile Labs, Living Knowledge Network and existing ECSA innovation hubs. Apart from their structure, the role and position of the innovators that make use of such hubs were taken into account.

5.2.1.1 FabLabs

FabLabs are hubs in an international network consisting of over 1100 nodes[vii]. FabLabs bring together a community of makers - people that invent and construct physical objects. Prof. Neil Gershenfeld started the movement, when he started a course and physical lab space for students at the MIT's Center for Bits and Atoms (CBA). Based on a shared set of principles, other fabrication spaces in the world can be part of the movement on the condition of sticking to these principles. This declaration is called the Fab Charter[viii]. Waag Society was the first European Union member of this network

A FabLab can be understood simply as a shared machine shop, equipped with standard set of machines that turn digital designs into physical objects such as 3D printers, laser cutters and CNC milling machines. On the other hand it can be understood as a distributed research facility, as all FabLabs are connected through a single network. The labs have similar machines, use the same open software and an online platform www.fablabs.io to present themselves and projects. Most FabLabs are also equipped with a video conferencing system, which allows users to immediately connect with another FabLab. Alternative platforms such as OpenThings, WeVolver and YouMagine[ix] are also frequently used by the innovators that use the FabLabs to scale-up and disseminate their work in an open and transparent way.

The FabLab network also has a shared educational program, called Fab Academy. Under the tagline 'How to make (almost) anything' it is taught at ±70 FabLabs in the world, including Waag Society, and has enabled thousands of people to become innovators.

Now that the movement has become well established, the focus is changing adaptively from a somewhat inward aim of enabling access to fabrication means ('invention') to a more outward looking aim of enabling cities to become self-sufficient ('innovation'). For example, the so called FabCity initiative is leading this transformation, and brings together scientist, engineers and policy makers to turn FabLabs into centres for globally designed, but locally produced products. These emerging roles of FabLabs have clear links with the RRI principles.

5.2.1.2 TCBL Textile Labs

TCBL Textile labs share a similar approach to invention, peer production and innovation as the Fab Labs, but are less rigid in how they operate. All 24 TCBL labs have a shared innovation goal: transforming the textile and clothing industry towards a more sustainable industry. The broad scope of activities that each Lab employs is depending on the (local) problems and opportunities that each is addressing connected to this sector.[x] Thus, there is a clear focus on inclusion and reflection.

Organisations or groups that have an interest in becoming a TCBL Lab can apply online on the network's website: www.labs.tcbl.eu. Before entering the network the applicant is

evaluated by Textile Labs that are already part of the network. Work that is conducted by Innovators in the labs can be documented on the same website http://labs.tcbl.eu/projects. These range from open source equipment, such as an open vacuum former, to material research, such as bacterial textile dyeing. The labs make use of the network by working together with other labs and businesses around such specific topics and cases. To make sure the labs share a similar mindset, all are obliged to agree on 7 principles (http://labs.tcbl.eu/principles). The collaborations with other labs and businesses, research focus, carried out activities and provided services are visualised in the Labs portfolio.

One of the outcomes of the TCBL Labs is a newly formed education program called Fabricademy. It introduces Innovators with no particular background in the fashion or textile industry into the subject and teaches several innovation approaches.

5.2.1.3 Hacker Spaces

Hacker spaces are the most loosely defined and organised out of the innovation hub networks analysed in this chapter. These physical spaces provide Innovators with the ability to learn, tinker and play with technology, as well as execute innovation projects. The over 1,300 hubs that are marked as active are most frequently run by an association of members, and according to the hackerspaces.org website, these associations run "*community operated physical places, where people can meet and work together on their projects*". There are no restrictions on the type of projects, but there is a clear tendency towards transformations that utilise technology and science. These are either applied for the creation of knowledge for society, clever hacks to improve everyday life and digital or electronic art for entertainment.

Any group or even individual can self-declare to start a hacker space. There is no formal application procedure; a single registration on the global webpage is sufficient. Since the network stems from the counter-culture, an ideology of sharing knowledge, expertise and designs is actively promoted and practiced. Therefore, these innovation hubs are arguably the most transparent but inclusion and diversity remain an issue due of the central focus on technology issues.

A community activity that is now widely adopted in mainstream society is the so-called 'Hackathon'. During these events Innovators with diverse backgrounds meet up to collaboratively work on an innovation project, typically with the goal to develop a working prototype within a relatively short amount of time (less than a week) to test the technical feasibility.

The absence of restrictions, general principles or strict hierarchy does not limit the impact or capabilities of the members. There are large self-organised events with thousands of participants such as Chaos Computer Conferences and hacker spaces have a large impact on today's society through their innovations.

5.2.1.4 Living Knowledge Network

The Living Knowledge Network is closely related to the citizen engagement activities that are carried out as part of DITOs. The Network consists of 25 so called 'science shops', which are not 'shops' in the traditional sense of the word. Instead these places provide a space for scientists to conduct research in response to concerns expressed by citizens. There is no restriction on the type of science, which means it may concern

the ‘social’ as well as the ‘natural sciences’. The Hubs engage in research, education and collaboration with other partners in projects, promoting public engagement and science education. The projects range from studying the environmental effects of artificial light pollution, to gluten intolerance and developing tools for children to research soil.

The innovators in these hubs can be understood to be both the citizens and the scientists involved and the process of influencing each other with ideas and concepts. The Science Shops promote participation on each level of research, starting from ideation, the development of methods, all the way to the execution and interpretation of the gathered information. The Network has stated its objectives on their website[xi], which explicitly includes the promotion of Responsible Research and Innovation principles.

There is no specific application process for becoming a hub in the Living Knowledge Network. Simply subscribing to the mailing lists is sufficient.

The Living Knowledge conference is one of the multiplier arrangements that the network employs to scale-up the impact of the local activities, as well as summer schools.

5.2.1.5 ECSA Innovation Hubs

The European Citizen Science Association (ECSA) is a non-profit association set up in 2013 to encourage the growth of the citizen science movement in Europe in order to enhance the participation of the general public in scientific processes, mainly by initiating and supporting citizen science projects as well as performing research on citizen science. ECSA draws on +200 individual and organisational members from over 28 countries across the European Union and beyond. These members and supporters collaborate in thematic working groups (WG). The WGs focus on research, exchange of experience and capacity building and are open to all ECSA members and supporters. For the sake of this analysis we will regard the WGs as innovation hubs within the ECSA network.

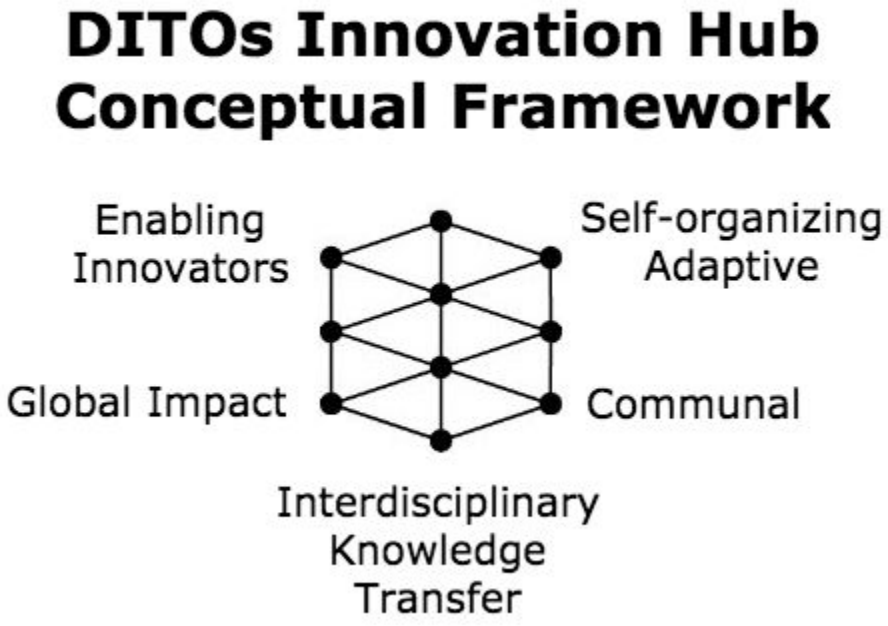
The Education and Learning WG was proposed by ECSA as a case study for structuring the conceptualisation of DITOs innovation hubs, because it is an active and successful working group. It presents an interesting situation by being closely linked to the COST Action WG, which exemplifies how synergies emerge between WGs. The Education and Learning WG consists of ±20 voluntary members and has several specific goals that were set by the members themselves:

- support, research, and evaluate learning and education in citizen science;
- research learning in citizen science;
- develop educational opportunities in citizen science;
- assist schools in using citizen science in the classroom;
- develop tools to evaluate outcomes.

In order to achieve these goals, the members have planned and conducted a range of innovation activities. These activities include a study into opportunities for volunteer learning, including institutional settings like schools and museums, as well as supporting teachers and project teams in providing educational opportunities using citizen science. Meanwhile the WG has built a network of teachers using citizen science in classrooms.

5.2.2 Innovation Hubs Shared principles

From the literature and the analysis of the above case studies, an initial set of principles for innovation hubs[xii] were derived which were then used throughout the rest of this deliverable:



1. **Communal**: an innovation hub encourages collaboration and togetherness
2. **Self-organising and adaptive**: an innovation hub allows Innovators to set the agenda and trajectory of innovation
3. **Interdisciplinary knowledge transfer**: innovators are transferring their knowledge and skills
4. **Enabling innovators:** the hubs transform participants in citizen science into innovators
5. **Global impact**: the innovations aim for tackling issues at a global scale

Figure 2: Principles of innovation hubs.

5.3 DITOs Innovation Hubs

DITOs innovation hubs are physical, mobile and online spaces that support the process of transforming ideas and concepts that are acquired through citizen science into practice. Hubs allow people to connect and work on interdisciplinary projects together. DITOs activities in WP1 and WP2 lean towards educating this practice (content) and explore working in a process oriented and bottom-up, collaborative manner (process and mindset).

There are three kinds of DITOs innovation hubs:

- physical hubs - independent or within an organisation;
- mobile hubs - such as the DITOs Do It Together Science bus;
- online hubs - thematic networks linking different organisations and research groups.

To be one of the three kinds of hubs the partners need to share the same principles and way of working (Figure 2), and the DoA prescribes that they need to share research and connect to the DITOs network as a whole by linking to ECSA and using the DITOs website. In other words the DITOs project provides Innovators with access to the network, to the physical labs, knowledge exchange and events. In order to assess the status quo and have a baseline to work towards D3.3 on a more practical level, the DITOs partners have shared insights on the following capacities of their organisations:

- **principles in practice**: how the DITOs partner organisation puts the innovation hub principles (Figure 2) into practice;
- **infrastructure & facilities**: material things that afford people to do something, such as physical infrastructure, IT;
- **audience profile**: people we involve in our activities (target audience, profile of hub users);
- **partners & stakeholders**: people and other organisations we work with;
- **multiplier arrangements**: mechanisms that are in place to share and increase the impact of activities;
- **future:** the plans and expectations for the development of the Hub and integration into DITOs.

5.4 Innovation Hub capacities of each DITOs Partner

Each DITOs partner organisation has analysed their capacities as an innovation hub in line with the principles (Figure 2), the practical capacities and future expectations mentioned in 5.2. Eutema is not included in this analysis as this consortium partner is only involved in the evaluation tasks of DITOs.

5.4.1 UCL Extreme Citizen Science Group

The UCL Extreme Citizen Science group is one of the leading research groups in the field of citizen science, focusing on bottom-up, community-led citizen science activities. The group is based at University College London (UCL). UCL is consistently ranked among the top 10 universities in the UK, and within the top 25 in the world. The Extreme Citizen Science (ExCiteS) group is based on nearly 20 years of experience in organising, running and coordinating public engagement, participatory mapping and the citizen science of environmental activities across the world. ExCiteS projects and activities address the challenge of inclusive engagement with people and communities and with them creation, co-production, and management of knowledge as well as their ability to engage in decision-making and problem-solving as active civic participants regardless of their level of literacy, background, and geographical location. With local needs and culture at the forefront, the ExCiteS approach provides communities a means to not only monitor their surrounding environment and analyse their findings but to also develop their own methodologies and tools that enable them to own, share, and act on their results.

5.4.1.1 Principles in Practice

The following description provides an insight into how UCL ExCiteS implements the principles in practice.

Communal

As part of the university, the ExCiteS group actively seeks to engage with researchers in the field of citizen science and participatory science throughout the world while also working with practitioners and community groups who are involved in specific projects. The group has a strong presence on social media with a website, blog, Facebook page and Twitter account, and newsletter. ExCiteS members are actively engaging in different mailing lists, conferences, workshops, and online events to share information about their activities and learn from other research centres across the world. ExCiteS organises conferences, meetings and events that actively seek to bring together people from across the spectrum of citizen science – from researchers to practitioners to participants. The group operates on the principle of openness to visitors from within and outside academia, with a large group of affiliated honorary researchers, and an open invitation to researchers from across the world that ask to spend some time with the group as a study visit.

Self-organising and Adaptive

The methodology that ExCiteS uses in its community engagement processes is structured but with deliberate areas in which co-creation takes place (Haklay & Francis 2017[xiii]). As Figure 3 shows, the process is deliberative, based on continued discussion with the participants, and with multiple paths that provide plenty of scope of participants to take control over the process. The process is adaptive to the needs of a specific community, and allows the selection of a path that suit their needs – from recording perceptions and opinions, to including citizen science activities.

ExCiteS follows several core principles that increase the level of inclusion of the activities that are being carried out in the group. These principles include: integrate technology with a social process, and take account of the social and political context;

use a directed process, with deliberate open elements to ensure co-design and local control; work with people where they are, don't expect them to come to you (physically and digitally); keep it simple, in order to make it inclusive (no cutting-edge tech for the sake of innovation). Similar actions are being done in events and conferences that ExCiteS is organising, through the inclusion of unconference or hackathon elements (e.g. during the Citizen Cyberscience Summits in 2012, 2014) and workshops with experts and researchers.

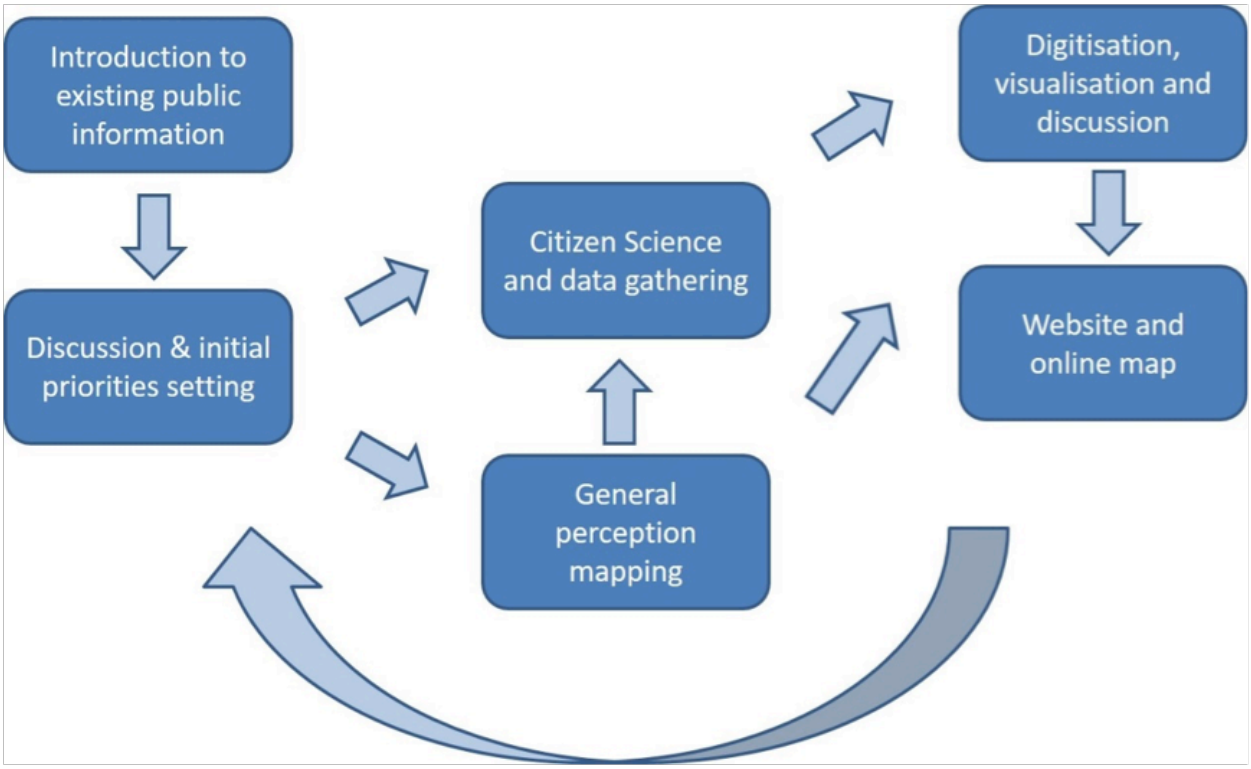


Figure 3: Participatory Process for Community Mapping (source: Haklay & Francis 2017)

Interdisciplinary Knowledge Transfer

ExCiteS is an interdisciplinary group because narrow disciplinary knowledge is not enough to develop citizen science projects. It requires the engagement of communities, overcoming many technical and human-technology interaction challenges and the ability to deliver practical solutions, in addition to an understanding of the questions surrounding the science of citizen science: what are the patterns of contribution and how to create suitable quality assurance systems. The ExCiteS group achieves this by drawing on the knowledge of geographers, anthropologists, computer scientists, human-computer interaction experts, designers, electronic engineers, ecologists and researchers in other fields. Over the past 5 years, the group has collaborated with scholars in physics, environmental science, synthetic biology, educational and cognitive psychology, computer science and human-computer interaction, urban design, history, structural engineering, public health and more. The group has developed internal procedures and practices to ensure an effective collaboration between experts in different disciplines, usually by co-locating and working closely together on a specific problem or a challenge.

