Milestone 9.3: Recommendations to ACTRIS facilities

Authors: Stephane Sauvage, Jochen Wagner, Carmela Cornacchia, John Wenger, Giuseppe Gargano, Simone Gagliardi

Work package no	WP9
Milestone no.	MS9.3
Lead beneficiary	IMT
Deliverable type	X R (Document, report) ☐ DEC (Websites, patent filings, videos, etc.) ☐ OTHER: please specify .....
Dissemination level	X PU (public) ☐ CO (confidential, only for members of the Consortium, incl. Commission)
Estimated delivery date	M18
Actual delivery date	03/11/2022
Version	Final
Reviewed by	Eija Juurola
Accepted by	Eija Juurola
Comments	

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

Contents

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

1. Introduction

This report is prepared in the framework of the ACTRIS IMP project, within the work package 9 dealing with innovation and cooperation with the private sector. The objective of this WP is to foster the role of ACTRIS in the innovation landscape, by increasing the interest of the private sector towards ACTRIS as an innovation platform and by promoting actions for an effective technology and knowledge transfer.

As part of the WP9, the task 9.3 aims at better identifying the needs and requirements of the private sector which ACTRIS can answer to. The first objective of this task is to provide a set of recommendations to the ACTRIS Central Facilities (CFs).

The methodology starts from the evaluation of the user needs for innovation on which ACTRIS can answer to. The analysis is based on existing partnerships and success stories in order point out the keys of success but also the bottlenecks which have to be understood. The innovation strategy has been drafted beforehand within the WP3. The main topics has been reviewed through consultative interactions with the ACTRIS community to list the challenges which NFs and CFs operators need to work on, to move innovation within ACTRIS forward.

As a first milestone of this task 9.3, this document reports the main outputs from interactive discussions held with each Topical Centre team during specific meetings. That provided very good comments and feedbacks about the place and the challenge of innovation in Topical Centres. This was a fruitful approach to draft a first set of recommendations to ACTRIS Facilities which come in addition to collaboration models identified in MS9.2 in order to foster partnerships and innovation.

This document presents firstly an analysis of ACTRIS and private sector relationships discussing the strengths and weakness ACTRIS should consider to better design its innovation strategy. A second part will clarify the scope of innovation for ACTRIS CF in order to finally come up with recommendations for Central Facilities.

2. ACTRIS and private sector interactions for innovation

2.1. Key points of the innovation strategy

The innovation strategy is the subject of the WP3 and has been expressed in the report D3.1 « Draft of innovation strategy ». It is first of all emphasized that scientific work and developments for the observation of RI naturally lead to innovation actions in connection with partners from the private sector. As a principle, the infrastructure is working to set up the best and the most recent observation techniques to be implemented which therefore facilitates an innovation approach.

In order to define the innovation strategy, a SWOT analysis was carried out within WP3, evaluating the positioning of the whole ACTRIS in the innovation landscape. This SWOT analysis has been updated for this task 9.3 and presented figure 1, focusing on CF to private sector relationships. This is a useful diagnostic as a first step to make suggestions encouraging further innovation development in CFs.

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

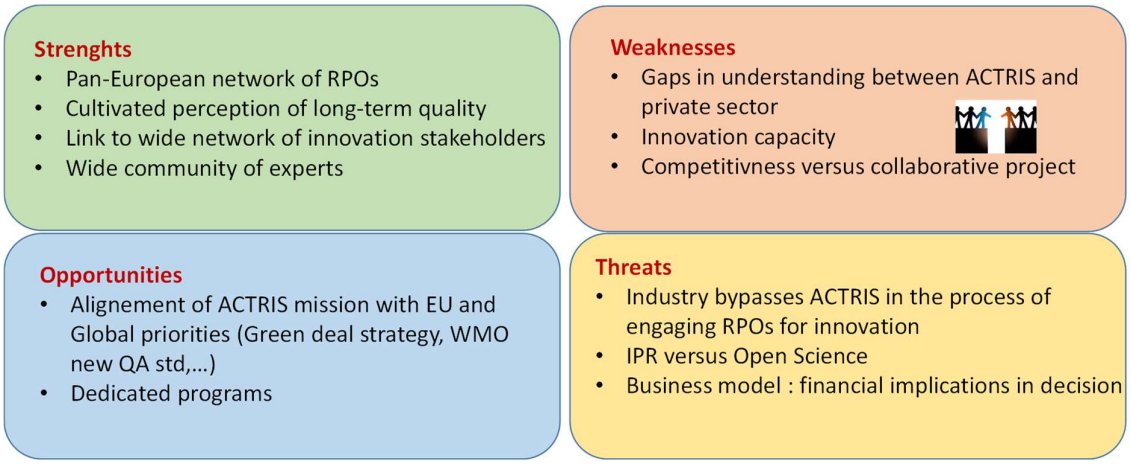

Figure 1: SWOT analysis completed and adapted from the ACTRIS IMP deliverable D3.1 Draft Innovation Strategy.

