INTEGRATING OPEN AND CITIZEN SCIENCE INTO
ACTIVE LEARNING APPROACHES IN HIGHER EDUCATION

Implementation Framework for Open Knowledge Activities

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Abstract:

The document corresponds to O3A1 of the INOS Project. This framework elaborates the literature on how to conduct open knowledge activities, and particularly focuses on the organizational aspects of how to create open knowledge activities between the higher education institutions and external stakeholders engaging the wider public. The framework proposes the model for implementing, evaluating and reporting open knowledge activities in O3A2.

Keyword list:

Open knowledge activities, public engagement, co-creation, co-design, evaluation, active participatory citizenship, design criteria, open data, knowledge creation

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List of Abbreviations

The following table presents the acronyms used in the deliverable in alphabetical order.

Abbreviations	Description
HEI	**Higher Education Institutions**
LDF	**Learning Design Framework**
OKA	**Open Knowledge Activity**

Executive Summary

The INOS project intends to involve academic and library staff, university students, citizens with various levels of expertise, community members and domain experts from different disciplines and sectors to the co-creation of the 12 Open Knowledge Creation activities (OKAs) with the aim of transforming knowledge into innovative artifacts. Co-creating OKAs aims at upskilling HEI (Higher Education Institutions - including universities and public research libraries) staff and students through the exposure to contemporary trends in public engagement as a means to critically reflect on pedagogical models conveying active citizenship and social participation.
This document proposes the implementation and evaluation framework for Open Knowledge Creation activities (OKAs) in HEI context following the INOS project proposal. As such it is an advisory implementation guideline each OKA development team can follow, but the specific steps for each OKA implementation may vary. The INOS project will document and formatively evaluate the OKA cases that project partners will run, which will in the end of the project provide better examples to how HEI's can do open knowledge activities. For consistent and case comparable evaluation purposes the document contains some requirements for OKA developers that INOS project partners should follow. The document is of wider interest since it provides for HEIs and other interested stakeholders an approach how to jointly conduct open knowledge activities that intend to transform HEI students, educators' and public participants' active citizenship competences. INOS implementation framework guides OKA development where the HEI educators develop activities for HEI students and external from HEI participants. It particularly provides the design thinking approach based support for HEIs that intend involving the HEI students to develop the OKA together with the educators and researchers. The framework is intended to be used together with the INOS learning design framework (LDF) that specifically guides the design of the learning activity.

For developing the implementation framework, literature review was conducted, the results of best practices from citizen science and public engagement projects for implementation and evaluation are embedded in sections 1-2, 4-5. Section 3 introduces the methodology of developing the guideline. Section 4 describes the principles for the open knowledge activities' implementation, evaluation and dissemination. The overview Figures 4-9 are provided in section 4. In section 4.4 the compulsory guidelines are checklisted for INOS partners. Section 5 elaborates the principles of developing the active participatory citizenship evaluation scales for OKAs. Annex 1 provides the formative evaluation guide for reporting OKAs. Annex 2 provides specific guidelines for collecting evidence from OKAs for the video testimonials. Annex 3 provides the

evaluation survey for participants which consists of a general part and the competences part. Annex 4 contains the information sheet and informed consent example for INOS OKAs. For successful usage the survey, informed consent and the design thinking templates shown at Figures 9-11, 13-14 should be translated to the languages of participants and adapted to the contextual OKA cases in the project.

1 Introduction

1.1 The role of open knowledge activities in the society and for Higher Education institutions (HEIs)

The Era of Citizen Governance in its early stages describes the challenges of people streaming for enacting community visions (Box, 1998). This required conceptually the redefinition of the role of citizen, from passive consumers of government services to active participants in governance, where citizens would take greater responsibility for determining their future communities (Box, 1998). Haywood and Besley (2013) highlighted two goal focuses in Citizen science - **the "public understanding of science"** tradition, guided by science education and literacy goals, and **the "public engagement in science" tradition**, guided by participatory democratic ideals. These traditions inform the planning and assessment of citizen science activities. The "science deficit" models often fail to consider whether or not the science research and application process is inclusive of multiple interests, the legitimacy of science research, and trust in science alongside education and outreach goals (Bauer, Allum and Miller, 2007). Participatory democratic philosophy suggests that transparency, negotiation and deliberation, as well as responsive policy systems, enhance collective understanding about critical societal issues, integrate diverse constituent groups into governance systems, and enhance the acceptance of collective decisions (Delli Carpini, Lomax Cook and Jacobs, 2004; Pateman, 1970). Mejlgaard and Stares (2010) proposed an integrative two-dimensional concept of **"scientific citizenship"** that incorporates both aforementioned aspects of scientific competence (basic knowledge) and interest as a prerequisite for engagement in larger participatory democratic systems of decision-making.

Gray et al. (2012) note that if science is going to be democratized in the classroom, educators and scientists must, from the onset, embed new frameworks that explicitly address the influence that norms and values have on science that is independent of scientific content. Specifically, classrooms and administrators must widen their scope and reframe their programs to embrace the uncertainties and pitfalls, including bias and measurement and analytical error, of generating scientific knowledge. Further, scientists need to be willing to give up some control in their research while offering structure and affording the tools of science to the classroom. This necessarily involves allowing learners to make mistakes and reflective activities. Learning experiences should include practices that acknowledge that all participants, regardless of training, contribute valuable perspective.

1.2 Scope

The INOS implementation framework guides the universities and research libraries (further referred to as Higher Education Institutions - HEI) in the joint development of Open Knowledge activities (further referred to as OKAs, the concept is elaborated in the Concepts section 2.1). It follows the design thinking approach in describing how the HEIs that aim for the active citizenship competencies' development may involve students to develop the OKA together with the educators and researchers and external from the university stakeholders from the communities.
Section 2 introduces conceptsbased on literature research. Section 3 gives brief a overview of the methodology of composing the INOS implentation framework for conducting OKAs in HEIs. Section 4 indicates when to use INOS Learning Design Framework (further referred to as LDF, see INOS report O2A3). An overview of the implementation framework components is provided at Figures 4-6 in section 4. In section 4.1 the suggested implementation guidelines in each OKA phase are described, that the teams can contextualize for their OKA development. Section 4.2 describes the evaluation framework and lists the indicators what the teams may use for OKA development and evaluation. Section 4.3 provides guidelines for dissemination activities for OKAs. For consistent and case comparable evaluation purposes the document contains in section 4.4. some requirements for OKA developers that INOS project partners should follow (see Section 4.4 for requirements and the Annexes 1-4). The INOS project will document and formatively evaluate the OKA cases that project partners will run, which will in the end of the project provide better examples to how HEI's can do open knowledge activities. Section 5 describes the active citizenship competences that INOSproject intends to develop with OKAs and measure with the survey (see Annex III).
The Annexes consist of the guideline for formative evaluation of the OKAs (Annex I) and the survey items for the OKA participants, that incorporate active citizenship competence scale and other questions related to the experience of OKAs (Annex III). The document also contains the guideline for collecting evidence for video testimonials (Annex II), and the template for informed consent (Annex IV).

1.3 Audience

The primary audience of this document is INOS project partners and the HEI students and external from the HEI stakeholders engaged in co-planning, codesiging, co-managing and co-evaluating the open knowledge activities during the project. The document provides an overview of how to implement and evaluate open knowledge activities (OKAs), and has a potential to be of wider public interest.

2 The concepts

2.1 Open Knowledge Activity (OKA) definition in INOS project

Here we provide the definition of OKAs as the INOS project proposal has defined it. The OKAs are bottom-up technology mediated open knowledge building activities that HEIs co-create together with students and external stakeholders for engaging wider public for social and community purposes. OKAs will engage wider audiences into building the scientific knowledge and data in a publicly open way using digital technologies support. As such OKAs may cover various forms of open science activities, including open data activities, open innovation and collaboration activities, citizen science activities, citizen inquiries, and various open educational practices. Examples of planned OKAs in INOS project are: Datathon, Data expedition, Knowledge Café, Service jam, Dotmocracy workshop, Gamified Design Thinking interdisciplinary problem-solving, Sensor-based CS problem-solving for civic society, Citizen science knowledge construction camp, Gamified outdoor problem-solving event, Scientific crowdsourcing event, and Edugame jam.

OKA's should make use of mainstream technologies (such as mobile phones), employing existing tools or methods to transform existing knowledge in HEIs or among the community partners.
OKAs in the INOS project may follow different co-creation approaches, but should follow the research integrity in open knowledge activities that makes created knowledge or data reusable for the others.
The aim of OKAs should be engaging HEI students together with the public and external stakeholders in the communities and experts from various sectors and disciplines to the evidence-based activities leading to:

- The development of technical and digital skills or the mastering of new tools among the participants.
- The creation of shared open resources in which each stakeholder has an equal interest (widely known as "commons creation"), in a participatory, bottom-up and user-driven way.
- The creation of evidence-based results to strengthen the evidence-building effort highlighted in EU policies.
- Change in mindsets regarding knowledge accessibility, open innovation, social engagement and the HEI role in society.

OKAs should be inclusive activities engaging individuals eager to learn and experiment. OKAs in INOS should address participants who are not necessarily familiar with

university studies or with specific types of knowledge, with the objective of making knowledge acquisition accessible and engaging. OKAs should engage particularly the participants with fewer opportunities at citizen science activities/open knowledge activities.
The OKAs of INOS project would in minimum require short-term engagement from specific participants (1-2 days) but have to be in long term sustained for iterative usage in HEIs with open participants. OKAs should be preferably developed and facilitated in collective team effort by the HEI educators, library specialists, students, experts and community members (see about engagement models in section 1.5) because it can best develop the active citizenship competences and follow open science practices. Yet, other engagement types of OKA development (e.g. developed only by HEI educators) that suit a particular HEI are possible to be tested out in the INOS project. The locations of OKAs should take place with open access at accessible locations (universities and public libraries) and other suitable places for the participants.
OKAs should provide the variety of tasks that participants can carry out, from very simple to very complex depending on participants' skills and willingness to learn, tinker and experiment, will remove any possible access barriers to these collaborative efforts.

The result of OKAs is the production of "commons creation" that is new open data (see section 1.4.2) or open knowledge and shared open resources (see section 1.4.3). The knowledge and data fulfil each stakeholders' interest, and are co-created by stakeholders. OKAs are intended to develop participants' (both HEI teachers/librarians, students, experts and the wider public from the communities) active citizenship competences which is described in the section 1.5.1, section 5 and Annex 3 below.

2.2 Open data in OKAs

Data is distinct pieces of facts that are not organised in any way. Information appears when data is processed in certain ways. Knowledge is the contextualised information for which people have given the meaning and purpose.
When people are engaged in OKAs their engagement may be only at the level of adding pieces of data to the common pool. This process is usually organised to make data more reusable as an information for knowledge building. For example, data formats are selected, data are described, linked and aggregated and provided with mechanisms of data management and knowledge building with data.
The INOS implementation framework derives the open data concept for OKAs from the O1A1 (p. 11): "Open Data are FAIR qualitative and quantitative data and datasets (Findable, Accessible, Interoperable and Re-usable data)." The open data should be provided with the context descriptors and metadata that make it findeable. Open data should be made accessible, repurposed for research and public good. Access provision is

often organised through digital repositories and open websites that enhance interaction opportunities with the data. Open data should use the commonly accepted standards that make it interoperable and support linking the datasets, and reusing the data. Algorithms may be used for aggregating the data specified ways and for enabling the further data reuse in knowledge building. Open data in INOS may be gathered or presented to OKA participants in different verbal, visual, geo-locative and interlinked forms.

Examples of open data are social interaction or research data that are provided in open repositories for the wider public. Such data may be collected by researchers or organizations or systems automatically, or the collecting may be done by people in crowdsourced ways. In INOS, open data are the data that have been collected, digitalized, enriched, validated or interlinked in crowdsourced ways as part of open science activities and made available for public interests. Such public reuse of data in knowledge-building may incorporate creating dynamic services that visualise data or use it for nudging the people, cross-using the data across open science projects, using data for decision making or as the justification in debate etc. Open data may be used also for personal purposes, such as individual study, justified decision-making, enactment, art-making or for cultural and gamified interaction.

When collecting, using and storing the data the ethical considerations and privacy guidelines for the data required by GDPR (https://gdpr-info.eu) must be respected. Participants of activities must completely understand the activity and give their full permission to participate in an informed consent. Informed consent applies not only to communicating to those residents around what data is collected and how it will be used, but how that data is collected and stored as well. Usual practice is to prepare an information letter for activities that contains adequate information and the consent to be signed (see example in Annex 5). Note that these must be understandable and in native language of the participants. The ethical guidelines require that caretakers would sign the informed consent behalf of their children or vulnerable people (e.g. elderly) they are responsible for engaging them into the activity. In each country the OKA organisers must follow the ethical guidelines of their country, specifically it is important to follow the rules that apply for underaged criteria (that differs in countries). Note that the parents may have signed the permission for their children to participate in specific digital activities only and not using social media, in some countries there are restrictions for public educational institutions to use corporal learning environments and such constraints should be followed when engaging with school students. At OKAs it must be ensured that participants have sufficient competence to act autonomously, they are not forced to partake and no coercion takes place. Regarding the data it is important to consider if collecting personal data is actually needed in the activity, and not to collect personal data without consent. Personal data should be processed in an appropriate manner (see GDPR) that ensures security of personal data, right to request that personal data be not processed and withdrawing personal data. Personal data have to be

pseudonymized or anonymized. Important is to train the OKA participants in correct data maintenance, and developing the thoughtful focus on data in the data management plan for OKAs. FAIR principles (Findability, Accessibility, Interoperability, and Reusability) (see Wilkinson et al. 2016) should be followed in the OKA data management plan (see section 3.2.3 below).
Tweddle et al. (2012), in the "Guide to citizen science" highlights **the intertwined aspects of quantity and quality of data which is important for designing OKAs.** Quality data usually requires more complex procedures and smaller amounts of people can be engaged in this depth of processes due to lack of competences and need for thorough instructions, training and mentoring. Quantity of data usually is achieved with the sake of simplifying the data collection procedures to be followed by a wider public.

2.3 Open knowledge in OKAs

Knowledge is not lodged in any physical or metaphysical organ but inheres in social practices and in the tools and artifacts used in those practices (Bereiter, 2002; p. 57). Knowledge building refers to the individual and social constructive process of creating new cognitive artifacts, which result in the formation of various forms of knowledge by individuals, groups and organizations (Bereiter & Scardamalia, 2003). Knowledge building is often mediated by digital tools and the resulting knowledge is a synergetic socio-technical object or phenomenon – for example, knowledge may be the increased credibility of certain artifacts, trust to certain approaches or people, knowledge may be the common shared practice, value, awareness or meaning that exists in the enacted form in the digital or real environments and places. The knowledge-creation view (Paavola & Hakkarainen, 2005) highlights the "trialogical" knowledge artifact creation approach that complements "monological" knowledge acquisition and "dialogical" interaction for sharing knowledge. In "trialogical knowledge creation approach" the emphasis of knowledge is not only on individuals or on community, but on the way people collaboratively develop mediating artifacts.
In INOS OKAs both the dialogical and trialogical knowledge creation takes place. Knowledge building in OKAs is the dialogical and trialogical creation, testing, and improvement of conceptual artefacts. The knowledge creation may be a face to face or digitally mediated collaborative activity in dialogical or trialogical mode. Knowledge creation may also be a self-organized cocreative event that is mediated by digital environments and results in the aggregation of joint knowledge. While collaborative knowledge creation is often led by common goals, group discussions, and synthesis of ideas, the self-organised co-creation is often building the integrity between individual contributions and the system level emergence of knowledge using the help of socio-technical systems (see INOS report O1A1, p. 18-20).

The INOS implementation framework for OKAs follows the open knowledge concept defined in INOS report O1A1 (p.16-17): "Open knowledge is understood as "knowledge (either embodied in artefacts, in social practices, or in research outputs) that is freely circulated – without any legal, technological or social restriction" (Open Knowledge Foundation, nd). Open knowledge is a kind of shared or crowd knowledge, developed in open knowledge building activities (OKAs), and is useful for its creators and beyond for the communities and other interested counterparts. Open knowledge that is created in trialogical mode should be accessible as knowledge artifacts for the wider public by open license. For knowledge, the FAIR principles (Wilkinson et al., 2016), and open license policies (creative commons) apply. The openness of dialogical knowledge, such as common ground, awareness or values may not be captured into digital artifacts but is rather shared and enacted between people and in different situations and places. Some of such knowledge may also take digital formats, such as trust, credibility, networks may be captured by digital tools with various functionalities (stars, ranks, endorsements, ratings, linked structures etc.). Open knowledge is a collectively developed resource that is shared, digitalized, interrelated, enriched, corrected or remixed by public crowdsourcing effort, and made available for public use in the public debate, digital heritage repositories, research repositories or other publicly accessible portals or sites. Examples of open knowledge are: shared understanding, awareness or common ground about something developed among participants in the discussion; a locative map for accessing digital heritage content, the automatically digitalized and corrected by people old newspapers; collectively gathered and edited, interlinked, remixed texts such as wikipedia resources and many more.

2.4 Engagement models for open knowledge activities

This section intends to provide an overview of what engagement models have been previously used in open science activities and builds some foundations for the INOS Implementation framework that is described below in sections 3-5. The engagement models described below (Shirk et al, 2012; Price and Lee, 2013; Haklay, 2012) focus on the aspects of "agency of people as active citizens" in OKAs (see 1.5.1.) for "creating data or knowledge" (see 1.4.2, 1.4.3) in "problem-solving activities" (see Jonassen, 2000). Thus, it is important while planning an OKAs in HEIs to think of what type of problem-solving it will require from the activity (Jonassen, 2000). According to Jonassen (2000), simple problems assume people to follow certain rules or procedures (e.g. story problems, rule-using or algorithmic problems), complex problems have uncertainty in the nature of the problem and its components; different complexity in the reasoning paths (e.g. deductive, inductive, abductive) how the problem may be solved; and in the availability versus need for choosing or balancing or creating the solutions (e.g. troubleshooting problems, design problems, inquiry problems, decision-making, dynamic decision-making, dilemmas). As described in the section of concepts, the results of OKAs may be open data and open knowledge in various forms, which are usually created in different phases of problem solving. In planning the OKA it is recommended to:

- Define the problem type and the problem-solving stages of the activity (that stem from problem type) where participants may be engaged;
- Define what data and knowledge is created in these phases;
- Define what is the participants' agency in the phases.

For example, the dilemma problems allow engaging people into open discussions. The dilemmas are complex problems which entail various alternative paths and solutions for different stakeholder groups, and the knowledge created from these activities may be both the awareness, common ground about the dilemma, or the values, as well as, the paper based or digital open knowledge artifacts could created to mediate solving dilemmas.

The design problems in open innovation may require people to engage and observe stakeholders to narrow down the design problem, and move from design idea to actual solutions that meet the needs of different groups of people.

The citizen science project may follow the deductive approach and require people only to collect data, or it may empower them as citizens to be part of defining the problem, the data collection approach, and making use of the data in decision-making for their community needs. As illustrated above different levels of engagement may be required in problem-based open science activities.

