Integrating Activities for Advanced Communities

D1.14 - Innovation Progress Report v0

Project No.871120– INTERACT

H2020-INFRAIA-2019-1

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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
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Publishable Executive Summary

Within the Innovation Watch Dog activities, the monitoring of indicators that measure the rate of innovation introduced in the INTERACT III project is envisaged. This is the mid-project report which aims to monitor the progress of 14 indicators out of a total of 23. The indicators measured belong to work packages WP1, WP3, WP4, WP5, WP6, WP7 and WP8. For some indicators this first measurement represents a sort of baseline. The final report that will be produced at the end of the project will provide a better overview of the improvement.

1. Introduction

1.1. Innovation in INTERACT III

As described in deliverable D1.13 – Innovation Monitoring Plan, innovation in INTERACT III is intended to enhance process efficiency, to improve service level, to develop new opportunities, to expand Arctic environment awareness, etc.

In INTERACT III several innovation factors have been identified and 20 of them have been selected as the most important (see table 1) to quantify improvements. Some of them aim to foster people awareness on Arctic themes (e.g. IF.3, IF.7, IF.14-15-16, and IF.19), some aims to improve process efficiency and service level to users (e.g. IF.5-6, IF.10), and some aims to involve as many new stakeholders as possible (e.g. IF.8, IF.20). Moreover, to grab new opportunities, innovative organization (IF.1-2), new procedures (IF.9, IF.17-18) and technological applications (IF.4, IF.11-12-13) will be pursued (Table 1).

Table 1. From the many Innovation Factors (I.F) in INTERACT III, 20 have been selected to be monitored throughout the lifetime of the project.

	Task /Del	Title	I.F.	Task /Del	Title
1	T1.3-5	INTERACT "Watch Dogs"	**11**	T5.2	Exploring new communication technology possibilities for remote sensor
2	T1.7	INTERACT non-profit legal entity	**12**	T6.2	Exploring possible applications of machine-learning for data mining focusing on topics
3	D2.7-8 D2.11-13	Pocket Guides	**13**	D6.4	Report on future strategy and planning for the area of AI and ML to be applied in Arctic Research
4	D2.9	Repository with selected data from INTERACT stations integrated in INTERACT GIS	**14**	D7.1-4	Outreach films
5	M3.2	Access modality selection flow-chart	**15**	D7.5	Educational tool-kits
6	T3.4	VA Single-Entry Point	**16**	D7.6	Online lessons for secondary schools
7	T3.5	Synthesis Papers	**17**	D8.2	Protocols for (target and non-target) screening of contaminants of emerging concern at INTERACT stations
8	T4.2	Arctic Resident Observing Network (Nenets)	**18**	D8.4	Plan for development of screening monitoring networks and enhancing application of screening monitoring
9	T2.1, T4.4	Arctic weather predictions improvement	**19**	T9.1	Educating the tourists and tourist operators
10	D5.1	Report on Significance of the Agreement on Enhancing International Arctic Scientific Cooperation for Research in the Arctic	**20**	D9.2	Recommendations for improving tourist policies and regulations

Every innovation factor could affect both the INTERACT network processes (promoting for example new organization and protocols) and external entities (stakeholders, public, communities, …).

Furthermore, these factors could have a mixed impact on technical and scientific development as well as economic evolution, such as quality improvement, efficiency and societal challenges. Finally, impacts could

be clustered in technology, process, social and educational evolution. Figure 1 shows the impacts distribution of innovation factors along the mentioned dimensions.

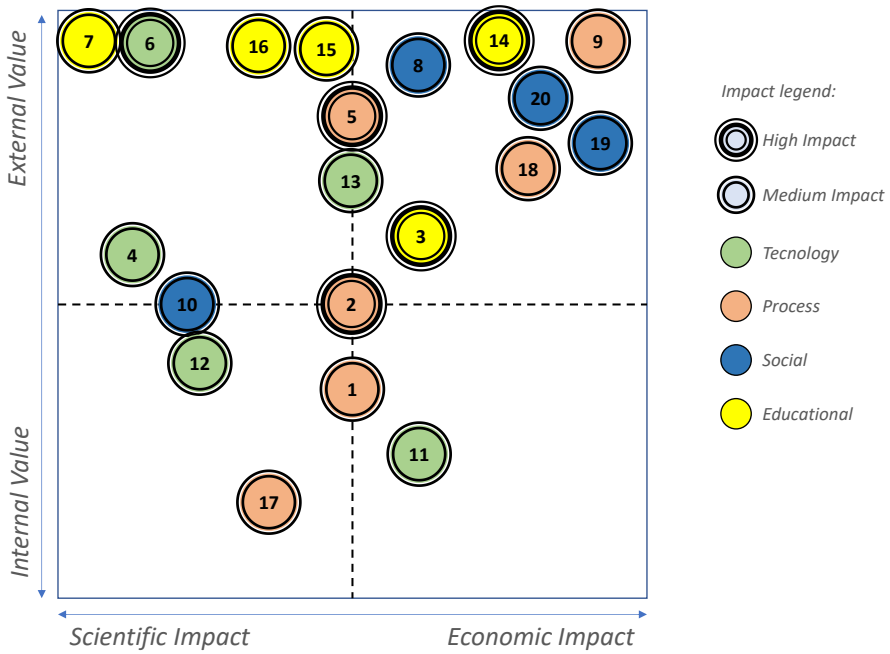


Figure 1. The expected benefits of the 20 selected Innovation Factors.

To measure impacts and improvements, WP leaders have been involved in metrics definition identifying one or more representative indicators for every Innovation Factors. The discussion that followed brought an important value to the project, promoting greater attention to impact measurement, process improvement and user (internal customers) satisfaction.

In general, indicators belong to two different categories:

- Key Performance Indicators (KPI)
- Key Activity Indicators (KAI).

KPI represents a result of project improvement, e.g. efficiency, effectiveness, quality, whereas KAI represents an impact measurement, or rather, the amount processed to achieve a purpose of project improvement.

In INTERACT III, like any non-profit consortium, KPI are used to highlight internal process improvement or better service level to internal customer (e.g. the Transnational Access Service Level in WP3 for INTERACCES applicants). KAIs are the most utilized indicator category in INTERACT III because they show the degree of involvement of communities and stakeholders to achieve a specific result, e.g. organization involved to adopt recommendations for improving tourist policies and regulations in WP9, stations engaged to plan for development of screening monitoring networks and enhancing application for screening monitoring in WP8, document produced such as Pocket Guides edited in WP2, or audience reached for educational purpose.

