BrightnESS

Building a Research Infrastructure and Synergies for the Highest Scientific Impact on ESS

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Deliverable Report: D3.6: TTO Industry Agreement

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Authorship	Written by:	Anke Lohmann, Dušan Štric
	Contributors:	Luis Ortega, Fredrik Livendahl, Mirko Menninga
	Reviewed by:	Ute Gunsenheimer
	Approved by:	BrightnESS Steering Board

3 List of Abbreviations

DTU	Technical University of Denmark
ESS	European Spallation Source ERIC
Organisation	IK4-TEKNIKER
R&D	Research and Development
TTO Industry Agreement	Framework Collaboration Agreement ESS – 0321893 Concerning Research and Development Support
TRL	Technology Readiness Level

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4 Executive Summary

The objective of Deliverable 3.6: 'Industry Agreement' is to support ESS with specialised R&D and innovation activities, including design, prototyping, testing, and validation to help ESS to operate more efficiently and cost effectively. Additionally, the organisation with whom the agreement was signed also has the capacity to support ESS in innovation through diagnostics, innovation management and market intelligence, which is particularly important for a young organisation that is still expanding its capabilities.

The framework agreement is signed with the Spanish company IK-4 TEKNIKER that has the status of a research centre and more than 28 years' experience in the field. The organisation has extensive research, engineering, and prototyping manufacturing capabilities. IK4-TEKNIKER is working with a number of large-scale institutions in various fields, including: high energy physics such as neutron sources, particle accelerators, fusion facilities, and telescopes. The company is ideally suited for an industry agreement that can be a guide for future agreements because it could interact in a number of different ways with ESS: as a collaborator and supplier and also as a user of ESS generated knowledge.

The agreement intends to create a framework that covers the whole innovation cycle. The framework agreement services will be supportive widely: from assessment of industrial viability of the early stage innovations Technology Readiness Level (TRL) 1 to 3, through to the more advanced levels of TRL 6 to 7.

The main internal stakeholders of the industry agreement are currently the TTO unit and the ESS Supply, Procurement, and Logistics Division who are responsible for dealing with the immediate internal needs of innovation-relevant services.

To support Innovation and advance new technologies development at ESS, the TTO and the ESS Supply, Procurement and Logistics Division will continue co-organising workshops to inform about the possibilities arising from the agreement following the successful kick-off meeting on 26th June 2018. As a first outcome ESS personnel is now discussing potential support for the development of custom made inductors of the ESS klystron modulators with IK4-TEKNIKER.

Further, ESS will be looking for other organisations with a similar focus that are able to support ESS with future challenges based on the advanced technologies needed to operate the most powerful pulsed neutron source.

5 Report on the Implementation Process and Status of the Deliverable

5.1 Background

The industry agreement that is subject of this report is the first agreement of its kind between the European Spallation Source ERIC (ESS) and an innovation services provider in which they propose the mutual intention of joint technology development and the transfer of innovation. The document is issued under the title: “Framework Collaboration Agreement” between ESS and Fundación TEKNIKER (IK4-TEKNIKER) and addresses their future collaboration. The ESS is, however, seeking other similarly oriented organisations to broaden its portfolio of available innovation-oriented support services.

The agreement needs also to be viewed against the backdrop of delivering an ESS infrastructure project with novel and demanding technology within very tight time and budget constraints. This requires innovative solutions to handle these challenges which are best dealt with in-house and only in very rare circumstances may they be outsourced; and only when they are not linked to core-capabilities. Then, support for research and development services, may become necessary. However, it is essential to establish the core-capabilities in house since ESS experience has shown that it is the most cost effective way to build up world class expertise - which will pay for itself many times over. Areas that are core to ESS are for example, detectors, electronics, guides and choppers as well as bespoke software.

One solution for making the development more efficient is to work with companies that do product development for deep-tech sectors. These companies employ people with a scientific, engineering, and more importantly a manufacturing background to operate at the interface of science and manufacturing. Areas of this type include, for example, space exploration and nanotechnologies. They understand the needs of scientific projects and, with their engineering and manufacturing expertise, can identify the optimum technical solution relatively quickly. The optimum result relates to fulfilling the needs at a reasonable or low cost, and rapid production. Those companies have links to a number of manufacturers that could produce the product. As previously stated, it is important to ESS to have the ability to find low cost solutions that can be delivered quickly.

There is an additional benefit to the solution of co-creation, in so far as the technology being developed may also address needs in other sectors and could be another route for technology transfer from ESS. This potentially increases the impact of the technical invention, and thus creates additional value for the innovation originating partially from ESS.

5.2 Needs Assessment

ESS continuously reviews and assesses its needs and in doing so became aware of the need to identify an alternative route for existing technology development in two different situations which will be described in more detail below. Naturally, with time and expansion of ESS innovation activities, other needs will become apparent and will require an adjustment to the industry agreement or a new industry agreement altogether, tailored to the situations and the companies.