Enabling Innovators

The ExCiteS group is supporting innovation through the establishment of its own social enterprise, Mapping for Change, which works closely with the group to bring innovation and developments that were established by the group to organisations and people who can utilise them to address issues that concern them such as air or noise pollution, or representation of local resources on logging companies maps so they are not included in the cutting schedule. In addition, ExCiteS publishes its software as open source and free software (see http://www.ucl.ac.uk/excites/software) allowing other people to use it and develop it further. ExCiteS publications are shared as open access on the UCL open access repository and the material on the blog is also published under a creative commons license.

Global Impact

ExCiteS' open access publications, software and toolkits as well as blog posts and videos explain the unique methodology of the group. This arrangement is focused towards allowing others to use the methods and tools that the group developed. In addition, Mapping for Change supports the active participation in applied projects that are not possible within a research context. This enables the group to provide the lessons that were learned through its activities as a service to different clients as well as within research projects that require very specific support in engagement activities.

5.4.1.2 Infrastructure & Facilities

The ExCiteS group makes use of the spaces and facilities available at UCL to organise events and activities. The availability of teaching rooms and laboratories at the evenings and during the weekends is suitable for engagement activities that are open to the public and to practitioners and experts. In addition, the group maintains a collection of digital sensing and computing devices that can be used in different community engagement activities that require digital tools – these include tablets, laptop computers, and mobile phones. However, most of the activities are planned within the locations of the communities within which the group operates, and therefore the facilities used are temporary locations in the vicinity of the projects.

5.4.1.3 Audience / Profile

The ExCiteS group usually works with adults from disadvantaged parts of society. Another audience that the group reach, are researchers and practitioners, and special attention is being paid to ensure that early career researchers benefit (those who are studying for or have recently completed a PhD), while at the same time ensuring that more experienced researchers will be part of the activity. As a result, activities can range from one-to-one meetings and mentoring of an early career researcher, to conferences with over 300 participants. Community led activities usually engage small groups of participants – between 3 and 20 – who are involved in shaping the research and carrying out data collection activities. The scope for innovation is emerging from the openness of the methodologies that are used, and from creating spaces and activities to support people at all levels to express their views and ensure that they are represented and can suggest elements to the common activity that is created within a project.

5.4.1.4 Partners & Stakeholders

As the coordinator of DITOs, ExCiteS has established relationships with many members of the consortium in addition to external contacts. Therefore, both internal and external relationships are contributing to the activities within the project. For example, for the past 5 years, ExCiteS has maintaining links to UPD CRI and exchanged ideas about citizen science, games, and synthetic biology research in an informal way.

In terms of external partners, ExCiteS has used the experience in DITOs to work with Earthwatch institute on a project about light pollution. Other DITOs activities involved developing links with other organisations in the UK that are actively engaged in citizen science to share the insights and lessons from the project – these include the Open Air Laboratories (OPAL) group at Imperial College, London Natural History Museum, as well as other universities. In addition, the ExCiteS group maintains a dialogue with UCL public engagement unit to allow the mainstreaming of citizen science across UCL.

5.4.1.5 Multiplier Arrangements

ExCiteS uses social media extensively, as noted above, and emphasises DITOs activities through these channels. In addition, academic publications, dissemination of project deliverables through the UCL Open Access Repository, talks in conferences and events throughout the world and the use of podcasts and other modes of dissemination allow the amplifying and enhancement of these activities.

5.4.1.6 How has DITOs helped you to extend these Capacities so far?

The resources that ExCiteS has are being leveraged to secure additional funding to increase the reach and impact of the DITOs project. DITOs provided resources to establish a post of community manager in ExCiteS that is dedicated to information dissemination and sharing.

5.4.1.7 Future

- **Sustainable funding –** is important for future development of ExCiteS in terms of software and hardware development and the ability to recruit and maintain professionals. In addition, the ability to sustain the living knowledge within the group and provide support to communities that approach it will allow it to enhance its activities;
- **Public location -** In addition to the base at the university, ExCiteS might grow to have a public location such as a local shop, which would become a common resource for people in the neighbourhood. An extensive equipment library would allow the group to support different community campaigns about a range of environmental issues;
- **Community outreach -** The ExCiteS group should continue to enhance its outreach capacities and to support many communities across London and beyond. This might require increasing the capacity of Mapping for Change or another spin-off from the group;

- **Partnerships -** In terms of partners, ExCiteS sees much potential with NGOs and other intermediaries who need the combination of technical and engagement skills that are available in the group;
- **Long term relationship -** As noted above, the possibility of a temporary base, potentially a pop-up shop in a neighbourhood to allow the development of long term and active local relationships is one of the more interesting option for the group;
- **Online course -** In addition, the group can develop a set of online courses and tutorials to allow the use of the methodologies and tools by other organisations from around the world. Waag Society

5.4.2 Waag Society

Waag Soicety —institute for art, science and technology— is a pioneer in the field of digital media. Over the past 22 years, the foundation has developed into an institution of international stature, a platform for artistic research and experimentation, and has become both a catalyst for events and a breeding-ground for cultural and social innovation. Citizen science practices are at the heart of many of its programmes, which is leveraged in DITOs WP1 activities.

5.4.2.1 Innovation Hub principles

Waag Society puts the innovation hubs Principles (Figure 2) into action by implementing the principles as described below.

Communal

The activities of Waag Society bring a growing community of innovators together and focus on connecting these people. Social media groups target specific DIYBio, bio art and bio design communities via Meetup and Facebook. On Open Saturdays the Waag building is entirely open to the public, which serves as an entry point for many to get to know Waag Society, the activities that are taking and the possibilities to work together on research projects.

Self-organising and Adaptive

Many DITOs events hosted by the Waag have a predetermined program in which visitors can participate. For example the DITOs Doing It Together bio workshops and Het Praktikum evenings. These events often attract a public that is getting to know the institute and its possibilities.

Next to those pre-programmed events, there is also a wide range of events with a set theme but without a specific program. These are the Open Lab evenings and Open Saturdays. Visitors themselves determine what they will do at these events in a self-organised manner.

Every now and then these visitors become organisers of new events themselves. For example the recent ‘BioHackathon’ (July 8 & 9, 2017) was entirely run by Waag community members. The events platform Meetup also allows for the members to initiate their own events, which sometimes take place outside of Waag Society premises.

Waag Society also offers individuals or small teams the possibility to use the lab facilities during the rest of the week. These individuals or small teams start by approaching one of the Waag employees, and together the possibilities are discussed. Recent examples are the development of a biotechnological artwork 'Return to Dilmun' by Roland van Dierendonck and Gunter Seyfried, and the development of perfume by Theodora Kotsi-Felici.

Interdisciplinary Knowledge Transfer

The knowledge transfer is organised via several channels depending on the needs of the users. For open evenings so called 'Project Canvasses' are used, which are updated weekly. In project journals the participants keep track on a more detailed level. Many use social media or their own website to disseminate their insights and results. For technical documentation the Github platform is frequently used, as well as a platform developed by Waag Society called OpenThings. The members are connected to each other via a Slack chat channel.

The issues that emerge from working interdisciplinary are tackled in a pragmatic ad-hoc fashion. The open events start with short presentations by the participants on their projects, and afterwards everyone is free to join any of the ongoing work. The need for additional expertise is analysed and discussed in a plenary session at the end of each evening in preparation of the next session.

Enabling Innovators

The interdisciplinary knowledge transfer leads to innovation. Waag Society mostly focuses on social innovation; there are no specific business innovation programs in place. Yet, new companies and products do sprout with the support of Waag Society activities and community events, such as Digi.Bio and Living Light. The social innovation programmes aim to increase the social relevance of innovation by shaping innovators perspectives on the moral dimensions of innovation. Participants are supported in having more in-depth discussions by the use of dialogue methods, such as statement games, storytelling and role-play. By focusing on the practice of Open Design and Open Source publishing, innovation is catalysed by enabling each other to build upon previous work. The open events allow innovators to tinker and prototype using the materials and tools that are available in the Waag Society labs.

Global Impact

The innovation activities at Waag Society often start with a local focus, but have international impact. Open source publishing ensures that others can adopt designs and materials. Innovators from all over the world adopt the open source hardware designs and use them to create similar devices (Figure 4). The workshops also include the use of existing open materials and kits, such as The ODIN CrisprCas9 kit. This ensures that local activities contribute to the development of an international open science movement.

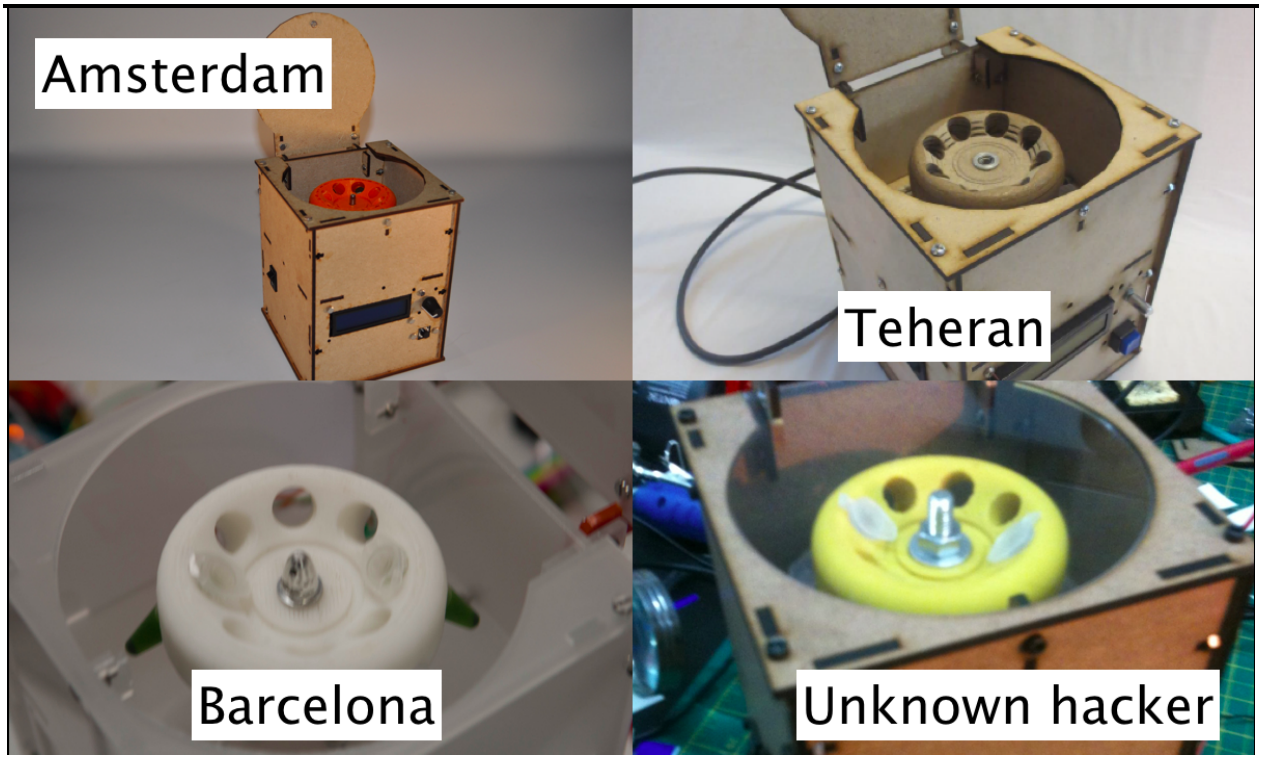


Figure 4: Open source lab centrifuge replications around the world.

5.4.2.2 Infrastructure & facilities

Waag Society offers 3 facilities to its visitors: the Open Wetlab, FabLab and TextileLab.

- **Open Wetlab -** This was designed as a multi-purpose biotechnology lab. It is a confined physical space, licensed for genetic modification works on Level S1. The (open source hardware) equipment is most suitable for molecular biology, microbiology, micro-algae research and neuro-science enabling innovators to bring modern biotechnology into their projects. The space is open to the public on Open Tuesday evenings and Open Saturdays. There is an online Meetup group with over 1000 members and a Slack channel that allows the users keep each other informed on the status of the lab and transfer knowledge about the usage of the facility. The inventory list has served as an inspiration for other community biolabs.

Figure 5: Some Open Wetlab equipment

- **Textile Lab -** This is a physical space that is equipped with machines that enable experimentation with textiles. It is a creative interdisciplinary research lab that explores fairer and more sustainable alternatives for the textile and clothing industry, combining practice based research and the development of relevant opportunities for today's value chains. The lab works towards an interdisciplinary research agenda that combines digital fabrication processes, biotechnology practices, the rediscovery of craftsmanship techniques and new materials through the field of textile. The research is always placed in a broader context to cultivate imagination, envision future possibilities and question the systems and value chains of today. The lab is open to public during events and by appointment. Knowledge is shared through the TCBL-platform (labs.tcbl.eu) and Facebook-page.

Figure 6: Workshop in the Textile Lab Amsterdam 2017.

- **FabLab -** The FabLab Amsterdam was the first FabLab in the European Union and has operated for more than 10 years. It is equipped with a standard set of FabLab machines: such as a laser cutter, 3D printers, CNC milling machine and vinyl cutter. It also has a fully equipped electronics area. These facilities are mostly used for projects related to design, Internet of Things and robotics.

5.4.2.3 Audience / Profile

Due to the 'no tracking' policy of Waag Society as little information as possible is kept on users. Yet from observations by the organisers, the Waag Society activities attract a broad range of people, ranging from designers, artist, sociologists, policy makers, scientists, engineers and business. Most of the time people attend Waag Society events in their free time. Typical participants are looking for inspiration, like-minded explorers, new social connections and a place to validate or prototype their ideas. The open atmosphere enables them to reflect critically on their own and each other's practices.

5.4.2.4 Partners & Stakeholders

For DITOs activities Waag Society has collaborated with a number of partner organisations. A special series of the Open Evenings was held at the Amsterdam Botanical Garden to make them also more acquainted with the grassroots citizen science movement. Traditionally there are no hands-on activities at the botanical garden, but these events were all about that and clearly brought an unusual audience to botanical garden.

The Het Praktikum evenings were held in collaboration with the National Bureau for Biosecurity and involved policy makers in the area of public health.

A special hackathon focussed on lab automation was held in collaboration with a start-up company called Digi.bio. The company has adopted an open innovation strategy that builds upon the principles of innovation hubs.

The workshops that will be used in the DITOs Science Bus have been tested and co-developed with Waag Society community members.

5.4.2.5 Multiplier Arrangements

Several mechanisms are in place to ensure that innovation activities at Waag Society are amplified. The participants in Waag's DITOs events are offered multiple opportunities to share their knowledge. Each Open Evening starts with open presentation slots where participants can present their aims and discuss methods and outcomes.

Waag's extensive social media presence is used to spread the online documentation by community members and bring them to a much wider audience. For example, workshops that have been developed for the Doing It Together Bio events have been noticed by organisers of other events in Europe. The micro-algae workshop is now invited to take place at the 'Innovative Citizen Festival' in Dortmund. As part of DITOs Waag Society is also organising the Science Bus. This brings the knowledge and skills co-developed with community members to a wide audience in Europe. Other Waag programmes such as BioHack Academy have also used outcomes of DITOs activities and will disseminate these further.

5.4.2.6 How has DITOs helped you to extend these Capacities so far?

The DITOs project has enabled Waag Society to further develop the support of the Open Evenings, collaborations with local partners and the development of new tools for social, ethical and moral deliberations. This was done in order to broaden the classical interpretation of 'innovation' to a more socially relevant dimension.

5.4.2.7 Future

Looking to the future, Waag Society anticipates the following hurdles:

- **Need to increase interdisciplinarity -** Waag Society attracts predominantly people with a background in the creative industries and government. We will seek closer collaborations with scientists and the science-based industry;
- **Need to increase knowledge transfer -** currently participants are not consistent in their documentation of knowledge. Waag Society has launched a new platform 'OpenThings' and migrated the existing database of > 600 projects to this system which is expected to lead to better documentation of projects;
- **Partners -** a partnership with Amsterdam Science Park is in development, to strengthen the connection between grassroots and academic science;
- **Infrastructure -** now that DITOs has led to the development of a Science Bus, we envision to do workshops outside of our fixed physical space more often;

- **Publics -** the current DITOs projects are primarily aiming at citizens that already have an interest in citizen science. In future events special attention will be paid to newcomers. For example, by organising Playshops similar to TK-UCL Citizens without Borders;
- **Connection to other DITOs Hubs -** introduce additional formats based on the experience of other DITOs partners.