1.2.General Definition

A standard table lists definitions, features, procedures, and organizations involved for each metrics. Below is a description of the different headings (Table 2).

Table 2. The definitions of the headings used to describe the monitored indicator.

Innovation Factor	Element identified inside the project that will improve and innovate internal processes, experiences, awareness, …
Description	An extended description of the Innovation Factor
Impact	Describes the expected impacts, internal and external, scientific and economic
Proposed Metrics	
Indicator	Indicator title
Indicator type	Key Performance Indicator (KPI) or Key Activity Indicator (KAI)
Performance monitoring	A description of performance or impact that the indicator monitors
Procedure	Illustrates data collection process and calculation model
Report Frequency	Defines monitoring frequency or specific due dates
Responsible	Who is responsible for indicator monitoring and data providing
Partners involved	Partners involved in data gathering
Final Target	Result expected for the indicator as a performance target

For every monitored indicator a general definition will be shown below.

1.3.Indicators Monitoring Plan

Throughout the project two Innovation Progress Reports have been planned to be produced, even though a continuous monitoring has been carried out by involved partners until now. The monitoring will be conducted until the end of the project, when a final release of the Innovation Report will be delivered.

Table 3 reports the timeline of indicators monitoring plan identified in the previous deliverable D1.13 (Innovation Monitoring Plan). The indicators that will be measured and stated in this report is presented in ***bold***.

At the moment, for three Innovation Factors (IF.11, IF.13, IF.18) a specific metric has not yet been identified, mainly for the unforeseen development related to high level of innovation (new communication technology, AI application and contaminant screening), but we are confident to identify them within the last release of Innovation Report.

Table 3. Timeline of indicators monitoring plan.

WP	Innovation Factor	Indicator	Months					
			13	20	25	29	37	48
WP1	IF.1 – Watch Dogs	Number of topics collected during the project as new educational resources						X
		Number of indicators monitored		**X**				X
	IF.2 – INTERACT non-profit legal entity	***Number of station members***	**X**	**X**	**X**		X	X
WP2	IF.3 – Pocket Guides	Breadth of pocket guides distribution					X	X
	IF.4 – Repository establishment	Repository degree of use					X	X
WP3	IF.5 – Access modality selection flow-chart	***TA/RA versus VA distribution***		**X**				X
		TA Service Level	**X**	**X**	**X**		X	X
	IF.6 – VA Single-Entry Point	***Costs saving estimation for VA adoption***		**X**	**X**		X	X
		Datasets value		**X**				X
	IF.7 – Synthesis Papers	Number of papers						X
WP4	IF.8 – Arctic Resident Observing Network	***Number of local communities and organizations involved***			**X**	X		X
	IF.9 – Arctic weather predictions improvement	***Number and nature of issues detected***			**X**	X		X
		Number of solutions adopted				X		X
WP5	IF.10 – Information of researchers' free movement bottleneck	***Number of scientists/stations involved on issues compilation and barriers description***			**X**			X
		List of policy briefing attendees						X
	IF.11 – New communication technology opportunities	*tbd*						X
WP6	IF.12 – ML application opportunities	***Time saving estimation using AI automatic detection***			**X**			X
		Cost saving estimation using AI automatic detection			**X**			X
	IF.13 – AI and ML application in Arctic Research	*tbd*						X
WP7	IF.14 –Outreach films	***Number of visualizations/downloads of each film***		**X**				X
	IF.15 – Educational tool-kits	***Number of students/teachers/secondary schools involved***		**X**				X
	IF.16 – Online lessons for secondary schools	Number of online lessons produced						X
WP8	IF.17 – Contaminants screening	***Number of scientists/stations involved on contaminants screening survey***			**X**			X
	IF.18 – Screening monitoring	*tbd*						X
WP9	IF.19 – Educating the tourists and tourist operators	Number of Station Managers trained						X
	IF.20 – Recommendations for improving tourist policies and regulations	Number of existing policies and regulations analyzed, confirmed, and reviewed						X
		number of indicators to be monitored	**2**	**8**	**9**	**3**	**5**	**26**

2. Innovation Progress Report

2.1. WP1 Project Coordination

2.1.1. IF.1 – Watch Dogs

As regards the watchdog activity, the indicator that should have been monitored in the first report on the progress of the innovation is the Number of Indicators actually introduced.

Innovation Factor	**IF.1 – Watch Dogs**
Description	Watch Dogs roles have been introduced in INTERACT III to keep watch on education, innovation and data management across the project
Impact	To achieve significant advances in beyond state-of-the-art activities for ensuring innovation, data accessibility and education
Proposed Metrics	
Indicator	**Number of indicators monitored**
Indicator type	Key Activity Indicator (KAI)
Performance monitoring	Due to the nature of some activity and the unknown progress, introducing a metrics to monitor innovation for all factors is challenging. That is why this indicator has been introduced, to monitor the real capacity of the project to monitor its own improvements.
Procedure	The Innovation Progress Reports that will be produced during the project will provide an immediate measure of indicators really monitored.
Report Frequency	At the Innovation Progress Report (deliverables D1.14 and D1.15)
Responsible	Giorgio Falsaperna, LINKPRO
Partners involved	LINKPRO
Final Target	20

Currently, the indicators with a real definition are 23 out of a hypothetical total number of 26 (the metrics of three Innovation Factors should be identified later in the project). This report provides a preliminary measure for 14 of them.

In general, the distribution of indicators by type and by category is shown respectively in figure 2 and figure 3, where:

- *KAI* (Key Activity Indicator) includes indicators that monitor an activity progress or a degree of involvement of communities and stakeholders to achieve a specific result.
- *KPI* (Key Performance Indicator) that represents a tangible result of project improvement.
- *Arctic awareness* category contains all measurable activities oriented to education, lessons produced, people involvement, …
- *Improvement* category comprises technology innovations, cutting-edge applications, forecast model progressions, and innovative contaminants screening processes.
- *Process optimization* includes indicators that monitor support and simplification to station management.

- *Organization* collects main organizational changes metrics (non-profit legal entity) and TA service level measurement.

