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## **ACTRIS PPP D3.1: ACTRIS Cost Book**

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## Deliverable 3.1: ACTRIS Cost Book (including CF, NF and services) Update [December 2019]

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Reviewed by	National Contact Points
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Comments	

## Table of Contents

Introduction.....	5
Mission of the Cost Book.....	5
Scope of the Cost Book.....	5
Structure of the Cost Book.....	6
General principles for the estimation .....	7
Cost estimation process .....	8
ACTRIS Cost Book .....	10
ACTRIS Cost Book - Central Facilities.....	10
Central Facility costs.....	12
Head Office.....	17
Data Centre .....	19
Centre for Aerosol In-Situ Measurements.....	21
Centre for Aerosol Remote Sensing.....	23
Centre for Cloud In-Situ Measurements.....	25
Centre for Cloud Remote Sensing.....	27
Centre for Reactive Trace Gases In-Situ Measurements.....	29
Centre for Reactive Trace Gases Remote Sensing.....	31
Focus on the Operation phase of Central Facilities - Operating cost.....	33
Focus on the Operation phase of Central Facilities - Personnel (in Full Time Equivalent) .....	35
ACTRIS Cost Book - National Facilities.....	36
National Facility costs.....	37
Observational Platform Types .....	38
Exploratory Platform Types .....	39
Appendix 1.....	41
References.....	46

## Table of Figures

<b>Figure 1</b> Cost Book structure. ....	6
<b>Figure 2</b> Central Facility costs – overview .....	12
<b>Figure 3</b> Central Facility costs - main categories .....	13
<b>Figure 4</b> Central Facility costs - overview per Country.....	14
<b>Figure 5</b> Central Facility costs - overview per Country and CF.....	15
<b>Figure 6</b> Head Office costs - hosting Countries .....	17
<b>Figure 7</b> Head Office costs - main categories .....	18
<b>Figure 8</b> Data Centre costs - hosting Countries.....	19
<b>Figure 9</b> Data Centre costs - main categories.....	20
<b>Figure 10</b> Centre for Aerosol In-Situ Measurements costs - hosting Countries .....	21
<b>Figure 11</b> Centre for Aerosol In-Situ Measurements costs - main categories.....	22
<b>Figure 12</b> Centre for Aerosol Remote Sensing costs - hosting Countries .....	23
<b>Figure 13</b> Centre for Aerosol Remote Sensing costs - main categories.....	24
<b>Figure 14</b> Centre for Cloud In-Situ Measurements costs - hosting Countries .....	25
<b>Figure 15</b> Centre for Cloud In-Situ Measurements costs - main categories.....	26
<b>Figure 16</b> Centre for Cloud Remote Sensing costs - hosting Countries .....	27
<b>Figure 17</b> Centre for Cloud Remote Sensing costs - main categories.....	28
<b>Figure 18</b> Centre for Reactive Trace Gases In-Situ Measurements costs - hosting Countries .....	29
<b>Figure 19</b> Centre for Reactive Trace Gases In-Situ Measurements costs - main categories.....	30
<b>Figure 20</b> Centre for Reactive Trace Gases Remote Sensing costs - hosting Countries .....	31
<b>Figure 21</b> Centre for Reactive Trace Gases Remote Sensing costs - main categories.....	32
<b>Figure 22</b> Average annual operating cost of the Central Facilities (replacement cost is excluded) .....	33
<b>Figure 23</b> Average annual operating cost of the Central Facilities by hosting country (replacement cost is excluded).....	34
<b>Figure 24</b> Personnel for the Operation Phase of Central Facilities (FTEs) .....	35
<b>Figure 25</b> National Facility type costs - overview .....	37
<b>Figure 26</b> Observational Platform Types - main cost categories .....	38
<b>Figure 27</b> Exploratory Platform Types - main cost categories (1) .....	39
<b>Figure 28</b> Exploratory Platform Types - main cost categories (2) .....	40

## Introduction

This document is intended to deliver the Cost Book for the ACTRIS Research Infrastructure.

It describes the mission of the Cost Book and provides details on the framework, principles and process adopted to collect cost data along the life cycle of ACTRIS in a common and homogeneous way.

The cost estimates, provided through dedicated charts for each Central Facility and National Facility, are those resulting from the ACTRIS configuration envisaged at the time of the ACTRIS PPP ending.

## Mission of the Cost Book

The Cost Book mission is to give a clear identification, definition and realistic planning of the overall infrastructure costs for the entire ACTRIS RI lifetime.

The Cost Book serves:

- to support the stakeholders' engagement by providing information on the value of the investment needed to realize the RI or one of its Central and/or National Facilities starting from scratch
- to assess the necessary information to evaluate the long-term sustainability of ACTRIS in the Financial Plan
- to provide comprehensive information for the ESFRI monitoring and evaluation activities.

As such, the Cost Book is a reference document to be used also in the future.

## Scope of the Cost Book

The scope of the Cost Book is shaped upon the technical requirement outlined in the adopted Facilities (Central / National Facilities) technical documents [2 - 6] and following the ESFRI life cycle costing approach. In particular, the Cost Book summarizes the costs for each phase of the RI starting from the Implementation Phase, through the Operation Phase and Decommissioning Phase as defined in the ESFRI Public Roadmap 2018 Guide [7]:

- **It includes all costs to construct** the Facilities from the ground up, following the technical documents adopted for them (*Implementation Costs occurring in the Implementation Phase*).
- **It includes the annual average costs to operate** the Facilities performing the activities planned in the technical documents (*Operations Costs occurring in the Operation Phase*)
- **It includes costs for dismantling** the Facilities (*Decommissioning Costs occurring in the Termination Phase*)
- **It excludes the costs** for features and services that are **not planned in the Facility technical documents** (e.g. costs for eventual new activities that can be designed and planned during the RI operations).

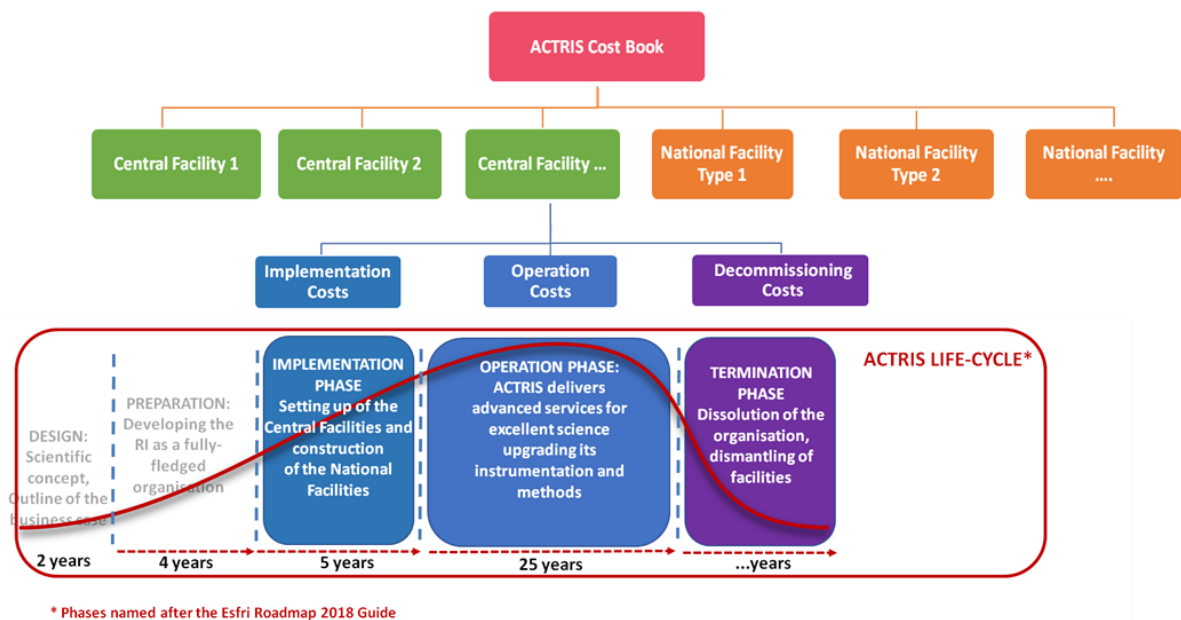
The Cost Book summarizes the Capital Investments for the RI, intended as the total assets of a RI or value of the investment to realize it. The value of the RI, i.e. what is worth for the users, is out of the scope of the Cost Book, since it will be part of the evaluations of the ACTRIS Business Plan.