Based on the degree of participation Shirk et al. (2012) distinguished five models in participatory public science projects: **i) Contractual projects,** where communities ask professional researchers to conduct a specific scientific investigation and report on the results; this model allows an expansion of traditional science research from being driven solely by the interests of researchers (or the needs of the field) to consider community-relevant questions and interests. **ii) Contributory projects**, which are generally designed by scientists and for which members of the public primarily contribute data; **iii) Collaborative projects**, which are generally designed by scientists and for which members of the public contribute data but also help to refine project design, analyze data, and/or disseminate findings; **iv) Co-Created projects**, which are designed by scientists and members of the public working together and for which at least some of the public participants are actively involved in most or all aspects of the research process; co-created projects, based extensively on volunteer initiative, may incorporate scientific expertise mainly to ensure that projects are conducted in a scientifically rigorous manner; projects are transformative; **v) Collegial contributions**, where non-credentialed individuals conduct research independently with varying degrees of expected recognition by institutionalized science and/or professionals. Price and Lee (2013) distinguish two types of **contributory models - passive and active,** defined by how actively participants were contributing data to the project. In the passive contributory mode, after the initial recruitment phase, participants are asked to monitor equipment that automatically collects data and transmits them to a central repository. In active contributory model participants are actively engaged in the process of data collection and/or data processing. Participants are required to make decisions such as how often to collect data and when to deviate from suggested protocol.
Haklay's (2012) has classified citizen science projects **based on the depth of their engagement with volunteers, within a four-level framework of participation** (Fig. 1.)**.**

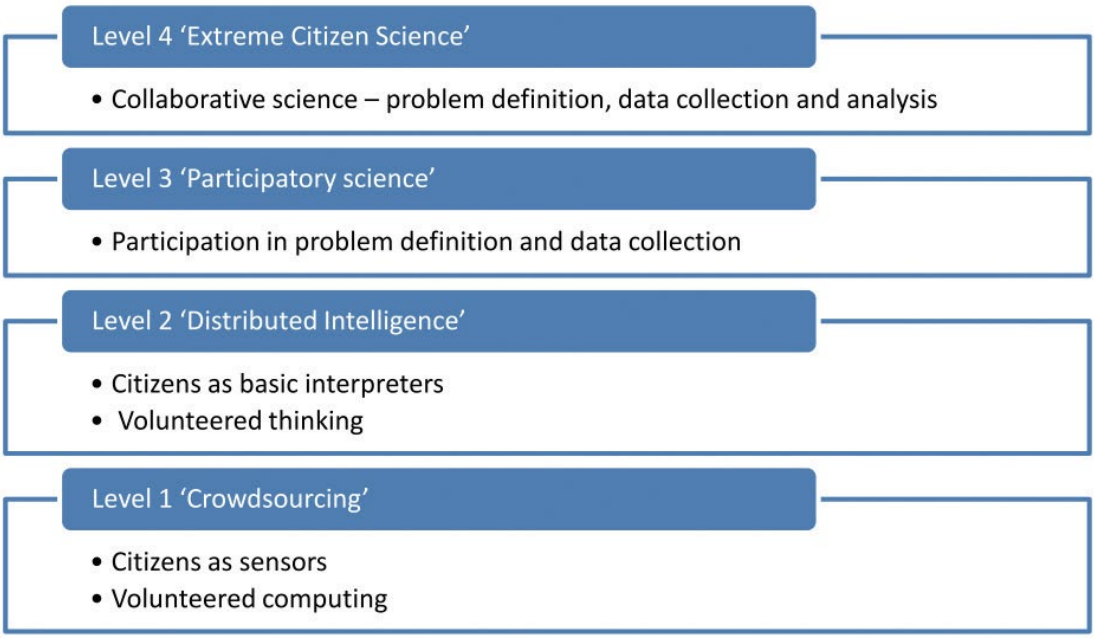

Figure 1. Levels of participation in citizen science projects (Haklay, 2012)

Extreme citizen science can include projects where citizens are the driving force behind the research and professional scientists are not involved at all.
The UK Environmental Observation Framework has split environmentally-focused citizen science projects into four categories according to their degree of mass participation (local or mass) and 'thoroughness' (a measure of investment of time and resources), and 'leadership' - contributory (led by experts), community-led, or co-created: Mass contributory, Local community led, Local co-created (Roy et al., 2012).
Elsewhere, three community involvement models in citizen science have been identified - **contributory** (mainly data are collected by public), **collaborative** (public collects data, analyzes and reports of it together with scientists), and **co-created** (public identifies the problem, co-creates the study with scientists and then is engaged in data collection, analysis and reporting of results) (Mannion & Ruck, 2019).
There is, however, the threat in these models that top-down organisers of citizen science will situate 'collaboration' with participants outside of **science-policy nexus** (Cornwell and Campbell, 2011). This may lessen the actual agency of the participants in the OKAs.
In designing OKAs in INOs we recommend to decide the engagement models based on the problem type in the OKAs and of the context the HEI can initiate/take part of the activity.

2.5 Active participatory citizenship

The growth of citizen science and open science initiatives is aligned to the idea of **active participatory citizenship**. Chilvers (2009, 401) points out that **participation** is a highly contested term that means different things to different people - participation is often called (or equated to) many different things such as 'engagement', 'empowerment', 'involvement', 'consultation', 'deliberation', 'dialogues', 'partnership', 'outreach', 'mediation', 'consensus building' and 'civic science'.

Active participatory citizenship concept is one that has been related with the changes of agency of citizens in the life of their communities. The key idea of active citizenship is that a person is engaged in participation in activities that support a community either in politico-legal, socio-economic or socio-cultural domains (Lisbon European Council, 2000). 'Learning for active citizenship" was stated as one of three major pillars in lifelong learning (Commission of the European Communities, 2001). Learning for active citizenship is seen as part of **lifelong activity in diverse formal and informal learning processes in which a person proactively constructs the crucial links between learning and societal action.** The contexts where citizenship can be learnt thus occur not only in educational organisations but in various areas of social life: civil society, work, and what is usually designed as the private sphere (Kalekin-Fishman, Tsitselikis and Pitkänen, 2007: 30). One form how active citizenship may be exercised is through open science activities that enable both taking action, making changes, increasing awareness of problems and its solutions, learning about how science is made, and **co-creating shared knowledge that has scientific as well as public value. Chapter 5 provides the in-depth overview of how active participatory citizen competences may be measured.**

2.6 Co-creation and co-design concepts

The concept of **co-creation** has been introduced in providing more active involvement and agency to the citizens in governing their communities. According to McBride et al. (2019) some definitions view coproduction and co-creation as something that involves only citizens in a government/research institutions-to-citizen type relationship whereas others posit that any actor can be involved and may initiate the co-creation. Secondly, many understandings of co-creation and co-production view it in a somewhat cyclical fashion where co-creators can get involved at many different stages of the open science activity.

The **co-creation concept is often used in parallel with co-production and co-design** concepts, although they are rooted in different disciplines - co-creation and co-production were originally developed within business studies and marketing for creating

value while co-design comes from the human computer interaction area and denotes user centred design approaches. Co-creation has been understood in educational domain as the co-production of shared understandings, making sense, and it results in knowledge objects, which is often achieved through artifacts such as wikis, as well as collaborative files and media creation; co-design and participatory design concepts have been adopted in education more in innovation creation process context. (Durall et al., 2020)

The aspects used in describing **co-creation and co-design concepts from the citizen engagement point of view are inclusion of non-traditional stakeholders, access with technologies to the process, transparency, innovation, public value creation and public value management, and effectiveness of the process** (McBride et al., 2019). Creating, sharing and building on open data has been found one way to empower citizens (Khayyat and Bannister, 2017; McBride et al. 2019). The empowering role has been given also to digital technologies because it orchestrates citizens' co-creative engagement (Lember, 2017). These co-creation, co-production and co-design concepts highlight the processual nature of public value creation - it must be developed at societal level, engaging different stakeholders in certain activity context either individually or as groups, considering how the stakeholders are involved into the process, and in which stages of the process they are involved (McBride et al. 2019). The value creation is tightly associated with the co-creation, the stakeholders must perceive the value the activity provides for them (Toots et al., 2017) and associate this value with the open data and knowledge.

The stages in the co-creation process have been generalized in the public service design process: Co-Planning, Co-Design, Co-Delivery, Co-Evaluation (Osborn et al., 2016). Durall et al. (2020) who have studied the phases of co-creation and co-design in innovative learning activities outside of classroom distinguish the following steps: i) mapping concepts for defining shared understandings; ii) finding challenges and opportunities; iii) prioritizing challenges and opportunities to select the joint focus; iv) Ideating the design solution. The co-design phases may be iteratively applied in the co-creation process phases, since co-design highlights the creation of design space among the participants who are engaged in the process, and provides tools and methods how to enable the design space to be iteratively transformed. Thus, the co-creation phases are more guiding the processes needed to design jointly the citizen science activity and support also the development of stakeholders' agency, while the co-design steps focus more on the open science activities and infrastructure design, and eliciting the values and needs the stakeholders have regarding the planned open knowledge activity, its outputs and impacts.

We may summarize that the process of running the **open knowledge activity in the co-created mode with public stakeholders should take the following phases:**

A. Co-Planning the Open Knowledge activity (Goal setting step of the Learning design framework (LDF) in O2O3):

i) Mapping concepts for defining shared understandings;
ii) Finding challenges and opportunities;
iii) Prioritizing challenges and opportunities to select the joint focus.

B. Co-design (Activity development stage in the LDF in O2O3):

iv) Ideating the design solution for the learning activity.

C. Co-Delivery (Run activity phase in the LDF in O2O3).

D. Co-Evaluation of impact (Reflection phase in the LDF in O2O3).

E. Dissemination, exploitation of results and sustainability.

2.7 Agency levels and participation modes

The different **levels of agency** have been described: the citizens may be asked to provide assistance in co-creation, they may be requested to participate (Whitaker, 1980), they may voluntarily want to participate or they themselves initiate the co-creation (Voorberg et al. 2015). The **participation modes** in activities may be individual, in groups cooperatively or collaboratively, and particularly current technologies nowadays enable individuals to contribute self-organized ways using digital systems for data collection, reporting problems, crowdsourced data curation or data enrichment, as well as, for adding their creative contributions to design or providing services (Paletti, 2016).

2.8 The implementation models for citizen science activities

In this section some design approaches are presented that have been developed previously to guide the process of designing citizen science activities. The INOS Implementation Framework for OKAs has considered the elements from these models but provides its own implementation model described in sections 3 and 4. Generally, the design approaches may **focus on the open science project tasks, phases and key elements (see Shirk et al., 2012; Tweddle et al., 2012), values that lead the design of OKA or dimensions of places where OKAs are conducted as motivators** (Newman et al., 2016) (see below for more details).

Shirk et al. (2012) describe the work that is necessary to design, establish, and manage all aspects of a project (see Figure 2). This work is generally conducted by a lead team, which may include scientists, members of the public, and/or others (educators, technologists, etc.). The work is described in the following steps:

1) Identifying the scientific or community challenge that will be solved. Note. In the sections above it is described that the team may use several design thinking approaches to do it.

2) Developing the project infrastructure:

- Designing sampling strategies and protocols;

- Developing data submission/data entry technologies;
- Designing data visualization;
- Designing training materials;
- Establishing a network of volunteers;
- Designing the communication and support mechanisms for networks.

3) Managing project implementation

- Maintaining the project activities at different phases;
- Holding meetings and events;
- Facilitating training;
- Distributing materials;
- Communicating with all collaborators/participants.

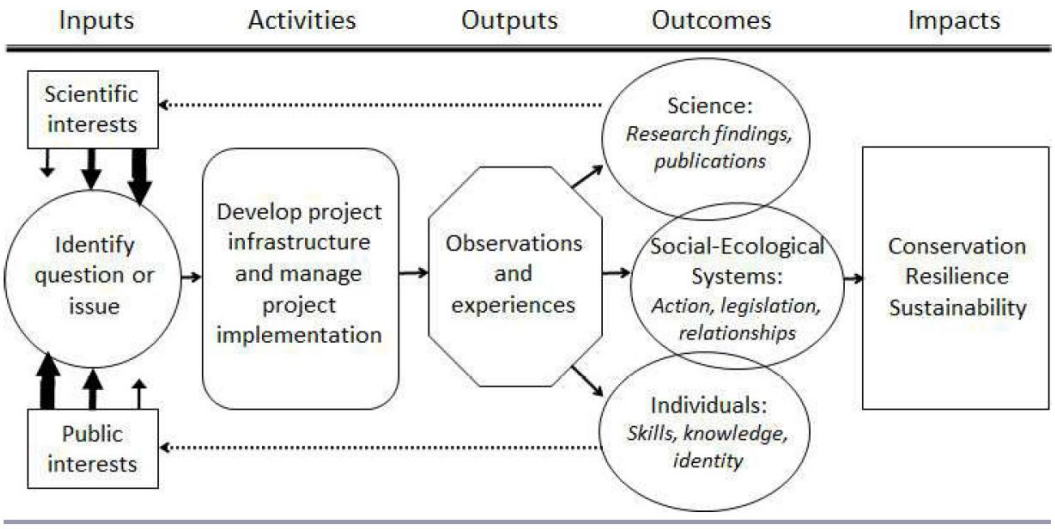

Figure 2. Framework for public participation in scientific research projects (Shirk et al., 2012)

For practitioners, Tweddle et al. (2012) provides in the "Practical guide to citizen science" the process of setting up and managing a citizen science project at a lower level of stakeholder engagement. This guide is freely available at: https://www.ceh.ac.uk/sites/default/files/Citizen%20Science%20-%20pratical%20guide.pdf.

This simplified process model incorporates five phases (see Figure 3): I. Before the project, II. First planning phase, III. Development phase, IV. Live phase and, V. Analysis and reporting phase. The model has a feedback loop from Analysis to the

Development phase. Important aspects in the model are the participants and stakeholders, the data, and the resources.

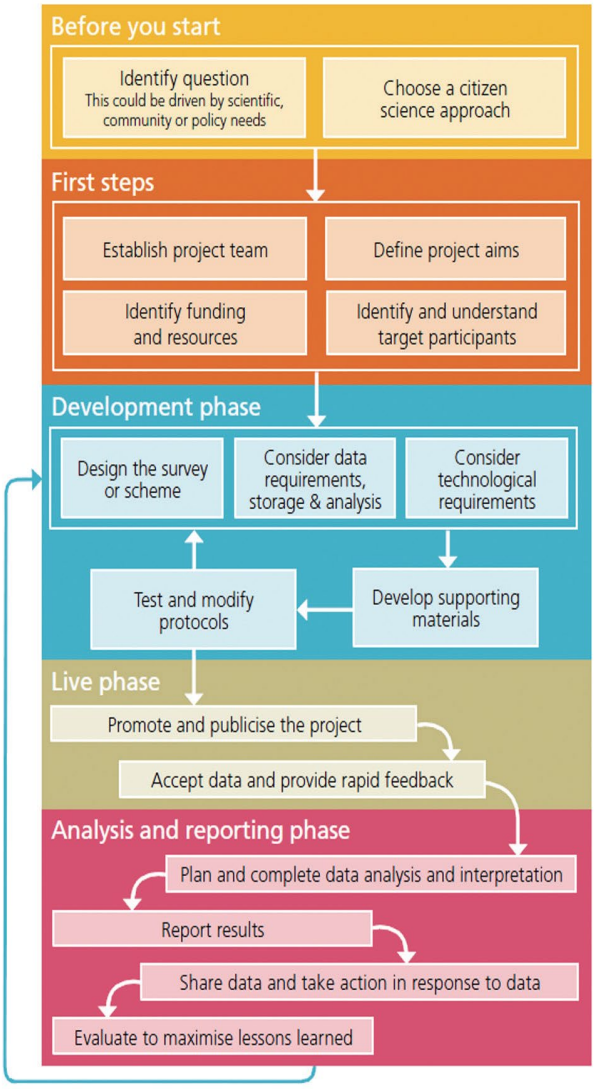

Figure 3. Sequential method for developing, delivering and evaluating a citizen science project (Tweddle et al., 2012).

Another example of steps for co-designing the citizen science project idea is provided by Price and Lee (2013). The team analyzed the literature about citizen science projects and the collective experiences of the staff in running citizen science projects and defined the conceptual ideas' based design principles:

- Design Principle 1: Use a Context Where Volunteers' Contribution Is Necessary and Meaningful for Their Scientific Inquiry.

- Design Principle 2: Provide Internet Resources to Help Volunteers Interact with Peers and Scientists.
- Design Principle 3: Actively Involve Scientists in a Role of Teaching and Communication.
- Design Principle 4: Support Participants for Analyzing and Presenting Their Own Data.
- Design Principle 5: Encourage Participants to Become an Active Member of a Research Community.

Another set of conceptual design principles focuses on the 'placemaking' and decision-making aspect of citizen science (Newman et al., 2016):

- Design principle 1: Explicitly incorporate 'place' into project design and implementation.
    - Use power of place to co-identify issues, goals, and objectives.
    - Tie citizen science to identify priority stressors, phenomena, and baseline needs.
    - Make decisions regarding changes based on initial data.
    - Bring in citizen science to evaluate impacts of interventions and progress towards goals.
    - Promote identification with place as a motivator for volunteer recruitment and retention.
- Design principle 2: Consider 'place' in project and platform design, especially related to data.
    - Include ecological interconnections of place by engaging locals who have a holistic and time-perspective view of the place and allow for greater breath of data.
    - Document protocols (data sharing APIs) and data following metadata standards that make data more discoverable, machine readable and interoperable with official databases.
    - Ensure data are geo-located and use geospatial analysis and GIS and geovisualization of place-based information (ESRI shape files and/or KML files), enable participants to perform their own data analysis with tools.
    - Make data open and promote open science.

- Design principle 3: Increase place-based collaboration in citizen science, enable to give back to the community.
    - Create place-based networks for collective impact.
    - Pool citizen science information & resources to offer an opportunity to collaborate to showcase, cross-promote, and catalogue volunteer opportunities across organizations and topics.
    - Connect with decision-makers.
    - Collaborate with small-scale projects.

In addition, Newman et al. (2016) have created the checklist for citizen science project design:

- Intent for decision-making: The program describes an intent to connect to decision-making such as stewardship, policy, or other users of data.
- Use in decision-making: the program has an explicit connection to decision-making such as stewardship, policy, or other uses of data.

Place dimensions for citizen science activity design are (Newman et al., 2016):

- Socio-ecological: In what types of social-ecological systems does the project take place and to what extent does the program emphasize connectedness to natural and human communities?
- Project materials emphasize interlinked human communities and ecosystems with specific details about socio-ecological system components and relationships.
- Symbolic through narratives and naming: What stories, local histories, and unique place names does the project include about place? Testimonials that share stories related to the place and/or to the citizen science activity within a place are featured.
- Knowledge-based: Does the project seek to include diverse forms of knowledge (local, traditional, scientific, and/or arts-based)? Project embraces multiple ways of knowing that include local/traditional knowledge and includes local people's inherent knowledge regarding their place and/or allows participants to collect/discover such local knowledge.
- Aesthetic and Emotional: How does the project promote emotional attachments to place? The project uses terms like love and beauty to describe itself.
- Performative: Is there a sense that the project is dynamic, seeking creativity and innovation, and including multiple ways in which participants can help shape the

project and the place, build relationships, and engage in active place-making? Project leaders demonstrate a commitment to building relationships as a key strategy to promote active place-making. Project activities performed are encouraged that shape the project and/or the place. The project offers and encourages activities that allow participants to shape the project and/or the landscape and that build a sense of ownership.

3 Methodology

3.1 Research goals

Building the INOS Implementation Framework for OKAs was guided by the following goals:

1. Identifying what components are integrated into the existing design and evaluation frameworks to support OKAs;
2. Identifying from research papers about case studies specific guidelines about designing and evaluating the components of the framework;
3. Collecting input from INOS partners about their planned OKAs for identifying important components;
4. Developing the integrated framework for designing the OKAs;
5. Developing the guidelines for evaluating OKAs;
6. Developing the reporting documents for OKAs and the survey items.

3.2 Identifying relevant sources

The papers collected by the COST action Citizen science to promote creativity, scientific literacy and innovation through Europe (CA15212) Workpacakge 2 "Citizen science in education" were used as the main pool of literature sources since the author of the framework participated in the compilation and it was considered representative. Additional papers were sought topically from the SCOPUS database for each framework component.

