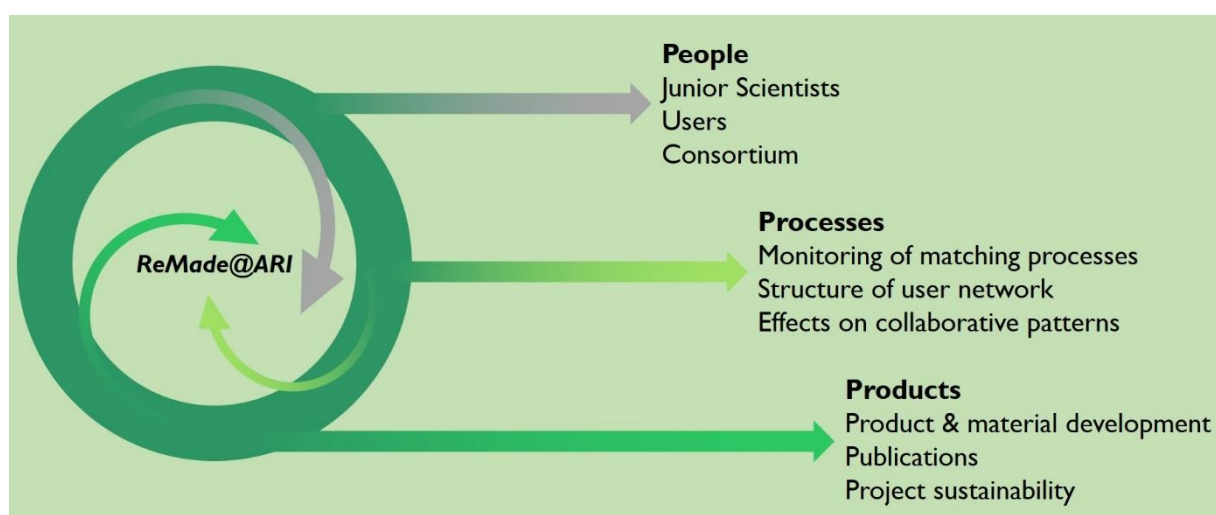


ReMade@ARI – WP2T2

Impact Assessment Framework and Key Performance Indicators

Key Points

- Monitoring the project’s performance and evaluating its impact generation is an integral part of ReMade@ARI.
- Existing frameworks for impact assessments provide a useful blueprint but they need to be adapted to the specific case of ReMade@ARI.
- The impact framework features a holistic approach that concentrates on three categories: **People**, **Processes**, and **Products**.
- For each of these categories, a combination of qualitative and quantitative techniques is applied to monitor changes in performance as well as to sketch potential pathways of impact within and outside of the project network.
- The structure of the monitoring and assessment allows for regular feedback to the project participants in order to positively influence the outcomes of the project.
- In addition to the regular reporting, the results of the activities are also summarised separately as reports on **in-depth case studies**, **training evaluations**, and a final **impact assessment whitepaper** at the end of the project.



Impact Assessment Framework and Key Performance Indicators

Preliminary remarks

ReMade@ARI is a collaborative project that aims to make a critical contribution to the transformation towards the Circular Economy (CE). To this end, it gathers seven networks of research infrastructures (RIs) and additional associated facilities that offer access to a broad range of instruments for materials research which are available to users from academia and industry. The aim is to advance the research and development of new recyclable materials and other tools for the CE.

The continuous monitoring of the project's activities is an integral part of ReMade@ARI. Equally important is the implementation of an accompanying impact assessment to estimate the project's effect on the associated project partners and the user communities, as well as the economy and society at large (see Box I).

Box I: Excerpt from the ReMade@ARI project proposal regarding the impact assessment.

Work Package 2, Task 2...

- "...reports key performance indicators (KPI) in order to contribute to the project's optimal and evidence-based governance on a regular basis and to maximize progress and desired outcomes and achievements."
- "...assesses and evaluates the project's impact generation."
- "...also seeks to understand, assess and evaluate those processes that establish relational ties between the services of RIs and the respective users as well as that create strategic knowledge reservoirs."