Considerations about the funding are also out of the scope of the Cost Book. They are part of the ACTRIS Financial Plan, together with any considerations of the inflation effects over the relevant time spans.

## Structure of the Cost Book

The Cost Book scheme closely reflects the organizational structure of ACTRIS.

For each type of Central Facilities and National Facilities, the costs are reported according to the ACTRIS life cycle.



**Figure 1** Cost Book structure.

The cost estimate is based on a **standardized** item list (see details in Appendix 1), to reduce the differences in the estimation process. Items were selected as wide as possible to be valid to include all the costs of each CF and NF, without losing the enough details. International standards for the classification of products and services as well as other relevant international references and examples from other RIs were referred to during the cost items selection [9 - 16].

The meaning of each cost item can slightly differ according to the life cycle phase, objectives and context. In particular, for each section of the Cost Book (implementation, operation and decommissioning), a table is reported in the Appendix 1 containing the peculiar description for each item.

To enable immediate identification of the most relevant costs, the items were grouped into three main cost categories, which for the implementation and operation phases are:

- Personnel
- Equipment
- Other Costs

The “Personnel” cost category groups the cost of all the staff dedicated to the Facility Management and Administration, Scientific and Technical activities.

According to the relevant life cycle phase, the “Equipment” cost category groups the estimates provided for the following cost items, which are detailed in Appendix 1:

- All costs related to the purchase of scientific equipment in the Implementation phase (Table 1 in Appendix 1):
- Major upgrade and replacement in the Operation phase (Table 2 in Appendix 1)
- Consumables and spare parts
- External expertise (maintenance of equipment, insurance, transport etc.)

The “Other Costs” category includes the estimates provided for the following cost items:

- Other direct costs:
  - Building & Construction
  - Travel
- Indirect Costs
  - Utilities
  - General administration
  - Other indirect costs.

## General principles for the estimation

### Usage factor

Since the RI includes a complex of different facilities located in different places and managed by different organisations, the costs of the RI are the sum of the costs of each component, disregarding its geographical location. In case different facilities, also non ACTRIS, are hosted in the same site, with some functional interrelation – e.g. energy, personnel, equipment – costs that are common to all the facilities are carefully apportioned to each facility. Moreover, in case a facility performs also non ACTRIS activities, only the portion of costs for ACTRIS related activities are reported in the Cost Book.



## Currency

Cost estimates are provided in euro. Cost expressed in different currencies are translated into Euro based on the Foreign Exchange Reference Rates published by the European Central Bank in Frankfurt/Main on the first day of the year of estimation.

## Year of estimation

The cost estimation is performed in 2019.

Since all resources required for the Facilities setup and functioning are estimated starting from scratch, future costs are estimated as forecasts/projections, while past costs (e.g. existing and already available assets like buildings, equipment, etc.) are provided considering historical data.

## Cost components excluded

Following the *ESFRI Guidelines on cost estimation of Research Infrastructures* [8], not operating expenses listed below are excluded from the cost estimate:

- Depreciation or reserve
- Interests
- Currency exchange losses
- Provision of future losses or debts
- VAT, unless it is not recoverable and thus represents an actual cash outflow
- Bank costs

## Inflation

Costs should be expressed in real terms. Prices must be constant at the base year: future costs must be forecasted according to realistic assumptions and should be net of inflation. [8]

## Cost estimation process

The Cost Book is the result of a collaborative work involving:

- Leaders and task partners of the ACTRIS PPP Work Packages, coordinating the process of estimation and delivering the collected information
- Lead persons and experts of the Central Facilities' hosts, providing the cost estimates
- Lead authors and writing team of National Facilities' technical documents, providing the cost estimates

Multiple iterations of the cost estimation process were necessary to produce this Cost Book, following the work on the technical documents of the Facilities, the selection of the Central Facilities' hosts and the implementation planning of the selected Central Facilities.

National contact persons of the ACTRIS national consortia were involved during the process to validate the estimates of each country having organizations involved in running the Central Facilities.

## ACTRIS Cost Book

The ACTRIS Cost Book is composed of two sections reporting respectively the cost information on the ACTRIS Central Facilities and National Facility types.

### ACTRIS Cost Book - Central Facilities

This section of the ACTRIS Cost Book reports the costs of the ACTRIS Central Facilities.

All the figures report the costs for providing the operation support and access to external users, following the technical and organizational requirements specified in the technical description of each Central Facility [2] and the implementation planning of the activities [3].

In particular, as the estimates for the Central Facilities are strictly linked to the actual positioning in the ACTRIS RI life cycle, which is such that during the implementation phase there will be co-existence of implementation and pre-operation activities, the total cost occurring in this phase is reported with no distinction between the implementation and pre-operation activities.

In summary, the following costs of the ACTRIS Central Facilities are reported:

- The total Cost occurring during the Implementation Phase:
  - implementation costs to construct the Facilities from the ground up, following the technical documents adopted for them (previous investments up to 2019 and implementation costs occurring in the period 2020-2024)
  - pre-operation costs related to activities that start to be operational and are effectively provided during the Implementation Phase (Operations Costs occurring in the period 2020-2024)
- The cost occurring during the Operation Phase (average annual costs from 2025 onwards) to operate the Facilities performing the activities planned in the technical documents.
- The total cost occurring in the Decommissioning Phase: costs for dismantling the Facilities.

In order to fix an appropriate time horizon, the 'start date' for the estimation of previous investment should be identified. *"This is not always straightforward to identify because the conceptual phase of a RI can be long and may include an initial period when the scientific mission is still open to different options defined in a very broad way. [8]"* As a general rule, the start date should be fixed when the first financial or in-kind allocation is made for activities of the already well-defined RI, i.e. the year of the ESFRI Roadmap application, namely 2015 for ACTRIS. Anyhow, the proper identification of starting point was left to the scientific expert at each facility.

**Figure 2** and **Figure 3** report respectively the costs of each Central Facility and the detailed view on the main cost categories.

In **Figure 4** and

**Figure 5** the costs are broken down into the countries having organizations involved in hosting the Central Facilities, following the consortium approved by Interim ACTRIS Council to proceed in planning the implementation of the Central Facilities.