As **strengths**, ACTRIS is a network of excellent research laboratories (RPOs) working on new methods of measurement with the duty to remain at the forefront of the state-of-the-art science while making sure of the robustness of observations. ACTRIS involves many experts with complementary skills and advanced scientific knowledge allowing to identify new ways of technical progress. Some of its experts have established privileged relationships with suppliers of scientific instruments in order to support their developments.

The infrastructure is operating in the EU landscape that promotes innovation. This leads to many **opportunities** through the calls for projects that are proposed in this objective. Moreover, national policies promote innovation offering several kinds of funding supports at the national scale favouring Public and private partnerships.

However, there are **weaknesses and threats** to be considered in the innovation strategy for CFs. There is often a gap of understanding between RPOs and private structures since their interests and their development objectives are very different. In terms of time scale, the private sector needs a quick response to go forward to a short-term commercialization while research projects are multi-year time scale development. Other reasons include the scientific motivation of RPOs versus the economic interest of the private sector, or collaborative projects and open science versus competition and intellectual properties. That's why research infrastructure may sometimes be considered by the private sector as a brake for innovation.

2.2. Private sector point of view

The private sector point of view is based on all relevant information coming from previous experiences and projects analysed within tasks 9.1 and 9.2. The objective was to evaluate the current position of all ACTRIS components in the innovation context. Interest that the private sector has for the ACTRIS RI can be pointed out. A first survey has been done in November 2020 within task 9.1. The number of answers was limited but this survey provided a first insight about how ACTRIS is perceived by the private

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

companies. As shown in Figure 2, the private sector uses ACTRIS services to test and certify new measurement instruments, including the possibility of access to platforms to perform tests.

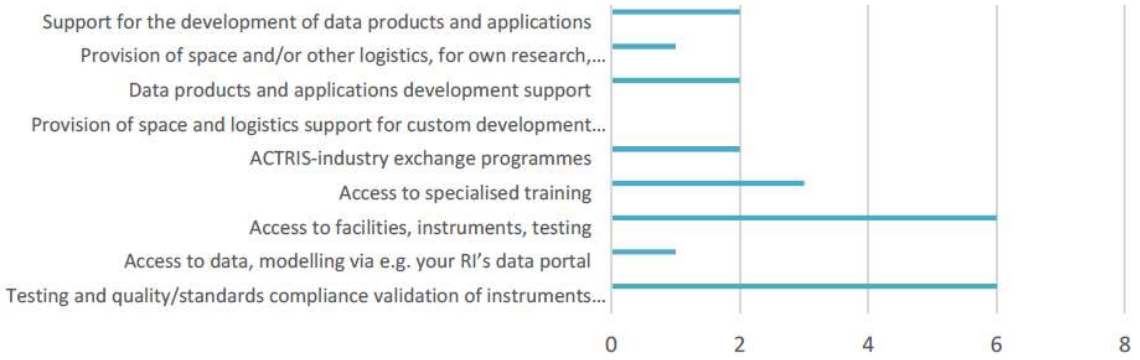

Figure 2: ACTRIS services used by companies (adapted from ACTRIS IMP deliverable D9.1 Progress report on the position of ACTRIS in the European innovation ecosystem).

However, Figure 3 indicates a fairly partial knowledge of ACTRIS facilities. While observation and exploratory platforms are of significant interest with 33 responses, Topical Centres (TCs) are less mentioned (#25), pointing out a lack of knowledge of their potential in terms of scientific watch, method development and validation.