The following report presents a comprehensive plan to monitor the performance of the ReMade@ARI project and to evaluate the impact generation over the project's life-cycle. It is structured in three sections. First, it provides an overview of common tools and approaches in measuring the impact of RIs. This is followed by an examination to what extent these approaches can be considered for the monitoring and evaluation of ReMade@ARI. In section two, an impact framework is developed. It is based a) on the specific structure and objectives of the project and b) on the requirements for a meaningful impact assessment. The resulting framework identifies three impact categories (People, Processes, Products). For each impact category, appropriate ways of measuring and observing are presented and relevant performance indicators are introduced. Section three contains an overview of the design of the activities, KPI that are to be reported on a regular basis, a tentative timeline for the investigation, and considerations on risk management.

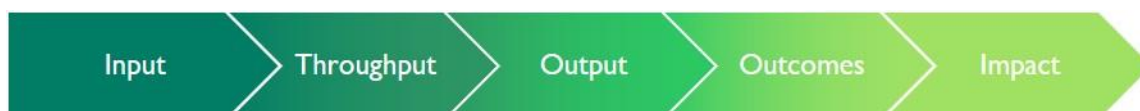
Section I – Literature review and project characteristics

I.I: Best practices

The last decade has seen an increasing tendency to invest in tools and guidelines to uncover and measure the effects of RIs for the economy and society at large. Relevant bodies in the field of science and innovation policy have addressed this issue. This includes special reports by the *ESFRI Working Group on Monitoring of Research Infrastructures Performance* (2019), the *OECD Global Science Forum* (2019b), *ERF-AISBL* (Kolar, Harrison & Gliksohn, 2018), Think Tanks like *Technopolis* (Griniece, Reid & Angelis, 2015) or the *Rathenau Instituut* (Horlings, Gurney, Somers & van den Besselar, 2012), a comprehensive guidebook by the Horizon 2020 research project *RI-PATHS* (Griniece et al., 2020), as well as academic research (e.g., Bastianin & Castelnovo, 2021; Bianco, Gerhart & Nicolson-Crotty, 2017; Catalano, López, Sánchez & Vignetti, 2021; Ecchia, O’Leary & Messori, 2021; Fabre, Egret, Schöpfel & Azeroual, 2021; Florio, 2019; Kroll, Hansmeier & Hufnagl, 2022; Scarrà & Piccaluga, 2022). In addition, there is a plethora of individual case studies and reports that examine specific RIs and research institutions (e.g. Beagrie & Houghton, 2021; Beck & Charitos, 2021; Brown et al., 2021; Brown, Glass, Simmonds & Vinnik, 2022; Euroconsult, 2019; Fryirs, Brierly & Dixon, 2019; Hallonsten & Christensson, 2017; Kuruvilla, Mays, Pleasant & Walt, 2006). The impact assessment of ReMade@ARI can draw on these suggestions, guidelines, and studies.

Box II: Output, Outcome & Impact

Typically, an impact assessment is based on a simplified linear model in which the activities of a given RI create effects at different qualitative levels over varying periods of time. Impact usually describes the effects on an abstract and temporally downstream level. This is, of course, a simplification, since empirically these steps are connected by a multitude of feedback loops, and causality is often obscured by the complexity of the process.



There are several ways of defining the term impact:

- “The extent to which the intervention has generated or is expected to generate significant positive or negative, intended or unintended, *higher-level* effects.” (OECD, 2019a, p. 11, emphasis added)
- “Positive and negative, primary and secondary *long-term* effects produced by a development intervention, directly or indirectly, intended or unintended.” (Kolar et al., 2018, emphasis added)
- “Intended and unintended long-term effects of activities using the resources of a Research Infrastructure or work performed by Research Infrastructure staff.” (RI-Pathways, 2020, p. 5)

Some key considerations from the existing body of literature and best practices include:

- Impact assessments can only provide meaningful results if they are tailored to the individual case as no RI or project is necessarily comparable.