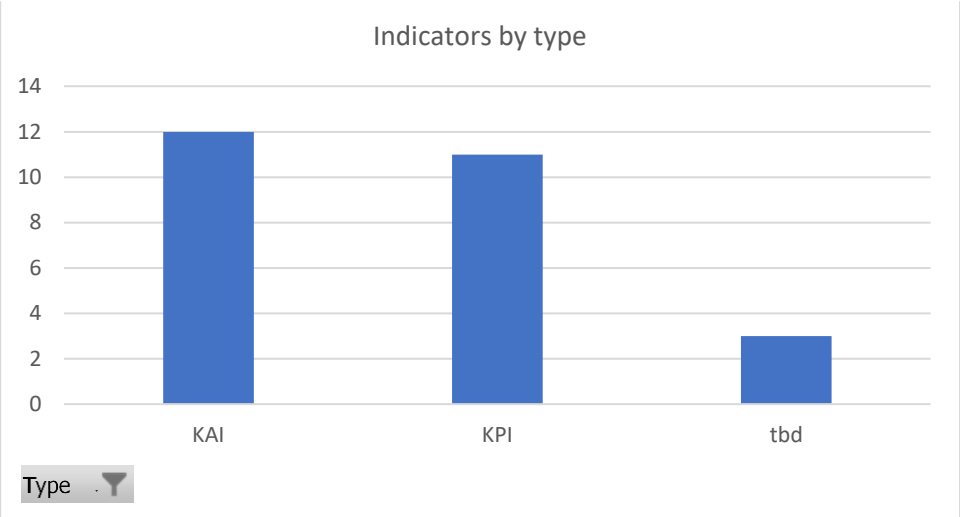


Figure 2. Distribution of the indicators by type.

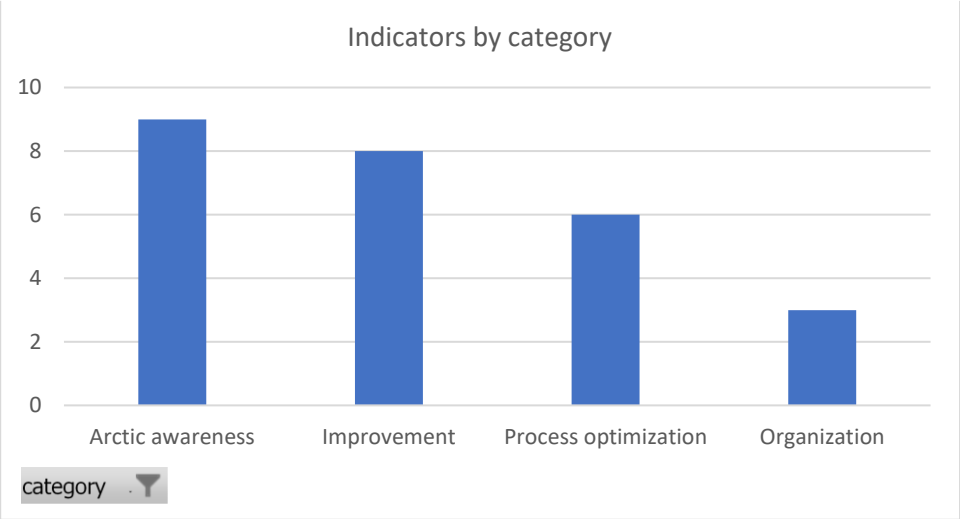


Figure 3. Distribution of indicators by category.

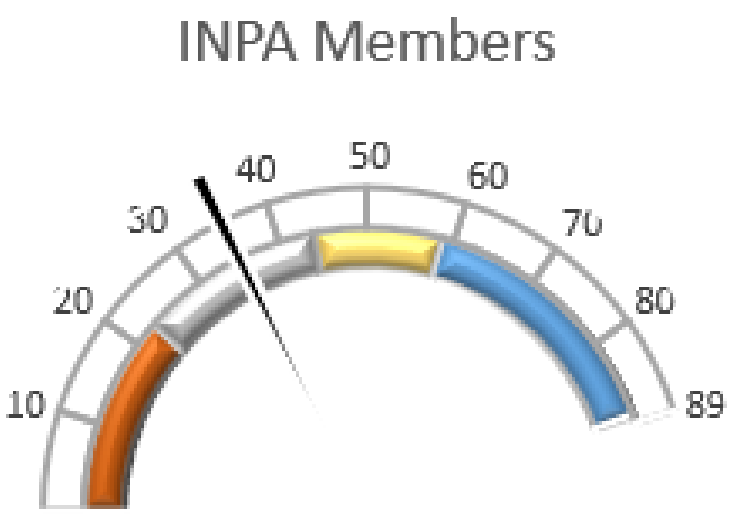
2.1.2. IF.2 – INTERACT non-profit legal entity

INTERACT member stations annually host thousands of researchers from around the world and is seen as a major terrestrial research infrastructure network in the North with global recognition.

INTERACT Non-Profit Association (INPA) has been formed to offer the INTERACT Stations a long term sustainable platform to continue to play a major global role to build capacity for research and monitoring throughout the Arctic, also in the future.
INPA's mission is to support the use and operational procedures of infrastructures in the Arctic, sub-Arctic, boreal and alpine regions, to support research and scientific development in the field of climate change and environment, and to increase general awareness about these topics within the general public and among politicians and decision makers.
To achieve its purpose, the main objectives of INPA are to improve international cooperation, to coordinate resources and research initiatives, to provide access to members' infrastructures, to improve infrastructures' operation and to financially support research and monitoring focusing on the Arctic, sub-Arctic, boreal and alpine areas and its global implications.
To measure the impact of this organizational innovation, INTERACT III project introduced the following indicator:

Innovation Factor	**IF.2 – INTERACT non-profit legal entity**
Description	Create an international non-profit association of stations members.
Impact	To secure a long-term sustainability of INTERACT and extend its activities
Proposed Metrics	
Indicator	**Number of station members**
Indicator type	Key Performance Indicator (KPI)
Performance monitoring	Number of terrestrial research stations registered as official member of INTERACT non-profit association
Procedure	A Membership campaign will be performed by INTERACT Non-profit association and all INTERACT Stations will be asked to join the Association as a Member. The INTERACT association Board (including DMG people) will constantly update Association Members List
Report Frequency	At all INTERACT General Assemblies and for the Innovation Progress Report (deliverables D1.14 and D1.15)
Responsible	Margareta Johansson, ULUND
Partners involved	ULUND, USFD, UCPH, UOULU, 4PM
Final Target	3 scenarios by the end of the project: Bronze: 23 stations Silver: 44 Stations Gold: 59 Stations

Today, 35 stations have expressed interest in joining the INPA association, 30 already partners of INTERACT and 5 external to the project. Figure 4 reports a dashboard that indicates that we are now in "silver scenario" and the geographical distribution of the stations.



