BrightnESS²

Bringing Together a Neutron Ecosystem for Sustainable Science with ESS

H2020-INFRADEV-3-2018-1

Grant Agreement Number: 823867

Deliverable Report

D3.1: Agreed joint working practices

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3. List of Abbreviations and Acronyms

ACCSYS	ACCelerator SYStem
AFC	Administrative and Financial Committee
ASCR	Academy of Science of the Czech Republic
AVCR	Akademie Vêd České Republiky
BOD	Beam On Dump
BOT	Beam On Target
CE (marking)	"Conformité Européenne"
CEA	Commissariat à l'Énergie Atomique et aux énergies alternatives
CF	Conventional Facilities
CNR	Consiglio Nazionale delle Ricerche
CNRS	Centre National de la Recherche Scientifique
EET	ESS Executive Team
EMT	Executive Management Team
EOC	End Of Construction
EOI	Expression Of Interest
ERIC	European Research Infrastructure Consortium
ESS	European Spallation Source ERIC
EU	European Union
FAQ	Frequently Asked Questions
FC	Field Coordinator
FS	First Science
FZJ	ForschungsZentrum Jülich
HoA	Head of Agreements
ICS	Integrated Control System
IFE	Institutt For Energiteknikk
IFJ PAN	Instytut Fizyki Jądrowej PAN
IK	In-Kind
IKC	On-Kind Contribution
IKCA	In-Kind Contribution Agreement

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IKRC	In-Kind Review Committee
INFN	Istituto Nazionale di Fisica Nucleare
INFN/LNS	Istituto Nazionale di Fisica Nucleare / Laboratori Nazionale del Sud
ISIS	*Not an acronym: it refers to the Ancient Egyptian goddess and the local name for the River Thames*
LASA	Laboratori Acceleratori e Superconduttività Applicata
LINAC	LINear ACcelerator
LLB	Laboratoire Léon Brillouin
MEBT	Medium Energy Beam Transport
NSS	Neutron Scattering Systems
PAC	Project Advisory Committee
PGE	Polska Grupa Energetyczna
PMT	Project Management Team
PS&A	Procurement, Support and Administration
PSI	Paul Scherrer Institute
RBOT	Ready Beam On Target
RFQ	Radio Frequency Quadrupoles
SOUP	Start of User Programme
STFC	Science and Technology Facilities Council
TA	Technical Annex
TBL	Test Beam Line
TU Delft	Technische Universiteit Delft
UKAEA	United Kingdom Atomic Energy Authority
VAT	Value Added Tax
WP	Work Package
WU	Work Unit
XRM++	eXternal Relations Management (++)
ZHAW	Zürcher Hochschule für Angewandte Wissenschaften

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5. Executive Summary

This document was orginally intended to be report on Joint Working Practices. Circumstances have changed here at ESS. The original organizational structure served ESS well from 2013 to 2018, enabling the project to be established on firm foundations. However, it turned out not to be as well suited to an organization delivering installation and commissioning. By restructuring the organisation over the Summer 2019, ESS set out to establish clearer direct responsibilities and improved decision-making.

Despite introducing restructuring in October, there is still considerable work to undertake before we have a smooth and fully functioning system. This document reports on this background, the work that has been carried out under Work Package 3 that is still pertinent and now identifies the work that needs to be undertaken following the restructure of IK Management responsibilities. The valued resources of BrightnESS^2 will continue to support ESS to evolve and develop new joint working practice. A report to complete this Deliverable will be made in QI of 2021 to update the Working Practice Actions in this report. This work will be developed with the different ESS Functions and the IK Partners - particularly the Field Coordinators network - to enhance the ESS IK Management system.

The European Spallation Source (ESS) has the vision to build and operate the world's most powerful neutron source. Neutron scattering is unrivalled in probing the structure and function of materials on the molecular scale and, once fully operational, ESS will beyond previous technological limits and enable some of the most sophisticated characterization of advanced materials and manufacturing processes in the world. Thus providing the opportunity for many thousands of researchers to make significant contributions to the interdisciplinary challenges facing our society, our economy and our planet.

A flagship investment in European Research Infrastructures, ESS is in its sixth year of construction on a green-field site in Lund in Sweden while its Data Management and Software Centre is being developed in Copenhagen in Denmark. It officially became a European Research Infrastructure Consortium in October 2015 and with the construction project 62% complete, the consortium of 13 nations building ESS has much to be proud of. Research facilities like this often require resources that go beyond of those available to any single nation or laboratory. As a green-field site – the vast majority of technical components for the accelerator, target, instruments and control systems needed to be provided by others - ESS was very much reliant on In-Kind Contributions (IKC).

BrightnESS provided invaluable support to the ESS project during some of the most critical years with a key theme being the development of a functioning In-Kind (IK) system. By implementing a robust system and strong communication channels to share learning, the results of BrightnESS quickly became apparent. With over 85% or 468 M€ of contributions now covered by signed documents, the contracting phase is now largely complete and the Implementation phase is well underway. This new phase - with Partners focusing on the manufacture of tailor-made parts and equipment and ESS teams focusing on installation and commissioning - brings its own challenges. BrightnESS^2 is bringing welcome support and assistance with Work Package 3.1, in particular, focusing on the evolution and refinement of the IK framework to adjust to these new challenges.

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This new ESS organizational structure that was formally introduced on October 1st 2019, also signaled a time to re-think the role and operations of IK Management. After some careful analysis, ESS has decided to streamline its IK system, resolving that responsibility for IK 'Supply Chain' Management should be the responsibility of the Project Director and responsibility for IK 'Framework' Management should be the responsibility of the Strategy Directorate.

Section 6 reviews the ESS context and the background of In-Kind Contribution management system at ESS, with particular reference to system prior to the recent restructure and the successes delivered by BrightnESS including the Network of Regional Hubs, the Field Coordinators, the XRM+ Information system and the Best Practice Exchange.

The key issues facing ESS during the completion of construction are the subject of Section 7, where the ESS restructure, the subsequent refocusing of the In-Kind management system and the timeline to deliver "First Science" in 2023 are explored.

Section 8 discusses the key issues ESS will be facing in successfully managing In-Kind contributions and how the IK system can be evolved to assist. Specifically, this section looks at how to align the system to help achieve First Science in 2023, deliver clear communications and remove the roadblocks that hamper installation and commissioning, noting the valuable support of BrightnESS^2 is during this period. In particular, this section examines issues like VAT, change of ownership and CE Marking. This section also identifies the following Working Practice Actions:

#1 Refine the IK management system to take account of the ESS restructure

#2 Evolving XRM+ by creating visible and shared IK reports

#3 Build on best practice exchange

#4 Maturing the network of Field Coordinators

#5 Refine shared communications to take account of the ESS restructure

#6 Develop a risk mitigation strategy for VAT exposure

#7 Develop a shared approach for In-Kind Contribution ownership transfer

#8 Develop and implement a shared working practice for CE marking of In-Kind Contributions

These need to be developed with our Partners – particularly the Field Coordinators - in order to complete this Deliverable.

Section 9 draws together the future implementation of this document.

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6. Background

The European Spallation Source (ESS) has the vision to build and operate the world's most powerful neutron source and is a flagship investment in European Research Infrastructures (Fig 1). Neutron scattering is unrivalled in probing the structure and function of materials on the molecular scale, yet creates impact on a very tangible, human level. From developing next-generation batteries to combatting antimicrobial resistance, from advancing quantum computing to creating sustainable energy solutions – ESS will enable European researchers make critical contributions to the interdisciplinary challenges facing our society, our economy and our planet.

Figure 1 Overview of the ESS facility layout

A genuine pan-European facility, ESS officially became a European Research Infrastructure Consortium in October 2015. It is currently under construction in Lund in Sweden while its Data Management and Software Centre is being developed in Copenhagen in Denmark. When fully operational, ESS' long-pulse 5 MW source is designed to go beyond previous technological limits, producing a neutron peak brightness of at least 30 times greater than current state-of-the-art facilities. Once realized, this will enable some of the most sophisticated characterization of advanced materials and manufacturing processes in the world.

By pushing the limits of human knowledge and understanding in this way - and by replacing many ageing nuclear reactor-based facilities - ESS will help Europe maintain its international lead in this multidisciplinary research field. The key contributions are the 15 state of the art instruments that are under construction and will serve the 6,000 strong European neutron user community. In the long term, expansion of the suite up to 22 instruments is anticipated.