5.4.3 The Royal Belgian Institute of Natural Sciences (RBINS)

The Royal Belgian Institute of Natural Sciences being both a research institute counting 140 scientists, and a museum developing knowledge and education activities in natural sciences for the general public is one of the largest natural history museums in Europe. RBINS is an active member of large international networks in research (from marine, through entomology to palaeontology and geology) and science communication. It has developed a long-term and traditional collaboration with citizen scientists dedicated notably to the improvement of the knowledge on its 37 million specimens and with citizens involved in its activities, locally or internationally in environment and biodiversity conservation and awareness. Within DITOs, RBINS activities are turned towards the WP2 environmental sustainability objectives and are in phase with the other WP upgrading the links between scientists, citizens and policy makers. It aims to improve knowledge on biodiversity conservation by communicating and making visible the work done by enthusiastic volunteers involved in science and the need for informed citizens.

5.4.3.1 Innovation Hub Principles

Communal

The RBINS' ambition is to play a key role in spreading and promoting scientific culture and not only scientific knowledge. To achieve this RBINS works both within and outside the walls of the Museum, notably through an educational framework, traditional and digital media, exhibitions and events. For instance, the creation of a biodiversity path in the Leopold Park at the foot of the institute, has led to the collaboration of local residents, associations of citizens, researchers and the local authority owners of the park. This path is one of the 6 Brussels initiatives depicted in a small touring exhibition telling the stories and landscape changes operated in each of the situations by the local 3 stakeholders (citizens, scientists, authorities).

Another example are the school classes involved in the XperiBird programme, an educational programme that distributes nest boxes equipped with a camera and a nano-computer to schools and educational partners around Belgium, leads to the creation of this new community of users that are contributing and enriching a database with their observation which are used by researchers. In this way, they become part of a virtuous chain and a new 'scientific and educational network'.

Self-organising and Adaptive

Partly due to an increasing lack in resources many scientists collaborate with volunteers (who become specialists) in activities such as research, fieldwork, collection work, databases, training or education. In turn, these citizen scientists get involved in the various networks of specialists and take part as a professional support, enhance the access to references, information, collections and archives, increase the facilitation of

networking and information exchange and have access to publication (co-author, contribution) or exhibition development. These citizen scientists have their own goals and come with their own expertise to collaborate with RBINS staff members when there is a common interest.

The educational programme Xperibird leaves the participants autonomous in the installation of the device and in its functioning. Schoolchildren and teachers manage the tool and collect their observations to feed the BeBird (Belgian Ringing Scheme) database on birds' migration.

Interdisciplinary Knowledge Transfer

According to the various activities different communication channels have been put in place. The observations from the school classes using the XperiBird programme are entered online by the children themselves and are accessible notably to the ornithologists from RBINS with whom they can exchange on their findings. Any technical problem is fixed through exchanges by phone, email or online in the system.

Among some of the citizen scientists working on a species of stick insects during the Phasma meeting (supported by DITOS), the group formed heterogeneous groups of 'experts' focused on DNA, taxonomy and breeding of insects. The people came from different countries, backgrounds and wide age range from 12 to 80 years old.

Exhibition developers, explainers and citizen scientists bring visibility to these citizen specialists and add to the variety of educational material and ways of communicating with the general public.

The Biodiversity path has involved decision makers (Municipality of Brussels), citizens and scientists from RBINS to transform an area into a more sustainable zone. A common management plan has been developed by the various stakeholders in order to address all the challenges to be faced and a forum 'LaboID' has been organised at the RBINS science hub to collect the ideas and progress of the collaboration.

Enabling Innovators

The citizen scientists collaborating with our researchers are working on some new species brought back from field missions and are trying to adapt new techniques to incubate eggs according to information from our researchers familiar with the zone where the species were collected.

The touring exhibition on the 6 areas in Brussels where collaboration showed a possible change in water management by the local authorities and environmental improvement is aimed at being replicated by other areas near Brussels. The visitors of the exhibition realise that changes in their own area can take place. Many are concerned by local problems they are trying to solve such as pollution or real estate obstructing a river and work with the scientists and authorities on the best way to solve these problems

Figure 7: Small touring exhibition developed in collaboration with a citizen association & RBINS

Global Impact

The impact of RBINS activities in citizen science takes place at various levels, local, national and global.

At local and national level, the school kids involved in the XperiBird programme are providing information through their observation on bird evolution and departure from the nests on bird migration in Belgium.

The facilitator of the small exhibition Classific'Action (for kids) gives workshops to the teachers on taxonomy so that the teachers can integrate the latest information on taxonomy and classification in their teaching of pupils.

The international network of collaborators working with RBINS scientists are not researchers belonging to any research institution, but are citizen scientists - experts that identify and publish on the species collected. The communication channels are Facebook or websites dedicated to the species.

5.4.3.2 Infrastructure & facilities

As a research institute and museum RBINS has a large infrastructure at its disposal, including:

- Education and workshop rooms: education material with real specimens as examples, large screens for 3D imaging visualisation;
- Labs with microscopes and micro CT scans enabling scanning and digitisation of collection;
- Collection storage of 37 million specimens available for visits to the general public. Mostly used for research;
- Exhibition rooms and temporary exhibition room of 750m2 for knowledge dissemination on natural sciences and visitors (350,000 visitors per year) – themes: Dinosaur Gallery (2,600m2), Evolution (1,200m2), Biodiversity in the city (800m2), 250 years of the RBINS (400m2), Mosasaures (150m2), Gallery of Human Kind (840m2). In Spring 2018 opening of Living Planet, a new permanent

gallery of 2,400m². The main visitors groups are school groups, families and individuals;

- Laboratories and research offices open and accessible to collaborators and citizen scientists (about 60) coming every day, trained by RBINS staff in specimen preparation for study and collection;
- www.XperiLAB.be, is a science truck that makes its way around Belgium eight months per year, reaching some of the smallest locations – 287 different municipalities since 2008. The truck was the result of a partnership with the Foundation Enterprise - Institute, and with the Solvay industrial group in particular. It contains nine activity modules which stimulate the active and personal experience of students aged 10 to 14, initiating them into the scientific method: observing, experimenting and deducing. Since 2008, XperiLAB.be and its facilitators welcome around 10,000 young people per year.

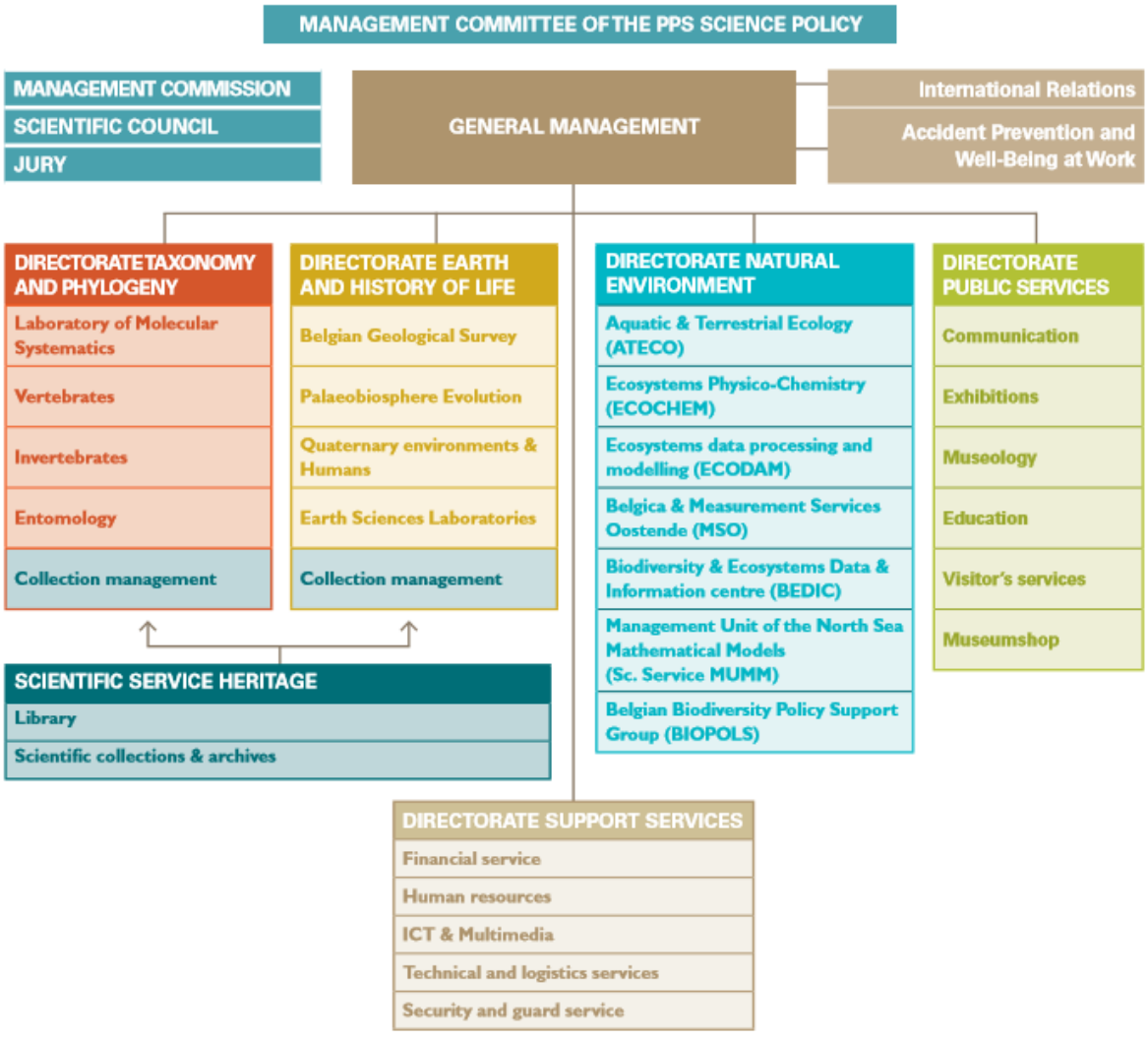


Figure 8: RBINS organisation chart

5.4.3.3 Audience / profile

The RBINS welcomes yearly 350,000 visitors. Out of these 80-90,000 of RBINS' visitors are in school groups. This audience draws on the educational service of the Museum whose facilitators work with around half the groups. To satisfy schoolchildren, students and teachers, RBINS is committed to renew the form and content of activities regularly: to fit the Museum halls and temporary exhibitions as well as addressing levels of audience and models of active pedagogy. The paleoLAB is a good example, with 40 hands-on activities. Another is the success of the 'Tell us' sessions, which take the shape of a storytelling visit designed for young children aged 5 and up, reaching 2,000 to 4,000 participants per year.

5.4.3.4 Partners & Stakeholders

The RBINS has developed partnership with local and federal authorities, the municipality of Brussels, universities and local citizens associations. The exhibition on water management and biodiversity is an example of ad-hoc methodologies applied in urban areas on collaboration between citizens, scientists and decision makers. It inspires other areas and their respective local stakeholders in their wish to improve their local environment through the triangular collaboration necessary for a common approach to changes in the urban landscape.

5.4.3.5 Multiplier arrangements

The Museum's activities are disseminated through direct channels (newsletter, website and social media) as well as press work. Numerous partnerships have been established and dozens of press releases are sent out every year, while a special relationship with a wide network of journalists has been set up. This work to make RBINS accessible has been rewarded with excellent media presence: over 500 mentions of the museum per year.

The RBINS became a science hub within the framework of projects funded by the European Commission (PLACES in 2010-2014, VOICES in 2013, and Sea for Society 2012-2015). This involved the organisation of citizen consultations on waste management and protection of the ocean, developing local partnerships and taking part in citizen initiatives, particularly in raising awareness of sustainable urban management of nature and water. This European impetus allowed the RBINS to play its role as a forum and meeting place, bringing scientific expertise to half a dozen Brussels projects in partnership with associations including Brussels Etats Généraux de l'Eau and City Mine(d) and public authorities including the City of Brussels and Brussels-Capital Region. These collaborations resulted in the exhibition Water and Biodiversity, which opened at the Museum in 2016 and travelled within Brussels. They also produced a project to create a biodiversity route in Leopold Park, the park surrounding the museum.

5.4.3.6 Future

RBINS benefits from a citizen recognition and trust. It has a long history of working with non-professionals to collect reliable data for research. This experience also works particularly well in stimulating citizen engagement. Moreover, it has been on the rise

recently thanks to new technologies notably developed for the XperiLab touring truck, the XperiBird programme.

- **Interdisciplinarity –** RBINS could explore more interdisciplinary knowledge mixing natural sciences with art and engineering activities. This would be another way to attract a difficult target audience such as teenagers. The collaboration with the DITOs partners is a great opportunity to explore these science communication fields together.
- **Content -** In Spring 2018 with the opening of Living Planet, a new 2,400m² permanent gallery spread across two floors of the Convent wing and the museum will have over 11,000m² of completely renovated exhibition space.
    - The museum must renovate, redistribute and improve these spaces and reception structures to ensure visitors have a coherent and pleasant experience visiting and provide the staff with functional tools for their work. This is a large-scale project, described in an extension to the masterplan as of 2015. It involves major structural and infrastructure work, requiring special financing that will ensure that in the future visitors are welcomed into a forum where all visitor services are consistent and up-to-date, with a focus on accessibility for all, including people with reduced mobility. The aim is to provide the perfect starting point for the visitor experience that encompasses every space in the Museum, as well as a place to enjoy before leaving with an excellent memory of the visit.
- **Open lab space –** There is a need for more working space for amateurs and in-house time and resources to dedicate to them. This would benefit both research and knowledge dissemination. Notably more visibility could be given to various fieldwork activities to which citizens scientists contribute as in paleontology (collecting (fieldwork) fossil specimens, studying them and analysing the results) or in geology by providing information about temporary outcrops such as excavations for new buildings and make a description of the outcrop to be included in the GeoDoc database and supply samples useful for the collection.
- **Diversify audience -** To diversify our audiences, another step was to create original formats for our activities, targeting niches of the public who are not spontaneously drawn to natural sciences but who are attracted by culture, museums and ‘smart’ leisure activities.
    - RBINS has added several types of recurring activity to the programme, often in the form of a pilot activity to test its effectiveness among the public, such as:
- ‘Coffee Workshops’ which target adults without children and older people, both of which are underrepresented among the visitors and which demonstrate hidden aspects of the collections and research;
- thematic Days that target informed amateurs and explore a natural science topic across a whole day of films, conferences and workshops;

- ‘Dino Aperos’ which targets fans of art and music, combining a visit of the Museum or one of its exhibitions with an unusual leisure activity.
- **Citizen science expo -** The new gallery Living Planet will integrate in its education labs the work from citizen scientist specialists on breeding stick insects. This is a first for the institute and has been has been due to the impulse of the DITOs project. These are the kind of collaborations already at work in research at the RBINS but are a very unusual approach for the museum part of the institute. These citizen scientists will be an example for other visitors and encourage them to be curious about science and prove that they can contribute to science communication;
- **Citizen science forum -** The several associations of citizen scientists hosted at the RBINS and their members are regularly collaborating with RBINS researchers and obtain good results that are often published in scientific journals. These members from different networks (entomology, palaeontology, geology) do not know each other and do not know the work being performed by each of these groups. We wish to organise a meeting were exchanges and transfer of practices could take place between these disciplines and passionate people. A new forum will thus emerge from these interactions;
- **Citizen consultations -** More specifically we will carry out focused surveys on the activity formats and scientific topics that the public expect will be performed. There will also be special meetings with experts and the creation of a travelling exhibition to be developed through co-creation with citizen panels.

5.4.4 Université Paris Descartes - Center for Research and Interdisciplinarity

The Center for Research and Interdisciplinarity (CRI) experiments and spreads new ways of learning, teaching, making research and mobilising collective intelligence in three main areas: life sciences, learning sciences and digital. The CRI has been created in 2005 by François Taddei and Ariel Lindner. The Bettencourt Schueller Foundation is an essential and key support to the CRI from its beginning. The CRI develops educational programmes within Sorbonne Paris Cité University (Paris Descartes University and Paris Diderot University) and benefits from the support of the City of Paris, from European and national public funding.