- Impact needs to be understood in a multi-layered way that includes scientific, socio-economic, and policy effects that can be traced back to the project’s activities.
- A successful impact assessment continuously monitors KPIs to estimate the effects of a given RI.
- There is no single method to track and understand the effects of RIs or projects to a full extent. Instead, it is necessary to combine different qualitative and quantitative techniques to reach this objective.
- The actual impacts of RIs cannot be readily determined due to numerous limiting factors, especially ex-ante. Limiting factors include the inherent uncertainty of research endeavours, the difficulties to measure “soft” outcomes of these projects such as skill development, the time-lag between research activity and impact, and the obscure pathways from research to impact on the society at large. Some of these constraints can be circumvented in ex-post assessments, in particular if RIs are long-established and have a significant track record.

The starting point of the impact study must be determined by specific characteristics of ReMade@ARI, with particular attention to the objectives and structures of the project.

I.II: ReMade@ARI as a network project

Objectives

ReMade@ARI was conceived as a project that contributes to the transformation towards the CE in line with the European Commission’s Circular Economy Action Plan (CEAP). Researching and developing new, recyclable materials and related tools is the overall goal of the project. This overarching objective was specified in several separate goals:

- Provide over 50,000 hours of trans-national access (TNA) to the project’s facilities.
- Create a single, tailor-made entry point for users from academics, industry, and Small and Medium Enterprises (SMEs).
- Reach out to target groups interested in developing new materials and products with a connection to key areas of CEAP (see Box III).
- Train 18 early career researchers to provide customised services to users according to their needs and specifications.
- Offer the services of a network of experienced researchers who, together with the early career researchers, ensure that an optimal match is made between the capabilities of the participating facilities and the ideas and products of the users.

Box III: Key Areas of the CEAP

- Electronics and ICT
- Batteries and vehicles
- Packaging
- Plastics
- Textiles
- Construction and buildings
- Food, water and nutrients

ReMade@ARI, in other words, is a project whose impact is most likely to be generated by the successful collaboration between users, early career scientists, senior experts, and facilities within the consortium. This influences the choice of relevant indicators to monitor and track the performance, outcomes and, finally, the impact of the project.

Structure

ReMade@ARI is a project within a network of networks (see Figure 1). This fact has significant implications for the design of the impact assessment. There is already a tried and tested collaboration within the network of the *Analytical Research Infrastructures in Europe* (ARIE). However, the characteristics of ReMade@ARI constitute a distinct, additional layer to this already ongoing collaboration.