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6.1. ESS progress to date

Figure 2 Aerial views of the ESS construction site in Lund (green field and by mid 2019)

The completion and delivery of early elements of accelerator hardware from IKC contributors in France, Italy and elsewhere have been installed and are entering commissioning. Target building construction is progressing steadily and building of ESS' world-leading instruments is well underway with Technical Agreements in place for seven out of the first eight instruments. Management changes to better match the installation needs over the next few years have been implemented across the entire organisation as of 1st October 2019. In short, ESS continues to deliver on the promise to build and operate the world's most powerful neutron science facility.

Figure 3 Nocturnal view of the target building showing the construction of the high-bay

In common with the construction of other large research facilities, this project has encountered some technical issues and challenges that have necessitated scope and schedule changes. The strengthened safety and security demands, as part of Europe's response to the serious incident at Fukushima, caused significant delays to essential parts of the construction and required the whole project to be re-

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baselined. This was achieved with full knowledge and endorsement by our Partners and following rigorous international peer review.

6.2. The ESS In-Kind system

With the whole project a green-field enterprise, IK has been an integral mechanism to deliver ESS success - 70% of the high-tech components for the accelerator, target, instruments and control systems are being provided through the collective IK effort of our Partners across Europe. Developing a functioning IK system was a key theme of BrightnESS, whereas the focus of Work Package 3.1 of BrightnESS^2 was to evolve and refine the IK framework with Partners.

Not only has this work established an excellent basis for international cooperation but, by extension, provides an exemplar for other international projects of the future. For example, establishing a network of Hubs and Field Coordinators has been very useful mechanism for enhancing communication between ESS and the IK Partners.

An IK system of the scale developed by ESS is relatively new in European Big Science and previous projects have not found it straightforward to implement. Facilities like ESS are often beyond the resources or expertise of any single nation or laboratory to develop and the IK system offers clear benefits for greenfield sites like ESS offering the prospect of a faster build than would otherwise be achievable. Whilst coordinating such an effort can be challenging and costly, the benefits are significant, with many countries attracted by the opportunity to increase their technical capability.

The IKC principles of openness, transparency and competitive process were developed and approved by AFC and the Steering Committee (precursor of Council) before the support of the BrightnESS grant, however BrightnESS then contributed much to consolidate the IKC process (Fig 4) and disseminate the relevant information to the IK Partners, especially through the network of the Field Coordinators.

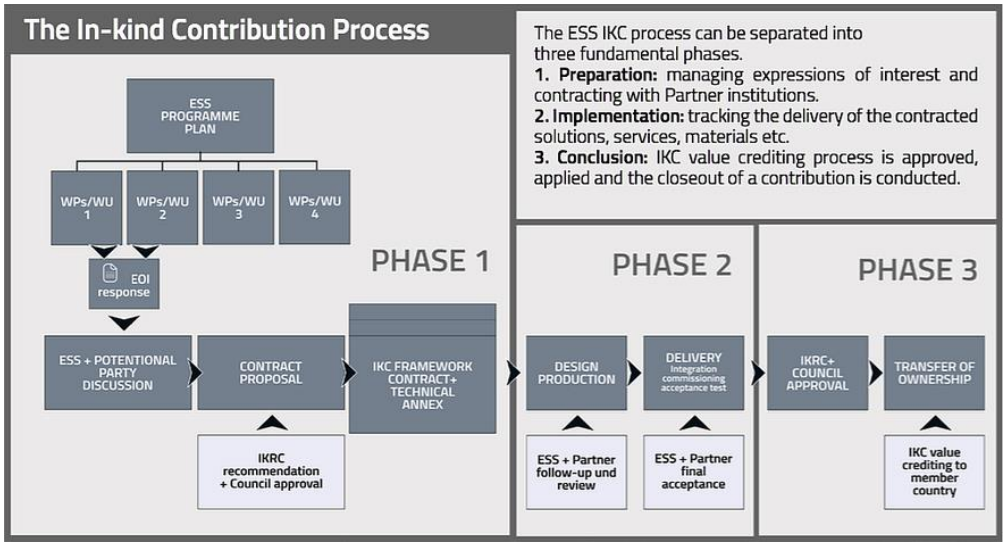

Figure 4 The overall ESS In-Kind Contribution process

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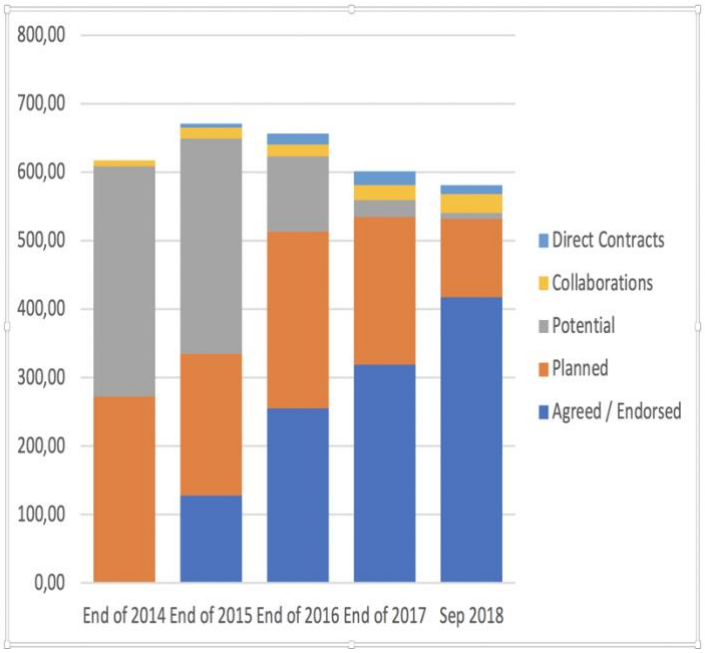
The preparation or contracting phase is now largely complete with 85% or 468 M€ of contributions covered by signed documents (Fig 5). The middle, or Implementation phase, is well on its way, with Partners focusing on the manufacture of tailor-made parts and equipment. While the integration of different components, by far the most challenging phase, is just starting to come on stream.



Despite this, the process has not always flowed smoothly. In retrospect, ESS Cost Book was deficient in several respects and issues such as VAT are still far from resolved. Contributions at the cutting edge of current technology are often delivered thanks to unique Partner capabilities and ESS' commercial-like contractual approach does not always fully reflect this. That said, the BrightnESS deliverables of 'Best practice online platform', 'the Management Information System' and the 'IKC Work Package Assignment Plan' helped identify many of these issues, ascertain next steps and go some way to addressing these efficiencies.

Figure 5 In-Kind Contracts from 2014 to 2018 (values in M€2013)

6.3. BrightnESS achievements

BrightnESS provided invaluable support to the ESS project during some of the most critical years of its Construction Phase. Establishment and evolution of Regional Hubs under WP 2 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 hubs. Strong communciation channels paved a way for sharing these models, which in turn expedited the finalization of TAs. The results of BrightnESS became quickly apparent – number of signed TAs began to rise, and by the end of the project ESS has signed more than 100 Technical Annexes with partners from across Europe. To put this number into perspective, at the time of BrightnESS Project inception, ESS has only had a few Technical Annexes signed, a number of Heads of Agreements – legally non-binding scope of works documents – in place, and only 1 In-Kind Contribution Agreement finalized.

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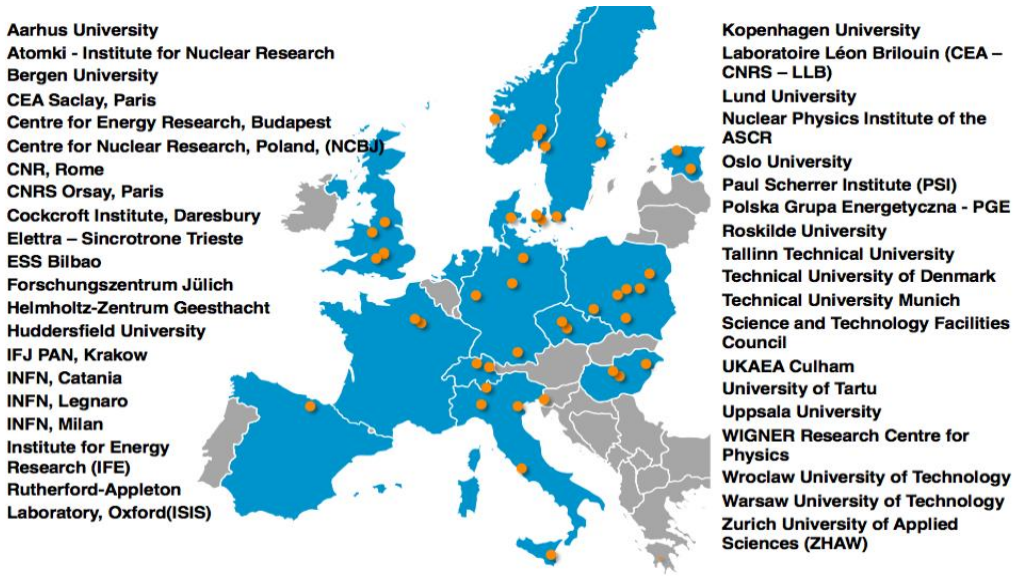

Figure 6 - ESS Partners in Europe

Today ESS has allocated 468 M€ of a total of 547 M€ IKC through more than 140 signed Technical Annexes, 24 collaboration agreements with Institutes from Host Countries, and a number of Direct Contracts. (Fig 7). More importantly, the laboratories and advanced technology workshops of over 40 IKC Partners around Europe which form the backbone of the IK network, are now well into the construction of the technical equipment needed to complete the facility.