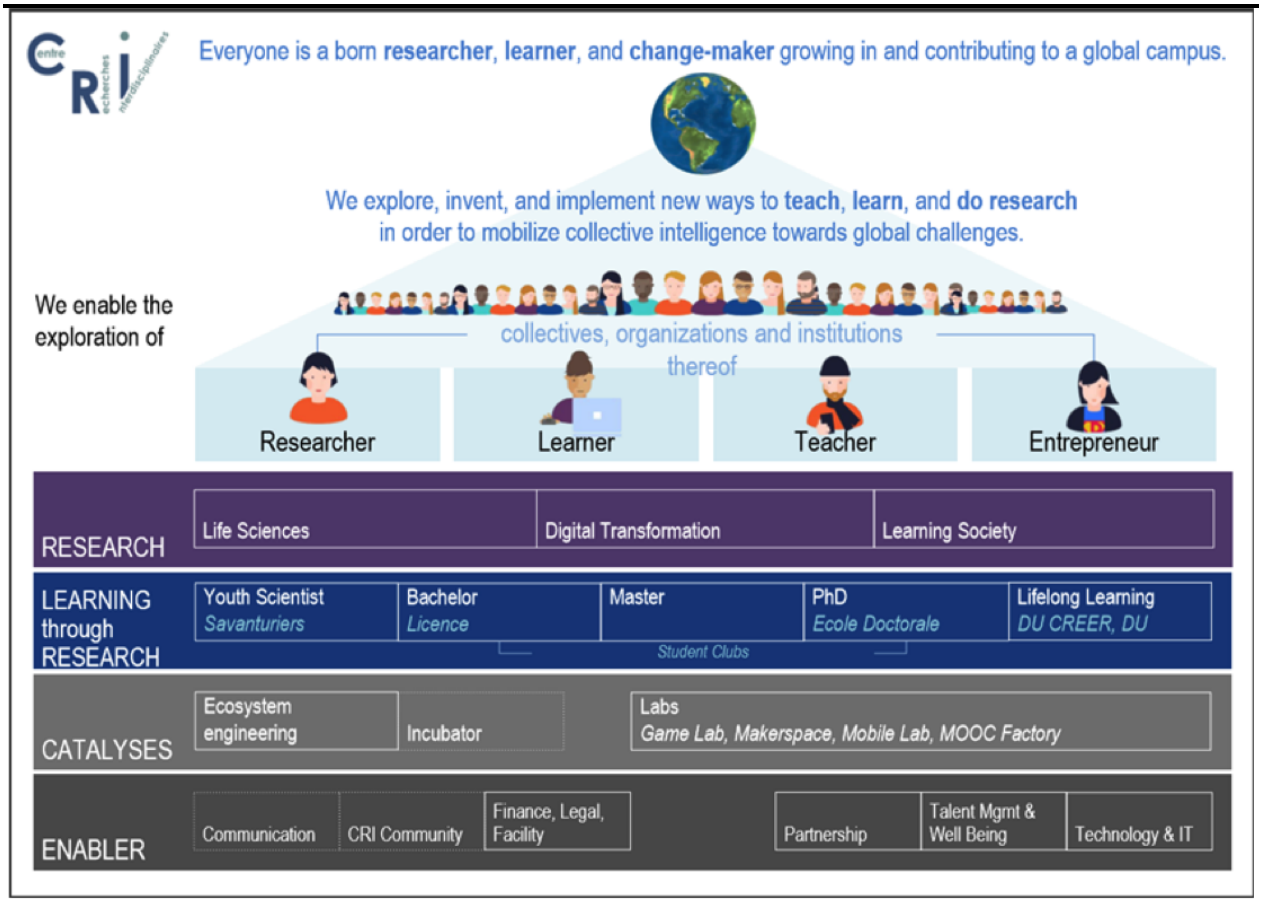


Figure 9: Organisational chart CRI Paris.

5.4.4.1 Innovation Hub Principles

The CRI puts the innovation hubs Principles (Figure 2) into action by implementing the principles in the following way:

Communal

The CRI gathers people working together to build a *learning society* in order to address the main challenges of our time. A *learning society* is one whose members are learning, both individually and collectively, how to learn, and as such will be equipped to resolve any issue that might arise. In this unstable world, the skills that CRI expects from people and the methods employed to acquire them must be seriously re-evaluated. It is essential encourage the young generation to:

- gain an awareness of the complexity of global problems;
- question the nature of the human race and the meaning they want to give their lives, as well as the concept of community respect and tolerance, empathy, sustainable development, creativity, and cooperation;
- participate in the collective effort to resolve ongoing problems;
- master the digital world, recognising both the potential and the risks therein;
- gain skills that machines do not have to help create the jobs of tomorrow, and;
- invent new means of contributing to a common future.

Self-organising and Adaptive

The CRI has a network of students, innovators, researchers and engaged citizens that can discuss, share, support and help nurture new developments of our programmes. They are invited to join meetings to have a say in the decisions that are taken related to collective issues such as communications, tools and equipment and infrastructure. For example, Open Forums are organised on a monthly basis. During these meetings, members of the staff and students share their ideas and projects. DITOs events at CRI usually have a predetermined programme, but they can always be nourished by the ideas of the participants. For example, participants of previous editions of our Co-lab Workshops have proposed new sessions for the Co-lab Workshop on BioArchitecture that happened last April 2017.

Interdisciplinary Knowledge Transfer

The CRI focuses on new ways of learning, teaching and carrying out research that stimulate collective intelligence, in order to address the challenges of our time. The CRI is working towards the realisation of a learning society by exploring subjects that are related to Life, Learning and Digital Sciences; producing new educational methods and digital tools to encourage people to question the existence, knowledge, commitment, and sharing of open solutions; participating in the transformation of systems responsible for teaching and research, stimulating in-depth thinking, and freely sharing the fruits of its expertise.

Enabling innovators

The CRI's benevolent framework and wealth of expertise makes it an area of freedom and creativity that is unique and recognised throughout the world. Its methods are based on digital, interdisciplinarity, collective intelligence, learning through research, and engagement and practice. The CRI programmes have in common the trust of learners, including the younger ones, and help them develop original approaches that go beyond disciplines to re-define problems and seek innovative solutions in the fields of health, education and digital transformation.

Three distinct mechanisms for innovators can be identified in CRI:

- **The Catalysis Division.** The CRI provides students, researchers, social innovators, entrepreneurs and innovative teachers a physical place, technical platforms, multiple skills and the means to support projects. The available spaces include: a multi-purpose laboratory where students can conduct research at the Living Interfaces, a GameLab, a MakerSpace, a MOOC Factory, a MobileLab, a Vrlab;
- **Entrepreneurship at the CRI.** The status of student-entrepreneur is strongly encouraged at the CRI. Many start-ups have been created by the students. For example Xavier Duportet, former student of the AIV Master and Doctoral School, founder of the Hello Tomorrow Challenge and Eligo Bioscience, a biotech that tackles the antibiotics market and raised €2.4 million. The CRI support for entrepreneurship focuses on the exploratory/mentoring/prototyping parties, with a guidance mission for the following phases that starts from the observation that the offer of incubation is highly developed in the Parisian area.

- Former students wanted to offer to the CRI some shares in the start-ups they have created in recognition of the environment and support they had at the CRI. The interest for the CRI to create a structure for managing these gifts or take equity in such start-ups should be studied by mid-2018;

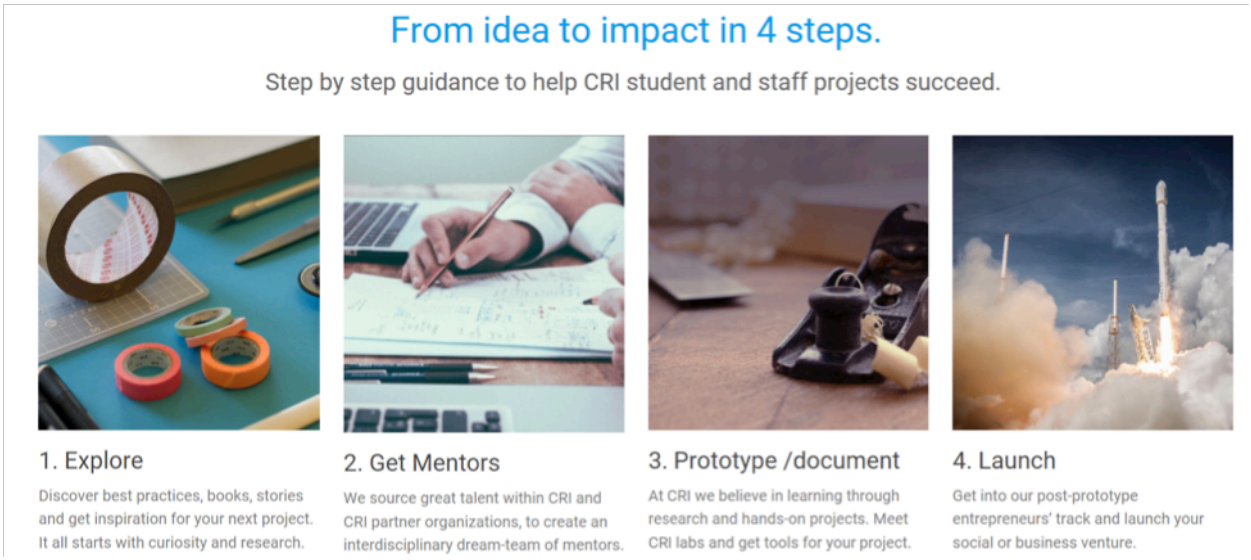


Figure 10: From idea to impact in 4 steps.

- **Go/NoGo process for new CRI projects** The implementation of a process of '*stage gate*' will ensure that the commitment on new developments take into account the adequacy with the mission and the dynamics of the CRI, and the impacts on the existing activities, people, finances, and commitments. This systematic assessment of costs and opportunities will maximise synergies and decide what should (or not) judiciously be done to facilitate and be internally or externally developed.

Global Impact

CRI is committed to find ways to expand exponentially its capacity, within constrained perimeter and resources. Start from a national ecosystem, based on targeted strategic partnerships, assisting in the creation of centres inspired by the CRI and contributing to structuring the national institutional framework to facilitate the creation of a learning society. And from there develop the international ecosystem by creating an international alliance of the learning society, develop spin-off mechanisms for CRI activities, continue the partnerships in China and Singapore and develop summer schools in collaboration with prestigious universities such as Harvard or Tsinghua University.

CRI is particularly embracing the exponential development of digital innovation that by definition takes places on a global scale. Many activities contribute to the digital transformation of research and allow the co-evolution, in an ethical framework, of men and machines intelligence.

5.4.4.2 Infrastructure & Facilities

The CRI initial buildings are being renovated to make the CRI a '*college*', and a place of reference for innovation on the ways of learning through research. The future premises of the CRI will house classrooms, research laboratories, technical platforms and

creativity spaces, and conviviality spaces and are designed to encourage exchanges and creativity. The first levels of the CRI form its core. They are thought of as a multi-purpose place of convergence, privileged spaces for encounters (image 9), opening up between the academic, research, business world and the general public.

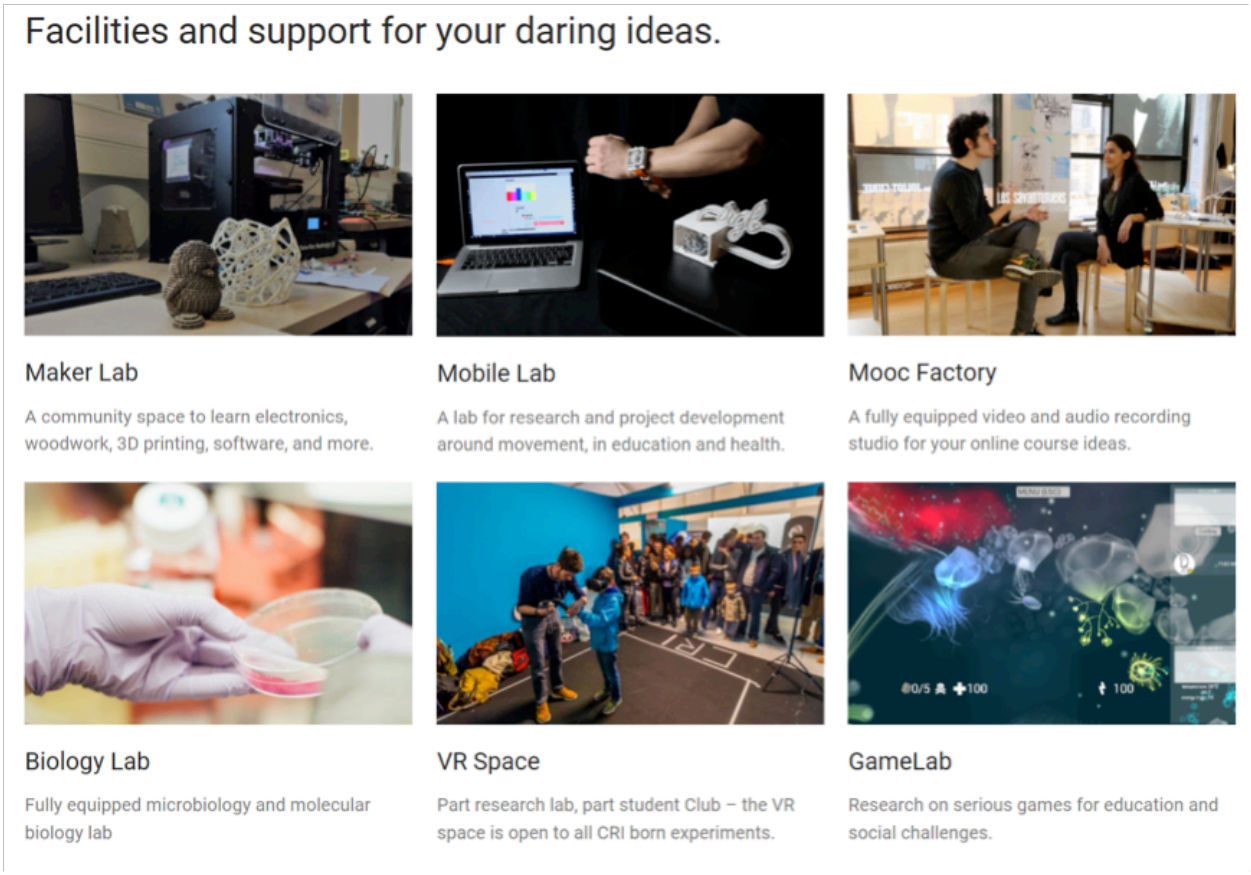


Figure 11: Multi-purpose places of convergence, privileged spaces for encounters.

5.4.4.3 Audience / Profile

The main profile of audience at CRI have an educational background equivalent to a bachelor, master or PhD degree in science, technology or art with a gender distribution of 50% women and 50% men. A secondary audience consists of pupils from primary and secondary school, with an equal gender distribution. They are not necessarily innovators but creative people that can turn into innovators. CRI helps them use the facilities, refine their objectives, create a network, make a prototype share knowledge. The age range is from 18 up to 60, with an average of 30.

5.4.4.3 Partners & Stakeholders

Throughout our DITOs activities, CRI had the chance to collaborate with diverse partners: universities (University of Cambridge, John Innes Centre, UCL, EPFL); high schools (eg. Lycée Marie Curie, Lycée Jean Jaurès); biohackspaces or makespaces (eg. Cambridge Makespace, Hackuarium, Volumes Coworking, La Paillasse); NGOs (eg. Open Science School, Blacksmith Institute, Engage, Creature); public administrations (eg. the French Secretary of State for Higher Education and Research, the City of Paris, Académie de Versailles); museums (eg. Cité des Sciences et de l'Industrie); media (eg. The Conversation); and more.

For instance, the partnership with the Lycée Marie Curie (high school) on a biodesign workshop inspired the teachers to adopt new methodologies (collective intelligence, design thinking, the use of DIY tools) and co-created outcomes (article for a student journal, database).

5.4.4.4 Multiplier arrangements

DITOs activities represent the main events that are organised by the CRI. Several mechanisms are in place to ensure that innovation activities at the CRI are amplified.

For example, the CRI is highly involved in the production of MOOC:

- 14 MOOC have already been produced and disseminated (eg. there is a MOOC on Synthetic Biology supported by DITOs);
- More than 50 000 views on FUN, Youtube and Vimeo;
- 13 MOOC scheduled for 2017.

Also, the CRI's extensive social media presence is leveraged to spread the online documentation by community members and gives them a much wider audience. In addition, other CRI programmes, such as Open Fiesta or Open Science School used methodologies of DITOs activities and will be disseminated further.

5.4.4.5 How has DITOs helped you to extend these capacities so far?

The DITOs project has enabled the CRI to further develop the support of the Co-lab Workshops and high school biodesign workshops, collaborations with local/national/European and international partners, but also the development of new tools and methodologies in a process of continuous improvement.

5.4.4.6 Future

To become a true innovation hub according to the innovation hub principles, CRI could improve the interdisciplinary knowledge transfer as well as our global impact.

- **Infrastructure -** In the future CRI will offer infrastructures that best matches our global impact objectives with the public and the team skills;
- **Diversify audience -** CRI wants to open up to new audiences: developing further access to less privileged public in cooperation with *Orange FabLab Solidaires* for example; assisting in the creation of programs inspired by CRI on early childhood;
- **Partnerships -** CRI wants to work with universities, research centres, museums, science centres, secondary schools and citizen scientists;
- **Impact assessment -** In order to have a framework providing the most efficient use of resources, both human and material, the CRI will implement appropriate tools so that each employee, student, teacher can better track their activities. The CRI contributes to sustainable social change both with its live audience, the environment and society in general. A first exercise to define various spheres of impact on audiences of the CRI was conducted and visualised in Figure 12 below.