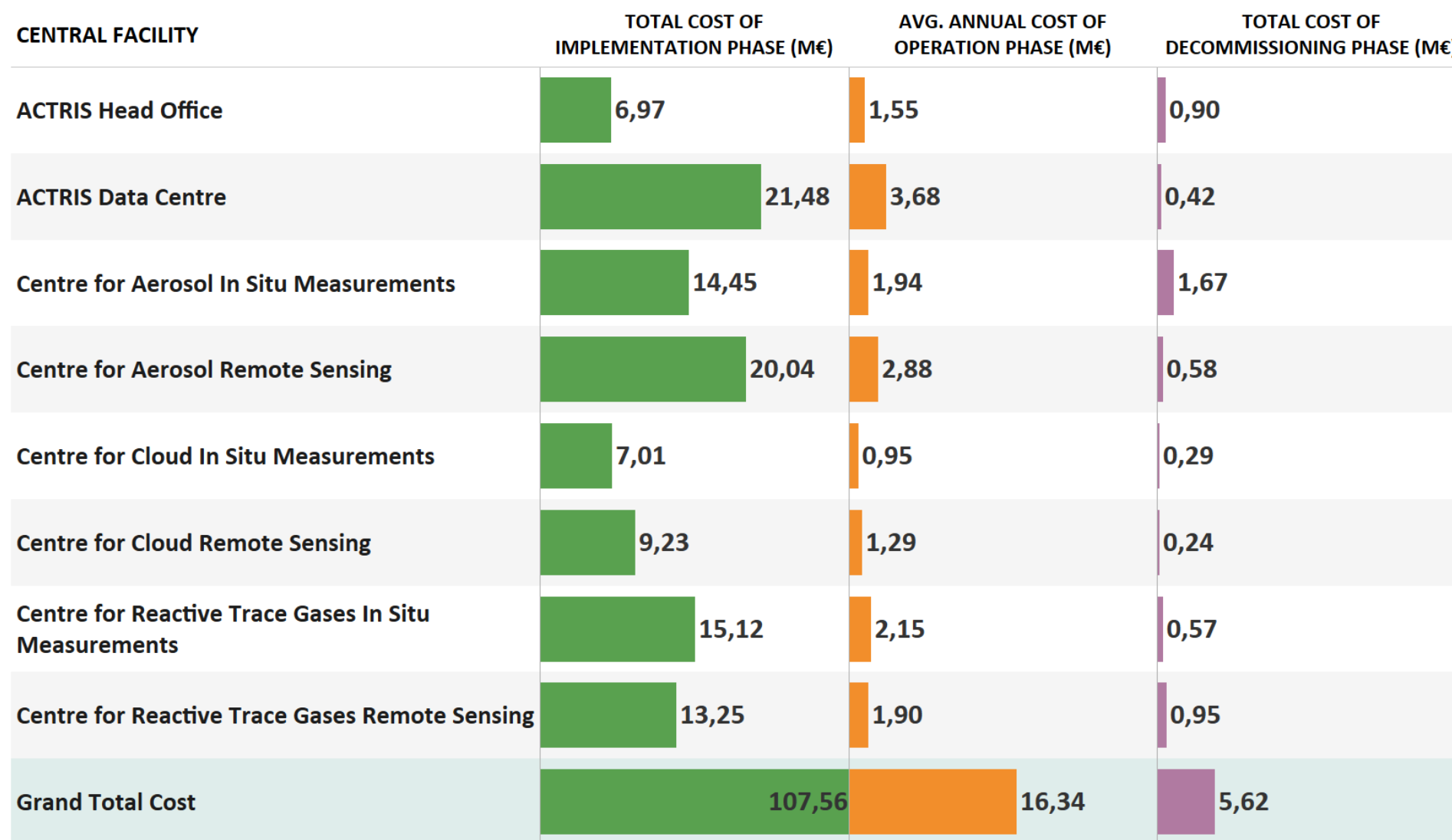
For each Central Facility two dedicated reports provide respectively the breakdown on the hosting countries and main cost categories (**Figure 6** to

**Figure 21**).

A focus on the operating costs and the personnel (in terms of FTEs) required for the Central Facilities during the operation phase is reported for all countries in **Figure 22** and **Figure 23**.

## Central Facility costs

**Figure 2** Central Facility costs – overview



**Figure 3** Central Facility costs - main categories

CENTRAL FACILITY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
ACTRIS Head Office	Personnel	4,35	1,06	
	Equipment	0,09		
	Other costs	2,53	0,49	0,90
	<b>Total cost</b>	<b>6,97</b>	<b>1,55</b>	<b>0,90</b>
ACTRIS Data Centre	Personnel	10,53	1,77	
	Equipment	4,15	0,72	
	Other costs	6,81	1,19	0,42
	<b>Total cost</b>	<b>21,48</b>	<b>3,68</b>	<b>0,42</b>
Centre for Aerosol In Situ Measurements	Personnel	4,92	0,89	
	Equipment	6,02	0,47	
	Other costs	3,51	0,58	1,67
	<b>Total cost</b>	<b>14,45</b>	<b>1,94</b>	<b>1,67</b>
Centre for Aerosol Remote Sensing	Personnel	7,27	1,45	
	Equipment	9,09	0,66	
	Other costs	3,69	0,77	0,58
	<b>Total cost</b>	<b>20,04</b>	<b>2,88</b>	<b>0,58</b>
Centre for Cloud In Situ Measurements	Personnel	2,05	0,44	
	Equipment	1,76	0,11	
	Other costs	3,21	0,40	0,29
	<b>Total cost</b>	<b>7,01</b>	<b>0,95</b>	<b>0,29</b>
Centre for Cloud Remote Sensing	Personnel	4,14	0,64	
	Equipment	2,87	0,23	
	Other costs	2,22	0,42	0,24
	<b>Total cost</b>	<b>9,23</b>	<b>1,29</b>	<b>0,24</b>
Centre for Reactive Trace Gases In Situ Measurements	Personnel	4,90	1,02	
	Equipment	4,16	0,31	
	Other costs	6,06	0,82	0,57
	<b>Total cost</b>	<b>15,12</b>	<b>2,15</b>	<b>0,57</b>
Centre for Reactive Trace Gases Remote Sensing	Personnel	6,58	1,10	
	Equipment	1,48	0,11	
	Other costs	5,19	0,69	0,95
	<b>Total cost</b>	<b>13,25</b>	<b>1,90</b>	<b>0,95</b>
<b>Grand Total Cost</b>		<b>107,56</b>	<b>16,34</b>	<b>5,62</b>

**Figure 4** Central Facility costs - overview per Country

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Austria	2,99	0,56	0,18
Belgium	5,16	0,73	0,51
Czech Republic	1,49	0,14	0,06
Finland	12,05	2,48	1,47
France	18,78	3,15	0,20
Germany	27,65	3,79	0,76
Italy	16,94	1,74	1,65
Netherlands	5,95	0,82	0,36
Norway	6,49	1,35	0,06
Romania	2,64	0,47	0,14
Spain	3,20	0,61	0,13
Switzerland	0,87	0,14	0,02
United Kingdom	3,38	0,34	0,09
<b>Grand Total</b>	<b>107,56</b>	<b>16,34</b>	<b>5,62</b>

**Figure 5** Central Facility costs - overview per Country and CF

COUNTRY	CENTRAL FACILITY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Austria	Centre for Cloud In Situ Measurements	1,05	0,20	0,08
	Centre for Reactive Trace Gases Remote Sensing	1,93	0,36	0,10
Belgium	Centre for Reactive Trace Gases Remote Sensing	5,16	0,73	0,51
Czech Republic	Centre for Aerosol In Situ Measurements	1,49	0,14	0,06
Finland	ACTRIS Head Office	5,01	1,17	0,75
	ACTRIS Data Centre	2,50	0,60	0,13
	Centre for Aerosol In Situ Measurements	1,79	0,27	0,25
	Centre for Cloud Remote Sensing	0,36	0,06	0,06
	Centre for Reactive Trace Gases In Situ Measurements	2,39	0,39	0,29
France	ACTRIS Data Centre	5,66	0,99	0,03
	Centre for Aerosol In Situ Measurements	3,75	0,45	0,04
	Centre for Aerosol Remote Sensing	2,49	0,46	0,03
	Centre for Cloud Remote Sensing	2,94	0,44	0,05
	Centre for Reactive Trace Gases In Situ Measurements	1,80	0,46	0,03
	Centre for Reactive Trace Gases Remote Sensing	2,13	0,36	0,02
Germany	Centre for Aerosol In Situ Measurements	6,18	0,90	0,23
	Centre for Aerosol Remote Sensing	4,82	0,89	0,09
	Centre for Cloud In Situ Measurements	3,67	0,53	0,22
	Centre for Cloud Remote Sensing	1,98	0,26	
	Centre for Reactive Trace Gases In Situ Measurements	10,06	1,16	0,22
	Centre for Reactive Trace Gases Remote Sensing	0,93	0,05	0,01



COUNTRY	CENTRAL FACILITY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Italy	ACTRIS Head Office	1,96	0,39	0,15
	ACTRIS Data Centre	6,43	0,61	0,19
	Centre for Aerosol In Situ Measurements	1,24	0,18	1,10
	Centre for Aerosol Remote Sensing	7,31	0,57	0,21
Netherlands	Centre for Cloud Remote Sensing	2,86	0,42	0,05
	Centre for Reactive Trace Gases Remote Sensing	3,09	0,40	0,31
Norway	ACTRIS Data Centre	6,49	1,35	0,06
Romania	Centre for Aerosol Remote Sensing	2,64	0,47	0,14
Spain	ACTRIS Data Centre	0,41	0,13	0,01
	Centre for Aerosol Remote Sensing	2,79	0,48	0,12
Switzerland	Centre for Reactive Trace Gases In Situ Measurements	0,87	0,14	0,02
United Kingdom	Centre for Cloud In Situ Measurements	2,28	0,22	
	Centre for Cloud Remote Sensing	1,09	0,12	0,09
<b>Grand Total</b>		<b>107,56</b>	<b>16,34</b>	<b>5,62</b>

