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Concept for a Science-driven Evaluation of Large Research Infrastructure Projects for a National Roadmap (Pilot Phase)

CONTENTS

A. Objectives

A national roadmap for large research infrastructures (hereinafter referred to as 'roadmap') is the result of an assessment process entailing the recording, comparison and evaluation of new research infrastructure projects in all areas of science at an early stage. The roadmap shall be created as a result of a complex process consisting of a science-driven evaluation of the projects, a respective cost assessment and prioritisation of the projects based on political considerations. In this context, the German Federal Ministry for Education and Research (BMBF) has requested the German Council of Science and Humanities to set up a pilot phase. During this phase, research infrastructure projects within the Ministry's area of responsibility will be subjected to a science-driven evaluation that shall serve as the basis for the national roadmap. The BMBF will appoint a separate institution to carry out the cost assessment. Both processes shall be closely integrated. Hence, the roadmap will comprise the results of the science-driven evaluation, the cost assessment and the political prioritisation for the projects' implementation. Essentially, the roadmap is expected to achieve two objectives:

A.I SUPPORT OF STRATEGIC RESEARCH POLICY DECISIONS AND IMPROVED INVESTMENT PLANNING AT THE NATIONAL LEVEL

The political decisions on large investments in research infrastructures should be taken in the context of a comprehensive, needs- and quality-driven research policy strategy. Early consideration of all projects across the various areas of science and potential sponsoring organisations is required to avoid duplicate investments, investment gaps or oversubscription of the funds available for investment. The research infrastructure roadmap fulfils this purpose and pursues the following objectives:

_ Improvement of the quality of strategic decisions thanks to (a) explicit, forward-looking consideration of the need for the projects as well as their objectives and quality and (b) a broader overview of competing / complementary research infrastructures at the national, European and global level.

_ Greater acceptance of far-reaching research policy decisions thanks to fair and transparent procedures.

_ In the case of large-scale projects: Sound decisions regarding the sponsoring of pilot studies and the preparation of research infrastructure drafts (scientific cases, technical design reports, cost and time schedules) as well as timely planning of further milestones or assessments.

_ Early forecasting of expected cumulative investment, upgrade and operation costs to facilitate medium and long-term financial planning.

A.II POSITIONING IN INTERNATIONAL NEGOTIATIONS

Due to financial, structural or scientific reasons, implementation of many large research infrastructures requires cooperation at the European or international level. The ESFRI process is an attempt to gain an overview of such projects and prepare a need- and quality-based shortlist. However, it must be assumed that the implementation of projects will continue to depend on the formation of multilateral consortia consisting of EU member states, and where necessary other states, that agree upon variable geometry funding. Hence, the preparation of a national priority list is not only an important factor at the national level, but also an important step towards the implementation of European or international projects. In this context, the following objectives are being pursued:

_ Support of political priority decisions identifying those international projects in which Germany should assume a leading role and initiate negotiations.

_ Consideration and prioritisation of possible German contributions to international projects not only among different international projects but also in competition to projects funded exclusively at the national level.

_ Clear positioning of the German delegation at ESFRI negotiations regarding the projects that will be supported for inclusion in the ESFRI roadmap.

The roadmap process shall follow certain principles to ensure that all of these objectives can be achieved: The roadmap development process must be open to all areas of science. Uniform evaluation criteria shall apply in all areas of science. Both structure and implementation of the procedure should be transparent. This also implies that the scientists responsible for the research infrastructure draft have the opportunity to advocate their projects and answer queries. Furthermore, the results of the roadmap process shall be published.

B. Subject area

For the purpose of this roadmap concept, research infrastructures consist of substantial research tools, resources or service facilities in all areas of science that are of at least national importance in the respective area of science. Research infrastructures may be single-sited, distributed or virtual. They have long life spans (generally in excess of 10 years). The total lifespan of a research infrastructure comprises various updating and renewal cycles making allowance for scientific progress and the limited predictability of scientific success. This definition also includes information-based infrastructures, such as collections, archives and other knowledge resources.

As a rule, a distinction between large research infrastructures and smaller infrastructures or devices is made on the basis of the investment volume or the operating costs involved. Different reference values apply to the various areas of science: In the case of the natural, biological, environmental, technological and medical sciences, minimum investment costs of EUR 15 million or minimum upgrade and operating costs (including personnel expenses) of EUR 5 million p.a. apply. In the case of the humanities, social and economic sciences, there shall be no *de minimus* limits in terms of investment costs |[1]; however, minimum upgrade and operating costs of EUR 1.5 million p. a. are a requirement. In individual cases, projects below the above thresholds may also be included in the roadmap process deliberations if a substantial structure-building or modifying effect on German science is expected to arise from the research infrastructure draft. |[2]