3.3 Structuring the data

In the revision of the papers several frameworks and framework components were thoroughly described. Next, several options for structuring the data for INOS purposes were discussed: by open knowledge activity design phases, by the key topics, or following the Learning Design Framework (LDF) proposed in O2A3. The consortium decided that since the open knowledge activities' design and evaluation framework should be coherent with the pedagogical framework templates, the LDF proposed in O2A3 should be followed where possible.

The Implementation Framework for OKAs' incorporates the learning design parts (see LDF report O2A3). LDF contains: topics, activity groups, example learning goals, general method descriptions, learning approaches, learning sequences, advantages of use for learning approaches, learning outcomes, collaboration/innovation facilities, tools and resources (human resources, apps, digital and OER resources, open data, open source software/hardware, specialist scientific equipment), motivators for learners, challenges for learning. The Implementation Framework for OKAs' particularly adds the aspects how to engage the stakeholders into the OKAs, what are the design stages for OKAs, what are the goals and outcomes of OKAs beyond pedagogical ones, and how to communicate and evaluate OKAs.

4 The INOS implementation framework for open knowledge activities (OKAs) within universities and public libraries (HEIs)

This chapter describes in-depth the INOS Implementation Framework for OKAs in HEIs. This Implementation framework intends to inform INOS partners and other interested people in HEIs and beyond who conduct OKAs about the useful implementation aspects.

The chapter organizes the suggested implementation activities so that they can support the pedagogical learning design part, which is thoroughly described in LDF (see INOS report O2A3).
Figure 4 presents the OKA implementation tasks' interrelations in the process phases' on the timeline from left to right. The INOS implementation framework and the INOS LDF (INOS report A2O3) are presented in parallel. Management and Communication tasks should be run during the whole OKA. Evaluation and Training tasks should start at Co-design and run until the end of OKA.

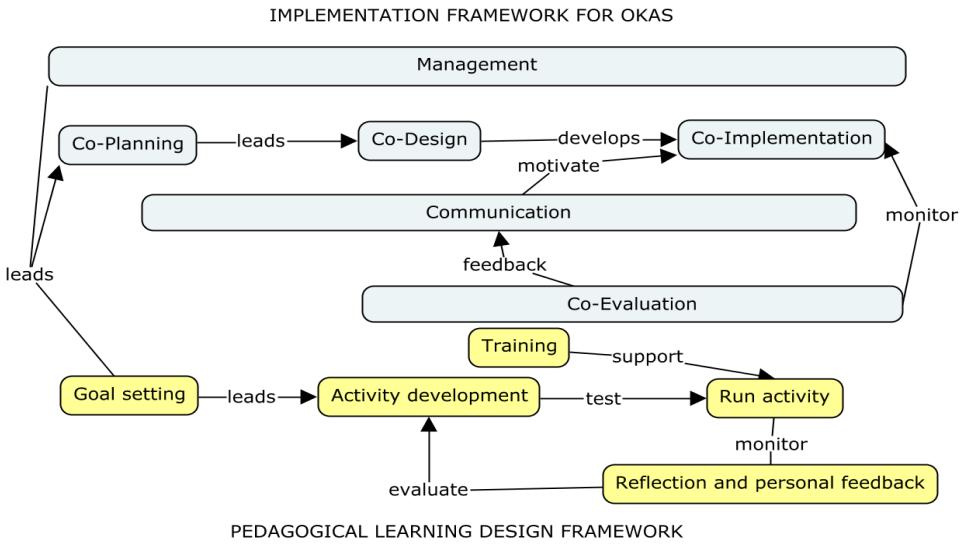

Figure 4. Open Knowledge Activity (OKA) implementation phases

Based on the literature review it was identified that the design and implementation of the open citizen engagement scientific activities **in the co-created mode** with public

stakeholders should **follow the stages that incorporate the INOS LDF elements (see O2A3)**. INOS LDF defines the following stages from the pedagogical activity design point of view:

1. Goal setting;
2. Activity development;
3. Activity format selection;
4. Running the activity;
5. Reflection and personal development.

LDF covers the following elements: topics, example learning goals, general method descriptions, learning approaches, learning sequences, advantages of use for learning approaches, learning outcomes, collaboration/innovation facilities, tools and resources (human resources, apps, digital and OER resources, open data, open source software/hardware, specialist scientific equipment), motivators for learners, and challenges for learning.

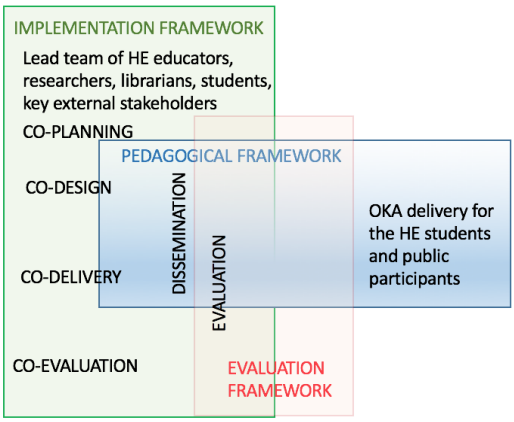

Figure 5. Interrelations of the INOS Implementation Framework and Learning Design Framework (LDF)

The INOS Implementation Framework (see Figure 5) is complementary to LDF and focuses on how the OKA design may be implemented so that it engages HEI students to develop the activity for other students and for external from HEIs paricipants. It also provides an evaluation framework and guidelines for the management and communication activities of the project.

The co-design approach can **make use of the design thinking strategy.** Following the design thinking suggests that **the design space for the OKA must be iteratively developed in the co-planning and co-design stages engaging the stakeholders** who can bring in the LDF elements both from educators', learners' and educationally aimed (and other) organizations' points of view.

For the simplified application the INOS Implementation framework components are described at Figure 6. It must be noted that the INOS Implementation Framework activities are not to be restrictively followed in each OKA the INOS project is conducting, but the guidelines can be modified and should be piloted in HEI's context.

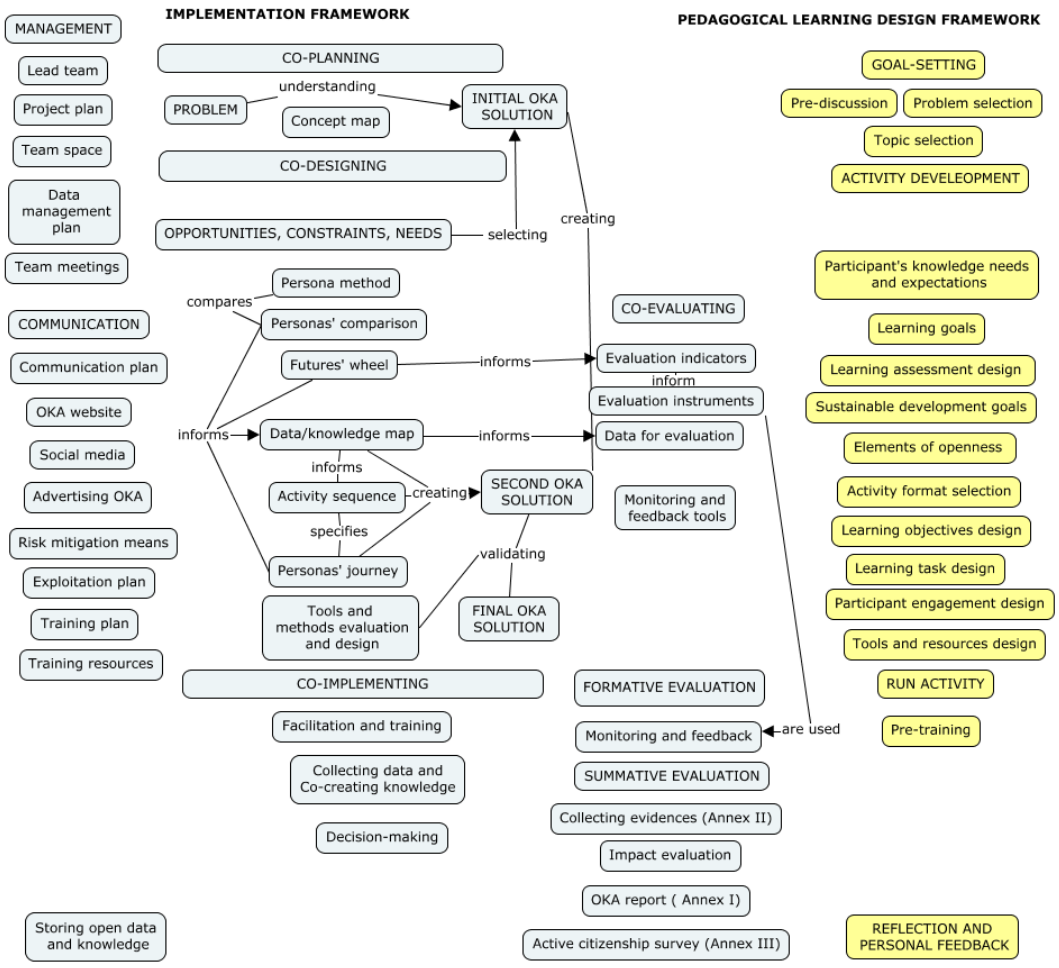

Figure 6. The concrete tasks, suggested methods and documents in each implementation phase (from top to bottom timeline) the team could develop and maintain. Note. The interrelations with the INOS learning design framework (LDF) are provided (INOS Report O2A3).

The designed OKA should be **formatively evaluated during the co-delivery stage**, and dynamically accommodated to the contextual factors, resources, software and data needs to improve the activity. **The summative evaluation means and instruments** for an OKA, and the **sustainable outputs for the exploitation stage**, should be designed early on **in the co-planning and co-design phases alongside the LDF**, since these also encapsulate the pedagogical learning outcomes.
Within all these stages of an OKA, **the management and communication activities** should be planned.

The chapter contains the following subchapters:
4.1. Co-planning, co-design and co-delivery of OKAs;
4.2. Planning for evaluation of OKAs;
4.3. Dissemination and exploitation in OKAs.
4.4. The checklist of compulsory evaluation activities that are needed to evaluate the OKA cases in INOS consistently.
The Annexes I-IV are to be applied by INOS partners in each OKA

4.1 Co-planning, co-design and co-delivery of open knowledge activities

4.1.1 Establish the lead team

Co-planning OKAs requires HEI educators, researchers, librarians and students to be involved in co-planning OKAs and engaging a wide range of interested external participants (experts, community stakeholders) to OKAs' planning, as well as, to scaling up the OKAs participation. The challenge for the HEIs is to **open up the planning activity for the students to increase their agency**, and **to involve other external stakeholders** and interest groups' representatives into planning.
According to the project INOS has planned to **involve at least 420 participants in all participating countries in OKAs.** These participants may take different agencies and roles in the activities.
Shirk et al. (2012) suggest **creating the lead team in a participatory manner**. In participatory public science research projects collaborations are intentional and engage members of the public in the process of research to generate new science-based knowledge (Shirk et al., 2012). The public stakeholders and scientists can jointly determine and execute the monitoring and analyses required and develop and implement methodologies, techniques and products that participants of the citizen science activity can use to adapt their behaviour. According to McKinley et al. (2012): "the science model, where user involvement is minimal or absent, often produces knowledge that cannot be readily used or easily accessed or does not adequately address the needs of

land managers, decision makers, and the public." True participatory democracy involves contributions from the widest possible spectrum of society: more inclusive approaches to engaging citizens are required to ensure that all sections of society are represented in citizen science projects (Environmental citizen science, 2013).
The lead team has to maintain their functionality from the start of OKA planning until its end. Thus, it is recommended **to develop the management structures** (such as **project roadmap, data management plan, risk mitigation plan**) for the project early on: the lead team should **define the roles and expectations to the agency levels of stakeholders (especially HE students' agency)** in the lead team as early as possible. In an ideal scenario the students should lead the OKA project, and the academic and research staff should facilitate the process, while the external stakeholders should be involved as advisors and proactive team members in decision-making on design, delivery, dissemination and evaluation tasks. The team should choose **joint media and networking spaces, modes and times for communication purposes**. These could be environments for running projects, enabling collaborative writing and sharing documents. It is recommended that at least in the first phase of planning, the lead team uses face-to face meetings and has **a shared virtual space for their OKA planning documents.** Later on, **regular meetings** may be held face to face for designing and decision-making, and virtual meetings for updating the team on project progress.
The examples of starting OKAs in HEI context include: i) creating the project tasks inside the formal educational activities in HEIs for student groups (such as LIFE projects in Tallinn University or Megaprojects in Aalborg University); ii) initiating the OKAs as part of wider public events (such as the "Looking the Cowslip" project of the Earth Science University in Estonia, https://www.nurmenukk.ee); iii) initiating novel university laboratories, incubators (such as University of Bordeaux) and research library usage practices for public engagement (such as in LIBER).
The following **OKA initiation process in HEIs** is suggested: i) the educators, researchers or library staff have to create the formal course or an informal event or practice with tasks; ii) the task description recruits students into the co-planning and design task for OKAs; iii) the students recruit some external stakeholders and **form the Lead team.** In other cases, **the initiator for OKAs may be the external customer,** who asks for services from the universities or libraries who can then initiate the lead team. In Tallinn University the interdisciplinary LIFE projects (see https://www.tlu.ee/en/life) can be initiated and led also by the student, that requires that specific guidelines and support structures were developed for such interdisciplinary project courses. Some universities have developed **specific researcher and student involvement procedures for service provision in the innovation laboratories to serve the public which may be associated with initiating OKAs**.
The lead team has increased agency and recruits team members into the **codesign, evaluation and dissemination activities of the OKAs.**

4.1.2 Distribute the key tasks in the OKA lead team

Discuss in the lead team the following **intertwined aspects** to **distribute the tasks** (see Figure 5):

- How can the lead team be managed while running the OKA?
- How can the impacts be achieved, captured and shared using FAIR principles (as data, forms of knowledge etc.)?
- How can targeted people be engaged and motivated to plan the OKA?
- How can the impacts and feedback be measured and collected to be used for further empowering the activity?
- What environment (actual places, digital environments, blended environment) mediates the whole activity successfully?

The OKA management, communication and evaluation activities are intertwined and should happen along the whole project. The team should consider an **OKA design in an iterative manner** that is described in the sections below. Generally, **in the first stage of Goal setting for the pedagogical learning design (LDF) for OKAs the team should do the following:**

i) Identifying the problem they want to solve with OKA;
ii) Planning for the OKA participants, their motivations, opportunities, needs and constraints, as well as, how to communicate with them;
iii) Planning for OKA goals and impacts that are important for all participants, and how to use those for evaluation;
iv) Planning for what data and knowledge OKA can create as an outcome and by what means, and how this data/knowledge could empower people and places;
v) Planning for the places (real, digital, blended) where data and knowledge would be collected, enriched and co-created, how it enhances the places, and how these places could mediate communication among the people and provide feedback;
vi) Planning for the tools and tasks that enable maintaining data and knowledge in this particular OKA and identifying the technical constraints.

Building on the design thinking practices (see the sections below), each of these activities in the planning stage could be opened up and mapped, and **in the second**

stage the constraints across different aspects have to be considered that will limit how the actual activity can be developed**.**
Note that in the INOS project we do not require that all OKAs will be co-designed with students and other external stakeholders (experts, researchers, community representatives) using design thinking approaches. HEI students' engagement into co-planning and codesign phases of OKA using design thinking as a structured and yet creation-focused approach is suggested as an option that INOS project can test out and verify. Thus, each OKA will formatively describe the implementation process they followed and the project will compose a report of best practices for HEIs for using open science with external from HEIs stakeholders.

4.1.3 Shift the agency to students giving them leading roles

Make the project team actionable, aware of their agency and empowered to lead – very often students come with the expectation that the lecturer or researcher is the leader of the team.
Designing the OKA in higher education settings with students leading the development requires providing them increased agency and decision-making. There is a double set of learning activities intertwined – one that develops the students' in the lead team, and another developed as a learning activity for a wider public. Experiences from different universities which engage students into interdisciplinary projects (e.g. Tallinn University to LIFE projects. https://www.tlu.ee/en/life) highlight that some **additional requirements might enhance making students aware of their agency - the specific learning outcomes in the course card may be defined, the students may be required to reflect upon their OKA design tasks and personal changes as active participatory citizens.**

4.1.4 Balance the tensions of interest in the lead team

There are often **tensions between interests** of different stakeholders. OKA design requires **establishing certain compromises among the stakeholders in the lead team** (Shirk et al., 2012). In balancing the tensions and motivating different stakeholders to be part of OKA it may be useful to **map each stakeholder using the persona method** that is described below (see 3.1.8).
McBride et al. (2019) make a list of **aspects that increase co-creation:**

- Relevancy of the problem for stakeholders increases their motivation and involvement;

- Try to integrate the activity with the other activities of stakeholders;
- Communicate and negotiate to establish common ground in the key values and concepts;
- Be open in sharing the data and the results with all stakeholders.

Additionally, Durall et al. (2020) highlight in the educational context the need of celebrating the diversity in co-design situations, for example:

- Providing opportunities for all to be engaged and to contribute;
- Respecting different value perspectives;
- Building on voluntary participation, interest, curiosity and fun;
- Bridging formal, informal and nonformal environments;
- Avoiding traditional assessment methods;
- Sustaining diverse competencies;
- Building on transversal competencies;
- Fostering transdisciplinary approaches;
- Recognizing the awareness of all stakeholders of learning and changes.

4.1.5 Extend the stakeholder network for lead group support

All OKAs will also engage the wider public into specific knowledge creation activities where their agency may be lower than for those that are part of the lead team. An important aspect of initiating citizen science activity is to **develop the stakeholder network** (van Vliet et al., 2014). Stakeholder networks may help in (van Vliet et al., 2014):

- Developing tools and methodologies to adapt;
- Monitoring timing of life cycle of citizen science events;
- Determining ecological and socio-economic impacts;
- Increasing the public awareness of changes and impacts.

Journalists have been found to play a role in **connecting scientists with other organisations and potential partners** as they often want to include information from more than one source (van Vliet et al., 2014). Journalists who are experienced citizen science projects may be particularly willing to communicate about the project when they find out how **data and knowledge will provide benefit to communities.**

The formation of the **community of stakeholders and participants** is an important factor in citizen science projects (Price and Lee, 2013). They noted that citizen science projects have a greater opportunity to build a social community (as evidenced in the forums) and to empower its participants more than individual or even classroom-based science projects. This agency stems both from a closer sense of ownership of the process and its products and, for collaborative and co-created projects, also from the influence

the participant has over the project structure. **The sense of community and personal empowerment is fostered by an active community** where **every participant has a role beyond that of an anonymous data collector or processor**. Online and interactive forums can support a more integrated community by narrowing the barrier between professional staff and participants. (Price and Lee, 2013)

4.1.6 Discuss the problem and the OKA idea using design thinking approaches

Designing OKAs may **make use of the design thinking strategy that iteratively expands and evaluates the design until it is finalized** (see Figure 7). The design thinking requires that the **design space** for the OKA must be iteratively developed in the co-planning and co-design stages, engaging the stakeholders who can bring in the LDF elements (see O2A3) from educators', learners' and educationally aimed (and other) organizations' points of view. Such an iterative design space mediates the discussions and enables shared understanding in the team.