		TA completed & accredited by Council	TA approved by Council	TA endorsed by IKRC	CA - Host countries Collaboration Agreements	DC (Direct Contract)	TOTAL
Accelerator	No #	5	25	8	13		51
	Value	792	186,401	67,785	20,200		275,178
Target	No #		5	7	1	4	17
	Value		22,281	42,687	204	10,053	75,225
NSS	No #	20	34	24	9	12	99
	Value	2,716	81,482	34,085	7,560	4,024	129,867
ICS	No #	3	14	2	1		20
	Value	515	13,877	1,148	425		15,965
TOTAL	No #	28	78	41	24	16	187
	Value	4,023	304,042	145,705	28,389	14,077	496,235

Figure 7 Current In-Kind Partner contributions

The first significant pieces of technical equipment delivered by the IK Partners have started to arrive on site. These have been principally for the accelerator but also to support development of the control systems and include, Ion Source, Radio Frequency Quadrupoles (RFQ), Medium Energy Beam Transport (MEBT), Cryo Distribution Systems, Radio Frequency Components, prototypes of Drift Tubes Linac and Cryo Modules, Warm Linac Units, Control Software packages. The Ion Source has now been installed in the accelerator tunnel and is undergoing cold commissioning; more recent arrivals such as the RFQ and MEBT will follow this path. The stream of IKC arriving for installation, heralded the next phase of the project and required some restructuring designed to support the successful installation and commissioning of the project and prepare for steady-state operations.

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Figure 8 BrightnESS and In-Kind Contributions

IKC were originally, and continue to be, identified as one of the key risks for ESS. Building a Research Infrastructure at this scale on a greenfield site cannot be achieved without the knowledge and capabilities of other laboratories, although the requirement for 70% of ESS' technical scope to be delivered by IK is very challenging and brought significant risk. The considerable support provided by the European Commission through the BrightnESS grant to address and mitigate these significant risks was invaluable. The success and achievements of ESS' IK system far, only came about because of the foundation work facilitated by BrightnESS. These activities provided a full range of support measures from training, best practice 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 a budget to cover VAT as it was anticipated that a facility within the ERIC framework would be exempt. So, the support provided by the EU in the past years through BrightnESS, and now through BrightnESS^2, continues to be of great value for the management of IKC. This additional funding is also a mandate to share ESS experience and best practice matured on IKC with the community and will result in Deliverable 3.4 "Lessons learnt from IKC on ESS", due at the end June 2021.

Network of Regional Hubs Created as sharing forums that met regularly, supported by local Field Coordinators, to discuss and act on the challenges and opportunities arising from the IK contribution system. They were particularly involved in matching Partner Institutes to IK opportunities, and facilitating the compilation and approval of contractual documentation and enhanced the interactions on this front by providing timely staff training in preparation for planned and potential IK contribution contracts.

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Field Coordinators Established over three years, this network of knowledgable professionals embedded in Partner Institutes, provided a useful bridge between ESS and Partners. 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.

Figure 9 In-Kind Field Coordinators in Trieste

XRM+ Information system for the coordination of IKC activities A centralized software platform that forms the backbone of IK management by providing support to the IK Management Coordination Office and Partners. It provides a single repository to track progress on IKC at National, Partner and contract level and funding for specific countries. It is used more generally to support ESS governance and stakeholders. The initial tool was developed by Elettra in Italy, and then was migrated to the ESS servers. The tool was positively received by ESS staff and also by the reviewers who have signaled that it would be a useful tool for future Research Infrastructure Projects in Europe.

Best Practice Exchange Three planned Best Practice Workshop focusing on different aspects of IK for large-scale research projects were held to identify needs and exchange best practice. The first in Bilbao, Spain in 2016 concentrated on engineering aspects, the second in Catania, Italy in 2017 focused on processes, requirements and preparation for installation while the third in Lund, Sweden in 2018 chose installation as its main topic. Streamlined access to all presentations, documents and best practice materials was provided on the Best Practice Platform that was developed to further support IK Partners. With the help of BrightnESS and some careful budgeting, an extra Best Practice Workshop took place in Lund, in July 2018. *ESS Workshop on VAT Exposure related to ESS Installations in Sweden* attracted more than 40 participants, and significantly improved shared understanding of VAT issues and options.

7. The key issues facing ESS during the completion of construction

7.1. ESS Restructure

The original organizational structure served ESS well from 2013 to 2018, enabling the organization to establish the project with firm foundations. However, it turned out not to be well suited as the organization moved into the phase of installation and commissioning.

All outstanding design, assembly, installation and commissioning tasks for the construction project were re-baselined in May 2018. This was a significant task necessary to accommodate the safety changes demanded by the EU following the Fukushima incident. Despite this, our December 2018 Annual Review noted that ESS continued to encounter schedule challenges, with some stemming from IK deliveries. Council responded by establishing a Project Advisory Committee (PAC) to provide them and the Director General with more regular project advice. One of PAC's first recommendations, made to our Council in June 2019, was to take advantage of forthcoming Executive team changes and

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reorganize the entire project management structure to encourage a more flexible, agile and focused approach in support of the forthcoming installation and commissioning phase.

This recommendation was supported and worked up over the summer. ESS rolled out its new project focused approach in October 2019 to establish clear project management responsibilities and better staff-resource alignment. To provide more focus and shorter decision-making chains, a core Project Management Team (PMT) responsible for executive decisions on budget and schedule was established. A wider ESS Executive Team (EET) was tasked with strategic decisions on whole organizational issues.

7.2. Overall timeline to completion of construction

While the project is 62% complete, much of this is civil construction and the project now needs to focus on delivery, assembly and commissioning of the technical IK components arriving from our European partners. Encouraging progress has recently been made on technical scope. A steady proton beam from the ion source has been established, while further sections of the accelerator have been delivered by the IK Partners and are now being installed and commissioned, i.e. the Radio Frequency Quadrupoles (RFQ) and the Medium Energy Beam Transport (MEBT).

ESS Statutes foresaw that the organization would need to initiate 'initial operations' in parallel to the construction project and identified an additional stream of funding to resource this work. To complete construction by 2025, the two streams of construction and initial operations funding must work in tandem. Our proposals to manage both budgets and schedules in a coherent and controlled manner, recently shared with Council, are set out in our Initial Operations Plan. There, we identify the activities until 2025 necessary to support host laboratory functions, bring completed IK equipment into operation, deliver science to users and establish a sustainable foundation for the long-term stewardship of the facility.

Progress towards these are staged according to pre-defined milestones (Fig 10) with the plan optimized to deliver:

- First Science (FS) with three instruments in 2023;
- Start of the user programme (SOUP) in 2024; and
- All 15 instruments in use or in commissioning by the end of 2025.

