Developing metrics and instruments to evaluate citizen science impacts on the environment and society

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Deliverable 3.2: Toolbox for Citizen Science Research: Accompanying Documentation Report

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Contents

1 Executive summary

Deliverable 3.2 "Toolbox for Citizen Science Research, Accompanying Documentation Report" presents the first iteration of an ongoing process that describes both the development of the MICS platform for measuring impact and the development of impact assessment indicators that will be incorporated from WP2. The MICS platform will improve over the following 12 months of the project, as indicators are operationalised, more software is developed, and user feedback is collected. This process's outcomes will be shared through the MICS repository (D3.3). The overall aim is to create and validate the MICS technical framework's toolbox and technologies for supporting citizen-science research.

2 Introduction

2.1 The context within the MICS project

The MICS project investigates how citizen science adds value to research and innovation and better understand the opportunities to improve this process. The project will develop several methods and procedures to measure citizen science impact, modified to be fit for purpose, and include original impact assessment indicators. To this end, the MICS project will collect a range of different data, both qualitative and quantitative, from several sources.

Deliverable 3.2 presents the initial version of an iterative document, describing the processes of developing both the MICS platform of WP3 and the impact assessment indicators of WP2 in parallel. It will explain the process of synthesising the work of WP2 into operationalised indicators, that can be practically included on the MICS platform in a way that citizen science practitioners can understand and interpret. It provides a space for discussion and feedback, so that the MICS platform and its toolbox can fully utilise existing assessment frameworks, whilst building upon any shortcomings in a citizen science context. As per the MICS ethos, this will be a **user-centred approach**, with the process being informed by feedback from the pilots of WP4 and other citizen science practitioners.

2.2 Context within WP3

WP3 will identify, adapt and develop (as appropriate) impact assessment tools for MICS, based on input from WP2 concerning relevant concepts and methodologies identified. This input will aid the implementation of the tools and their initial running. The WP will also be informed by the validation activities conducted in WP4.

To incorporate all of this information, WP3 will work in short and focussed iterations. D3.2 provides the first version of the documentation on how this process will proceed and evolve. It will attempt to balance the platform specifications derived in D3.1 (Report on the technical requirements) with the identified user and visualisation requirements first considered in D3.4 (Participatory adaptive, personalised information-delivery web platform, period – 1 prototype), and provides a first direct link in combining the applied work of WP3 and the theoretical impact assessment framework developed in WP2 compiled by IHE Delft. The final iteration of this document will inform D3.5 (Participatory, adaptive, personalised information-delivery web platform, period – 2 prototype), the updated MICS platform released in month 33 at the end of the validation phase.

3 Platform development

The MICS project's most significant contribution is developing a platform providing tools and guidance for citizen science coordinators to consider and evaluate their project's impact across multiple domains through an intuitive, easy-to-understand process. D3.4 (Sprinks *et al.*, 2020) represents the initial prototype of the platform. However, as a first iteration, it focuses on technical aspects of the design, the services and software used, the general infrastructure of the data and its storage, and access protocols.

Since the completion of D3.4 (M18, June 2020), work has begun to move the platform's design from a purely technical standpoint, towards considering usability and interface design. This process will continue over the remainder of the project, with progress being recorded in this iterative document, the aim being to create an impact assessment platform that is both technically reliable and usable. Figure 1 shows the MICS platform's initial layout, representing the foreseen user journey through the system.