## Head Office

**Figure 6** Head Office costs - hosting Countries

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Finland	5,01	1,17	0,75
Italy	1,96	0,39	0,15
Grand Total	6,97	1,55	0,90

**Figure 7** Head Office costs - main categories

COUNTRY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Finland	Personnel	3,40	0,85	
	Equipment	0,09		
	Other costs	1,53	0,32	0,75
	<b>Total cost</b>	<b>5,01</b>	<b>1,17</b>	<b>0,75</b>
Italy	Personnel	0,95	0,21	
	Equipment			
	Other costs	1,01	0,18	0,15
	<b>Total cost</b>	<b>1,96</b>	<b>0,39</b>	<b>0,15</b>
<b>Grand Total</b>	<b>6,97</b>	<b>1,55</b>	<b>0,90</b>	

## Data Centre

Figure 8 Data Centre costs - hosting Countries

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Finland	2,50	0,60	0,13
France	5,66	0,99	0,03
Italy	6,43	0,61	0,19
Norway	6,49	1,35	0,06
Spain	0,41	0,13	0,01
Grand Total	21,48	3,68	0,42

**Figure 9** Data Centre costs - main categories

COUNTRY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Finland	Personnel	0,84	0,14	
	Equipment	0,86	0,33	
	Other costs	0,79	0,13	0,13
	<b>Total cost</b>	<b>2,50</b>	<b>0,60</b>	<b>0,13</b>
France	Personnel	3,15	0,51	
	Equipment	0,78	0,19	
	Other costs	1,74	0,29	0,03
	<b>Total cost</b>	<b>5,66</b>	<b>0,99</b>	<b>0,03</b>
Italy	Personnel	2,18	0,22	
	Equipment	2,46	0,19	
	Other costs	1,78	0,21	0,19
	<b>Total cost</b>	<b>6,43</b>	<b>0,61</b>	<b>0,19</b>
Norway	Personnel	4,13	0,83	
	Equipment	0,05	0,02	
	Other costs	2,31	0,50	0,06
	<b>Total cost</b>	<b>6,49</b>	<b>1,35</b>	<b>0,06</b>
Spain	Personnel	0,22	0,07	
	Equipment			
	Other costs	0,18	0,06	0,01
	<b>Total cost</b>	<b>0,41</b>	<b>0,13</b>	<b>0,01</b>
<b>Grand Total</b>		<b>21,48</b>	<b>3,68</b>	<b>0,42</b>

## Centre for Aerosol In-Situ Measurements

**Figure 10** Centre for Aerosol In-Situ Measurements costs - hosting Countries

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Czech Republic	1,49	0,14	0,06
Finland	1,79	0,27	0,25
France	3,75	0,45	0,04
Germany	6,18	0,90	0,23
Italy	1,24	0,18	1,10
<b>Grand Total</b>	<b>14,45</b>	<b>1,94</b>	<b>1,67</b>

**Figure 11** Centre for Aerosol In-Situ Measurements costs - main categories

COUNTRY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Czech Republic	Personnel	0,35	0,06	
	Equipment	0,85	0,04	
	Other costs	0,28	0,04	0,06
	<b>Total cost</b>	<b>1,49</b>	<b>0,14</b>	<b>0,06</b>
Finland	Personnel	0,50	0,09	
	Equipment	0,58	0,07	
	Other costs	0,71	0,10	0,25
	<b>Total cost</b>	<b>1,79</b>	<b>0,27</b>	<b>0,25</b>
France	Personnel	1,47	0,21	
	Equipment	1,11	0,07	
	Other costs	1,16	0,17	0,04
	<b>Total cost</b>	<b>3,75</b>	<b>0,45</b>	<b>0,04</b>
Germany	Personnel	2,08	0,44	
	Equipment	3,02	0,23	
	Other costs	1,09	0,22	0,23
	<b>Total cost</b>	<b>6,18</b>	<b>0,90</b>	<b>0,23</b>
Italy	Personnel	0,51	0,08	
	Equipment	0,46	0,05	
	Other costs	0,27	0,05	1,10
	<b>Total cost</b>	<b>1,24</b>	<b>0,18</b>	<b>1,10</b>
<b>Grand Total</b>		<b>14,45</b>	<b>1,94</b>	<b>1,67</b>

## Centre for Aerosol Remote Sensing

Figure 12 Centre for Aerosol Remote Sensing costs - hosting Countries

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
France	2,49	0,46	0,03
Germany	4,82	0,89	0,09
Italy	7,31	0,57	0,21
Romania	2,64	0,47	0,14
Spain	2,79	0,48	0,12
<b>Grand Total</b>	<b>20,04</b>	<b>2,88</b>	<b>0,58</b>



**Figure 13** Centre for Aerosol Remote Sensing costs - main categories

COUNTRY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
France	Personnel	0,98	0,22	
	Equipment	0,96	0,12	
	Other costs	0,55	0,13	0,03
	<b>Total cost</b>	<b>2,49</b>	<b>0,46</b>	<b>0,03</b>
Germany	Personnel	2,12	0,55	
	Equipment	1,84	0,13	
	Other costs	0,85	0,21	0,09
	<b>Total cost</b>	<b>4,82</b>	<b>0,89</b>	<b>0,09</b>
Italy	Personnel	2,16	0,19	
	Equipment	3,64	0,15	
	Other costs	1,51	0,23	0,21
	<b>Total cost</b>	<b>7,31</b>	<b>0,57</b>	<b>0,21</b>
Romania	Personnel	0,90	0,24	
	Equipment	1,35	0,12	
	Other costs	0,39	0,12	0,14
	<b>Total cost</b>	<b>2,64</b>	<b>0,47</b>	<b>0,14</b>
Spain	Personnel	1,11	0,25	
	Equipment	1,31	0,15	
	Other costs	0,38	0,09	0,12
	<b>Total cost</b>	<b>2,79</b>	<b>0,48</b>	<b>0,12</b>
<b>Grand Total</b>		<b>20,04</b>	<b>2,88</b>	<b>0,58</b>

## Centre for Cloud In-Situ Measurements

**Figure 14** Centre for Cloud In-Situ Measurements costs - hosting Countries

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Austria	1,05	0,20	0,08
Germany	3,67	0,53	0,22
United Kingdom	2,28	0,22	
<b>Grand Total</b>	<b>7,01</b>	<b>0,95</b>	<b>0,29</b>

**Figure 15** Centre for Cloud In-Situ Measurements costs - main categories

COUNTRY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Austria	Personnel	0,58	0,13	
	Equipment	0,34	0,01	
	Other costs	0,14	0,06	0,08
	<b>Total cost</b>	<b>1,05</b>	<b>0,20</b>	<b>0,08</b>
Germany	Personnel	1,14	0,21	
	Equipment	1,36	0,09	
	Other costs	1,17	0,23	0,22
	<b>Total cost</b>	<b>3,67</b>	<b>0,53</b>	<b>0,22</b>
United Kingdom	Personnel	0,33	0,10	
	Equipment	0,06	0,01	
	Other costs	1,90	0,11	
	<b>Total cost</b>	<b>2,28</b>	<b>0,22</b>	
<b>Grand Total</b>		<b>7,01</b>	<b>0,95</b>	<b>0,29</b>

## Centre for Cloud Remote Sensing

Figure 16 Centre for Cloud Remote Sensing costs - hosting Countries

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Finland	0,36	0,06	0,06
France	2,94	0,44	0,05
Germany	1,98	0,26	
Netherlands	2,86	0,42	0,05
United Kingdom	1,09	0,12	0,09
<b>Grand Total</b>	<b>9,23</b>	<b>1,29</b>	<b>0,24</b>