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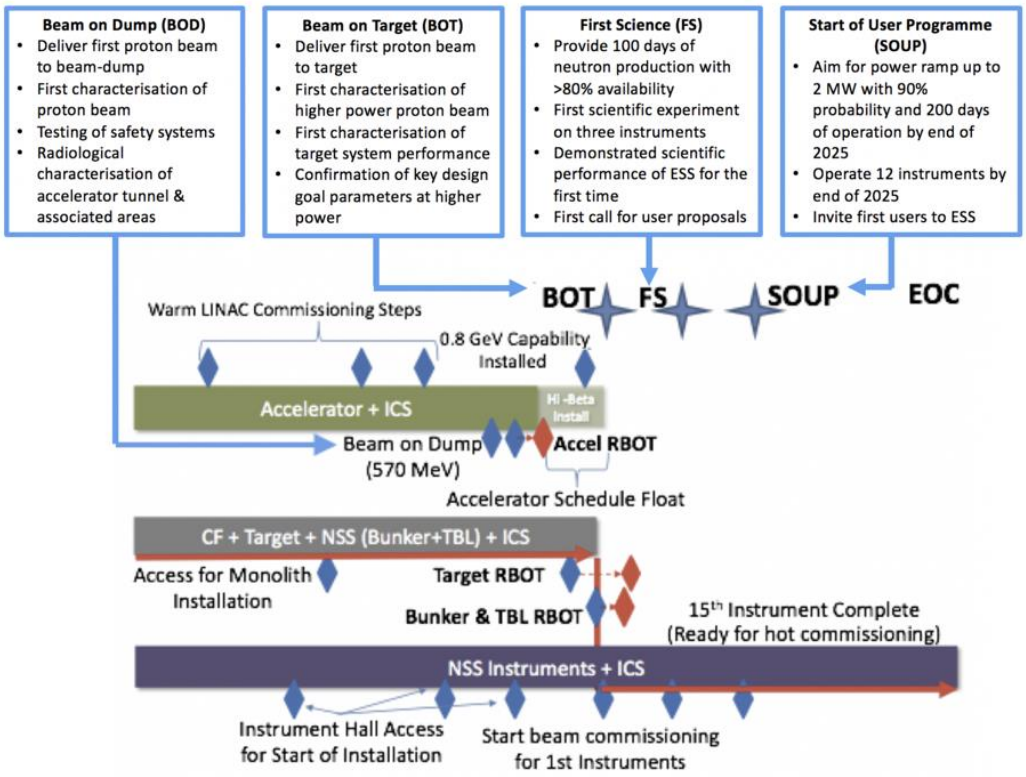

Figure 10 Summary Critical Path and High-Level Milestones to the End of Construction
(A full list of abbreviations and acronyms is set out in Section 3)

7.3. Refocussing of In-Kind management responsibilities

By restructuring the organisation, ESS set out to establish clearer direct responsibilities and improved decision-making in support of the forthcoming installation and commissioning phase.

Although an In-Kind Group has been in place since the Autumn 2013, coordinating the activity relevant to the IK Contributions, the work was actually shared between different functions and teams inside ESS associated with the four Directorates shown in (Fig 11). During this time, the activity of the IK Group focused on the development and formalization of IK contracts and collaboration agreements including the Technical Annexes, whereas the technical and scientific relationship with the IK Partners was managed by the Technical Divisions. This has become more and more important as the implementation phase ramps up with issues like manufacturing, acceptance tests, quality control / assurance, installation and commissioning quickly coming into play.

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However, as the purpose of the system changed and evolved, it became more and more evident that the responsibilities for IK management had to be better defined deliver clear ownership and coordination with distinct roles for each Directorates. In particular, it was more and more evident that IK Management could be characterized by two main environments, i.e. the IK "Framework" and the IK "Supply Chain" that manages the budget and the schedule of deliver of IKC.

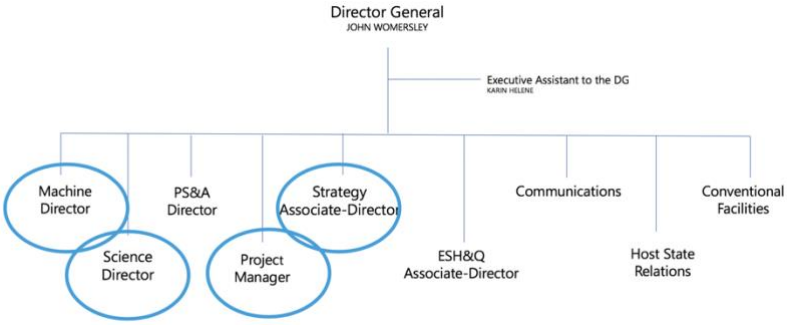
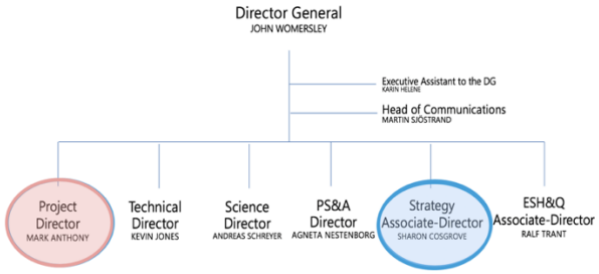


Figure 11 Former EMT with In-Kind responsibilities



With IK Partners calling for clarity and PAC advising we minimise schedule risk, we reviewed all alternative options. Our initial preference was to group all activities under the Project Director as it would provide clarity of leadership, responsibility and reporting.

Figure 12 New EET with revised In-Kind responsibilities

However, it quickly became clear that the Project Director and his team did not have the capacity or capability to address significant system issues such as VAT and CE Marking with PAC advising such issues would be an unwelcomed distraction for the Project Manager's team, who instead should entirely focus on improving the IK supply chain. We therefore resolved that responsibilities for IK Management for the foreseeable future should be shared between the Project Manager and Strategy Directorate, as set in Figures 12 and 13. This approach was strongly supported by the In-Kind Review Committee in October 2019.

IN-KIND FRAMEWORK MANAGEMENT

- *Responsibility:* ***Strategy Directorate***
- *Organisation*: Single In Kind Team
- *Focus:* Relationships, General, organizational issues
  - Contracts, amendments, legal aspects, liabilities, warranties
  - VAT, CE Marking /quality,
  - Contacts with Funding Agencies, Ministries, National Bodies

IN-KIND SUPPLY CHAIN MANAGEMENT

- *Responsibility:* ***Project Directorate***
- *Organisation*: Work Package leaders matrixed to In Kind Project Coordinator
- *Focus:* Supply chain management
  - Schedule, budget and performance control
  - Requirements that could be filled by Initial Operations IK
  - Contacts with Partner Institutes

Figure 13 Summary Post-Reorganisation In-Kind Management Responsibilities

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Despite introducing this new plan for sharing IK Management responsibilities in October, there is still considerable work to undertake before we have a smooth and fully functioning system. For example, roles and responsibilities of internal teams as well as external Partners and the Field Coordinators will need to be considered and either endorsed or remodelled. Equally, In Kind plans, procedures and joint ways of working will require close scrutiny and refinement. At the outset of BrightnESS², it was not anticipated that we would have just revised all our IK responsibilities. While it was the perfect opportunity to hone the system to meet present and future needs, the consequence is that there is now additional work to undertake in order to deliver Work Package 3.

The remainder of this document will report the work that has been carried out under Work Package 3 that is still pertinent, it will also identify the work that needs to be undertaken now that ESS has restructured its IK Management responsibilities. The valued resources of BrightnESS² will support ESS in refining and developing new joint working practices to enhance its IK Management system.

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8. The key In-Kind issues facing ESS in successfully managing IK

8.1. Description of key challenges

It was challenging enough to construct a Research Infrastructure when 70% of the technical scope was being provided through IKC. However, this challenge was made more intense when it transpired there was no funding to establish the management of the IKC system and that the ERIC legal framework was insufficient to provide a reasonable way to deal with VAT. BrightnESS injected crucial resources to address the management funding mismatch by allowing us to develop a functioning framework. Without this, ESS would not have approved 81 Technical Annexes, endorsed 41 Technical Annexes, awaiting Council approval, and signed 26 In Kind Contribution Agreements by the end of the BrightnESS grant period allowing the ESS construction project to have made such significant progress. However, the VAT issue is more challenging.

Since it was clear from the beginning that ESS would become an ERIC, and ERICs are exempted by legislation from VAT, it was assumed that it was unnecessary to include provision for VAT in the cost book. However, when this decision was made, it was not appreciated that the VAT exemption was only for Members of the ERIC and not any of the IKC partners. A lot of hard work has been undertaken to by ESS and the IKC Partners to develop 'work-arounds' for VAT on IKC in Member States but not for the Installation of IKC in Sweden but fundamentally ESS does not have the necessary legal framework to fully resolve these issues or an agreement with the Swedish tax authorities that IKC are contributions from Member States and therefore VAT exempt.