Inclusion of an infrastructure project in the roadmap process requires such projects to be of strategic relevance to Germany as a location of science and re-

|[1] Cp. Wissenschaftsrat: Recommendations on Research Infrastructures in Humanities and Social Sciences, Cologne 2011, p. 77.

|[2] Projects of the Humanities or Social Sciences are usually decentralised and staff-intensive. The Council has therefore pronounced that the main criterion for inclusion in the roadmap process should consist of the "reliable forecast of structure-building and modifying effects of the proposed infrastructures" (cp. l.c.).

search. This condition may be met in cases whereby, in the absence of the respective infrastructure, a certain area of science in Germany cannot develop at a competitive level. In contrast to research infrastructures included in the ESFRI Roadmap |[3], infrastructures on the national roadmap do not necessarily have to be "unique" (at the global, European or even national level). Research infrastructures are, however, of national relevance if, for one, they are open to external use and a large proportion of scientists is expected to derive from research institutions other than the one running the research infrastructure |[4]. In many cases, the group of users has an international background. Secondly, research infrastructures of national relevance are usually expected to make an important contribution to the facilitation of top-level research in the respective research areas. Thirdly, the research infrastructure should be integrated into the training of the new generation of academics in an appropriate way. |[5]

Access to the research infrastructures should be controlled via scientific quality. External experts shall judge the quality of the various projects in the context of a science-driven, transparent process. In this, they will work together with the institutions running the projects.

In the medium-term, all research infrastructure projects that meet these criteria should be included in the national roadmap development process, irrespective of intended sponsoring and financing. This requires regular updating of the national roadmap. Projects submitted in earlier rounds of the roadmap process that have not yet been implemented may be revised and re-entered in the competition. The above-mentioned objectives of the roadmap process cannot be pursued in the long-term unless the process is repeated on a regular basis and all of the research infrastructure projects up for evaluation are included.

New projects and those that have not yet been implemented as well as extensive upgrades of existing large research infrastructures are eligible for inclusion in the roadmap. In either case, they must have an assessable draft and a cost estimate that is open to discussion. The subject of such a draft may either be the

|3 "They are facilities, resources or services of a unique nature that have been identified by pan-European research communities to conduct top-level activities in all fields." ESFRI Roadmap 2008, p. 10.

|4 For the purpose of this roadmap concept, institutions include both universities and non-university institutes or centres; according to this definition, "external use" would, for example, consist of use by members of a centre under the Helmholtz Association of National Research Centres other than the one running the project.

|5 The (replacement) procurement of a research ship in the "global" category with an investment volume in excess of EUR 100 million, for example, should also be included in roadmap consultations if several such ships already exist at the national, and particularly at the international, level and the ship is to be available not only to the (top 5 %) top-level scientists but also to all marine scientists within the framework of a quality-driven competition.

realisation of research infrastructures or, in the case of very large research infrastructure projects, the funding of preliminary studies resulting in prototypes. The development of a national roadmap represents an important step in a multi-level decision and quality management process. Where preliminary studies are funded as a first step, the final decision regarding the implementation of the respective research infrastructure cannot be taken before the results of the preliminary studies have been submitted. Such results are also used as a basis for reliable cost estimates in the case of very large research infrastructures.

C. Structure and content of the science-driven evaluation process

The science-driven evaluation of the projects is carried out in a process comprising four different dimensions (cp. section D.). Each project is evaluated individually in each separate dimension as well as in comparison to the other projects in all other areas of science and subsequently assigned to a ranking group. The main result of the evaluation process consists of a differentiated comparison of the projects in the individual dimensions of evaluation. This overall result forms one of the bases of the subsequent political decisions.

Table 1: Science-driven evaluation of projects

Projects	Dimensions of evaluation			
	Scientific potential	Utilization	Relevance to Germany as a location of science and research	Feasibility
Project A	****	**	***	****
Project B	**	***	****	***
Project C	***	*	**	*
Project D	***	****	****	***
...				

The above use of asterisks "**" to represent the different ranking groups is merely a suggestion that can be optimised once the number of ranks is known and the different weighting of the dimensions is taken into account. The aim

shall be to achieve straightforward comparability of the projects in the individual dimensions.

In addition, each project should receive a brief verbal evaluation and a recommendation for further action that takes account of the project's maturity and the urgency of its implementation. Analysis of strengths and weaknesses in the respective field of research must be included.

This evaluation is not intended to rank the drafts. On the contrary, the aim is to create a basis for prioritisation by the political decision-makers who, in turn, also take into account the results of the cost assessment.

The evaluation report published by the German Council of Science and Humanities should also contain a standardised brief description of each project.

D. The dimensions of evaluation of research infrastructure projects

All projects shall be compared and evaluated with respect to four separate dimensions. This comparison shall be based on an evaluation of each project according to a number of criteria taking into account the specific traditions prevailing in the respective research area. Evaluation of all projects according to uniform criteria shall create the conditions necessary for comparison across all different fields of research.

