

**BrightnESS<sup>2</sup>**

**Bringing Together a Neutron Ecosystem for Sustainable Science with ESS**

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**Handbook of Lessons Learnt from In-Kind Contributions**



## 1. Project Deliverable Information Sheet

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### 3. List of Abbreviations and Acronyms

ACCSYS	ACCelerator SYStems
BMBF	BundesMinisterium für Bildung und Forschung (German Federal Ministry of Education and Research)
BP	Best Practice
BP&LL	Best Practice & Lessons Learnt
BSBF	Big Science Business Forum
CBV	Cost Book Value
CDTI	Centro para el Desarrollo Tecnológico Industrial (Centre for the Development of Industrial Technology – Spain)
CNR	Consiglio Nazionale delle Ricerche
COVID-19	COrona Virus Disease 2019
DMSC	Data Management and Software Centre
EAC	Estimate At Completion
EC	European Commission
Eoi	Expression of Interest
ERIC	European Research Infrastructure Consortium
ESS	European Spallation Source ERIC
FAT	Factory Acceptance Test
FC	Field Coordinator
FZJ	ForschungsZentrum Jülich
HoA	Head of Agreements
HZH	Helmholtz-Zentrum Hereon (formerly HGZ)
IK	In-Kind
IKC	In-Kind Contribution
IKCA	In-Kind Contribution Agreement
IKCF	In-Kind Central Function
IKFC	In-Kind Field Coordinator
IKRC	In-Kind Review Committee



ILO	Industrial Liaison Office
INFN	Istituto Nazionale di Fisica Nucleare
ISO	International Organisation for Standardization
JCNS	Jülich Centre for Neutron Science
PAC	Project Advisory Committee
PDF	Portable Document Format
PMO	Project Management Office
PO	Programme Office
PoC	Point of Contact
PSI	Paul Scherrer Institute
SAT	Site Acceptance Test
SoW	Scope of Work
STFC	Science and Technology Facilities Council
TA	Technical Annex
TUM	Technische Universität München
VAT	Value Added Tax
UK	United Kingdom
WP	Work Package
WPM	Work Package Manager
XRM+	eXternal Relations Management (plus)



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## 5. Executive Summary

The European Spallation Source ERIC is one of the largest science endeavours and technology infrastructure projects in the first quarter of the 21<sup>st</sup> century.

The facility design and construction include the most powerful linear proton accelerator ever built, a five-tonne, helium-cooled tungsten target wheel, state-of-the-art neutron instruments, a suite of laboratories, and a supercomputing data management and software development centre. In the context of its history and future as a scientific organisation, however, it is more than the sum of its parts. It is a brand-new Big Science Organisation and a very first brick-and-mortar research facility to assume the ERIC legal form.

Europe's need for an advanced, high-power neutron spallation source was articulated at the beginning of years 2000. The European Spallation Source was envisaged as a-European project, with 13 European nations as members, including the host nations Sweden and Denmark. The ESS facility is located in Lund, while the ESS Data Management and Software Centre (DMSC) is located in Copenhagen.

As a full green field project, ESS needed the support and the knowledge of many Research Institutions, Universities and Laboratories across Europe and worldwide.

These Partner Laboratories, Universities and Research Institutes also contributed human resources, knowledge, equipment, and financial support through In-Kind Contributions that will comprise up to 30% of the construction budget.

Adopting an In-Kind model for a green-field Project of such complexity and size was a calculated risk by the participants. Many factors concurred to ensure its success, including the support given to the In-Kind Contribution Management by the BrightnESS and BrightnESS<sup>2</sup> European Grants, specifically with the creation of the network of regional Hubs and Field Coordinators.

Managing In-Kind Contributions was a rich and complex set of activities, spanning from the initial involvement of potential Partners to a long-lasting contractual phase, to increasing a support to the Project Office, the Technical Divisions and the IK Partners. The implementation phase led to the installation and commissioning of all the high-tech equipment for the accelerator, the target, the neutron instruments and control systems.

The evolution of IK Management in almost ten years of the realization of ESS is a story of trials and errors, building a tremendous amount of organizational knowledge, that can be represented in a series of Best Practices and Lessons Learnt, which form the subject of this Report, and refer to bright examples of organizational learning curve.

The sections that follow the general Introduction (section 6), briefly recall the status of In-Kind Contributions and Organisation at ESS (section 7), and review the support given to In-Kind Contributions by the BrightnESS and BrightnESS<sup>2</sup> Grants (section 8).

A number of Best Practices and Lesson Learnt are then addressed as separate sub-sections of section 9. Each sub-section is described independently, in such a way that the Reader may address those of her/his interest without necessarily having to go through the rest of the document.

Topics addressed in Section 9 are as follows:

1. Ensure an appropriate delivery and acceptance process is adopted, communicated and agreed early in the Project;
2. Developments of industry capability and capacity for supplying Big Science Projects;
3. Changes of requirements after signature of technical annexes;

4. Participation/involvement of In-Kind Management Representatives in the Sub-Project activities and specifically in Technical Meetings;
5. Collection of information from In-Kind Partners on the real schedule of IK Contributions;
6. Establishment of project and programme management offices for the coordination of in-kind contributions to ESS;
7. Central support to Partners for tax and tariff management (specifically for VAT);
8. Central host organization management and support for host country specific matters, regulations and interpretations;
9. Early definition and confirmation of appropriate installation plans and site access plans;
10. In-Kind Stakeholders management;
11. Legal and fiscal implications on secondment of In-Kind personnel;
12. Involvement of the In-Kind management function in the supervision of the IK contribution supply chain.

The topics presented cover a wide range of aspects. That notwithstanding, this Handbook must be considered as a work in progress document, in the sense that more BP&LLs with respect to those described in the following sections can be further elaborated and expanded.

The relevant work is expected to result in an updated version of this document, which will cover a wider range of Best Practices and Lessons Learnt, to be released by the end of the BrightnESS<sup>2</sup> grant in December 2021.

## 6. Introduction

This Report (Deliverable 3.4) is released six months in advance of the end of BrightnESS<sup>2</sup> project, in the frame of Work Package 3 “In-Kind Contribution Management”, after a challenging period during 2020 and 2021 for the ESS Project, owing to the combination of internal and external factors, with particular reference to the outbreak of the COVID-19 pandemic.

As presented in some details in next section, at the time of the release of this report, the ESS Project is well advanced and the site has taken its final shape, as can be seen in the following Figure 1.



Figure 1: Aerial view of the status of the ESS Site in Lund in June 2021

Most of the buildings have been handed over from the construction company to ESS and the installation of high-tech equipment is proceeding at a positive pace, notwithstanding the drawbacks caused by the COVID pandemic and the consequent restrictions, in Sweden and in the rest of Europe.

Of course, the most challenging and exciting phases are still in front of the Project, with the assembly and commissioning of the most powerful proton accelerator ever built worldwide, the operation of the target system which employs the rotating wheel technology, never used before, the instruments which must be able to manage and use an unprecedented flux of neutrons.

The construction of the ESS neutron source occurs when many nuclear research reactors in Europe have come (or are coming) to the end of their technical life span. It is harder to win acceptance for building new research reactors at universities that often are in or close to big cities. The scientists who primarily use neutrons for research are looking for new neutron sources to replace the research reactors. When in full operation, the European Spallation Source will support the experimental activities of more than 3000 scientists. Not all these people will need to come to Lund for every experiment, some might choose to follow the experiment remotely and get their data over the grid from the ESS computer center in Copenhagen. In any case the neutrons and the instruments in which measurements are performed, as well as the sample preparation and handling labs will all be at the ESS site.

Hence, the ESS site in Lund will inexorably become a center of excellence for neutron science in the next decades, both at the European and at the international level. In such a context, it will be of paramount importance to manage in the most efficient and effective way firstly the transition between the construction and the operation phase, then the functioning of ESS as a first-class User Facility.

To learn from experience and from mistakes is part of the growth of any organization and the basics for implementing policies of continuous improvement. This report demonstrates that ESS went along an impressive learning curve.

Documenting lessons learnt are an important asset in strengthening organizational knowledge. Hence the realization of this Handbook, which represents at the same time a Deliverable in the frame of BrightnESS<sup>2</sup> Grant, a source of information for present and future improvements of the ESS organization, and a reference for other Research Institutions which use or will plan to use in future the In-Kind Contribution model.

## 7. Status of In-Kind Contributions and Organisation at ESS

The ESS Project was fully in the construction and installation phase by the end of 2018. By mid 2021 the construction of the buildings was completed, and most already handed over from the SEC construction company to ESS. Realization, delivery, installation and commissioning of high-tech equipment for the Accelerator and the Target systems were steadily increasing, while the development of neutron instruments entered the detailed design level, mainly at the Partner Institutions.

On the other hand, even if a small number of potential Technical Annexes were still in the “planned” status, for pending IK Contributions of approximately 22 M€, the work on contractual issues was progressively reducing.

in October 2019 an important reorganisation of the ESS managerial structure occurred. Further to that, a clearer picture of the overall “In-Kind System” at ESS was developed, showing roles and interactions between the different organisational functions involved. The management of the administrative, legal and “political” aspects of In-Kind Contributions were referred to as “In-Kind Framework Management”.



That was in tandem with the “In-Kind Supply Chain Management”, responsible for overseeing the activities necessary to assure that all the equipment and services supplied as In-Kind Contributions (IKC) met the required specifications, were delivered according to the necessary schedule and within the defined budget. The In-Kind Framework was responsibility of the Strategy Directorate, acting through the In-Kind Framework Management Group, while the In-Kind Supply Chain was responsibility of the Project Directorate, and namely of the Project In-Kind Coordinator.

There was just the time to put in place all that in the last part of 2019 and beginning of 2020, that the COVID-19 pandemic came into play. As the situation evolved during the year, it became more and more evident that the pandemic would have affected in an important way the Project schedule in general, and the In-Kind Contributions in particular. If the need to move the attention from the contractual phase to the realization and delivery phase was already clear in 2019 and actually was at the basis of the re-organisation of IK Management, effective October 2019, it became evident the need to deploy a much more “aggressive” approach to IK Management performance aspects in order to contain the effects of the pandemic on the IK Contributions. The discussion on this started in late Spring 2020 with considerations and recommendations coming from the Project Advisory Committee (PAC) and from independent third-party evaluations of the Project Status.

The consequence was an internal analysis of the possible further evolutions of the organisation of IK Management at ESS, and namely of the opportunity to bring together all responsibilities, authorities and competences of In-Kind Management in a single organisational structure.

The result of such analysis and discussion was, just before the end of the year 2020, the decision of the ESS Director General to establish a new “Associate Directorate for In-Kind Management”. The new organisational structure was aimed at bringing together all people and competences on IK formerly belonging to the Project and Strategy Directorates. This second re-organisation was presented at the beginning of December 2020 to the ESS Council, which strongly supported it, and became formally operational on January 1<sup>st</sup>, 2021.

As a further re-focusing of attention on In-Kind Contributions, a discussion started about the mission and operation of the In-Kind Review Committee (IKRC), in the construction and start of operations phases of the European Spallation Source. It was decided that the IKRC would be re-focused to consider IK performance issues – both at ESS and the IK Partners – as well as the necessary administrative functions.

## 8. Short review of In-Kind Contributions in BrightnESS and BrightnESS<sup>2</sup> Projects

BrightnESS and BrightnESS<sup>2</sup> ran from September 2015 up to now, i.e. in the most challenging years of the ESS Project, granting an invaluable support to the set-up and management of all processes relevant to In-Kind Contributions.

The establishment and the evolution of Regional Hubs under Work Package 2 in BrightnESS fostered stronger collaboration across ESS Member States. Field Coordinators, who were positioned in various Regional Hubs, quickly started creating best practice models for managing In-Kind Contributions within their respective Hubs. Strong communication channels paved a way for sharing these models, which in turn expedited the finalization of IK contract and specifically of Technical Annexes (TA - technical schedules attached to the general In-Kind Contribution Agreements).

The results of BrightnESS became quickly apparent as the number of signed TAs began to rise, and, by the end of the first BrightnESS project, ESS had signed more than 100 Technical Annexes with Partner Institutions from across Europe. To put these numbers into perspective, at the time of BrightnESS Project inception, ESS had in place only a few Technical Annexes signed, a number of Heads of



Agreements, legally non-binding documents defining the scope of works, and only one In-Kind Contribution Agreement finalized.

By mid 2021 ESS had allocated 575 M€ of overall planned IK Contributions, distributed as follows:

- 542 M€ of running IK Projects;
- 11 M€ of completed Projects and accredited by the ESS Council;
- 22 M€ of Contributions still in the negotiation phase.

All this has been achieved through 170 signed Technical Annexes, 40 Collaboration Agreements and Direct Contracts with Institutes from Host Countries. Even more importantly, the laboratories and advanced technology workshops of over 40 IKC Partners around Europe, which formed the backbone of the IK network, were well into the realization of the technical equipment and the neutron instruments needed to complete the facility.

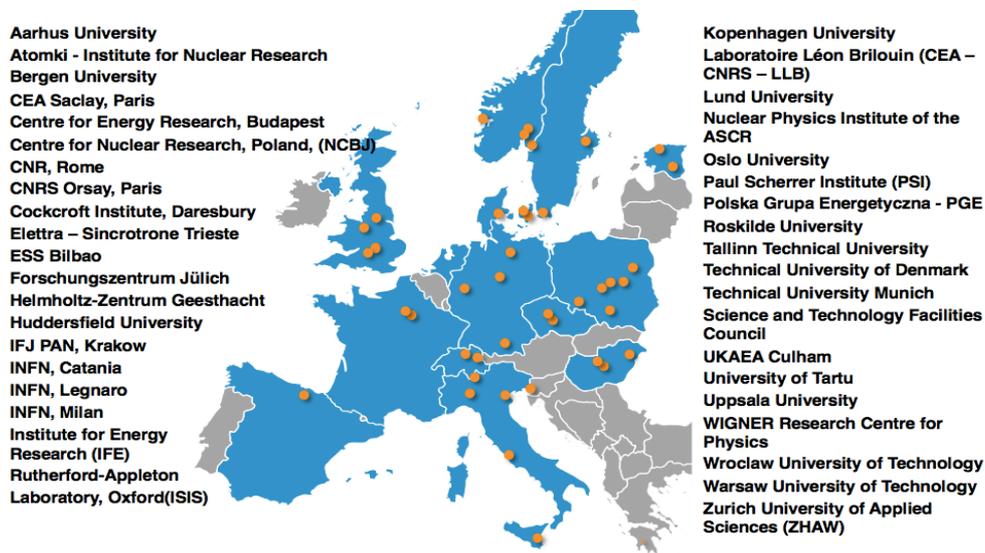


Figure 2: ESS Partner Institutions across Europe

In-Kind Contributions were originally, and continued to be, identified as one of the key factors for technological prowess of ESS, but at the same time one of the major challenges. Building a Research Infrastructure at this scale on a greenfield site could not be achieved without the knowledge and capabilities of other laboratories. The considerable support provided by the European Commission through the BrightnESS and BrightnESS<sup>2</sup> grants to address and mitigate the connected risks has been invaluable. The success and achievements of ESS' IK system only came about because of the foundation work facilitated by BrightnESS first, and BrightnESS<sup>2</sup> afterwards. These grants provided a full range of support measures from training, best practice identification and the development of specific tools, to the creation of specific networks to empower and deliver the system.