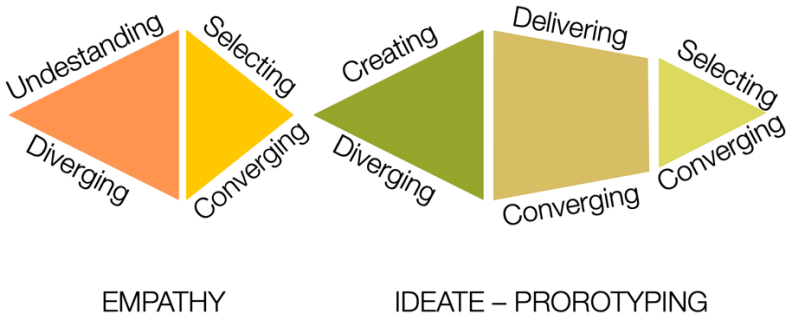

Figure 7. The design thinking process

Design thinking provides methodological approaches to visualize the design space and document the progress and iterations in developing the design idea for OKAs.

- **The generation of multiple open ideas** (e.g. brainstorming, brain-dumping, 'the dark horse', creative writing, speed-storming in changing pairs);
- **The convergent thinking techniques** where multiple resources are used to assimilate inductively one design hypothesis (e.g. open grouping for ideas, naming groups and structuring, affinity diagrams);
- **The integration techniques** (e.g. sketching), and attitude techniques.

The designed OKA should be formatively evaluated during the co-delivery stage, and dynamically accommodated to the contextual factors, resources, software and data needs to improve the activity.

The suggested phases for OKA development in the lead team using the design thinking approach are the following.

Problem definition (do it in the LDF phase Goal setting - see O2A3)**: The initiation phase requires determining the factors around the problem and developing appropriate methodologies to eliminate the problem causes.** According to Vliet et al. (2014) in citizen science activities various stakeholders within the society have to take action to solve the societal problems. People have to be aware of the problems they face and they can or should adapt or change their behaviour to prevent problems from taking place or to reduce their impact. They need to know what they have to do when and where in order to prevent problems.
For finding challenges and opportunities the team should try to first **expand the problem areas they are concerned with**, their causes and consequences, and then **narrow down to select the problem** they will aim to solve with the OKA. Various **empathizing strategies of design thinking** may be used in the codesign of OKAs in the lead team: brainstorming and brain dumping, building on analogies and metaphors, Venn diagram, fishbone diagram, problem tree, causes tree, futures wheel, etc. The team should do the following:

1. Narrow down the problem space and define THE PROBLEM to solve: the iterative approach requires prioritizing and selecting joint focus in challenges and opportunities for OKAs.
2. **Develop the initial idea**: in the co-planning stage it is important to come up with the OKA initial idea, but **keep it open and not too specific details too early.** Use design thinking methods to create coherence about the OKA idea, such as **concept mapping** (see Figure 8), card-sorting of values, focus groups for brainstorming, among the team members.
3. Ask:

- Why do we do it?
- What do we value and what values will we create?
- How do we do it?
- Where will we do it?
- For whom and with whom will it be done?

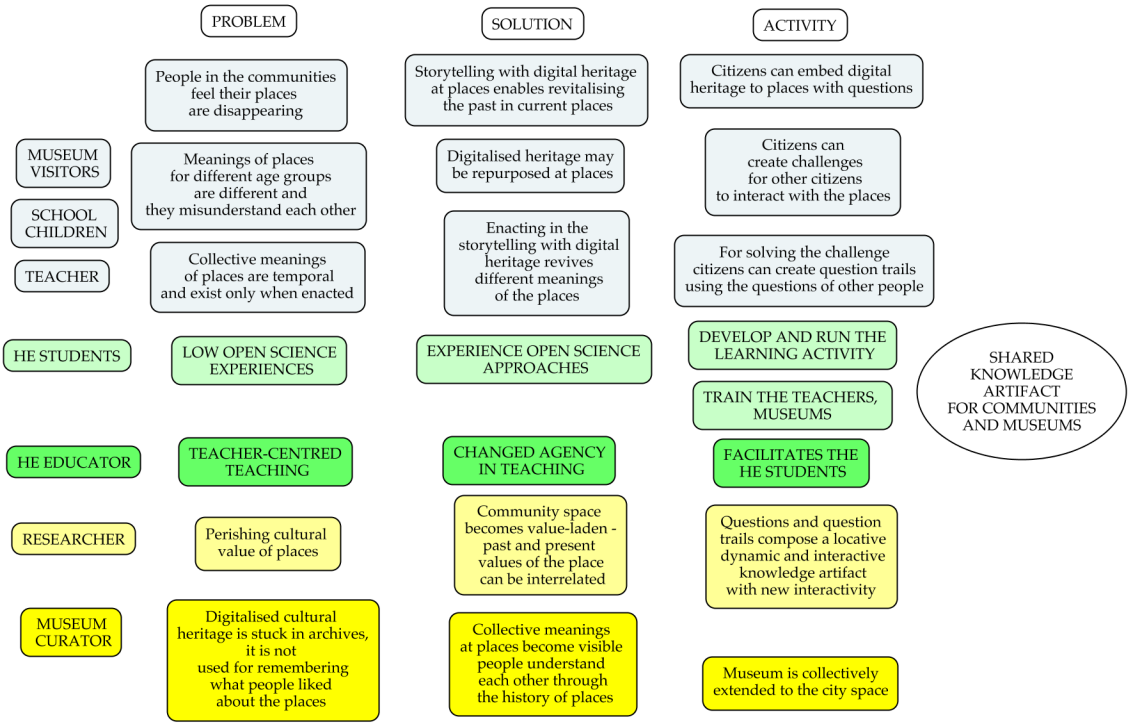

Figure 8. Example of the problem and idea development for an OKA in history domain. Different needs are considered when jointly developing the idea and initial solution

Think, how does your APPROACH contribute (eliminates the causes, fights with the consequences)? How may the stakeholders contribute to the approach? The lead team may use defining strategies of design thinking: e.g. persona-based constraining, SWOT analysis.

The start of the codesign phase that is including the Activity development phase in LDF development (see O2A3) should be quite open and **not restricting the idea to the existing environments and resources – narrowing down the idea to specific OKA activity will be done when the idea evolves.** Yet, often codesign of OKAs requires a series of parallel activities that map the resources, environments, places within the OKA idea and possible stakeholders (such as experts, community representatives) and participants that is discussed in sections below.

4.1.7 Discuss the participants in OKAs

In the INOS project we have agreed that OKAs should **recruit participants who are not necessarily familiar with university studies or with specific types of knowledge**, with the objective of making knowledge acquisition accessible and engaging. **The**

participants with fewer opportunities of participating in citizen science activities/open knowledge activities (OKAs) should be engaged. Good access points may be youth centres, schools, elderly centres or regional interest groups for communities. If and when possible, the lead team should i**nvolve key stakeholders in different communities to open up access to the rest**. Public fairs or outdoor events, as well as media advertisements may also provide temporary access to a wide range of people. INOS activity organizers must consider that **OKAs are focused on inclusion** and **intend to involve individuals eager to learn and experiment (this means voluntary participation).** INOS members hosting OKA's should **capitalize on participants' motivation** to fully **engage participants in thought provoking, inclusive and collaborative processes** beyond educational and cultural barriers. This engagement may be well done if involving external from HEI participants to the co-design team or to the formative evaluation activities. INOS project envisages OKAs as open to a wide audience and INOS partners will particularly strive to **involve citizens without prior knowledge of citizen science activities/OKAs.** For this purpose, some requirements for HE educational activities and teams must be created. Such **INOS project requirements include diversity and interdisciplinarity among the lead team participants.** The specific means to ensure diversity and inclusion in OKAs include limiting the number of participants by capacity and resources of the organizing partner (as defined in the project proposal), in cases where more applications than the maximum number assigned by each institution express interest, an ad hoc selection committee at each institution will make the choice, selecting the participants with no previous experience. Motivation will serve as one of the key criteria. In order to facilitate selection based on agreed upon criteria, **an online registration system with an open-ended field for motivations and previous involvement in similar events** should be **created at least 1.5 month prior to the event.**

4.1.8 Create the participants' user models (personas)

The lead team should **develop user models (personas) for OKA**. User models or personas are descriptions of typical stakeholders who have various interests in the OKA, such as educator, librarian, researcher, HE student, expert, external from university participants (students at schools, youth centres, elderly, customers or other various interest parts in the communities where OKA will be launched). For creating personas (see Figure 9) the lead team may use the persona card method known from design thinking practices. The team can identify who are key stakeholders related to the planned OKA (they may already be involved into the team or the team can investigate the problem situations and contexts around which they plan to do OKA and decide, which stakeholder groups could be recruited to the OKA, and what are their stakes in the OKA. The Personas are mapped on separate cards by the team using the large paper and paper clips. Each persona may have different motivations to participate in the activity, as well as, specific opportunities

that they bring in and constraints may apply in engaging them. Section 3.2.1. highlights some expected outcomes for different personas.

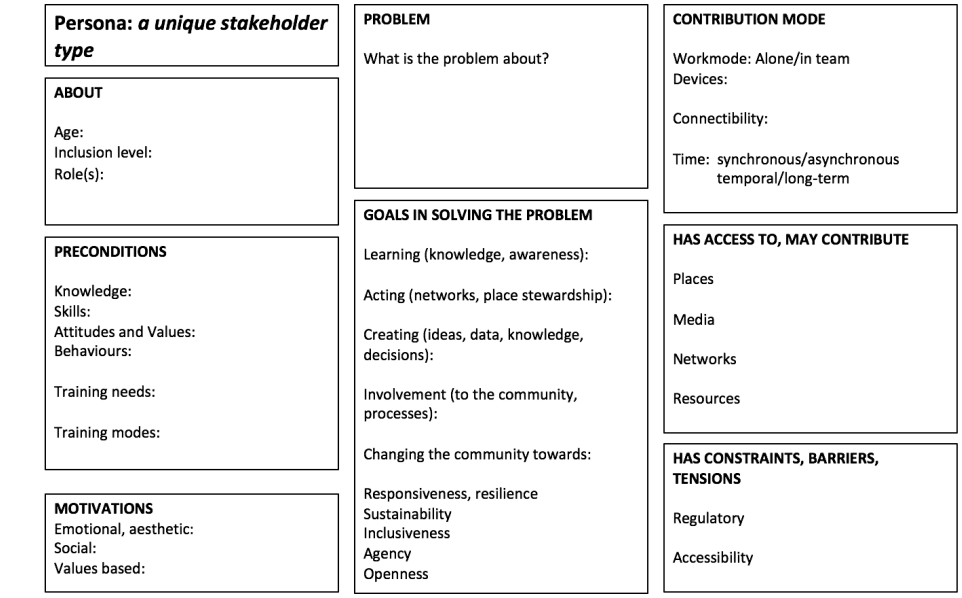

Figure 9. Mapping for personas (unique stakeholders) who have interest in the OKA

In the next phase **the personas' interests and tensions in the project should be compared that provides input into deciding what pedagogical needs they have and which pedagogical learning outcomes they could have** (see LDF in INOS report O2A3)**.** For this two approaches may be used.

First approach is to compare personas' to identify tensions, and find the input requirements for your OKA design (see Figure 10).

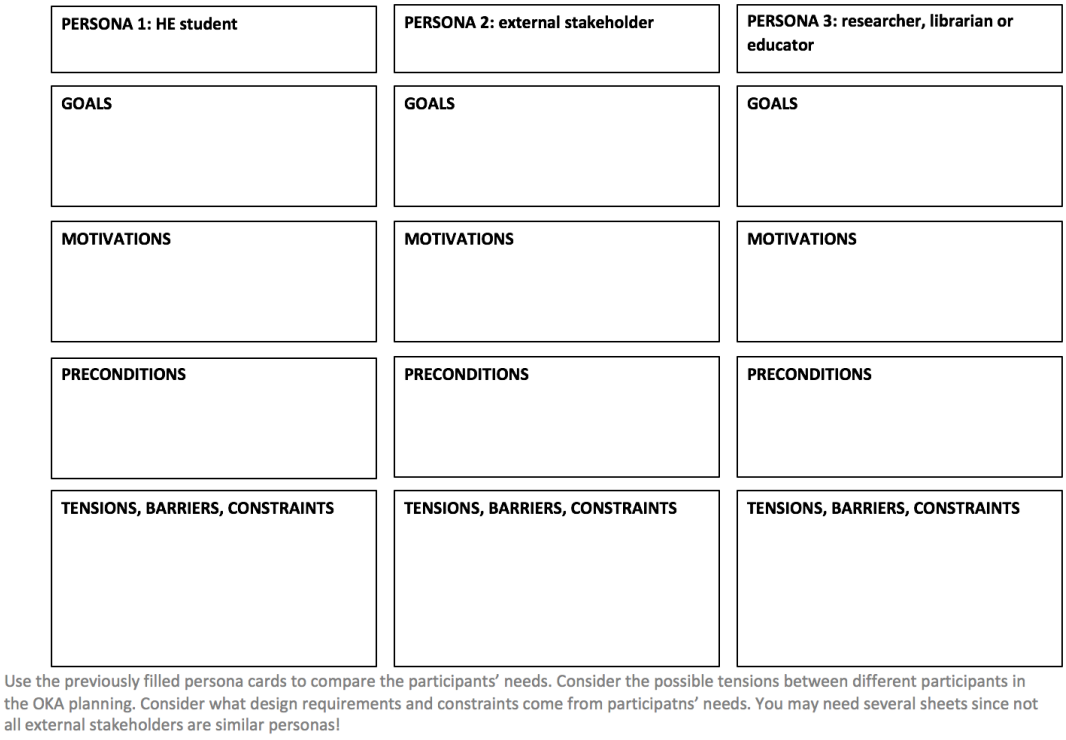

Figure 10. Comparing the personas to get information for the OKA design

Second approach to follow is mapping the planned learning activity phases, and then mapping on the phases the persona's interaction with the activity in each phase (the Journey map) (see Figure 11). Note that instead of using the templates on the paper, you should provide a sheet of white paper and the colored sticky notes that people can fill in, glue on the paper or board and move when needed. The journey map particularly highlights what is expected that people do in the activity phases, what (de)motivates people in different phases of the activity (Aha moments) and how to better consider their needs.

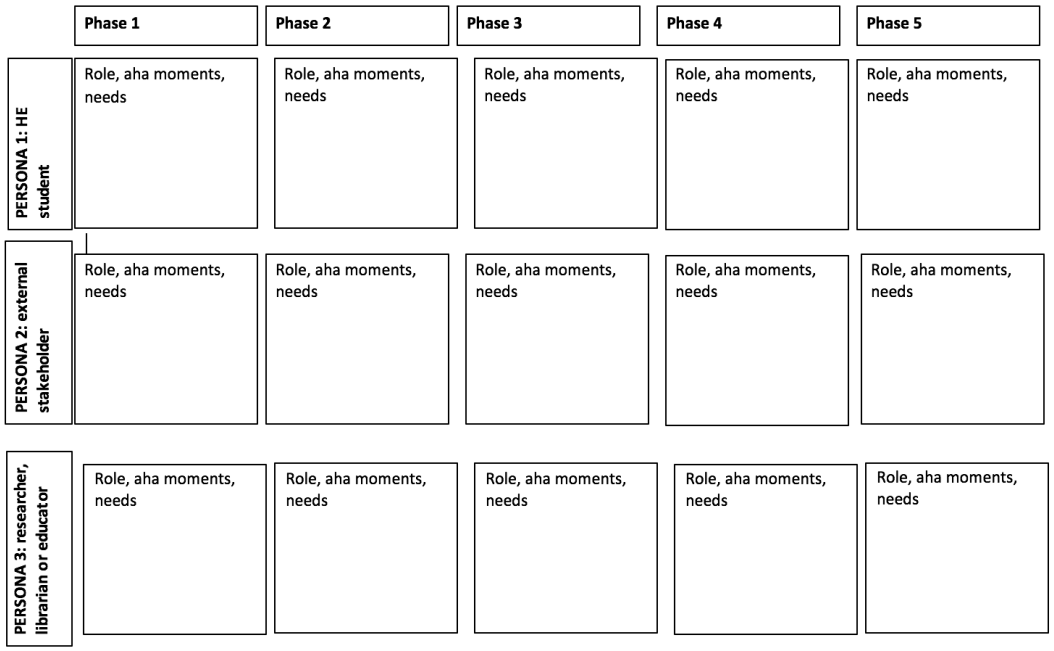

Figure 11. The OKA journey map validation with the OKA persona's needs

Below some information is provided that has been generalized from citizen science research. Consider with your team what might apply to your personas. The **barriers to co-creative approaches in citizens' engagement** are the intrinsic motivation of citizens (Juell-Skeilse et al., 2014), their personal characteristics and values, awareness of participation opportunities, participation skills, perceived capacity to participate in co-creation initiatives, perceived responsibilities in the process, trust in co-creative activities (Voorberg et al., 2015), relative importance of the co-produced product or values, available time and resources (Jakobsen, 2013), trust among different stakeholders, the communication between different stakeholders, and the understanding of the roles and leadership of different stakeholders in the co-creation process (McBride et al., 2019).

One of the key factors in involving anyone to the activities is their motivation. **Extrinsic motivational elements** can be provided with **external rewards and punishments**, for example the participants may be getting rewards for productivity in their contributions, for helping others etc. **Rapid feedback** is a powerful way of motivating participants for contributions, which may be c**ollected from the data, or provided by the mentor** depending on the activities.

Another type is **intrinsic motivation.** People self-regulate their activities, they set for themselves goals in the activities and **OKA design may help participants to set such goals explicitly, and provide support for people monitoring if they are achieving their goals.**
Intrinsic motivation comes from how important persons consider the activities for themselves and for their communities. Motivation elements of this type are pre-existing knowledge and/or expertise in the area being investigated; gaining skills, increasing employability or changing career paths; the perceived value of contributions that align with their values; visiting attractive surroundings is one of the major motivating factors for involvement in environmental projects.
Community aspects stem from the feeling of responsibility in improving their neighbourhood, creating dynamic responsiveness to the communities and places (such as with monitoring, sight stewardship), contributing to the sustainability, inclusion and social cohesion and trust among the community members are thought to be strong motivating factors for continued participation in citizen science activities; people with active citizenship competences may have the desire for contributing to the social, environmental or political change. Encouraging and supporting participants' involvement in citizen science research papers and activities beyond the project has found to be motivating self-regulated participants (Environmental citizen science report, 2013; Tweddle et al., 2012; Rotman et al., 2012).
In order to support this type of motivation the **OKA should have explicit goals that align with the goals of the participants. Feedback may be provided on how the goals are achieved by consolidated efforts in OKA**, so that participants can feel ownership to the activities. For example **personal data reports, or opportunities to analyze data for personal goals** have been good approaches. Provision of **dynamic updates** (e.g. newsletter) is a strong motivating factor for continuing participation, since it **helps people to see how they move towards the shared vision in their communities.**

Social alignment is also a strong motivator in continuing the activities, it is important to **provide for people means to gain credibility in the OKA community**, for example they may be provided with mentoring **roles**, they could have larger access to collaboration with the team. Rewarding the most skilled or enthusiastic participants by i**nviting them to take on extra responsibilities**, such as analysing data or managing groups of volunteers increases intrinsic motivation (Environmental citizen science report, 2013; Tweddle et al., 2012; Rotman et al., 2012).
It has been found that people want to establish social groups and connections, attribution and recognition (ranks, gratifications etc.) (Environmental citizen science report, 2013; Tweddle et al., 2012; Rotman et al., 2012) are good social alignment type motivators.

Holding a **feedback or closing event that incorporates social activity is also a good motivator** that keeps people going.

Rotman et al. (2012) developed the process model of volunteers and scientists' involvement in citizen science projects (see Figure 12). This model is based on Batson's et al. (2002) **four types of motivations for social participation towards common goals**: **egoism, altruism, collectivism, and principlism.** Egoism occurs when the ultimate goal is to increase one's own welfare. Altruism has the goal of increasing the welfare of another individual or a group of individuals. Collectivism has the goal of increasing the welfare of a specific group that one belongs to. Principlism has the goal of upholding one or more principles dear to one's heart (e.g., justice or equality). The authors suggest that in order to ensure long term, sustainable volunteer participation, their range of motivations should be repeatedly acknowledged and addressed throughout the project lifecycle.