Moving ESS' into the next phase, where the scale of delivery and installation of IK equipment quickly accelerates, there are additional risks and challenges. By using the resources of BrightnESS^2, and strengthen the IK Framework established in BrightnESS, our ambition is to evolve the Framework to make it stronger, sustainable and more robust enabling ESS and its Partners to respond positively to the new challenges.

8.1.1. Field Coordinators

The Field Coordinators, funded by BrightnESS, were able to build excellent foundations of cooperation and thereby provide a bridge between ESS and the Partners. This was not just an excellent reference model for transnational collaboration but also had some real practical benefits to the ESS IK Framework. Improved capacity to align activities across institutes and borders while identifying potential technical risks, helped the joint teams maintain synchronicity between construction activities in Lund and the delivery schedule of the technical IKC.

Where Field Coordinators were embedded within a Partner Institute - and therefore had a close and intimate understanding of Partner activity - they acted as mediators and translators enhancing communications, providing an early warning of issues in both directions and helping mitigate and manage the risks. Where a Field Coordinator was not well-embedded in an Institute, or there was no Field Coordinator at all, these benefits were not so apparent or as quickly realised.

8.1.2. Network of Regional Hubs

As BrightnESS was not able to fund an even distribution of Field Coordinators across all countries, the solution - at that time - was to establish regional hubs to provide a more direct and continuous way of

collaborating with Partners around Europe. Five regional hubs were created during the first year of BrightnESS to act as the main point of contact for IK Partners in the region and enable effective quality control (Fig 14). Each Hub, supported by the local Field Coordinator, adopted roles and responsibilities best fitting their specific needs, challenges and level of maturity. The reports developed during BrightnESS illustrate how this approach went some way to facilitating and supporting the IK Framework, although the approach did not overcome the uneven resources as well as we had hoped. Now funding for Field Coordinators has reduced in BrightnESS², ESS Consortium needs to find other ways to address this issue if the benefits provided by the capacity and capability developed during BrightnESS is not to be lost.

Cluster / Regional hubs	Owner	Countries
North-West	STFC TU Delft	UK NL
Central	FZJ	DE, CZ, CH
Iberia	Bilbao	ES
Gallia	CEA	FR
South-East	INFN	IT, HU
Nordic / ESS HQ	ESS	DK, SE, NO, IS, LT, LV, EE, PL

Figure 14 *European distribution of the BrightnESS Regional Hubs which supervise the timely and qualitative delivery of IKC in their region*

8.1.3. XRM+ Information system for the coordination of IKC activities

Reliable management of the supply chain of IKC is another important issue that needs further strengthening as requirements for timely deliveries to meet the project schedule and critical path increase. This was anticipated during BrightnESS with the development of XRM+, an information system for the coordination of IKC activities. This centralized software platform developed by Elettra in Italy, was migrated onto ESS servers during BrightnESS to form the backbone of our IK management system. By using data straight from P6 - our project management tool *Primavera 6* - combined with data on signed and planned contracts, it enables coordinated sharing of project and IKC financial data to manage and coordinate IKC for the project. It continues to provide useful information, helping Partners keep track of the IK for which they are responsible, and allowing ESS to track progress both at an overview and more detailed level. Some minor evolution of the platform using ESS resources could be undertaken to improve reporting for the project's next phase. Since XRM+ is built on a

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scalable platform which is deeply integrated within the ESS Information System, the teams at ESS have a direct line of communication between each other, facilitating any potential future developments.

8.1.4. Best Practice Exchange

Finally, the next two years will see an acceleration of installation and commissioning activities that requires carefully planned actions, detailed technical information and configuration control. The Ion Source has recently been installed and commissioned and has provided valuable experience for future installation activities. It benefitted from ESS and Partners anticipating a need for further information and processes and the outcomes of the 3rd BrightnESS Best Practice Workshop that was devoted to IK Installations. Here, the full range of potential issues were explored and potential roadblocks identified by ESS and Partners that impede progress as the project navigates the important transition from contracting and design activities to manufacture, installation and commissioning. Some valuable information was developed and shared on the BrightnESS website which forms a basis for continuing to facilitate best practice exchange. For other specific critical issues - such as VAT, quality documentation, declaration of conformity and CE marking - there remains a need for follow-up capacity to develop useful solutions to these potential roadblocks quickly.

8.1.5. Strengthening the ESS In-Kind Framework

The conclusion of an informal IK system review, in the first half of 2019, was that the outcomes delivered during BrightnESS established an excellent Framework and should be built upon to strengthen the Framework as we move into the installation phase of the project. Issues that would benefit from further strengthening include

- Aligning the system to deliver First Science
- Delivering visible, clear and timely communications
- Removing the roadblocks that threaten delivery and installation of IKC

8.2. Aligning the system to deliver First Science

For ESS to deliver First Science in 2023 it needs to find ways to positively and proactively strengthen the management and oversight of the delivery of IKC to minimize schedule and cost risk. As observed during BrightnESS, it is critical to build a constructive and collaborative environment to balance the formal relationship between ESS and its Partners defined by contracts, penalties and other strict commercial requirements. Treading this fine line between a valued collaboration and a risk-averse agreement is a delicate balance, but one that builds on the valued outcomes of BrightnESS. Parties in all parts of the IK system should identify opportunities to reinforce the message that the ESS-Partner relationship is collaborative and constructive. There are many examples of effective two-way engagement and reporting that foster a positive sense of openness. These should be celebrated and expanded upon to build mutual trust.

8.2.1. Strengthen shared work processes to take account of the ESS restructure

The second area that must be delivered to improve our prospects of delivering First Science in 2023 is to strengthen the Framework delivered in BrightnESS to take account of the ESS restructure so that it delivers a smooth and fully functioning system.

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The large number of interfaces between each work package represents a further challenge. Different IK Partners have to design, test and integrate components, based on requirements provided by the ESS. This multitude of physical component requires coherent and consistent functional and physical interface definition which is not easy to achieve. For example, the Elliptical Cryomodules final delivery to ESS relies on shared responsibility between three different ESS IK Partners. The medium-beta cavities are manufactured by INFN/LASA and then assembled by CEA/Saclay. The high-beta cavities are manufactured by STFC/Daresbury and also assembled by CEA/Saclay. The transfer of ownership across all partners remains a grey area for which the ESS had to play a coordinating role.

Figure 15 Pictorial representation of the "In-Kind System" at ESS

The relationships of the IK system are best represented by a series of concentric circles. At the core stands the relationship between the ESS Work Package Leader and the In-Kind Partner. This relationship is the strongest connection between ESS and an IK Partner. It deals with the technical specifications, quality, cost and schedule of a particularly IKC and is usually managed via a weekly meeting.

Each successive concentric circle has a more comprehensive view of the overall status of IK contributions and a far less detailed appreciation of each individual IK contract. The first circle around this core represents the Sub-Project team, led by one of the Sub-Project Managers, e.g.

IK ACCSYS = Accelerator Sub-Project Leader **IK NSS** = Neutron Scattering Systems Sub-Project Leader

IK TARGET = Target Sub-Project Leader **IK ICS** = Integrated Control Systems Sub-Project Leader

These Sub-Project leaders have the overview of the different IK contracts pertaining to that Sub-Project and responsibility for ensuring that IKC are delivered on budget, on time and to the required quality. The Sub-Project Leaders are key contributors to the Supply Chain Management, reporting to the Project Director. The Project Director manages the IK Supply Chain by focusing on performance, cost and schedule.

The most external shell in represented by the In-Kind "Framework" Management, a responsibility of the Strategy Directorate, which manages the systemic and strategic issues, from contractual aspects, through to VAT, through to specific support to the Partners.

The BrightnESS Field Coordinators who are typically embedded in a Partner Institution span all the concentric circles, thereby providing a useful link between the Partner and ESS and between different ESS groups.

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Process improvement and refinement are key as are clarity of roles and responsibilities for all actors in the system (Fig 15). As already mentioned, this will extend to IK plans, procedures and joint ways of working in order to fully deliver the requirements of Work Package 3 and will have implications for delivering clear communications in section 8.3.

WORKING PRACTICE ACTION #1
Refine the IK management system to take account of the ESS restructure
Undertake an IK process mapping as a precursor to refining, re-modelling or rejecting processes no longer appropriate and developing new ones to improve the prospects of attaining First Science in 2023. New ways of working will be introduced to reduce overlapping roles, minimize schedule risk and assist the smooth delivery and installation of IKC. Terms of reference for internal and external meetings responsible for IK and new ways to engage management at the Member State level will also be addressed.