Country	# stations
Russia	8
Poland	3
Canada	3
Greenland	5
Austria	2
Finland	3
Iceland	2
USA	1
Sweden	1
Svalbard	5
UK	1
Faroe Islands	1
TOTAL	**35**

Figure 4. Number of Stations that have expressed interest to join INPA.

2.2. WP3 Giving Access to the Arctic

2.2.1. IF.5 – Access modality selection flow-chart

With the aim of improving the service to researchers and at the same time making the exchange of data and information to as many users as possible efficient and effective, the following indicators have been introduced:

- **TA/RA versus VA distribution** to monitor the amount of access that could be addressed to the most efficiency Virtual Access modality;
- **TA Service Level**, considering the applicant as a customer, this indicator evaluates the service level provided during the application procedure.

Innovation Factor	**IF.5 – Access modality selection flow-chart**
Description	This tool will support selection of access modality (TA/RA/VA) for TA applicants. Thanks to this interactive tool, applicants will be addressed to the most appropriate access modality.
Impact	Part of a range of service tools, together with Station selection tool and TinderAct tool, it specifically promises to optimize the use of resources through costs saving adopting VA modality when data are already available online instead of TA/RA.
Proposed Metrics	
Indicator	**TA/RA versus VA distribution**
Indicator type	Key Performance Indicator (KPI)
Performance monitoring	Structured as a wizard, the tool can monitor the distribution of users addressed to TA/RA versus VA in percentage.

	Knowing this percentage helps to identify a distribution model of access modality (for example 60% TA/RA, 40% VA). In terms of ideal performance, the greater VA modality the better.
Procedure	The indicator will be automatically tracked by the online tool. At every flow-chart completion the counter of the suggested modality (TA/RA or VA) will be updated.
Report Frequency	Monthly or quarterly for internal use. For the Innovation Progress report (deliverables D1.14 and D1.15)
Responsible	Hannele Savela, UOULU
Partners involved	UOULU, INKODE
Final Target	NO

In the period Sep 2020 - Dec 2021 46 wizard compilation events were recorded on the website. The distribution in the various suggested access modalities is found in Figure 5. Communication plans also based on social media are being studied to spread the knowledge of the VA modality and aim at an increase of this already interesting percentage.

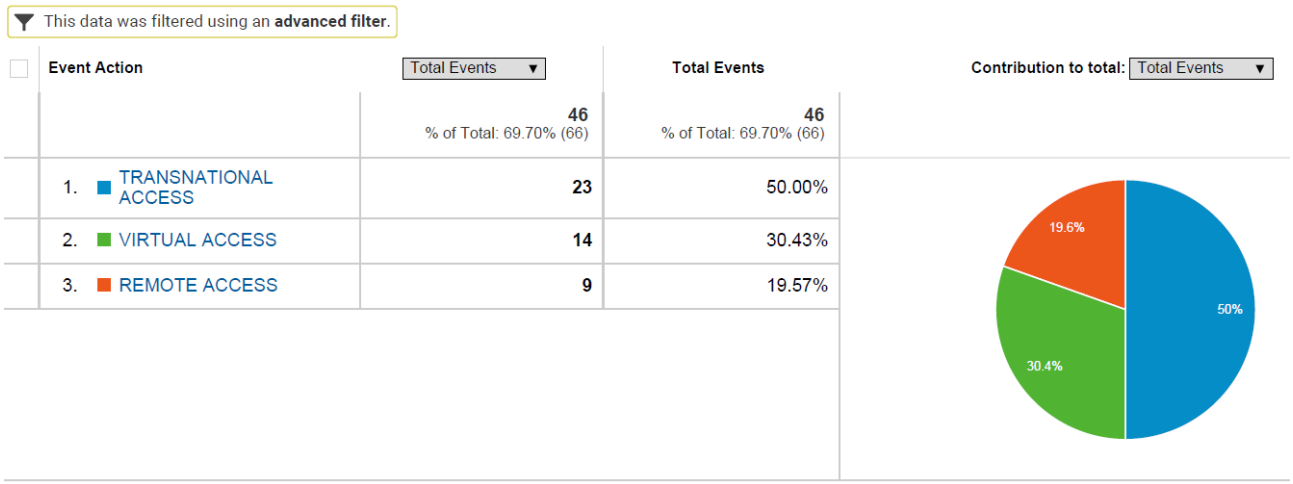


Figure 5. An overview of wizard compilation events from September 2020 to December 2021.

Proposed Metrics	
Indicator	**TA Service Level**
Indicator type	Key Performance Indicator (KPI)
Performance monitoring	The scope of this indicator is to monitor the service level provided to TA applicants in terms of process efficiency. Several components contribute to its evaluation: • Time from call closure to Evaluation (by TA Coordinator) • Time from TA Board meeting to access decisions (by TA Coordinator) • Time from access decision to announcement (by Coordinator) • Time from access visit to project report (by TA User) • Time from project report to reported publications (by TA User) • Time from access visit to reimbursement (by TA Station) • Time from recommendation to decision (by TA Station)

	To summarize in one specific KPI, the overall improvement rate (e.g. average time reduction of all proposed time lapses together) over project life will be calculated. In addition, this indicator could be monitored for every station identifying best practices and solutions to be shared.
Procedure	Every time interval will be automatically collected by INTERACCESS on-line application, evaluation and reporting system used by both TA Users, Stations and TA Coordination. To have a complete trend of this indicator, every component will be evaluated from the beginning of INTERACCESS tool (2017).
Report Frequency	At all INTERACT General Assemblies and for the Innovation Progress Report (deliverables D1.14 and D1.15).
Responsible	Hannele Savela, UOULU
Partners involved	UOULU, INKODE
Final Target	NO

Since these are newly introduced and complex indicators, it is normal that the measurement process needs a period of fine-tuning, but as a first draft the result represents a good baseline (Table 4). However, the importance of these measurements is emphasized in order to proceed towards measurable continuous improvement.

Table 4. The first results from this indicator is used as the baseline for future references.

Key Indicator	INTERACT II (2017-2021)		INTERACT III (30 June, end of RP1)		INTERACT III (30 Dec 2021)	
	days	#projects	days	#projects	days	#projects
days From Call Closure To Evaluation	9	*430*	15	-	17	*204*
days From Access Recommendation To Decision	37	*326*	30	-	28	*100*
days From Access Decision To Announcement to TA Applicants	13	*326*	24	-	27	*100*
days From Access Visit To Reimbursement	238	*181*	-	*0*	-	*0*
days From Access Visit To Project Report	82	*198*	50	*8*	53	*18*
days From Project Report To Reported Publications	545	*62*	-	*0*	71	*3*

In general:

- The indicators technically function mostly as planned, but their use is not as straight forward as thought in the beginning because of several confounding factors (some trigger events used to count these indicators not well registered, e.g. date of final reimbursement) and covid-19.
- The parameters are most accurate and reflect the real situation best in the early part of the access provision workflow (application, evaluation, recommendation and decision stage).
- The parameters calculated after the decision stage are more over confounded by the delays and cancellations due to covid-19.