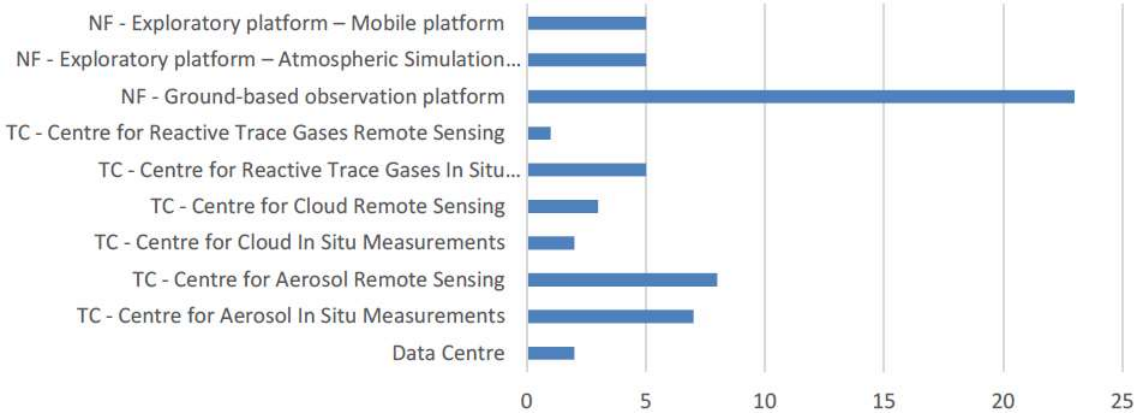

Figure 3: The types of facilities in which companies operated. (adapted from ACTRIS IMP deliverable D9.1 Progress report on the position of ACTRIS in the European innovation ecosystem).

Another interesting element of this survey concerns the support to develop collaborations between ACTRIS and the private sector (Figure 4). If national and European calls for projects definitely stand for major tools, it is worth noting the interest of maintaining privileged relationships between ACTRIS and the private sector through the organization of meetings or training sessions. Beside presenting the potential of ACTRIS in different fields of expertise, the meetings and training sessions are places where both CF and private sector partners may evaluate their needs and come up with future innovative developments.

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

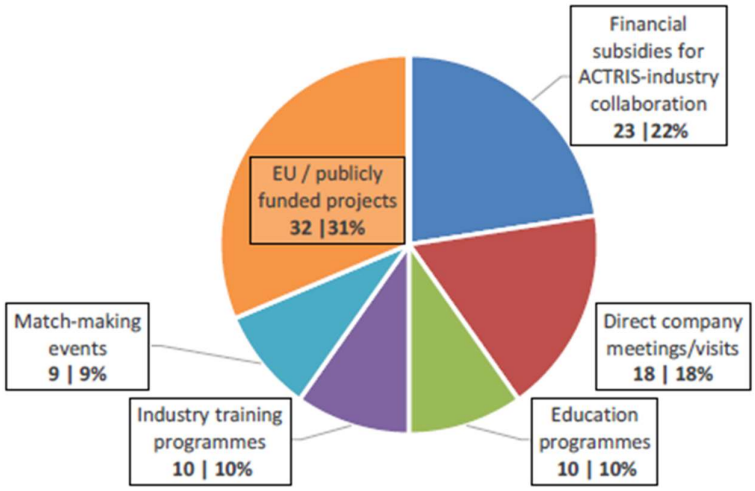

Figure 4: Measures that would be beneficial to develop collaboration between ACTRIS and the Industry. Shown are the number of answers and percentage of the total answers (adapted from ACTRIS IMP deliverable D9.1 Progress report on the position of ACTRIS in the European innovation ecosystem).

Several complementary actions have been implemented within WP9 and WP6. In addition to specific survey launched in the first phase of ACTRIS-IMP, a continuous survey is in place on the ACTRIS website (https://www.actris.eu/form/survey-test) to monitor the evolution of the demand. This survey has to be advertised and encouraged as much as possible and an analysis of the responses has to be regularly done. Workshops (Innovation in Atmospheric Science workshop 18 May 2021 and Innovation forum 2 June 2022) have been successfully organized to make the work and needs of RIs better known (for atmospheric domain such as ACTRIS, ICOS and IAGOS) but also for the private sector to present their latest developments. These are good opportunities for discussions and surveys to assess the needs up to build new partnerships and new projects

3. Central Facilities and innovation

3.1. What do we call innovation

The definition of innovation needs to be clarified in order to identify which developments are identified as such in the activities of CFs. The meeting held with each CF showed that this definition depends on the domains as well as the type of technology used for observation. Technologies can be categorized as:

- **Evolving** instruments (e.g. LIDAR) → These instruments have been developed and optimized over the long term. New developments can focus on part of the instrument (e.g. lasers) or specific application for example miniaturization in order to use these instruments on board of mobile platforms. The number of potential partners remains limited in this case. For example, eVe (ground based lidar) is specifically designed in collaboration with a private company to fulfil ESA requirements for the Calibration and Validation (Cal/Val) of the Aeolus satellite mission. However,

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

some companies have recently proposed complete and commercial instruments with established partnerships with the ACTRIS Topical Centre for optimization and validation.