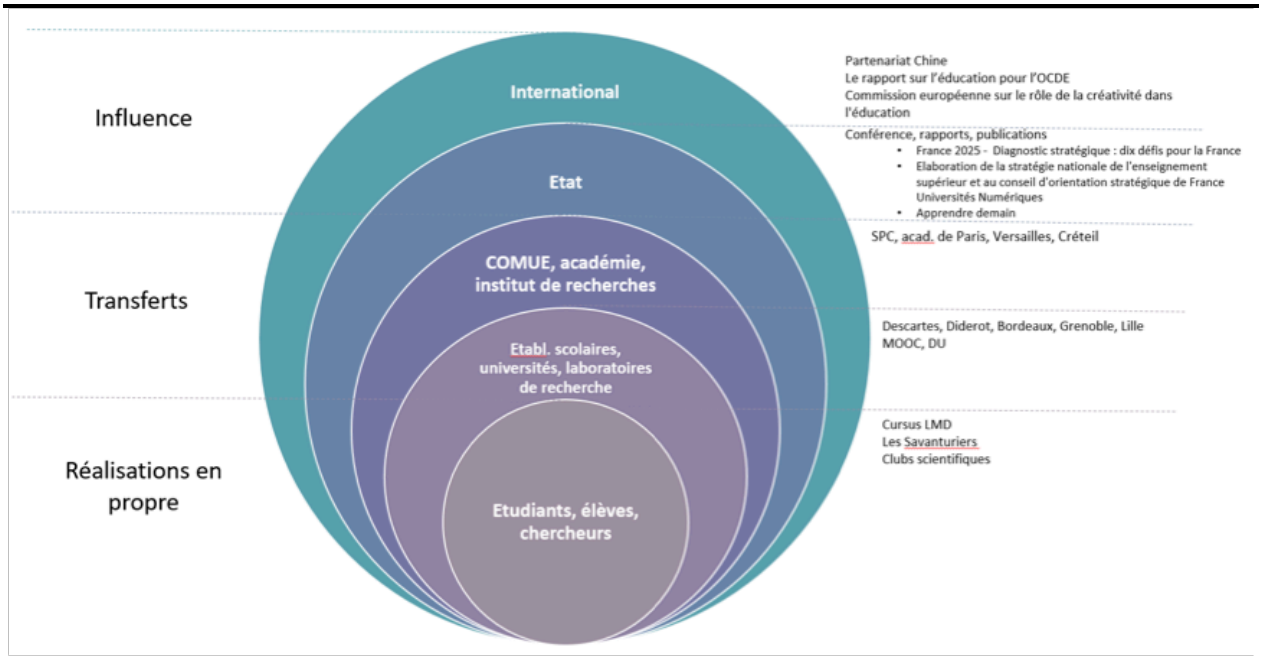


Figure 12: CRI Impact assessment framework

The CRI would like to take this assessment of its social impact much further and:

- recognise and value the work of the teams to renew their motivation and commitment;
- guide its strategy, manage its activity and support the decision-making process by engaging in a process of improvement and facilitate the change of scale;
- introduce a new form of dialogue with partners based on a willingness to account for the use of their 'investment';
- publicise and communicate by making the actions more visible and more readable.

Identify precisely the purpose of the assessment and the questionings that come with it is not an easy but essential exercise in implementing the CRI's own assessment.

5.4.5 European Citizen Science Association (ECSA)

The European Citizen Science Association (ECSA) is a non-profit association set up to encourage the growth of the citizen science movement in Europe in order to enhance the participation of the general public in scientific processes. This is done by initiating and supporting citizen science projects as well as performing research on citizen science. ECSA frames citizen science as an open and inclusive approach, for example by supporting and being part of the exploration, shaping and development the different aspects of the citizen science movement, its better understanding and use for the benefit of decision making. ECSA has established a broad network of organisations from 27 EU countries, Turkey, Israel, Thailand, Australia, New Zealand, USA, Argentina, Ecuador and Brazil; and in various sectors including: NGOs, universities, research institutes, museums, civil society organisations, SMEs, policy and decision makers, as well as other local and national institutions.

5.4.5.1 Innovation Hub Principles

Communal

ECSA offers the opportunity to interact among groups and disciplines that already have or want to build a relation to citizen science, through activities in H2020 projects, contributing to policy briefs, the open science policy platform, by being part of the development of principles for good practice in citizen science and by participating in ECSA working groups (Figure 13). Information about each working group's objectives, acting chairs and co-chairs, members and activities can be found on the ECSA website[xiv].

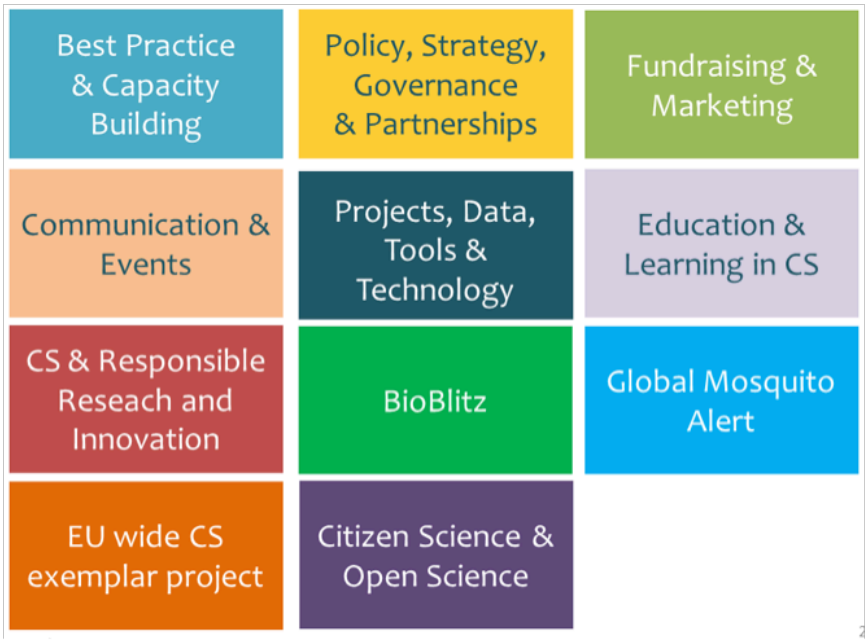


Figure 13: ECSA working groups.

Self-organising and Adaptive

ECSA working groups (WG) come together voluntarily and by self-interest of the members. To become formally established, an ECSA WG needs to define a main purpose, objectives and potential relation to other WG within or outside ECSA, and have a minimum of five members.

Generally, WG members meet remotely to first get to know each other, propose activities of potential common interest and plan together how to move forward.

Periodical communication via teleconferences, emails and collaborative spaces (such as Basecamp) enable groups to make progress together and adapt actions.

Interdisciplinary Knowledge Transfer

Knowledge transfer and communication takes place through various channels and at different levels. Thanks to UCL and the DITOs project, WG count with a Basecamp space (Basecamp 2), as well as mailing lists and a teleconference platform offered by the German research agency (DFN). WG chairs are part of the ECSA Steering Committee together with ECSA Board of Directors and Executive Board. The Steering

Committee meets every two months to share information and discuss any ECSA, CS, and WG related matters. Furthermore, some WG share members and have some overlapping interest or strategically collaborate. For example, ECSA WGs 'Education & Learning' and 'Projects, Data, Tools & Technology' have found synergies to similar working groups in the COST Action CA15212 Citizen Science to promote creativity, scientific literacy, and innovation (Figure 13). In the same way, the 'Projects, Data, Tools & Technology' WG is part of the international Interoperability working group together with ECSA counterparts in USA (CSA) and Australia (ACSA) (Figure 14).

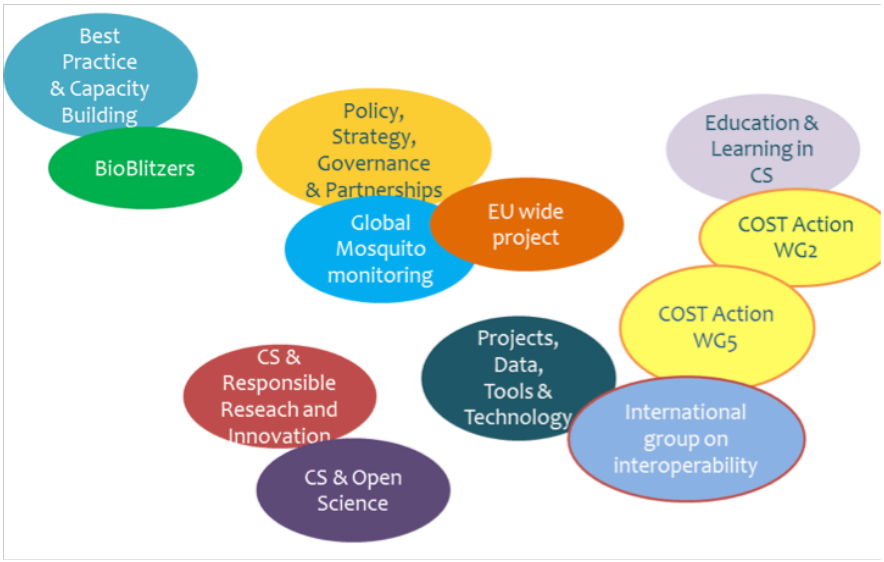


Figure 14: Collaboration and knowledge exchange among ECSA WG, COST Action for Citizen Science and International group on interoperability.

Enabling Innovators

ECSA doesn't have specific innovation programmes in place. Some innovative ideas that emerged from ECSA WG need additional resources. For example, the Education and Learning WG has the aim of mapping citizen science projects with educational components in Europe. Such activity requires setting up an interactive map and survey where people can enter data about their projects.

Global Impact

Since ECSA is an international community, WG members come from all over Europe and the world. For example, in ECSA Open Science and Citizen Science working group, members come from Europe, USA, and Africa bringing together different experiences, regional perspectives and understanding of such a broad and complex topic as open science. Members of this WG have agreed to collaborate on writing the DITOs policy brief on Open Science including case studies related to citizen science.

Due to the high number of ECSA members and non-members expressing interest in a particular topic and associated working group, ECSA has strategically formalised the establishment of the Task & Finish groups. These are formed under the scope of one or more working groups and considered as task forces of experts in a specific area of interest with a defined work plan and duration. A work plan is developed based on the needs identified by members and resources available.

The BioBlitz Task & Finish group, was established under the Sharing Best Practice and Capacity Building WG, with strong links to the objectives of other WGs such as the Policy, Strategy, Governance and Partnerships; Projects, Data, Tools and Technologies; and Learning and Education in Citizen Science.

As BioBlitz events become popular in several European countries, increased cross-boundary exchange of experience and networking opportunities are needed to maximise the impact of this approach. Therefore, the purpose of this group is to connect people, communities and organisations involved and interested in the organisation of BioBlitz events, to facilitate the sharing of good practice and build capacity for this type of event across Europe.

The work plan was outlined for 2017, 2018 and 2019, as some activities run in association with the DITOs project. At the end of the three-year work plan, the purpose and objectives of the Task & Finish group will be reviewed and updated accordingly to adapt to the needs of the members. The group begins to work after a call for participation is issued. The chair invites members to take part and to contribute to a particular task. Since participation is open and voluntary, members within a group are distinguished as either part of the ´core group´ (members who will actively take on tasks), or the ´interest group´ (members who will keep in touch with developments and contribute in a less extensive way). This approach helps to efficiently coordinate the activities and work conducted.

The BioBlitz group has resulted in a productive collaboration and attracted interest from European stakeholders and beyond. Some of the objectives and activities planned have been achieved, such as the initial DITOs policy brief on ´Cross-border research and collaboration for environmental sustainability´ that focused on BioBlitzes. The European BioBlitz network established via the ECSA Task & Finish group is opening opportunities for interdisciplinary collaborations with a wide range of stakeholders that see the potential of BioBlitz events as make a valuable contribution to science, environmental management, policy and public engagement. The development of the policy brief started a conversation about the needs of stakeholders such as citizens, researchers and policymakers. In future events, we will address these needs via capacity building workshops and stakeholder roundtables.

Another example is the Global Mosquito Alert Task & Finish group where key citizen science mosquito monitoring initiatives agreed to work together to enable members of the public to join scientists to understand the spread of mosquito species and provide information to help health professional and citizens manage associated risks. The group agreed to share current approaches to monitor breeding sites, and measure the nuisance value of the citizen mosquito experience to support health risk management. It was also agreed to pool knowledge and experience on citizen science programmes to monitor biodiversity of mosquito species using the latest DNA identification techniques[xv].

The development of the ECSA Ten Principles of Citizen Science[xvi], led by the ‘Sharing best practice and capacity building’ group, has had the greatest impact. The principles have been voluntarily translated to 26 languages and are cited in several documents from all over the world and from different disciplines.

5.4.5.2 Infrastructure & Facilities

ECSA's infrastructure is targeted towards connecting its members. It includes the ECSA webpage[xvii], that provides information about the organisations' bodies and roles, relevant documents and resources, ECSA's and other citizen science events and members' information.

On top of that there is an ECSA members mailing list with +315 recipients and specific ECSA mailing lists for working groups as well as Basecamp spaces for WGs and steering committee. The general ECSA newsletter (bimonthly) has +1300 subscribers. ECSA is active on all current social networks such as Facebook, Twitter, LinkedIn and YouTube.

These channels contribute to the aforementioned principles; however we could increase their functions by having them linked to a common place where innovation is registered, made accessible to the broader community and further used/re-used, documented and developed.

5.4.5.3 Audience / Profile

The number of members in each ECSA WG ranges from 5 to 30. Their educational background is mostly higher education. In terms of gender distribution, ECSA estimates that about 50% of the participants are women and the ages range is between 20-50 years.

5.4.5.4 Partners & Stakeholders

Throughout the duration of DITOs project, ECSA coordinates DITOs events and activities linking to ECSA members and Working Groups. The BioBlitz Task & Finish group and the Open Science Working Group are good examples. The DITOs policy briefs have already benefitted from contributions by these formalised groups.

The European Stakeholder Round Table on Citizen and DIY Science and Responsible Research and Innovation, organised on 8th November 2016 in Berlin by ECSA within the framework of DITOs, has been an opportunity to bring together more than 50 participants from the ECSA network, who have contributed to the discussion with their perspectives on citizen science and DIY Science as stakeholders from science, communication, government, business, civil society and art[xviii].

5.4.5.5 Multiplier Arrangements

Since ECSA is a network organisation the multiplier arrangements are in line with what has been described above as infrastructure & facilities. Any initiative, ideas and/or processes scale up through the use of these channels.

5.4.5.6 Future

- **Website -** For the future ECSA finds it essential to support dissemination of the innovation hubs network on a well-structured web-page. This web-page is envisioned to provide access to an open infrastructure includes the following features:

- allowing for online research, for example mapping of citizen science projects related to learning and education, surveys;
- allowing for communication, taking decisions, organisation of activities and identifying people responsible for tasks;
- making it is easy to make structural changes, and create embedded 'MOOCs' for example;
- allowing the sharing of publications/tools like Zotero[xix];
- linking to projects;
- linking to Basecamp;
- linking to other innovation hubs;
- showcasing events & reports/products on past events.

- **Connection -** Above all there is a strong desire to enhance the connections and collaboration with other partners outside of the ECSA network, such as the global CS community including CSA and ACSA. In terms of the audience ECSA wishes to strengthen the links to the DIY science community.

5.4.6 Medialab-Prado

Medialab-Prado is a citizen laboratory of production, research and broadcasting of cultural projects that explore experimentation and collaborative learning and have emerged from digital networks. It is part of the Department of Culture and Sports (former Department of Arts, Sports and Tourism) of the Madrid City Council.

Medialab's goals are very much in line with the innovation hub principles:

- to enable an open platform that invites users to configure, alter and modify research and production processes;
- to sustain an active community of users with the development of these collaborative projects;
- to offer multiple forms of participation that allows people with different profiles (artistic, scientific, technique), levels of specialisation (experts and beginners) and degrees of implication to collaborate.

Medialab-Prado is a part of the Department of Culture and Sports (former Department of Arts, Sports and Tourism) of the Madrid City Council. It has its origin in the 2000 at the Conde Duque Cultural Center. In 2002 took the name MedialabMadrid and in 2007 moved to its current location at the Plaza de las Letras in the basement of the old Belgian sawmill. From then on it was named Medialab-Prado referring its new location near el Paseo del Prado. After its renovation, in April 2013 the old Belgian sawmill opened to the public and became the headquarters of Medialab-Prado.

5.4.6.1 Innovation Hub Principles

Communal

The vast majority of the activities of Medialab-Prado are designed to bring interdisciplinary profiles to collaborate in the creation of prototypes. Every activity is

open, free of charge and every participant is encouraged to document the process and the results under a free/open license to make sure all the knowledge that emerges during these processes can be shared without restriction. Our goal is to make knowledge abundant and sharable by giving proper credits to the participants without emphasising the institution that acts as a mere facilitator.