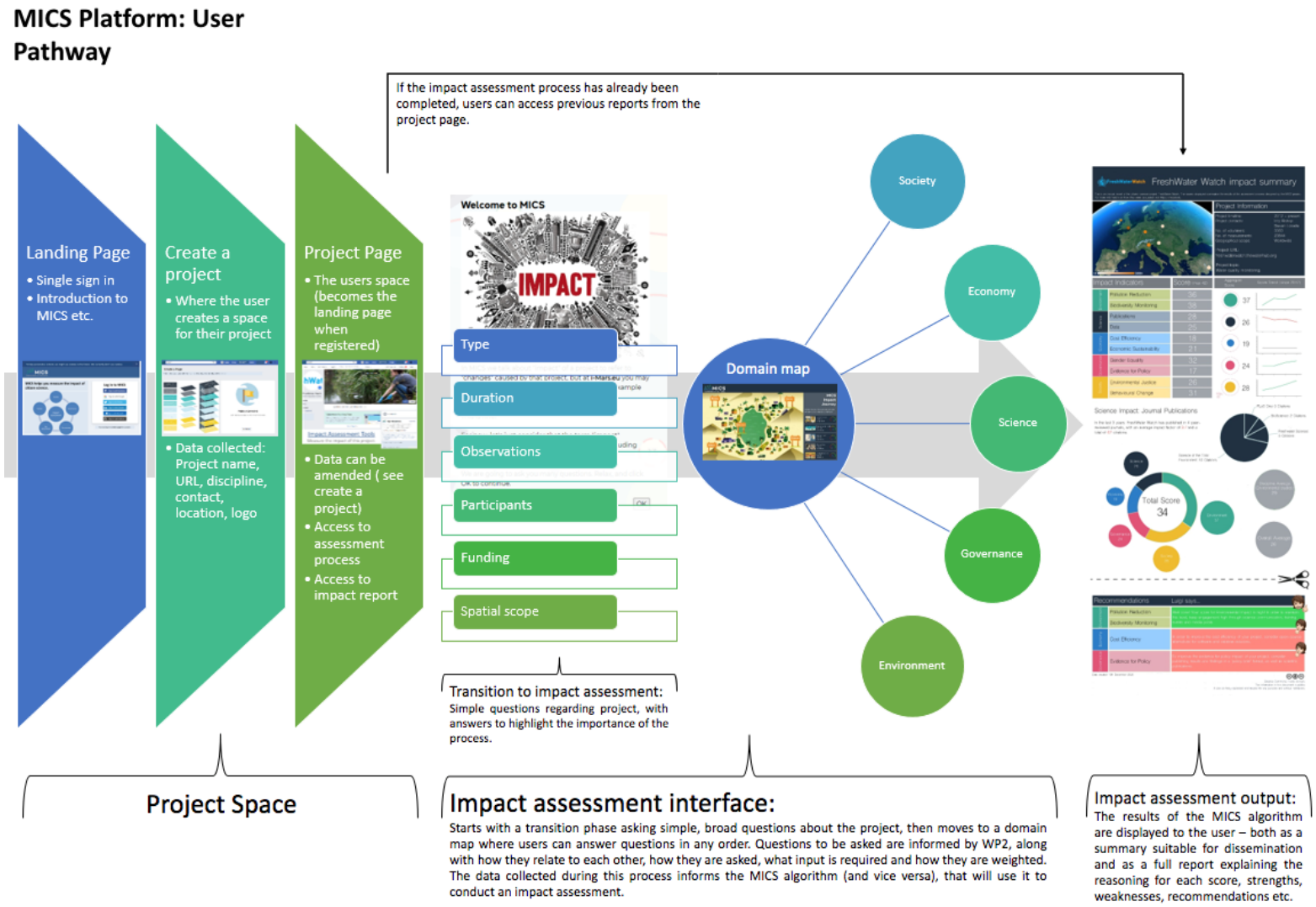

Figure 1: User pathway through MICS platform

The use pathway consists of 3 main sections:

- **The project space:** This space is where users can set up a presence on the platform, creating a project space that holds and displays general project information (name, URL, contact, location).
- **The impact assessment interface:** Via this interface, accessed from the project space, users can provide information to assess their project's impact. It starts with several 'transition' questions; those that are perhaps more standardised and recognisable and therefore more comfortable for users to answer before heading into questions requiring greater depth of knowledge. This leads to the domain-specific questions (society, economy, science, governance and environment) – many of these questions may overlap, and so will only need to be answered in one discipline. It is envisaged that users can choose which domain to attempt, based on the information they have to hand at any given time.
- **The impact assessment output:** This section represents the user's reward for the time they have committed to completing the assessment. It will consist of both summary statistics regarding the impact of their project, and a fuller report looking at their score for each domain and the reasoning behind it. This will also include a description of strengths and weaknesses, and potential advice on what can be learnt from other, similar projects.