In addition to serving to monitor continuous improvement, the analysis of the causes that determine a deterioration in performance can help identify problems and solutions. As an example:

- The longer time lapse from access decision to announcement to TA Applicants was due to the need to revise the station's access decisions in order to avoid over consumption of their TA Budgets in the uncertain situation (need for quarantine costs, increased travel costs etc.).
- The longer time lapse from call closure to evaluation between INT II and INT III is due to increased work load and full time schedules of the TA Coordination, requiring more time to assign the applications to evaluation.

2.2.2. IF.6 – VA Single-Entry Point

The VA access modality allows to avoid expenses of collecting and extracting data and information already available. The use of this modality therefore allows to avoid operating costs that could be easily estimated. With this in mind, the savings associated with the use of VAs can be estimated and a value to online datasets could be assigned.

Innovation Factor	**IF.6 – VA Single-Entry Point**
Description	The online INTERACT VA Single-Entry Point will provide users an easy and efficient way to access metadata, data, and related data products, visualizations and services.
Impact	Data availability will improve quality research giving access to a wide range of data and information and optimizing access costs: users could collect and use available data avoiding duplication of TA/RA costs. A large VA Single-Entry Point adoption should optimize resources without any limitation on knowledge dissemination.
Proposed Metrics	
Indicator	**Costs saving estimation for VA adoption**
Indicator type	Key Performance Indicator (KPI)
Performance monitoring	To estimate savings related to VA adoption two scenarios should be considered: VA Single-Entry Point versus the absence of this utility. The main question is: what if we did not have VA Single-Entry Point? Most likely, the duplication of TA/RA to collect same or similar data already available could not be avoided. Thus we can say that, for every use of VA Single-Entry Point platform, an equivalent TA/RA cost would be saved. This equivalence is comparable with the effort to create from scratch the same data or information: travel costs and labor costs, just to mention the main quantifiable efforts, other than risks and carbon footprint as a not easily quantifiable cost. Since number of downloads cannot be tracked, the only way to estimate that saving is to consider the real amount of TA granted proportionally to TA/RA and VA distribution (see previous IF.5 indicator **TA/RA versus VA distribution)**. For example, with 4 M€ transnational access granted (TA_g) and 60% ($TA/RA_{\%}$) - 40% ($VA_{\%}$) distribution between TA/RA and VA, the estimated saving is: $S_{VA} = \frac{TA_g \times VA_{\%}}{TA/RA_{\%}} = \frac{4 \times 0{,}4}{0{,}6} = 2{,}67\ M€$ Actually, the TA granted is a limited budget value and likely part of total applicants not granted could take advantage of VA Single-Entry Point as well, so this value could be underestimated even though it is based on a statistical assumption.
Procedure	IF.5's indicator evaluation and yearly granted transnational access amount are needed to be estimated
Report Frequency	At all INTERACT General Assemblies and for the Innovation Progress Report (deliverables D1.14 and D1.15).
Responsible	Hannele Savela, UOULU
Partners involved	UOULU
Final Target	NO

With 900 k€ approximately granted for two completed TA/RA calls so far, and with a VA modality access that in average weight for 30% of total, the actual addressed VA access would save 392 k€. It will be interesting to monitor this effect at the end of the project.

Proposed Metrics	
Indicator	**Datasets value**
Indicator type	Key Activity Indicator (KAI)
Performance monitoring	As mentioned before, the VA adoption will represent a very efficient way to access data and information, avoiding TA/RA costs. Thus, datasets will acquire a real value that could be estimated comparing each of them with the equivalent effort to collect a dataset by TA.
Procedure	The average estimated value of one dataset obtained by an equivalent TA is based on the length of a usual TA visit per user group (an average of 40 days) and the daily unit cost of the specific station, considering also the estimated cost of travel and logistics per user group to the station and back. Multiplying the number of available VA dataset with the average cost of a dataset will rapidly demonstrate the increasing value of the data provision as we more and more populate the new VA single-entry point. A report will be produced automatically by online tools.
Report Frequency	Monthly or quarterly for internal use. For the Innovation Progress Report (deliverables D1.14 and D1.15).
Responsible	Hannele Savela, UOULU
Partners involved	UOULU, INKODE
Final Target	NO

The estimated value of dataset for the following representative stations is presented in Table 5.

Table 5. Estimated value of data sets from 10 research stations.

Station	Value per dataset (€)	Datasets per station 31/12/2021 (mid term)	Value per station 31/12/2021
Abisko Scientific Research Station	7.710	54	416.340,00 €
Arctic Station	14.540	43	625.220,00 €
CEN Whapmagoostui-Kuujuarapik Research Station	16.667	59	983.353,00 €
Greenland Institute of Natural Resources	16.508	84	1.386.672,00 €
Pallas-Sodankylä Stations	16.050	29	465.450,00 €
Research Station Samoylov Island	14.560	301	4.382.560,00 €
Station Hintereis	6.542	135	883.170,00 €
Svartberget Research Station	9.150	557	5.096.550,00 €
Tarfala Research Station	11.940	89	1.062.660,00 €
Zackenberg Research Station	19.675	209	4.112.075,00 €
TOTAL		**1.560**	**19.414.050,00 €**

2.3.WP4 Unpredictable Arctic

2.3.1. IF.8 – Arctic Resident Observing Network

To identify societal impacts of extreme weather and other events, and explore ways in which local communities can contribute to identify these events and their impacts, there is a unique opportunity for

INTERACT to work with a development of a new and innovative network led in conjunction with a health organization in the Nadym area of the Yamal-Nenets Autonomous District, Russia. The organization assembles community members including the Nenets reindeer herders, workers in the gas and oil fields and other Arctic residents to provide an observing network that will initiate increased data flow (e.g. photos, temperature measurements, snow depth) on extreme weather events, unexpected changes in ecosystems and perceptions of changes in health and wellbeing from the phenomena reported.