Self-organising and Adaptive

There are different methodologies in the activities we propose (both within and outside the DITOs programme). One involves a mentor guiding small workshops where the general public can participate. But the main activities MP organises are open space events where the public can submit proposals for projects, such as the Interactivos activities in DITOs WP2. In these cases, MP aims to build a supportive atmosphere for these proposals to flourish through collaboration until they reach a prototype stage. MP provides infrastructure and resources such as mentorship, technical knowledge, and materials. MP tries to listen to every participant to improve its daily operations and adapt to the participants' needs when requested. Besides that, every group working on a project is totally self-organised and free to explore and work in the way they decide.

Interdisciplinary Knowledge Transfer

Medialab-Prado takes a completely open approach to all workshops, as every workshop is accessible to everybody. The first stage of such a workshop involves organising an open call for projects. Interdisciplinary projects are particularly encouraged. When the call closes, a selection made by different professional profiles. MP always makes an effort to select projects to balance their perspective and nature (artistic, scientific, goal oriented or speculative). Once the selection is complete, MP opens a call for collaborators, where different profiles are requested (but not only). This method demonstrates an attempt to encourage diverse and interdisciplinary visions and ways of working from the start.

Knowledge transfer is encouraged in two ways. Firstly, informally during the work sessions, since all the people who are collaborating in a project are sharing their abilities and experiences with the rest of the group. Secondly, formally through the importance that MP gives to properly document each project and each contribution, to make sure that anybody else can contribute subsequently to every project and even, anybody can access the project and adapt it for themselves.

The licenses MP encourages participants to use are:

- Documentation: Attribution-ShareAlike 3.0/4.0 International (CC BY-SA 4.0)[xx]
- Source code: GNU AFFERO GENERAL PUBLIC LICENSE v3[xxi]

Enabling Innovators

As said, activities are open to everyone that might be interested. What usually happens is that an interdisciplinary team is constituted for each project to work on a certain prototype. The main idea is to develop an idea into the real work by creating a working prototype. This process by its own nature enables the participants to be part of a real project where everyone can contribute leading to new ideas and innovative processes. The participation in this process increases the feeling of being capable and proactive and opens a new range of possibilities that empower the people involved.

Although the goal of MP is not to facilitate business opportunities for projects, it promotes collaborative learning and sharing knowledge, MP is starting to make the effort to put projects in contact with possible interested institutions. This might lead to further support and continuity of the initiated projects.

Global Impact

Many of the workshops MP organises are international at every stage. First, the call for projects is open worldwide and we offer travel and accommodation for one member for each selected project outside of Madrid. The call for collaborators is also international and MP offers accommodation for a limited number of participants from other cities.

This methodology applied in workshops such as Interactivos have been so successful that other countries have decided to organise their own Interactivos with MP support. Some examples are workshops in Brazil, Perú, USA, Mexico, Ireland or UK:

- http://medialab-prado.es/article/taller_mexico08_-_tecnologias_de_la_risa
- http://medialab-prado.es/article/interactivos__eyebeam
- http://medialab-prado.es/article/interactivosbirmingham
- http://medialab-prado.es/article/interactivos10_bh
- http://medialab-prado.es/article/taller_interactivos_lima09_magia_y_tecnologia_
- http://medialab-prado.es/article/interactivos12_dublin_workshop
- http://medialab-prado.es/article/interactivos12_liubliana_tecnologias_obsoletas_del_futuro

5.4.6.2 Infrastructure & Facilities

Medialab-Prado offers:

- a permanent space for information, consulting and encounters, attended by cultural mediators, who explain the nature of the space and connect different people and projects with each other;
- Open Calls for the presentation of proposals and the participation in the development of collaborative projects;
- an activities programme that comprises workshops, seminars and debates, as well as meetings of different work groups, exhibitions, conferences and other events such as concerts and performances;
- a work atmosphere dedicated to cooperation and exchange, where there is room for life and affects; and informality and closeness are supported;
- open spaces for collaborative workshop;
- an auditorium for more than 200 people;
- a supervised Fablab with CNC, laser cut, 3d printers, etc;
- a mobile wetlab with optical microscope, atomic force microscope and flow cabin;
- the whole building is accessible for people with functional diversity;

- there are some equipment such as laptops, projectors, blackboards that are provided to workgroups free of charge.

Every person can access Medialab-Prado installations during opening hours (Monday – Saturday) and move inside the building freely. The only two spaces with more restrictions are the Fablab and the Wetlab for security reasons due to the risks associated with some machines. This free access to the installations and building enables anybody to come and start participating. The institution welcomes people with a team of eight cultural mediators that provide help, connect interest with MP activities, promote collaborations and disseminate the principles of free culture.

5.4.6.3 Audience / Profile

Most of the people that participate in Medialab have university degrees coming from s wide range of disciplines such as philosophy, fine art, anthropology, engineering, computer science and biology. The common age range is from 25 to 40 years old and the gender distribution is equally (50%).

The majority of these people are familiar with digital culture, citizen labs, innovation activities, free and open software movements, DIY hobbies, etc. However new programs are being created to reach a more diverse audience. One interesting example is Experimenta Distrito, which aims to establish temporal citizen laboratories in different neighbourhoods across the city that are more connected to local realities and grassroots dynamics.

5.4.6.4 Partners & Stakeholders

MP works on a daily basis with very different professionals and institutions. Within DITOs, MP has collaborated with Ibercivis, ECSA, BIFI, WWF, Real Jardín Botánico, OpenLab Madrid.

In some cases, these collaborations are temporary (a speaker or a mentor for a seminar or workshop) but in other cases MP articulates medium and long-range relationships. This is the case of OpenLab Madrid, a citizen association passionate about DIY biology, which MP supports by giving them space and tools to form an open workgroup of DIYbio. Or the Royal Botanic Garden and the GBIF researchers where MP helps them to promote their tools to capture biodiversity.

5.4.6.5 Multiplier Arrangements

The work of MP usually finishes when the project becomes a working prototype. Therefore, MP does not count with a clear agenda and protocols for the dissemination of innovations.

However, MP offers its space to teams that want to continue to develop their projects. MP also offers a network of contacts and a vibrant community that might help some of them on different stages of the innovation processes. Ultimately, MP starts opening channels with public companies and institutions to arrange meetings for some projects that can be useful to propose solutions to urban problems or to experience the cities in innovative ways.

5.4.6.6 How has DITOs helped you to extend these Capacities so far?

DITOs is a very interesting vibrant framework where new collaborative networks are established. Having the opportunity to work shoulder to shoulder with Christian Nold and Cindy Regalado from UCL and Gaia Agnello and Claudia Goebel from ECSA, just to give a pair of examples, has been a great opportunity to exchange knowledge about practices and it has also represented an excellent opportunity to boost and connect innovative projects made by citizens in different countries.

5.4.6.7 Future

Based on the DITOs principles, Medialab-Prado might be considered already an innovation hub, since it is a mix between a hacker space, a fablab and a citizen lab open to everybody and with a clear vocation for free and open knowledge and software. However there is room for improvement.

- **Long term partnerships -** A long-term closer collaboration and communication between DITOs partners (innovation hubs) will foster best practices and spread innovation. Some open-source tools might be shared that can improve infrastructure for sharing knowledge.
- **Openness -** MP wants to be truly open, this means it has to make an effort to include more immigrants, elderly, and people at risk of exclusion and other people without a degree. These people have to feel invited to participate and exchange their knowledge and practices. The goal for approaching different publics is to give a real meaning to the word ‘open’ as in open doors, open knowledge, open science and accessibility.
- **Mobile lab -** MP is working to have a small mobile wetlab people can carry out experiments with the support of the OpenLab Madrid DIY bio grassroots association.
- **Promotion -** MP is open to any collaboration that promotes open and free access to knowledge and works for a better city and quality of living.

5.4.7 Kersnikova Institute

Kersnikova Institute is a not-for-profit cultural institution operating in the fields of investigative art, culture and education focusing on the future at the nexus of art, technology and society. It is an active production platform that encourages, facilitates and showcases investigative artistic production, creates public debate and stimulates critical understanding using citizen science and innovative education – named investigative learning approach.

The Kersnikova Institute was established in 2000 by the student organisation of the university of Ljubljana. Its philosophy is based on an ambition of becoming the central platform for contemporary investigative art & education in the region. To this end the institute is developing numerous programmes and projects that allow artists, young adults, researchers and scientists to efficiently express their creative energy, sharpen it with educational activities and assess it with the help of the audience.

Kersnikova Institute has extensive experience in cutting edge international production of artworks, as well as hosting artists and projects winning prestigious awards such as the Golden Nica. Since 2012, Kersnikova Institute has also approaching children and young adults with innovative educational model called investigative learning. It is based on Do-It-Yourself, Hands-on and Do-It-Together principles where artist, researchers, scientists and young people share their knowledge and experiences.

5.4.7.1 Innovation Hub Principles

In the analysis of the innovation hub principles Kersnikova focusses on recent developments within the institute.

By 2016, none of the Slovenian art organisations developed activities that would systematically support research & development, that would be interesting for art, science and industry, and thus operate in the market acquiring funds for additional financing of basic art and artistic activities. Based on this assessment and some international examples (Ars Electronica Futurelab, MIT Medialab, and more), Kersnikova is establishing the 'Platform' that will combine the activities of artistic producers throughout Slovenia and facilitate support for industry innovation.

The progressive companies include designers in the innovation process from the very beginning of the production processes (Design Thinking) to reach higher levels of relevance and performance product. The service within the 'Platform' (Art Thinking) precedes design methods and enables innovation for the long-term future to encourage more sustainable and far-reaching innovations, and overcoming existing disciplinary divisions.

The even closer coexistence of people and high technologies in the future will demand the creation of a philosophical, theoretical and socially consistent position that will empower the people in relation to technology, so that technology will serve people and not vice versa. In the broadest extent, this activity is called the ‘culturalisation of the techno-sphere’, where scientists and industry offer tangible result in the development and sustainability of new technological products and linked services.

The mission of the Platform for contemporary art research is to create conditions that will enable contemporary art research activities to have good and stable conditions for functional ecosystem stakeholders from education, science, business and industry, who recognise and promote national and international policies.

The activities are focused primarily on link between individuals, society and high technology in relation to quality of life. 'Platform' high-tech includes ICT, advanced computer technology, robotics, space technology, advanced branches of architecture and urbanism, to variable biological and biotechnological practices, and technologies that are currently used for the exploitation of natural resources.

Communal

Kersnikova organises incubation groups that are built around specific art projects and focuses on audience / participators and collaborators rather than innovators. In the last year, Kersnikova had projects that required specific equipment to be built either as an element in scenography or as research equipment used in the project development phase. In both cases, the artists, curators, scientists, experts, manufacturers and research institutions, worked together to design a new prototype of an incubator that

could be used in the art project as all the available equipment did not meet the needs or was too expensive. When the equipment was built and used in an art project, a representative of the incubator-manufacturing company visited Kersnikova and recommended a collaboration with their development team as the incubator the team built could be a useful model for many institutions as it solved many restrictions that appeared while using contemporary incubators.

Self-organising and Adaptive

Kersnikova strives towards enabling 'incubation' groups to materialise their ideas whilst not envisaging artists and Kersnikova collaborators as innovators (either in prototyping or in social innovation. This means providing them with space, the needed materials, help and advice from experts, equipment, and curatorial input. The institute also links them with specific companies (biotechnology, medicine, software development). The initiative lies with the individuals and groups to find synergies by themselves but they are not very autonomous; the 'needs of innovators' or rather, their projects and ideas firstly need to be in the field of the interest of Kersnikova's art, culture and educational programme and follow the institute's curatorial practices.

Global impact

For now, there has been no 'global impact' from innovation activities at Kersnikova, but with the set-up of the 'Platform', Kersnikova aims, with the help of the Ministry for Economic Development, to start an initiative that addresses cross-border collaboration with neighbouring countries and will 'export' the innovation labs to institutions and collectives outside Slovenia.

One scale-up might be considered through exhibitions – art projects that are being hosted abroad and showcase the results of the incubation processes. There are usually one or two exhibitions per year that have been produced by Kersnikova and are being hosted either by other institutions in Slovenia or abroad.

5.4.7.2 Infrastructure & Facilities

Kersnikova Institute is an institution, comprising four main physical 'departments'. Kapelica Gallery is the main art production platform for facilitating and showcasing contemporary art production in the field of hybrid art (art & science, bioart/art working with life systems). RAMPA Lab & BioTehna are departments that are classified as maker / hacker spaces / fablabs, which is a meeting point (physical and conceptual) for artists, scientists, engineers, designers and companies. These spaces offer access to materials and equipment such as laser cutters, CNC machines, 3D printers, laboratory and programming equipment. The difference between the spaces is that RAMPA Lab is more of a technology (machine, robotics, programming) lab, whereas BioTehna is a wetlab focusing on exploring life systems. The meeting point is the so-called 'Vivarium' that provides a cross-section of processes used in the aforementioned labs on projects and activities that address machine – plant interactions such as the Green Wall project.

5.4.7.3 Audience / Profile

The audience of Kersnikova institute varies depending on the activity and which department facilitates the activities and processes. While Kapelica Gallery hosts mainly adult / mature audience (18+) and is able to accommodate around 200 people per

opening and up to 1000 people during an exhibition, RAMPA Lab and BioTehna host groups up to 15 people per specific workshop or similar activity. These are mostly children and youngsters 8 – 18 years of age and there are either groups from diverse social backgrounds or gender specific groups (women only). The groups can be even smaller – the incubation processes are usually composed with up to 6-8 people, consisting of cultural workers (producers, artists, curators, etc), scientists (biotechnology, biochemistry, chemistry) and technical experts (computing, programming, robotics) that are joined in executing the project by designers, manufacturers and other individuals translating innovations into 'products' (elements, equipment, materials).

5.4.7.4 Partners & Stakeholders

For DITOs related activities, we have had a couple of notable partners that have joined in our innovation processes and have already benefited from the processes. The National Institute of Chemistry has borrowed Kresnikova equipment for running some workshops and has already benefited from user feedback regarding the equipment. The manufacturer of 'environmental test chambers' donated a chamber worth €2K to BioTehna lab for research purposes and will continue collaborating in the mentorship programme, as will another manufacturer of 'incubators' that observed the specially-developed incubator for an art project. Other collaborators such as a manufacturer of high-end laboratory scales and robotics laboratory have also expressed their intent to be a part of the 'Platform' and incubation processes by contributing equipment, materials and young people – either the ones starting their careers or as scholarship grantees.

5.4.7.5 Multiplier Arrangements

Usually, the dissemination of 'results' and 'innovations' is carried out in the frameworks of public events, such as art exhibitions or science café-type events, where participants are able to comprehend the innovation holistically and put it in the context of everyday life, characteristics of the world we live in, our relation to technology and science discoveries.

The younger population comes in contact with various innovations (either material or social) via education programmes, where they work on individual phases, mimicking the ones that enabled the original innovation and learn to understand technical aspects and the 'meaning' behind a specific innovation.

5.4.7.6 How has DITOs helped you to extend these Capacities so far?

DITOs has helped in legitimising the visions and programmes of Kersnikova. This is important since institutions from more established sectors sometimes have doubts about the benefits of collaborating with an art institution. DITOs has enabled some experts that are collaborating with artists or in the programme of Kersnikova in general, to be paid fairly for their work. This is important since cultural institutions are rarely able to pay experts sufficiently large fees to reflect their actual importance within a project.

5.4.7.7 Future

In the future, the idea is to bring in more companies and research & development to participate in the 'Platform'. The Platform is set to facilitate at least 6 'innovation labs' in

Slovenia in different regions, with each lab being connected to local (national) cultural organisations. These allow artist to collaborate in the production of contemporary investigative art projects with materials, knowledge and equipment and in return receive access to the incubation processes where the team will explore innovations in specific fields.

Kersnikova is very keen to be an active member of the DITOs / ECSA innovation hub network as a representative of a Slovenian network of innovation hubs/labs. After the conclusion of the process of establishing the innovation labs under one local/national hub, Kersnikova has an interest in exchanging people, materials, equipment and practices among other members of the DITOs hub. Kersnikova would mostly be interested in providing artists / researchers scientific and technical assistance from other (foreign) members in the hub networks and in return offer access to new ideas and product stemming out of the already completed or ongoing processes to other partners in the hub.

5.4.8 Meritum

The Center for Training and Personal Development MERITUM is a Polish association founded in 1999. Its mission is to build civil society and improve the quality of human resources with respect to principles of sustainable development. MERITUM was created by high-ranked professionals and volunteers. The association has extensive experience in the implementation of training projects. Since 2006 almost 600 people graduated from the MERITUM School of Trainers, a 9th months learning programme for professional trainers (level 5. EQF – European Qualification Framework). An important part of the MERITUM philosophy is a DIY approach. Participants of projects and the School of Trainers are responsible for leading their own small projects within their communities. In the project ‘Green Revolution on Kłodnica River’ (PHARE support) the participants – 49 teachers - activated inhabitants of Katowice to undertake bottom-up actions to save the river. In the ‘Youth in Action’ programme, MERITUM led a project on civil assessment of Agenda 21 implementation in selected cities in Poland, Italy, Spain and Portugal. Since 2012 MERITUM leads monthly science café on sustainable development and ecology as well as project eco21.pl in partnership with Mapping for Change. It aims to introduce change in Poland via local agents with the support of social mapping tools.