**Figure 17** Centre for Cloud Remote Sensing costs - main categories

COUNTRY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Finland	Personnel	0,19	0,03	
	Equipment			
	Other costs	0,17	0,03	0,06
	<b>Total cost</b>	<b>0,36</b>	<b>0,06</b>	<b>0,06</b>
France	Personnel	1,48	0,24	
	Equipment	0,68	0,07	
	Other costs	0,78	0,13	0,05
	<b>Total cost</b>	<b>2,94</b>	<b>0,44</b>	<b>0,05</b>
Germany	Personnel	0,79	0,11	
	Equipment	0,88	0,06	
	Other costs	0,31	0,09	
	<b>Total cost</b>	<b>1,98</b>	<b>0,26</b>	
Netherlands	Personnel	1,31	0,22	
	Equipment	0,85	0,06	
	Other costs	0,70	0,14	0,05
	<b>Total cost</b>	<b>2,86</b>	<b>0,42</b>	<b>0,05</b>
United Kingdom	Personnel	0,36	0,04	
	Equipment	0,46	0,04	
	Other costs	0,27	0,03	0,09
	<b>Total cost</b>	<b>1,09</b>	<b>0,12</b>	<b>0,09</b>
<b>Grand Total</b>		<b>9,23</b>	<b>1,29</b>	<b>0,24</b>

## Centre for Reactive Trace Gases In-Situ Measurements

**Figure 18** Centre for Reactive Trace Gases In-Situ Measurements costs - hosting Countries

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Finland	2,39	0,39	0,29
France	1,80	0,46	0,03
Germany	10,06	1,16	0,22
Switzerland	0,87	0,14	0,02
<b>Grand Total</b>	<b>15,12</b>	<b>2,15</b>	<b>0,57</b>

**Figure 19** Centre for Reactive Trace Gases In-Situ Measurements costs - main categories

COUNTRY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Finland	Personnel	0,54	0,11	
	Equipment	1,14	0,14	
	Other costs	0,71	0,14	0,29
	<b>Total cost</b>	<b>2,39</b>	<b>0,39</b>	<b>0,29</b>
France	Personnel	0,93	0,24	
	Equipment	0,24	0,05	
	Other costs	0,63	0,16	0,03
	<b>Total cost</b>	<b>1,80</b>	<b>0,46</b>	<b>0,03</b>
Germany	Personnel	2,85	0,57	
	Equipment	2,71	0,11	
	Other costs	4,50	0,48	0,22
	<b>Total cost</b>	<b>10,06</b>	<b>1,16</b>	<b>0,22</b>
Switzerland	Personnel	0,59	0,10	
	Equipment	0,06	0,01	
	Other costs	0,22	0,04	0,02
	<b>Total cost</b>	<b>0,87</b>	<b>0,14</b>	<b>0,02</b>
<b>Grand Total</b>		<b>15,12</b>	<b>2,15</b>	<b>0,57</b>

## Centre for Reactive Trace Gases Remote Sensing

Figure 20 Centre for Reactive Trace Gases Remote Sensing costs - hosting Countries

COUNTRY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Austria	1,93	0,36	0,10
Belgium	5,16	0,73	0,51
France	2,13	0,36	0,02
Germany	0,93	0,05	0,01
Netherlands	3,09	0,40	0,31
Grand Total	13,25	1,90	0,95



**Figure 21** Centre for Reactive Trace Gases Remote Sensing costs - main categories

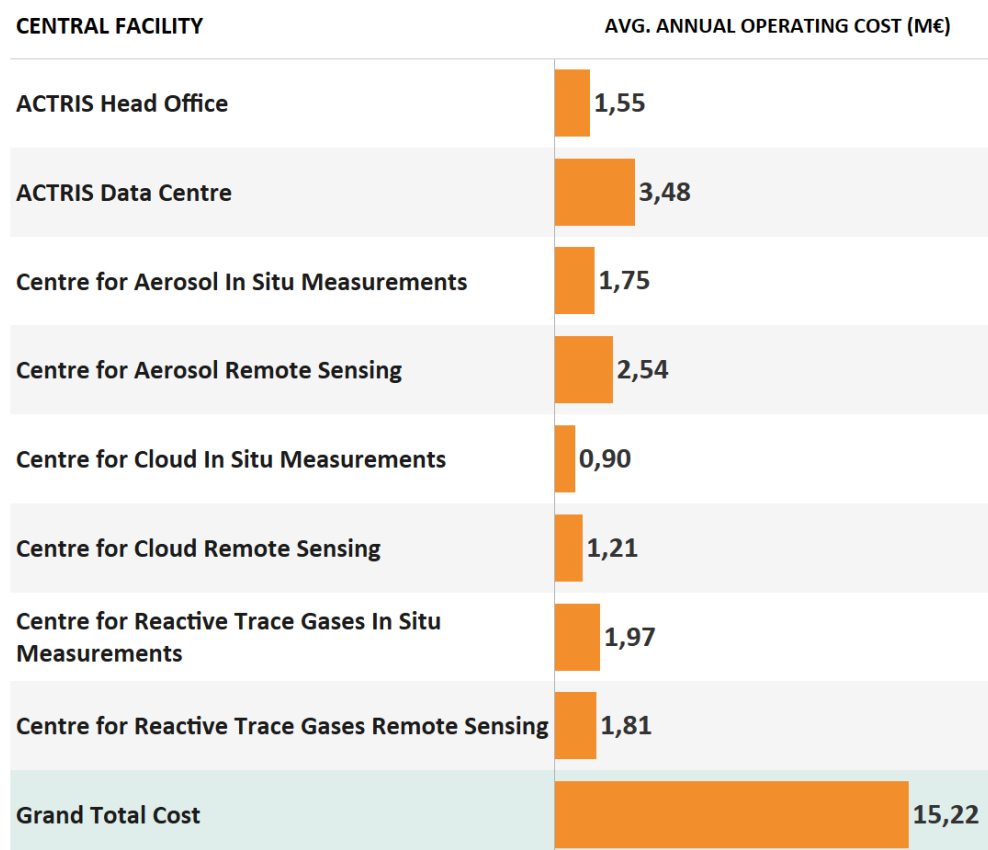
COUNTRY	COST CATEGORY	TOTAL COST OF IMPLEMENTATION PHASE (M€)	AVG. ANNUAL COST OF OPERATION PHASE (M€)	TOTAL COST OF DECOMMISSIONING PHASE (M€)
Austria	Personnel	1,18	0,20	
	Equipment	0,23	0,03	
	Other costs	0,53	0,13	0,10
	<b>Total cost</b>	<b>1,93</b>	<b>0,36</b>	<b>0,10</b>
Belgium	Personnel	3,28	0,52	
	Equipment	0,32	0,05	
	Other costs	1,55	0,15	0,51
	<b>Total cost</b>	<b>5,16</b>	<b>0,73</b>	<b>0,51</b>
France	Personnel	1,21	0,21	
	Equipment	0,12		
	Other costs	0,80	0,15	0,02
	<b>Total cost</b>	<b>2,13</b>	<b>0,36</b>	<b>0,02</b>
Germany	Personnel	0,18	0,03	
	Equipment	0,21		
	Other costs	0,55	0,01	0,01
	<b>Total cost</b>	<b>0,93</b>	<b>0,05</b>	<b>0,01</b>
Netherlands	Personnel	0,74	0,13	
	Equipment	0,59	0,02	
	Other costs	1,76	0,25	0,31
	<b>Total cost</b>	<b>3,09</b>	<b>0,40</b>	<b>0,31</b>
<b>Grand Total</b>		<b>13,25</b>	<b>1,90</b>	<b>0,95</b>

## Focus on the Operation phase of Central Facilities - Operating cost

The costs occurring during the Operation Phase (average annual costs from 2025 onwards) to operate the Facilities are reported in all the previous charts including, as an average annual value, also those investment that will be needed during the Operation Phase to replace the major equipment at the end of their useful life.

Annual operating cost, that are actual expenses incurred in each year and associated with running the planned activities on a day-to-day basis, can be then obtained by removing the estimated annual value of replacement costs.