D.I SCIENTIFIC POTENTIAL

Within the context of the present state of the art in the respective field of research in which the planned infrastructure will be incorporated, evaluation of the potential of the respective infrastructure project must be based on both technical and interdisciplinary aspects. Specifically, the following questions must be answered across all projects in the context of comparative analysis:

_ Which central questions does the research infrastructure intend to address?

_ Who is likely to use the planned research infrastructure? Does the expected user group include sufficient numbers of researchers with significant research potential who are interested in using the new research infrastructure?

_ Does the project involve various fields of research? Which new scientific knowledge can be expected in the respective fields of research? What significance does this project have for the development – at the moment and on the long run – of the field(s) of research?

_ Which new fields of research could be made accessible through the planned research infrastructure? Is this the only possible approach to opening up such new areas?

_ To what degree does the planned research infrastructure promote the establishment of new interdisciplinary cooperations?

_ How wide is the range of potential modes of operations, can these change within the course of the lifetime of the infrastructure (multipurpose platform), or is it a specific infrastructure?

_ How relevant are the scientific-technological innovations that may arise from the planned research infrastructure?

_ Is the project outstanding or unique in comparison to existing or other planned research infrastructures? In case of an overlap, what is the additional benefit? Are synergies made use of?

_ If the project did not receive any support, would there be serious consequences for science? Are there any issues that can only be answered in the context of this infrastructure?

D.II UTILIZATION

Research infrastructures are used in many different ways. The various rules that apply to the use of such infrastructures have partly grown organically over time and partly been tailored specifically to the respective research infrastructure. In many cases, new research infrastructures bring user groups from other disciplines into play who would not otherwise have been approached and introduced to the new infrastructure. Given this background, the following questions arise:

_ What is the size and structure of the respective user groups (disciplinary and institutional origin, number of persons involved, perhaps differentiated by their intensity of utilization) that use, intend to use or will be able to use a new research infrastructure? Does the capacity of the planned infrastructure fit to the size of the expected user group?

_ How big is the percentage of international users? What motivation to use the research infrastructure project exists at the international level?

_ Does industry have an interest in the research infrastructure?

_ What impact will the planned research infrastructure have on the use of other already existing research infrastructures? Does the planned research infrastructure compete with an existing infrastructure or replace it?

_ Is it ensured that access to the planned research infrastructure primarily depends on the quality of the planned projects? Will access procedures vary for

users from different countries, different institutions or industry? If so, what are the additional access criteria aside from scientific quality?

_ How will the operation of the research infrastructure be financed? To what extent are the research institutions involved responsible for the operating costs? In cases where users will be required to pay user fees, how will access for top quality projects be ensured?

D.III RELEVANCE TO GERMANY AS A LOCATION OF SCIENCE AND RESEARCH

This dimension of evaluation relates to the relevance of the research infrastructure project to the future development, visibility and attractiveness of science in Germany. Specifically, the following questions must be answered:

_ To what extent does the planned research infrastructure contribute towards boosting the respective areas of science and scientific institutions in Germany in the context of international competition?

_ To what extent does the research infrastructure contribute towards the recruitment and training of the new generation of academics?

_ How does the research infrastructure support the universities' teaching responsibilities? Will it also be employed at undergraduate level? Why is its use necessary in teaching?

_ How does the planned research infrastructure support the medium- and long-term visibility and attractiveness of Germany as a location of science and research within the European and international context?

_ How does the planned research infrastructure fit into the whole field of research infrastructures in Germany, in Europe and world-wide? Does the research infrastructure project tie in with Germany's existing strengths and/or with existing complementary research structures? Which competing projects exist, what is the outlook for the planned project given this competition?

_ Does the use of the research infrastructure promise to deliver an answer to grand challenges that are of outstanding relevance to Germany? Have measures been arranged for the support or activation of the realization of concrete solutions?

_ In case of an international project: What position does Germany have (leading position/taking over important work packages)? Have the interests of Germany been adequately taken into account within the concept?

_ Are there any further arguments supporting the claim that the planned research infrastructure is of exceptional political significance?

D.IV FEASIBILITY

The feasibility of the project is assessed on the basis of both the technical requirements that primarily relate to the research infrastructure and are independent of location and the institutional and personnel requirements primarily relating to the hosting institution |[6]. The cost estimate will be effectuated by the institution in charge of this task.

IV.1 Technical requirements

_ Are there technical innovations necessary for the realization of the research infrastructure? How likely is the timely technical realisation of these innovations?

_ Have technical alternatives – also in respect of cost-benefit-aspects – been checked? Is the decision in favour of the selected technology well founded both in terms of scientific-technological considerations and with a view to the basic required funding?

_ Are preliminary studies necessary and, if so, have any detailed and realistic plans been developed?

_ If available, what are the results gained from completed preliminary studies?