Innovation Factor	**IF.8 – Arctic Resident Observing Network**
Description	Information and data collection will be useful to process information and consult with appropriate analytical laboratories in Russia and INTERACT, while seeking guidance from the ECMWF on which observations and measurements are most beneficial for improved weather forecasts.
Impact	Beneficiaries of the proposed development include Indigenous and other Arctic residents, local enterprises and public services.
Proposed Metrics	
Indicator	**Number of local communities and organizations involved**
Indicator type	Key Activity Indicator (KAI)
Performance monitoring	The objective of this indicator is to highlight the breadth of the analysis
Procedure	Statistical information will be collected during the task
Report Frequency	In progress report at M24, and final report at M29
Responsible	Jonathan Day, ECMWF
Partners involved	ECMWF
Final Target	NO

The result of information and data collection is as follow:

- Reports from about 500 people including local residents, administrative staff, emergency service, teachers and students of secondary and vocational schools, reindeer herders reporting to https://siberiaweather.ftf.tsu.ru/ by mobile phone and browsers
- Visits to settlements with medics
- Large scale surveys (almost 1000 people)
- In-person meeting of citizen science network in September 2021

2.3.2. IF.9 – Arctic weather predictions improvement

To evaluate the degree of weather prediction model improvement, the following key activity indicator has been introduced:

Innovation Factor	**IF.9 – Arctic weather predictions improvement**
Description	Arctic regions pose specific challenges to quality of weather forecasts related to processes which are historically difficult to model. This task would demonstrate the utility of data collected at the INTERACT stations for improving weather forecasts by using them to diagnose the sources of forecast errors.
Impact	To improve the skill of forecasts and their usability over time.

Proposed Metrics	
Indicator	**Number and nature of issues detected**
Indicator type	Key Activity Indicator (KAI)
Performance monitoring	An important step in making forecast improvements is identifying issues with it. The work proposed in Task 4.4 aims to do just that by confronting forecasts at four INTERACT stations with actual observations from those sites. The aim is to identify common forecast issues in the Arctic region. This could be a systematic or conditional error in a certain parameter.
Procedure	A list of classified issues by nature will be collected at the end of task 4.4 (M29)
Report Frequency	In progress report at M24, and final report at M29
Responsible	Jonathan Day, ECMWF
Partners involved	ECMWF
Final Target	NO

Even though it is part of the project to seek solutions to implement real improvement to the forecast model, measuring the number of errors introduced by the model based on real data is still an important value because by identifying and addressing these issues the forecast scores improve.

Report in task 4.3 focussed on evaluation of forecasts of extreme heat in the Arctic at leadtimes of 1-6 weeks and links to land surface properties and their errors and the analysis so far has identified two main problems which are linked:

1. The first is that snowmelt is too slow in the model in Northern Europe and snow stays on the ground longer than observed.
2. The incoming solar radiation seems to be too low at the Sodankylä site (which will contribute to the causes of 1).

Most likely there will be further items to add to the error list by M29. In terms of solutions: ECMWF is working on some developments to the model still in testing.

2.4. WP5 Connecting the Arctic

2.4.1. IF.10 – Information of researchers' free movement bottleneck

Even though the indicator introduced for this innovation factor is only indicative of the degree of representativeness of the analysis, the final result is certainly innovative from the point of view of process optimization.

Innovation Factor	**IF.10 – Information of researchers' free movement bottleneck**
Description	Identify and help to reduce barriers of exchanging people and transporting scientific samples across national boundaries
Impact	Studying the benefits and possible shortfalls of implementation of the Agreement on Enhancing International Arctic Scientific Cooperation
Proposed Metrics	
Indicator	**Number of scientists/stations involved on issues compilation and barriers description**
Indicator type	Key Activity Indicator (KAI)

Performance monitoring	To confirm that the analysis is sufficiently representative
Procedure	Data collection in charge of WP2 (D2.6)
Report Frequency	At the Innovation Progress Report v0 (deliverables D1.14)
Responsible	Svenja Holste, APECS
Partners involved	UCPH
Final Target	NO

A review of the permit systems of relevance for scientists travelling to any of the Arctic countries has been realized. Permits needed to conduct science in the Arctic include station access systems, visa application systems, sample and equipment import/export systems as well as other authority permits. While scientists are responsible for ensuring they possess all relevant permits, navigating through all the different national permit systems appears to be a challenge.

Ten (10) representative stations participated in the drafting of the template and subsequently provided the data relating to their country:

- Abisko Scientific Research Station, Sweden
- Aktru Research Station/ Research Station Samoylov Island, Russia
- CEN stations, Canada
- FINI, Faroe Islands
- Finse Research Station/The Research Council of Norway, Norway
- Greenland Institute of Natural Resources, Greenland
- Pallas-Sodankylä Stations, Finland
- Sudernes Science and Learning Center, Iceland
- Sverdrup Research Station/Norwegian Polar Institute, Svalbard
- Toolik Field Station, USA

National rules and regulations are now available on the INTERACT website (https://eu-interact.org/accessing-the-arctic/arctic-fieldwork-permits-and-regulations/) as a service provided for researchers for the following categories:

- Cross border travel (persons, equipment, samples, chemicals),
- Access to specific areas,
- Permits to conduct fieldwork and collect samples,
- Field instrumentation,
- Safety equipment and
- Regional/local level permits.

2.5. WP6 Climate Action

2.5.1. IF.12 – ML application opportunities

Artificial intelligence applications represent in INTERACT III a real innovation which, in addition to expanding the possibilities of data analysis, implies improvements in the efficiency of the analyzes. With this in mind, the following indicators have been introduced:

Innovation Factor	**IF.12 – ML application opportunities**
Description	Cutting-edge applications of Artificial Intelligence and Machine Learning come true in the last years, introducing new business models, improving process efficiency and quality, supporting human activities. In Interact Project a pilot project has been implemented to evaluate benefits of these applications
Impact	Employ AI/ML techniques by helping to reduce manual work for researchers.
Proposed Metrics	
Indicator	**Time saving estimation using AI automatic detection**
Indicator type	Key Performance Indicator (KPI)
Performance monitoring	Automatic Image recognition would avoid human work simplifying detection and categorization of images.
Procedure	Estimation of human work saved in the pilot project (work days)
Report Frequency	In progress report at M24, and final report at M29
Responsible	Maria Erman, AFRY
Partners involved	AFRY
Final Target	NO
Proposed Metrics	
Indicator	**Cost saving estimation using AI automatic detection**
Indicator type	Key Performance Indicator (KPI)
Performance monitoring	Automatic Image recognition would avoid human work simplifying detection and categorization of images.
Procedure	Estimation of human work saved in the pilot project (stated in €)
Report Frequency	In progress report at M24, and final report at M29
Responsible	Maria Erman, AFRY
Partners involved	AFRY
Final Target	NO

Assuming the accuracy that can be achieved using human classification and AI, as demonstrated in [1], to be comparable; the main time saving pertains to an AI automatically detecting and classifying images instead of a human manually detecting and classifying the same images. This would decrease labour time and costs in proportion to the number of images classified.

