

## Deliverable 7.2: ACTRIS strategic report from current status to 30-year vision

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Work package no	WP7
Deliverable no.	7.2
Lead beneficiary	UHEL
Deliverable type	<input checked="" type="checkbox"/> R (Document, report) <input type="checkbox"/> DEC (Websites, patent fillings, videos, etc.) <input type="checkbox"/> OTHER: please specify .....
Dissemination level	<input checked="" type="checkbox"/> PU (public) <input type="checkbox"/> CO (confidential, only for members of the Consortium, incl Commission)
Estimated delivery date	M30
Actual delivery date	13/12/2019
Version	Final
Reviewed by	Sanna Sorvari Sundet
Accepted by	Sanna Sorvari Sundet
Comments	

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## 1. Preamble

Our atmospheric environment is changing at all times, linked to growth of the human population and the associated mobility demand for people and goods, to the increasing energy demands and the expanding industrial activities in some regions of the World, to intensification of agricultural activities worldwide and the associated changes in land use, to changes affecting some very vulnerable regions like the Arctic, to changes affecting the global cycle of pollutants. The atmospheric environment is also changing due to effectiveness of environmental policies for reducing emission of pollutants, mitigating climate change and improving air quality. The nature of research will also evolve, from process understanding to providing atmosphere-related services liable to respond to societal demand and offering custom products such as projections on future changes, advice on best practices, and any other initiative that support adaptation, mitigation and disaster risk management. At the other part of the value chain, expertise in ACTRIS should also serve establishing standard procedures and reference methods that may be used for new generation of instruments for characterizing the atmosphere.

Our capacity to understand our changing environment and make predictions for the future is also evolving. New scientific findings, new available technologies, new computing capabilities are constantly reshaping the scientific questions that should and can be answered by the scientific communities. Technologies will evolve rapidly, towards both more sophisticated instruments used in laboratory experiments and deployed for remote and in situ measurements and affordable low cost sensors that will be more widely used for different applications. Public participation in scientific research, and in atmospheric research in particular, will be increasing involving, among others, data collection by members of the public transferred to the academics.

Challenges in this context will be linked to ability of research to translate future wealth of climate and atmospheric data and information into services, that will contribute to help decision-makers finding ways to a clean-air, climate-resilient and low-carbon society. It can be expected that Research will more and more rely on “other” funding (crowdsourcing) to operate, and will have, more than ever, to consider its value and its capacity to respond to demand-driven climate services from an economy viewpoint.

It is also expected that interlinkages and cooperation between different fields of science will, more and more, be necessary to deliver services to society. Actions towards a cleaner air, or strategies to mitigate climate change, will require cross-disciplinary approaches, not only in the environmental sciences but also in humanities. Understanding the interaction between people and the environment is essential to deliver the level of services required by society and the proper indicators to decision-making.

While the ACTRIS vision and mission may remain in the medium-term,

### **ACTRIS Vision**

ACTRIS is the fundamental European Research Infrastructure for short-lived atmospheric constituents increasing the excellence in Earth system research and providing information and knowledge on developing sustainable solutions to societal challenges.

### **ACTRIS Mission**

ACTRIS shall establish, operate, and develop a pan-European distributed research infrastructure for providing data, information and services about short-lived atmospheric constituents. ACTRIS shall

provide effective access for a wide user community to its resources and services, in order to facilitate high-quality Earth system research.

conditions for implementing that vision will change over the years, and ACTRIS will have to considerably evolve to account for the strongly evolving societal needs.

ACTRIS strategy with long-term (20-30 yrs) and mid-term perspectives (10-15 yrs) will be updated every 4-5 years. In addition to the long-term perspective, the ACTRIS strategy will set up specific strategic goals for the forthcoming five years covering full funding period of ACTRIS ERIC.