It is worth noting that the ESS Cost Book did not foresee any specific budget for IKC Management or any budget to cover VAT, as it was anticipated that a facility within the ERIC framework would be exempt, a point that turned out to be much more complicated than initially assumed and expected. So, the support provided by the EC in the years through BrightnESS and BrightnESS<sup>2</sup>, was definitely of great value for the management of IKC. This additional funding was also a mandate to share ESS experience and best practice matured on IKC with the community and resulted in this Deliverable 3.4 “Lessons learnt from IKC on ESS”.

The network of Regional Hubs was invaluable as a sharing forum, with regular biweekly meetings, supported by local Field Coordinators, to discuss and act on the challenges and opportunities arising from the IK contribution system. The Field Coordinators were particularly involved in matching Partner Institutes to IK opportunities, and facilitating the compilation and approval of contractual documentation, and enhancing the interactions on this front by providing timely staff training in preparation for planned and potential IK contribution contracts.

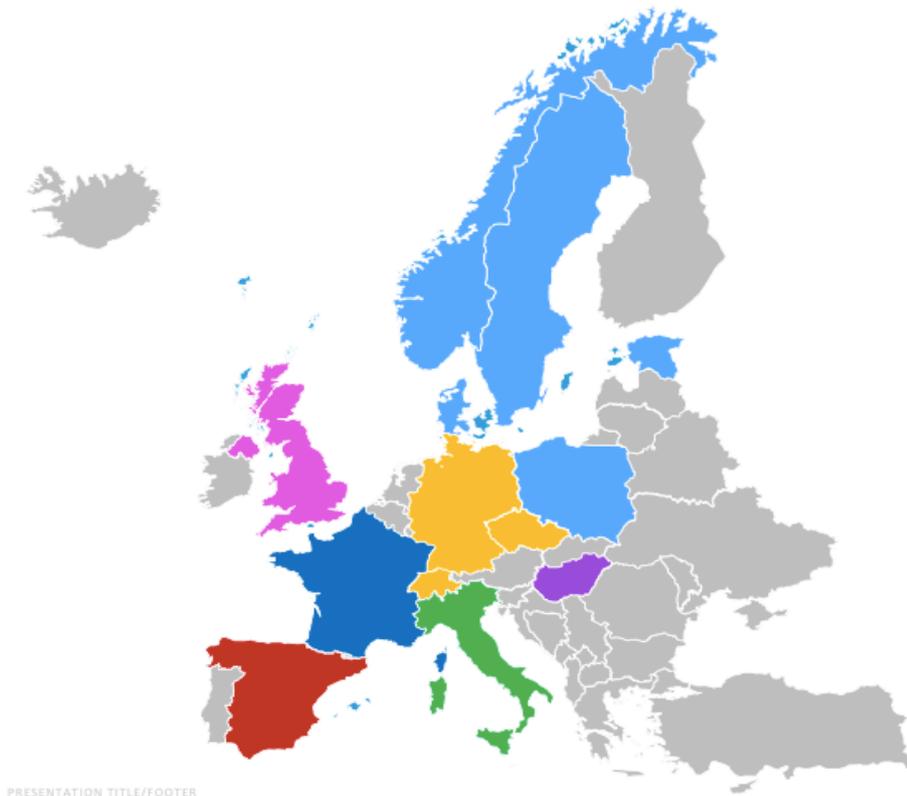


Figure 3: The structure of the Regional Hubs across Europe in BrightnESS<sup>2</sup>

Established soon in the frame of the first BrightnESS grant, this network of knowledgeable professionals embedded in Partner Institutes, continued to provide a useful bridge between ESS and Partners, that proved to be even more important during the COVID-19 pandemic. They shared information, assisted in problem solving and developed accepted standards on issues such as data transfer routes and logistics. Their activities resulted in clearer lines of communication, better monitoring of progress and faster contract negotiation.

Four Best Practice Workshop focusing on different aspects of IK for large-scale research projects were held to identify needs and exchange best practices.

The first one in Bilbao, Spain, in 2016 concentrated on engineering aspects; the second in Catania, Italy, in 2017 focused on processes, requirements and preparation for installation; the third in Lund, Sweden, in 2018 chose installation as its main topic; while the last one, held remotely in August 2020, reviewed Best Practices already implemented and identified possible new Best Practices for the future.

With the help of BrightnESS and some careful budgeting, an extra Workshop took place in Lund, in July 2018. As a dedicated ESS Workshop on VAT Exposure related to ESS Installations in Sweden, the

workshop attracted more than 40 participants from Member Countries, and significantly improved shared understanding of VAT issues and options.

Streamlined access to all presentations, documents and best practice materials were provided on the Best Practice Platform that was developed to further support IK Partners.

The Field Coordinators network, as a legacy of the first BrightnESS project, continued to be one of the most enduring pillars of ESS In-Kind management during BrightnESS<sup>2</sup>, and represented an organizational structure delivering a most important contribution to the whole ESS project.

From the point of view of ESS IK Partners, the Field Coordinators have been long appreciated because they were able to mediate between the different interests of ESS and the Partners themselves. The relatively smooth flow of information between ESS and the Field Coordinator Network and the thorough knowledge of local personnel and circumstances offered continued opportunities for Field Coordinators to provide help and add value.

If during 2019 a discussion was in place about involving the Field Coordinators in the issues related to the supply chain of In-Kind Contribution, after the reorganization which brought about the IK Management Directorate and Division it became straightforward to involve them also in the supervision of progress on In-Kind Contributions. Of course, each Field Coordinator was in a different position regarding these issues, according to personal education and experience, the extent of contributions from the relevant Partner Country, and the involvement with the different Institutions and subcontractors.

Nonetheless a bright example of involvement of the Field Coordinators occurred already in 2020, with reference to the survey conducted by the ESS Project Office on the impact of COVID-19 on the different Hubs and Partner Institutions. A dedicate questionnaire was prepared by the Project Office and sent by the ESS Director General to the Heads of each Institution involved. The questionnaire requested information in three separate sections dedicated to:

- Overall information on COVID-19 impact;
- Information on In-Kind Contribution Suppliers (mainly industrial subcontractors);
- Status of key In-Kind deliverables.

Even if formally the Head of the specific Partner institution was responsible and accountable for the information supplied to ESS, actually the Field Coordinators played a major role through their already established networks to connect all the local stakeholders involved and collect the requested detailed information.

The survey was very successful as a thorough map of the impact of COVID-19, which has been a most valuable information for ESS in order to assess and review the potential schedules for the subsequent phases of the Project.

Another example of important contribution given by the FCs has been the coordination at national level with the local ESS Industrial Liaison Officers. The ILO Network has been instrumental and a key asset for the establishment of the Projects the and construction activity. Each ESS Member Country has a representative in the Network and finances its own ILO activities. Even if this assumed different importance and intensity in the different Partner Countries, it was a powerful factor of capacitation for local industries in order to afford the challenges and opportunities of the big science market.

The interactions between the environments of In-Kind Contributions and Industrial Supplies at the overall level of BrightnESS<sup>2</sup> reflected a coordinated management, even a sort of hybridization, between Work Package 3 and Work Package 4 “Innovation and industry”.

To summarize and to conclude this review of BrightnESS and BrightnESS<sup>2</sup> contribution to the implementation and management of the In-Kind model at ESS it could be said the having EU grants to support the relevant actions has been by itself a major Best Practice and a tremendously positive Lesson Learnt.

## 9. Handbook of Best Practices and Lessons Learnt

As discussed in the previous sections, specifically in section 8, BrightnESS and BrightnESS<sup>2</sup>, in the frame of Work Package 2 the former and Work Package 3 the latter, gave great support for the management of In-Kind Contributions for the ESS Project.

The identification and implementation of Best Practices were issues crossing all four tasks in Work Package 3 of BrightnESS<sup>2</sup>.

The four plus one Workshops held between 2016 and 2020, mentioned in the previous section, are nothing but one objective evidence of the importance and the role that Best Practices and the consequent Lessons Learnt covered in the two BrightnESS grants.

A lot of experience was accumulated by ESS both at the central level and in the Network of Regional Hubs about processes, procedures and ways of working in the field of In-Kind Contributions Management. Success stories, opportunities to do better in the future, as well as some mistakes form a strong basis of organisational knowledge and steps of paramount importance along the organizational learning curve, that, if can still partly contribute to improve the way of managing IK Contributions at ESS, can definitely help other Research Infrastructures which are using at present, or will use in the future the In-Kind approach to build, update and/or operate their facilities.

This Report, and specifically the present section, are consequently only partly addressed to the ESS Consortium, and fully offered to external Readers, as a in practice contribution of experience for improving at a general level the In-Kind Contribution model.

The next sub-sections describe in detail a number of significant Best Practices implemented in BrightnESS and BrightnESS<sup>2</sup>, together with the relevant Lessons Learnt (BP&LL).

The description is arranged into a typical and comprehensive “What, Why, Who, Where, When, How” structure.

In case further information on any aspect presented and discussed in the following sub-sections is sought the reader can address any enquiry to the following address: “[info4ik@ess.eu](mailto:info4ik@ess.eu)”.

The description of the different Best Practices and Lessons Learnt is organised as independent chapters, in such a way that each is self-consistent and can be read independently from the rest of this Report.

Best Practices and Lessons Learnt span from organizational issues to technical, through administrative and legal ones. Before starting with the detailed description of BP&LL, at a general level it is a pleasure to recognize, also further to the discussion above relevant to the contributions to the ESS Project by BrightnESS and BrightnESS<sup>2</sup> Grants, that the first and a most important Lesson Learnt for an appropriate management of the In-Kind Contributions is the following:

## LESSON LEARNT

The In-Kind Contribution model relies on the collective effort of a number of Research Infrastructures, Universities and Laboratories, with the relevant support of industrial manufacturers.

In-Kind Partner Institutions cannot and must not be seen just as solely suppliers of goods and services. They are actually an effective component of the common effort to realize that particular project.

From this perspective it is mandatory to have an In-Kind Management function with representatives both from the central site (ESS in Lund in the present case) and the Partner Institutions.

A model like the BrightnESS Regional Hubs and Field Coordinators, which has been demonstrated to be highly successful, should then be pursued and implemented from the very early stages of the project.

### 9.1. ENSURE AN APPROPRIATE DELIVERY AND ACCEPTANCE PROCESS IS ADOPTED, COMMUNICATED AND AGREED EARLY IN THE PROJECT

With the ESS Project well into the installation phase of high-tech equipment, in large part supplied in the form of In-Kind Contributions, delivery and acceptance was still managed in different ways by different IK Partners (and by ESS), not always for actual specific needs.

Then it was recognized that a clear and effective process “To receive, accept and accredit In-Kind Contributions” (in the following also “Delivery/Acceptance” process) was needed as a standard baseline for managing the delivery and acceptance of all IK Contributions from any Partner.

#### 9.1.1. What

The process “To receive, accept and accredit In-Kind Contributions” is a complex sequence of activities pertaining to many different fields of competence, like logistics, engineering and technology, quality control and quality assurance, administration and finance, legal and fiscal.

The appropriate definition of each step of this process, both from the operative and formal points of view, was recognized as a key factor in order to manage in a smooth and effective way the delivery and acceptance of Contributions from the IK Partners.

An overall representation of this process is given in the following figure:



Figure 4: Schematic representation of the process “To receive, accept and accredit In-Kind Contributions”. Red, green and blue boxes refer respectively to activities under the responsibility of Technical, Logistic and Legal Functions

## 9.1.2. Why

With the progressing of the equipment installation and commissioning phase of the ESS Project, it became more and more evident the strategic and operative importance of the overall process for the delivery and acceptance of IK Contributions, from the shipment to Lund until the accreditation of the Contribution by the ESS Council.

It was realized that there was no unique implementation of the relevant process, and not even a common understanding of the concept of “Acceptance”, which was used, in different cases but analogous situations, referring to the reception of the goods at the ESS site in Lund, the first quality check, the Site Acceptance Test (SAT), the recommendation by the In-Kind Review Committee or the Final Approval of the IK Contribution by the ESS Council.

At that point it became clear the necessity of an overall review and analysis of the Delivery/Acceptance process, with a clear understanding of the different steps, the actions and the document pertaining to each step, and a univocal definition of involved concepts, with specific reference to “Acceptance”, especially because the acceptance triggers administrative aspects, e.g. the start of the warranty period, when provided by the contract.

## 9.1.3. Who and Where

Even if the Delivery/Acceptance process was mostly managed by ESS at the Lund site, the involvement of the In-Kind Partners was of paramount importance, not only at the moment of shipment of equipment from the Partner Institution to Lund, but also during all phases of testing, installation and commissioning.

In order for ESS to start a thorough review, optimization and standardization of the Delivery/Acceptance process, an important trigger was given by the Colleagues of ESS Bilbao, who raised the issue, specifically in view of the Site Acceptance Test (SAT) of major components like the Target Vessel and the Target Wheel, of clarifying in a precisely defined way the procedure for testing and accepting the specific IK Contribution (project result).

## 9.1.4. When

In Autumn 2020 the work of review and analysis of the Delivery/Acceptance process started, mainly managed by the In-Kind Management Group, and a presentation of the first outcomes was given in the occasion of the Accelerator Collaboration Board Meeting at the end of October. Then the work continued in the following months, also under the responsibility of the newly appointed In-Kind Management Division, effective January 1<sup>st</sup>, 2021, and was in final review by higher management for implementation at the moment of the release of this Report.

## 9.1.5. How

While reviewing the overall Delivery/Acceptance process, it was important to concentrate firstly on a possible way to solve the problem of the objective determination of the documents applicable to the Site Acceptance Test (SAT), as it was decided to reserve the words “Acceptance” to the positive outcome of SAT itself.