To develop these sections, allowing for user feedback to be considered and absorbed, the following timeline shown in figure 2 has been created for the development of the MICS platform. Whilst the process is described in as much detail as possible, the timeframes and overlaps included reflect the need to be agile, responding to user feedback and other issues through an iterative process.

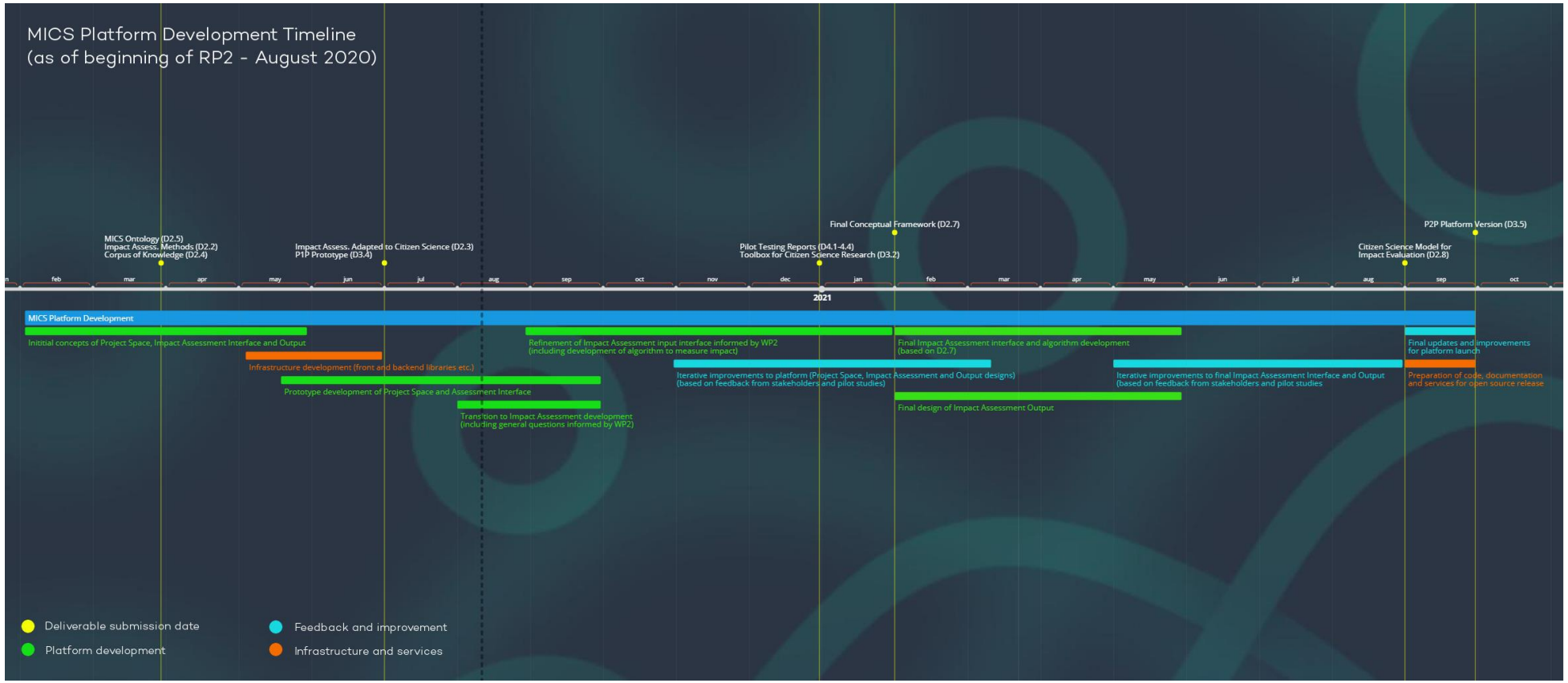

Figure 2: MICS Platform development timeline. Vertical yellow lines correspond to deliverable submissions, green bars represent platform development, blue bars represent periods of user feedback gathering and responding improvement, and orange bars represent general infrastructure and services development.

Table 1 below represents the platform development timeline's critical tasks, allowing for any variations to be recorded and completed tasks to be signed-off.