The revision of the ACTRIS Strategy will involve many parties and steps. As a part of the strategy process the assessment of the ACTRIS performance, relevance and impact will be done internally and externally (e.g. ESFRI monitoring of ACTRIS in 2020 and future ESFRI assessments). The process also includes the assessment of the external environment (PESTLE analysis) and foresight activity to identify trends and weak signals in the user needs and societal changes. For the foresight activity reports on user needs and user feedbacks are utilized during the mapping phase. During the strategy formulation phase, consultation and feedbacks both from ACTRIS actors (ACTRIS operators, managers and NF PIs) and stakeholders (users, Scientific and Implementation Advisory Board, ACTRIS General Assembly) are gathered and reiterations on the strategy formulation and strategic goals are done according to the input received. Director General together with management committee is steering the strategy process with the support of RI committee, National ACTRIS Consortia and National Facility Assembly. ACTRIS Strategy and strategic goals are approved by the ACTRIS General Assembly. After the approval of the ACTRIS Strategy, the 5-year ACTRIS work plan is drafted and then the 5-year financial plan is based on the ACTRIS Strategy and the 5-year work plan.

This strategy document (D7.2) outlines some of the aspects that ACTRIS needs to take into account when drafting the ACTRIS Strategy, process starting in 2021/2022 and performed as described above. The overall aim of the ACTRIS PPP Work Package 7 was to design a 30-year plan for the development of ACTRIS, embedding it within the current European and international landscape, and to define the conditions for maintaining a high and adaptable level of services in the medium to long-term, after implementation phase. To reach this goal, maintaining the involvement of user communities at a high level represents a strategic issue, together with continuously addressing the needs of stakeholders, at national, European and international levels. Analyzing the last 30 years of atmospheric and climate science is very informative about the changes that ACTRIS will have to face to maintain its attractiveness: techniques that now constitute core measurements in ACTRIS deployed in almost all facilities were research instruments operated by very few research groups 30 years ago. Similarly, current operating techniques will be obsolete at some stage during the ACTRIS operational phase.

Services provided by ACTRIS need to remain optimally configured by responding to current and emerging scientific challenges related to air quality, climate and related areas. ACTRIS will account for the current and future landscape of the integrated Earth observing system to ensure that services provided remain unique, well-connected to user requirements, and embedded in national, European and international initiatives. The strategic framework will define the conditions for the effective evolution of ACTRIS, including its integration as a service provider for space agencies (in particular, ESA and EUMETSAT), Copernicus, observing networks and modelling initiatives, but also a tool for the private sector to test new instrument or develop innovative usage of data. Further, the strategy must be capable of responding to emerging challenges including the provision of enhanced services, the adoption of new technologies, and new opportunities provided by ICT, High Performance Computing

and European initiatives (EGI, PRACE, European Open Science Cloud, EuroHPC). To this end, the definition of the long-term ACTRIS strategy is a crucial element of the whole construction. The private sector represents one of the ACTRIS stakeholder categories and can be a user of ACTRIS facilities, of data and services, as well as a supplier to ACTRIS when they provide products and instrumentation used in Central Facilities.

In the future, and in the medium 5-15-year term, ACTRIS must continue to respond to the following challenges:

- 1) Challenge 1: continue to offer the fundamental tools to build knowledge in atmospheric sciences that enables predictive capability for the distribution, variability and trends of reactive gases, cloud and particles.
- 2) Challenge 2: continue to provide access to platforms (observational or exploratory) equipped with state of the art research instruments and skilled personnel supporting operations and data provision.
- 3) Challenge 3: continue to offer the fundamental tools to quantify emissions of short-lived atmospheric compounds, their atmospheric variability and trends and the mechanisms for wet and dry deposition
- 4) Challenge 4: continue to provide the proper information that serves improving the predictive capacity of chemistry, weather and climate models in a changing Earth system.
- 5) Challenge 5: provide the mean for understanding the feedbacks between atmospheric composition and climate change, and evaluate the efficiency of public policies on climate and air quality.
- 6) Challenge 6: provide the proper tools to better quantify the impact of atmospheric species most deleterious to society (e.g., human health) and the biosphere.
- 7) Challenge 7: continue being at the forefront of the Earth Observation system, providing complementary information to space-borne observations, and establishing all conditions relevant to a Global Research Infrastructure.
- 8) Challenge 8: Continue to provide an expertise for developing standard reference and methods to be transferred to industry

## 2. ACTRIS, next decades

ACTRIS must evolve in a changing World adapting to needs and technologies. Instruments now being developed in research laboratories and commercial companies will become more affordable and ready for operational use in the research infrastructure. Performances of modeling tools will improve dramatically and will be suited to the diversity of applications required by the disparate spatial and temporal scales of atmospheric impacts on climate, human health and ecosystems but also by the business service needs. Development of new satellite sensors, smaller, lighter, and thus easier and less expensive to launch than those currently used will further complete the Earth observing system, providing information with much better spatial and temporal definitions.