IV.2 Institutional requirements

_ Are the hosting institution and the planned location suitable for the particular research infrastructure project? If the project is part of a research network or some other project-like research association, will this association outlast the existence of the project?

_ How does the new research infrastructure tie in with the long-term research strategies of the hosting institution? Does the hosting institution show a high level of commitment? How does this commitment show? Will an appropriate contribution be made to the financing of the project's establishment and its operating costs?

|[6] For the purpose of better readability, the singular form will be used in the following despite the fact that the implementation of research infrastructure projects may be shared by several institutions including universities and non-university scientific organisations.

_ Does the hosting institution have the required technological expertise as well as the respective service orientation?

_ Has a sound governance concept [7] been developed that may take different forms in different implementation phases?

_ Do any ethical and/or legal issues or environmental consequences need to be taken into account concerning the implementation of the project? How high is the risk of modification or abortion due to ethical, legal or environmental reasons? Have adequate methods been planned as to clarify these issues and to come to a decision?

_ Do any relations (membership, user agreements, or similar) with established major European research organisations exist, such as CERN?

IV.3 Personnel requirements

_ Does the hosting institution have sufficient maintenance staff in the scientific-technological field as well as specially qualified scientists? If not, have concepts for the recruitment been developed?

_ How will the new generation of academics be recruited and trained? Do any concepts exist? Do any cooperations with (further) universities exist?

_ How does the hosting institution ensure sufficient diversity (diversity management) in recruiting (scientific) staff and young scientists?

[7] In the context of research infrastructure drafts, governance refers to regulatory structures that coordinate and control interaction between players in the preparation of research infrastructure drafts and/or the implementation of projects.

E. Organisation and procedure

E.I COMPOSITION OF THE COMMITTEE ON "SCIENCE-DRIVEN EVALUATION OF LARGE-SCALE RESEARCH INFRASTRUCTURE PROJECTS FOR A NATIONAL ROADMAP (PILOT PHASE)"

The committee on "science driven evaluation of large research infrastructure projects for a national roadmap (pilot phase)" is primarily responsible for the entire procedure. Achievement of the two central objectives of the roadmap process as mentioned in section A. depends on comparison of research infrastructure projects according to uniform evaluation criteria across all areas of science. The committee should therefore include representatives from all major areas of science. As a minimum, a distinction shall be made between the following areas of science:

_ engineering and natural sciences

_ environmental sciences

_ biological and medical sciences

_ humanities, social sciences, law and economic sciences

_ IT infrastructures.

Each area of science will be represented by three high-ranking scientists with international experience who derive from different disciplines. |[8] The staffing of the committee is open to the public. Due to the limited capacities of the committee, some disciplines will not be represented. A representative of the in-

|[8] In the context of the pilot process, less than three scientists should be sufficient for the areas of science that do not have any research infrastructure projects within the area of responsibility of the BMBF in the pilot phase.

stitution in charge of the cost assessment may attend committee meetings as a guest.

E.II ORGANISATION OF THE PROCESS

_ In preparation of the committee's comparative analysis across all scientific fields, the individual projects are subjected to an assessment in each of the four different dimensions based on specific criteria. For this purpose, three international reviewers will prepare written appraisals (specialists' votes) which will be summarised and presented by a expert member of the committee (rapporteur).

_ The specialists' votes will be discussed with the committee (joint consultation taking into account more detailed information on comparable research infrastructures).

_ The scientists responsible for the research infrastructure projects are given an opportunity to present the draft to the committee and answer questions submitted by the members (presentation and discussion of the draft with those in charge).

_ Subsequent to this discussion, in the context of an internal consultation, the committee prepares a qualitative individual evaluation as a first step. On the basis of all individual evaluations, the committee prepares a comparative evaluation (in terms of the "asterisks" in table 1) that leads to the establishment of ranking groups in the four different dimensions of evaluation.

_ As a last step in the internal consultation process, the committee members discuss the contents of the evaluation report (comparative overall evaluation).

E.III PROCEDURE

The tasks required to develop an evaluation in the context of the roadmap process can be summarised in five work packages. The processing of these work packages may overlap in some cases (cp. section F. Time schedule):

1 – Preparation of the process

Staffing of the committee; development, consultation and approval of the guideline for the evaluation of research infrastructure drafts, the criteria and the evaluation procedure by the committee; creation of short presentations of the projects by the Head Office of the German Council of Science and Humanities.

2 – Supplementary investigations (concomitant/overlapping)

Analysis of databases and enquiry about competing and complementary research infrastructures / projects, inter alia via a survey of experts (e.g. at alliance organisations, project management institutions, national contact offices, international science organisations, specialised departments of the BMBF) as well as procurement and analysis of various data to facilitate an assessment of the strengths and weaknesses of the relevant fields of research in Germany by the Head Office.