Table 1: Platform development schedule

Task	Timeframe	Variations	Reason	Completed
Initial concepts of project space, impact assessment interface and output	Feb-May 2020	N/A	N/A	Yes
Infrastructure development (front and back end)	May-June 2020	N/A	N/A	Yes
Prototype development of project space and assessment interface	May-Sept 2020	N/A	N/A	Yes
Transition to impact assessment development	July-Sept 2020	Ongoing	To fully incorporate WP2 work	No
Refinement of impact assessment interface informed by WP2	Sept 2020 – Jan 2021	N/A	N/A	No
Iterative improvements to the platform (project space, assessment interface and output) – based on feedback from users and case studies	Nov 2020 – March 2021	N/A	N/A	No
Final impact assessment interface and algorithm development (informed by D2.7)	Feb-May 2021	N/A	N/A	No
The final design of impact assessment output	Feb-May 2021	N/A	N/A	No
Iterative improvements to final impact assessment interface and output (informed by users and case studies)	May-Aug 2021	N/A	N/A	No
Final updates and improvements for platform launch	Sept 2021	N/A	N/A	No
Preparation of code, documentation and services for open-source release	Sept 2021	N/A	N/A	No

4 Impact Indicator development

The indicators chosen to represent the different types of potential impact in each domain are a vital component of the MICS platform that will guide the entire impact assessment process. These indicators will drive the questions we ask on the MICS platform and how they interact to produce an impact assessment report that can be explained and provide genuine guidance to the user. The identification and development of the MICS indicators form a significant part of the work of WP2 (Methods for measuring citizen-science impact), and as with platform development work has already begun on this process. D2.2 (Wehn *et al*., 2020a), completed in March 2020, describes a report reviewing existing impact assessment methods and identifying suitable methods for capturing citizen science's impact within distinct domains.

Building on this initial review, D2.3 (Wehn *et al*., 2020b) completed in June 2020, represents a draft version of the MICS Citizen Science Impact Assessment framework. It presents the methodological approach and steps applied in developing the framework, and progress towards the initial version at three levels of abstraction: i) overarching impact domains; ii) the intervention logic; and iii) the identified conceptual and practical approaches within each domain. An illustration of how the domain descriptions are completed with relevant indicators is shown in figure 3, for the economy domain.

Economy - Indicators ID		
Indicator Characteristics		
Name of Indicator	Company growth	International trade & investment
Primary/Secondary data	Primary (surveys) and Secondary data	Primary (surveys) and Secondary data
Description	<copy from D1.10>	
Qual/Quantitative	Quantitatve	Quantitative & qualitative
Source of data	dedicated survey	dedicated survey
Time-series	Yes, survey should be repeated	Yes, survey should be repeated
Unit of measurement (observation)	absolute values & nominal (see data collection)	absolute value
Unit of analysis	Organisation	Organisation
Analytical level	Outcome; Impact	
Links with indicators in other domains	n.a.	n.a.
Data collection	Survey - questions: How many jobs are currently directly related to [CO topic] and enabling technologies? What is the nature of these jobs? (junior, medior, senior position(s)) [nominal] How many of your products/services are relevant for the provision of COs? What was your organisation's annual turnover in [year]? What is your organisation's market share in the business of COs? How many clients does your organsition have in the CO business?	Survey - questions: How many international clients does your organsition have in the CO business? What specific customer segments does your organisation serve related to COs? How much has your organisation invested in CO-related activities in [year]?
Indicator building	Items: # subject-related jobs Nature of jobs # of CO related products/services Turnover Market share in the business of Cos	Indicators: # of international clients CO business and enabling tech-nologies Customer segments (sectors) related to CO Amount of investment in CO-related activities <explain relation of analysed results across items above>

Figure 3: Illustration of indicators entered in the economy domain (Wehn et al., 2020b p37)

Developing the MICS impact indicators will continue and culminate in D2.7 (a finalised version of the conceptual framework). This document will be updated with indicator development up to its delivery (due Jan 2021), and throughout the final year of the project.

5 Operationalisation of indicators

The work carried out to the point of the formulation of this documentation in its first instance, in terms of both platform and indicator development, has been primarily completed in parallel but separate. However, efforts have begun and processes put in place to combine these outcomes, integrating the impact assessment conceptual framework with the tools and services offered by the MICS platform.