If it is premature to imagine how exactly ACTRIS will evolve, it seems evident that, in the longer 15-30 year term, ACTRIS shall evolve into a more service-oriented RI, closely connected, if not integrated, to other RIs possibly in other fields of the Environmental sciences, acting as a data integrator from

different ground-based data providers, including the citizens and capable of producing ready-for-use societal services.

In particular, we retain that ACTRIS will have to respond to the following technological challenges:

- Develop the capacity to deliver information products in a form directly adapted to policy applications and policy-relevant work, possibly in Near Real Time. Real-Time products provision will likely gradually substitute the delayed time information on physical or chemical variables. ACTRIS will very soon have to develop provision of application-oriented variables such as health-damaging potential of aerosol, real-time source apportionment, or early-warning systems,
- Respond to the fast-developing low-cost sensor availability. Non-conventional methods for monitoring air quality are attracting more and more attention and it is expected that their performances will rapidly be suited to user requirements in ACTRIS, leading to a necessary evolution of ACTRIS Topical Centers.
- The nano-satellite revolution will drastically change space observations, providing a huge increase in information available from both space agencies and private companies, opening opportunities to provide ground-truthing services assuming ACTRIS anticipated precisely the future demands.
- It is likely that the demand for services will go beyond the strict atmospheric domain and that the demand for cross-domain services will increase. Environmental RIs will have to integrate their services more and more, moving away from the strict domain-specific data production to integrated global services. This direction implies that the current organization of target-specific Research infrastructures would have to be totally revisited by eventually merging several entities.
- The revolution for ACTRIS will also come from the “big data” evolution in the environmental science. It is expected that vast and multidimensional datasets but also services will become more and more available, requiring increasingly large resources to be managed. Mechanisms will be needed for effectively and efficiently archiving, sharing, and discovering data, to ensure availability of services to the broad scientific community and to the public. Competition will be very strong with data services offered by private companies (check for example the recent Google initiative to support data sets for computer research) at a much lower price than that proposed by RIs for providing the service internally. On a shorter time-scale, establishing the European Open Science Cloud may also rapidly move some services currently managed by the RIs to more generic data hubs.
- The share of ACTRIS revenues from Market and application-driven research must increase in the next decade, following a general evolution of R&D research in Europe.

### 3. ACTRIS adaptation to challenges

Responding to this expected evolution of the landscape, ACTRIS will be required in the upcoming 5-15 year operations to:

- Closely monitor evolution of requirements and needs from the user communities. This implies that all elements in ACTRIS must be ready to propose new expertise within current TCs or outside, to respond to new available technologies on the market, particularly regarding the new low-cost sensors. This comprises for example new requests arising for monitoring emerging pollutants or new species. The challenge in ACTRIS will be to be

prepared to rapidly modify its TC perimeter. Annexes 1 and 2 of this document proposes procedures for enlarging ACTRIS perimeter.

- Access provision in ACTRIS needs to adapt to user demand first by maintaining attractiveness of all platforms (observational/exploratory) for a wide type of users, through a constant effort to continue to offer unique technologies and unique services. Second, access to data will need constant upgrade to ensure all data-products and data-related services are maintained at very high-level.
- Providing sustained and reliable services to a wide community of users and stakeholders, with secured financial resources, consolidated business plan and clear and evolving catalogue of services.
- Acting as a global research infrastructure with identified World counter-parts constituting an essential piece of the EOS as key provider to COPERNICUS and GEOSS applications and a key element in connecting ground-based and space segments of the EOS
- ACTRIS must ensure it is proper dimensioned to respond to future challenges of ever-increasing demand on computational needs. Increasing amounts of data and needs for data treatments but also the expected tendency to further develop the Level 3 products which likely will involve advanced visualization tools, model results with high spatial resolution. ACTRIS must have evolved, either as a single RI, or within a cluster of RIs, or in recognizing the utility of the integrated use of advanced e-infrastructure services for accessing, processing, curating data, and securing computational capabilities, an increasingly challenging task over the next two decades.