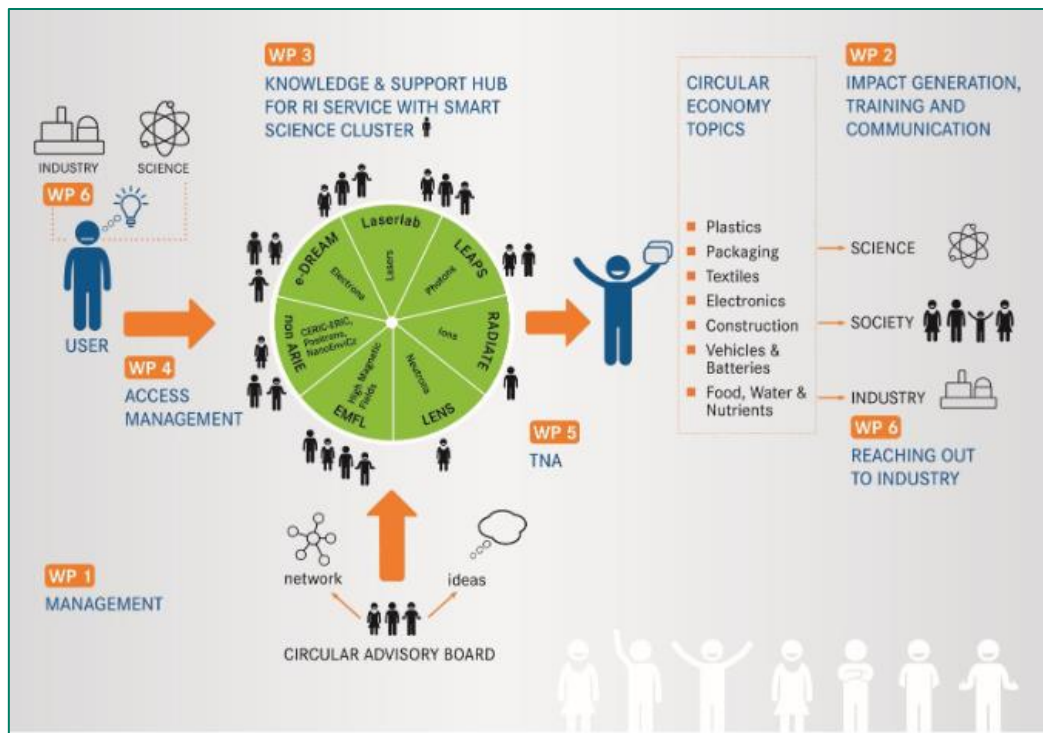


Figure 1: Overview of Work Packages and workflows in the project at the time of application. The current structure of the project may slightly differ from this depiction.

Firstly, the project’s structure includes a plethora of stakeholders, ranging from members of the facilities to newly employed junior scientists, and users. Similarly, it includes a wide range of very different RIs that host a multitude of instruments. They are affiliated with different scientific fields and institutional frameworks across Europe. This includes genuinely international facilities like, for instance, ESRF, or institutions that are structured in the legal form of European Research Consortium (ERIC) but also national facilities like DESY in Hamburg, Germany, or MAX IV in Lund, Sweden.

The very broad approach of CEAP with its seven key areas of materials likewise might attract a very diverse group of potential users to the facilities. This includes users from academia as well as from industry which might have very different needs and objectives. For example, the experience levels of different users might diverge greatly, as the project is explicitly designed to appeal to users who have not previously worked with the specific techniques and facilities that are part of the consortium.

Secondly, ReMade@ARI is a temporary structure whose institutionalisation is still undecided. This means that there is no track-record of outcomes and impacts compared to longstanding RIs. Nevertheless, the structure of the project may provide the opportunity to assess effects and impacts already within the project duration. However, long-term impacts will be difficult to measure, which leads to the expectation that higher-level effects of ReMade@ARI will only emerge after the project and the impact exercise have been concluded. The impact assessment thus stands between a pure ex-ante study and a post-hoc investigation.

Section II – Defining an impact framework

Based on the characteristics of ReMade@ARI and best practices in conducting impact assessments, we use a threefold framework to investigate the internal and external effects of the project. More specifically, we focus our analysis on **People**, **Processes**, and **Products** (see Figure 2). This framework is to be primarily understood as an analytical tool to structure the monitoring and impact assessment as the individual categories have numerous interconnections.