3 – Evaluation of individual projects

Receipt of the drafts by the BMBF; recruitment of experts for external appraisals by the Head Office; preparation of individual evaluations and compilation of evaluations by the Head Office and rapporteurs of the committee; presentation and discussion of the drafts with the responsible scientists in the committee context involving external reviewers; committee's preparation and consultation regarding the qualitative evaluation of the individual projects according to the agreed criteria.

4 – Preparation of the evaluation report

Comparison of all individual projects and their evaluation results, establishment of ranking groups in the four dimensions of evaluation, discussion of recommendations regarding individual projects and establishment of the core statements of the evaluation report in the committee context; preparation of the evaluation report by the Head Office.

5 – Approval of the evaluation report

The committee will approve the evaluation report and submit it to the Council for purposes of information and publication.

In order to guarantee a speedy process and uniform treatment of all projects, the drafts should be presented successively in a session lasting two to three days. Even assuming each presentation lasts no more than 30 minutes plus 15 minutes of internal consultation, a maximum of 12 research infrastructure drafts can be presented. Should the number of drafts substantially exceed this figure, or should other reasons require a preliminary discussion of selected drafts, the committee should be entitled to establish working groups for individual cases that prepare preliminary evaluations of research infrastructure drafts in areas of science that have provided a large number of drafts and discuss such projects with the responsible scientists.

The Head Office will establish a dedicated project group to oversee the process. This project group shall organise the process, coordinate the exchange of information with the responsible scientists, alliance organisations, specialist de-

partments of the BMBF, project management institutions and international experts, undertake the necessary investigations and prepare the draft texts as well as the publication of the consultation results.

According to the plan, the committee will require four meetings in the pilot phase: In the first meeting, the guideline for the draft development, the list of criteria and the further procedural steps will be approved. In the second meeting, which will last at least two days, all projects will be reviewed and those in charge of them will be granted an opportunity to present their drafts. On the basis of the submitted scientific appraisals and the discussion with the responsible scientists, the committee may agree on preliminary evaluations of the individual projects. The third committee meeting serves to revise and approve the individual evaluations and the comparative evaluation and should result in a preliminary agreement on a report. On the basis of this preliminary agreement, the Head Office prepares a final report which will be discussed and approved in the fourth meeting. At least, this will be the procedure in the pilot phase.

The experiences gained in the course of the research facilities procedure have shown that once the procedure is well-established, the committee may find agreement on the content of the evaluation results in just one session (which may last several days), allowing them to approve the report in the context of a written consent procedure. However, to ensure acceptance of the procedure, a further meeting should necessarily be provided for when the procedure is first implemented.

Upon conclusion of the pilot phase, the experiences gained in the newly developed procedure should be assessed in the context of the final meeting. The detailed organisation of the long-term procedure should be decided soon thereafter to create a solid basis for planning in German science.

F. Time schedule

In order to ensure that the national roadmap is ready in time for the government's budgeting process in spring, the evaluation report should be completed in November of the preceding year, submitted to the Council and subsequently published. The following rough schedule results, presented here for the pilot phase 2011/2012:

Pilot phase
(= first round of consultations on up to 12 research infrastructure drafts):

Phase	Date/period	Process
Preparation phase	July 2011	Inclusion in the work schedule; Forwarding of the list of relevant projects
	August-September 2011	Staffing of the committee; Preparation of the guideline for the evaluation of research infrastructure drafts; Preparation of the meeting
	October 2011	Discussion and approval of the guideline, criteria and evaluation procedure
	End of October 2011	Forwarding of the results relating to guideline and evaluation procedure to the responsible scientists
	November-December 2011	Enquiry about complementary and competing research infrastructure projects; Search for data for analysis of strengths and weaknesses

Individual evaluations and preparation of an evaluation report for the national roadmap	10 January 2012	Deadline for receipt of final research infrastructure drafts
	January 2012	Formal preliminary review and consistency check
	January – February 2012	Recruitment of reviewers (for written votes)
	March – April 2012	Preparation of external expert appraisals (suggested evaluation); Assessment of the drafts, compilation of experts' suggested evaluations
	April 2012	Presentation of research infrastructure drafts and discussion of the drafts; Initial consultations regarding evaluation
	May – June 2012	Preliminary project-based individual evaluations
	Start of July 2012	Comparison of all individual evaluations, consultation on comparative evaluation, where appropriate recommendations regarding individual projects
	July – mid-September 2012	Draft evaluation report
	Start of September 2012	Consultation on evaluation report
	September–October 2012	Revision of evaluation report
Approval of the evaluation report	October-November 2012	Approval using written consent procedure
	January 2013	Submission of evaluation report in Council meetings (for the Council's information)
Publication of the evaluation report	Subsequent to the Council meetings	Presentation of the evaluation report / the national roadmap (Council press conference or joint BMBF/Council press conference)
		Assessment of the pilot phase and, where necessary, clarification of unresolved issues relating to the procedure
	Spring 2013	Public discussion (in the context of the national roadmap)

G. Basic information

Essentially, evaluation of the research infrastructure projects will be based on the documents submitted for the research infrastructure draft as well as the draft presentation and the subsequent discussion with the responsible scientists. A pattern shall be developed for the submission of documents to ensure that projects can be compared and all criteria-related questions can be answered. There will be an upper limit to the length of the research infrastructure drafts and the types of admissible appendices will be defined.