8.2.2. Visible and shared information

Timely, visible and shared information is critical for improving managing the IK supply chain. As mentioned in section 8.1.3, the XRM+ information system developed during BrightnESS was an excellent start and it was noted that the platform could be evolved to improve data reporting. Evolvement to meet the new requirements of the installation phase are what is now needed. By combining real-time data in XRM+ and our Project Management Suite, we have recently started to develop an "IK Key Milestone Report" (Fig 16) that extracts more from the available information and resolves some of the data issues that arose from the ESS re-baselining. The next phase will be to augment this with a revised risk register.

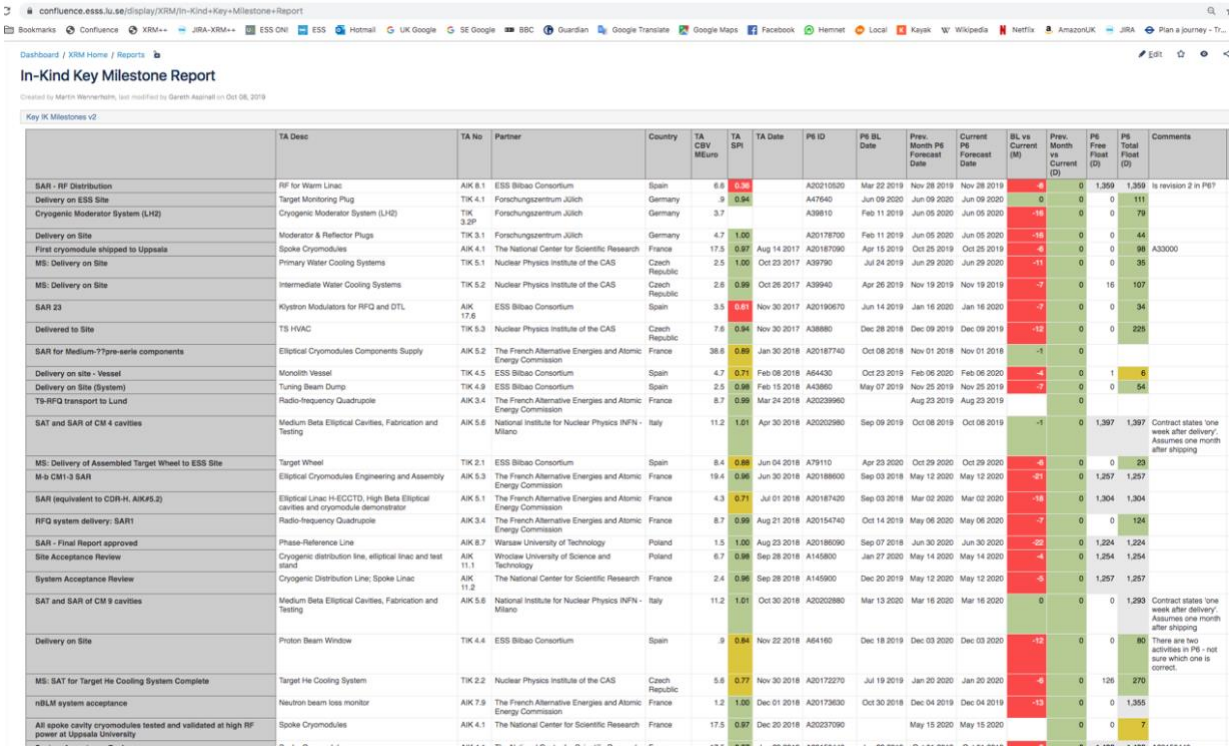

Figure 16 Screen shot of the "living" In-Kind Key Milestone Report

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WORKING PRACTICE ACTION #2
Evolving XRM+ by creating visible and shared IK reports
Improve the utility of data in XRM+ and Primavera 6 to create visible and shared periodic reports to assist IK management, both in terms of information obtainable "with one click" and the number of users relative to potential. Reports will include a Key Milestone Report or Dashboard and an upgraded IK risk management report to track and mitigate IK risks - agreeing relevant milestones, risks and mitigation actions will involve ESS Work Package Leaders and IK Partners. Having increased functionality, both ESS and the Field Coordinators will put in place specific actions to extend the use of XRM+.

8.2.3. Promoting Best Practice

Finally, there is an opportunity to keep developing and reminding ourselves of best practice and making that information readily available and useful. Turnover of personnel at ESS and Partners means that many issues that were discussed at the 3rd BrightnESS Best Practice Workshop re-emerge today as if encountered for the first time. There are also many IK situations that are genuinely new that could usefully be transformed into learning for others, these could be shared at a further workshop in Lund in 2020. Previous best practice material that remains pertinent today should be made readily available and updated periodically to increase training and fill learning gaps.

WORKING PRACTICE ACTION #3
Build on best practice exchange
Challenges once addressed and solved can be usefully turned into lessons learned. The best practice material from BrightnESS should be more widely shared and promoted including posting on the BrightnESS² website. To better respond to new issues raised by Partners the IK Group at ESS, together with the network of Field Coordinators will compile and makes available appropriate web pages, check lists, and answers to selected frequently asked questions (FAQ) and hold another IKC Best Practice Workshop in Lund in 2020.

8.3. Delivering clear communications

Communication is at the core of the IK relationship between ESS and our Partners and runs through the BrightnESS² Work Package 3 described in the proposal (H2020-INFRADEV-2018-1 "Bringing together a neutron ecosystem for sustainable science with ESS").

BrightnESS² recognized that the complexity of the installation phase increases the need for effective communication channels while acknowledging that much was delivered through BrightnESS. The ambition of the grant proposal was for channels to reach their full potential, so that ESS could secure the technical support and IKC required.

8.3.1. Maturing the network of IKC Field Coordinators

Given the areas that need further work, strengthening the involvement of BrightnESS² Field Coordinators is an approach that would be well advised. This would allow us to build on the strong foundation and communication strategy developed in BrightnESS.

ESS and the Field Coordinators have been working closely during 2019 to mature the network by developing the expertise to manage the transition to installation and commissioning. Regular video meetings with the IK team and with ESS Sub-Project Heads ensure communication channels remain open and relationships effective while participation in external events (i.e. IK Best Conference, Big Science Business Forum) and visits to other Research Institutions greatly enhance engagement.

Two Field Coordinators Network meetings in 2019, as part of this work package, have reviewed status and progress, shared lessons learned, identified missing activities, defined interactions between Hubs and analysed the impact on ESS and Partners. As a consequence, specific areas for future improvement have been identified and developed. For example, closer collaboration between the ESS IK Group members, the Field Coordinators and the ESS Work-Package activities which will be picked up as part of Working Practice Action #2. The next Field Coordinator meeting will be a joint one with the Industry Liaison Officiers of Work Package 4 in February 2020.

As part of this work, it has been observed that the Field Coordinator concept has been most successful where a Field Coordinator can concentrate on working with one country and where they are well-embedded in one of the Partner's Institutes. There are fewer resources available in BrightnESS² but in maturing the concept of Field Coordinators, it also seems necessary to develop the coverage if we are to use their skills and functioning to further deliver a well-coordinated and mature system.

WORKING PRACTICE ACTION #4
Maturing the network of Field Coordinators
Not all IK Partners are represented by Field Coordinators and nor have they been recognized or effectively integrated into the ESS IK management system. Further development and adjustment is required if Field Coordinators are to continue as a productive forum supporting First Science in 2023. The shared ambition to identify a Field Coordinator in each Partner country, each well-embedded in a Partner Institute

8.3.2. Enhancing communication within all parts of the In-Kind system

The frequent weekly communication between the ESS Work Package Leader and the Partner established during BrightnESS provides the backbone of the IK system. However, there are many other people – both from ESS and Partners – currently involved in the system and the ESS restructure has amended some elements including the addition of an IK Coordinator in the supply chain management (Fig 17). This increases the potential for ESS to speak with less clarity and consistency.

BrightnESS² communication channels should be further strengthened to reach their full potential, helping to assure the levels of technical support and organization needed to deliver the IK contributors. Such communications need to fully engage ESS staff, IK Partners and Member States, celebrating progress and success.