It was recognized that such documents must be defined by ESS and agreed/accepted by the Partner/supplier in advance of shipment of the goods to Lund. This in order to set an objective and shared basis to perform the subsequent SAT.

A simple cover document, listing such applicable documents or the relevant parts of them, was considered necessary and adequate to collect such information. This was developed in the form of a

checklist to be prepared by ESS, namely in the person of the Work Package Leader, then reviewed as necessary and finally approved by the Head of the relevant Sub-Project.

The whole process of SAT was thoroughly reviewed, as the key of the formal acceptance of equipment, with implications, as outlined before, also from the administrative and legal point of view. In particular, the attention was placed on the reasons why the existing procedure and report template were or were not used.

On a more general level, it was recognized as mandatory to have consistence between what is described in the documents describing the overall process and any single step of it and what was actually made in practice, and vice versa. In short, the basic and simple principle of quality assurance “Say what you do, do what you say” had to be applied.

Of course, the possibility to effectively review the Delivery/Acceptance process, to make all Work Packages behave according to standard procedures and to use a homogeneous set of templates strongly depended on the decisions and support of the highest levels of Management.

Hence the need for the IK Management Division to get approval and support on the actions put in place and the ones to be possibly further implemented. A strong mandate to monitor the Work Packages on the practical implementation of the “rules” and applicable documents represented a further factor for the success of the whole improvement of the Delivery/Acceptance process.

## LESSON LEARNT

When an In-Kind model is implemented for the realization of a new Research Infrastructure, as well as for the update/enlargement of an existing one, the overall process to deliver, receive, accept, and accredit In-Kind Contributions is a key success factor that needs to be considered from the outset.

This process has implications in many different areas, like logistics, engineering and technology, quality control and quality assurance, administration and finance, legal and fiscal.

In order to have a univocal and smooth way of working, all aspects of this process should be clarified with a thorough analysis and mapping of the process itself and the definition of appropriate procedures, guidelines, templates and other applicable documents.

Also, strong support by the top management has to be sought, in order for all Work Packages of the project to put in place any relevant procedure, guideline, template, and to act accordingly to how the process has been planned.

## 9.2. DEVELOPMENTS OF INDUSTRY CAPABILITY AND CAPACITY FOR SUPPLYING BIG SCIENCE PROJECTS

The European Spallation Source is a green field project, that notwithstanding it is one of the largest research infrastructure projects being built in Europe, and relies on the common effort of 13 European Nations and more than 40 In-kind Partners, who provide non-cash contributions in labour, materials and/or equipment to ESS, with the major support of the European high-tech industry.

In line with the provisions set out in the ERIC Regulations, ESS has adopted its own procurement rules. The rules were approved by the Council of the European Spallation Source ERIC in July 2015 and have been effective since 1<sup>st</sup> October 2015. They apply to all contracts for the provision of goods, works, and services, concluded in writing between ESS and third parties and financed by the ESS budget. The procurement rules are public and available on the ESS website.

## 9.2.1. What

The area of this discussion is the effort of Field Coordinators (FC) also in collaboration with the Industrial Liaison Offices (ILO) to build capacities in the national industry and suppliers to enhance their participation in Big Science Projects.

During BrightnESS (2015-2018) the network of Hubs and Field Coordinators was set up, and has done an excellent job, hugely enhancing communication between ESS and the Partners. The FCs have enhanced the communication channels, strengthened interfaces, reinforced quality Control and Quality Assurance procedures, standards and best practices by facilitating the flow of critical information between the Partners and to/from ESS. In BrightESS<sup>2</sup> this network has continued maturing and getting involved in IK management activities. The Field Coordinators developed a central role as liaison between project teams and suppliers, while setting up accepted standards with ESS, supporting with logistics (transportation, taxes and duties, insurances), monitoring of TA, and other IK related activities.

On the other hand, a very important asset of ESS is the ILO Network that has been instrumental and key to the establishment and construction activities. Each ESS Member State has a representative in the Network and finances its own ILO activities. The Network brings together highly-qualified experts, many of whom have an engineering background and experience from other large-scale facilities. The foundation of ESS is based on In-Kind delivery and cash contributions from the different Member States. This means that ESS does not operate on the principle of “juste retour”, hence the engagement of the ILOs is highly quality and business-driven. Based on this, the Network has shown a very high value in the construction phase of ESS where procurement transparency, coordination and expectation alignment amongst the 13 Member States has been crucial to success.

## 9.2.2. Why

The In-Kind Contributions to ESS allowed Partner Countries to politically justify their investments in an international project outside their borders by ensuring that some of the value of their contributions remains with their respective institutions and industry.

One of the activities proposed in the Task 3.2 “Refining co-working processes” of BrightnESS<sup>2</sup> Work Package 3 was the coordination with ILOs. Since national industries have been involved indirectly into the IKC, the Field Coordinators had regular interactions with the national ILOs to support them in their role as mediators between ESS and the industry. It was essential that the work was properly tracked and reported back to the Commission, both through routine timecards and records of expenses (tracking inputs) as well as through progress reports (tracking outputs).

## 9.2.3. Who and Where

Among the network of Regional Hubs and Field Coordinators, this practice has been more extensively implemented in some of them than in others. This was the case of Iberia, Central and Nordic Hubs and, especially during the original BrightnESS project, of France.

In any case all Member States involved the respective national industries in the realization of In-Kind Contributions.

## 9.2.4. When

While the IK Field Coordinators Network was established at the beginning of BrightnESS in 2015 with the aim of strengthening the In-Kind Contribution Coordination, the ESS ILO Network has been an integral part of the ESS Project since its inception back in 2013.



The ILO Network is regulated in the ESS governance, to promote business opportunities from ESS to national industries. In the period 2015-2021, the ILO Network has been deeply integrated in the Procurement activities of ESS.

Along this period several different interactions with industry involving FCs and ILOs have been developed by meetings, visits, workshops, industry days and other events.

In particular, several “ESS Industry Days” in different countries were organised, as well as the Big Science Business Forum Conference (the first one in 2018 in Copenhagen and the following postponed due to the pandemic) and joint ILOs-FCs Strategy Workshops in Budapest and Catania were carried out respectively in 2019 and 2020.

### 9.2.5. How

As an example, in the case of Iberia Hub, Field Coordinators have carried out visits and promoted meetings with Spanish industries and local suppliers that have helped towards a better description of the scope of work for ESS work packages. In these interactions the FCs have explained to the industry the way to identify opportunities and get involved either through the ESS Bilbao tender system (for IK contributions) or directly with ESS through the procurement portal.

On the other hand, Spanish ILO is staff to the Centre for the Development of Industrial Technology (CDTI), a Public Business Entity, reporting to the Ministry of Science and Innovation, which fosters the technological development and innovation of Spanish companies. It is the entity that channels the funding and supports applications for national and international R&D&I projects of Spanish companies.

Furthermore, ESS Bilbao is committed to promoting the technological developments and innovation of the local and Spanish industries. One of the aims of ESS Bilbao is to ensure that investments into science and technology generate benefits in Spain by acting as a driving force for the industry. ESS Bilbao is collaborating with industry in projects funded by CDTI or regional administrations in areas of particle accelerator and neutron instrumentation.

As a result of the close coordination FCs-ILOs-industry, on one hand up to 76% of the total expenditure in contracts for IK work since the beginning of the collaboration has stayed at national or regional level. Furthermore Spain, in the period 2017-2019 was the country with the highest cumulative value of almost 30 M€ of ESS contracts awarded (with a value higher than 50,000 € each).

ILO and FC Networks collaboration can deliver innovation opportunities too. As previously discussed in this document, but also in other BrightnESS<sup>2</sup> reports, the unique value proposition of the ESS facility assures large investments in the areas of innovative, cutting-edge technologies. These technologies are often pioneering, requiring cross-border collaborations between numerous stakeholders, ranging from Industry to Scientific Institutes and Universities.

The collaborations between Industry and the Research Community are required precisely due to the uniqueness and pioneering element of said technologies needed by ESS. Developing new products, or radically improving the existing ones is a common thread in this collaboration. As a result of these efforts, both the industrial Partners and the Research Community benefit. The industrial Partners develop new skills and “know-how”, while the Research Community pushes the envelope of currently possible scientific solutions available. As a consequence, the Industrial Partners acquire the necessary skills and techniques needed to penetrate new markets and niches, offering a more innovative product portfolio to their customers; while the Research Community engages in new scientific activities, publications, and program development.

This “push-pull” method of developing innovation is not unique to the ESS Facility but is easily demonstrable. The innovation impact of the collaboration between Industry and Research Institutes involved in ESS is clear, but will become even more apparent and palpable once the Facility becomes



fully operational. The Field Coordinators and the ILOs play an important role in demonstrating this impact early on, capturing its effect and assuring that the trickle-down effects of collaborations between Industry and the Research Sector are properly utilized.

## LESSON LEARNT

Working in close collaboration with both industry and Industrial Liaison Offices, with frequent exchange of information by phone, mail, meetings, workshops and other events, can lead to an industry capacitation that ensures a high level of returns on investment to politically justify the country participation in international big science projects.

Analyzing the case of the European Spallation Source ERIC, the coordination at the national level between the In-Kind Field Coordinators and the ILO Representatives has resulted in a high participation of national industry in both In-Kind Contributions, as well as in direct procurement contracts.

Furthermore, developments of industry capability and capacity for supplying Big Science Projects was demonstrated as a powerful tool to open new opportunities for innovation, and access to a wider market.

## 9.3. CHANGES OF REQUIREMENTS AFTER SIGNATURE OF TECHNICAL ANNEXES

In the process for managing In-Kind Contributions (IKC) at ESS, two types of contractual documents are considered, i.e. the In-Kind Contribution Agreement (IKCA) and the Technical Annex (TA).

While the IKCA is the framework agreement for the collaboration with the IK Partner, the Schedule, which is also called Technical Annex, details the delivery deadlines (i.e. schedules), scope of works (SoW) for the specific In-Kind Contribution, the Partner's and ESS's obligations and include applicable and supporting documents as well as project, configuration and quality management requirements, as well as other relevant requirements.

### 9.3.1. What

The IKCA and TA are submitted to the ESS Council, after being recommended by the In-Kind Review Committee, which has been established precisely to oversee the In-Kind process. The In-Kind Review Committee reports directly to the ESS Council. Its role is to manage the implementation of the rules and of the legal framework for IKCAs between ESS and the In-Kind Contributors, as well as to follow the implementation and final accreditation of the IKCs. The IKRC recommends Technical Annexes to the Council for approval and accreditation. The IKRC can also act as the forum of first recourse in the event of any disputes between an In-kind Contributor and ESS.

In the case of necessary changes to the requirements stipulated in the TA, ESS has established a process to review, recommend and re-approve the amended Technical Annexes. The required changes are discussed and agreed with the Partner. It is therefore important that the Partners understand the ESS change procedure, and equally important for ESS to recognize that, depending on the own internal governance procedures, the Partner may have additional bodies that should be notified and/or will be entitled to approve amendments to the Technical Annex.

Changes to Technical Annexes may be subjected to the Internal ESS Change Control, conforming to the ESS Change Procedure. This procedure is applicable in case of changes to the baselines of the ESS Project. Input to this procedure is a request for a change that has an impact on technical, cost or schedule baselines. The request may be based on, but not limited to stakeholders' requirements, recommendations or non-conformities.

Depending on the own internal governance procedures, the Partner may have additional bodies that should be notified and/or are entitled to approve amendments to the Technical Annex. As an example, STFC (UK) has established a Change Management Plan and Procedure which is governed by the UK-ESS Board, which the body which supervises all IK Contribution contracts from UK.

### 9.3.2. Why

It is important that the process for amending Technical Annexes follows a strict version control approach, whereby the original version of a Technical Annex shall be version 1, the first amended Technical Annex shall be version 2, the second amended Technical Annex shall be version 3, and so forth. ESS requires that updated Technical Annexes are maintained through strict document version control to ensure that both ESS and Partner have access to the latest, most up to date Technical Annex to refer to. This ensures that TAs are contractually managed by ESS and the In-Kind Partner, as it will be clear to both parties which is the current TA at any given time. In turn this lowers the risk of late and defective deliverables caused by disagreement over the time schedule or specifications. Any changes made to the requirements of a TA by email or during meetings have no contractual validity.

ESS Projects and In-Kind Partners must retain both the Word and PDF versions of all agreed TAs in an appropriate document managing system, to ensure consistent document version control.

### 9.3.3. Who and Where

Awareness of the procedure for changes of the requirement for the TA throughout the Regional Hubs and Field Coordinators is important to secure that agreements stipulated in the revised contracts are legally complying with the ESS statutes. It is also important that the Partner and ESS have the same understanding of what scope, schedule and budget have been agreed in the revised contract. The general layout of the ESS procedure is generally appropriately implemented among the partner colleagues that are responsible for IK management. However, all the details of the procedure may not be well known.

### 9.3.4. When

Amendments of TAs can occur at any time of the life cycle of an IK Contribution, for many different reasons. A common cause of amendments is the fact the technical requirements of the Contribution may be not sufficiently detailed in the TA at the time of the initial TA negotiation.

This fact can cause multiple changes in the relevant TA, after the original signature. The result of this changes are extra cost and delays that usually are intended to be assumed by the Partner.

### 9.3.5. How

Following the internal ESS approval of change and the Partner's own approval process (if required), the level of approval required from ESS Governance (IKRC and Council) is to be determined. There are two levels of approval, called "A" and "B", with "A" requiring the highest level, and level B a lower level of authorization.

- Level A is for any change to the cost-book value. It is also for any scope change that by its scale should result in a new cost-book value. Significant changes to key milestones for critical deliveries could also be classed as Level A. These changes need to be presented to the IKRC for recommendation and then taken to the Council for approval.
- Level B is for all other changes. In case Level B changes were close to the critical path of the project they were presented to the IKRC by the Head of the particular Sub-Project for information only.

It is important to notice that, if a Partner does inform ESS of changes in the TA, then ESS shall officially be ‘notified’ of the changes. ESS should not ‘agree’ or ‘accept’ the changes unless the updated TA is planned with the points mentioned in the previous paragraph taken into consideration.

The In-Kind Amendment Flowchart, represented in next figure 5, shows the intended process to handle the Variations of ESS Technical Annexes in the future.