A detailed cost schedule and a financing concept including both investment and operating/decommissioning costs will also be required. These documents shall be submitted to the committee for information and subsequently for assessment to the cost assessment office charged by the BMBF.

Each concept shall specify the name of a contact person who will answer any questions the Head Office, rapporteur or cost assessor may have. All documents shall be assessed for formal completeness and accuracy. Drafts that cannot be evaluated may be returned to the project coordinators. Projects may not enter the actual roadmap procedure before this assessment has been completed.

Additional information is required to validate the information provided by the responsible scientists and to place the drafts in the national and international context:

_ Information regarding **existing and planned research infrastructures** at the national, European and international level: The BMBF is the primary contact for the national overview; however, requests for information may also be submitted to further organisations. At the European level, the European research infrastructure database (riportal.eu) can be accessed. However, since the database is not complete, not completely up-to-date and limited to the EU, separate research is required in the case of large-scale projects intended for international use. Altogether, there must be an effective exchange of information with the alliance organisations, specialised departments of the BMBF, project management organisations and national and international scientific organisations.

_ Information regarding the **strengths and weaknesses of the German research landscape**: In order to assess the strategic relevance of a research infrastructure project to Germany, it is important to analyse the strengths and weaknesses of the German research landscape. Aside from the experience gained by the committee members, further data can be researched. It should be checked whether purchase of the "National Science Indicators" product by ThomsonReuters or a competing product by Elsevier is a cost-efficient way of carrying out in-house data analysis.

_ Depending on the respective target user group, the expected national **utilization** of a research infrastructure is contingent, among other factors, on the number of researchers in a particular field of research, subject area or subject. It may be necessary to order and analyse special overviews from the Federal Statistical Office in order to arrive at a sound assessment. Usage data from existing research infrastructures should also be collected and analysed.

Throughout the procedure, the Head Office shall carry out data enquiries and analysis in such a manner that the results can be integrated in the evaluation of the research infrastructure projects. The establishment and maintenance of the necessary databases requires sufficient processing capacities.

Appendix: Guideline for the assessment of drafts of research infrastructures within the proceedings for the preparation of a national roadmap

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Guideline for the Assessment of Drafts of Research Infrastructures within the Proceedings for the Preparation of a National Roadmap

CONTENT

PRELIMINARY REMARK

A national roadmap of large research infrastructures should be established within the course of a process, which includes the science-driven evaluation of the projects, their financial analysis and a political prioritization of the projects. This evaluation will initially be realised in form of a pilot phase dealing with research infrastructures that lie within the area of responsibility of the Federal Ministry of Education and Research. The German Federal Government has asked the German Council of Science and Humanities to subject the research infrastructure projects to a science-driven evaluation. All projects will be evaluated and compared with each other via four separately outlined dimensions. At the same time the financial concept will be examined. The Institute for Innovation and Technology within VDI/VDE Innovation + Technik GmbH will undertake this on behalf of the Federal Ministry of Education and Research. Based upon these results the Federal Ministry of Education and Research will set up a national roadmap.

The establishment of a national roadmap takes place within a multi-level quality management process. Participating in the assessment does not automatically imply that the research infrastructure will be accepted for the planned roadmap of the Federal Ministry of Education and Research. Only those projects that will be assessed positively and their funding for the phase mentioned in the draft is solid will be accepted. A periodical update of the national roadmap is planned and will be based upon the latest respective results.

INSTRUCTIONS

Drafts for the assessment of research infrastructure projects within the framework of establishing a national roadmap need to be written in **English and German** and handed in by the 10th of January 2012 at the latest. Write the draft in the following format: font Arial 11 pt, line spacing 1,5 lines; 3 cm margin. The German version of the draft must not exceed 50 Din-A4-pages (without cover page, list of contents and appendix; including the questions). Any appendices have to be submitted in English and may additionally be provided in German.

Please provide a paper and an electronic version (documents in doc-format and in pdf-format |[1] on a CD-ROM). Please send

- 5 German copies as well as 1 CD-ROM (English and German) to VDI/VDE Innovation + Technik GmbH, Head Office FIS, Steinplatz 1,
  10623 Berlin, Germany, E-Mail: geschaeftsstelleFIS@vdivde-it.de, and

- 40 English copies, 10 German copies each with a CD-ROM (English and German) to the Head Office of the German Council of Science and Humanities, Brohler Straße 11, 50968 Cologne, Germany.