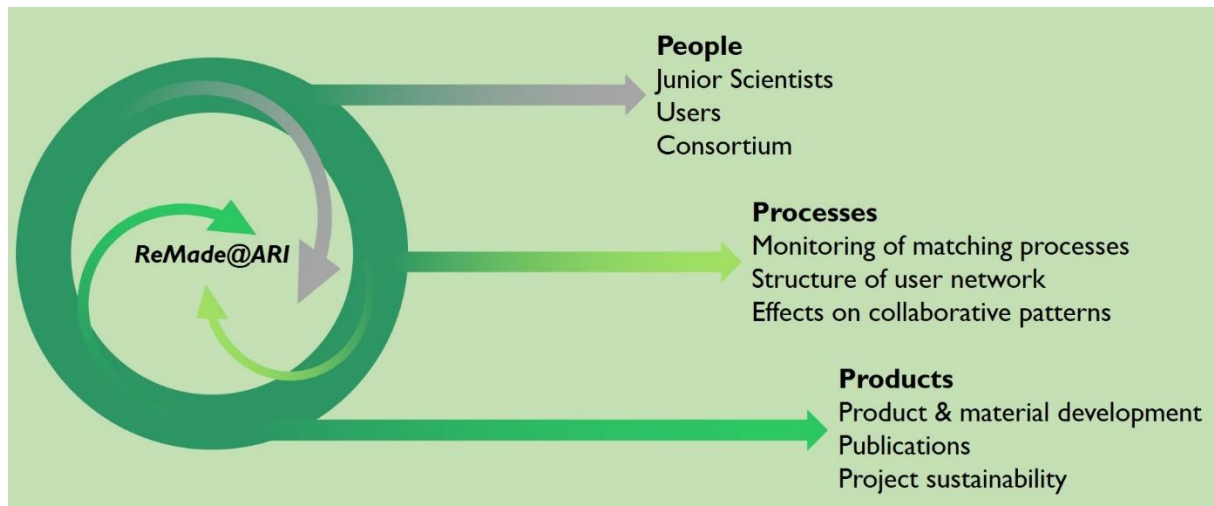


Figure 2: Core categories for monitoring and assessing the performance of ReMade@ARI.

In the following, each impact category is briefly described. The section highlights which WPs will be covered by the impact assessment and how the assessment exercise fits into the overall project structure. Each category is accompanied by a short overview of the primary activities that WP2 will pursue. Best practice here is to link these methods to KPIs that comply with the RACER criteria (see Box IV).

Box IV: Key Performance Indicators & RACER criteria

Key Performance Indicators can be defined as...

- “Project-management tools used to monitor the performance vis-à-vis objectives, and to ensure the efficient use of resources.” (RI-Pathways, 2020, p. 28)
- “a means of monitoring the performance of a RI with regard to progress towards its stated objectives from inputs, through activities and outputs to outcomes.” (ESFRI, 2019, p. 6)

In accordance with guidelines from ESFRI (2019, p. 6), these KPIs “should be

- **Relevant** – i.e. closely linked to the objectives of the RI over a particular period of time.
- **Accepted** by the RIs (at all levels) and stakeholders otherwise there will be limited implementation.
- **Credible** for non-experts, unambiguous and easy to interpret.
- **Easy to monitor** – e.g. data collection should be possible at low cost.
- **Robust** – e.g. against manipulation.”

Since outcomes and impact cannot be easily attributed as a linear result of the project activities, these KPIs do not constitute performance targets that go beyond those of the project proposal, i.e. the results and impacts that have been estimated by the project consortium. Rather, they help to monitor and visualise the course of the project and create opportunities to track the impact pathways in a multi-dimensional way.

Category I: People

The project already has an effect on the participating RIs. Staff was hired or diverted from other tasks to implement the project. This is especially true for **the Junior Scientists of the Smart Science Cluster (WP3)** who collaborate with the users and will spend a significant amount of their time working on the project. Considering that the project also hosts regular meetings, workshops, and trainings, network creation and community building might be boosted. It can therefore be assumed that ReMade@ARI will have effects on the career development of the in-house researchers involved and on community-building at a larger European scale. At the same time, it is important to incorporate the perceptions and experiences of the network of senior experts who support the interactions between the Junior Scientists and users.

Externally, “users” is the main group of people who will be involved in the project. Here, too, it is important to recognise baseline conditions and changes within the user communities that interact with the project in order to be able to assess to what extent the project influences the work of the users cognitively and structurally. Similar to the inhouse workshops and trainings, users will participate in **training and educational activities provided by WP2T3** that will influence their interactions with facility staff, change their knowledge base, and have an impact on their academic or commercial activities. Addressing the users will require close cooperation with **WP4 (Access Management)** and **WP6 (Industry and Innovation)**, which are responsible for coordination with the academic and industrial partners respectively.

Primary activity in Category I	Performance Indicators
<ul style="list-style-type: none"> • Interviews and surveys among the Junior Scientists 	<ul style="list-style-type: none"> • Skill development • Success of user-expert interactions
<ul style="list-style-type: none"> • Surveys among the users 	<ul style="list-style-type: none"> • Ratio of first-time users to experienced users • Perception of project contribution to product development based on Technology Readiness Level (TRL) • Perception of interaction with facilities
<ul style="list-style-type: none"> • Surveys among the senior experts 	<ul style="list-style-type: none"> • Success of user-expert interactions
<ul style="list-style-type: none"> • Evaluation of trainings and seminars 	<ul style="list-style-type: none"> • Subjective assessment of skill development by participants • Number and affiliation of participants

Category II: Processes

The matching process between the ideas of users and the capabilities of participating facilities is at the core of the project. It is therefore of central importance to examine to what extent the processes work efficiently. This includes the complete course of interaction, from the application of user-projects to the consulting of the Junior Scientists and senior experts, from acceptance of the proposals to conducting the experiment and analysing the results. The category of products thus has direct links to the work of the **Smart Science Cluster (WP3)**, the **Access Management (WP4)**, and the **management of trans-national access (WP5)**.