An AI model can run 24/7, hence, the actual time used classifying images is tripled compared to a normal 8-hour work day for humans. The AI model is also significantly faster in classifying images than humans. Specifically for INTERACT III, using Örn's master thesis work [2] conducted in connection to INTERACT III, conservatively estimated, the time used for classifying one image using the AI tool Google Colab [3], is 1

[1] M. S. Norouzzadeh, A. Nguyen, M. Kosmala, A. Swanson, C. Packer, and J. Clune, "Automatically identifying wild animals in camera trap images with deep learning," *Proc. Natl. Acad. Sci.*, vol. 115, Mar. 2017, doi: 10.1073/pnas.1719367115.

[2] F. Örn, "Computer Vision for Camera Trap Footage : Comparing classification with object detection," Division of Visual Information and Interaction, Department of Information Technology, Mathematics and Computer Science, Disciplinary Domain of Science and Technology, Uppsala University, 2021.
[3] "Google Colaboratory." https://colab.research.google.com/ (accessed Jan. 17, 2022).

second, while the human equivalent is in the order of at least 10 seconds [1]. This means that the ratio of images classified is 30 times greater using AI compared to humans.

Human: 8 x 3.600 / 10 images per work day and per person = 2.880 images per day and person

AI: 24 x 3.600 = 86.400 images per day

The pilot project in INTERACT III classified 15.300 images, giving time savings of roughly 5 working days. The general expression for the number of saved days is:

Number of images/2.880 - Number of images/86.400,

which in the case of the pilot yields

(15.300/2.880) - (15.300/86.400), i.e., approximately 5 working days.

Regarding cost saving estimation using AI automatic detection, **t**he main cost savings entail less labor costs set against the cost of cloud computing resources. As the AI tool used for the work in [2], Google Colab [3], is free of use, no additional cost for running the AI tool was accrued. However, it should be noted that there are limitations to the free tier version of Google Colab (and the pro version is only available in a few selected countries), meaning that the user will be allotted resources depending on availability, and performance may hence vary. As such it should only be used for prototype purposes.

The cost saving estimation is thus the cost of labor. As 15.300 images were classified in the pilot project with a time saving of roughly 5 working days, the cost saving can be estimated as 5 days x 8h x c €, where c is the salary in € per hour.

2.6. WP7 Preparing for a future world

2.6.1. IF.14 –Outreach films

All the metrics in work package 7 measure the improvement of social education and awareness of the scope and impacts of global change and the Arctic's role.
To counteract public inertia on climate action and to influence policy, awareness of climate impacts in the Arctic and its widespread implications will be increased at a global level by producing high quality outreach videos made by a world leading organization. Consequently, the first indicator introduced want to measure the spread of views:

Innovation Factor	**IF.14 – Outreach films**
Description	Increase public awareness of Arctic environmental change and its global implications producing video clips freely available using the vast outreach sources of INTERACT.
Impact	To counteract public inertia on climate action and to influence policy, awareness of climate impacts in the Arctic and its widespread implications at a global level.

Proposed Metrics	
Indicator	**Number of visualizations/downloads of each film**
Indicator type	Key Performance Indicator (KPI)
Performance monitoring	Number of visualizations/downloads measure the level of diffusion of the message and, indirectly, the real impact on public opinion.
Procedure	For films uploaded on INTERACT's YouTube channel will be very easy to count number of views. Google analytics will be used for any different link provided on websites.
Report Frequency	At the Innovation Progress Report (deliverables D1.14 and D1.15).
Responsible	Katharina Beckmann, ULUND
Partners involved	USFD
Final Target	No

The film production has been postponed to M42 so the measure will be available at the end of the project.

2.6.2. IF.15 – Educational tool-kits

Similarly to the first indicator, the following wants to monitor the spread of views of educational tool-kits on the social media and INTERACT website.

Innovation Factor	**IF.15 – Educational tool-kits**
Description	Developing online educational resources in the form of tool-kits for schools
Impact	To empower younger generation with knowledge and tools to adapt to the most profound impacts of climate and environmental change.
Proposed Metrics	
Indicator	**Number of students/teachers/secondary schools involved**
Indicator type	Key Performance Indicator (KPI)
Performance monitoring	It is evident that this indicator will show the real impact of this educational program.
Procedure	Gradually, count students/teachers/schools involved.
Report Frequency	At the Innovation Progress Report (deliverables D1.14 and D1.15).
Responsible	Katharina Beckmann, ULUND
Partners involved	IGF-PAS
Final Target	No

The INTERACT newsletter for teachers, English version, was sent to 926 teachers and educators from around 60 countries and the Polish version to 432 Polish teachers: 1358 total teachers, more than expected.
Regarding the educational tool-kits published on Youtube social media, this is the statistical distribution of views:

Youtube video	Views	Date of publications
Patterned ground	3.088	10/04/2019
Tundra permafrost dynamics	1.396	10/04/2019
Glacier Dynamics	1.300	10/04/2019

Glaciation and hanging valleys formation	38.874	22/05/2019
Analysis and importance of peatlands	287	14/10/2019
Secrets of dead plants	61	20/01/2020
The Rapidly Changing Arctic in a Global Context	99	20/03/2020
TOTAL VIEWS	**45.105**	

Finally, the unique views of INTERACT website publication pages follows:

PAGE	UNIQUE VIEWS
/publication/	1.320
/publication/images-of-arctic-science/	788
/publication/interact-station-catalogue-2020/	642
/publication/interact-fieldwork-planning-handbook/	591
/publication/interact-practical-field-guide/	509
/publication/1349/	383
/accessing-the-arctic/publications/	313
/publication/interact-stories-of-arctic-science-ii/	193
/publication/test-publication/	196
/publication/interactive-e-book-stories-of-arctic-science-ii/	148
/publication/interact-management-planning-arctic-northern-alpine-research-stations-examples-good-practices/	157
/publication/research-and-monitoring/	196
/publication/interact-communication-and-navigation-guidebook/	160
/publication/interact-station-card-game/	163
/smf-publications/	115
/publication/?publication_type=interact-publications	71
/publication/ta/	58
/new-interact-publication-images-of-arctic-sciences/	57
/publication/interact-reducing-the-environmental-impact-of-arctic-fieldwork/	51