- **Widely used** instruments (e.g. gas analysers, ceilometers ..) → These are commercial instruments used already on many measurement sites. Upgrades are continuously proposed by the suppliers themselves with the aim to improve the metrological performances. Topical Centres are here reference lab for testing and approval according to the quality criteria defined in the RI.
- **New generation** of instruments (ex. sensors, multicomponents) → New technologies may emerge, that are not yet considered as recommended methods for long term observations. One can cite instrument miniaturization for massive deployment or embedded measurement. Multi-component instruments are as well among the new developments. These new developments can be carried out in partnership with RPOs on testing and validation. That may include the proposition of new measurement strategy these new techniques can offer, up to the management of new type of data.
- **Embedded** instruments → associated with the new generations of instruments, a better spatial coverage of observations leads to the use of mobile means such as drones, trains or airplanes. The use of embedded techniques forces innovation for instance using micro-sensors in mobility with technical issues such as energy autonomy, recovery and exploitation of geolocated data. It may also concern lightening or configuring advanced instruments (eg. LIDAR, PTR-MS) to be embedded on mobile exploration platforms. In all cases, these methods require specific test protocols and a specific quality assurance program to insure data reliability and comparability.
- Deployment of **new variables** (bioaerosols, SVOCs, new tracers…). Scientific development in atmospheric sciences continuously bring new needs for observations. RIs such as ACTRIS must anticipate the capacity to document new variables. Therefore, new techniques have to be developed and considered, together with new skills. Specific actions need to be set up for new variables in order to test new instrumentations and to prepare measurement as well as data validation protocols.
- New advanced **data handling** → Large and robust datasets acquired within RIs over the long term and more recently in near real time offer a very high and sometime unexplored potential of exploitation. Data sciences (Artificial intelligence, deep learning and others) are booming and allow to extend the interpretation of data. These are new approaches for developing new products (L3 level) as a part of the innovative developments which can be addressed together by the Topical Centres and the Data Centre, potentially in partnership with data science research units.

3.2. Innovation in Topical Centres

Innovation is based on the partnership of ACTRIS community with the private sector. There are three different ways to view this partnership. The private sector is considered as a supplier to ACTRIS, with ACTRIS defining its needs and fostering innovation in the private sector to fulfil those needs. The other way around is to view the private sector as an user of ACTRIS. Alongside these two main models, industry

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

can be seen as a full partner in collaborative projects. All types of partnership are developed to some extend in the Topical Centres depending on the domain.

Private sector as a supplier (e.g. CARS, CREGARS, CCRESS)

- In this case, the motivation for innovation is science oriented. The objective is to propose new or better observation techniques to better address a scientific question. It is the RPOs which express the need to the private sector. In such case, the private sector answering are often spin-off companies originating from research groups, which helps in maintaining privileged relationships with the RPOs. In the case of evolving instruments such as LIDARS, long term bilateral partnerships already exist between RPOs, TCs and companies with a permanent development of technologies.

Private sector as a user (e.g. CAIS-ECAC, CIS, CIGAS)

- Mature and already operational Topical Centres usually have a long history with instrument suppliers. For instance, CAIS-ECAC has a whitelist of recommended instruments by several suppliers. That consists of instruments that have already been tested several times and with optimizations that have been validated by the CAIS-ECAC. In this case, companies are systematically invited to participate in demonstration campaigns and intercomparisons. They are in permanent contact with TCs and have privileged access to platforms to test new versions.

4. Recommendations to boost innovation activities

Different ways of promoting RI innovation capacities, evaluate the needs

As previously mentioned, the private sector is asking for events organized by the RI to better understand the capabilities of the Central Facilities and from RI point of view to better assess the need for innovation. It is indeed relevant and efficient to co-organize these events in collaboration with other RIs in the atmosphere domain such as ICOS and IAGOS. For instance, across RIs Workshop on innovation has been successfully organized on the 2nd of June, 2022 with up to 400 attendees. However, it remains still difficult today to evaluate the impact of such events. The challenge is to ensure a follow-up, one idea being to set up an online forum to maintain exchanges between Central Facilities and instrument suppliers.

Organizations at the European level such as the European Network of Research Infrastructures and Industry for Collaboration (ENRIITC) aims at building a Europe-wide network of Industry Liaison and Industry Contact Officers to enhance the collaboration between research infrastructures and industry.