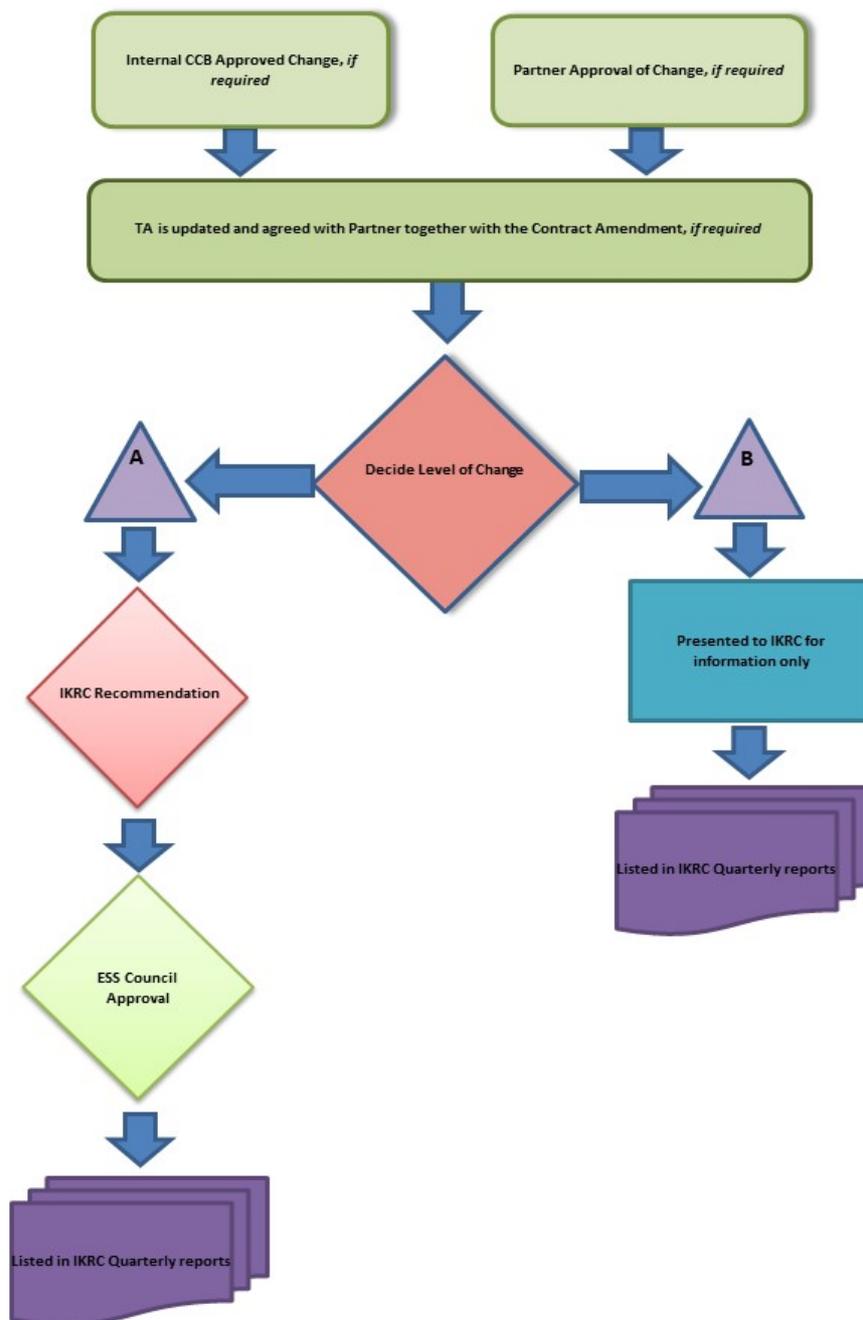


Figure 5: Flowchart for the process of Amendment of In-Kind contracts

## LESSON LEARNT

It is important to precisely define the characteristics and requirements of an In-Kind Contributions since its initial conception and report the relevant detailed information in a contractual document, that in the case of ESS is called a Technical Annex (TA).

As in any case, for many different reasons, during the realization of the said contribution, there can be the need to update/change/detail the Technical Annex. It is important to establish, since the early stages of the Project, a precise and reliable change process, with relevant supporting documents (procedures, guidelines, templates, etc.). This in order to support in a planned and ordered way the definition, approval/authorization of the amended contractual document, and the relevant implementations.

## 9.4. PARTICIPATION/INVOLVEMENT OF IN-KIND MANAGEMENT REPRESENTATIVES IN THE SUB-PROJECT ACTIVITIES AND SPECIFICALLY IN TECHNICAL MEETINGS

The ESS technical project, for the realization of the most powerful neutron spallation source ever built, was organized with reference to the four major components of the future facility, i.e. Accelerator, Target, Integrated Control Systems, Neutron Scattering Systems, with four corresponding Sub-Project Divisions belonging to the Technical Directorate.

The IK Management Group was always outside the ESS technical environment, and, since November 2018, was part of the Strategy Directorate. In December 2020 a new Associate Directorate for In-Kind Management was established, with a dedicated In-Kind Management Division, effective on 1<sup>st</sup> January 2021.

### 9.4.1. What

The topic discussed here is the opportunity and importance that the IK Management Representatives be involved in the “life” of Technical Divisions, with no interference at all in technical matters, but with an invaluable action of support and interconnection between the central site of ESS and the IK Partner Institutions, managing the mutual relations between technical, logistic, quality, administrative and legal issues. For the present discussion “IK Management Representatives” refers both to the personnel of ESS central IK functions (the IK Management Division at the time of the release of the present document) and the Field Coordinators at the Regional Hubs. This is further stressed by the purpose and content of Tasks 3.1 “Maturing the network of IKC Field Coordinators” and 3.2 “Refining co-working processes” of BrightnESS<sup>2</sup> Work Package 3.

At the moment of the release of the present document, the organization of In-Kind Management at ESS was as represented by the following organigram:



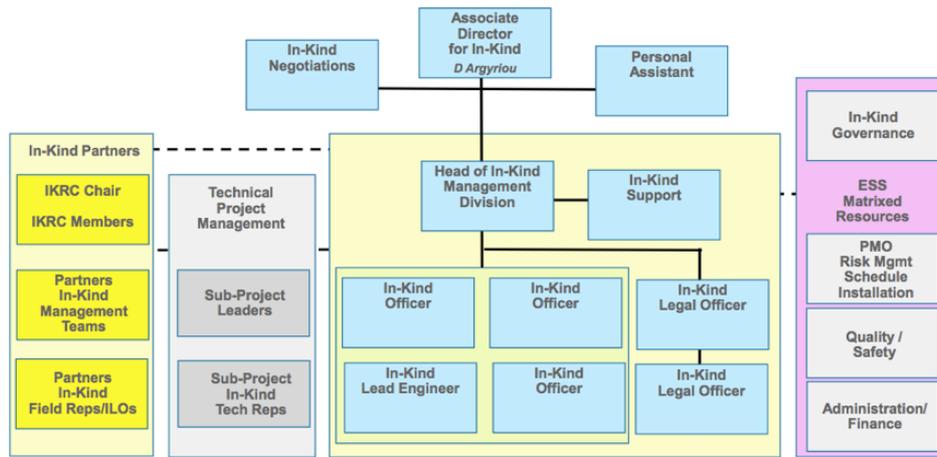


Figure 6: Organization chart of the ESS Associate Directorate for In-Kind Management

### 9.4.2. Why

Since the inception of the ESS Project, the at-the-time In-Kind Management Group was mainly concentrated on contractual issues. Being ESS a true green field project, the IK Management mission was to build the network of In-Kind Partners, finalize the relevant “umbrella” agreements with the Partner Institutions (In-Kind Contribution Agreements – IKCA) and the consequent operative schedules (Technical Annexes – TA). In fact, at the beginning of the project (2013-2014), all the potential contributions were collected in a “Cost Book” and the Partner Institutions from the Member Countries were called to give possible “Expressions of Interest” (Eoi) for the contributions they were interested and available to supply.

A work of paramount importance was then made by the IK Management Group in the following years, in particular with the support of BrightnESS and BrightnESS<sup>2</sup> grants, to reach, as presented at the BrightnESS<sup>2</sup> Mid-Term Review in August 2020:

- 575 M€ of planned IK Contributions, distributed as
- 542 M€ of running IK Projects;
- 11 M€ of completed Projects and accredited by the ESS Council;
- 22 M€ of Contributions still in the negotiation phase.

With the ESS Project entering the installation and commissioning phase, with major IK contributions starting to be delivered to the Lund site, it became more and more clear that the focus of IK Management had to be enlarged to operatively support the implementation of the Project itself. Issues of paramount importance came into play, like managing the schedule of IK contributions delivery and the related interfaces and interferences, understanding the impact of quality control and quality assurance aspects, understanding associated risks, optimizing logistics, solving administrative and legal issues like VAT liability, etc.

Of course, all these issues are strongly interrelated with each single IK Contribution and their relevant technical aspects.

### 9.4.3. Who and Where

As can be seen in the organizational chart shown above, the Associate Directorate for IK and specifically the IK Management Division, were established in order to have direct and strong

connections with many other Functions in the ESS organization, and namely with the Technical Directorate, not to mention the continuing relationship with the IK Partners and the management of the network of BrightnESS Hubs and Field Coordinators.

As discussed in next section, the Director General took the decision to establish the Associate Directorate for IK at the end of 2020, with the consequent re-organization of In-Kind Management at ESS. Even if this re-organization had a strong impact on the overall network of Partner Institutions, it was basically an internal issue of ESS.

#### 9.4.4. *When*

The amalgamation of all In-Kind resources under one work area was recommended by the Project Advisory Committee (PAC #5 on 17 September 2021) and endorsed by Council at its 21<sup>st</sup> Meeting on 7 October 2021.

The Associate Director for In-Kind Management was appointed by the Director General on the 5<sup>th</sup> November 2021. The In-Kind Division organisational structure was endorsed by the ESS Program Management Team at a series of meetings in December 2020.

The Head of the In-Kind Management Division was appointed with effect from 1<sup>st</sup> January 2021 together with the move of the former In-Kind Management Group members to the new IK Division, effective from the same date.

Since then, representatives of the new In-Kind Management Division have been appointed as “Points of Contact” for the four ESS Sub-Projects: Accelerator, Target, Integrated Control Systems, Neutron Scattering Systems, with the mandate to interact with and support the four Divisions in all matters related to In-Kind Contributions and the authority to attend all meetings, specifically technical ones, with particular reference to meetings with the participation of IK Partners.

#### 9.4.5. *How*

The IK “Points of Contacts” did not interfere with any technical issue, whose responsibility and authority lay completely with the Heads of each Sub-Project and the relevant Work Package Leaders. Rather, they played an important role in connecting the Sub-Projects, the IK Management Division and the IK Partner Institutions on a number of issues which included, but were not limited to:

- Stakeholder management aimed at improving a one-team project culture with the In-Kind Partners;
- Negotiation of IK Contribution Agreements, Technical Annexes, TA amendments, and approval of final reports;
- Operational management of the Field Coordinators Network and Hubs;
- Contract management advice including secondment of personnel, warranties, transfer of ownership;
- Support to the Program Director on all In-Kind Management performance and reporting;
- Support of Planning team’s interfaces with In-Kind Partners;
- Support of Installation teams’ interfaces with In-Kind Partners;
- Risk management support as it relates to In-Kind management.
- Support of quality control and assurance interfaces with the In-Kind Partners and their suppliers;
- Support on financial aspects of In-Kind management, call-off’s/funding, accounting of IK contributions towards ESS Construction;



- Management of VAT issues and support on relevant aspects both internally and externally;
- Escalation and resolution of high-level issues to be dealt at the level of head of institute or Council or other governance committees;
- Support to the Director General and the Communications Division with In-Kind management reporting.

#### **9.4.5.1. A quicker path to escalation**

The introduction of IK Points of Contact allowed ESS Sub-Projects to escalate In-Kind opportunities and threats more quickly than before. The direct line of communication between the Sub-Projects and the PoCs, established through various meetings, forums, and one-on-one discussions with principal stakeholders, allowed for a more streamlined communication channel to the ESS IK Directorate Management team. In turn, a better decision-making process was assured; improving visibility, and developing a strong feedback culture in the process.

To illustrate with an example: The Estonian Funding Agency contacted ESS with a query about the unused In-Kind Funding which should be utilized before the end of the year. The IK PoCs took this information and disseminated it with the Project Leaders directly. The feedback from the Project Leaders was also given to the PoCs, who in turn contacted the Estonian Funding Agency and shared it. The IK Directorate Management was constantly kept informed of the situation, but did not need to get involved. As a result, the PoCs assured that only decision-making stakeholders were directly involved in the issue, while keeping the communication channels open towards other stakeholders, assuring their appreciation of the situation.

#### **9.4.5.2. A quicker path to sharing Best Practice**

The ability to be deeply integrated within the ESS sub-projects allowed the PoCs to share previously learned Best Practice in key areas of ESS In-Kind effort. This way, common experience and accumulated knowledge on documentation, administrative and legal frameworks, quality, funding, as well as other important practices of in-Kind Management were shared more freely and systematically with sub-projects around ESS.

To illustrate with an example: The NSS sub-project might be expecting a large delivery consisting of multiple different specially designed packages. Handling of such equipment with care was of the utmost importance. The equipment was arriving from another EU country, but was originally procured from outside of the EU. In this case, instead of engaging in multiple communication channels with various stakeholders around the organization to learn what to do, the NSS team could utilize the In-Kind PoCs. The PoCs could then gather the Accelerator Sub-Project best practice (since Accelerator had already received many specialised deliveries by now), set up meetings with the Logistics teams, and assured that the IK Legal Counsel was appraised of all of the legal formalities related to the delivery, including the proper Incoterms. This way, a single individual assumed responsibility of being a principal channel of information, speeding up the dissemination of proper ways of working, and previously accumulated knowledge in the organisation.

## **LESSON LEARNT**

Management of In-Kind Contributions is demonstrated to be a multidisciplinary activity, with operative implications which change and assume different importance in the different phases of a project for the realization of a new Research Infrastructure, as well as in a project for the major update of an existing one.

In order to exploit all the benefits of In-Kind Management, the actions of relevant officers must not be limited to one single area of activities (e.g. contractual). Rather they must be given responsibility and authority to deal with matters that span the project from as early a phase as is practicable. These activities include the schedule of IK contributions delivery, impact of quality control and quality assurance aspects, in-kind associated risks, logistics, administrative and legal aspects, taxes and VAT and secondment of in-kind personnel.

All this, of course, being involved but not interfering with the core activities of the competent organizational technical functions, and supporting the communications and interactions between them and the IK Partner Institutions.