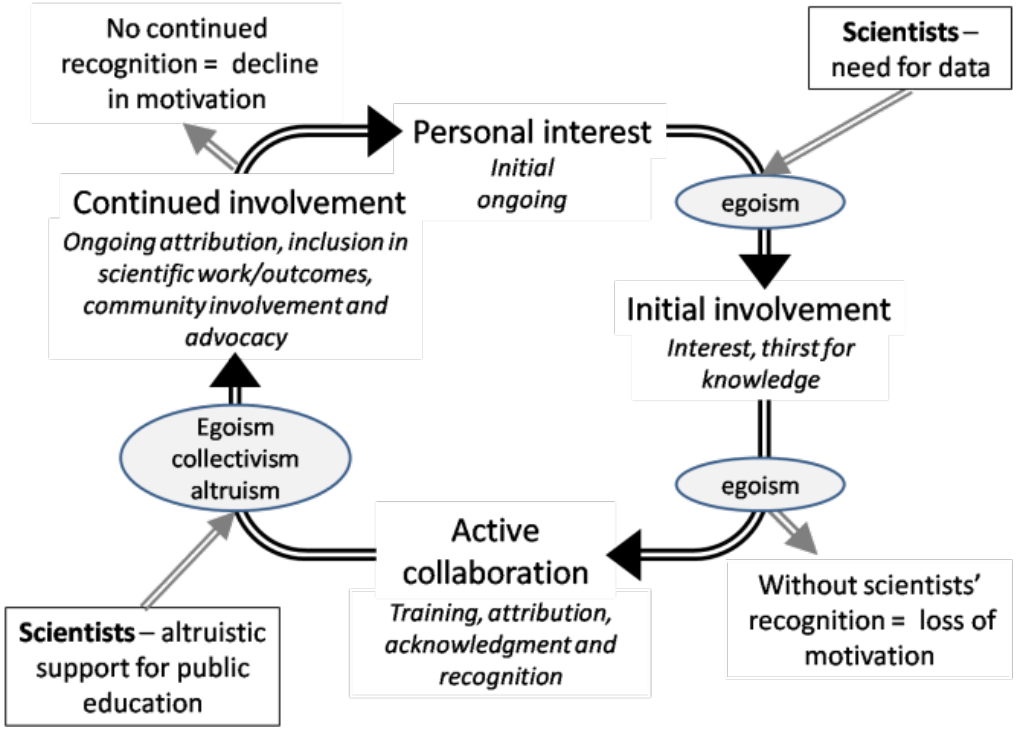

Figure 12. A process model of volunteers and scientists involvement in citizen science projects (Rotman et al., 2012)

According to Rotman et al. (2012), an in-depth exploration of the motivational factors affecting participation of both groups in collaborative projects revealed that both

scientists and volunteers presented **egoism as the primary motivation for engagement in citizen science projects**. Volunteers were found to want to do something that would satisfy their needs - interest and educate them through their participation - while scientists wanted to promote their careers. For volunteers, egoism was satisfied through attaining attribution and recognition, particularly by scientists. Collectivism was accomplished by the scientists providing group feedback to the volunteers, and also through community involvement and advocacy, where collectivism emphasized locality. Altruism was achieved by aiding scientists in data collection (and, rarely, data analysis) processes. Scientists indicated that altruism (public education) was the second important motivational factor after egoism, which for them was tied to the need for scientific data and desire to publish.
The one significant difference between volunteers and scientists was in their perception of collectivism – volunteers saw it as being just as important as other motivational factors, while the scientists indicated that working with volunteers will not be greatly beneficial to the scientific community as a whole.
Rotman et al. (2012) found that **time has a significant effect on motivation:** when volunteers' motivations are explicitly recognized they will engage further in active contribution to collaborative projects. Where these motivations are ignored (even if this is done inadvertently) volunteers' participation will decline.

Rotman et al. (2012) provide some **design criteria for increasing motivation**:
Timing. To ensure that the proper motivational probes are emphasized at the right time, the design should enable identification of points in which participation declines (or can decline) such as the end of a task, and interject the proper motivational probes. For example, when a project is initiated, recruitment materials can emphasize the inherent interest of the topic and volunteers' chance to learn, but materials provided to recruited volunteers should emphasize opportunities for recognition, advanced training, and social engagement. Throughout the lifecycle of the project appropriate materials can accentuate volunteers' contribution to their community or to the greater good. Games, with their intrinsically rewarding mechanics, may be used to attract people who are not initially interested in a less appealing topic (i.e., bacteria; worms) or engage them further in a topic of their liking.
Tip: Use the journey map to identify the points where the motivational support needs to be added. Plan into the roles and tasks of participants, to the communication plan, and data management the elements that can increase the motivation.
For example, OKA team may **create a leaderboard** to plan how the participants **gain points and move up in the levels.** Each level may provide different tasks, visible credibility, accesses. Leaderboards are designed as paths from where people can gain points or open badges. For example, there may be tasks like contributing with data/information, validating the contributions of other people, providing facilitation to

other people. Count how many events there are where people contributed to these tasks. Provide points for accomplishing the event. Write feedback when they accomplish. The feedback from each event should be provided so that people can see if they move towards their goal. For this, create the summative points, and visibility of top achievers. The visible comparison of how different OKA participants move towards the goal can create the competition. Getting the social rewards (stars, endorsements, likes) from the community when being helpful to others or to the community may be exchanged to the points or badges. There should be some points, which people can predict, and also the surprise points they may get for specific activities such as being supportive, responsible etc.
In the learning activity design (see LDF in INOS report O2A1) the leaderboard may be used for specific learning outcomes assessment purposes and for gamifying the activity.

Highlighting data use. Rotman et al. (2012) suggests that the selected open science system should make for the lead team and for the participants available information about where, how and to what extent the data were used, in order to provide feedback to the volunteers. Collaborative citizen science projects environments can include an automated mechanism that tracks each time data is used and what it was used for (publication, online repositories, etc.), augmenting a notification mechanism which routinely highlights cases when volunteer-generated data is used, and notifies volunteers periodically. Similarly, attribution should be clear, accentuated and easily manageable.

Locality. Local interests were often mentioned as catalysts for continuous involvement. Designing tools that are grounded in the local flora and fauna, or associated with local groups, highlighting the most pressing needs for local conservation, will accentuate ways in which volunteers' contribution to their immediate community is crucial, and can help in maintaining their engagement for longer periods of time. Also, for some people the opportunity of visiting other localities may provide additional motivation. Generally, contributing to their community and place is a strong intrinsic motivator. (Rotman et al. 2012)

Synergy. Rotman et al. (2012) suggests that by setting common standards for collaborative science projects, small scale and local projects can be networked in a way that will leverage locality into mass endeavors (such as the yearly bird counts). Synergistic ties between smaller communities will enable the discovery of data, people and projects that may be of interest. Networked synergy can be created by providing open APIs to local databases, setting common standards for data entry, storage and publication.

Matching scientists, volunteers and tasks. Overcoming geographical barriers by creating a common infrastructure, or a "pool" for citizen science projects in various domains, where scientists can create missions, or ads, for volunteer services, based on their need for data, analysis or other services. Volunteers who offer their services will be asked, at signup, to select their areas of interest, location, and expertise, and suggest potential roles in which they can contribute. At a later stage the system can be designed to automatically unearth secondary motivations (locality, desire to educate others) based on data derived from users and behavioral patterns that intervenes at pivotal times of participatory decline, and assign tasks appropriately. (Rotman et al. 2012)

Breaking tasks into smaller scale "building blocks". Similar to locally based projects, smaller scale building blocks allow volunteers to easily find tasks that would appeal to their interest and anchor their engagement for a sustainable period of time. This approach will also aid in overcoming some of the initial awe of mass scientific projects, and enable volunteers to take control over their level of participation. (Rotman et al. 2012)

Win-win model. Togwood (2013) identified normative, instrumental and substantive motivation dimensions for engaging the public in citizen science projects. A key focus concerns **the 'win– win' model of public participation in scientific research** that attempts achieving simultaneous and coterminous benefits for data generation, education and democracy (Cohn, 2008). There are three main rationales for expert-driven science initiatives involving the public. The first is the **normative rationale** that regards public involvement as democratic and enables re-establishing science as a legitimate arbiter of public policy (Togwood, 2013). **Instrumental rationale** for public participation is justified with the need to increase the completeness of data, engaging people through guided normative action and in parallel, educating them, providing them thereby with the knowledge to participate in scientific debates. Such a public engagement process feeds a professional analytical process (Togwood, 2013). The third, **'optimal' or 'substantive' rationale** suggests that public involvement results in more open, publicly accountable science, particularly around specific large-scale issues (Leach et al., 2005).

4.1.9 Discuss what might be the possible impacts of OKA's

There are micro-level impacts for students in the lead team and OKA participants, as well as meso-level and macro level impacts that the project creates. The impact design is fully described in section 3.2. **Consider how your impacts are associated with the learning objectives defined in the pedagogical framework (O2A3).** It is suggested that the **OKA team would use the Futures wheel approach** (see Figure 13) that enables to map the current situation at three levels, the current situation, the expected

situation when OKA is accomplished and identifying the means how this can be achieved. In the centre the OKA problem is positioned. Use large paper and stickers to fill in the map with the team.

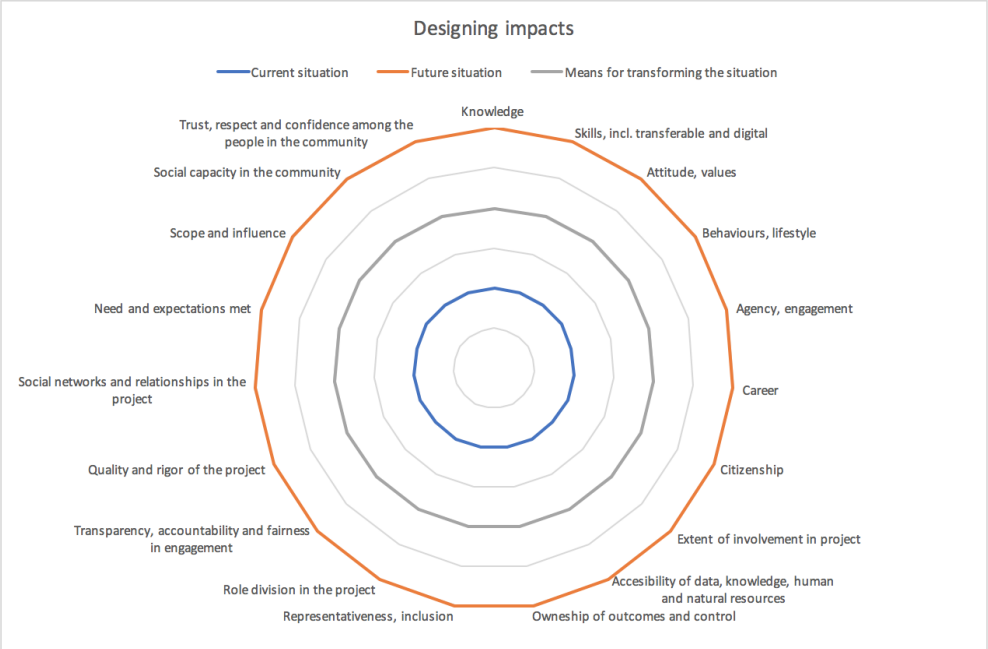

Figure 13. Mapping for OKA goals with the Futures' wheel method. Note the impact areas are aligned to the Haywood and Besley (2013) three-segment comprehensive evaluation framework of Citizen science activities presented in section 4.2 below. The design team may use their own indicators as well.

4.1.10 Involve students in deciding the learning outcomes for their learning and work in lead team

The OKAs in INOS may be composed by teams where there are only educators, librarians and researchers directing the OKAs to HE students and external from the HE people. On the other hand, in order to increase students' agency the HE students should be involved in planning the OKA. INOS envisages for **HE students to get new experiences in open science practices.** When students are involved actively in planning the OKA and participating in the OKA, they will have several learning outcomes that cannot be defined beforehand (before the OKA is designed). Therefore, it is suggested

that the **lead team participates in partially defining their learning outcomes and their measurement indicators.** The following explains how it is practically done in Tallinn University in LIFE projects:
The student or the educator may initiate the LIFE project course. LIFE is an interdisciplinary project course every student must take, which intends developing specific transversal competencies in working with projects. LIFE course has a universal course card, which is partially open with regard to course tasks and learning outcomes and assessment indicators, and there is a requirement that students' team together with the educator will define it in the beginning phase of the project. After recruiting the interdisciplinary team, the team discusses and finalizes the course programme for their group. With such an approach, the learning outcomes are jointly defined and this increases students' self-regulated learning.

4.1.11 Create the temporal or long-term community space

The teamwork, and the work with external participants in OKAs requires having **a common information space**. The information space requirements need to be decided early on and could be mapped already at the Persona cards and when planning the OKA environment. **Create for your team the temporal or long-term community spac**e (digital space, media space, real space) for the lead group participants' empowerment with network and project resources.
Create the common area for OKA participants. Build on cross- and transmedia experiences, as well as, placemaking ideas (see for more in the Communication and Networking sections below). Note that socio-technical and locatively interwoven places require mediation and prompting bursts to keep them active. Long launching time is needed that the common space will emerge and accumulate people, resources, trust, and credibility.
The actual places, as well as, social media and web environments may be used. In such environments the different results from OKA data collection and knowledge building, as well as, the **results of some formative evaluation activities may be feeded back to participants** in real time, asynchronously in face-to-face or virtual modes, **empowering the whole OKA as the citizens science and learning ecosystem and the individual participants.**

4.1.12 Plan the interaction modes in OKAs

This section describes some thinking that has to be done for planning the interactions for the learning design in open knowledge building activities. INOS Learning Design Framework (LDF)(see INOS report O2A3) suggests 5 types of open science

activities: passive, informal science activities, discussion based activities, inquiry based activities and problem-based activities. The inquiry based and problem based OKAs may be designed for individual **self organisation and self-regulated participation**. This requires good guidelines to be provided to people as learning resources. In such activities **crowdsourcing** is the approach used. Very often the **system will aggregate the data or knowledge** collected by individuals.
In the discussion based activities usual interaction is in the group. Group work usually presumes that a common goal is established. This may be done with different models; **cooperative models** require task division by individual members, **collaboration** rather than recruiting people for different tasks, and building on group discussions. Group work often additionally requires **human mentors**.
Individual contributions often use **open design models**, such as opening the ideas up to change, iterating the ideas, diverging the ideas, outsourcing the work etc.
OKA funding may be acquired using **crowdfunding models**. The necessary **resources may be crowdsourced** for the project to get started, or outsourced – such as using some existing data or services that complement the OKA. The place-related interactions may be considered as a result of OKAs, such as **place stewardship.** For example, in social science-related citizen science activities the site stewardship model has been used (Smith, 2014). In the site stewardship type of interaction citizens may be used for ground-truthing (collecting and validating information in locations - for example, in historic sites), site monitoring, and site discovery (Smith, 2014).
Interactions with the data and knowledge are described in the concept sections above.

4.1.13 Planning for tools and methods for data collection

The development or choice of tools and data collection or knowledge building methods in OKA is guided by the phases of the OKA activity. The choice of tools and methods always constrains and changes the planned learning activity to some extent. The general guidelines for choosing digital tools for the activity are:

- Ensure that digital tools are free for use;
- Ensure that tools are interoperable at the level of data and knowledge you create with the tools;
- Ensure that tools can be used with different devices, possibility with mobile devices as well;
- Ensure that the tools collect data FAIR way;
- Propose different apps that people may use for collecting the necessary data (not all apps work in different mobile platforms);
- Prepare user guides for your tools that introduce the data collection process;

- Test out the tools and methods before the activity.

When using citizens science tools the variety of free environments are available for building up projects. The OKA team should test out the systems mapping the activity needs to the system functionalities and vice versa, iterating the activity needs based on what opportunities the systems provide. Example environments are:

- http://Anecdata.org,
- http://Scistarter.org,
- http://Zooniverse.org,
- Citizen science project builder https://lab.citizenscience.ch/en/,
- https://pybossa.com,
- http://www.wildlifesightings.net.

Interesting resources for tool development can be found at: https://www.zentrumfuercitizenscience.at/en/helpful-tools.

4.2 Planning for evaluation of open knowledge activities

In order to observe the skills and competences development among participants in OKAs, an active citizenship competence scale for survey is developed (see section 5, Annex III). These scales together with other questions, related to the experience of participating in such activities were combined. **This survey will be distributed online to the participants of all OKAs** with the aim to collect quantitative and qualitative data on competence development and experiences in OS activities. **The survey must be translated to the local language.** Surveys enable practicing the unified across cases data collection. **At least a 65 % response rate is required from each project partner.** The collected data will be analyzed using correlational and statistical analysis methods, in order to draw conclusions on the effect of OS activities on skills and perceptions. The OKAs will be documented using elements from the implementation and pedagogical guidelines. They will be formatively evaluated (see Annex I) in terms of triggering interest, their impact, their applicability for open co-construction of knowledge, potential impact on open science knowledge and practices for the community, and transferability to other contexts.

In each OKA the summative evaluation means and instruments, and the sustainable outputs for the exploitation stage, shall be designed early on in the co-planning and co-design phases, alongside the pedagogical framework, since these activities also encapsule the pedagogical learning outcomes. Important aspects are:

- **Planning for outputs during co-design phase;**
- **Monitoring for outputs with formative evaluation** during the co-delivery phase;

- **Summative evaluation** of outputs and the project sustainability during the co-evaluation phase.

4.2.1 The outputs of OKAs

Citizen science projects take a "participatory turn" that focuses on "knowledge for action", such as resource monitoring for management, engaging diverse stakeholders, making power relationships transparent, encouraging constituents (Shirk et al., 2012). Participatory citizen science projects generally strive for outcomes that fall into one or more of the three main categories, as follows. However, projects do not always consider or acknowledge all three categories of outcomes. **In OKA planning these outcomes can be considered when filling in the Persona cards.**

- **Outcomes for research** (e.g., scientific findings such as collecting data about trends, distribution, abundance, frequency, diversity, spread, time or space or life-cycle related changes, implications; managing, digitalizing, curating, enriching data and networking data);
- **Outcomes for individual participants** (e.g., acquiring new skills or knowledge or values, awareness, an improved sense of place and/or stewardship; deepened relationships among people and the surroundings and social contexts, scientific literacy, expertise, increased agency, enhanced self-efficacy, increased social capital, community capacity);
- **Outcomes for social–ecological systems** (e.g., improved relationships between communities and management agencies, influencing policies, increased likelihood of participant engagement in policy processes, building community capacity for decision making, taking conservation action, community responsiveness to stakeholder knowledge and values, adaptive monitoring, rapid detection and responsiveness, increased resilience of systems) (Shirk et al., 2012).

According to Shirk et al. (2012), contributory projects are associated with robust scientific research outcomes and content knowledge gains; co-created projects affect timely policy decisions and enhanced resource management capacity of communities.

Jordan et al. (2012) have distinguished in their framework for evaluating citizen science projects' three levels of learning outcomes:

i) individual learning outcomes

Increases in . . .

- awareness, knowledge, understanding of ecology,

- understanding of the science process,
- engagement with and interest in science and nature,
- motivation to participate,
- science process and inquiry skills,
- environmental stewardship behaviors,
- science and ecological identity.