/publication/page/2/	33
/publication-available-pan-arctic-report-on-gender-equality-in-the-arctic/	33
/publication/?publication_type=interact-publications&publication_year=0&search=	20
/new-publication-from-interact-ta-users/	20
/publication/?publication_type=station-catalogue	20
/publication/?publication_type=smf-publications	17
/publication/interact-pocket-guide-on-data-management/	13
/station-managers-forum/publications/station-catalogue/	13
/new-interact-publication-available-how-to-reduce-the-environmental-impacts-of-your-fieldwork/	14
/publication/interact-card-game-2020/	14
TOTAL VIEWS	**6.308**

2.7. WP8 Cleaner Arctic, cleaner world

2.7.1. IF.17 – Contaminants screening

Pollutants have a range of impacts in the Arctic that depend on the nature of the pollutant. To document and respond to a full range of pollutants, considerable potential exists using the INTERACT station network as both a core resource for looking into local sources of pollution and also ensuring that the stations themselves are not contributing to this pollution. For this reason, the following indicator has been implemented to measure Arctic awareness:

Innovation Factor	**IF.17 – Contaminants screening**
Description	Identifying emerging pollutants where INTERACT can play a role, and where policies may be suggested to reduce or minimize their use and impacts
Impact	Existing information on chemicals of emerging Arctic concern will be reviewed to identify those that are most relevant with respect to possible use/presence at or around selected INTERACT research stations, for possible investigation of occurrence and/or actions to reduce possible local contamination
Proposed Metrics	
Indicator	**Number of scientists/stations involved on contaminants screening survey**
Indicator type	Key Activity Indicator (KAI)

Performance monitoring	To confirm that the analysis is sufficiently representative. The survey will be repeated at the end of the project to measure the awareness improvement on contaminants topics
Procedure	Data collection in charge of WP8
Report Frequency	At the Innovation Progress Report v0 (D1.14) and at the end of the project (D1.15)
Responsible	Simon Wilson, AMAP-SEC
Partners involved	AMAP-SEC
Final Target	NO

The screening survey has involved 30 stations. The preliminary survey describes a situation full of opportunities in terms of contaminants screening. Figure 6 represents the percentage of "yes" answers to the main questions posed in the survey. After planned activities during the project, will be interesting to redo the survey close to the end, measuring the awareness improvement.

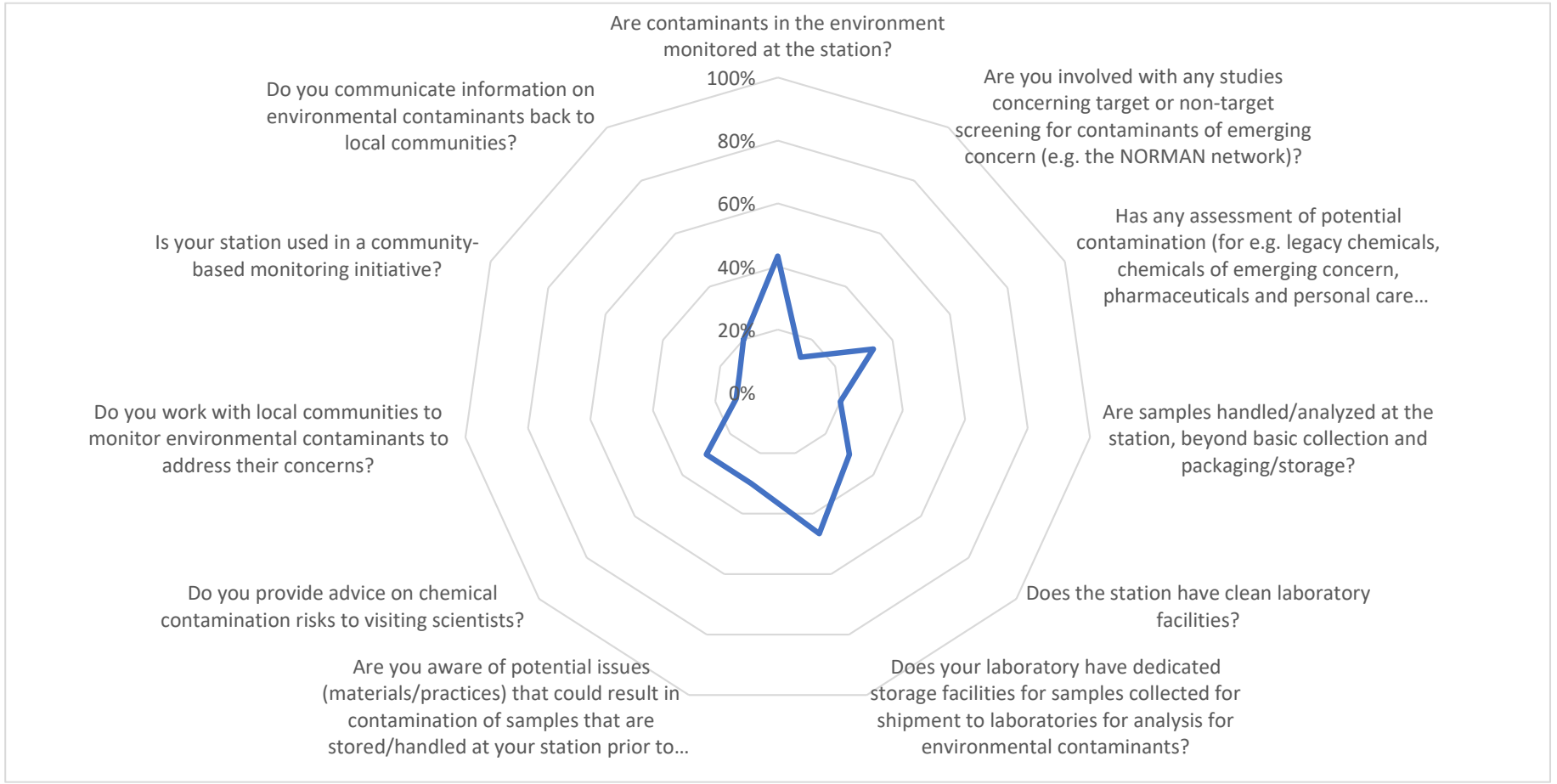


Figure 6. The results from a screening survey including 30 research stations.