There are multiple processes within this category that deserve attention. Apart from time-efficient processing of the proposals and user-projects, it involves a series of data that provide insights into the workflows and structures of ReMade@ARI. Parameters here are, for example, the extent to which the pre-proposal process is accepted by the users or the ratio of successful applications. Moreover, it is possible to analyse the user data to track changes in the network of participating users in terms of the distribution of projects across CEAP areas, but also in terms of geography and scientific fields.

Monitoring the processes at the intersection of **WP3**, **WP4**, and **WP5**, it is also important to establish (causal) links between the project's activities and the results of the user projects and potential impact pathways of ReMade@ARI.

Primary activity in Category II	Performance Indicators
<ul style="list-style-type: none">Monitoring of matching process	<ul style="list-style-type: none">Ratio of successful proposals to submitted proposalsUse of pre-proposal processTime-efficient processing of proposals and user-projectsChanges in network indicatorsDistribution of projects in terms of CEAP areas and geographyDefinition and understanding of CE

Category III: Products

The project is designed to support users in developing new materials in line with CEAP. The impact assessment must therefore aim to track the degree to which this development is advancing. It is also necessary to recognise failed attempts to develop new products, e.g., if experiments do not produce meaningful results. In addition to the pure number of user projects pursued and the relation between success and failure of individual projects, attention should also be paid to the extent to which ReMade@ARI has an effect across the spectrum of the key areas outlined in CEAP. Similar to Category II, this requires close collaboration with the teams of **WP3**, **WP4**, and **WP5**.

It is likely that the participating facilities will profit from the project as well. The core functions of RIs are particularly important here. Products of the participating institutions can first of all be scientific publications that are generated in the course of the project. These publications represent a well-

established measure of productivity and performance. Thus, publications also feature in the impact assessment insofar as they can be understood as products of the project. The same applies to the provision of data sets, which can be made available to the public if this appears technically and legally feasible (e.g., it is important to consider embargo periods and the specific data policies of the institutions involved). Even if it is not the core concern of ReMade@ARI, this output must also be assessed for its impact. Moreover, the outreach and dissemination activities of **WP2** will be monitored for its impact on different audiences and the wider public. Another relevant aspect is the question of sustainability of the project infrastructure. Here, the impact assessment will report on the steps that are in motion to institutionalize the structures and processes of ReMade@ARI beyond the project's duration (in accordance with **WP2T4**).

Primary activity in Category III	Performance Indicators
<ul style="list-style-type: none"> In-depth case studies 	<ul style="list-style-type: none"> User-facility interaction and product development Progress of product development according to TRL
<ul style="list-style-type: none"> Monitoring of publication activities 	<ul style="list-style-type: none"> Scientometric indicators
<ul style="list-style-type: none"> Monitoring of outreach and dissemination activities 	<ul style="list-style-type: none"> Altmetric indicators
<ul style="list-style-type: none"> Participant observation of project meetings 	<ul style="list-style-type: none"> Steps towards a long-term consolidation of the project

In addition to these activities in **WP2**, the actual access numbers that were spelled out in the project proposal will be monitored continuously. This will happen in collaboration with **WP4** and, for the industrial partners, with **WP6**.

Hours of trans-national access to the project's facilities:



Number of SME accesses in sub-project TamaTA-CE:



Number of industrial companies that worked with the project within the sub-project TamaTA-PiP:



Section III – Design of investigation, KPI, and timelines

At its core, the operationalization of the impact framework builds on a multi-perspective approach that includes subjective views that are generated in interviews, surveys and evaluations, objective measures which build on the analysis of data from the user portal, in-depth case studies that follow impact pathways in detail, and observations made by the impact assessment team throughout the project's life-cycle. Additional measures might be included during the project's life-cycle if stakeholders or circumstances call for it.