**Figure 22** Average annual operating cost of the Central Facilities (replacement cost is excluded)



**Figure 23** Average annual operating cost of the Central Facilities by hosting country (replacement cost is excluded)

COUNTRY	AVG. ANNUAL OPERATING COST (M€)
Austria	0,54
Belgium	0,68
Czech Republic	0,13
Finland	2,36
France	2,92
Germany	3,50
Italy	1,55
Netherlands	0,79
Norway	1,35
Romania	0,42
Spain	0,53
Switzerland	0,14
United Kingdom	0,31
<b>Grand Total</b>	<b>15,22</b>

## Focus on the Operation phase of Central Facilities - Personnel (in Full Time Equivalent)

**Figure 24** Personnel for the Operation Phase of Central Facilities (FTEs)

COUNTRY	ACTRIS Head Office	ACTRIS Data Centre	Centre for Aerosol In Situ Measurements	Centre for Aerosol Remote Sensing	Centre for Cloud In Situ Measurements	Centre for Cloud Remote Sensing	Centre for Reactive Trace Gases In Situ Measurements	Centre for Reactive Trace Gases Remote Sensing	Grand Total FTE
Austria					2,0			2,3	4,3
Belgium								5,2	5,2
Czech Republic			1,7						1,7
Finland	8,5	2,4	2,1			0,5	2,2		15,7
France		6,0	2,5	3,2		3,0	3,3	2,5	20,5
Germany			4,4	6,5	2,9	2,0	7,1	0,3	23,2
Italy	3,6	4,2	1,5	3,5					12,7
Netherlands						3,0		1,5	4,5
Norway		5,4							5,4
Romania				4,0					4,0
Spain		1,0		6,3					7,3
Switzerland							0,8		0,8
United Kingdom					1,6	0,5			2,1
<b>Grand Total FTE</b>	<b>12,1</b>	<b>19,0</b>	<b>12,2</b>	<b>23,6</b>	<b>6,4</b>	<b>9,0</b>	<b>13,4</b>	<b>11,7</b>	<b>107,3</b>

## ACTRIS Cost Book - National Facilities

This section of the ACTRIS Cost Book reports the estimates per National Facility type, following the relevant technical documents and regardless of the "real" Facilities established at national level in the different countries.

The figures below report the resources needed for each National Facility type, considering the possible configurations envisaged in the technical documents, i.e. Minimum Requirements/Optimum setup:

- IMPLEMENTATION: the total overall costs for the implementation of the National Facility up to the full operation
- OPERATION: the average annual cost for operating the National Facility
- DECOMMISSIONING: the total overall costs for dismantling the National Facility.

The costs for each National Facility type are reported in **Figure 25**.

Costs are also broken down into the main cost categories, both for the Observational Platforms (**Figure 26**) and Exploratory Platforms (**Figure 27, Figure 28**)

Average EU prices [17] were used for the cost estimation of personnel profiles in order to take into account the possible differences among the different countries.

## National Facility costs

Figure 25 National Facility type costs - overview

		IMPLEMENTATION		OPERATION		DECOMMISSIONING	
Observational Platforms	Aerosol in-situ observations	615K	2.056K	155K	388K	88K	188K
	Aerosol remote-sensing observations	1.889K	2.184K	395K	440K	231K	231K
	Cloud in situ observations	742K	2.288K	90K	526K	84K	221K
	Cloud remote-sensing observations	606K	1.648K	154K	307K	39K	74K
	Trace-gas in situ observations	501K	1.742K	131K	373K	72K	152K
	Trace-gas remote-sensing observations	1.058K	2.702K	163K	397K	118K	299K
Exploratory Platforms	Ground-based mobile - Aerosol in situ measurements	547K	1.617K	152K	275K	35K	76K
	Ground-based mobile - Aerosol remote sensing and Cloud remote sensing		1.474K		312K		109K
	Laboratory platform	1.373K	1.373K	213K	311K	55K	55K
	Shipborne mobile platform	2.307K	2.546K	265K	423K	72K	121K
	Atmospheric Simulation Chamber (cheapest)	1.267K	2.748K	278K	472K		
	Atmospheric Simulation Chamber (most expensive)	7.758K	8.215K	478K	650K	246K	246K
	Airborne mobile platform balloon	445K	1.352K	191K	441K	43K	74K
	Airborne mobile platform UAV	163K	445K	70K	144K	6K	12K
		MINIMUM REQ.	OPTIMUM SETUP	MINIMUM REQ.	OPTIMUM SETUP	MINIMUM REQ.	OPTIMUM SETUP