## 4. Establishing ACTRIS as a Global Research Infrastructure

The 2030 Agenda for Sustainable Development, adopted by the United Nations (UN) General Assembly in 2015, will serve as the central element for national and international policymaking over the next 10 years. The agenda identifies 17 Sustainable Development Goals (SDGs), of which several are linked, either directly or indirectly, to the environmental wellbeing. The grand challenge of ACTRIS, as for other RIs in the Environmental Domain, is to be recognized as an essential tool for implementing policies towards achieving the SDGs.

The main SDG connected to ACTRIS is clearly Goal 13: Take urgent action to combat climate change and its impacts. The community's challenge is to provide decision-makers with the scientific facts and analyses they need to adapt to climate change impacts and build climate resilience. Science will help guiding valuable emission-reduction actions at different scales, from local to national and continental.

However, ACTRIS also brings elements that will contribute to other goals:

- Goal 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture: capacity to forecast weather and weather extremes will assist farmers to their operational decisions
- Goal 3: Ensure healthy lives and promote well-being for all at all ages: better climate forecasting will be key to anticipate the key risks that climate poses to public health in particular countries and regions.
- Goal 6: Ensure availability and sustainable management of water and sanitation for all: better prediction of cloud formation and precipitation in a changing climate is essential to predict evolution of water resources.

- Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all: aerosol are directly impacting solar radiation and a improving capacity to simulate events of dust Worldwide is essential to estimate future capacity for solar energy production and energy-management decisions with weather and climate information.
- Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable: supporting policies for air quality improvements is key to ACTRIS that will be helping planners to make cities more resilient to respond to heat-waves and the associated impact on air quality.

Although the 2030 Agenda invites governments to submit National Plans for addressing SDGs the supporting policies towards achieving the SDGs must also be established at international level and will require partnerships and cooperation. ACTRIS, together with essential partners such as WMO, but also counterparts in different World areas (Cooperation on Research Infrastructure) should contribute to building common agendas supporting SDG policies.

In this context, ACTRIS must have achieved the following goals in the next decade:

- 1) ACTRIS must be established as a Global Research Infrastructure and be central in an international organization. Evidently addressing global research challenges (climate-change, air quality, atmospheric hazards), ACTRIS must be offering technology, innovation, and advanced research training goals to a larger community than it actually does. It must have received a clear mandate from its members to engage in international cooperation with the appropriate coordination capacity, on behalf of its European members.
- 2) ACTRIS must enhance its service offer to a wider community of users, worldwide and must be clearly recognized as key player in the EO system, supporting WMO, ESA, or GEO policies. ACTRIS must have implemented effective access policies that will be driven by scientific excellence regardless of the country of origin or ability of the proposer to contribute financially, in the international context. In essence, attractiveness of ACTRIS services to international users must be considerably enhanced in the next decade
- 3) ACTRIS must be managing data and data-products that are not limited to the European dimension but must be of value and utility to a broad scientific community and to policy-makers outside of Europe political boundaries. ACTRIS must be benchmarking with other complementary Research Infrastructures to develop products outside of its current scientific perimeter.
- 4) ACTRIS must have enhanced its revenues from non-public sources and have produced a clearly measurement economic impact. Proper indicators must still be defined to evaluate these achievements but leveraging private financing to enable innovative research is essential in the next decade.

## 5. Conclusions

Looking back at the atmospheric science landscape 30 years ago is a very good way of considering challenges that ACTRIS as Research Infrastructures will face in the future. Several lessons can be learned from other experiences: CERN was established almost 70 years ago, and maintains its attractiveness today, offering very different services to the research community and remaining a unique tool for research even beyond its original scope. Other initiatives were less successful and are not in the landscape anymore, evidently not responding to evolving needs of the research communities.



Changes will most likely come gradually and predicting precisely what ACTRIS 2.0 will be like in 30 years is difficult to predict. However, it must evolve and develop the condition for doing so in an agile way, a clear change with respect to establishing ACTRIS today. Conditions for evolution described in section 2 and 3 are essentially based on methods that drove the construction of ACTRIS, i.e. a long-term maturation towards operational ACTRIS. While successful so far, the long process for decision-making may become problematic at some stage. Contrary to CERN, and other very large Research Infrastructures, ACTRIS and other distributed RIs may face strong competitors in the future, in particular for the access to data and services. ACTRIS should find ways to maintain its uniqueness, and its quality of services yet turning into much more agile project management methods. An agile structure will not be easily organized in an international multi-partnership framework and solutions to maintain ACTRIS as a key tool for research in the next 30 years will address the need for fast responses to changing requirements, working closely with customers and create the right product to satisfy their needs. There is no alternative today to maintain the multi-step process for the evolution of ACTRIS but while those steps have been implemented in a multi-year process in the past, ACTRIS should turn into much shorter development cycles to allow for rapid adjustments continuous improvement in the development of a product or service.