5.4.8.1 Innovation Hub principles

Communal

The activities of Meritum bring a growing community of innovators together and focus on connecting these people. Each year Meritum runs up to two edition of the School of Trainers, promoted on website and social media. Each month Meritum organises workshops on sustainability and every year organises Endorphines – a special festival for women. All the activities bring people together and create liveable community around the institution.

Self-organising and Adaptive

Many of Meritum events have a predetermined program, in which visitors can simply participate: for example the DITOs DIY Lab workshops or science cafes. These events usually attract a public that is getting to know the institute and possibilities.

On the other hand, Meritum also organise several possibilities for self-organising of communities. The workshop rooms and kitchen is open for anyone to organise their own activities. Additionally, the Endorphines Festival includes several workshops that are prepared and led by community leaders.

Interdisciplinary Knowledge Transfer

The knowledge transfer is organised via several channels, depending on the needs of the users. Facebook groups are used for sharing information and documents. Reports or ready-to-use products like maps are shared on website eco21.pl. During the School of Trainers workshops, participants are co-creating the training agenda.

Enabling Innovators

Meritum is focused on social innovation. The philosophy of Meritum's actions is to work with leaders who aim to change themselves to change the world. Meritum enables several tools for innovators such as improvement of communication skills (eg. interpersonal training) and development of their understanding of the environment (eg. training based on principles of George Sessions and Arne Naess).

Global Impact

The innovation activities at Meritum usually start with a local focus, but have international impact. First we publish all the documents and tools with Creative Commons open license. Innovators from all over the world can use them in their research and actions. Meritum also runs a network of co-operating institutions for exchange of knowledge between people (eg. Fix the City Foundation, Association 'Workshop for All Beings' and Fastener Association).

5.4.8.2 Infrastructure & Facilities

Meritum offers two fully equipped workshop rooms with social facilities. These rooms are open for members of community after booking. Additionally, there is kitchen that is suitable for cooking workshops.

5.4.8.3 Audience / Profile

Meritum does not track the users of the infrastructures. Instead it tries to build a community feeling and responsibility for common goods. Activities bring a broad range of people from corporate workers to freelancers. Most of the time people attend events in their free time. Typically, participants are looking for inspiration, like-minded explorers, new social connections and a place to search for ideas or new paths in their lives. The audience is composed mainly of women around 25-35 years old.

5.4.8.4 Partners & Stakeholders

Meritum creates wide networks of institutions, partners and stakeholders that contribute to its activities and exchanges of knowledge. An important part of its work consists of

the training program developed by Meritum. Here people can transfer their knowledge and improve their interpersonal skills. Meritum closely co-operates with Fix the City Foundation, Association 'Workshop for All Beings', Fastener Association and the Silesian University.

5.4.8.5 Multiplier Arrangements

Meritum tries to develop several mechanisms to ensure that innovation activities are amplified. The participants of Meritum activities can exchange their knowledge during events. The social media presence is leveraged for spreading the online documentation by community members and immediately gives them a much wider audience.

5.4.8.6 How has DITOs helped you to extend these Capacities so far?

The DITOs project helps to develop wider community thanks to cyclical organisation of science cafes and co-operation with new organisations (eg. Silesian Festival of Science, TEDxKatowice). It also enables international transfer of knowledge between partners of the project and adaptation of their experience to Polish conditions, such as the BioBlitz.

5.4.8.7 Future

- Identify existing resources within already operating innovation networks, especially at the local level. For example to support the need of participants that organise events that require a bigger room or additional equipment. As an innovation hub Meritum would like to direct them to these partners.
- Attract more people with a science and research background. This will help to build a more mixed community that will be more innovative.
- Connect to other DITOs Hubs: introduce additional formats based on the experience of other DITOs partners. Adaptation of such actions to national conditions.

5.4.9 UNIGE

The Bioscope is part of the University of Geneva (UNIGE) Scienscope – a series of public laboratories that offers schools and the general public a new way to discover the world of scientific research and their social consequences through hands-on activities. The Bioscope is devoted to the life sciences and the biomedical sciences. It offers a unique environment – part lab, part classroom, part hacker-space – that brings together innovative models of teaching, learning and discovery. It offers a large panel of activities for school children and the general public and themes ranging from biodiversity to the neurosciences. The Bioscope runs citizen science projects such as « Participatory Biodiversity », where children and the general public contribute to barcoding insects and plants of the Geneva region. Finally, the Bioscope is a research laboratory for developing new approaches to teaching science and involving the greater public in scientific research.

5.4.9.1 Innovation Hub Principles

Communal

The Bioscope draws from its insertion in a university to connect academic researchers with school children, the greater public, and various stakeholders outside the university, including schoolteachers and entrepreneurs. By bringing academic researchers to participate in public events, the Bioscope aims to provide enriching experience for the public and transform the understanding that research scientists have of the perceptions, opinions, and aspirations of the public. The Bioscope is particularly attentive to overcoming the barriers existing between academic researchers and grassroots communities.

Self-organising and Adaptive

The Bioscope values self-organisation and agenda setting by participants. However, these aims are particularly difficult to implement within the limited time (90 minutes) and resources (around 20 students at one time) available for out-of school education activities. However, the Bioscope offers the possibility for individual students (age 17-18) to develop their own research project in one year using the DNA bar-coding technique. More generally, the Bioscope offers a fully equipped biological laboratory for people who want to carry out research projects of their own, for example in developing new technologies at prototyping and testing stages before moving to the start-up foundation.

Interdisciplinary Knowledge Transfer

The Bioscope team is highly interdisciplinary, bringing together people with backgrounds in biology, medicine, science education, communication, and science and technology studies. It collaborates with a number of sectors in the university, including psychology, educational studies, computer science as well as the natural sciences. It also collaborates with the outreach laboratories in mathematics, chemistry, and physics in order to develop educational activities on real world themes that do not easy fit in unique disciplinary frameworks, such as conservation, sustainable development. However, the Bioscope is attentive to disciplinary differences that should not be ignored, but rather highlighted and contextualised.

Enabling Innovators

The Bioscope offers its laboratory space and lends its support to innovators who want to develop new biomedical or educational technologies. The start-up SwissDeCode, which offers a new technology for the rapid identification of food products through DNA barcoding, was in part developed at the Bioscope by a postdoc from the University of Geneva, Dr. Gianpaolo Rando. The technology also solved a problem faced when using DNA barcoding for outreach activities, namely that it takes over 24 hours to obtain a result. The new technology has brought this down to 30 minutes, making it possible to obtain results during the 90 minutes activities conducted with the public. The Bioscope is also used as a technology and educational laboratory by schoolteachers who want to develop new devices. A number of such technologies were developed and tested at the Bioscope, such as unique tool to visualise in real-time microscopic observations or an image-sharing platform that fits the specific needs of school teachers.

Global Impact.

The Bioscope hosts a number of international visitors (Europe, Unites-States, Asia, and Africa) who want to learn about our outreach activities and learning technologies. Its first conference on DIYbio, 'Biofabbing: Fabrications and Fabulations' brought together over one hundred biohackers, artists, scholars, and activists from Europe as well as the United States, Colombia, Nicaragua, China, Nepal, Bangladesh, Indonesia, Japan, Turkey, and Cameroon.

5.4.9.2 Infrastructure & Facilities

The Bioscope has a dedicated open space (currently under transformation) within the University of Geneva where it conducts its outreach activities, as well as a preparation laboratory, and offices for the staff. Being part of the university allows it to access the many facilities of the university and organise visits to research laboratories.

5.4.9.3 Audience / Profile

The Bioscope works mainly with school children aged 10-19 years old as well as the greater public and professionals in fields, such as health, business, and education. It tries to reach out to underserved audiences, such as patient groups, or other underprivileged groups.

5.4.9.4 Partners & Stakeholders

The Bioscope partners with other research organisations in Geneva, such as the Museum of Natural History and the Conservatory and Botanical Garden, with schools, and out-of-school learning spaces and hackerspaces (Hackuarium, Swiss Biolabs Network), health organisations, local government (especially around issues of education, health, and the environment), and public private foundations and companies, mainly in the science and technology sector. It also partners with grassroots organisations such as the Hackteria Network.

5.4.9.5 Multiplier Arrangements

Bioscope uses social media (Instagram and Twitter) to interact with the public as well as a dedicated web platform. It is also regularly showcased on public television and radio in relation to issues of citizen science and public participation in science.

5.4.9.6 How has DITOs helped you to extend these Capacities so far?

Thanks to the DITOs project, we were able to organise an international conference, 'Biofabbing: Fabrications and Fabulations', bringing together Biohackers, DIY activists, and academics helping each of them connecting while sharing knowledge and strategies. The various contacts within the DITOs network have also proved most valuable to share and learn new outreach strategies and skills.

5.3.1.7 Future

The main goal for the Bioscope is not to become a large innovation hub as this is not the main mission in the community. Nevertheless, we will continue our work on creating network between academic and non-academic local communities, using the experience gathered with our DITO partners. In the future, we will continue working with our local

partners, especially schoolteachers, supporting them in innovating and creating new ways of doing science with children. The Bioscope is set to move in the next year which will offer will more space for outreach activities.

5.4.10 Tekiu

Tekiu Ltd is a knowledge transfer company passionate about creating opportunities for policy and decision makers to experience the latest developments in research and innovation within international settings. Tekiu's principle service is the **Discovery Trip (DT),** which is a ~2 day focussed study visit to another country offering delegations the opportunity to meet with thought leaders and actively witness examples of good practice. Tekiu works with groups from government, civil services, academia, industry and trade associations. The thematic focus is on the life sciences, digital economy & environmental sciences and Tekiu's specialty geographies are Scandinavia, the United Kingdom and German-speaking countries.

5.4.10.1 Innovation Hub Principles

The following descriptions provide an overview of how Tekiu Ltd puts the DITOs Innovation Hubs Principles into action.

Communal

The underlying motivation for the DT format is to offer an engaged communal experience and develop a positive group dynamic around knowledge sharing. Tekiu takes mixed delegations to an international location where they meet with their counterparts and individuals/organisations that are pushing the boundaries of innovation. The DTs are opportunities to have an immersive experience moving beyond information sharing via typical written formats such as reports and policy briefs. DTs offer the opportunity to build networks both within the group and with host organisations. The act of taking the participants out of their usual professional contexts and surroundings to guide them along a mutual journey in a different geographical location is fundamental to developing a sense of community amongst the group members.

Self-organising and Adaptive

Tekiu takes time developing the programme for DTs, to ensure that they reflect the specific interests and/or address the objectives of the group. This happens through an iterative process in the early planning stages of a DT.

Built into the DT programmes, Tekiu offers delegates the opportunity to interact with each other in informal and unexpected settings. Examples from past Discovery Trips have included taking a Segway tour in Holland or visiting a cheese farm in Switzerland. Such 'brain breaks' interspersed within the rest of the programme allow participants to reflect on the shared experience in a more relaxed way, drawing on their individual experiences to gain a new understanding of the topic in focus and develop future collaborations.

Due to the logistical challenges of coordinating international group study visits, much of the programme is pre-determined, leaving little space for self-organisation and adaptability. Tekiu has considered offering different sub-streams of activities within a wider DT programme, so they may develop more flexible formats in the future.

Interdisciplinary Knowledge Transfer

Tekiu's programmes are designed to address the particular knowledge gaps on policy themes identified by their clients. These themes often lie in the boundaries between disciplines and so the DTs are necessarily interdisciplinary. Tekiu often includes meetings with organisations on the fringes or newly emerging in the sector, to provoke new ways of thinking. Typical DT programmes can include meetings with MPs, on-site visits to industry leaders or civil society projects, etc. For example, during a trip to Germany on the topic of migrant integration & infrastructure, the Tekiu delegation visited the in-house incubator at Deutsche Bahn, DB mindbox; the civil society managed asylum project at Templehof Airport in Berlin and met with civil servants and mayors of four German cities.

Tekiu plans these trips via briefing packs, infographics and audio files to prepare delegates for the DT. This background material allows them to take full advantage of meetings with hosts even if they work in different sectors. The participants have often commented that the preparatory material helps them to get the most out of the exchanges.

Tekiu also facilitates hands-on workshops within the DT programme, to allow time to process and reflect on the messages that are learnt throughout the trip. This helps to integrate the knowledge gained from meetings with different organisations and disciplines.

Enabling innovators

Tekiu delegates and hosts are innovators because they are interested in sharing knowledge and experiences across borders. They are open to meeting with others to discuss the challenges and solutions available to specific policy issues, and to build international networks of practice.

Through careful planning of creative programmes Tekiu enables the participants to gain inspiration and establish new connections. These developments can be difficult to capture and track long term, but the participants have reported that they take the learning acquired during trips and share it with colleagues, sometimes triggering new directions of work and informing organisational change. By including meetings with social enterprises, civil society organisations and entrepreneurs in the DT programmes, Tekiu provides a platform for change makers. These groups have a chance to demonstrate their innovations to high-level decision makers and therefore increase their impact. Previously, a meeting to the Unternehmer TUM incubator in Munich with a group of Swedish mayors helped to establish a collaboration between one of the companies and the city of Gothenburg.

The Tekiu team are developing strategies for longer term 'aftercare' within our networks. These will help to track longer-term innovations that have been enabled by Discovery Trips.

Global Impact

Tekiu's principal service, the Discovery Trip, is built on the belief that international knowledge sharing and network building lies at the core of innovations and solutions to policy challenges. By taking participants outside of their normal setting and enabling

their meetings with counterparts in other countries we ensure that the resulting impacts and networks are informed by a global context. Previous trips have helped to establish new connections and agreements for collaboration between organisations based in different countries.

5.4.10.2 Infrastructure & Facilities

Tekiu does not run activities from a permanent base, therefore we currently rely on host organisations for infrastructure & facilities during DTs.

5.4.10.3 Audience / Profile

Tekiu typically engages with policy makers, regulators, civil servants, industry and trade associations. This will also be the target audience for the DITOs Discovery Trips. The group size for DTs typically range between 8-25 people.

As an example, the first DITOs DT delegation (taking place Sept 2017) are a mixed group from Poland: 11 representatives from regional government, civil servants, entrepreneurs and civil society organisations (4 female, 7 male).

5.4.10.4 Partners & Stakeholders

The work of Tekiu has the potential to complement the activities and events being run by all DITOs partners and Tekiu is keen to work collaboratively. To this end, Tekiu has been developing relationships with many of the partner organisations:

- Tekiu is working closely with the ECSA team on policy engagement for DITOs and this is helping to identify audiences for our respective work;
- working with Meritum to organise the first DITOs Discovery Trip (taking a Polish delegation to London), which will feed into a longer term effort to create a cross-sector working group focussed on air quality issues in the Upper Silesia region of Poland;
- in discussions with most other partners e.g. Waag Society, UCL, ECSA, Medialab Prado, Kersnikova to collaborate on future Discovery Trips. Tekiu adapts the Discovery Trip service according to the needs and aims of individual partners, their local policy context and the events that they have planned for the remaining 2 years of DITOs. This stage requires working together & learning from one another.

Through the offer of combining DT with existing partner events, Tekiu is enabling partners to get involved in a new activity and attract a new audience for their work (policy and decision makers). Tekiu also benefits greatly from these relationships as they are getting the opportunity to work in new geographies, and learning new methodologies and facilitation approaches. The final result is a truly collaborative effort that needs both sides to succeed.

5.4.10.5 Multiplier Arrangements

Discovery Trips are opportunities to build networks and sustained relationships for the participants, both within the delegation and with the host organisations in the international location. Tekiu integrate workshops and ‘informal mixers’ into the programmes of DTs to allow delegates to form connections and share ideas.

After the DTs, Tekiu produces a summary pack that includes a presentation overview from the trip, links to any resources and documentation shared by host organisations and shares contact information between the delegation members. These materials are typically used by the participants to disseminate lessons learnt within their organisations and beyond.

The Tekiu team has taken part in activities organised by other partners such as running a policy workshop at the Biofabbing Conference in Geneva. Tekiu participated in the online discussion forum hosted by Hackteria in the build-up to the conference to share resources and some of these were taken up by other participants at the conference.

5.4.10.6 How has DITOs helped you to extend these Capacities so far?

- The DITOs project has allowed Tekiu to connect with new audiences and to realise the value of their services focussed on knowledge sharing to sectors beyond policy such as academia and civil society organisations.
- Association with EC project funding has allowed Tekiu to gain visibility and build relationships with new clients in the UK and on the European level.
- The project is enabling Tekiu to expand to new geographies through collaborations with partners, e.g. Poland.
- Through interactions with DITOs partners, Tekiu is learning about other effective formats for interdisciplinary knowledge sharing and some of these are very relevant for them to incorporate into the services that are offered to clients in the future.