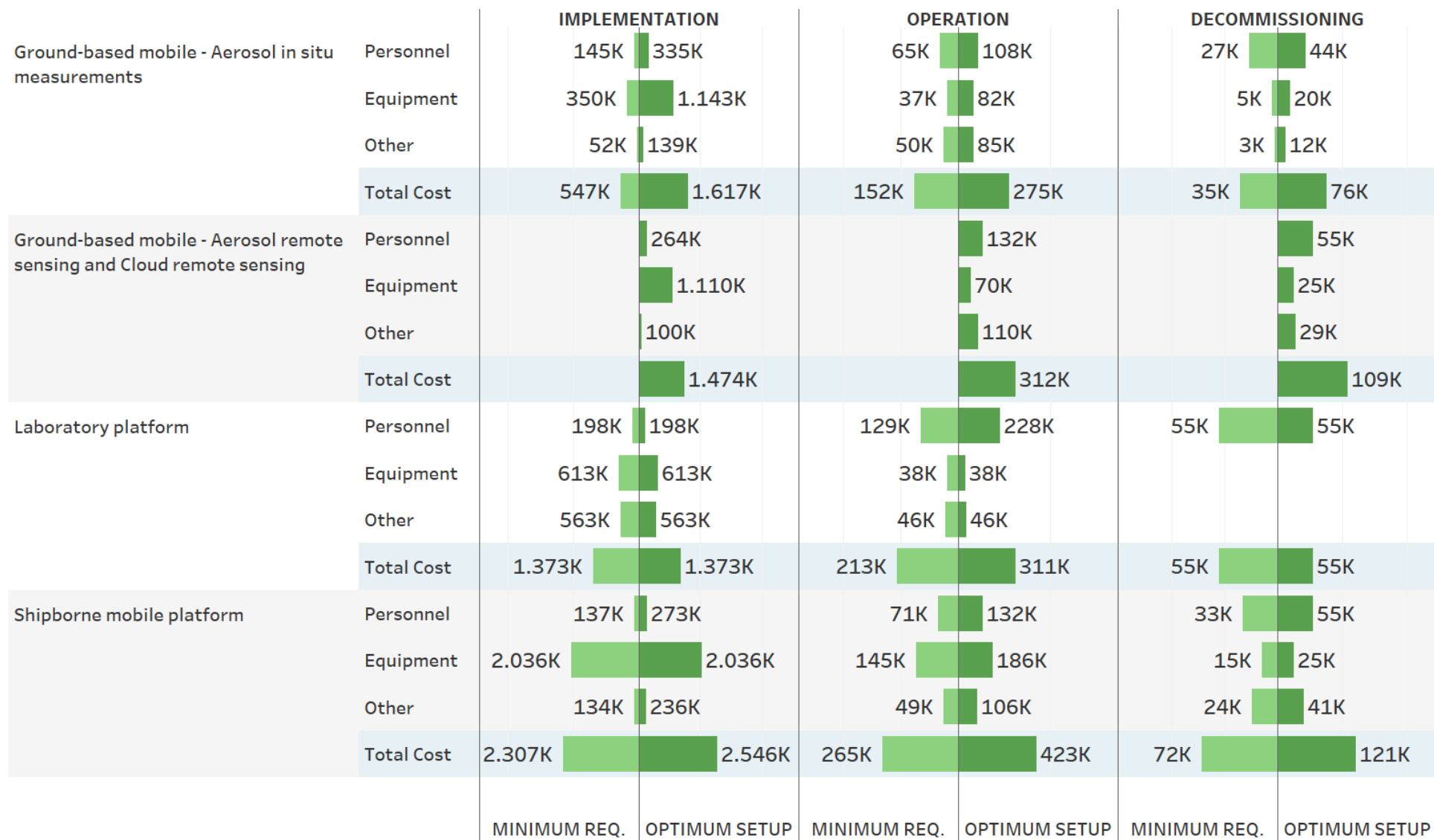
## Observational Platform Types

**Figure 26** Observational Platform Types - main cost categories

		IMPLEMENTATION		OPERATION		DECOMMISSIONING	
		MINIMUM REQ.	OPTIMUM SETUP	MINIMUM REQ.	OPTIMUM SETUP	MINIMUM REQ.	OPTIMUM SETUP
Aerosol in-situ observations	Personnel	145K	335K	67K	220K	44K	73K
	Equipment	280K	1.283K	37K	82K	5K	20K
	Other	190K	438K	50K	85K	39K	95K
	<b>Total Cost</b>	<b>615K</b>	<b>2.056K</b>	<b>155K</b>	<b>388K</b>	<b>88K</b>	<b>188K</b>
Aerosol remote-sensing observations	Personnel	558K	558K	270K	270K	144K	144K
	Equipment	1.012K	1.277K	83K	103K	3K	3K
	Other	319K	349K	42K	67K	85K	85K
	<b>Total Cost</b>	<b>1.889K</b>	<b>2.184K</b>	<b>395K</b>	<b>440K</b>	<b>231K</b>	<b>231K</b>
Cloud in situ observations	Personnel	299K	1.139K	60K	407K	45K	124K
	Equipment	245K	690K	7K	21K	2K	21K
	Other	197K	459K	22K	98K	37K	76K
	<b>Total Cost</b>	<b>742K</b>	<b>2.288K</b>	<b>90K</b>	<b>526K</b>	<b>84K</b>	<b>221K</b>
Cloud remote-sensing observations	Personnel	157K	275K	66K	119K	33K	59K
	Equipment	440K	1.355K	79K	171K	4K	14K
	Other	9K	18K	9K	18K	1K	1K
	<b>Total Cost</b>	<b>606K</b>	<b>1.648K</b>	<b>154K</b>	<b>307K</b>	<b>39K</b>	<b>74K</b>
Trace-gas in situ observations	Personnel	120K	265K	67K	220K	30K	46K
	Equipment	222K	1.042K	28K	68K	4K	20K
	Other	159K	435K	36K	85K	38K	87K
	<b>Total Cost</b>	<b>501K</b>	<b>1.742K</b>	<b>131K</b>	<b>373K</b>	<b>72K</b>	<b>152K</b>
Trace-gas remote-sensing observations	Personnel	103K	282K	103K	288K	103K	261K
	Equipment	512K	982K	44K	63K		
	Other	444K	1.439K	16K	46K	15K	38K
	<b>Total Cost</b>	<b>1.058K</b>	<b>2.702K</b>	<b>163K</b>	<b>397K</b>	<b>118K</b>	<b>299K</b>

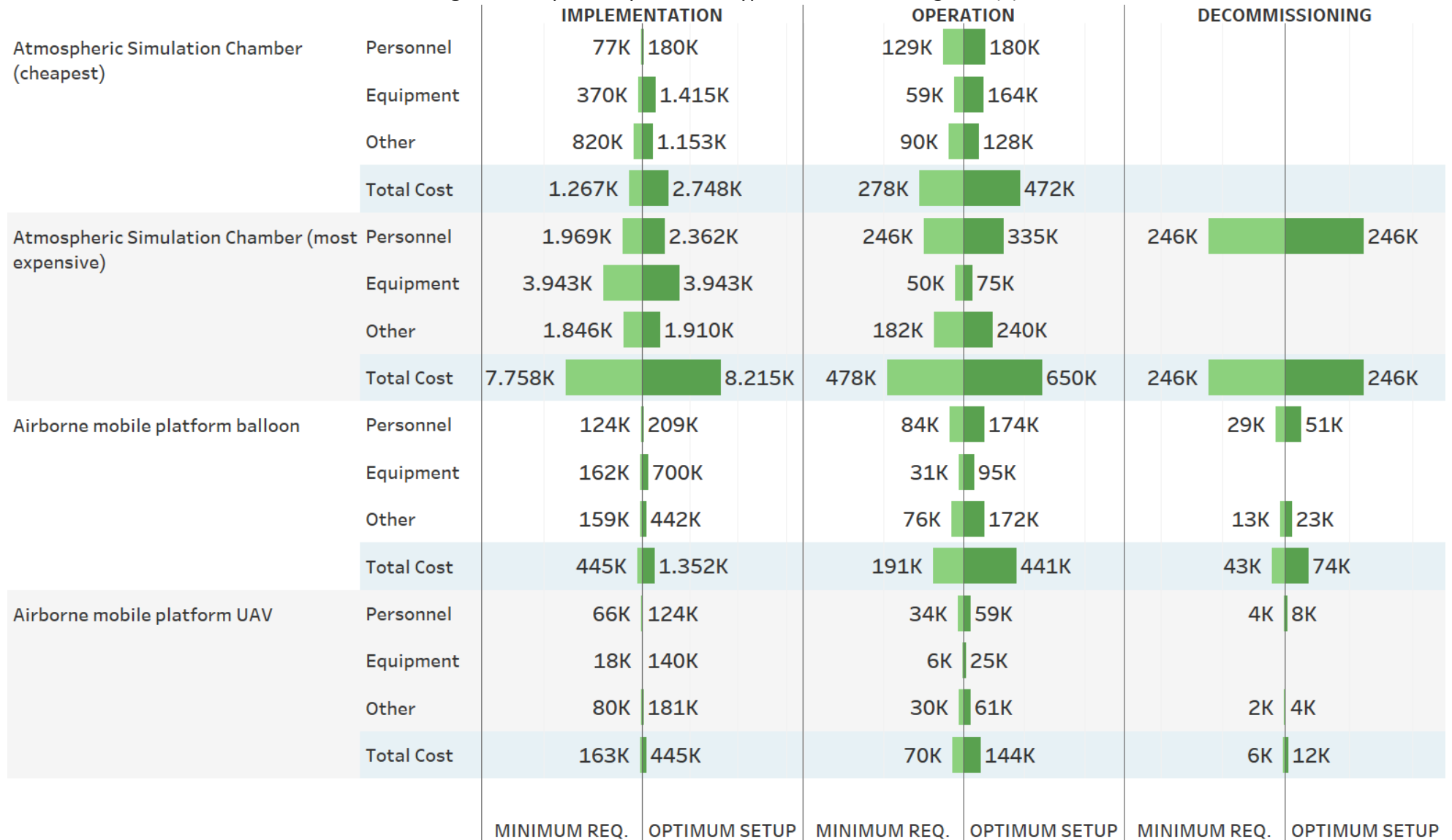
## Exploratory Platform Types

**Figure 27** Exploratory Platform Types - main cost categories (1)





**Figure 28** Exploratory Platform Types - main cost categories (2)



## Appendix 1

Table 1: Implementation Phase - Cost items description

COST ITEMS	DESCRIPTION
<b>Building &amp; Construction</b>	<p>NOTE: TOTAL OVERALL COST FOR THE SETUP OF THE FACILITY</p> <p>DESCRIPTION: Costs for land purchase, construction of offices and laboratories, rental of space, repair and maintenance during the setup phase.</p> <p>EXAMPLES:</p> <ul style="list-style-type: none"> <li>- purchase of land, with or without a building structure.</li> <li>- construction of a new building or addition to existing buildings.</li> <li>- site restoration, that is restoring the site on which the infrastructure is located and/or dismantling and removing previous items.</li> <li>- Rentals of spaces (offices, laboratories, outdoor, etc.)</li> <li>- replacement expenditure to replace substantially all of an existing asset. For example, gutting an existing building and replacing electrical, plumbing, heating, ventilation, air-conditioning systems and other major components, to improve its useful life.</li> <li>- replacement of parts of an asset during the setup of the Facility.</li> </ul>
<b>Equipment</b>	<p>NOTE: TOTAL OVERALL COST FOR THE SETUP OF THE FACILITY</p> <p>DESCRIPTION: All costs related to the purchase of scientific equipment in the implementation phase, including advanced research modules or mobile units, advanced ICT systems as well as basic ICT systems.</p>
<b>Personnel</b> (Management and Administration, Scientific and Technical)	<p>NOTE: TOTAL OVERALL COST FOR THE SETUP OF THE FACILITY</p> <p>DESCRIPTION: All the staff in terms of Full Time Equivalent (FTE), dedicated to the Facility Management and Administration, Scientific and Technical activities during the implementation phase, employed according to national legislation, trade union's agreements, etc.</p> <p>EXAMPLES: The staff working on:</p> <ul style="list-style-type: none"> <li>- Setting-up and running the Facility administration and management (facility manager, finance and accounting department, purchasing department, legal department, administrative / management, logistic, etc.)</li> <li>- Designing, planning, setting up and testing the services</li> <li>- Planning the access services</li> <li>- Support equipment installation and setup</li> <li>- Education and training</li> <li>- Coordination of scientific activities with national or international related initiatives</li> </ul>