Annex 1. A proposed mechanism for including new ACTRIS variables

Annex 2. Proposed procedures for upgrading ACTRIS to emerging user needs

## **Annex 1. A proposed mechanism for including new ACTRIS variables**

A major objective in ACTRIS is to respond to challenges in science, innovation and society; strengthen ACTRIS position and leading role in the global landscape of environmental research; to promote ACTRIS contribution towards the development of global research infrastructures; to foster capacity building in technology and innovation in ACTRIS; and to support researchers to address societal challenges of global relevance. To meet with these objectives, it is key that ACTRIS organizes internally the mechanisms by which all services will remain upgraded, and up-to-date to attract a maximum number of users.

At the base of attractiveness of ACTRIS is the perimeter of the Research Infrastructure, defined by its strategy and catalogue of services. Essential to the catalogue of service is the ACTRIS data that not only is provided through the ACTRIS Data Centre but also justifies the instrumental deployment characterizing the ACTRIS exploratory and observational platforms. “ACTRIS data” is defined in the ACTRIS data policy and means the ACTRIS variables resulting from measurements that fully comply with the standard operating procedures (SOP), measurement recommendations, and quality guidelines established within ACTRIS. A list of ACTRIS variables and data is included in Annex 1 and Annex 2 of the data policy document. ACTRIS data is classified:

- ACTRIS level 0 data: Raw sensor output, either mV or physical units. Native resolution, metadata necessary for next level.
- ACTRIS level 1 data: Calibrated and quality assured data with minimum level of quality control.
- ACTRIS level 2 data: Approved and fully quality controlled ACTRIS data product or geophysical variable.
- ACTRIS level 3 data: Elaborated ACTRIS data products derived by post-processing of ACTRIS Level 0 -1 -2 data, and data from other sources. The data can be gridded or not.

For ACTRIS data, the ACTRIS research infrastructure needs to be able to control all steps, e.g., formats and procedures including procedures for quality assurance, quality control, access, data policy, interoperability, licenses etc. ACTRIS services are offered to all levels, e.g., for level 0: calibration tests of instruments.

ACTRIS variables define the scientific perimeter of the Research Infrastructure. In the context of a future evolution of the ACTRIS perimeter, it is important that an unambiguous definition for an ACTRIS variable is provided:

1. The variable must be related to the observation of aerosol, clouds and trace gases, and their interactions,
2. The methodologies for the determination of the variable must be defined as part of an ACTRIS Topical Centre,
3. The service provided by the ACTRIS Topical Centre must be unique in Europe, and ACTRIS must have a leading and influential role in the definition of measurements and quality control procedures. Evaluation of the leading role is measured by adoption of ACTRIS standards and SOPs at a wider level than the strict RI,
4. ACTRIS should have the control the whole processing chain for the ACTRIS variables which requires:

- a) production of data in the National Facilities performed with ACTRIS recommended instrumentation responding to agreed data delivery frequency
- b) production of data in the National Facilities performed with ACTRIS accepted methodologies and operating procedures
- c) quality assurance procedures implemented within National and Central Facilities (Topical Centre and/or Data Centre) as documented in data flow charts,
- d) quality control implemented following procedures defined by ACTRIS Central Facilities
- e) data curated through one of the units of ACTRIS Data Centre, access through single entry point (the ACTRIS data user interface) under ACTRIS data policy

For variables complying with whole value chain (4a. to 4e.) and if the requirements 1. To 3. are met, the variable is approved and updated to the list of ACTRIS variables. ACTRIS variables are subject to ACTRIS licensing and data policy.

In addition, implementation of Topical Centre internal support or services requires that:

5. The Activity needs to be aligned with ACTRIS strategy,
6. The activity is properly described in Topical Centre documents (e.g. in concept document, implementation plan or the work plan), meaning that the internal support and services are regularly revised on a suggested 5-year plan after the adoption of ACTRIS Strategy and 5-year strategic goals,
7. The activity performed in Topical Centre should serve a minimal number of NFs or users in different ACTRIS member countries.

