of the collected and aggregated data and eventually provide insight such as:

- The laboratories and universities, and therefore the affiliated countries, which produce scientific articles based on data produced at ILL, in collaboration with ILL users but without currently being LL scientific partners
- Emerging use of neutron scattering techniques in scientific fields (worldwide) and geographical map of different scientific community using neutron scattering
- Research strengths (or weakness) at ILL in view to reinforce experiments (and publications) in leading edge research, or to put new research areas forward
- Evolution of the impact of the different neutron scattering techniques
- Citation and use of ILL data
- Analysis of research trends for new collaborations
- Time between a proposal submission and the related publication
- The time between the date of publication of an article and its first citation by another publication
- The delay between the publication of an article and its citation in a scientific proposal submitted at the ILL.

Data collected and analysed in WP3 will be stored at and managed by ILL. ILL will continue to maintain and expand the database information also after the *FILL2030* project has finished, as it is a key instrument to promote the ILL's usefulness to its (future) Members.

Work package number	4	**Start and End Date**	M1 – M48
Work package title	Funding model for new services and markets		
Participant number	1		
Short name of participant	ILL		
Person/months per participant	28,8		

Objectives

Apart from the technical instrument upgrade which is well underway at the ILL for it to remain the world leading centre of neutron science at least for the next decade, the contractual and financial interaction as well as the service level agreements with the Associates and Scientific Members need to be adapted.

The initial business model, developed at the ILL, has been successfully adopted over the past decades by several other research infrastructures. With the changing environment of neutron research in Europe and especially with the construction of ESS, it now becomes necessary to review the business model of the ILL. This review has to take into account in the short term the evolutions required to consolidate customer loyalty with the Scientific Members and the acquisition of new user groups. In the long term, the requirements of the Associates in terms of complementarity and symbiosis between ILL and the ESS will need to be addressed. The required changes have to cover further improvement of current services provided and the development of new services needed to cope in the most efficient way with the changing requirements of the research environment (e.g. new research groups who have less knowledge about neutrons and putting together meaningful experiments). This requires the review of the current contractual framework to allow for new and innovative ways of funding as well as an honest evaluation of potential technology transfer towards the stakeholders.

Considering the importance to improve the services to be provided to industrial partners, special attention will be given to the elaboration of the most efficient practices and legal frameworks for collaboration either directly with industry or for collaboration with industry via academia.

The business model described above can be considered as a significant adaptation and optimisation within the framework in which national funding agencies cover the costs, on a medium to long term basis, of their scientists using ILL. Direct industry use of neutron beams at ILL is the only other way in which beam time costs are directly covered by the user. In the context of the expansion of neutrons at ILL into new communities, which will often be small and potentially fluctuating, it is of fundamental importance to develop new, flexible access

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and/or funding mechanisms, beyond the current framework, which are adapted to the future research and innovation environment.

Description of work

Task 4.1: Organize and develop further 'Scientific Member and Associates Forum'

The scientific members of the ILL participate in the governance of ILL through the participation of one observer, nominated jointly by all scientific members, in the subcommittee for Administrative questions and through the participation of one observe from each scientific member country or consortium in the ILL steering committee meetings. They are also represented on the scientific council and its subcommittees. Although they are rather well integrated in the different ILL committees, it is important to install on a yearly basis a forum for discussion between all stakeholders of the ILL to improve the communication both ways. This will include the Associates of the ILL, the ILL management and the scientific representatives and funding bodies of the Scientific Members.