The German version is the binding draft. **The date on which the draft arrives at the Head Office FIS is the decisive date of receipt.** With her/his signature the sender confirms that the German and the English documents as well as the duplications have the same content.

Please do not use any password protection or access restrictions on reading, copying or printing for the pdf-files. **The draft has to correspond with the structure as listed below.** Detailed information about essential questions is specified beneath each caption. We recommend using the file (WORD-document) provided by the Head Office.

Please use a language that also experts of other scientific disciplines can understand. Especially avoid using abbreviations and acronyms, which are only used within specific scientific communities.

If you want to state any bibliographical references or references to relevant documents or sources, you may also insert a link.

| [1] Pdf-documents should be compatible with Adobe Acrobat 9.

The Federal Ministry of Education and Research has commissioned the VDI/VDE Innovation + Technik GmbH to coordinate the whole proceedings. For any advice please contact Dr. Wolfgang Domröse (VDI/VDE Innovation + Technik GmbH, E-Mail: wolfgang.domroese@vdivde-it.de; Phone: +49 30 310078-489). The science-driven evaluation will be undertaken by the German Council of Science and Humanities.

Guideline for completing the draft of the research infrastructure

„Title“ <in German>

Acronym <in German>

„Title“ <in English>

Acronym <in English>

Institution in overall charge: (Name)
Responsible scientist: (Title first name last name)
Contact person: (Title first name last name)

Address:
Tel.:
Fax:
E-Mail:
Homepage:
Place, Date

_____
Name, signature

If applicable further institutions in overall charge: (Name/s)
Responsible scientist: (Title first name last name)

Address:
Tel.:
Fax:
E-Mail:
Homepage:
Place, Date

_____
Name, signature

Please add links to relevant web pages!

I. BASIC INFORMATION ON THE RESEARCH INFRASTRUCTURE PROJECT

1 − Please describe the planned new research infrastructure or the planned extension of the research infrastructure and its relevance for the affected scientific or technical field on a national, European and global level (max. 2 pages).

2 − If applicable, please name further cooperating institutions and add each of the on-site responsible scientists and contact persons.

II. DIMENSIONS OF EVALUATION

If possible and useful, please reinforce your information on the four dimensions of evaluation (scientific potential, utilization, relevance for Germany as a location of science and research, feasibility) also with quantitative data.

1 − Scientific potential

1.1 What is the significance of the research infrastructure? Which issues of the relevant field(s) of research can be addressed via the research infrastructure? Which new fields of research could be made accessible through the planned research infrastructure? Which alternative ways have been explored to scientifically work on these research questions or fields of research? Please answer these questions with a short report against the background of the present state of research.

1.2 For which field(s) of research is the research infrastructure of relevance? What significance does this project have for the development – at the moment and on the long run – of the field(s) of research? What would the consequences for the field(s) of research be if the research infrastructure was not supported?

1.3 Which scientific and technological innovations are expected of the research infrastructure? Will new cooperations be supported within and beyond the discipline due to the planned research infrastructure?

1.4 Which possible modes of operations will be opened up by the planned research infrastructure? Can these change within the course of the lifetime of the infrastructure (*multipurpose platform*), or is it a specific infrastructure?

1.5 What are the differences between the planned and other existing or planned research infrastructures? Please specify competing and complementary research infrastructures from all over the world in the appendix. In case of an overlap, what is the additional benefit? Are synergies made use of?

2 − Utilization

2.1 Who will use the planned research infrastructure? Please define the size of the user groups, their disciplinary and institutional origin, preferably differentiated by their intensity of utilization. Does the capacity of the planned infrastructure fit to the size of the expected user group? Are new user groups supposed to be attracted by the new research infrastructure? Do concrete expressions of interest of institutions exist? How big is the percentage of international users? Why is the international community of users interested in the research infrastructure? Are companies interested in the research infrastructure?

2.2 What impact will the planned research infrastructure have on the use of other already existing research infrastructures?

2.3 How will the access to the planned research infrastructure be organised? The choice of research projects respectively the authorised people is based on which criteria? Will access procedures vary for users from different countries or institutions? Will the operating of the research infrastructure be co-financed via user fees?

2.4 Which expertise is required for the utilization of the planned research infrastructure? How will it be ensured that users actually have this expertise?

3 – Relevance for Germany as a location of science and research

3.1 Does the planned research infrastructure follow up on the strengths of Germany's research or does it compensate a weakness? In what respect does it strengthen Germany's research? How does the planned research infrastructure support the medium- and long-term visibility and attractiveness of Germany as a location of science and research within the European and international context, especially with the new generation of academics in mind?

3.2 For which German scientific institutions (universities/non-university research institutes) is the planned research infrastructure of importance? Which role does the research infrastructure play especially for the training of the new generation of academics?