It is important to consider that:

- The variable included as minimal requirements identified by Topical Centers should be 1) listed as ACTRIS variable AND 2) ready for implementation.
- The variable included as optimal set-up identified by Topical Centers should be listed as ACTRIS variable AND be ready for implementation.

As a consequence, although key to the understanding of the atmospheric processes, the following are not ACTRIS variables:

- Meteorological variables that define the state of the atmosphere (variables listed in CIMO WMO-No. 8 (2014 edition, Updated in 2017) Part I #2- to #15) and Part II
- Air quality variables using methods defined by the EU Air quality directives (variables are listed in <http://ec.europa.eu/environment/air/quality/standards.htm>)
- Atmospheric variables defined by other European environmental research infrastructures prior to establishment of ACTRIS as ESFRI project
- Ancillary variables that have been defined as measurements covering fundamental parameters needed to process or evaluate ACTRIS data and follow established international standards.
- Variables linked to instruments installed in exploratory platforms not listed as ACTRIS variables.

It will be expected that ACTRIS platforms, will however provide some non-ACTRIS variables together with the measurement of ACTRIS variables whenever requested for proper interpretation of ACTRIS data.

In essence, an evolution in ACTRIS service provision related to ACTRIS data is first about preparing ACTRIS components (NFs, TCs, and DC) for adoption of new variable as new instrumentation is required in NFs, TCs need to plan and implement a new calibration procedures and services, and Data Centre to be ready to process, curate, manage and distribute the data related to the new variable. The final approval on the intake of new variable can be only done when the whole data work flow for the new variable is described and in place. After the final approval of the ACTRIS variable, the new variable will be added in the list of ACTRIS variables and in the corresponding catalogue of services. The ACTRIS process for upgrading the ACTRIS perimeter must therefore be clearly organized at all levels.

## **Annex 2. Proposed procedures for upgrading ACTRIS to emerging user needs**

As of today, ACTRIS variable list comprise more than 80 atmospheric variables (including also variable categories) and 24 atmospheric data products, which makes ACTRIS parameter rather large compared to other distributed research infrastructures in the atmospheric domain. It is expected that the current list of ACTRIS variables will not be revised before ACTRIS is operational in 2025. However, the steps for engaging in a revision must be clearly agreed upon by the ACTRIS scientific community and should involve a number of steps, of concern to the ACTRIS scientific communities, and of the ACTRIS NFs and CFs. This can be done either by need or during the ACTRIS Strategy process.

In the longer time frame of ACTRIS, the potential direction indicated in section 1 will possibly require an in-depth re-organization of ACTRIS that will not be addressed in this document. Instead, a multi-step approach can be proposed to simply respond to the evolution expected in the 2025-2035 time period.

### ***Step 1: identifying gaps in ACTRIS service provision***

ACTRIS must organize regular activity reviews where gaps in service provision are discussed. Regular monitoring of data usage in ACTRIS, targeted meeting with other communities, internal review meetings and meeting with policy-makers should be organized at ACTRIS-initiatives to monitor the evolving demand, in particular from the primary users. The ACTRIS ERIC should at this stage receive a scientific document analyzing the needs for a missing variable in ACTRIS that can be evaluated internally,

### ***Step 2: Defining the conditions for new service provision***

The ACTRIS ERIC nominate an expert group, possibly including the relevant Topical Center(s) and the Data Centre , to precisely defining implication for ACTRIS: needs for a new Central Facility, needs for a new Central Facility unit, needs to enlarge the perimeter of existing Central Facility unit(s). Step 2 precisely describes how the key services and operation support to be provided by the Topical Centres a) procedures and tools for quality assurance and quality control of ACTRIS measurements and data, b) transfer of knowledge and training to ACTRIS operators and users, and c) improvements of measurement methodologies for aerosol, clouds, and reactive trace gases, will be implemented as an amendment of ACTRIS Concept document, implementation plan or ACTRIS work plan (target document depending of the life-cycle of ACTRIS). Dimensioning the potential quantity of internal support and users will be part of this step.