	<ul style="list-style-type: none"> <li>- Setting-up and coordinate users' communities</li> <li>- Planning the outreach and dissemination, promotion of innovation, activities to foster the use of research infrastructures by industrial researchers, promotion of long-term sustainability, etc.</li> </ul>
<b>Consumables</b>	<p>NOTE: TOTAL OVERALL COST FOR THE SETUP OF THE FACILITY</p> <p>DESCRIPTION: All costs related to the purchase of consumables, materials and spare parts specifically used for the laboratory set up and functioning in the implementation phase</p>
<b>Travel</b>	<p>NOTE: TOTAL OVERALL COST FOR THE SETUP OF THE FACILITY</p> <p>DESCRIPTION: Travel and subsistence costs needed for the Facility setup in the implementation phase.</p>
<b>External Services</b>	<p>NOTE: TOTAL OVERALL COST FOR THE SETUP OF THE FACILITY</p> <p>DESCRIPTION: All costs for equipment maintenance, engineering services, scientific and technical services, legal and audit services provided by professionals with a high level of expertise during the setup phase.</p>
<b>Utilities</b>	<p>NOTE: TOTAL OVERALL COST FOR THE SETUP OF THE FACILITY</p> <p>DESCRIPTION: Electricity, water and gas used for the Facility functioning.</p>
<b>Other costs</b>	<p>NOTE: TOTAL OVERALL COST FOR THE SETUP OF THE FACILITY</p> <p>DESCRIPTION: Residual category including all costs that cannot fall into previous ones.</p> <p>For Instance:</p> <ul style="list-style-type: none"> <li>- costs for general services (cleaning, medical, library, publication, communication, printing, postage, dues and subscriptions, clothing, literature, transport, catering, office supplies and equipment, etc.)</li> </ul>

Table 2: Operations Phase - Cost items description

COST ITEMS	DESCRIPTION <i>AVERAGE ANNUAL VALUE FOR THE OPERATION OF THE FACILITY</i>
<b>Building &amp; Construction</b>	<p>NOTE: AVERAGE ANNUAL OPERATING COST</p> <p>DESCRIPTION: Cost for building maintenance, cost for space rentals</p> <p>EXAMPLES:</p> <ul style="list-style-type: none"> <li>- replacement expenditure to replace substantially all of an asset. For example, gutting an existing building and replacing electrical, plumbing, heating, ventilation, air-conditioning systems and other major components, to improve its useful life.</li> <li>- replacement of parts of an asset during the operation of the Facility.</li> </ul>
<b>Equipment</b> (major upgrade and replacement)	<p>NOTE: AVERAGE ANNUAL OPERATING COST</p> <p>DESCRIPTION: Average annual operating cost for equipment major upgrade, i.e. technology foresight, for replacement of equipment due to substantial damages, and an annual average estimation of the need of replacement due the end of useful life.</p>
<b>Personnel</b> (Management and Administration, Scientific and Technical)	<p>NOTE: AVERAGE ANNUAL OPERATING COST</p> <p>DESCRIPTION: All the staff in terms of Full Time Equivalent (FTE), dedicated to the Facility Management and Administration, Scientific and Technical activities in the operation phase, employed according to national legislation, trade union's agreements, etc.</p> <p>EXAMPLES: The staff (principal investigator, scientist, administrative, technicians etc.) working on:</p> <ul style="list-style-type: none"> <li>- Management and administration of the Facility (facility manager, finance and accounting department, purchasing department, legal department, administrative / management, logistic, etc.)</li> <li>- coordination of scientific activities with national or international related initiatives</li> <li>- coordination of users' communities</li> <li>- operating the services</li> <li>- education and training</li> <li>- grant access services</li> <li>- outreach and dissemination, promotion of innovation; activities to foster the use of research infrastructures by industrial researchers, promotion of long-term sustainability, etc.</li> </ul>
<b>Consumables</b>	<p>NOTE: AVERAGE ANNUAL OPERATING COST</p> <p>DESCRIPTION: Average annual cost related to the purchase of consumables, materials and spare parts specifically used for the laboratory operations</p>

<b>Travel</b>	<p>NOTE: AVERAGE ANNUAL OPERATING COST</p> <p>DESCRIPTION: Average annual cost related to travel required during the operation phase (for instance, for Central Facilities to operation support/services), including accommodation.</p>
<b>External Services</b>	<p>NOTE: AVERAGE ANNUAL OPERATING COST</p> <p>DESCRIPTION: Average annual cost for equipment maintenance, engineering services, scientific and technical services, legal and audit services provided by professionals with a high level of expertise during the operations phase.</p>
<b>Utilities</b>	<p>NOTE: AVERAGE ANNUAL OPERATING COST</p> <p>DESCRIPTION: Average annual cost for electricity, water and gas used for the facility functioning in the operations phase.</p>
<b>Other costs</b>	<p>NOTE: AVERAGE ANNUAL OPERATING COST</p> <p>DESCRIPTION: Residual category including average annual value for costs that cannot fall into previous categories.</p> <p>EXAMPLES:</p> <ul style="list-style-type: none"> <li>- cost for general services needed in the operations phase, e.g. to ensure service provision by the CF or functioning of the NF (cleaning, medical, library, publication, communication, printing, postage, dues and subscriptions, clothing, literature, transport, catering, office supplies and equipment, etc.)</li> </ul>

Table 3: Decommissioning Phase - Cost items description

COST ITEMS	DESCRIPTION
<b>Building &amp; Construction</b>	NOTE: TOTAL OVERALL COST FOR THE DISMANTLING OF THE FACILITY  Costs per unit (m <sup>2</sup> or m <sup>3</sup> ) for the site restoration and dismantling, or total overall cost for space rentals during the decommissioning phase.
<b>Equipment</b>	NOTE: TOTAL OVERALL COST FOR THE DISMANTLING OF THE FACILITY  Total over cost for equipment, if needed for this phase of ACTRIS RI.
<b>Personnel</b> (Management and Administration, Scientific and Technical)	NOTE: TOTAL OVERALL COST FOR THE DISMANTLING OF THE FACILITY  All the staff in terms of Full Time Equivalent (FTE), dedicated to the Management and Administration, Scientific/Technical activities for the Facility dismantling, employed according to national legislation, trade union's agreements, etc.
<b>Consumables</b>	NOTE: TOTAL OVERALL COST FOR THE DISMANTLING OF THE FACILITY  All costs related to the purchase of consumables, materials and spare parts to supply provisions for the laboratories during the decommissioning phase.
<b>Travel</b>	NOTE: TOTAL OVERALL COST FOR THE DISMANTLING OF THE FACILITY  Travel and subsistence costs needed for the Facility dismantling in the decommissioning phase.
<b>External Services</b>	NOTE: TOTAL OVERALL COST FOR THE DISMANTLING OF THE FACILITY  All cost items for technical services ( <b>obsolete equipment disposal/recycling, waste disposal, waste treatment, ...</b> ), engineering services, legal and audit services for the Facility dismantling provided by professionals with a high level of expertise during the decommissioning phase.
<b>Utilities</b>	NOTE: TOTAL OVERALL COST FOR THE DISMANTLING OF THE FACILITY  Electricity, water and gas used for the Facility dismantling in the decommissioning phase.
<b>Other costs</b>	NOTE: TOTAL OVERALL COST FOR THE DISMANTLING OF THE FACILITY  Residual category including all costs that cannot fall into previous ones. For Instance: cost for general services

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