## 9.5. COLLECTION OF INFORMATION FROM IN-KIND PARTNERS ON THE REAL SCHEDULE OF IK CONTRIBUTIONS

As discussed in different points in the present Report, ESS is a greenfield project, which had to rely on the common knowledge and contributions of a network of Partner Institutions providing labour, services and high-tech equipment, working in the frame of an In-Kind Contribution model.

The legal status of ESS, becoming an ERIC (European Research Infrastructure Consortium) in 2015, gave even more importance to the collaborative aspects of the central ESS site in Lund, and the Partner Institutions spread all over Europe in the 13 Member States of the ERIC.

### 9.5.1. What

In-Kind Contributions are not simple supplies, and In-Kind Management is not Procurement Management. Even if, at the end of the day and in both cases, a truck arrives in Lund and unloads a piece of high-tech equipment, the two processes work quite differently. Even for the two there are legal contracts, IK Partners are not suppliers, which receive a payment for some goods or services; they supply knowledge with goods or services to their own ERIC, without receiving any money from ESS. They contribute to the project with tangible assets, instead of contributing with money.

Hence IK Partners are an integral part of the project, and must be seen as an “internal” component of the operative organization supporting the project.

In-Kind Contributions are often at the leading edge of the current technology, and in the case of ESS, a number of solutions have been adopted that were never used before.

Hence the schedule of a complex and challenging IK Contribution cannot be treated as the schedule of a standard industrial supply. An IK schedule must be considered in some way “stochastic”, subjected to uncertainties and possible adjustments along the realization of the contribution. With the consequent need of a continuous interaction with the IK Partner in order to dynamically adjust the overall schedule of its contribution, and consequently of the overall project.

### 9.5.2. Why

As widely recognized since the times in the fifties and sixties of the last century, when in Japan was developed the Company-Wide Quality Control (CWQC), better known in the Western World as Total Quality Management (TQM), in order to understand, control and continuously improve processes, the involvement and the effort of people directly working on such processes are mandatory. In fact, the (correct) assumption behind that is that nobody knows the process better than the ones who work daily on it.

Now, if we consider that a project, whatever complex, is basically an interrelated network of single processes, it is straightforward to extend the above concept to the project itself, and to easily realize

that, if you want to know the real status of the project, you have to get fresh information from people directly working on single tasks (processes).

This perfectly confirms and adds to the considerations developed in the previous “What” section about the need to constantly receive fresh information from IK Partners on the real status and schedule of their contributions.

### **9.5.3. Who and Where**

It was from these simple arguments that the IK Management Group started already in 2019 to point out that there was the need to supplement and cross-check the information present in the Official Primavera P6 suite at ESS with more information coming from the IK Partners.

More specifically it was repeatedly suggested, that, besides the regular flow of information between the two work package managers at ESS and at the Partner Institution for the single contract, a more global and comprehensive analysis of the schedule for the different IK Contributions which could take into account also interrelations and interdependences.

Several attempts were made, during 2019, to include such additional information in different reports and dashboards, as well as in the XRM+ suite for IK Contributions Management. However, for one reason or the other, that path was never pursued.

The confidence in “official” data on project schedule present in Primavera was almost absolute, to the point that “the truth is in P6” was often the remark which closed any further discussion.

### **9.5.4. When**

It was the COVID-19 pandemic to change the situation, when the strict lockdown all over Europe stopped for months all technical activities both at ESS in Lund and at the Partners locations.

It was necessary to understand the situation of each IK Partner Institution regarding the operation (or non-operation) of laboratories and workshops, the impact on IK Contributions contracts, the status of the industrial supply chain necessary to procure materials and components.

Hence the Strategy Directorate of ESS, through its In-Kind Management Group, in May 2020 started to prepare a questionnaire to collect such information from the Partners in order to have a clear overview of the general impact of COVID-19.

At the same time, it became crystal clear that the new situation consequent to the pandemic would have had a direct impact on the project schedule, with the consequence that whatever planned and forecasted in Primavera P6 was no more “the truth”.

Hence a discussion started between the Strategy Directorate and the Project Directorate in Summer 2020 about the necessity to further implement the COVID questionnaire with the request of more specific information about the impact of the pandemic on each IK contribution contract.

The original questionnaire soon became a full survey, with three sections, respectively devoted to general information about the Partner Institution and the relevant laboratories and workshops, the status of the industrial supply chain, and the impact on the schedule of each IK contribution contract.

### **9.5.5. How**

The lead of the first COVID survey was taken by the Project Directorate, who prepared the questionnaire to be sent by the ESS Director General to the Heads of the IK Partners Institutions, and collected the relevant feedbacks.

Late in 2020, from the overall elaboration of the answers to the survey by the IK Partners, it became clear that there was a considerable impact on the Project schedule due to restrictions consequent to COVID-19, and that this was just adding to some other delays, independent from the pandemic and typically due to technical problems.

Late in 2020, as discussed above in Section 7, the new Associate Directorate for In-Kind Management was created, with a dedicated In-Kind Management Division, incorporating all personnel formerly belonging to the IK Group in the Strategy Directorate and taking all responsibilities and authorities for the management of both the contractual and supply chain aspects of IK Contributions.

It was in the frame of the new In-Kind Management Division that the work on the IK Partners surveys was continued and was further implemented. In fact, a second survey was conducted in March 2021 with the feedback collected and elaborated in April. The results, presented to the In-Kind Review Committee at the beginning of May, showed an overall situation of the schedule which was very different from the official schedule of the project, to the point to require a complete re-baseline of the project itself.

In order to acquire more information and more precise data for the incoming project baseline, scheduled for the last part of 2021, a third even more comprehensive IK Partners survey was scheduled and was in preparation at the time of the release of the present Report.

## LESSON LEARNT

With an In-Kind Contribution model, especially when IK Partners are from Member States strictly connected in an ERIC legal entity, like in the case of the European Spallation Source, the Partners Institutions, far from solely being suppliers, are intimately part of the overall organization.

If the complexity of Contributions, often at the leading edge of current technology, is further considered, it is straightforward to realize that IK Contributions assume a sort of “stochastic” characteristic, with uncertainties and possible adjustments along their realization.

For all these reasons a continuous and rigorous connection must be maintained between the central site of the Project and the IK Partners, in order to keep under control any possible variation in the real schedule of each contribution and the consequences on the overall schedule of the Project. A continual acquisition of information from the IK Partner should be a regular activity of the Project Office, in order to have a realistic and holistic view of the current situation and future evolution.

## 9.6. ESTABLISHMENT OF PROJECT AND PROGRAMME MANAGEMENT OFFICES FOR THE COORDINATION OF IN-KIND CONTRIBUTIONS TO ESS

Project management in a Pan-European project to realize a cutting-edge technology research facility with a large amount of In-Kind Contributions is orders of magnitude more challenging than project management in a usual R&D environment.

In-Kind Partners are not simple supplier of goods and services; actually, they are an integrating part of the project, and contribute first of all in knowledge, particularly in a green field project like ESS.

Hence the way to manage both the relation with the central site and the realization of the specific contribution requires a level of organization and complexity far greater than in the case of a pure industrial supply.

## 9.6.1. What

The European Spallation Source ERIC is a joint project of 13 European Countries. The States are formally the Members of the ERIC (European Research Infrastructure Consortium), which provide resources to ESS partly in cash contribution and mainly with equipment and services.

Whilst the overall legal contract of cooperation is generally agreed and signed by ESS and the Member State usually at the government level, the technical schedules (Technical Annexes) occur between ESS and the single Institution providing the In-Kind contribution.

In order for a Member State to assure an appropriate return of the investment it is important that the different contributions from the participating national Institutions are managed in the most effective and, where necessary, coordinated way. So, it was in the interest of Member States to establish ways, and possibly operative structures, for the supervision and control of the implementation of the different structures.

The establishment of a Programme Management Office (PMO) at the national level that could act in this way was an initiative that started in some countries, like in the UK, and then was adopted by other countries or Partner Institutions with a benchmarking process. In UK, there was also a so-called UK-ESS Board, which supervised all IK Contributions from UK to ESS.

Undoubtedly, one way the benchmarking was realized in the ESS case was the implementation of the network of Field Coordinators in BrightnESS, further exploited in BrightnESS2, which largely contributed to exchanges between Partners on how the project was managed in different countries and facilities.

One successful example, following the example of the British Partners, was the one of Germany, where the local Field Coordinator helped to establish a Programme Management Office (PMO) embedded in the FZJ-JCNS organization. The Field Coordinator herself was occupying the position of Programme Manager in the JCNS-PMO.

## 9.6.2. Why

The motivation for the Member States to contribute to the realization of a research facility not located in their respective territories lies, apart the overall spirit of scientific cooperation in Europe, also in the development of knowledge and competences at the national level in local scientific institutions and in the involvement of local industry in the realization of high-tech components.

It is of course a specific interest of each Member State to plan, organize and manage the participation to the particular project, ESS in this case, in the most efficient and effective way as possible. Hence the decision by some States to established dedicated offices or boards to oversee and coordinate at the national level the participation and contribution to the common project.

## 9.6.3. Who and Where

Different Member States managed in different ways their participation to the ESS Project and their contributions In-Kind.

In some countries there was just one single Research Institution involved in the ESS Project and the relevant contributions, while in other there was a multiplicity of IK Partners and industrial sub-contractors.

Where different Partners were participating to the ESS project, the degree of coordination between them varied from case to case.

Even if there was not a perfect model, different models turned to be more or less effective.



Undoubtedly, where a project/programme office was established, especially if coordinating all the Partners and contributions from that particular Country, the organization and management of In-Kind Contributions turned to be easier, better structured and supervised, and in the end more effective.

**9.6.4. When**

The ESS Project started to be operative in 2013, and the legal status of the European Spallation Source as an ERIC was finalized in 2015.

The ESS organization grew during the years and changed to follow the challenges and opportunities that progressively showed up in the Project, as well as the organization of the IK Partners in the Member States, especially following the progressive change from the design/contractual phase to the installation/commissioning one.

Hence also the organization at national level of the IK contributions evolved accordingly. So, project/programme offices and boards were established at different times and stages of the Project.

**9.6.5. How**

In order to give an insight on how Project/Programme Offices (PMO) can be established at a national level, the case of Germany can be considered.

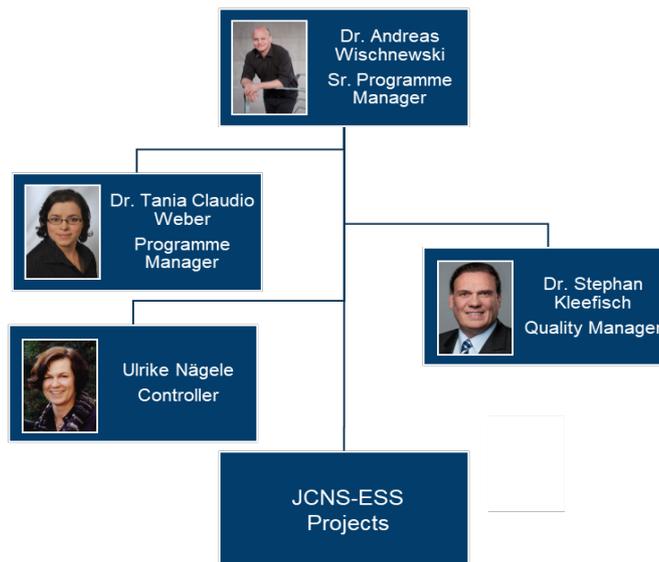


Figure 7: Organization chart of the ESS Programme Office at Forschungszentrum Jülich (FZJ),

The figure above shows the structure of the PMO, where the Senior Programme Manager position is occupied by the Head of Department: JCNS – Instruments for ESS, who is the line manager for human resources within this Department, and member of the JCNS Directorate. The Quality Manager acts as point-of-contact for all matters relating to Quality Management in the Programme and provides support to the project teams to ensure consistency of approach and standards. The Controller supports the Senior Programme Manager and the Programme Manager in all administrative activities that arise in connection with the ESS Programme.

The PMO developed a full controlling system, through which a monthly financial report is delivered to each Project Manager in the middle of each month. Furthermore, a Programme financial report is also produced enabling the PMO to monitor and control expenses, money flow, compare the actual costs

to the Cost Book Value (CBV) and the Estimate at Completion (EAC). This tool enables the PMO to benchmark the projects, and propose corrective actions when necessary.

Due to the huge number of procurements in such challenging projects, the PMO has established the following procedure internally at the JCNS – Instruments for ESS, which should be followed before the final signature by the Senior Programme Manager.

The Controller is the first point of contact for all administrative questions concerning the procurement. Furthermore, to make sure that the documentation is complete, a checklist has been created. This checklist is to be signed by the Quality Manager, Programme Manager and Controller before it is sent together with all necessary documentation to the Senior Programme Manager for signature. This ensures that the procurement is assigned to the right project number and the documentation and specifications meet the quality requirements.

These are only a few examples of the work currently being carried out through the establishment of the JCNS-PMO. And as the primary point of contact with the Funding Agency (BMBF), the PMO updates them monthly on all matter concerning all German contributions to the ESS, and is therefore in regular contact with all other German Partners: HZH and TUM.

Soon after the establishment of this Programme Management Office, a similar position was created at PSI in Switzerland. The project and programme managers from FZJ (DE) and PSI (CH) have proposed a common approach towards a risk register based on the STFC (UK) template.

The exchange between the Partners in the ESS project have been very fruitful and constructive in the management of the projects.

## LESSON LEARNT

Project management in a Pan-European project to realize a cutting-edge technology research facility with a large amount of In-Kind Contributions (IKC) is orders of magnitude more challenging than project management in a usual R&D environment.

Countries participating with In-Kind Contributions to the projects should maximize, also at the national level, the return of the investment.

In order to coordinate, supervise and control the appropriateness and coordination of the IKC from the different national IK Partners, the establishment of dedicated Boards and Project/Programme Offices, better if operative since the early stages of the Project, has demonstrated to be a very efficient and effective way to keep under control the quality, costs and schedule of IK Contributions.

## 9.7. CENTRAL SUPPORT TO PARTNERS FOR TAX AND TARIFF MANAGEMENT (SPECIFICALLY FOR VAT)

VAT is today a matter of paramount importance in any commercial transaction, and, for the purpose of the present document, in a project of construction or update of a Research Infrastructure. In fact, the current rates of VAT, even with some differences from country to country across Europe, makes an important difference, in excess of 20%, in the costs of realization, according to the applicability or non-applicability of VAT.

Whatever is the case, there must be absolute certainty of the situation since the very beginning of the project, as the most dangerous situation arise in the case the relevant budget is made under an assumption that, later in the project lifetime, turns out not to be the right one.