A significant part of this integration is the operationalisation of the impact assessment framework indicators. Operationalisation is the process of defining the measurement of a phenomenon that is not directly measurable. Many of the assessment indicators linked to citizen science's impact perhaps do not have a natural, intuitive or quantitative way of measuring them, so a process of defining representational measures for these indicators is required. Once this has taken place, the practical considerations of converting these measures into suitable questions for the platform, that citizen science coordinators can understand and answer accurately, can be fully explored.

As a start to this process, several indicators across each of the five MICS domains have had an initial, high-level pass at operationalisation. These indicators have been informed by the work of WP2, supplemented by existing frameworks such as ECSA's characteristics of citizen science (Haklay *et al*., 2020), and the UN's Sustainable Development Goals (SDG) framework (Griggs *et al*., 2013). Figure 4 shows a flow diagram of the related questions that have resulted from this process for the environment domain.

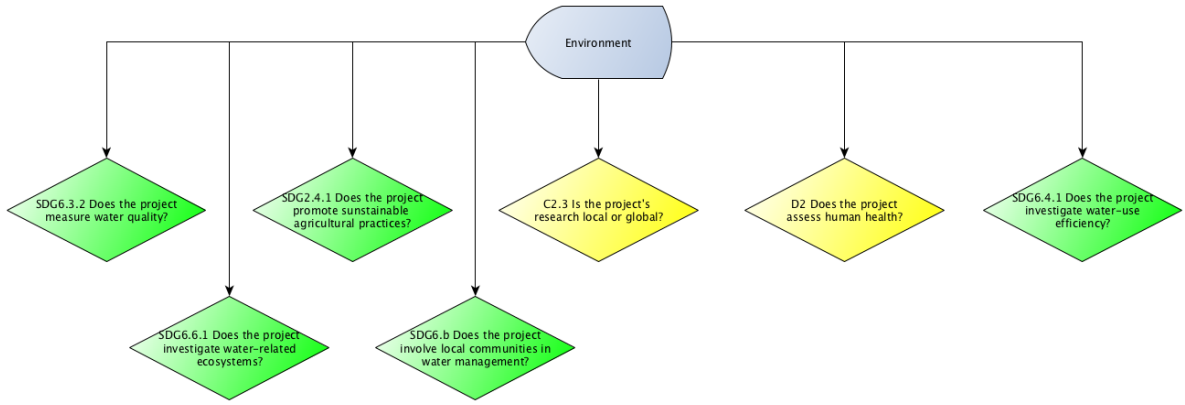

Figure 4: Environment domain indicator questions from initial operationalisation. The green questions have been derived from the SDG framework, the yellow questions from the ECSA characteristics.

The purpose of this initial approach is to formulate some potential impact assessment questions in order to investigate the best way to represent them within the platform. Issues regarding their position in the user pathway (figure 1), how the questions relate to each other and any logic in terms of the order they are answered can also be considered. It is important to note that these are 'place holder' questions, and in no way represent the indicators and associated questions that could feature on the final MICS platform. The operationalisation process will continue throughout the remainder of the project, informed by user feedback, with this iterative documentation updated regularly updated with the outcomes.

6 Future Development

The development of the MICS toolbox, platform and impact assessment framework has predominantly been carried out as part of WP2 and WP3, and the associated project partners. For the remainder of the project, bringing the platform and the framework together, through the operationalisation of indicators and the development of the MICS interfaces, will be opened up.

A dedicated group to discuss the process has been organised, involving the full MICS consortium, to collect feedback on the indicators considered and the resulting impact assessment questions. Specifically, feedback will be sort from the case-studies of MICS (WP4), as representatives of the MICS platform's end-user. To facilitate this process, the indicator questions have been uploaded to a shared

Microsoft Form instance, allowing feedback to be gathered not only on the content of the questions but also their format and potential answers. Figure 5 shows a snapshot of this online resource, with different question types and potential answers displayed.