There are also initiatives at the national level with the objective to foster innovation and partnerships between research and the private sector. The main actions consist in organizing exchange days with the presentation of success stories taking advantage of these experiences to set up partnership projects. Also, it is worth mentioning conferences on technology development for industries which include more and more room for research infrastructures. For instance, the recent one, Conference on Industrial Technologies, IndTech, 2022 held in Grenoble, France (27-29 June), included a village of research Infrastructures allowing the private sector to see the capacities of support and access proposed by the RIs.

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

It is definitely of importance for RIs to be present at these events in order to exchange on the need for innovation and to foresee new development projects. However, as these activities are often requiring substantial resources, it is important to do fact-finding and research to identify the most suitable events considering the main target groups in fostering innovation in ACTRIS.

Finally, the TCs plan among their operational activities the organization of technical workshops, training sessions as well as specific experimental sequences (e.g. intercomparison) welcoming private companies in the events to establish new partnerships for innovation.

Innovation strategy development

More broadly, calls for projects will be an important framework to implement the ACTRIS strategy for innovation. As an example, the ATMO-TECH project was recently submitted to the HORIZON-INFRA-2022-TECH-01 call, although unfortunately not selected despite a good evaluation. The objectives of this proposal were to test, improve and make a sustainable strategy for innovation. This proposal involved ACTRIS, ICOS and IAGOS with the ambition to create a new framework for fostering industrial-RIs partnerships and to boost research and development activity.

The number of the feasible ideas which came up during the proposal preparation shows the potential of the RIs in European innovation ecosystem and it is foreseen that this kind of project will have chance of success in coming relevant calls.

Strategy for an RI-Compliance of new technics

During the interview, the Topical Centres all expressed difficulty in setting up and managing approval tests. These approvals test aim at demonstrating that an instrument fulfil the performance criteria to be considered as a recommended method within the ACTRIS framework. A standard approval can take different forms. It can be a reference list of recommended instruments, which is managed and updated by the Topical Centre. For instance, CAIS-ECAC set up a whitelist of instruments based on well-established and traceable test protocol. Also, companies regularly request support letters for different projects and to support the publicity of their instruments. There is here a concern from the TCs about the use by the companies of such support letters and test reports. When providing such documents, TCs have to precisely define the protocol of the tests, the criteria of approbation, the scope of the report, the usage policy as well as the duration of validity.

In any case, the question arises for TCs on the openness to new instrument providers. Could there be a risk for the ACTRIS TCs to orient and possibly limit the instrument market and the potential for innovation from new private companies? Can the TCs provide truly objective approbation tests when historical partnerships exist? May there be partnerships that require exclusivity? Thus, to tackle these questions, to foster open innovation and identifying new partners, harmonized testing and approval protocols would be necessary.

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115

Room for Innovation in the first phase of ACTRIS operations

Finally, it is worth noting that TCs are currently very busy with the implementation phase as well as with the starting NF labelling process. It is therefore very difficult in a short-mid-term for TCs to set-up an active strategy for innovation to develop new partnerships. This topic comes more timely when ACTRIS approaches the operational phase.

5. Conclusion

This report is a milestone of the task 9.3. It is evolutive and will be further completed along the development of the whole WP9 together with WP3,4, 5 and 6. As a first output, a tentative list of recommendations towards Central Facilities to foster innovation is given:

- **Keep a place for innovation**, this is among operational activities planned by Topical Centres and definitely crucial for staying in forefront in term of expertise and science,
- **Be connected with the private sector** by strengthening links between ACTRIS and private stakeholders through specific workshops, dedicated visits of the platforms, training and specific experiments,
- **Promote added values of ACTRIS** for innovation such as access to platforms, specific experiments, expertise for consultancy,
- **Use opportunities in European and national contexts**, with funding potential to develop partnerships with the private sector. Utilise the specific Infrastructure calls aiming at improving the innovation strategy for the RI,
- Define a **harmonized compliance strategy** with defined criteria and clear protocols together with a common policy of approval certificates,
- Stay objectively **open to new instrument providers**,
- Finally, **have a cross-RI strategy** to extend the offer towards the private sector, combining expertise and building a harmonized innovation approach.

ACTRIS IMP (www.actris.eu) is supported by the European Commission under the Horizon 2020 – Research and Innovation Framework Programme, H2020-INFRADEV-2019-2, Grant Agreement number: 871115