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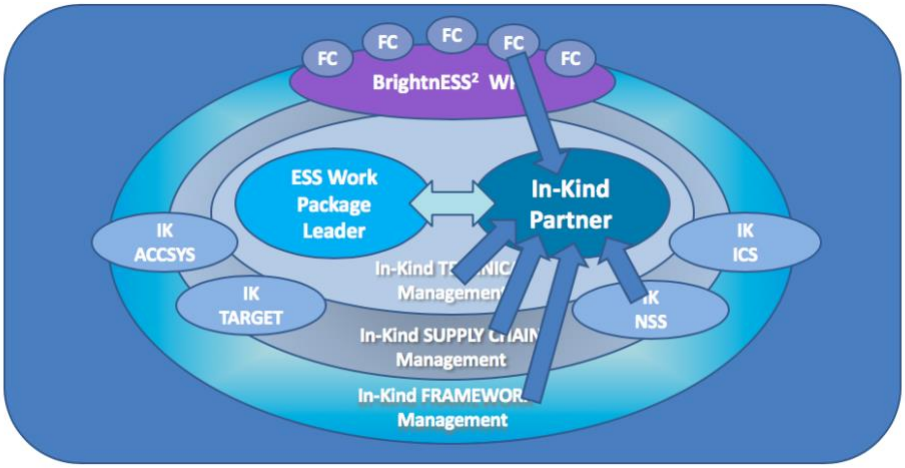

Figure 17 Possible channels of communication from ESS to the specific IK Partner

This diagram builds on Figure 15 to explore possible future relationships of the IK system, again using a series of concentric circles to represent the different levels. At the core of the diagram still stands the relationship between the ESS Work Package Leader and the In-Kind Partner but this diagram shows how the Supply Chain management layer will connect to the IK Partner – through the newly appointed In-Kind Coordinator who reports to the Project Director – and also how the In-Kind Framework management team will connect to the Partners on relevant areas, e.g. on contracts.

The remainder of the diagram is the same

IK ACCSYS = Accelerator Sub-Project Leader **IK NSS** = Neutron Scattering Systems Sub-Project Leader

IK TARGET = Target Sub-Project Leader **IK ICS** = Integrated Control Systems Sub-Project Leader

WORKING PRACTICE ACTION #5
Refine shared communications to take account of the ESS restructure
Evolve and strengthen shared communications in support of achieving First Science in 2023, engaging all parties in issues, progress and success. Identify and resolve potential disconnects, especially where different people offer information on the same issue. Enable greater alignment and information sharing within and across levels, from work package leaders to Partner Ministries.

8.1. Removing the roadblocks to delivery and installation of In-Kind contributions

The impressive advancement to deliver 62% completion of the ESS construction project in Lund is a major achievement for all Parties involved. The trickiest part of the construction project - the installation and integration of many thousand components in a unique functional system, never tested before, to deliver the most advanced and powerful source of neutrons for research – lies ahead. Given

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the stage of the project, there will be some challenges that will not be able to be entirely resolved and others where a pragmatic solution will have to be adopted.

In this final section of this chapter on the key IK issues facing ESS, we consider possible roadblocks in the journey towards completion and the joint processes that need to be developed in response. Risk identification, analysis and mitigation is therefore a key activity and one that is receiving increased attention in ESS, with the recent appointment of the new position of Project Risk Manager in the frame of the newly defined Project Directorate. As part of this work, we have been identifying which risks would prevent the attainment of First Science in 2023. Out of large number of risks in our register, there is a smaller number that have the potential to cause severe delays to schedule or to increase costs if not managed properly. The BrightnESS 3rd Workshop on installation and the original proposal for the present BrightnESS² grant which built on this, identified the areas that are likely to create serious "roadblocks" if left to themselves:

- Uncertainty surrounding VAT payments on delivery and installation of IKC in Sweden still poses significant risks to the project
- Management of the issues surrounding ownership, liability, warranties
- Support to IK Partners for technical and quality documentation, including declaration of conformity and CE marking.

In order to "refine" the co-working processes for these areas in a future report, it is first needed to define and describe the challenges and resolve how they should be dealt with – only then can processes involving the ESS IKC Management and Partners be developed. This activity of mapping and describing processes is currently underway and the Field Coordinators will be involved in facilitating the operation of the processes once we have workable solutions.

8.1.1. VAT in relation to In-Kind Contributions

As described in section 8.1 above, ESS does not have the necessary legal framework to resolve the VAT issues associated with IKC. A lot of hard work has been undertaken by ESS and the IKC Partners to develop 'work-arounds' over the last four years. Now, with more than 468 M€ of IK Technical Annexes signed, VAT issues remain a risk with potential to significantly increase costs for Member States and / or delay the schedule. The VAT issue is two-fold. VAT legislation for the Partners' commercial activities within their respective Member States and the VAT situation concerning transfer of goods and services to ESS in Sweden. Much progress has been made to better understand the VAT question over the past few years; arranging joint workshops with other grant collaborations, joining forces with the other ERICs to advocate for change and dedicating an entire panel discussion to the topic at the Closing Conference of BrightnESS.

However, the fundamental issue is that the ERIC legal framework does not provide IK Partners with VAT exemption by default. As this is not about to be fixed quickly, it is necessary to understand two separate VAT scenarios in order to devise potential solutions:

- VAT costs associated with activities by Partners in Member States;
- VAT costs related to deliveries and installation in Sweden.

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Member State VAT The European Union's ERIC Regulation[1] defines the relationship of ERICs towards the EU VAT Directive via a recognition of ERIC as an international body or organization by the ERIC Host Member State(s)[2]. The interpretation of both what "members" as well as what recognition truly means differ in each EU country. As a result, Member States can have slightly different mechanisms for handling VAT. ESS worked in close cooperation with Partners and the Field Coordinators BrightnESS to understand where each country and, more importantly, each IK Partner stood on VAT issues. At present, the situation in each country is reasonably well understood and different work-arounds have been developed for individual Member States. Whilst the risk is now greatly minimized, this all took a lot of time, resources and significant effort and has not resolved all issues in all Member States.

VAT on delivery and installation in Sweden The application of VAT in Sweden to the transfer of goods and services including installation work at ESS has not yet been fully clarified but at 25% of the value of IKC remains a significant risk. A dedicated workshop organized in Lund in mid-2018, under the umbrella of BrightnESS, helped to share common issues and look forward to the identification of possible solutions. Since then, and still thanks to the support of BrightnESS[2], we have been building understanding about options and individual IK Partner positions.

IK Partners are becoming most concerned that the issue remains unresolved and are starting to delay procurements and transfer technical scope back ESS to avoid VAT risk - putting additional pressure on ESS in-house installation teams and reducing the pool of expertise available. Even though specific work arrangements have been found for certain countries, no final and comprehensive solution for all ESS Partners has yet been found. As an amendment of the ERIC framework is unlikely in the short-term, there are basically two strategic ways the VAT issue in Sweden can be approached now:

- Either, develop a general solution for all ESS Partners where the Swedish tax authorities recognise IKC as Member State contributions

- Or, develop a Partner by Partner approach, where a specific 'work-around' for each Partner is developed and implemented.

Unless VAT risk is clarified and mitigated, schedule could be deferred or additional funding required from Member States. ESS and its Partners would clearly prefer a general solution, however are working on both approaches, with ESS exploring and evaluating additional consultancy support from qualified tax experts in Sweden. Once an approach for mitigation is developed, BrightnESS[2] Field Coordinators will play an important role facilitating implementation with their Partner colleagues while ESS plays a coordinating role.

[1] "*Council Regulation (EC) No 723/2009 of 25 June 2009 on the Community legal framework for a European Research Infrastructure Consortium (ERIC)"* accessed on December 15th, 2019 - https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009R0723&from=EN

[2] IBID. (10) page 2.

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WORKING PRACTICE ACTION #6
Develop a risk mitigation strategy for VAT exposure
Build a better understanding of the precise approaches to deliveries and installations used by different IK Partners in different Member States and - in some cases - in the same Member State. Explore options with Swedish government authorities for reducing VAT exposure on delivery and installation for IKC Partners, procuring external tax expertise to support this endeavour. Work with the BrightnESS² Field Coordinators to implement potential processes once a solution or solutions have been identified.

8.1.2. Ownership transfer, liability and warranties for In Kind Contributions

As ESS moves into the next phase of the construction project and IKCs arrive on site in increasing numbers, new issues come to the fore - such as the timing and arrangements for the transfer of ownership from Partners to ESS and how they dovetail with liability and warranties.