## 9.7.1. What

VAT has been an ongoing challenge over many years for ESS and its Partners, due in part to original assumptions that the benefits forming an ERIC would bring, with regard to VAT, could flow down to the In-Kind Partners. Unfortunately, this did not prove to be correct under current legislation, leading to a situation where VAT had been excluded from budgets and funding but was potentially still due, putting project delivery at risk.

Moreover, the whole VAT matter was complicated by the fact that there were two separate even if interconnected aspects to be taken into account, i.e. the VAT liability/non liability with respect to transactions made by IK Partners in their respective Countries, and transactions made towards Sweden.

While it was reasonable to leave the IK Partners the responsibility to manage this matter at the national level, it was not appropriate to let IK Partners manage autonomously and independently the VAT issues with respect to the Swedish Tax Agency (STA).

## 9.7.2. Why

Over many years ESS and Partners had therefore to invest much time and cost, both in house and via consultancy services, to endeavor to work through and find solutions, both in each partner country, and in the host country of Sweden. This was complicated by differing national interpretations of the VAT legislation resulting in a myriad of different approaches having to be taken.

A number of aspects were not sufficiently clarified at the right time, which caused uncertainties when specific transactions became reality. Possible examples include, but are not limited to, the following:

- There was not complete clarity on the mutual relationship between ERIC and VAT legislation, with an overall solution at the EC to high level, thereby avoiding taxpayers money being spent across the EU on resolving VAT issues rather than delivering the core objectives of scientific collaborations.
- Early discussions had to take place with the relevant tax authorities to confirm national interpretations and approaches, before budgets and funding were set and before agreements were signed. For the host country this could have most efficiently done by the host organizations themselves.
- Collaboration Partners should have carefully investigated the VAT implications of activities before they agreed to undertake them, e.g. with regard to foreign VAT registration requirements. Central organization support, or shared access to a consultancy resource, would have been an efficient way to do this.

## 9.7.3. Who and Where

Regarding the ESS Project, the VAT issues were equally spread over the all ERIC, with similarly tricky national aspects and host country ones.

At the national level the major problem was generally the VAT applicability or non-applicability to the purchases performed by the IK Partner Institutions, because, as noticed before, the benefits granted to the ERIC were not automatically inherited by the ERIC Member States and IK Partners. Hence national-specific solutions had to be undertaken, which generally allowed the IK Partners not to pay (or to pay and reclaim) VAT on the purchases of material, equipment and services for the ESS Project.

In some cases, creative solutions were required to overcome the difficulties. For example, this was the case of Italy, where a specific question to the Tax Agency about the non-liability to VAT for the National Institute of Nuclear Physics (INFN), as ESS ERIC Representing Entity, was positively answered and

prevented INFN to have its purchases subjected to VAT. The additional problem was that this was not applicable to the other two Italian IK Partners: National Research Council (CNR) and Elettra Sincrotrone Trieste, which were not recognized as Representing Entities. The VAT problem was solved having all purchases made directly by INFN and considering CNR and Elettra as sub-contractors of INFN for the realization of their specific contributions. This solution led to inefficiencies in the day-to-day work, with an extra layer of approvals and communications involved in all procurements.

#### 9.7.4. *When*

The problem of VAT liability was present in the ESS Project and the ERIC Consortium since their inception.

Actually, during the initial years of the ESS Project (2013~2018) the attention was addressed to the aspects of VAT liability in each Partner Country, as generally there were no transactions between the IK Partners and Sweden.

As mentioned in Section 8 of this Report, in 2018 a BrightnESS Workshop was organized in Lund and fully dedicated to the VAT exposure. It was important to clarify many aspects, but still there was no decision to have managed the VAT in Sweden directly by ESS.

It was in the following years, when equipment started to be shipped to Lund from the different Member States and labour for installation began to be provided as IK contribution, that the problem of the VAT in Sweden became apparent in all its complexity. Enquiries to the Swedish Tax Agency (STA) started to be placed by the different Partners, with separate approaches to the tax authority and with contradictory information. One major example was two Partners enquiring the Tax Agency with the assumption that IK deliveries were commercial transactions in one case, and the assumption that they were NOT commercial transactions in the other case.

At that point it became clear that an action at the central level was necessary.

In 2020 a great effort was then made and noticeable results have been obtained in settling the issue of VAT (non)liability of IK Contributions. Already at the end of 2019 a search was made on potential consulting firms able to take care of the VAT problem. A final choice was made at the beginning of 2020 and a contract was signed with a consulting company based in Stockholm and Malmö. After a number of meetings, a strategy was devised in order to present to the Swedish Tax Agency an approach able to grant in a consistent way the non-exposure to VAT for all IK Contributions.

This approach was presented and discussed in a series of (virtual) meetings with top Representatives of Tax Agency in Spring and Summer 2020. In early Autumn the Tax Agency responded positively, and the details for the application of the general principles to the different specific situations were set in the first half of 2021.

Three informative workshops were held in May, where the Legal Officer of the IK Management Division, who was the main actor in solving the VAT issue, presented the general approach to the IK Partners. Such workshops were followed by 1:1 meetings with single IK Partners, dedicated to clarify more specific issues.

#### 9.7.5. *How*

The most optimal solution from the collaboration's perspective, is of course that this issue could be resolved at high level via a change in the ERIC and/or VAT legislation. In the absence of this however there are important lessons for any future collaboration like ESS.

The VAT story on ESS was not yet fully complete at the time of the release of the present Report, but good progress was made in moving toward a comprehensive solution, led by the efforts at ESS on the

Swedish side, greatly appreciated by Partners. For a future collaboration such an undertaking by the host organization should be planned at the outset; as with other country specific topics, it is most efficient for the host organization to lead on understanding and resolving the host country aspects for all Partners, rather than piecemeal activity by each partner which also risks creating further problems by separate approaches to the tax authority with contradictory information.

From a timing perspective it is also vital that understanding of the VAT situation is reached before budgets and funding are set and agreements are entered in to. This would avoid needing to retrofit agreements and activities that have already taken place into a different VAT context, which may have consequences like retrospective VAT registration requirements and potential interest charges as well as unexpected administrative burdens on all. Similarly, if the outcome is that VAT is due and unrecoverable then this can be factored into budgets from the outset.

Both collaboration Partners and the host organization should also carefully assess the implications of the activities they are agreeing to carry out, both with regard to VAT and also other requirements such as Intrastat reporting. As Partners may be research institutes, not internationally trading commercial enterprises, they may well not have the in-house expertise to do this. Planning from the outset for the host organization to recruit staff or consultancy services with expertise in these areas (and budget to do so), could be an efficient way to support Partners through these challenges as well as ensuring that both Partners and the host organization are able to reduce the risk of unintended consequences.

## LESSON LEARNT

The management of VAT issues is of paramount importance in any project for realizing/updating a Research Infrastructure.

If not resolved a priori at the European or international level for the particular kind of organization the project refers to and its relevant legal status, it is mandatory that a full understanding of the VAT situation is reached at a very early stage, before budgets and funding are set and agreements are entered into force.

Where a central site of the Research Organization is present, the most obvious and efficient way to clarify the implication of VAT with respect to the Host Country, is that the central organization will deal with this matter, as far as legal practicalities allow, on behalf of all the Partners of the Project, in a unique, definite, and holistic way. If Partners are unable to get complete clarity on VAT liability at the outset, they need to budget significant resources, including some at senior level, to devote to this issue.

## 9.8. CENTRAL HOST ORGANIZATION MANAGEMENT AND SUPPORT FOR HOST COUNTRY SPECIFIC MATTERS, REGULATIONS AND INTERPRETATIONS

ESS is one of the rare examples of a Research Infrastructure under construction in a setting without previously established Scientific or Research Facility in place. Although in the early days of the project ESS had strong support from Lund University, most of the administrative and management policies, processes, practices, and procedures had to be established anew. This greenfield status of the facility created many challenges, but also some opportunities.

### 9.8.1. What

Here are a number of challenges encountered:

- ESS had to establish an entire suite of management documents which were to govern many of the processes within the organization. The development and refinement of said documents took time,



and required a substantial effort in the early days of the project. Furthermore, many of the topics this suite of documents managed possessed nuances which required continuous improvement and refinement of administrative and management tasks. This in turn led to even more time and effort spent on establishing and revising procedures.

- The lack of an established research facility in the “background” of the ESS project meant that all of the engineering, quality, and safety standards had to be drawn anew. This exercise, like the one mentioned above, required a lot of effort, many iterations, and constant updating. It also led to frustrations with some Partners and Suppliers since the changing nature of principal guiding documents meant that the Partner commitments to designs, quality standards, or installation plans were more difficult to secure and sustain.
- The establishment of the ERIC status of ESS in 2015 meant more streamlined legal provisions for its operation. Although this is correct in many senses, the relative novelty of the ERIC concept in Europe combined with the (at times) unclear relations between the ERIC Guidelines, EU regulation, and national legislation, slowed down many of the interactions between ESS and the Host State.
- The ERIC set-up, unlike the Intergovernmental Organization (IO/IGO) did not allow expatriate tax annulment schemes. This put ESS at a disadvantage compared to many other International Research Facilities due to the fact that it couldn't offer the same level of financial remuneration package to its potential staff as other, tax-free facilities can.

That notwithstanding a number of opportunities were present and exploited:

- The new set of management documents and principles allowed for ESS Facility and its Partners to start without the bureaucratic burden of the legacy systems. Without the historical baggage, ESS could focus on developing streamlined and result-oriented documentation that facilitated quick and efficient collaboration with Partners.
- The greenfield setup of the ESS facility removed the burden of legacy software and hardware installations and equipment that needs to be accommodated for when planning the construction project. As a result, the ESS Facility could focus on harvesting the most advanced technologies available, utilizing contemporary design, latest software, and developing its facility, as well as its components truly for the future.
- The ERIC legal framework together with ESS ERIC Status was recognized by the Swedish State in the early days of the project. This resulted in the ability of ESS to utilize some of the ERIC provisions to their full extent. For example, the organization was capable of setting up and utilizing the ERIC VAT regime, assuring the return on any incurred VAT costs during the duration of the project, and subsequent duration of the Operation Phase. Furthermore, the ERIC regulations allowed ESS to develop its own Procurement Rules. These procurement rules, although based on the Common EU Procurement Practices, allow for a greater degree of freedom when dealing with supplies to the project. They also allow for a tighter grip on the arbitration process, overall increasing the ability of ESS to control its supply chain more actively.

### 9.8.2. Why

For any collaboration where Partners are required to interact with a host country that is not their own, it can be challenging and time consuming for them to navigate local laws, regulations and interpretations where they have no previous experience of working in this host country. Whilst the precise host country specific aspects will vary from collaboration to collaboration, it is almost certain that some will arise.



Efficiencies could be achieved by planning, from the outset, for the host organization to coordinate, manage and/or advise Partners on such matters and to fund the host organization accordingly, rather than for each Partner to try and navigate these matters individually.

Examples, from ESS, of activities or information that have been challenging for Partners to navigate in Sweden include (but are not limited to):

- Swedish tax authority's interpretation of VAT legislation;
- Swedish labour laws;
- Swedish construction site access regulations (see case study in the following);
- Swedish regulations and restrictions during the COVID-19 pandemic;
- Swedish building regulations.

### **9.8.3. Who and Where**

Of course, different items impacted in different ways on different Partners.

For instance, labour laws and site access were of paramount importance for Partners supplying installation and commissioning services, as COVID restrictions impacted more on Partners who needed to travel to Lund, and less on Partners who were still doing design work and in general activities that could be carried on from home.

### **9.8.4. When**

As previously discussed, ESS successfully managed to clarify a number of Host Countries specific issues, and support the Partners who were affected.

The point is that this activity was more reactive than proactive. In other words, in many cases, even if not always, problems were addressed and solutions provided once they showed up.

Many examples could be done, and here it is worth recalling just a couple of them.

VAT appeared since the very beginning (2013-2015) an issue both at the Partner national level, and at the central Swedish level. If leaving to solve the national-specific issues to the single Partner was obviously correct, but was not effective to leave each Partner find autonomously how to deal with VAT in Sweden. Only in 2020/2021 finally ESS took the initiative to negotiate and agree a successful way to manage in a homogeneous way VAT in Sweden.

Starting 1<sup>st</sup> January 2021 Sweden adopted the "Economic Employer" approach, which basically implies that a person working in Sweden for more than 45 working days, irrespective of the nationality of the company she/he works for, has to pay the personal income tax in Sweden. Being Sweden's tax system different, and in general more costly than other Nation's systems, this caused an unexpected increase of labour costs for IK contributions that included manpower effort, e.g. for installation, testing and commissioning, with respect to the costs considered in the original Cost Book and agreed in the IK contract.

### **9.8.5. How**

How to manage Host Countries specific regulations is of course matter specific. The common ground is that the central organization should clarify at an early stage of the project how to proceed, informing and assisting the Partners as necessary.

An example case study can be taken from ESS: ID06 cards and STFC (UK).



A requirement for anyone needing to access the ESS site was to hold an 'ID06' card, to meet the Swedish requirement for an electronic personnel ledger on construction sites. The process for applying for such cards had been set up with applications from commercial companies in mind and the more detailed information was in Swedish only.

Trying to navigate this application process as a foreign government research institute was extremely challenging and time consuming, involving STFC's lawyers, procurement and finance teams as well as the UK Field Coordinator, simply to achieve a few access cards. Eventually STFC did succeed in registering and ordering the necessary cards, and very helpfully ESS later took over this role for collaboration Partners.

Whilst this specific challenge with ID06 applies only to the ESS circumstances and the challenges in a different host countries would of course be different, there will no doubt be similar aspects for which it would be most efficient for the host organization to administer/action from the outset, or if that is not possible, for example in cases where the Partner organization legally has to be the signatory, then to coordinate with the relevant host country body and advise the partners how to proceed.

## LESSON LEARNT

The greenfield projects do not have the luxury of relying on the accumulated experiences, common practices, or sets of documents developed by the facilities preceding them. As a result, many of these need to be developed from scratch, utilizing valuable resources in the process. One way to circumvent this problem is to involve the Partners in this process, gathering valuable feedback on what works and what can still be improved.

From the outset the host organization should be funded and resourced to deal with host country specific subjects on behalf of Partners, coordinating with the relevant host country body/authorities, managing any actions directly where possible or advising Partners in cases where Partners are required to take action themselves.