While each impact category is assigned one or more primary activities, it is intended that the individual parts of the assessment complement each other. This allows to cross-link subjective and objective measures and to provide a differentiated view of the respective categories (see Figure 3). For instance, while publications represent a common indicator of productivity on the facility level, they also have significance for the scientific development of the junior scientists and thus also touch on impact category I.

Each activity is linked to one or more performance indicators. Additional data collection may be included that does not directly pay in on these indicators but is meant to illuminate the complex interactions of the involved partners. The performance indicators are mainly intended as anchor points for the implementation of the impact assessment. It is planned to highlight a small set of KPIs from all indicators collected that cover all three impact categories. These are meant to be reported to the project's executive board and the project management (**WPI**) on a regular basis (see subsection "Timelines"). This feedback loop will provide a formative assessment which offers opportunities and suggestions for readjustment during the project period. Additional performance indicators may be reported if they are deemed particularly interesting or relevant on an ad-hoc basis. The accumulated findings from all activities will be consolidated into an Impact Assessment Whitepaper (**Deliverable D2.10**) at the end of the project (M48).

KPIs for regular reporting

- Success of user-expert interactions
- Perception of interaction with facilities
- Perception of project contribution to product development based on TRL
- Use of pre-proposal process
- Ratio of successful proposals to submitted proposals
- Coverage of CEAP key areas
- Distribution of facilities and geographical regions
- Scientometric and altmetric indicators

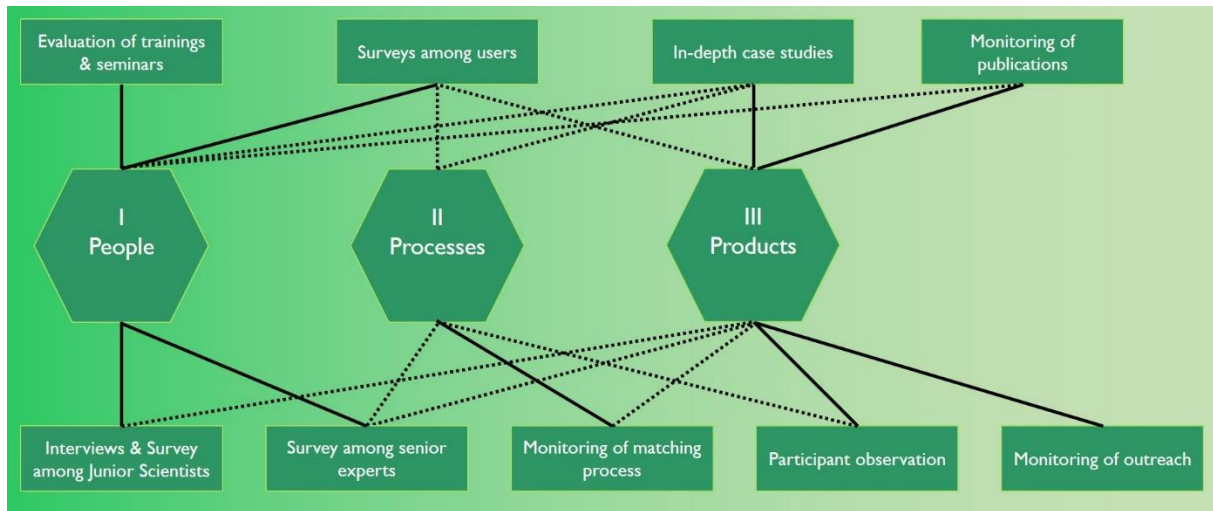


Figure 3: Relation between activities and impact categories. Solid lines indicate the primary association of activities. Dotted lines indicate cross-references to other impact categories.

Timelines

The impact assessment activities can be well adapted to the time structure of the ReMade@ARI project (see Figure 4). The biannual calls of the project allow for a structuring of the collection of survey data, interviews, and evaluations of the portal data, which makes it possible to identify changes over a relatively long period of time.