The IK framework seeks to ensure that risk, liability and ownership are appropriately allocated and that their transfer occurs at suitable points for all parties. The standard IKCA template separates the transfer of risk from that of ownership. Risk is implicitly transferred to ESS as soon as the IKC – particularly where they are tangible goods - arrive on site in Lund. Whereas ownership – which is governed by Article 11 of the standard IKCA template - is transferred explicitly after the installation, testing and commissioning of components and endorsement of IKRC and finally approval by ESS Council. This is an important way of managing the liability and quality issues of IKC.

This distinction has several implications. Firstly, from a legal and practical point of view, once technical components have arrived on site then ESS is both in possession of the components and holds any associated risk but the components are still owned by the respective Partners. Secondly, because IKC components may be stored for significant periods of time prior to installation and testing, the transfer of ownership and allocation of earned value may not be for several years. Thirdly, the warranty period on some components may expire before ownership actually transfers, thereby producing a complex mosaic of ownership, risk and liability across different components and Partners which has to be managed in a coordinated way.

To complicate matters, where Partners have been funded with European Union Structural Funds for their ESS IKC, there are often very specific constraints over the transfer of ownership, which must be taken into account, even if they are not fully aligned with the general rules adopted by ESS. Failure to do so would put the original funding from the EU at risk and thereby the IKC itself. Notwithstanding the ownership arrangements, each partner will then need to have access to parts and equipment to assemble, test and commission components to produce the various sub-systems of the ESS facility. This will include careful consideration of the nature of the equipment and whether it will be installed as a permanent fixture or not.

Such issues were well anticipated by the 3rd BrightnESS workshop on installation in 2018. Now that ESS has reorganized the project management to focus on installation challenges, ownership transfer is one of the more important joint working processes to be developed.

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WORKING PRACTICE ACTION #7
Develop a shared approach for In-Kind contribution ownership transfer
Different Member States, IK Partners and ESS will have different requirements and constraints as far as the transfer of equipment ownership is concerned which need to be considered alongside issues of risk, insurance and asset value. A shared approach should be developed with the Field Coordinators, following a thorough survey of the specific situation of each Partner. Development of a dashboard containing all the relevant information would be of great help, both for ESS Management and for the Partner Institutions.

8.1.3. Quality management of In-Kind Contributions

Quality assurance and control are very important to ESS. The purpose of its quality management system is three-fold; to endorse the appropriate level of equipment reliability and integrity, confirm the safe use of all equipment by ESS and visiting personnel, and to provide ESS and Partners with legal protection in case of accidents or claims.

In 2017, after reviewing potential approaches to quality management, ESS set out how it would rely on the CE-Marking system to ensure that high safety, health, and environmental protection requirements are met. Details of the ESS approach are set out in ESS-0103087 “ESS Strategy for CE Marking”. CE Marking is not just matter of good engineering practice but, in many cases, is a requirement of law. Compliance requires complex and detailed work that must be carried out meticulously before the declaration of conformity can be signed and equipment CE Marked. However, the process is not assisted by the volume of relevant legislation - there are over twenty CE Directives & Regulations to consider – the most commonly applicable to ESS IKC are:

- Machinery Directive 2006/42/EC;
- Low Voltage Directive 2014/35/EU;
- Electromagnetic Compatibility Directive 2014/30/EU;
- Pressure Equipment Directive 2014/68/EU.

If one or more Directives applies to an IK component, it is a legal requirement to CE mark it and explicitly refer to the specific legislation. That said it is unlawful to CE Mark a component if it does not fall within the scope of any of the CE Directives and it is not always obvious how the legislation applies to some IK components. Where there the conclusion is that an IKC should not be CE Marked, it is necessary to document reasons for the exemption.

Not all of this was apparent in ESS documentation at the outset of the project. The development of ESS rules and policies has matured since but CE Marking was not explicitly referred to in the Technical Annexes, although IK Partners were requested to comply with all European Directives.

Some Partners and other stakeholders participating in developing and delivering products to ESS have the experience, competence and the processes and tools to be able to comply with the EU legislation for their specific ESS contributions. However, that is not always the case and the process and understanding of the applicability of CE legislation can be a strenuous undertaking for organizations

without prior experience or resources to perform the task. ESS recognised they needed to support ESS In-Kind Partner Institutes that were unfamiliar with the CE Marking process when it launched its CE-Marking campaign in 2017.

BrightnESS and BrightnESS² resourcing has been invaluable in this regard. CE-Marking was tackled as an important issue during BrightnESS, including at the 3rd BrightnESS Best Practice Workshop devoted to IK Installations. ESS Quality Division now has a more coherent understanding of the needs, has produced directions set out in ESS-0127031 "ESS Rules for CE Marking" and is drafting guidance and lessons-learned documents. The procedure has now been established in practice although needs some refinement before codifying as a joint working practice with the Field Coordinators.

While the key steps for each relevant piece of equipment might be standard, the application of them has to be tailored to each deliverable, this combined with the familiarity of the IK Partner with CE Marking means that Partners require significant and personalised support. In some cases, it will make sense for the Partner to provide the IK equipment fully CE Marked, in others it might be more appropriate for ESS to CE Mark the equipment but on the basis that the Partner has provided all necessary technical and quality documentation. BrightnESS² support can play an important role in this. Each IKC must have the appropriate level of documentation, supported by the correct validation methodology, as well as the data stored in the right place in ESS's document management system. Much advice and guidance can be provided by the ESS In-Kind Group and Field Coordinators who can usefully bridge the needs of the Partners and the ESS Work Package managers, and thereby assist the implementation of ESS CE Marking Strategy.

The Field Coordinators, who are inside the Partner organizations, are a major asset for dealing with complex and time-consuming issues arising from this work. Their assistance to the technical staff of the IK Partners as they proceed toward CE Marking can really make a difference and deliver a successful outcome.

WORKING PRACTICE ACTION #8
Develop and implement a shared working practice for CE marking of In-Kind Contributions
Collect information on the specific status of CE marking at Partner Institutions. Using the relevant process and ways of working procedures as a basis, develop shared working practice with the Field Coordinators to translate the standard steps into an appropriately tailored approach that can meet the circumstances of each IK deliverable and Partner Develop a process of support to help Partners move forward in the appropriate direction.

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9. The key issues facing ESS in successfully managing In Kind Contributions

The IK Framework developed under BrightnESS has added considerable value to the ESS facility by framing, consolidating and identifying mechanisms for sharing the risks associated with a large project and an ambitious IK programme developed by its Members. The welcome EU backing from BrightnESS and BrightnESS² has supported ESS in developing an extraordinary level of international cooperation necessary to succeed in this collaborative endeavour. This report has identified eight Working Practice Actions to further evolve the ESS IK Framework (Fig 18). An updated version of this Deliverable will be made via report in QI of 2021 to report on implementation of the Working Practice Actions below. This work will be developed with the different ESS Functions and the IK Partners and specifically the Field Coordinators

Working practice actions as per Deliverable 3.1		ACTION	2020 Q1	2020 Q2	2020 Q3	2020 Q4
	#1	Refine the IK management system to take account of the ESS restructure	Define responsibilities and authorities between Strategy Directorate, Project Directorate and Partners, refining processes to remove overlapping roles and reduce schedule risk.			
	#2	Evolving XRM+ by creating visible and shared IK reports	Identify and develop specific reports to assist management of IK contributions. Having increased functionality and use of data, ESS and Field Coordinators will develop the use of XRM+.			
	#3	Build on best practice exchange	More widely share and promote best practice material both from BrightnESS and current learning. ESS and Field Coordinators to compile information, FAQ and check lists for dissemination and host another Best Practice workshop in Lund in 2020.			
	#4	Maturing the network of Field Coordinators	Further development and strengthening of Field Coordinators network as valuable support for First Science in 2023. Work to increase coverage of Field Coordinators, with shared ambition for one in each country, embedded in a Partner Institute.			
	#5	Refine shared communications to take account of the ESS restructure		Evolve and strengthen shared communications, engaging all in resolving potential disconnects while celebrating progress and success.		
	#6	Develop a risk mitigation strategy for VAT exposure	Engage expert consultants and identify options to mitigate VAT risk, working with Swedish government authorities			
	#7	Develop a shared approach for In-Kind Contribution ownership transfer	Review current contractual conditions and the different requirements and constraints of Partners, developing a shared approach with the Field Coordinators			
	#8	Develop and implement a shared working practice for CE marking of In-Kind Contributions		Collect information on the specific status of CE marking at Partner Institutions. Develop and implement an appropriately tailored, shared working practice with the Field Coordinators		

Figure 18 – Figure 18 Working Practice Actions timetable

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