Haywood and Besley (2013) note that there has been the tendency to evaluate these categories among activity contributors only, rather than among all stakeholders (e.g. researchers, HE teachers). **In the INOS project we consider it important that we evaluate how OKA impacts all the participants: HE students, HE educators, researchers and librarians, as well as external from the university participants**. Thus we ask every OKA to conduct the survey among these participants after the activity (see Annex III).

ii) Programmatic outcomes

Improvements in . . .

- understanding of natural systems,
- audience reach, engagement with the public,
- understanding of program strengths and weaknesses,
- understanding of community issues,
- understanding of participant experiences, motivation, satisfaction,
- accessibility and utility of data,
- contribution to scientific research and monitoring, peer reviewed publications,
- relationship between program and community.

iii) Community level outcomes

Enhanced . . .

- social capital,
- community capacity,
- economic impact (job creation),
- trust between public, scientists, and land managers.

Haywood and Besley (2013) propose a **three-segment comprehensive evaluation framework of Citizen science activities.** They describe a set of holistic criteria that might guide the development and evaluation of Citizen science programs to integrate "education outreach" and "participatory engagement". The criteria are accompanied by guiding questions. **In the INOS project we propose that this thorough framework may be useful for planning the OKAs using the Futures wheel method described above.**

Segment 1. *Segment one focuses on micro-level output indicators of science education and learning, which incorporates behavioral outcomes, and the negotiation of values, perspectives, opinions and attitudes about science and society.*

Science Concepts, Theories, and Phenomena - Degree to which participants interact with, analyze, and assimilate information about scientific concepts, theories, or phenomena into existing knowledge.
For Citizen Scientists: Are participants able to interact with novel concepts, theories, and phenomena to expand their understanding of science and relate knowledge to their personal lives?
For Professional Scientists/Staff: Are project leaders able to interact with novel perspectives and expand awareness of how science concepts, theories, and phenomena relate to social processes or the lives of others?

Scientific Process and Skills - Degree to which participants increase awareness and understanding about science processes (i.e. framing measurable questions, designing research protocols, collecting and analyzing data)
For Citizen Scientists: Are participants exposed to steps in the science process in a systematic manner and are they allowed to practice research skills in an integrated fashion? Does knowledge about the science process increase or the acquisition of skills occur?
For Professional Scientists/Staff: Are project leaders able and willing to revise or adapt the research process to integrate citizen participants? Is new knowledge developed regarding how best to incorporate citizens into research design?

Career Connections - Degree to which participants expand awareness and understanding of careers in science, associated contributions to society, and the relevance of science to others.
For Citizen Scientists: Are participants exposed to various careers in science and able to analyze the contributions of those careers to society?
For Professional Scientists/Staff: Are project leaders challenged to consider novel connections between their own careers and research and those of citizen participants?

Transferable Skills - Degree to which participants are able to cultivate transferable skills throughout the project (i.e. writing, technology use, oral presentations).
For Citizen Scientists and Professional Scientists/Staff: Are participants provided opportunities to expand skill sets that are transferable to other settings and applications? What new skills are developed?

Values, Perspectives, Opinions, and Attitudes (VPOA) about Concepts, Theories, and Phenomena; the Scientific Process; and Science and Society - Degree to which participants are encouraged and challenged to negotiate VPOA about science concepts, theories, and phenomena; the scientific process and the knowledge produced; and the relevance and applicability of science to society.
For Citizen Scientists: Are participants encouraged to reflect on and discuss current VPOA relating to general science concepts and the research project? Are project leaders or other participants able to respectfully challenge and interrogate pre-existing beliefs? Do changes in these VPOA occur?
For Professional Scientists/Staff: Are project leaders actively engaged in reflection and discussion about their own VPOA relating to general science concepts, the research process or the role of science in society? Are citizen participants able to respectfully challenge and interrogate pre-existing beliefs? Do changes in these VPOA occur?

Attitudes about the Environment - Degree to which participants are engaged in reflection and discussion about VPOA on the environment to include how social, economic, and environmental priorities are set.
For Citizen Scientists and Professional Scientists/Staff: Are participants and project leaders challenged to consider individual and collective VPOA about the environment in relation to the research project, as well as how the research may impact changes in personal beliefs about social, economic, and environmental priorities?

Lifestyle Changes - Degree to which participation in the project influences changes in behaviors or lifestyle choices (i.e. pro-environmental behaviors, time engaged in similar projects, time engaged outdoors).
For Citizen Scientists and Professional Scientists/Staff: As a result of new knowledge, interactions with other project members, or the negotiation of VPOA, are participants and project leaders encouraged to evaluate individual behaviors against project experiences? Do participants or project leaders exhibit changes in behavior or lifestyle choices?

Citizenship - Degree to which participation in the project influences changes in behavior related to citizen-action activities, community involvement, or general participation in decision-making processes.
For Citizen Scientists and Professional Scientists/Staff: As a result of new knowledge, interactions with other project members, or the negotiation of VPOA, are participants and project leaders encouraged to evaluate elements of

citizenship against project experiences? Do participants and project leaders exhibit changes in behaviors towards community action, political processes, or advocacy?

Engagement in Science - Degree to which participation in the project influences changes in behaviors related to participation in science-related activities, discussions, and policy making.
For Citizen Scientists and Professional Scientists/Staff: As a result of new knowledge, interactions with other project members, or the negotiation of VPOA, are participants encouraged to evaluate individual science engagement behaviors against project experiences? Do participants exhibit changes in behaviors regarding engagement in public science projects and processes?

Segment 2. *Segment two highlights process indicators of inclusivity, representativeness, and mutual benefit and proposes that the assimilation of citizen participants into the entire research process and the level of interaction among project members should be considered.*

Extent of involvement - Degree to which citizen participants are integrated into the research project and process (e.g. research design, data collection, data analysis and interpretation.
How early are citizen participants consulted in the process and what stage/s of the research process are citizen participants included in? What roles do citizen participants have in the process compared to project leaders? (e.g. is there a division of labor? Are citizens included in analysis and interpretation of results?

Accessibility (Information, Human, Material, Time - Degree to which citizen participants have appropriate information, materials, and time to contribute to the research project or process (e.g. are participants able to review research abstracts, literature reviews, or mandates compelling the research.
Are citizen participants able to access pertinent research findings, salient literature, or project information used to inform the project before research begins? How independent is this information? Are citizen participants able to interact with project leaders to ask questions, receive information, or pose ideas? Has adequate consideration been provided to allow citizen participants time and space to participate in the research given other demands and responsibilities?

Role Definition/Instruction/Organization - Degree to which citizen participants are involved in the creation and defining of group and individual tasks, the clarity and structure of this process, and the availability of sufficient instruction where needed.

Are citizen participants engaged in the negotiation of project tasks and responsibilities? (e.g. who does what, how is the research organized?) Are clearly organized task and decision-making processes in place that facilitate interaction and engagement among participants? (e.g. regular meetings, conferences). What instruction and training is necessary? When and how will this be provided?

Ownership of Outcomes and Control - Degree to which citizen participants are engaged in data analysis, involvement in the compilation and dissemination of results and application of research.
Are potential research outcomes and applications discussed with citizen participants in the initial phases of the project? Do citizen participants engage in data analysis processes? Are potential intellectual rights and financial benefits discussed if necessary?

Representativeness/ Inclusion - Degree to which project participants are representative of the population that is/may be affected by the research. This may be measured by assessing the degree to which project participants represent the range of VPOA relating to the topic.
How are citizen participants initially recruited and are diverse constituent groups targeted? What groups are missing? (e.g. minorities, private industries, etc.) Do citizen participants and project leaders discuss the various human and non-human groups or VPOA that may be affected by the research? (e.g. what opinions about the science topic exist? What options have been proposed to address concerns?) Are efforts initiated to engage these groups or to ensure that advocates for affected groups are involved?

Transparency, Accountability, and Fairness - Degree to which the project, research process, and decision-making procedures are open and responsive (e.g. all interested parties can participate, procedures are clear and communicated openly, participants are treated fairly in the process of engagement.
Is information about the research process shared with impacted or interested groups not directly involved in the process? Are citizen participants and project leaders open to debate key issues, procedures, or goals? What efforts are made to ensure that all participants are afforded a reasonable and meaningful voice in the project?

Quality and Rigor - Degree to which the project is perceived as rigorous and credible. This may be peer-review for project leaders or the plausibility of research recommendations.

Are citizen participants and project leaders encouraged to discuss expectations of quality and rigor during the initial phases of the research? Are efforts made to ensure that the quality standards of all participants are upheld? Are novel integrated concepts of quality and rigor developed in the process?

Social Networks and Relationships - Degree to which the project facilitates new networks and relationships among project members or reinforces.
Do new networks, connections, or collaborative efforts result from the project or interactions among project participants or are existing connections strengthened? How do these networks contribute to science or enhance the lives of participants? How are these networks sustained upon completion of the project?

Segment 3. *Segment three focuses on science in society to produce a more open, inclusive, and transparent society and provides broad, community-scale outcomes (e.g. how does the research shape public health, economic systems, or local zoning restrictions?).*

Needs Met - Degree to which the products generated (intellectual or material) meet the legitimate needs and expectations of participants (e.g. early warning systems, relevant information by which to make health decisions).
Are the needs and expectations of citizen participants and project leaders articulated in the early phases of the project? Are issues of potential conflict acknowledged and discussed? Is space provided to assess these needs and expectations at the conclusion of the project and how are unmet needs and expectations addressed?

Scope and Influence - Degree to which products generated (intellectual or material) impact broader social, economic, or environmental systems and relevant policy (e.g. local laws and procedures, national standards, corporate practices).
Are citizen participants and project leaders involved in determining how and when research results are expected to influence relevant policies or management practices? How successful is the project at influencing relevant policies or management practices? Are project results utilized for these purposes and if so, in what ways? What are the social, economic, and environmental implications of the research project including issues like social justice, cost-effectiveness, and natural resource management?

Community/ Social Capacity - Degree to which the project influences the capacity of communities/social groups to respond to social or ecological challenges, negotiate conflicts, and develop solutions.
How does the project influence the ability of citizen participants to initiate action to address local challenges or scientific questions? Does the project enhance the resiliency or adaptive capacity of socio-ecological systems? Are residents better prepared to face future challenges?

Trust, Confidence, and Respect - Degree to which the project fosters general trust, confidence, and respect among project participants and in science.
Does engagement in the project influence the level of trust, confidence, or respect among citizen participants and project leaders? Does engagement in the project influence the level of general trust or confidence in science or the scientific process among citizen participants or project leaders?

Shirk et al. (2012) propose a framework illustrating the relationships between the quality of participation in citizen science projects and its outcomes. Regardless of the research context—project outcomes are influenced by (1) the degree of public participation in the research process and (2) the quality of public participation as negotiated during project design (Shirk et al., 2012).

Citizen science project outputs are often quantified, for example, in terms of the number of observations in a database, or the numbers of individuals, website visits, volunteer hours, workshops, and trainings (Shirk et al., 2012). Haywood and Besley (2013) note that **metrics to assess** broader questions about how science is produced and enacted within the context of Citizen science activities (e.g. who controls the science, what should it be used for?), the responsiveness of scientific research (e.g. who should the science serve and what needs considered?), and ontological and epistemological assumptions of the scientific process (e.g. what constitutes evidence, proof, fact?) are generally absent in evaluation frameworks of CS.
Project outputs often hinge on how and why data are gathered, how they are used, and the meaning they are given, as well as the depth and meaning of the lived experience (Lawrence 2010). Choices of what data are collected, and how those data are made available and usable for different constituents, also heavily influence outputs, including publications, education, and decision making (Shirk et al., 2012).
In INOS project OKAs our particular interest is to collect specific numerical outputs about engagement in the OKAs (see the partner responsibilities for OKAs). Each OKA also produces data and knowledge artifacts.

4.2.2 Data and Knowledge artifact outputs

Data collection and knowledge creation are central activities in many citizen science projects. OKA outputs include observations recorded as data, knowledge artifacts and active experiences of making, facilitating and/or analyzing those observations or measurements (Shirk et al., 2012).

Data management in citizen science projects must be planned, as in other types of projects. A Quality Assurance Plan and a Data Management Plan (DMP) are essential to improve the data quality and access to data. For INOS the consortium will develop a DMP with the aim of mainstreaming open data strategies at HEIs.

INOS project will **produce, when possible in OKAs, open datasets** following a robust Data Management Plan of the INOS project.

Each INOS OKA should describe what kind of data the activities will produce (see Figure 14). This is also important for designing the OKA activities, planning for tools, developing the OKA outputs and indicators for evaluating impacts. The list of questions each OKA team needs to answer are the following:

- Data Collection
  - What data will you collect or create?
  - How will the data be collected or created?
- Documentation and Metadata
  - What documentation and metadata will accompany the data?
- Ethics and Legal Compliance
  - How will you manage any ethical issues?
  - How will you manage copyright and Intellectual Property Rights (IPR) issues?
- Storage and Backup
  - How will the data be stored and backed up during the research?
  - How will you manage access and security?
- Selection and Preservation
  - Which data are of long-term value and should be retained, shared, and/or preserved?
  - What is the long-term preservation plan for the dataset?
- Data Sharing
  - How will you share the data?
  - Are any restrictions on data sharing required?
- Responsibilities and Resources
  - Who will be responsible for data management?
  - What resources will you require to deliver your plan?

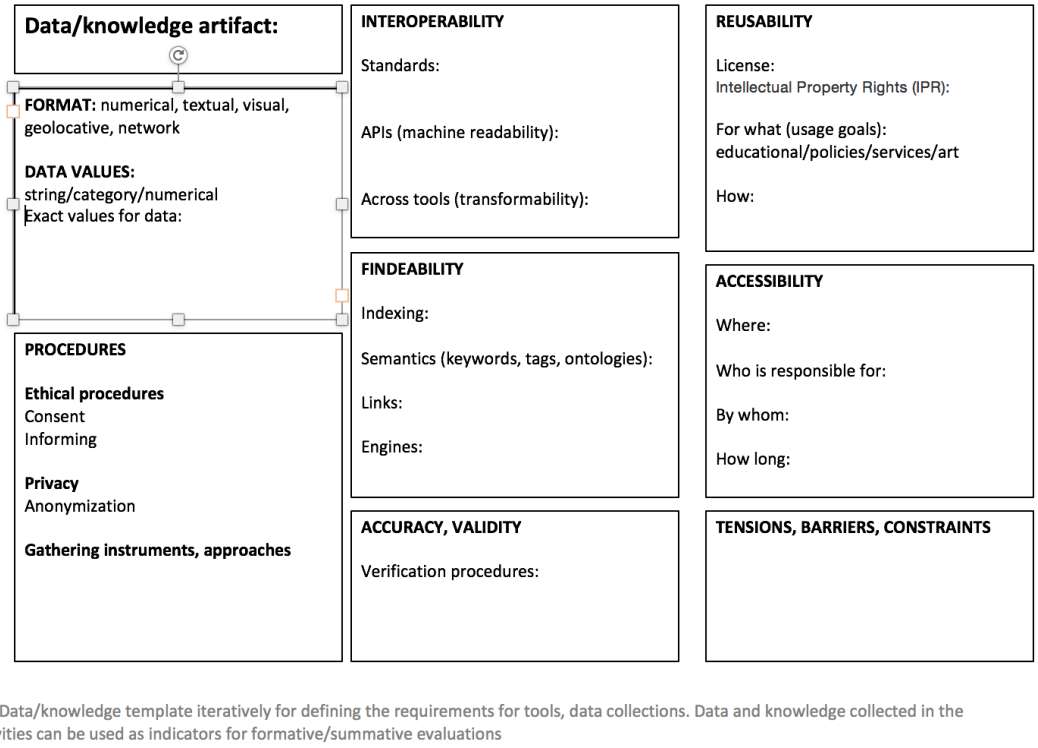

Figure 14. Mapping for data and knowledge artifacts created in OKAs

The OKA evaluation data also applies for data management regulations.
The formative evaluation data are collected by observations made by INOS partners when running the OKAs. The Annex I provides the data description and Annex II describes how the visual data should be collected from OKAs and managed according to the regulations. All the OKA formative evaluation data will be anonymized and pseudonymized regarding participants, but the cases will be identifiable. The formative evaluation data will initially be collected by partners and kept in their universities, the reports will be sent to Tallinn University who creates the dataset that is kept in Tallinn University, School of Digital Technologies server. The dataset will be used for preparing the report. The qualitatively coded and pre-structured dataset of OKAs will be prepared as an open dataset. The access to it is provided from the server providing the link at INOS project website.

The survey data are collected as anonymous data. The surveys are provided with the information sheet and the consent in participating the surveys will be obtained if it is required. The data will be collected together, translated into English (since the surveys

will be conducted in national languages) and pseudonymized if it is necessary. The data will be preserved in the server of TLU, School of Digital Technologies. The data from the citizen science survey will be prepared as an open dataset and provided access to the Internet through the link at INOS project website.

Planning for data collection, storing and accessing requires following the **ethical guidelines to collect data**, **data protection legislation, intellectual property rights** as well as considering the FAIR principles (Findability, Accessibility, Interoperability, and Reusability) (see Wilkinson et al. 2016). These aspects have been described at Figure 12.

The plan for data analysis procedures must be developed before data collection starts. One part of this plan is to ensure how data can be cleaned, and how openness of the data may be achieved the best. Confidence limits and verification levels should be documented alongside all data gathering procedures. Quality of data is likely to increase its use by scientists and policy makers (Tweddle et al., 2012). Nerbonne and Nelson (2008) have found that publishing low-quality data reduces expert trust in citizen data.
Data accuracy - Data accuracy is a component of data quality, and refers to whether the data values stored for an object are the correct value. In order for data to be accurate, the data value must be the right value and must be represented in a consistent and unambiguous form.
Data validity - Validation may be an expert based or automated process of checking if data satisfies a certain criterion (Tweddle et al., 2012).
Data verification - Verification (or ground truthing) is an additional, usually manual, process through which data can be checked by experts. One approach is to verify a subset of the data. Verification can also be crowdsourced (Tweddle et al., 2012).
The plan must consider how the **data will be visualized** during the running of the project to provide feedback to the stakeholders in the understandable and motivating format. (Tweddle et al., 2012)
One type of data in Citizen science projects is **spatial data**. See et al. (2016) have mapped different types of public initiatives with crowdsourced spatial data, such as geographic citizen science, geo collaboration, mapHacking, participatory Sensing, Web mapping, PPGIS, Neogeography, Ubiquitous Cartography. In citizen science, the data often have geolocation. Such data may be used for monitoring, feature or trend mapping, reporting of issues.
For achieving data quality **testing and validation of data collection procedures** should be done beforehand in realistic situations and with sample stakeholders (Tweddle et al., 2012).
Nerbonne and Nelson (2008) have created the typology to analyze **the data usage goals in the projects:**

- For educational goals, such as to provide educational experiences, to change behaviours, create awareness or knowledge;
- For policy change, to improve legislation, to use data as arguments in court, to use data in local planning decisions, to influence policies;
- For providing direct services based on data that improve local places.

Nerbonne and Nelson (2008) suggested that projects should use **the indicator of data usage to measure their impact**. For example, how many times the data were used in the official reports, in newspapers, at public hearings or events, how often data were used for informing the local government, for illustrating trends. The data quality in citizen science does not also correlate with a volunteer group's desire to use their data to promote regulatory change (Nerbonne and Nelson, 2008). Group size and number of years of monitoring positively influenced whether a group used their data. More data use was correlated with a group's feeling of connection to a network of engaged citizens and professionals. Citizens perceive that by publicizing their data, they are doing more to increase their networking potential (social capital outcomes) than they are directly impacting policy change. The authors found also that group size and the degree to which citizen groups perform tasks on their own (rather than aided by professionals) positively correlated with the quality of data collected.