Task 4.2: Economic and scientific business case for stakeholders after 2018

This Task will define the Unique Selling Point (USP) of ILL to user groups and stakeholders (differentiator to ESS and other facilities) – what will you be able to offer and at what parameters (cost, access time etc.). This also includes the revision of contracts with Members, Associate members and industry:

- new services: new service packages in terms of users support and support platforms, remote access to ILL instruments, special support for non-expert users: improvement of communication platforms and interfaces between new users and the facility for proposal submission, sample preparation and data treatment through to publications; shared user interface with other facilities, facilitate interoperability across facilities, help new users to attain the necessary level of excellence
- ensure that scientific results can be produced and published as efficiently as possible
- Improve timely delivery of scientific results and impact to provide the scientific return for stakeholders
- Improve further the interface between the ILL and new, non-expert users through additional software to simplify facility use e.g. for access requests, sample preparation and handling and data treatment, management through to publications.
- pilot access scheme to allow potential new members to test the facility before making a financial commitment
- considering the requirements to attract new non expert user group to the ILL on a European and international level, will require the provision of remote access to be in the position to engage more effectively with more geographically distant communities
- facilitates the industry-via-academia use of ILL and enables ILL to demonstrate the impact of this facility use
- sharing best practices and strengthening collaboration and highlighting new opportunities through international collaboration with strong neutron scattering communities in North America, South-East with a different business approach (funding, research and innovation cultures Asia and Australia)
- excellence-driven access with protection of intellectual property
- creation of service hub for industry: ILL has recently established a research collaboration with industry via academia through the construction of a dedicated instrument combining neutron diffraction and x-rays. We will use the lessons learned through this collaboration for the creation of a service hub for industry, which may also involve the transfer of an existing instrument of the ILL into this dedicated industry group. Apart from modifying access procedures to suit industry requirements (fast access, support….) we will then simultaneously also review the career model for scientists working on this type of instruments. The prevailing assessment of beam-line scientists through publication output is likely not appropriate/relevant in an industrial research setting. A career model more based on business criteria will then need to be applied.

Sub-task 4.2.1: **Review of contractual framework for Scientific Members**

In the current funding model of the ILL, the Associates contribute about 78% of the budget of the institute and 22% are provided by the Scientific Members. Their contribution is currently based on a fixed fee and a variable fee. The fixed fee covers initial capital investment, a contribution to forthcoming upgrade programmes and a

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participation towards future decommissioning costs. The variable fee, depends on the contractually agreed percentage of beam-time allocation, amounting to 1% of ILL's annual budget for each 1% of beam-time. According to the current contracts, the Scientific Members would be entitled to a use of about 16% of the available beam-time. The actual average use over the last two years is closer to 30%, corresponding to an overuse of a factor of two.

During the 2013 contract renewal negotiations, the Scientific Members requested a review of the contributions and in particular the fixed fee. Other research infrastructures request from new members a one-off entrance fee (sometimes also stretched over a maximum period of 10 years). Scientific Members have indicated that they would be ready to pay for use but not any more for the initial capital investment of the institute. However, compared to other research infrastructures, the decommissioning cost of ILL will be significantly higher and therefore some continued contribution from the Scientific Members towards future decommissioning costs should be kept. Considering the funding models for other RIs, the ILL has to work out a renewed sustainable model which takes into account the need to finance the operation of the ILL at the best economic level and provides efficient levers to allow for a suitable financial compensation for beam time overuse. Compared to other RIs, the requirement of the ILL for future decommissioning costs have to be included into this model. It will require some effort to combine these requirements into a funding model which will be comprehensive and easy to sell to the funding agencies. In addition to funding model, Bibliographic results obtained from task 3.4 will allow a better tracing of the evolution of research and research groups and hence allow the timely identification of key areas. These result would then be communicated back to the funding agencies to support and justify their financial contribution towards neutron research for scientists from their country.

Although ILL has been able to keep its initial funding model based on cash contributions in place until now, there is a strong request from the scientific members for possibilities of dedicated cash contributions (money to be spend back in their country) or direct in-kind contributions towards upgrade programmes or operations cost. Risks related to managing possible in-kind will be managed through the exchange of best practices with other Research Infrastructures (ITER, ESS, etc.).

The proposed modifications and evolutions of the current business model will require the revision of the existing contract framework including the proposed evolutions on proposed services, financial contributions, participation in committees and compensation for beam-time overuse.