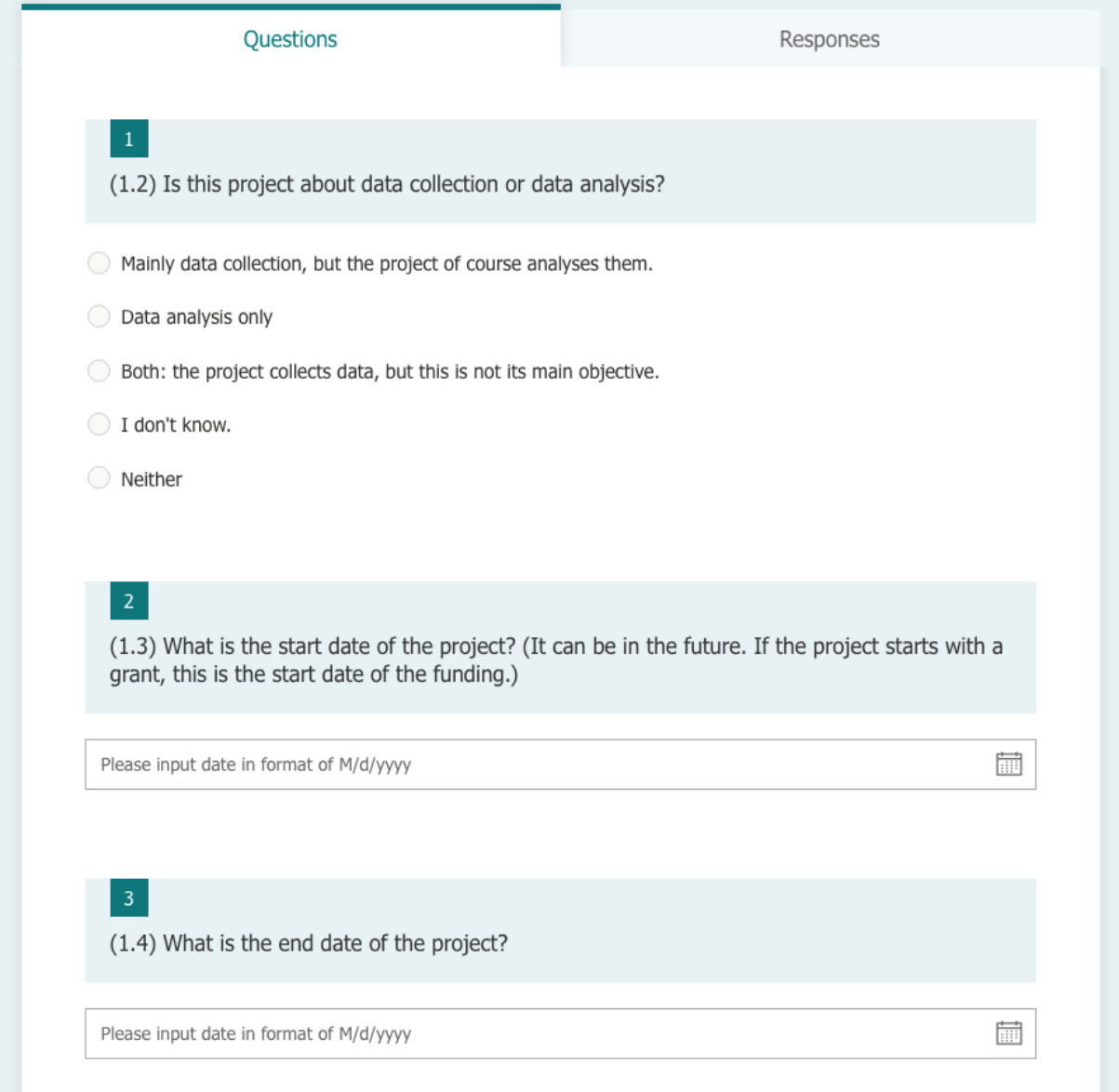

Figure 5: Microsoft Forms instance with indicator questions and potential answers shown

This documentation will be, as before, iteratively updated with the results of this action. When considered to be at a developed enough stage, the questions will be shared with a broader audience of citizen science coordinators representing various projects in differing disciplines, to gather feedback from a wider range of end-users.

Feedback in terms of the impact assessment indicators used and their representation is also embedded into the MICS platform. As part of T3.5 (Development of mapping and visualisation tools), an online forum will be created on EU-Citizen.Science allowing collaborative editing of the framework to create a shared understanding of the most important areas and topics.

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