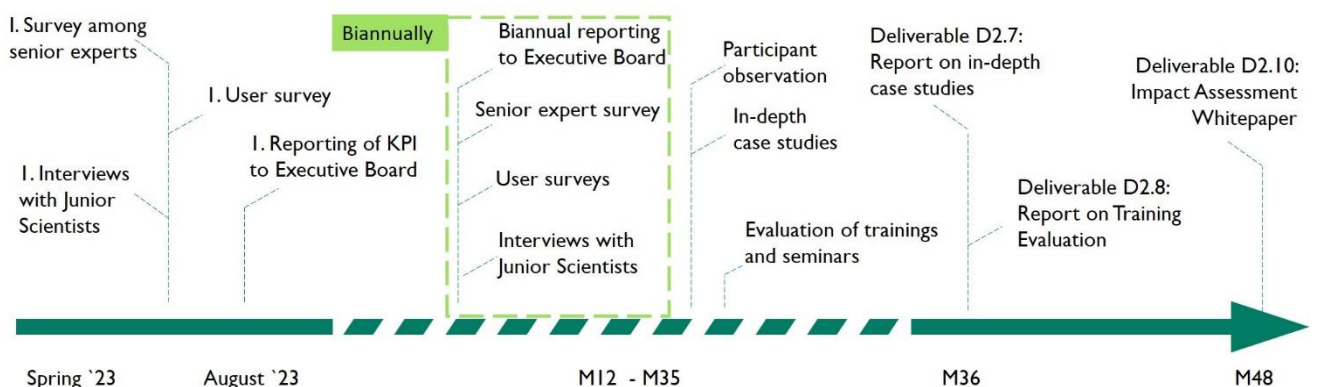


Figure 4: Workflow of activities and deliverables within WP2T2. “M” indicates “Project Month”.

It is planned that interviews and surveys will start with a brief time lag after the call is closed. The evaluation of the data from the portal will take place in parallel. The first wave of data collection will be conducted after the completion of the spring 2023 call for proposals. Analyses for this wave will be completed by August 2023. The results will be reported in time for the annual report of the ReMade@ARI project. This scheme of data collection, analysis and reporting is to be implemented on a semi-annual basis for the entire duration of the project.

The approach is complemented by the in-depth case studies and the evaluation of trainings and seminars. Here, the aim is to accompany one case at the beginning of the project and to add another case at a later stage. In accordance with the project proposal, the results of these studies will be reported in **M36 (Deliverable D2.7)** and published via OpenAIRE. Also, in **M36**, the results of the training evaluation (**Deliverable D2.8**) are synthesised and reported. The evaluation of these trainings that are conducted in **WP2T3** will also feed into the analysis of effects and impacts of ReMade@ARI on

users and members of the facilities. Finally, the Impact Assessment Whitepaper that is to be published in **M48** will encompass the consolidated findings from all activities (**Deliverable D2.10**).

Risk analysis

The impact assessment must also address the risks that are created if important activities cannot be carried out or other difficulties arise during the course of the project. Usually, these risks include:

- Turnover of relevant personnel (e.g. Junior Scientists, key project personnel)
- Uncertain willingness of users to participate in in-depth case analyses
- Lack of acceptance and support by relevant groups
- Changes in the composition of the data collected which in consequence prevent longitudinal observations
- Changing objectives on the project level which question defined KPI and activities

In order to manage these risks, care is taken in all steps of the impact assessment to inform the relevant target groups transparently about the impact assessment planning and activities. Currently, options are being worked out in close collaboration with **WP4** and **WP6** to inform users early in the process about the in-depth case studies to ascertain the interest of this group. This includes addressing users via the portal. To secure reasonable rates of participation in the surveys, established contacts between users on the one hand and Research and Technology Organisations (RTOs) or liaison officers of facilities on the other will be used. The process of data collection, analysis, and data conservation will be conducted in accordance with the requirements of the General Data Protection Regulation GDPR. To this end, the methods of investigation are coordinated with an ethics advisor (**WP7**) in advance.

In general, the combination of different research techniques is meant to protect the assessment against the drop-out of individual target groups or failures of single methodological approaches. Finally, the impact framework is to be understood as a formative instrument that may be subject to changes during the project's life-cycle.

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