### ***Step 3: Identifying the hosting institution(s) for a new CF or CF unit***

Topical Centre host selection procedures must be implemented based on the procedures applied for the selection of the current Central Facilities. It is recommended that any evolution of the Central Facilities in ACTRIS would adopt the same procedures and new host candidates will be evaluated along the following three criteria:

- 1) Scientific excellence and experience on specific service provision;
- 2) Feasibility, including the service description, user description, resources and implementation plan, and the governance;
- 3) Demonstrated institutional commitment;

Applicants will be asked to provide a solid implementation plan, and a financial plan on how they will reach the full operative mode and the resources provided. The financial plan will include operation costs for delivering services but also information on construction and implementation costs supported by the host institution(s).

#### Step 4: validation of CFs' services and activities

A validation of the ACTRIS operation support and service provision that considers all the relevant technical, financial, administrative, legal and strategic aspects of ACTRIS Central Facility activities (operation support to National Facilities, services to users, management of the Central Facility, training, outreach etc.) is required for implementation of ACTRIS. For the preparation of ACTRIS ERIC Step-2 submission, a procedure was proposed for validating ACTRIS CF activities and related costs to prepare the 5-year financial plan. It is recommended for clarity and fairness in ACTRIS that the same exact procedure should be adopted for any evolution of Central Facility services.

All ACTRIS Central Facilities will undergo an extensive validation during the ACTRIS implementation phase. This validation will verify whether the Central Facilities are in a position of providing the planned operation support and services to ACTRIS and to external users, and to check that the planned activities are needed, feasible and adequately dimensioned, and that the respective costs are justified, reasonable and well defined. The validation will assure the ACTRIS member countries that their financial commitment is justified and cost-effective.

The validation process focuses on all foreseen activities of the new CF/CF unit expected when entering in operation, i.e. when delivering the service(s).

The validation will include the following aspects:

1. Scientific and technical validation: Addressing the ACTRIS validation from a scientific-technical point-of-view means to confirm that the technology and methodology of each type of operation support and service is best-suited for the activity, robust and feasible (also in relation to the time and the economic investment needed to implement it). The technical validation shall enable better compatibility and comparability across the ACTRIS Central Facilities. This uses information prepared for step 1 and 2.
2. Cost and financial validation: This is to ensure that the costs are justified with regard to the work involved, adequately planned for optimal benefit, and that the methodology for defining the costs is sound, transparent, and in line with EU and national regulations and the accounting principles of the host organizations.
3. Strategic validation: The validation of strategic aspects shall ensure that the overall operations in the CFs are properly planned to provide the whole chain of operation support or service. It has to be assessed whether the number and type of the operation support and service provision offered by each Central Facility is adequately dimensioned according to the needs of the ACTRIS community to ensure the operation of the RI, as well as the needs of the wider ACTRIS user community in an optimized manner.
4. Administrative-legal validation: The administrative and governance aspects of the CFs need to be validated as well, assuring that the CFs are in legal position to make agreements with ACTRIS ERIC, and to ensure that the management of the CF is effective and adequately resourced.

It is recommended that a ad-hoc committee, including representatives of the ACTRIS council and experts would follow the process

#### **Step 5: ACTRIS council decision**

Like any decision in ACTRIS, the ACTRIS council shall agree on the 5-year implementation plan for the new CF/CF unit.

#### **Step 6: upgrading ACTRIS variable list and the ACTRIS catalogue of services**

The evolution of ACTRIS to integrate new variables requires an update of list of ACTRIS variables , update of NF requirements, Topical Centre(s) implementation/work plan, revision of ACTRIS Data Management Plan and ACTRIS catalogue of services, before final approval and adoption on ACTRIS officially integrating the new variables. As a part of ACTRIS strategy process, ACTRIS will revisit the ACTRIS perimeter in a regular manner.

#### **Step 7: closing existing CFs**

Enlarging the perimeter of ACTRIS cannot be done without a regular evaluation of adequacy of existing services. It is important that, considering human resources, and the financial limitations, engaging in any change in ACTRIS is parallel with either cost reduction in providing other services or abandon of services not meeting expectations in terms of cost/benefits and/or contributing to the ACTRIS Strategy. It is beyond the scope of this deliverable to define the procedures for closing activities in ACTRIS, although it is strictly connected to opening new one.

For now, all ACTRIS variables are not necessarily provided in an operational way and a ramp up procedure may be revised regularly (the procedures for revision will be described in another document), including additional variables but a priority will be implementation and delivery of current identified and listed ACTRIS variables. Topical Centre services that are not fulfilling the above-mentioned principles can be considered as strategic development targets for implementation at later stage, whenever requirements are met.