4.2.3 Monitoring and the impact of the citizen science project

According to Bonney et al. (2009), in order to measure scientific literacy, citizen science projects can utilize project participation data (e.g., data submission logs), pre- and post-surveys, analysis of e-mail and listserv messages, self-report surveys, focus groups and interviews. Post activity monitoring may be done by sending the participants the survey of understanding how participation impacts them (van Vliet et al., 2014). McKinley et al. (2012) note that whether the citizen science projects lead to behavioural change is not guaranteed automatically as many other social and personal factors play a role.

4.2.4 Participation

Participation may be used as an indicator for measuring project impact, since opportunities for increased degrees of participation can open doors to a wider range of potential outcomes (Shirk et al., 2012). Rowe and Frewer (2000, 2004) have defined **two types of public participation evaluation**: acceptance criteria and process criteria. **Acceptance criteria** (e.g. influence, transparency, representativeness) relate to how a project or research procedure is conceived, constructed, and implemented. **Process criteria** (e.g. task definition, cost effectiveness) relate to elements of project or research

procedure design that may influence the legitimacy of the project in broader social settings.
Shirk et al. (2012) suggest measuring the degree of participation in citizen science projects as the extent to which individuals are involved in the process of scientific research: from asking a research question through analyzing data and disseminating results. Degree of participation can be measured in terms of duration of:

- involvement (Ballard et al. 2008);
- research effort (Dickinson et al. 2010);
- numbers (Wilmsen and Krishnaswamy 2008);
- diversity of participants (Cheng et al. 2008);
- the depth/intensity of involvement in the process (Wilmsen and Krishnaswamy 2008);
- the power that participants have over the processes in which they engage.

Quality of participation describes the extent to which a project's goals and activities align with, respond to, and are relevant to the needs and interests of public participants (Shirk et al., 2012). High quality participation requires:

- credibility and trust (Wynne 1992, Wulfhorst et al. 2008);
- fairness (Rowe and Frewer 2005, Cheng et al. 2008);
- responsiveness (Gaventa 2004);
- relevance (Cumming et al. 2008);
- agency (Cleaver 2004);
- due diligence in the development of appropriate research strategies (Cheng et al. 2008).

4.2.5 Attitude changes

The attitude changes among adult participants as a result of different citizen science activities have been comparatively measured with survey items (Brossard et al., 2005), but the authors indicated that these methods were not sufficiently sensitive. Price and Lee (2013) have measured positive attitude change towards science and epistemological beliefs about the nature of Science as a result of 6 months participation in citizen science projects. They used the survey items, performed interviews with some participants to clarify their experiences, as well as collected interaction data from the website (about communication, teamwork and observation practices) that were categorized for analysis. Their findings indicated the importance of community and communication with other participants and the experts to gain in attitudes towards science as a result of citizen science activities and feeling that they belong to the scientific team.

4.2.6 Changing the places, decision making, resilience in locations

Evaluation of citizen-science programs may help foster resilience - collective system's capacity for learning and adaptation (Jordan et al., 2012). The assert that when learning about an ecological system and its associated social institutions (e.g. policies, management practices) through citizen science, a group of individuals gains collective knowledge that increases the capacity of the socioecological community to reorganize and adapt to changes.

Citizen science can transform humans and their environment, but many projects struggle to meet decision-maker needs, generate useful data to inform decisions, and improve social-ecological resilience in locations (Newmann et al., 2016). They have defined the concept of leveraging the 'power of place' in citizen science by combining its material and symbolic perspectives which together create the capacity for citizen science to foster sustainable place-making. There is a need to understand the barriers to use of citizen science data in decision-making and understanding how knowledge gained from citizen science translates into conservation decision-making processes. The phrase 'power of place' embodies actions motivated by the emotional, cultural and material connection that many people have for the place in which they live, sometimes expressed as 'love' or 'attachment to place'. It also includes actions guided by the interconnected understandings which can come with this intimate connection (McGinnis, 2016). Citizen science projects and platforms that 'leverage the power of place' are those that connect with these motivations and understandings (Newmann et al., 2016).

Newman et al. (2016) identify place dimensions that are both symbolic and material, whereby place is socially constructed (agreed upon by people and existing within local and global cultures) and related to an actual physical reality. 'Place' includes (1) the physical location and ecological life support system i.e., a Social-Ecological System); (2) the narratives and place names that people ascribe to a place (narratives and place names); (3) the local knowledge(s) people have about a place (knowledge-based); (4) the emotional attachments people feel (emotional and affective); and (5) the ever-changing dynamic of active place-making (performative). The power of place in citizen science context is recognizing our dependence on, and connections within, social-ecological systems. The multiple forms of knowledge that influence our understanding of place can have a dramatic impact on our activities in relation to place. The emotional and affective dimension of place refers to levels of experience. Potential for active place-making may occur through citizen science and associated stewardship activities and the informed and empowered involvement of individuals in social-ecological decision making (Newmann et al., 2016).

4.3 Dissemination and exploitation in open knowledge activities

4.3.1 Social networks as an internal/external dissemination tool

The role of social networks can be considered in shaping the community space.
Some questions the team (lead team, together with participants or not) can be:

- Does the team plan to communicate internally through a social network, such as a Facebook (closed or open) group, or dedicated citizen science space (such as Galaxy Zoo, SciStarter, Spotteron), or dedicated learning management system (Moodle, etc.)?

If the team opts for a social network, as this may interfere with online identities users shape through social networks, **make sure everyone gives consent to use this social network for the OKA.**

- Does the team plan to use social networks to share processes and results of the OKA? If yes, then the choice of the social network/s, responsibility, disclosure level and sustainability/ownership after the end of the OKA are some of the points to be addressed beforehand.

If social networks are to be used for networking with the community or stakeholders or any other expert, it is advised to establish as a team a list of relevant persons to watch/follow so that these persons are aware of the OKA and help in its promotion (through retweets, posts in other platforms, etc.) It is not enough to post items but to ensure that there is a network of users/stakeholders eager to maximize the reach of the posts/messages.

- Independently of the use of social networks, it is important to have a web page, even the most elementary static page (on the institution's website or a simple blog) so that Internet users who connect with you on social networks have the possibility to learn a bit more about your project. This page should contain a very brief outline of your OKA and a list of the persons involved, as a minimum recognition of effort and commitment. In the INOS project we will orchestrate the links of OKAs to the INOS project pace to larger visibility.

4.3.2 Communication about the activity in the advertising phase

Before people can decide whether they want to participate, they need to know that the project exists and that they can participate. An open call for participation to OKAs will be broadly announced in English and in the native language of the host, so that participants with various educational and cultural backgrounds may join. The partners will promote the organization of OKAs through their communication channels, existing networks, and related initiatives.

Find a mass media communication channel via which they can show the following (van Vliet et al., 2014):

- That the project is interesting;
- Who can participate;
- What is expected from participants (what to do, when, where and how frequent);
- That participation is not too difficult;
- What the benefits of participation are for the participants themselves, for society and for the research.

4.3.3 Internal communication among the activity stakeholders

Communication in Citizen science activities should be seen as a means to engagement among the different stakeholders, and is thus an **indicator of the engagement level** in such projects. Citizens are not only recipients of information, but also important providers. The public should be given the means to aggregate, combine and generally re-use information according to their various needs; and to contribute with their own information, in their own language (Commission Staff Working Document SWD, 2013). Haywood and Besley (2013) note that asking people to engage in the science process for "engagement sake" does not automatically lead to more effective, efficient, or responsive science research or policy outcomes. The focus on discourse dominated by "scientific authority" should be moved from towards a more "contextualized" public communication centered on how science is situated and negotiated within socio-political contexts (Gerhards and Schafer, 2009).

4.3.4 Communication about the activity to the wider public

In the context of the INOS project and for dissemination purposes, each OKA team will collect in run-time content for video testimonials and provide this content to W2L, who will produce these video testimonials. This will take into account ethical and privacy requirements. The guidelines for this INOS task are provided in Annex II.
Each OKA is responsible for fueling visibility on the internet and social networks in the form of blog posts, multimedia sources, etc.
Communication about citizen science projects increases the newsworthiness of scientific information. Societal publications help facilitate the recruitment, retention and instruction of observers, stimulate the generation of new ideas and partners that lead to an increase in knowledge, awareness and behavioural change of the general public or specific stakeholders (van Vliet et al., 2014). According to them, societal publications can generate a snowball effect resulting in many other societal publications and an extended access to different target audiences as well as new partnerships.

Vliet et al. (2014) suggest the following **means for communication about the projects**:
i) Project website where:

- background and objectives of the project could be introduced;
- Instructions for participating and data collecting could be shared;
- data can be uploaded;
- observations could be visualized;
- project news could be delivered;
- social media news could be pulled in;
- partners could be involved (cooperation contacts).

ii) digital and paper newsletters;
iii) magazines and brochures;
iv) presentations;
v) fairs and workshops may be used for giving more personal instruction to participants and answering questions;
vi) conferences;
vii) social media news in Twitter, Facebook, blog that increase the sharing in peer-to-peer networks;
viii) Youtube videos;
ix) educational programmes (including educational materials and training workshops);
x) reports and books for professionals;
xi) radio and tv programmes.
For effective communication, a media module is suggested for citizen science projects, that orchestrates via RSS feeds the information distribution to different communication channels, is responsible for media quality for different target groups, looks for frequency of delivery, monitoring for media attention impact etc. (Vliet et al., 2014). The easiest practice is running for OKAs the blog. The blogs can be built up using both pages and the blog posts - pages should present content that is of longer term interest and that should be available from a website with few clicks. Such can be the goals of the activity, the team, the descriptions of the tools and processes', the learning materials, the newsletters. The pages can be categorised according to the sections like learning materials, tools, project information. The second option in blogs is blogroll with blog posts - that usually is presenting the latest news and should be frequently updated. The blogrolls can be pulled in to other social media systems, such as these can be aggregated centrally to the "mother" blog of INOS project, or around the university initiatives in open science. In order to increase the findability of older blog posts thematically, the categories and tags may be used for filtering the content and the categories and the tag clouds may be added to the social media tool. The blogroll categories have unique RSS addresses and can be separately filtered and pulled to other media environments. For creating the cross-media experiences the OKAS could also use other media spaces such

as Facebook groups, Instagram posts, Youtube channels from where media can be pulled together using the feeds and hashtags. It is suggested that the OKAs have unique hashtag (#) defined which is cross-used in different media spaces. The social media channels should not only copy the same content but try to create the complementing transmedia experiences for the communities that follow the channels. Each media space has its own unique qualities for telling stories - the images coming from the activities should be some ways tied with the knowledge building task, so that people could both collect information but also had an opportunity to share what they are doing with the friends not involved in the activity. The most shared are funny contents and contents where people can demonstrate themselves from the positive sides. If the OKA has a FB page, share on the page similar initiatives' content and monitor which organisations are sharing your OKA media content.

The experience is that shared blogs and groups in social media with community authorship might provide the voice to the participants, generally the media approach should be inclusive and encourage the OKA participants to post rather than having only the core team who is responsible for timely posts that others can read and share. It is suggested to establish some media rules for such communities to avoid negative or irrelevant content. For example one role the team can share with OKA participants is media mediator role. Also active leadership roles in media posting may be rewarded in the OKA communities.

The OKA's media should be inclusive for different interest groups, also to those not in the social media spaces. Thus the actual places where people meet, such as community and youth centres, elderly care centres, cafe's and community shops may be used to distribute information about the activity. One approach that people like much is getting free stickers or badges. For example, create a series of stickers that have different comics style visuals about the activity to trigger interest. If possible tie some of the media contents delivered in real spaces to the contents that are in digital mode in social media and in the websites where OKA activities should be conducted. Prompt to seek answers and follow-ups to the initial information so that people are tempted to follow the "trace" so that they can find the actual OKA activity.

For formative feedback of how well media creates attention the social media channels should be monitored. This may be done using the built in tools in the social media for visits, or adding to social media pages the Google analytics service.

Particularly from social media environments the content with the predefined unique tags and hashtags could be filtered out for analysis of the outreach.

Vliet et al. (2014) list five reasons how media posts directed to the public using different channels are useful for citizen science projects:

- Recruitment, retention and instruction;
- Generation of new ideas and partners;
- Increase of knowledge, awareness and change behaviour of people;

- Increase of credibility and authority of researchers;
- Implementing tools and methodologies to adapt.

Estimating the impact of citizen science projects by **media posts' outreach** has been found difficult, since differently from research papers such media contents do not have metrics (van Vliet et al., 2014).
The interest of public media communication channels to share the project information may be raised in association with specific events, in association with the health-related issues and similar.
The stakeholders' willingness to respond with action to the communicated citizen science projects depends on whether people know and trust the sender of the information - **the credibility and authority matters** (van Vliet et al., 2014). These authors provide a list of **factors or actions that can increase the chances of media attention for citizen science projects:**

- Actively inform journalists about your knowledge or findings by sending out press releases or simply emailing or phoning journalists.
- Gather the contact information of journalists you had contact with and keep them updated.
- Provide timely information before the events, have pre prepared stories for a wide variety of stakeholders and societal challenges.
- Be available for interviews.
- Have credible partner organizations on board who have high authority, show their stakes visibly, yet be cautious that some of your partners' stakes may violate your objectives.
- Have some participants as willing representatives to share their experience in the media.
- Be clear: what is the news/message I want to spread?
- Use visualizations that are catchy.
- Have free of charge pictures available, consider the consent of publishing pictures with stakeholders.
- Be aware of public discourse.
- Tailor information to different stakeholder groups.
- Don't give too many details, use understandable concepts.
- Designate contact persons for communication.
- Keep track of all the related communication and media.
- Monitor the press release effects.

van Vliet et al. (2014) suggest some **example models for communication**: describe the event; explain the causes and effects, socio-economic changes, ecological and societal relevance and impact, quantify the consequences, provide forecasts, suggest taking actions. For recruiting educational stakeholders (e.g. teachers, youth centres) it is very important to share the results and outcomes of the citizen science project clearly.
The communication should not be one way**,** from organizers to participants.
Societal publications can trigger people to ask questions to or to discuss a topic with scientists. These questions (particularly the 'so what?' question) and discussions are very valuable in getting a better understanding of the need for knowledge, information, tools and methodologies (van Vliet et al., 2014).
Societal publications can also help to inform colleagues, (potential) partners, (potential) funding organisations and governmental organisations about the work, results and tools and methodologies (van Vliet et al., 2014).
It has been theorized that the increased exposure via media will stimulate the **"third-person effect" or the "influence of presumed influence"**, prompting people to adjust their own attitude and behaviour because they perceive media as influential and think that it influences others (van Vliet et al., 2014). They write that being exposed in media news in association with citizen science activities may also increase personal credibility and engage through peer-to-peer networks the others to take part of those.

4.3.5 Training plan

Training in OKAs should be provided based on the pre-defined needs the external from HEI participants and HEI students have. These needs should be generally modelled when creating the Persona cards (see above). **For actual persons the training needs can be identified by short pre-survey the OKA teams can administer together with the consent and information sheets about the OKA.**
The training needs of HEI students who participate in the OKA team and design the OKA together with the educators are supported with the design thinking elements during the implementation process, as well as the INOS framework document O3A1 should be explained for them. Being engaged into the implementation activities develops various transversal skills that are obtained in action.
The members of the OKA team, HEI educators, researchers and the students may be prepared for taking some mentoring and facilitation tasks in OKAs. One opportunity in longer OKAs is to recruit active external from HEIs participants to the mentoring role. This is supposed to motivate them, since it increases their credibility in the OKA community.
The lead team should develop the training plan early on. Training resources must be orchestrated with the activity development. What may need training:

- how to use the OKA environment;

- how to collaborate and provide impact as an active decision-maker;
- how to handle data-collection instruments and follow the methods.

The Communication plan should be orchestrated with the training resource development - often the communication resources, such as cases, testimonials etc. may serve as good training materials for the next participants.
The training may be conducted face-to face in groups, the training may be mentor-based individual approach (in small-size projects), or it may be provided asynchronously as a self-study with digital (or paper based) resources.

4.3.6 Impact and sustainability

Compared with outcomes, impacts are long-term and sustained changes that support improved well-being, sustainability and other determined universal values in the project. Short-term (1-3 years) and long term (4 -6 years) impacts should be considered and planned for. Such impacts are difficult to measure and confirm. Types of achievable impacts in citizen science projects could be **sustained stewardship, knowledgeable and empowered citizenry, resilient and cohesive human-natural communities, responsive scienc**e (Shirk et al., 2012).

4.4 The implementation checklist for INOS project

Checklist of compulsory implementation activities for INOS partners:

- Develop your OKA (Period 09.2020-05.2021)
- Take formative observation notes, images, videos during your OKA planning and running. Be aware that you need to ask permission in the informed consent. Fill in the formative evaluation template (Annex I). Provide the formative evaluation data to partner Tallinn University as soon as your activity ends but no later than 05.2021.
- Create your OKA website and share the web address to INOS website developer.
- Translate the information sheet and consent to your local language (see Annex IV). Provide the participants with information sheets and ask their consent in participating in the OKA, using the data, engaging them into the networks, collecting evidence from their activity.
- Open the (online) registration to your OKA 1.5 month in advance. Share the informed consent.
- Provide inclusive access to the OKA participation to external stakeholders. Take notes how access is inclusive.
- Translate the survey (Annex III) to local language. Deliver online survey to participants after OKA. Check how many participants (HEI students, educators, external from HEI participants) filled in the survey, does it meet the success indicators in the project for your partner? Provide the survey data to the Tallinn University partner no later than 05.2021.
- Collect evidences and provide input for video testimonials (see Annex II). Make agreement with some participants to give interviews, ask their consent in using the data.
- Collect nonsensitive interaction data from systems about the activity during its lifetime (if applicable). Consider it in your OKA's data management plan.
- Inform your participants about lessons learnt - provide in the information letter the address to the website where information can be found; in case if you can send to participants information, do it after the OKA and thank them as well.

5 The survey for measuring active participatory citizenship competences in open knowledge activities

One goal of OKAs is to develop participants active participatory citizenship competences, and therefore, a survey instrument needs to be developed. Several frameworks and definitions of active citizenship can be found from the literature. The most used definition seems to be that active citizenship is "participation in civil society, community and/or political life, characterised by mutual respect and non-violence and in accordance with human rights and democracy" (Hoskins, 2006).
One of the most used frameworks in Europe is Active Citizenship Composite Indicator (ACCI) framework which was developed based on the European Social Survey 2002. ACCI covers 19 European countries and it consists of 61 basic indicators divided into four dimensions of active citizenship: Protest and social change, Community life, Representative democracy and Democratic values (Hoskins & Mascherini, 2009). The items in these dimensions are the following:

- Protest and social change - protest (containing signing a petition, taking part in a lawful demonstration, boycotting products, ethical consumption and contacting a politician), engagement in human rights organisations, trade unions and environmental organisations (each containing membership, participation activities, donating money and voluntary work).
- Community life - engagement in religious, business, cultural, social, sport, parent-teacher organisations (each containing membership, participation activities, donating money and voluntary work) and providing unorganized help.
- Representative democracy - engagement in political parties (containing membership, - participation, donating money or voluntary work for political parties), voter turnout (containing voting on national elections and European elections) and participation of women in political life.
- Democratic values - democracy (containing values in relationship to citizenship activities), intercultural understanding (containing immigration) and human rights (containing relationship to law and rights of migrants).