On top of this, it is of paramount importance to ascertain all possible Host Country specific matters, at a very early stage of a project, and not as the different problems arise later on, in order to be prepared to deal with them in a definite and effective manner. To this end defining the relevant processes and developing the appropriate supporting documents (procedures, guidelines, templates, etc.) is an activity that must be addressed in the conception phase of the project.

## 9.9. EARLY DEFINITION AND CONFIRMATION OF APPROPRIATE INSTALLATION PLANS AND SITE ACCESS PLANS

In a complex environment as the system of In-Kind Contributions from the Member States to the European Spallation Source project, a composite set of equipment, services and knowledge was provided by the different IK Partners.

While the requirements and specifications of equipment could in general be sufficiently well defined in the technical schedule of each contract (Technical Annex), the conditions for services, like installation, commissioning, and in general support by the Partner to the relevant ESS Function could be clarified only with time.

### 9.9.1. What

During the period of BrightneESS<sup>2</sup> the ESS Project has moved into the installation phase, and it has become clear that the plans for onsite work in that phase were not sufficiently defined. Orphan scope



arises daily in the form of tasks which the Partner had assumed ESS would do, and which ESS had assumed the Partner would do.

Resolution of the issues on a day-to-day basis has been made harder by the “customer/contractor” relationship inherent in the In-Kind agreement, which means that each side is responsible for the costs of what they do. Towards the end of the Partner’s project, of course, they have already run out of money. And ESS has budget issues too. One instance of these costs was site access for Partners and their subcontractors: inevitably there are safety requirements such as attending site safety briefings, or such as only certain qualifications being acceptable for certain work (welding, electrical wiring, etc.).

It is easy for the Partner to argue that these requirements are imposed by ESS who should pay, and it is easy for ESS to respond that the Partners should have anticipated some such costs even before the details were known. Another example is on-site handling. Who pays for things to be moved around site? Even when they weigh hundreds of tonnes?

While the plans were being drawn up in the contracting phase each side (ESS/Partner) was being encouraged to reduce cost, which increased pressure for them to weed out costs where there was any prospect of deferring the issue, and perhaps handing on the costs to others, later. So, it is no surprise to see the consequences of that approach. “Later” happened and the fallout had to be managed.

### 9.9.2. Why

The situation, with each side forlornly hoping the other will pay, led to underestimation of costs, skimping on installation, and costly delays while the parties argued over money. Such issues continued to arise because of the way the IK programme was structured.

To fix them it was necessary to be realistic about how much money was missing and ensure that it appeared once in estimated cost to complete. This would require a genuinely collaborative effort between the Partner and ESS, with each side being open about what costs were yet to be incurred and what they cut out of their early estimates. The news would not be welcome at Council, who could decide they would rather not know until later.

### 9.9.3. Who and Where

The involvement of IK Partners on installation work happened under different initial hypothesis and contractual conditions. While in some cases the subject of Partner’s contribution and the relevant Technical Annexes was explicitly and uniquely installation activities to be carried out by the Partner’s representatives on site in Lund, in other cases only support to the ESS Functions was scheduled. Another occurrence was the need to have Partner’s technical personnel in Lund to complete the assembling and/or testing of a particular piece of equipment.

### 9.9.4. When

As outlined before, the issues and challenges connected with on-site work were partly scheduled since the beginning and explicitly included in the relevant contracts, in other cases the necessity to have Partner’s personnel in Lund became clear only at a later stage of project implementation.

Perhaps this problem was foreseen at the time that the IK system for ESS was designed. That system was always going to be a compromise between addressing the lessons learned by other major projects, whilst coming up with something that the all the parties would find politically acceptable and which held out the prospect of making overall project management at least tractable.

For the longer term – for future collaborations – there will be a strong case to add ESS experiences to the body of knowledge accumulating on what worked well and what didn’t work for internationally-

built scientific infrastructures. There is a strong case for a body such as the EU to fund that work and keep the expertise alive, in anticipation of future collaborative projects.

## 9.9.5. How

There is no ideal solution, and it may be that a review of the reasoning behind the ESS IK system would show that, for all its shortcomings, it was the best possible. Such a review should be done, and it would provide very valuable input to other major collaborations in the future. This is already an active field of study (e.g. <http://icri2021.ca/program/> would be a good place to start, or Bent Flyvbjerg's books on so-called megaprojects) and any review would only have value if set into the context of that field. From the Partner's perspective, at least as seen by some Partner, it feels that the formal IK arrangements at ESS have moved too far away from a collaborative approach.

An interesting example came from the UK contribution for the Active Cells.

To confront the situation that the Partner found itself at the time of the release of this Report, the pragmatic solution agreed between ESS and the UK as regards the Active cells facility was to establish a fund, jointly funded from contingency with the split 50/50 between ESS and the UK, managed by a single person who reported how the money was spent in tranches of ~100 kEuro. It was agreed between the ESS Target Division and the UK Programme Office what would be an equitable split of the funding and how future tranches would be funded. As it was not clear whether there would be enough contingency to complete the work, this approach required explicit agreement from the management teams at ESS and in the UK.

## LESSON LEARNT

When in a complex system of In-Kind Contributions to the project of construction of a large Research Infrastructure it is necessary to consider work on site, all the relevant aspects should be identified and appropriately planned at an early stage as possible.

Adopting a proactive approach will avoid major difficulties at a later stage of the project, when the actual work of installation and commissioning is well on its way and access to the site is necessary.

A careful planning of on-site activities will avoid the necessity of reactive solutions case by case for difficulties that can arise both from the point of view of the schedule and the budget, as well as from the point of view of personnel management.

## 9.10. IN-KIND STAKEHOLDERS MANAGEMENT

In today's organizations Stakeholder management is a key for assuring not only the success, but even the overall survival of the enterprise or institution.

Even the standard for Quality Management ISO 9001, in its version dated 2015, defines Stakeholders management as a key requirement in order to understand the context of the organization and consequently define the most appropriate policies and operative objectives.

Clause 4.2 of ISO 9001:2015 "Understanding the needs and expectations of interested parties (stakeholders)" states:

*Due to their effect or potential effect on the organization's ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements, the organization shall determine:*

*a) the interested parties that are relevant to the quality management system;*



*b) the requirements of these interested parties that are relevant to the quality management system. The organization shall monitor and review information about these interested parties and their relevant requirements.*

### **9.10.1. What**

The European Spallation Source ERIC has a track record of successful awareness raising activities and campaigns, which have helped the organization to engage Stakeholders in various countries and increase the overall amount and quality of IK Contributions (IKC).

Within the framework of the EU-funded project BrightnESS, ESS has established Regional Hubs in its Partner Countries to maximise the common knowledge on how to best execute IKC. The organisation has also set-up an online IKC Best Practice Platform, which allows the Partners and other Stakeholders to find and exchange information, and benefit from sharing key documents that facilitate both the preparation and the implementation of an in-kind model in European Big Science Projects.

### **9.10.2. Why**

Stakeholder relations management was always considered crucial to the success of the project, to complete the facility and start operations. Therefore, it needed to be structured and coordinated.

ESS key stakeholders include the Host States (Sweden and Denmark), Member States, In-Kind Partners, scientific partners, governance bodies, industry (as providers), universities, local schools, future users (scientific and industrial) and society in general.

At the Partner's level, being usually public research institutions, national central governments and sometimes regional local ones, as owners, are key internal stakeholders. Their main expectations relate usually to return on investment, such as contracts with industry and viability beyond the construction of ESS, that is usually related with participation in other national and international projects.

A further internal stakeholder is the IK Partner's staff, sharing usually some common needs and expectations, like for example safe employment, technical/scientific involvement, adequate remuneration, participation in decisional processes, job security and good level of information.

### **9.10.3. Who and Where**

As research facilities, many of the ESS IK Partners have the main focus on the scientific output of their institutes. Therefore, the main motivation for some of the Partners to participate to the ESS project was to manage and operate instruments at ESS as they currently do as outstation in other research facilities. When this option was discarded as a possibility for those Partners, they had / have little motivation to continue contributing to the ESS project.

On the other hand, external stakeholders such as clients, suppliers, research centres (both collaborators and competitors), institutions, and society at large search for good collaborations, long-term relations, good level of communication, exploitable results. The general public is mostly interested in value for money, exploring new knowledge paths and general benefits in terms of returns.

### **9.10.4. When**

Stakeholder management has been object of attention at ESS since the early days of the project. As far as Stakeholders directly connected with In-Kind Contributions were more and more involved as the contracts for IKC had to be finalized. BrightnESS and BrightnESS<sup>2</sup> grants assured an important support to these actions.



All that said, it must be noticed, however, that a structured database of IK Stakeholders, as the one discussed in next section, was never developed. An exercise of identification of major ESS Stakeholders for each Member State, with particular focus on Stakeholder important for IK Contributions, was carried out in 2020, but still not organizing the information collected in a structured database.

### 9.10.5. How

For In-Kind management, it is essential to have a good Stakeholder and Communication Management which will help to ensure that stakeholders are effectively involved in Project decisions and their execution throughout the lifecycle of the Project. Therefore, after identifying the key stakeholder groups mentioned previously a very good and reliable Stakeholder Register (database) should be developed. Such register should contain at least:

- Relevant information: name, title, groups, organizations, interests, involvement, interdependencies, influence, and potential impact on Programme success;
- Group information: name, number of stakeholders, description, level of impact, issues, opportunities, and current and desired state of change-readiness.

To ensure that the correct approach is developed for each stakeholder or each group, standard project management methodologies can be used to categorize and analyse all stakeholders, such as:

- Categorizing the stakeholder as unaware, resistant, neutral, supportive or leading;
- Defining the status of stakeholder's category as current or desirable;
- Measuring impact on the Programme by classifying this as High (H), Medium (M) or Low (L);
- Categorizing each stakeholder group using the Power/Interest Grid.

Furthermore, the communication or type of engagement should also be added to the Stakeholder Register, and an evaluation should be done to assess if the current communication strategy is sufficient or if a new communication strategy should be developed and adapted to each group's needs (monitoring).

In the case of a large research facility, several stakeholders are involved in different committees. This information should also be added to the register, together with their term and background.

Stakeholders, their information and their type of engagement may change constantly, in particular in a project involving the design, construction and operation of a large-scale facility. Therefore, the Stakeholder Register is not a static document, and should be updated at least quarterly.

## LESSON LEARNT

Stakeholders identification and management is a topic of paramount importance in today's organizations, both at the industrial and at the academic/research levels.

For a green field project, like the European Spallation Source ERIC, this matter is vital, above all when referred to Member States and Partners Institutions contributing In-Kind equipment and service to the project.

It is then wise, if not mandatory, to set-up since the very early stages of a project a system to collect, retain and maintain appropriate information on each single Stakeholder identified. A structured register or database could well aid this purpose.

For projects relying on In-Kind Contributions for their realization, a thorough and updated information on each of the relevant stakeholders is key to achieving the results expected in the schedule planned.



## 9.11. LEGAL AND FISCAL IMPLICATIONS ON SECONDMENT OF IN-KIND PERSONNEL

The term "Secondment" is primarily used in British English because this type of employment originated in the British Colonial Civil Service. Nowadays, however, it is frequently applied in international organizations.

### 9.11.1. What

*Secondment is a temporary assignment of an employee from one organization to another for a specified period of time, usually to carry out a particular project.* It can be internal – at a different department within your company, or external – at a sister company, or in a client's or partner's company. It can be a domestic or expatriate assignment. During the secondment, the employee continues to be employed by their original employer. At the end of the secondment, it is anticipated that the employee will return to their original position.

A secondment is typically conducted by a written agreement that sets out details of the relationship between the two organizations and the employee. One type of secondment agreement is between the two organizations. A second type of secondment agreement is between the original employer and the employee, specifying the terms of the secondment. The types of provisions included in these agreements must address which entity will pay the salary of the secondee during the secondment and identify who will manage the day-to-day activities of the seconded employee, among other provisions.

### 9.11.2. Why

In the early development and innovation days (2015-2017) of the Construction Phase of ESS, seconded staff of the IK Partners gave the excellent opportunity for ESS to use a very wide range of scientific and engineering expertise while IK Partners were allowed to get first-hand experience of the different sub-projects of ESS (ACCSYS, Target, NSS, ICS and DMSC), so they could truly understand what these sub-projects involves. Junior secondees especially were allowed to learn new practical skills at ESS site and possibly even gain a new qualification or train in a new system. IK Partners had the chance to improve soft skills such as communication, networking and building relationships, as they joined to ESS teams and met new colleagues there.

If ESS is considered not as a single research facility in Sweden but as a full-fledged European Research Infrastructure (ERIC) built upon a wide international network of European research organizations with a common not-for-profit cause, then external and expatriate Secondment is an excellent tool to meet the requirements of Section 2 of Article 28 "Employment" of the Commission Implementing Decision (EU) 2015/1478 of 19 August 2015 on setting up the European Spallation Source as a European Research Infrastructure Consortium (ESS ERIC) which says: *"Subject to the requirements of national legislation, each member shall within its jurisdiction facilitate the movement and residence of nationals of the members' countries involved in the tasks of the Organisation and of the family members of such nationals."*

A secondment is an excellent networking opportunity both for ESS and for its IK Partners. They have the chance to meet and become friends with whole new teams of scientists and developers, and these relationships can prove to be beneficial throughout the later phases of the ESS (Initial Operation and Steady State Operation Phases). In this way, they can really implement the "Access Policy" policy required by Section 2 of Article 17 of the above-mentioned Commission Implementing Decision (EU). Therefore, secondment by all odds will have an impact of the future of the ESS project.