3.3 How does the planned research infrastructure fit into the whole field of research infrastructures in Germany, in Europe and world-wide? How is it related to existing German research infrastructures that are competing or complementary? Please add a list of competing and complementary research infrastructures of the field from around the world which already exist or are planned in the appendix. How have the preparation, construction and operation of these research infrastructures been coordinated with the institutions?

3.4 How can the research infrastructure help Germany address the grand challenges? Have measures been arranged for the support or activation of the realization of concrete solutions?

3.5 In case of an international project: What position does Germany have (leading position/taking over important work packages)? Have the interests of Germany been adequately taken into account within the concept?

3.6 Where does the exceptional political significance of the planned research infrastructure for the German science and research landscape additionally lie?

4 – Feasibility

Technical requirements

4.1 Are there technical innovations necessary for the realization of the research infrastructure? Which steps are planned for these?

4.2 Have technical alternatives – also in respect of cost-benefit-aspects – been checked? (Justification required not only in terms of the general financing but also from a technological point of view)

4.3 Are preliminary studies necessary? If this is the case, are these already scheduled or planned? (For completed preliminary studies cf. III.1.2)

4.4 Are there special requirements for e-infrastructures? If so, which plans exist for the provision of it and how is it embedded into the national and European landscape of e-infrastructures?

Institutional requirements

4.5 Why is the hosting institution interested in becoming the headquarters of the planned research infrastructure project? How is the new research infrastructure integrated into the long-term strategy of the hosting institution (and the cooperating institutions)? How will the hosting institution get involved (including the financial support)?

4.6 If the project is part of a research network or some other project-like research association: How is it guaranteed that the project outlasts the existence of the association?

4.7 What kinds of scientific expertise already exist within the hosting institution regarding the field(s) of research that is/are related to the research infrastructure?

Please quote five relevant publications of scientists of your institution of the last five years.

4.8 Which technological expertise is necessary for the preparation, construction and operation of the research infrastructure? Which skills do the involved have? (For maintenance staff cf. 4.11).

4.9 Which concepts of governance – if applicable also for different implementation phases – have been developed?

4.10 In case of a totally new construction will existing facilities of the hosting institution be abandoned? To what extent could costs be reduced?

4.11 Do any ethical and/or legal issues need to be taken into account concerning the construction, operation and decommissioning of the project? Any environmental consequences? How high is the risk of modification or abortion due to ethical, legal or environmental reasons? What method has been planned as to clarify the issue at an early stage and to come to a decision?

Personnel requirements

4.12 Which personnel capacities in the scientific and technological (maintenance staff) area do the involved have? If these are not sufficient for the preparation and respectively the operation, what concepts for the recruitment have been developed?

4.13 How will you recruit and train the new generation of academics? Do any concepts exist? Do any cooperations with (further) universities exist?

III. LEVEL OF REALIZATION

1 – Project status

1.1 Which level of realization has the project reached? Please add a detailed work breakdown structure in the appendix.

1.2 What kind of preliminary studies already exist? If there are any, how should the results of the preliminary studies be assessed? Please add the results to the appendix.

2 – Level of negotiation

2.1 Are there any expressions of interest or commitments of further hosting institutions?

2.2 Are there any expressions of interest or commitments of financiers (organisations, companies, nations)? Please add the corresponding documents (e.g. Letters of Intent; Memorandum of Understanding etc.).

3 – Time schedule

Please specify the precise schedule with all the possible starting points, the duration of the preparatory phase with the duration of preliminary studies as well as the duration of the construction, operation and decommissioning phases of the research infrastructure. Please enclose your schedule for the whole process of the realization and of the operation of the research infrastructure in the appendix.

4 – Financial concept

4.1 Please tabulate an estimation of the expenses (quantity structure) necessary for the realization of the planned research infrastructure. Please detail them as follows:

Investments:

_ Construction/ Building
_ Acquisition of real estate
_ Special technical equipment
_ Supply / construction of devices and equipment

Operating costs

_ Personnel costs
_ Material costs (also membership fees or other payment of contributions to organisations)
_ Other noteworthy investments (replacement purchases) required for keeping the infrastructure and equipment on an adequate level, reflecting the state-of-the-art

4.2 Please tabulate the expenses for the realization of the research infrastructure (investment costs) on the basis of the time schedule (annual tranches). In doing so please also present the operating costs for the first five years after the completion of the construction phase. Please also consider the additional noteworthy investments or replacement purchases during the planned/estimated life expectancy.

4.3 If costs have already been estimated, please also tabulate these estimations. Please specify the basis of the cost estimate (add the corresponding documents).

4.4 Please outline a table of required public funding for the research infrastructure (in annual tranches). How many own financial resources will the hosting institution supply? How many third party funds are expected (please add the corresponding documents, q. v. above III. 2.2)? What is the expected amount of user fees (science and economy)? Please also list potential financial risks.