5.4.10.7 Future

Tekiu's focus continues to be the passion of knowledge sharing between individuals from different backgrounds. It aims to continue to develop services and to move even closer to the shared values embodied by innovation hubs identified by the DITOs project.

The first targets include:

- **Self-organisation -** Consider increasing opportunities for self-organising and adaptability where possible. In the current framework of DTs, Tekiu has had little opportunity for more flexible portions to the programme. Depending on the aims of future DTs, there might be more of a need to create these opportunities.
- **Infrastructure and support -** we are working towards expanding the business to allow Tekiu to have a permanent London base. This would allow Tekiu to offer an expanded range of services and activities for the local community.
- **Dissemination -** Through DITOs, Tekiu is learning about more effective dissemination efforts through online platforms. The team is currently developing their social media presence through blogs & Twitter and will continue to work on this into the future.
- **Network -** Tekiu will continue to develop ideas for collaborations on DTs with other DITOs partners. Tekiu will keep expanding their European network through participation in partner and other relevant events. We will also continue sharing

experiences and learning from other partners about how best to reach new audiences. We are particularly interested in exploring how to bring more diverse and underserved stakeholders into sustained interactions with high-level decision makers.

5.5 Overall Analysis

The analysis of each partner provided the opportunity to establish an individual benchmark for the establishment of the DITOs innovation hubs network. This chapter, has presented an overall analysis that highlights the commonalities and differences of the partners as well as their desires for the future.

In the analysis of the current implementation of innovation hub principles one aspect clearly stood out: the dedication of each partner to openness. Open and free access, open knowledge, open labs, open data, open minds were frequently mentioned as key values and drivers of the partners. This is remarkable because of the diversity in the type of institutes that the DITOs consortium consists of and aligns well with the RRI focus on Openness & Transparency as well as the EC's agenda on Open Innovation.

Communal

The DITOs partners are all committed to create communal innovation hubs by following a number of guiding actions. Most partners do not position themselves just as facilitators, but perceive themselves as practitioners of innovation too, and therefore express a sense of togetherness. Most events are open to any public as well as the social media platforms. When facilitating communal processes the hubs find it necessary to organise subgroups, in what are called 'working groups' or 'incubation groups'. Special attention was paid to the content of events, for example by not focussing too much on the latest tech for the sake of innovation.

Self-organising - adaptive

In DITOs the partners prefer activities that revolve around a directed process by mentors or so called 'mediators' or 'facilitators'. These mentors make sure that the activities bear an open atmosphere, welcoming co-creation and encouraging the initiative of the participants. Although the programs have clear open elements that allow for self-organisation and adaptation, the participants are directed towards making a plan, a prototype or establish knowledge exchange. In the activities that have a focus on social innovation, the mentors guide the deliberations.

Interdisciplinary knowledge transfer

Interdisciplinary knowledge transfer is the sole purpose of some of the DITOs partners. It is achieved in a wide range of activities, often by combining hands-on experiences with documentation and knowledge sharing sessions. All partners find the context of innovation as important as the innovation itself, and in order to include that context participants with a wide range of educational and professional backgrounds are brought together. The co-locating and mediation on a personal level is described as a fundamental element too, which is curated in the case of MP Interactivos or left completely open such as in Open Lab sessions of WS. For connecting CS with publics that are unfamiliar with the subject, for example policy makers, special programs are

tailored to their needs. Apart from physical interactions in real life, all partners have created online platforms for knowledge transfer.

Enabling innovators

Clearly there is no consensus on the term innovator within the consortium yet. Some indicate that the participants in events should not be addressed as innovators at all. Also, the DITOs activities are often not specifically targeted towards innovation. In those activities that do have innovative outcomes the use of open and free tools, such as open software and hardware, and the atmosphere that is described as encouraging, inspirational and extending capabilities is indicated as of great importance.

Global Impact

Many activities do not have a focus on global impact. The use of open tools and kits do bring a global community context, and contributions to open repositories in order to have a global effect. The outlining of generic principles in a manifesto, such as the ECSA 10 principles of citizen science, has proven to be most effective. Also MediaLab Prado and Kersnikova have described how other institutions replicate some of their programs. There is a desire to have those type of collaborations with the DITOs consortium too.

Infrastructure & Facilities

Almost all DITOs partners provide meeting spaces for innovators and some even offer specific permanent dedicated laboratory infrastructures or access to similar infrastructures on ad-hoc occasions. In the case of MediaLab-Prado these spaces, apart from those containing dangerous machines, are completely open to the public during opening hours. Others have created temporary, mobile spaces or have no permanent space at all. UCL mentioned offering a collection of devices that are available for lending as one of their facilities.

Audience / profile

One of the priorities of RRI is a focus on inclusiveness and diversity, which is one of the reasons why the profile of DITOs activities audiences are equally diverse as the range of activities themselves. The majority of activities are focussed towards adults up to the age of 50 years, although specific programs address adolescents primarily between the age of 12 and 18. The majority of participants have a higher education background, while efforts are made to include a more diverse group as well as include disadvantaged groups. Notably, an equal gender distribution is observed apart from special women-only activities. The number of participants ranges from 5 - 1000.

Partners & Stakeholders

Basically the partners mention two different types of partners and external stakeholders. First of all specific project short-term event partners relevant to local events or speakers at local events are mentioned as partners. On the other hand, long lasting strategic thematic partnerships are forged that are often internationally relevant. These partners could already be involved in citizen science, but this is not an absolute requirement. Some DITOs partners perceive their community members as partners too.

Multiplier arrangements

Several mechanisms are used to amplify the impact and reach of the innovation activities. Obviously all partners have extensive online presence that is used to promote the innovative processes and work, and use innovative ways to utilise these such as Podcasts and Vlogs. Apart from that the outcomes of activities are translated into open kits or educational programs, that ensure knowledge and skills get transferred to a wider audience. Finally, perhaps needless to say, the partners present outcomes at festivals and conferences.

Role of DITOs

The role of DITOs in becoming and strengthening the innovation hub capacities of the DITOs partners on top of the ability to execute the activities described in the DOA are mainly distinguished as an increase visibility and an extension of current audiences. DITOs has exposed the partners to trends and methodologies from new geographies, which are stimuli much needed to trigger creative thinking that is crucial to the innovation processes.

Figure 15 presents a mapping of the DITOs partners according to their emphasis on public or policy audiences across the environmental sustainability and biodesign topics. It shows how the DITOs partners complement each other and what areas are already well covered within the project.

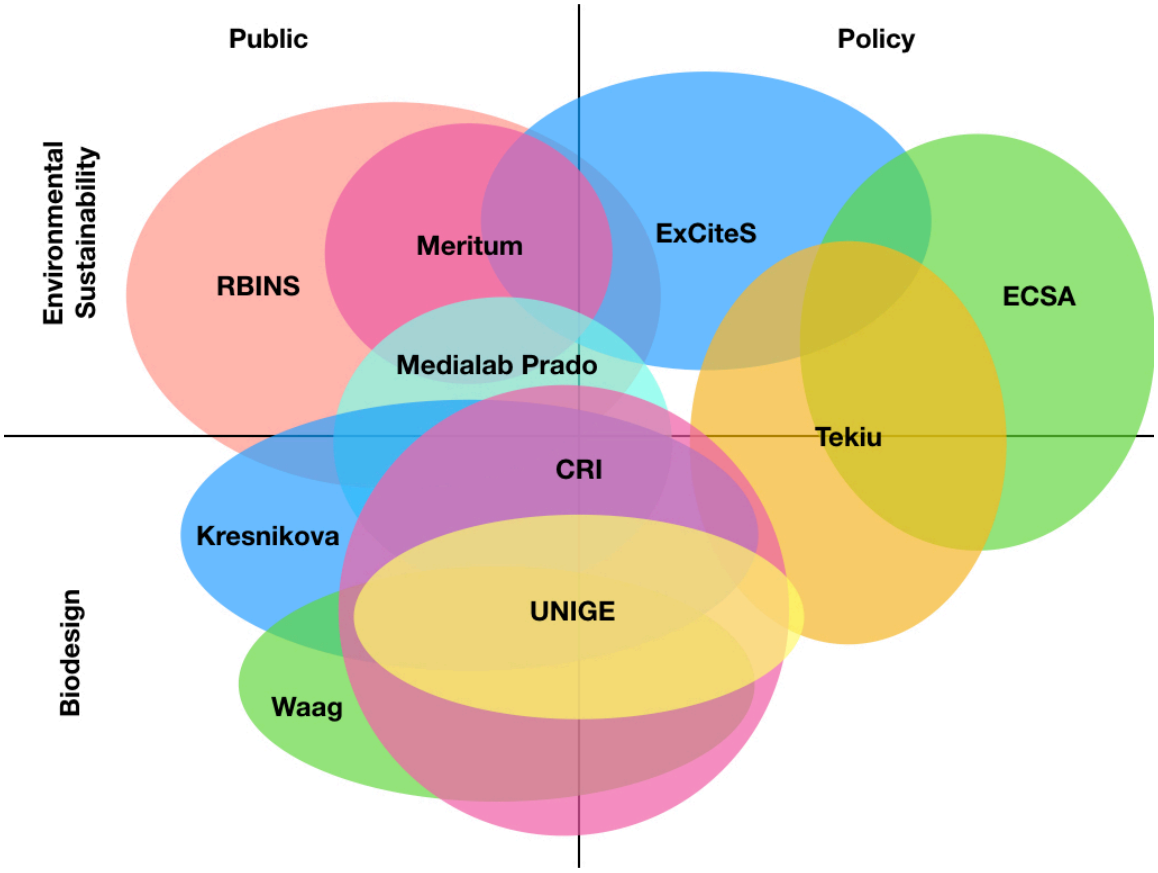


Figure 15: Mapping of DITOs partners according to environmental sustainability and biodesign topics and the public and policy audiences

Future

The analysis above mainly addresses the status quo of the current innovation hub landscape of DITOs. The next step is to identify the needs and desires for the remaining 18 months of the project.

These desires point in two directions. Either there is a focus on improving the local innovation capacities, through the extension of the physical space and infrastructure, provide additional support to the local community or attract additional funding.

On the other hand, there are needs and desires that point in the European and global direction. Many partners have expressed a need for an online platform that provides ways to connect, map, evaluate and teach CS. The DITOs partners can also mediate the national ecosystem of innovation hubs to the European level.

6 Conclusions and Next Steps

This deliverable describes the concept of innovation hubs and out of the analysis of the status quo it shows that DITOs partners encompass several characteristics of innovation hubs (Figure 2). This analysis will serve as the benchmark or starting point for the next 18 months, in which the network will be structured, exchange between partners enhanced, and networking capacities enlarged. In order to achieve that eight factors can be distilled from the analysis, detailed below:

6.1 Eight steps for DITOs Innovation Hubs

6.1.1 Fine-tune the Innovation Hub Concept and Principles

The concept and definition of a hub that facilitates the transformation of new ideas, concept or methods in the context of citizen science as a whole and DITOs in particular will require additional fine-tuning. Especially the definition of term ‘innovators’ raises questions about whether there is a difference, and if so what distinguishes regular citizen science from citizen science focused on innovation.

In the upcoming consortium meetings and online conference calls special sessions need to be prepared on the fine-tuning of the consortiums understanding of these concepts.

6.1.2 Enhance the Exchange of Best Practices

The DITOs partners often excel in one or a few principles of an innovation hub, but all have room for improvement on other principles as well. The primary focus of the innovation hubs should be the further exchange of best practices, and thereby raising and levelling the playing field simultaneously. Not just the hubs, but also the participating citizen scientists themselves, should co-create these processes.

It has also been suggested to organise an exchange program on citizen science. A program that enables professionals or students from a partner organisation to spend up to one month in another organisation to learn about the structure, share best practices and co-create a project or event.

6.1.3 Increase the Functionalities of the Online platform

For the individual hubs to meet and connect between the regular consortium meetings it makes most sense to utilise an online platform. This could either be the DITOs project website www.togetherscience.eu, which will be adopted by ECSA by the end of the project, or the current ECSA website. Specific desires such as the possibility to map, evaluate and teach CS have been pointed out, including the hosting of MOOCs. There is also a desire to connect the existing documentation platforms of the DITOs partners.

A more detailed functional platform design plan is necessary for:

- The visibility of the hubs in the ECSA network;
- Online support for the workflow of the hubs;
- A system for external parties to contribute;
- The application process for new innovation hubs;
- Links and integration to different platforms, such as meetups;
- Initiation of research questions & projects;
- Facilitation of interaction between users and organisations.

6.1.4 Outline a Legacy Plan for DITOs Innovation Hub Network integrating into ECSA

There is a need for a legacy plan; a consistency plan for the DITOs innovation hubs to continue their work once the DITOs project is over. In D3.3 ECSA will report on this. Most importantly it needs to address the challenge of maintaining participation that has been pointed out by several partners.

6.1.5 Key Performance Indicators for Innovation Hubs

A number of project partners have expressed an interest in exploring whether it is appropriate to measure the effectiveness of innovation hubs by Key Performance Indicators. The Spheres Framework that is currently in development at UPD serves as a great qualitative starting point, from which a more quantitative model can be derived.

6.1.6 Draft a DITOs Innovation Hub Manifesto

The aim of the DITOs innovation hubs network is not limited to the commitment of DITOs partners, but to include non-DITOs organisations into the network as well. The analysis of existing innovation networks, as well as ECSA's experience of spreading the '7 principles of Citizen Science', show the power of having a comprehensive, easily shareable and adaptable manifesto. Therefore, it is recommended to create a public DITOs innovation hub manifesto.

6.1.7 Present Value to External Stakeholders

Several partners have indicated the need for including business partners and policy makers in their activities, while a number have already successfully done so. A key success factor was the ability to present a clear value proposition.

6.1.8 Diversify Audiences

A special working group could be started that focuses on the diversification of audience profiles. The majority of the DITOs partners have indicated a desire to continue to improve this aspect of their innovation practices, and this aspect is a priority in RRI practices.

6.2 Conclusion

All the steps above have the common aim of converging the current parallel activities, and creating a clearer value proposition for citizens, scientists and all other innovators. Considered as a whole, the DITOs partners encompass the full breadth of an innovation hub. It is now time to diffuse the expertise that resides in each node through the network of partners.

7 Bibliography / References

[i] "Open Innovation, Open Science, Open to the World - a Vision for Europe." Digital Single Market. 2017. https://ec.europa.eu/digital-single-market/en/news/open-innovation-open-science-open-world-vision-europe.

[ii] InterActive Terminology for Europe ID 1475993 http://iate.europa.eu/FindTermsByLilId.do?lilId=1475993&langId=en

[iii] "Innovation Union: A Pocket Guide on a Europe 2020 Initiative.", Publications Office of the European Union, 2013. https://publications.europa.eu/en/publication-detail/-/publication/6f270d5f-8086-4b70-82b2-c4353d253720.

[iv] "Guide to Social Innovation - European Innovation Partnership", European Commission (2013) https://ec.europa.eu/eip/ageing/library/guide-social-innovation_en.

[v] Gryszkiewicz and Friedrici, 2014 http://www.innovationmanagement.se/2014/12/15/learning-from-innovation-hubs-fluidity-serendipity-and-community-combined/

[vi] Owen, Macnaghten and Stilgoe. "Responsible Research and Innovation: From Science in Society to Science for Society, with Society." Science and Public Policy 39, no. 6 (2012)

[vii] Van Holm, Eric Joseph, 2014 What are Makerspaces, Hackerspaces, and Fab Labs?

[viii] http://fab.cba.mit.edu/about/charter/

[ix] http://www.openthings.wiki, http://www.wevolver.com and http://www.youmagine.com

[x] http://www.tcbl.eu

[xi] http://www.livingknowledge.org

[xii] Friederici, 2014. What is a tech innovation hub anyway? http://cii.oii.ox.ac.uk/2014/09/16/what-is-a-tech-innovation-hub-anyway/

[xiii] Haklay, M., and Francis, L., forthcoming 2017. Participatory GIS and community-based citizen science for environmental justice action, in Chakraborty, J., Walker, G. and Holifield, R.(eds.), *Handbook of Environmental Justice*, Routledge

[xiv] https://ecsa.citizen-science.net/about-us

[xv] https://ecsa.citizen-science.net/global-mosquito-alert

[xvi] https://ecsa.citizen-science.net/documents

[xvii] http://ecsa.citizen-science.net/

[xviii] Göbel, C., Agnello, G., Baïz, I., Berditchevskaia, A., Evers, L., García, D., Pritchard, H., Luna, S., Ramanauskaite, E. M., Serrano, F., Boheemen, P. v., Völker, T., Wyszomirski, P., Vohland, K. (2017):European Stakeholder Round Table on Citizen and DIY Science and Responsible Research and Innovation. Doing-it-Together Science Report. URI: http://discovery.ucl.ac.uk/id/eprint/1563626

[xix] https://www.zotero.org/groups/citizen_science_reference_database/

[xx] https://creativecommons.org/licenses/by/4.0/

[xxi] https://www.gnu.org/licenses/agpl-3.0.html