The need for external support is particularly important for internal innovation developments identified by ESS' TTO. The first ideas collected by the TTO already indicated that an external developer might be needed to move some of them towards a feasible project. This requires a company that understands the broader technology landscape and different manufacturing methods. Having access to an organisation that can support assessment of technology and prototype development with focus on commercial applications would be advantageous to ESS's TTO. The main need for such an organisation is expected after ideas have been identified and require a feasibility and viability assessment from an actual industrial partner. If the idea is considered to be both feasible and viable to be further developed and invested in, it is expected that the support (mainly technical) is increased whilst the technology development progresses through stages of technology readiness levels.

However, not insignificantly, a similar need also exists for the Supply, Procurement and Logistics Division when they receive a number of requests for purchases from in-house teams struggling to identify companies that could deliver the specific solutions or technical support for their in-house technical solutions. The identification of a made-to-measure provider was found to be a necessary solution to satisfy this urgent need.

Based on those general requirements, the needs were further assessed in more detail through interviews with a number of departments belonging to the Machine Directorate and Science Directorates, such as the Instrument Technologies Division, the Target Division, Machine Engineering Services and Engineering, and the Integration Support Division. The outcomes of the interviews fed into the scope of the agreement. Including the input from ESS' TTO, the main areas for technical support were then stipulated in the agreement, and include:

- Feasibility and viability analyses (short and long-term reviews of the economic and technical aspects of ESS innovation projects);
- Needs identification, conceptualization and verification (based on the specific technical problem, IK4-TEKNIKER identifies the potential solution, presents and verifies the concept);
- Preliminary requirements specification (setting up a set of requirements for the product before designing, prototype manufacturing, and testing stages);
- Preliminary selection of materials and manufacturing techniques (based on the problem, IK4-TEKNIKER proposes the best materials and manufacturing techniques to be applied);
- Conceptual and preliminary design activities (designing and concept preparation based on ESS' needs);
- Design review and validation (final assessment before the prototyping);
- Prototype manufacturing (to be available for testing);
- Prototype testing and validation (to assess if the product has potential to be used in operation);
- Technology demonstration activities (support with showcasing the proof of concept);

- Final requirements specification (after testing and the initial test in an operational environment to be fully functional).

5.3 Identification of IK4 – TEKNIKER

Within Brightness, ESS was seeking an industrial partner with whom it could establish collaborations to address the needs listed above and with whom it could sign an industry agreement that would also serve as an example for future agreements with other companies, albeit modified.

It identified IK4-Tekniker as an ideal partner, able to deliver against the requirements listed in the previous section, and take on a broader role in supporting ESS' TTO by transferring ESS technology to other customers and may even become a licensee of ESS technology itself. IK4-TEKNIKER is a Spanish non-for-profit organisation providing research and development (R&D) services in relation to research, testing, experimentation, study, or development in connection with the construction of ESS. Based on article 16.2.c of the European Spallation Source ERIC Procurement Rules, ESS negotiated and awarded a framework service agreement without publication of a call for tenders. ESS Procurement Rules can be downloaded: https://europeanspallationsource.se/procurement#procurement-rules. The article states:

Article 16: Procedure without publication of a call for tenders

(1) In the specific cases and circumstances laid down in this Article, the Organisation may award contracts by way of direct negotiations with one or more suppliers, without prior publication of a call for tenders. In such cases, Article 29 shall not be applicable.

(2) The Organisation may award contracts following the procedure under this Article in the following circumstances:

a) in the absence of competition for technical reasons or due to exclusive rights including intellectual property rights, where no reasonable alternatives are available;

b) where only one or no applications, requests to participate or suitable tenders have been submitted in response to a previous call for tenders, provided that the initial conditions of the contract or the tender documents are not substantially altered, that the tender to be awarded the contract complies with the original exclusion and selection criteria if such were required, and that no more than one year has elapsed since the publication of the original call for tenders;

c) for research and development contracts which are performed by non-commercial entities solely for purpose of research, testing, experimentation, study or development in connection with the construction of the Organisation, provided that the contract does not include quantity production to establish commercial viability or for recovering general research and development costs;

d) in external circumstances of an urgent nature, unforeseeable and not attributed to the Organisation, where the time limits under in Article 13, Article 14 and Article 15 cannot be complied with;

e) for additional deliveries by the original supplier where a change of supplier would oblige the Organisation to acquire supplies or services having different characteristics which would result in incompatibility or disproportionate technical difficulties in operation, maintenance or application; or

f) for strict security reasons.

Very relevant to ESS is that IK4-TEKNIKER is working with number of large-scale institutions in various fields, including: high energy physics, such as neutron sources; particle accelerators and fusion facilities. Examples of the organisations IK-4 TEKNIKER cooperates with include: CERN, ESRF, ILL, ESO, FAIR, ITER, and XFEL. Together with those organisations, it has designed and built high-end instruments, neutron choppers, vacuum chambers, monochromators and collimators, environments to handle samples and more.