### 9.11.3. Who and Where

The "ESS Guideline for Compiling In-Kind Technical Annex" (document no. ESS-0039570) was released on February 26, 2016. In this document it was rightly considered that IK Secondment had some special features, therefore special TA template was developed for IK Secondment. In Section 5.2. "**Secondment of IK personnel to ESS**" of the document, IK Secondment was defined as follows:

*"Secondment describes when staff from other partners work for and are managed by ESS for a certain period. IKCs can include staff secondment to ESS. As the obligations for ESS and the partner are different for seconded staff a separate template for the TA should be used (see TA section 7.3). An IKC should not be a mixture of seconded staff and other deliverables.*

*For an IKC of seconded staff the amount of staff, their experience and skills and duration of their work need to be specified as well as the deliverables they will provide during their secondment. Secondees could remain physically situated at their home location, visit ESS extensively or even move to ESS in either Lund or Copenhagen (for the DMSC)."*

A further section of the document, 5.3. "**IK Staff working in Sweden or Denmark for ESS**," was dedicated to some special features of ESS IK Secondment, given the reason:

*"For IK staff that plan to be situated in Sweden or Denmark for long periods of time certain costs and restrictions occur. This is irrespective of whether staff are seconded or work directly for an IK partner."*

As early as December 9, 2015, ESS released the "**ESS Guideline for In-Kind Secondment**" (document no. ESS-0046794). Section 4.2. "Taxation" of this document provided a general description of the issue but more importantly an "Appendix 1 – In-Kind Taxation" was annexed to the document which provided the necessary Glossary of Terms to make Swedish tax regulation understand to IK Partners. The general description stated:

*"Taxation in Sweden will mainly depend upon individual's place of residence, and duration of stay. Swedish tax legislation distinguishes between unlimited tax liability and limited tax liability. All In-Kind personnel that would stay in Sweden for less than 6 months, precisely less than 183 days during a period of one year, would not be subjected to Swedish income tax. This applies only if individual's income is paid by a non-Swedish employer with no permanent establishment in Sweden. If an In-Kind Seconded would stay at ESS premises for more than six months, he/she would need to become a Swedish resident, and as such would be required to pay Swedish taxes."*

In the more detailed "Appendix 1 – In-Kind Taxation" an important sentence were added to the general description:

*"Sweden does not apply the economic employer concept."*

### 9.11.4. When

During the "ESS Workshop on VAT Exposure related to ESS Installations in Sweden" on July 5, 2018 in Lund, information was received by the IK Partners that the Swedish Tax Agency issued a memorandum to the Swedish Department of Finance in June 2017. The memorandum was about to introduce the "economic employer concept" in Sweden. The proposition prolonged several times, and finally was issued only on June 2020. The new rules came into force on January 1, 2021, when the Government bill was accepted by the Swedish Parliament.

Back in October 25, 2019, upon request of the Chair of IKRC, the Human Resources Division of ESS gave a presentation to IKRC #21 on "Swedish Income Tax & Social Security concerning IK Secondment at ESS." It provided an early warning that "Sweden will most likely change from legal (or formal) employer

to economic employer on January 1, 2021. The company or institution that benefits from the performed work will be regarded as the actual employer rather than the company that pays the salary both according to the tax treaties and internal legislation. The 183 days rule will no longer be applicable if economic employer and taxation starts from day 1."

On January 27, 2021 the Human Resources Division of ESS prepared a document for the Video Meeting of the IKRC #22 on the so-called **Economic Employer Concept**, "which is focused on hiring out of labour from a non-Swedish employer to a Swedish legal entity. The actual change in the legislation is to apply the Economic Employer Concept when interpreting the so called 183-days rule in both internal legislation and also in the double tax treaties. The suggested changes will potentially impact the taxation for in-kind staff in Sweden. The in-kind staff will be subject to taxation in Sweden and the actual taxation rate is dependent on the length of stay in Sweden. The new legislation also contains various legislative changes regarding registration and reporting obligations for foreign companies in Sweden. "

Finally, on June 19, 2021, the Human Resources Division of ESS released a new document for the Video Meeting of ESS Council #23 entitled "Taxation and tax withholding obligations in Sweden in effect from 1 January 2021." It says: "Non-residents working in Sweden for a non-Swedish employer without a permanent establishment in Sweden are tax liable in Sweden if the beneficiary of the employee's work is an entity in Sweden and the work is performed under the management and control of the Swedish entity. Previously non-Swedish employers have only been obliged to deduct tax from payments for work carried out in Sweden if they have a permanent establishment in Sweden. The new regulation stipulates that non-Swedish employers with no permanent establishment in Sweden will also be obliged to deduct tax from payments made to employees working in Sweden. There are no exemptions for neither ESS as an organisation nor In-Kind partners. There is however, an important exemption for Government Services. This follows from the double tax treaties Sweden has concluded with many countries including all countries who are members of European Spallation Source ERIC."

### 9.11.5. How

The "**Taxation and tax withholding obligations in Sweden in effect from 1 January 2021.**" document explains and states:

"It is important to bear in mind that it is not ESS who will have the actual liability on behalf of the in-kind partner and there are no direct costs involved for ESS. However, the uncertainty around the legislation and its interpretation can impact the decision-making process of the in-kind partners and their staff, and we are definitely risking delays and (potentially) claims of some kind from in-kind partners due to higher costs. ESS encourages In-Kind partners and commercial suppliers to familiarize with the rules and to contact the Swedish Tax Agency if you have further questions. For In-Kind partners we kindly ask you to contact ESS In-Kind group for further assistance and guidance.

ESS is in a continuous dialogue with the Swedish Tax Agency to get their view on whether in-kind staff and their activities in Sweden will actually trigger the economic employer status or not. Most commercial agreements such as consultancy agreements, etc. will be affected by the new legislation."

ESS Human Resources Division rightly rang the storm-bell that the new Personal Income Tax (PIT) rules of Sweden pose a serious threat to the future of ESS In-Kind Secondment. At the same time, it is incomprehensible why the HR Division is trying to shift the responsibility for supporting IK Partners to the already heavily overburdened IKM Division, which does not have the appropriate expertise to address the PIT issue. See the sentence

"For In-Kind partners we kindly ask you to contact ESS In-Kind group for further assistance and guidance."



As in the case of the Swedish VAT regulations, where ESS has essentially postponed the solution of the problem for 7 years long, it does not seem wise for ESS not to seek a proactive solution to the PIT problem within Sweden but to leave the struggle for solution to the unprepared non-Swedish IK Partners. Based on the sad VAT experiences, it is easy to see that exporting the handling of the PIT issue to the IK Partners could lead to further delays in IK Deliveries. ESS Management, and in particular the Project Support & Administration Directorate, could play a coordinating role so that, if necessary, the Member States of ESS could take diplomatic steps in relation to Swedish VAT and PIT regulations which are clearly detrimental to the whole ESS project.

## LESSON LEARNT

Personnel secondment from In-Kind Partners is a strategic issue in a project for realizing/updating a Research Infrastructure. It can bring great benefits to both the Central Organization (ESS in the specific case), the IK Partner Institution, and the secondee.

However, secondment is subjected to a complex legislation that must be completely clarified before any IK contract is finalized, as not fully understood requirements and, worse than this, requirements that change in the course of the contract can alter the boundary conditions of the contract with a negative impact on costs and secondary effects on contribution schedule.

For these reasons it is of paramount importance that the Central Organization takes full responsibility of comprehension of the legal framework and assists the IK Partners for any relevant issue with personal taxation in the Host Country. Also, when negotiating an IK contract for secondment, it is mandatory to figure out which implications could have possible future variations in the legal framework

## 9.12. INVOLVEMENT OF THE IN-KIND MANAGEMENT FUNCTION IN THE SUPERVISION OF THE IK CONTRIBUTION SUPPLY CHAIN

The topic relevant to this Section is another aspect of the role of a central function dealing with the management of In-Kind Contributions. As such, it relates with the *Participation/involvement of in-kind management representatives in the sub-project activities*, presented in Section 9.4, and with the *Collection of information from the In-Kind Partners*, presented in Section 9.5.

### 9.12.1. What

At the European Spallation Source, the overall activities relevant to the relationships with IK Partners have been always a distributed responsibility. More specifically a central function called “In-Kind Management Group”, established since the beginning of the project, traditionally dealt with contractual and administrative issues, making a tremendous work in the years, to secure In-Kind contributions for an overall amount of 575 M€.

While the responsibility of the so-called In-Kind Contribution Agreement (IKCA) was sole responsibility of the In-Kind Group, the preparation and negotiation of the relevant Technical Annexes (TA) was a shared responsibility of the In-Kind Group and the competent Technical Functions.

Once finalized the contract, in the subsequent phases of its implementation, the relationship with the In-Kind Partner was completely taken by the Technical Divisions, which took full and sole responsibility of managing the relevant supply chain.

## 9.12.2. Why

All this was perfectly coherent with the organizational model implemented in ESS, which gave the greatest importance, and some degree of independence, to the four major Sub-Projects, i.e. Accelerator (ACCSYS), Target, Neutron Scattering Systems (NSS) and Integrated Control Systems (ICS). Each Sub-Project took care of the different activities through a number of Work-Packages, which did not have necessarily a one-to-one relation with the IK Contracts (Technical Annexes). This because one specific work package could refer to more TAs, as well as a complex TA could be managed through different work packages.

It was embedded in this organizational model that, once finalized the contract and started the relevant activities, the management of the relationship with the In-Kind Partner became essentially responsibility of the Technical Divisions through the competent Work Package Manager (WPM). Hence the supervision, management, testing and approval of all IK supplies, arriving directly from the Partner Institutions or through them from industrial subcontractors was matter of WPM responsibility and authority.

## 9.12.3. Who and Where

It was pointed out in many parts of this Handbook as managing In-Kind contributions of high-tech equipment and services for a such large value, and for a green field complex project like ESS, was not an easy task. And this was experiences both from the organizational and technical point of view.

Hence, beside the IK Group, specific bodies were established to the purpose, with primary attention to the In-Kind Review Committee. Composed by representatives of the Member Countries, its main responsibility was to supervise, endorse and recommend to the ESS Council the finalized IKCAs and TAs for final formal approval. It is straightforward that, being this the duty of the IKRC, there was a strong connection with the IK Group.

The IK Group, in turn, entered the newly established Strategy Directorate at the end of 2018.

At the beginning of 2019 the BrightnESS<sup>2</sup> project started, with the official opening in Rome in mid-January with the first General Assembly. The network of the Regional Hubs and Field Coordinators, established during the first BrightnESS grant all over Europe was confirmed in its role of connection between the central IK Group and the IK Partner Institutions.

By then, The Project Management Office was only indirectly involved in In-Kind Management, through the planning of the activities of the Technical Work Packages in the Primavera P6 platform for project management.

## 9.12.4. When

It was precisely at the end of 2018 that the first technological equipment started to arrive in Lund, the first one being the ion source, supplied In-Kind by the “Laboratori Nazionali del Sud” of the Italian Institute of Nuclear Physics (INFN).

In the following months, and along the subsequent year 2019, the rate of deliveries started to grow and continued to increase.

It was at that point that the traditionally separated contractual and technical aspects of In-Kind Management started to mix-up: shipping, delivering and receiving a piece of equipment was undoubtedly a technical issue. However, administrative and legal aspects returned forcefully to the scene. In fact, just to make a couple of examples, issues like VAT and transfer of property had to be managed in practice and any relevant aspects quickly clarified, even case by case.

Also, whilst the technical relationship with the IK Partner was basically a one-to-one relation by the WPM at ESS and the corresponding technical responsible at the Partner Institution, the need of a transversal management of the supply chain became apparent.

The In-Kind Group strongly felt the need of more human resources dedicated to the new challenges. Then, thanks to the Strategy Director, the Group was implemented with a Senior Legal Officer, and two Senior Engineers, growing to a total of six people.

Additional competences were then directly available for the In-Kind network of Field Coordinators and IK Partners, and a stronger connection was established with the Technical Divisions.

At the end of the year 2019 the implemented IK Group was fully operative, and the interactions and cooperation with the Technical Divisions and Work Package Managers started to grow.

Just ready for the outbreak of the COVID-19 pandemic at the beginning of 2020, which, as discussed also in other parts of this Handbook, highlighted even more the need of a comprehensive management of the In-Kind Contributions.

### 9.12.5. How

As already presented and discussed, it was during the second half of 2020 that the discussion started about how to deal with such a need, and the idea to establish a new Directorate fully dedicated to In-Kind Management started to be considered.

The new “Associate Directorate for In-Kind Management” was established by the end of 2020 and its “In-Kind Management Division” was effective starting January 1<sup>st</sup> 2021, taking all personnel, competencies and responsibilities of the former In-Kind Group.

Since then the interaction and cooperation between the Technical Directorate, Project Directorate and In-Kind Management Directorate was more and more reinforced, with the latter supporting the formers in any aspect of the IK Management, helping specifically in the supervision and optimization of the supply chain, even if not entering any Technical or Project Management decision.

A dedicated re-focusing of the In-Kind Review Committee and the Network of Field Coordinators also enlarged their role in helping to keep under control and optimize the IK Supply Chain and then the performances of the project in terms of schedule and budget.

## LESSON LEARNT

Any Research Institution wishing to adopt an In-Kind Contribution model, whichever will be the actual form of its implementation, it is of paramount importance to establish a central function for In-Kind Management, defining appropriately its responsibilities and authorities.

Given that the IK Central Function (IKCF) shall not interfere in any technical or project management decision, it is important, as effective for the whole project, not to limit the field of action of the IKCF in terms of support of any aspect relevant to IK Contributions.

Hence the IKCF should have competencies and resources appropriate to grant an adequate support to issues like administration and legal, contracts, logistics, quality assurance and quality control, delivery and acceptance, and, for the sake of the topic of this section, IK Supply Chain.

## 10. Lessons Learnt:

### Present conclusions and future developments

In-Kind Contributions are at the core of the European Spallation Source Project.

The IK model was never applied before to a green field project to the scale of ESS, for which it was however a must, in order to acquire the necessary knowledge and support to design and realize all the high-tech components and systems necessary for the accelerator, the target and the neutron instruments.

Managing In-Kind Contributions at ESS was an exciting learning process, supported by BrightnESS and BrightnESS<sup>2</sup> European grants. A most effective network of Regional Hubs and Field Coordinators were set up in the frame of Work Package 2 of BrightnESS and further exploited with Work Package 3 of BrightnESS<sup>2</sup>.

During the years a wealth of Best Practices have been put in operation, learning from successes as well as from problems. The consequent Lessons Learnt represent an invaluable asset of organizational knowledge at disposal of ESS for the rest of the construction phase and possibly for the operation phase, and, even more importantly, a baseline for other Research Infrastructures that use or will use in the future the In-Kind approach for the realization of new facilities or for the update of existing ones.

This Report, released in June 2021 as Deliverable 3.4, presented a number of Best Practices and Lesson Learnt (BP&LL) in different disciplines connected with In-Kind Contributions Management. The set of BP&LL presented will be extended after the release of this document, with a second edition that will be released before the end of the BrightnESS<sup>2</sup> Project in December 2021.

In the meantime, more information can be obtained and possible forums can be organized contacting the ESS IK Management Division at the following address: "[info4ik@ess.eu](mailto:info4ik@ess.eu)".

As a very last closing remark the most important Lesson to be Learned is that In-Kind Management on projects as complex as ESS is not easy, and the function needs to be collocated as soon as practicably possible in the project life-cycle in order to speak with one voice both internally and externally.

It is then important

### TO LEARN FROM LESSONS LEARNT