In addition, Campagna et al. (2020) focused on two types of participation: cultural and civic. The participation in civic life was defined as: "the behaviours and attitudes through which people express their willingness of interacting within the community and contributing to its well-being, as far as four dimensions are concerned: Political life, Civil society, Community life and Civic sense." (Campagna et al., 2020; p 6). The participation in civic life is more related to the INOS project. Several scales exist that study the participation in civic life: Keeter et al. (2002) have developed the Index of Civic and Political Engagement; Doolittle and Faul (2013) have proposed the Civic

Engagement Scale; Talò and Mannarini (2015), and Hoskins and Mascherini (2009) have developed the Active Citizenship Composite Indicator.
Several frameworks concerning active citizenship among youth can also be found. For example, Miranda et al. (2020) developed a model suitable for measuring youth citizenship which included two dimensions: community dimension (individual's relationship with their community associations) and civic dimension (institutional processes such as voting and/or political activism). Šerek & Jugert (2018) reanalysed survey data from the International Civic and Citizenship Education Study (ICCS) conducted in 2009 in 38 countries across the world. Among others, they looked into youth trust in country-related institutions (national government, national parliament, local government, courts, police, and political parties), trust in European institutions (European Commission and European Parliament), participation in wider community (e.g., environmental organization or a voluntary group doing something to help the community), participation at the European level activities (e.g., activities in local area that involve meeting people from other European countries or school trips to another European country), political interest (in local, national, foreign and international political issues and national social issues), discussing political issues (discussion with parents and friends about political or social issues and international events), watching news on TV to stay informed about European news, post-materialist value orientation including support for equal rights for immigrants and support for gender equality.
All these frameworks show similarities in the dimensions of active citizenship, but the focus is mostly on political participation. To develop a survey instrument that fits the scope of the INOS project and can be used after OKAs, the following three dimensions of active citizenship were used: **socio-economic, socio-cultural and politico-legal** (see Figure 15). We developed the three-dimensional model for active participatory citizenship, where we have considered particularly the Micro, Meso and Macro level outputs of open science activities.

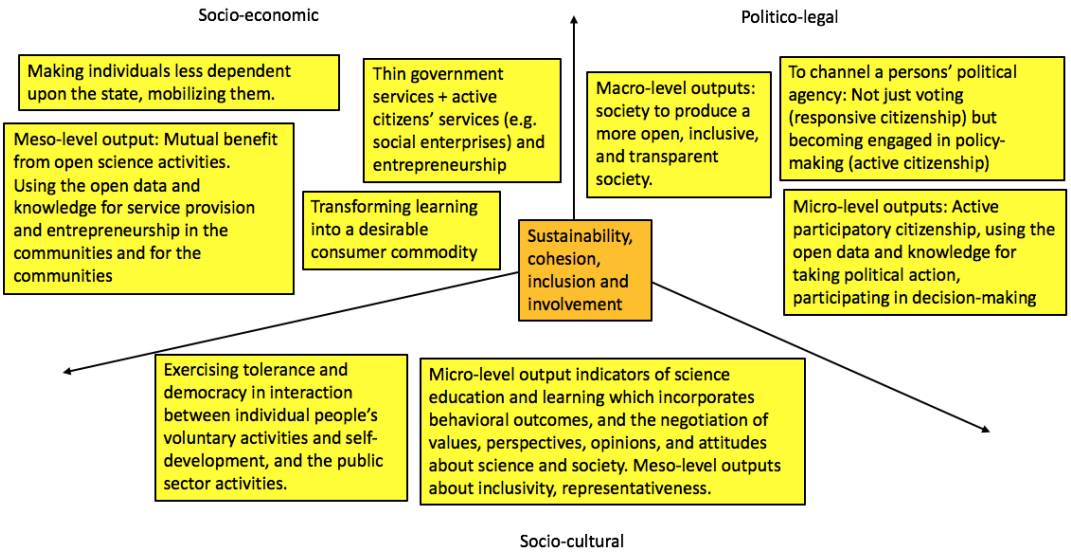

Figure 15. Framework of active participatory citizenship used in the survey instrument

The survey has the following components: the survey starts with asking respondents' background information and feedback about the OKA. Then items of the three dimensions (socio-economic (items 1-5), socio-cultural (items 6-10), politico-legal (items 11-X15) are evaluated on a 5-point scale (from "I certainly agree" to "I certainly disagree"). Each dimension includes 5 items that focus on either gained knowledge (items 1, 2, 6, 11, 12), future activities (items 3, 7, 8, 13) or values (items 4, 5, 9, 10, 14, 15). The whole survey instrument in presented in Annex III.
It should be considered that the instrument is not tested for validity and reliability. Tallinn University plans to test the instrument in teacher training which focuses on citizen science. In addition, each INOS partner should translate the questionnaire to the native language of the OKA participants.

6 Conclusion

This document was provided to guide the INOS project's open knowledge activity (OKA) implementation. The document complements the LDF for open science activities (INOS report O2A3). It must be noted, that conducting the open science activities with HEI students and external from HEIs participants is a challenge that INOS project intends to test out. Thus, we do not yet have good case studies, what way the implementation process would work the best in the HEI context. In this framework, we have taken the advanced step in suggesting that the HEI students should be involved in developing the OKAs, because it increases their agency and may develop their active citizenship competences better than just passively participating in the learning activities developed by HEI educators and researchers. If the partners in the project do not engage the HEI students into the lead team, the framework is still applicable and guides the process phases. To fill in the design thinking templates is provided as an option, not the obligation.

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8 Annex I
Formative evaluation guideline for implementing OKAs

Name of the OKA activity:
Name, name of the INOS organization(s) and other stakeholders who are (jointly) responsible:

Topic of the activity:

Domain area: (check all relevant): natural sciences/social sciences/arts/humanities
The length of the activity (planned execution period):
Activity duration: short-term/medium/long-term
Who are participants in OKA:

- HE students (bachelor/master/PhD)
- "citizens" (children in school, museum/library visitors, youth centres, people accessed via digital channels or events, elderly centres)
- researchers, HE educators, librarians

Mode of engagement: individual/small group(s)/large group
Delivery mode of the activity: face-to-face/blended/online; synchronous/asynchronous
Tools and resources contributed and needed for planning OKAs, running OKAs, exploiting OKAs outcomes (provide short list or links):

- collaboration facilities
- tools/equipment
- apps, software (including open software and Citizen science project software)
- learning resources (online/on paper, including OER, learning resource repositories)
- data, knowledge, repositories

Frequency of interaction: one time interactive event/periodic submissions or interactions
Activity approach: Please provide short information about how you planned and implemented the activity. Phase: Where? (place, medium) Who? (HE educator, researcher, librarian, HE student, external from HE participant) What? (what they do) With what? (data, knowledge, resources) Why? (goals, outcomes, outputs, impacts)

Preparation of the activity:
Phase I:
Phase II:
…

HE students participation mode: Compulsory/optional formal learning activity for your HE students (as a course, course task or project they get graded)/Voluntary informal learning opportunity they can do at their free time
Note. We assume that the OKAs engage HE students to participate and organize citizen science activities.
HE students' agency in the responsibility areas:

i) OKA idea generation: missing/low/high; **(please specify)**
ii) OKA co-planning and co-design: missing/low/high; **(please specify)**
iii) OKA team management: missing/low/high; **(please specify)**
iv) OKA execution: missing/low/high; **(please specify)**
v) OKA evaluation: missing/low/high; **(please specify)**
vi) OKA communication: missing/low/high; **(please specify)**
vii) using the results of OKA: missing/low/high; **(please specify)**

How were "citizens" accessed/involved and by whom: (e.g. by researchers/HE students/local stakeholders in organizations; what way you accessed e.g. social media/event-related (workshop, meeting)/place-related contact (in school, library, centre etc)
What are educators', librarians', researchers', and HE students' preconditions for participation:
Note: here we collect information that can support HEs in planning OKAs as open science learning activities.
Mentoring needs during the OKA: provide short paragraph about mentoring needs during OKA design, implementation, evaluation with students
Grading the HE students: **explain what way grading was organised for OKA**
Please describe the difficulties in the crisis time to deliver your planned activity:
Past history of the OKA: Conducted earlier/Conducted something similar/Totally new
If available provide here links to the activity resources.
Explain shortly, what did HE educators, librarians, researchers, HE students, external participants, organizations achieve with implementing and participating in the OKA:

- the creation of shared open data, knowledge and resources in which each stakeholder has an equal interest (widely known as "commons creation"), in a participatory, bottom-up and user-driven way.
- the development of technical and digital skills or the mastering of new tools among the participants.
- the creation of evidence-based results to strengthen the evidence-building effort highlighted in EU policies (decisions, problem solutions)
- change in mindsets regarding knowledge accessibility, open innovation, social engagement and the HE role in society.

How long can the OKA outcomes be used: short-term/long-term
How did you follow ethical, privacy requirements and copyright policies?

- How did you follow ethical guidelines in recruiting participants?(e.g. consents, information sheets)
- How did you manage the data? (describe using FAIR principles)
- How did you follow copyright policies?

9 Annex II
Guidelines for video testimonials common to INOS' O3 and O4 activities

Prepared by Katerina Zourou, Ania Skowron and Giulia Torresin, Web2Learn (W2L), on May 27, 2020. Comments are very welcome!

1. Context

For O3 and O4 citizen science (CS) activities foreseen, partners having the responsibility of carrying them out will produce, with the technical support of W2L, short videos of approximately 1-1,5 minutes to maximize impact of the local activities, to share them broadly with the international community as well as to connect all CS activities of INOS project happening at different locations, under a common identity of the project.

2. Profile of interviewees and expected result

As citizen science is a multifaceted phenomenon, we opt for one (1) interview with a participant and one (1) interview with a mentor/coordinator of the event, for each of the 2 outputs. Therefore, the final result will be:
O3: one participant video and one mentor video= 2 videos
and
O4: one participant video and one mentor video = 2 videos
Total: 4 videos by partner
If a partner wishes, the video with the mentor can take the form of a short recorded online interview that we can carry out (yourself acting as the interviewee and us (W2L) acting as interviewer) through a videoconferencing system.

3. Choice of the event during which the interview will take place

Because in each Output every partner carries out two CS activities, each partner decides which event is more suitable to carry out the recording. It is thus up to the partners, as organisers of the event, to find the most suitable participants from the suitable event. INOS focuses on the potential of CS to Higher Education, so university students as participants seem to be ideal interlocutors. This also allows them to overcome the obstacle of participants of minor age.

4. Duration

The total duration of the video is expected to be around 90 seconds (can be up to 120 seconds). The point of keeping the duration short is a) to adopt the general trend for short videos as a guarantee that the entire video is watched and b) to maximize the overall number of videos views, in a way that connections/transitions happen between all INOS videos gathered by all partners. Through this strategy we ensure a bigger reach: a more diversified audience (from more countries than the local/national community of the interviewees), and a complementarity of points of view (participants/mentors).
The total duration of each video will be slightly bigger than the mere collation of video extracts (around 10 seconds more) because we plan to add pictures and 3 slides, namely a) the INOS project identity b), the event factsheet (cf. point 8 below) and c) a disclaimer slide with all our communication channels.

5. Content

We opt for common questions to be asked to all interviewees, participants as well as mentors, as a means to familiarize the audience with the wealth of CS projects and all connections between the different CS projects.

Task: agree on 3-4 questions common to all participants
Task: agree on 3-4 questions common to all mentors

6. Recording a video

Some basic advice on how to shoot your video[1]:

· Audio Conditions – Film in a quiet place, where you are not likely to be interrupted.
· Lighting – Film in a bright room, in the shade outdoors, or under cloud cover. Avoid bright sunlight as it creates harsh shadows. Avoid lighting that comes only from directly above.
· Camera Orientation – Film with landscape orientation (horizontally) This will be most practical for viewing on all types of devices.
· Composition – Having your subject in the center of the frame, looking directly into the camera, creates a very personal feel and can load your video with emotion.
· Camera Angle – Keep the camera just above your subject's eye level, slightly angled down, which is flattering for most people.

7. Images

To make an attractive video we also need pictures from each event. Pictures are ideal especially when we need to remove some small extracts from the video due to factors such as noisy extract, very silent voice, etc. Please take as many pictures as you can, and

in case of a person of minor age, we can edit these pictures (by blurring them) if needed afterwards, at editing stage.

8. Event factsheet

We will add one slide with short event identity so we kindly ask you to fill in the following data for each event:

- Title of the event
- Type of event (cf. types of event in O3 and O4 description in the INOS proposal)
- Location
- Start/end dates and duration
- Participants (e.g. 17 university students & 2 mentors)
- (any other information you would like to indicate, for instance, names of the participants (optional as it depends on institutional policy- see also informed consent form below)

9. Storage of videos

The final videos, after being edited by W2L, will be stored at each institution's site, according to each institution's data sharing policy/GDPR. We can also foresee that all videos are not hosted by each institution but on the INOS website (depending if other institutional partners are OK with it). In the first case the videos will be internally linked to the project website and can be disseminated by other partners.

10. Language

In case of non-English interview: partners must translate the content of the interview in their language and link it to time stamps (connect the sentences with a timestamp) so that we are able to add subtitles.

11. Informed consent form

Participants and mentors will sign a consent form allowing us to use the recorded video. Because each partner may emphasize different aspects of disclosure and data privacy, each partner should use an informed consent form that aligns to his/her institutional policy. The consent should be given for full exploitation and (re-)use of the entire video. Participants may prefer to give their final opinion about it before public release: we prefer not to add this level of complexity. But if your institutional policy says so then that's fine on our side as well. Please make sure you share with W2L the template for the O3A2 and O4A2 records, thank you.

12. Responsibilities

AAU, LIBER, TU, UBx and UO[2]:

- Identify an informed consent form that fulfils the data security policy at your institution.
- Record the raw videos. In case you have more than one video with the same interviewee please do share as well (perhaps you needed to do a second video, but in case in the first video there is a piece to exploit, do send it along). For LIBER
- Take pictures (we can always blur some faces, for instance from minor participants)
- If in another language, transcribe and translate the content of the interview

W2L: edit all videos in an engaging format. Also add transitions and intermediary slides, such as a) INOS project identity b), event fact sheet like short bullet points and c) disclaimer slide at the end.

13. Partner tasks at this stage (May-June 2020)

AAU & LIBER: comments as project coordinator (AAU) and LIBER (communication expert) from the point of view of project identity
TU and UBX as O3 and O4 leaders: identify questions relevant to the interviewees, participants and mentors (they can be the same as different, as you like).

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[1] Guidelines adopted from https://www.givegab.com/blog/9-guidelines-for-creating-video-content/
[2] For LIBER it applies to O3 only as not involved in O4.

10 Annex III
The survey

This questionnaire is meant for measuring active participatory citizenship competences in open knowledge activities in INOS project. The answers will be anonymous and used only for scientific research. Questionnaire must be translated to local languages.

Background information
What is your role?
HE educator
librarian
researcher
expert
HE student
other participant outside from university

Gender: male / female

Age:
up to 19
20-28
29-35
36-50
51-65
66 and older

Feedback to the activity
How satisfied were you with the activity?
very satisfied / rather satisfied / rather not satisfied / not satisfied

What was positive about the activity? (e.g., benefits for you, for community ect.)

What are your suggestions to the organizers to improve the activity?

Active participatory citizenship
Evaluate the following statements through your experience in the activity.

Statement	I certainly agree	I rather agree	So and so	I rather disagree	I certainly disagree
1. I know how open science and open knowledge can be used in social entrepreneurship.	5	4	3	2	1
2. I know how citizens can use open data and knowledge for developing various services for the communities.	5	4	3	2	1
3. I will offer my skills and knowledge for developing for the communities various services that use open data and knowledge.	5	4	3	2	1
4. It is important that citizens offer their knowledge and skills for developing for the communities various services that use open data and knowledge.	5	4	3	2	1

5. It is important for citizens to participate voluntarily in crowdsourcing to help the community.	5	4	3	2	1
6. I acknowledge that my participation in open science practices changes my knowledge, behaviour and values about the importance of science for the society.	5	4	3	2	1
7. In the future I will voluntarily help others in my community using open science approaches.	5	4	3	2	1
8. I will use open science and open knowledge to make my community better for everyone.	5	4	3	2	1
9. Tolerance and democracy are important values in the society.	5	4	3	2	1
10. All citizen should be equally included to the community.	5	4	3	2	1

11. I know how open science practices can help political decision making.	5	4	3	2	1
12. I know how to use open data and open knowledge for political decision making.	5	4	3	2	1
13. I will express my opinions about political and social issues publicly in the future.	5	4	3	2	1
14. It is important for a citizen to be active in political decision making using open science practices.	5	4	3	2	1
15. All political decisions should be open for the citizens to part-take in the discussions or collect evidence.	5	4	3	2	1

11 Annex IV. Information sheet and consent example

INOS PROJECT INFORMATION SHEET TEMPLATE

We behalf of *xxx activity organisers* FROM XXX HEI are delighted that you are taking interest to our open knowledge creation activity.

WHY?
We believe that if people actively engage in open science activities they can jointly make the world more open, inclusive, cohesive, sustainable and happy.
The INOS project (https://inos-project.eu) that is funded by ERASMUS+ intends to give to university students and people in the communities more decision-making power by part taking in open science practices. We aim increasing everyone's understanding how to contribute to improving the places, communities and nature using open science-based approaches.

WHAT I CAN DO?
The *HEI* xxx invites you to take part of the open knowledge activity *Name* that intends to *(list the activity goals)*. In this activity you can contribute with the following *(activities, tasks, roles).* The main outcomes of the activity will be open for everyone's benefit *(list open data, knowledge)* and shared with *xxx license, where how, with whom.*
To understand how well the open knowledge activity was run, we will collect some pictures during the activity that do not reveal your identity. We ask some volunteers to share their impressions of the activity and videorecord this for sharing publicly at the INOS project website. The video will be shown to them before publishing and they can suggest changes. We ask you to participate in the end of the activity in a short and anonymous survey that asks about your impressions and rates the active citizenship competences you might have gained with the activity. We will make a report and share with all participants at INOS website the results of how the activities were making impact to people, their communities, places, nature. By collecting data about how the activity went we want to promote open science experiences and empower people with science practices.

WHAT VALUES WE RESPECT?
In our activity we honour your personal privacy, we do not collect or reveal any of your personal data. In the activity we follow the general data protection regulation (GDPR) and respect intellectual property rights (IPR) and copyright principles.

CONSENT FORM TEMPLATE

I / a *person under my custody* have/has been asked to participate in the open knowledge building activity conducted by *xxx organization*. I have received both written and oral information about the activity, what data will be collected, how the privacy and Copyright and IPR rules are followed. I was given an opportunity to pose questions about the activity and procedures to the organisers. I understand that participation of *myself/my child/person I am responsible for* in this activity is voluntary and that I have the right to decline or withdraw my consent of participation at any time without offering any reason. I also understand that all data and information will be treated in confidence and respecting the personal privacy and GDPR.

Please tick if you agree to the following

☐ I have read the information letter.
☐ I give my consent (for) _____to participate in this open knowledge building activity.
☐ I understand that participation is voluntary and with freedom to withdraw this consent at any time.
☐ I understand that I can contact [*name, email of OKA organizers*] to discuss the activity at any time.
☐ I am aware that the general results of the open learning activity are made available for me at [*provide a web address]*
☐ I agree that the following results of the activity *[make a list data and knowledge]* will be made available as an open knowledge that everyone including myself can use for my own and my community's benefit.
☐ I agree that the organisers may take pictures during the activity which do not reveal the identy. These pictures of the activity will be used for adverticing the activity and for evaluation purposes to illustrate how the activity went.
☐ I give consent to volunteer to participate in the short interview to tell to the other people about this activity, also I agree that the interview is vidotaped and it may be shared at INOS project website. Giving this agreement, I will have the possibility to see and agree with the video content before it is published openly.
☐ I agree part taking the anonymous survey after the activity and give my consent to use these anonymized survey data to evaluate theis knowledge building activity.

Signature, Place and date / Signature of researcher, Place and date

We behalf of INOS project are thankful for your contributions!
Contact person name, email