With regards to innovation potential and translating ESS technology into other areas, IK4-TEKNIKER is also working with customers from other sectors, and so has a good understanding of different sector roadmaps. As a consequence, technologies that are being co-developed with ESS could also potentially address other sector needs, thus leading to a wider impact of the ESS project. For example, IK-4 TEKNIKER has broad experience in advanced manufacturing, surface engineering, ICTs, and product engineering and with that it supports companies in aeronautics and space, automation, biomedicine, renewables, science industry, infrastructures, machine tools and manufacturing, E-health, and social technology.

Due to an already positive experience with ESS, and with the organisation joining the preparation of a project in 2010, the way forward to complete the framework agreement was very straightforward. In addition, their highly positive references from some big science facilities, some of whom were also operating within the same field as ESS, and the fact that their services within research and development support are almost identical to the needs of ESS, made it a clear decision.

The terms of reference were prepared jointly by the relevant ESS technical and innovation stakeholders and the technical and scientific division leaders, who are expected to be the primary target group.

In terms of innovation capacity building, IK4-TEKNIKER is able to help with evaluation for industrialisation (the early stages of ideas suitable for knowledge transfer) and can work on pre-production samples and the further testing of early stage prototypes.

5.4 Summary of the contract

There is broad consensus among the relevant departments at ESS to work with IK4-TEKNIKER, and an understanding of the need for an industry agreement to allow the two parties' staff to communicate effectively and openly to enable the assessment of innovations created at ESS, as well as for assistance with co-development of innovative technologies needed for the operation of ESS.

The framework therefore addresses the exchange of knowledge, experience, information, hardware, services, and documents. It deals with confidentiality of information (with the requirement of the highest level of confidentiality, where all exchanged information is considered to be confidential and access to any information on the side of receiving party shall be on a need-to-know basis) and the handling of intellectual property rights coming out of or directly related to the agreement. The joint ownership of the rights distribution is applied. For a simplified means of communication, the agreement also identifies a named contact on both sides. Any disputes arising from the agreement or related to the agreement are settled by the alternative dispute resolution mechanism.

However, the framework does not replace contracts for individual projects. It is just an enabler for simpler communication and a higher level of trust between both entities to make the utilisation of the agreed cooperation much easier for ESS. The framework is set for a duration of five years. This is

a framework collaboration agreement, As such, there is neither fixed commitments/deliverables nor room for conflict of interest. ESS has also in place internal procurement measures effectively identify, prevent and remedy conflicts of interest to ensure integrity, equal treatment of all suppliers and tenderers and to avoid any distortion of competition.

The services available under the agreement comprise several activities in connection with research, testing, experimentation, study, or development related to the construction of the ESS facility. These activities can also be described as those typically falling within technology readiness levels (TRL) 1 - 7, with reference to the European Commission Horizon 2020 TRL definition set out below:

European Commission Horizon 2020 TRL definition	
TRL 1	Basic principles observed
TRL 2	Technology concept formulated
TRL 3	Experimental proof of concept
TRL 4	Technology validated in lab
TRL 5	Technology validated in a relevant environment (an industrially relevant environment, in the case of key enabling technologies)
TRL 6	Technology demonstrated in a relevant environment (an industrially relevant environment, in the case of key enabling technologies)
TRL 7	System prototype demonstration in operational environment
TRL 8	System complete and qualified
TRL 9	An actual system proven in an operational environment (competitive manufacturing, in the case of key enabling technologies; or in space)

6 Conclusion

In conclusion, the industry agreement is a tool for carrying out technology developments more efficiently and cost effectively, required for both the development of ideas into products to support ESS' TTO and for the construction of advanced technologies needed at ESS. The latter is particularly important in the ESS building phase, and later on during instrument upgrades. The efficiency is achieved through agreeing to a framework for collaboration with an industrial partner whose expertise is in the design for manufacture of a variety of science projects on a comparable scale to ESS. The framework allows both sides to discuss and initiate early stages of technologies co-development without the need for a new contract and a higher degree of trust in the case of longer cooperation every time a new project is discussed, thus speeding up collaborations. The framework is a good basis for other future industry agreements.

7 Next steps

Following the framework agreement, the next steps are:

1. After the first workshop that took place on 26 June 2018 with potential users of the services, where IK4-TEKNIKER gave a detailed overview of their activities, more specialised workshops will follow focusing on the specific areas where those services could be beneficial for the additional support in building, and later the operation of the facility.
2. Running a focused set of trials based on the industry agreement to obtain examples and test the framework. One of the areas currently being considered are the components required for linear accelerators (klystron modulators). The discussion with IK4 TEKNIKER have started about their support for inductors for the modulators, which are high voltage pulsed power supplies that supply radio frequency amplifiers;
3. The wider promotion of the collaboration opportunity with IK4-TEKNIKER within ESS to maximise the benefits for the building phase of ESS by improving efficiency and reducing cost;
4. Identifying and setting up similar frameworks with other suitable European organisations to broaden the range of supporting opportunities for the ESS innovation framework, and improve the potential impact with the stronger technical assessment base.