Sub-task 4.2.2: **Specific engagement with SMEs**

As a service institute for academic scientists (= users) from its Member countries, technology transfer to industry is mostly done directly by the users of ILL. Over the years the ILL has also developed key technology in neutron science. Competence is available at the ILL in the areas of detectors, neutron optics, sample environment, etc. Attempts have been made to transfer this technology to industrial partners, but this has not been conclusive so far. The changing neutron landscape, however, opens a new perspective for the transfer of these technologies to SMEs. The fact that ESS is being constructed through large-scale in-kind contributions from its partners, opens up the possibility for ILL to build additional collaborations through/with ESS and its Members ESS (which mostly are Associates or Scientific Members of the ILL). This type of collaboration may be an additional incentive for Scientific Members of the ILL (or persuade current members of the ESS, which are not yet members of the ILL) to join the institute and thus contribute to an increased transfer of knowledge to SMEs of key technology and/or the use of neutrons in their own product/service development. In this way, sub-task 4.2.2 will contribute to the sustainability of the neutron technology community and its companies through the availability of already existing ILL technology.

The task therefore has two strands:

(1) to establish an 'outreach'-framework with ILL's Associates and Members toward technology companies in their countries. A basic framework already exists at ILL with the purchasing advisors from the Associates and Scientific members for international calls for tender. This will be adapted for the purpose of technology transfer.

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Once the framework is established, an initial set of companies will be invited to ILL to explore in detail technology transfer possibilities based on existing ILL technology. A dedicated session on technology transfer will be held during the annual meeting of the purchasing advisors. The target is to identify 10 companies per year, leading to two or three potential collaborations per year.

(2) measuring the technology transfer activity of ILL users to SMEs depending on neutron research. A survey will be performed as the basis for demonstrating impact of investment in ILL to its stakeholders.

Sub-task 4.2.3: **Collaboration in the area of innovative isotopes for medical applications**

There is a rising demand for high quality radioisotopes for medical applications. ILL's reactor has a unique capacity to produce these isotopes, but that will require the installation of a dedicated automated irradiation system. This development is already in progress. Taking into account the current project schedule, ILL should be in the position to start industrial production of innovative radio-isotopes by 2019.

The current business plan foresees that the capacity of the system should be used for about 80% for the production of innovative isotopes like LU-177 n.c.a and W188. The commercialisation of these isotopes will be realised with already identified business partners in the nuclear medicine value chain. The remaining 20% will be kept for the production and research on emerging radio-isotopes with research groups from the Associates and Scientific member's countries. To strengthen the ongoing collaborations, bibliographic review from WP3 will be used to target already existing research collaborations in the partner countries and inform them about the possibility offered by the ILL. The deliverable of this Task will be a report on potential collaborations with existing or new members in the area of emerging isotopes for medical applications. The production of radioisotopes is not part of the *FILL2030* project.

Sub-task 4.2.4: **Review legal framework for interaction with academic users, industrial users and industrial users through academia**

The changing type of collaboration with non-expert users and the requirements for open access publication requires the review and reinforcement of the legal commitment between the user and the ILL. The existing user interfaces, from the time of the proposal submission up to the provision of the experimental reports by the user at the end of the experiment, have to be renewed with regard to the legal commitment of the user to comply with the laws and ILL regulations in force. In this context special attention is given to the use of industrial via academia as these users also have to comply at the same time with the legal commitments towards their industrial partners.

Direct access by industrial partners has sometimes proven to be cumbersome due to the extensive legal framework to be put in place sometimes with the legal departments of the clients before allowing access to the ILL instruments. To reduce this administrative barrier, and to allow this type of collaboration to be treated directly by the purchasing offices, a set of general conditions, to be used with standard purchase orders, should be put in place. This would require a detailed analysis and accurate development of the general conditions to assure that the ILLs' obligations as nuclear operator is guaranteed.

Task 4.3 New funding mechanism – beyond the current framework

New national communities at ILL will, invariably, be small (at least initially) and potentially fluctuating, statistically due to their small size and, in practice due to human mobility and changing research priorities. The model in which national funding agencies support long-term commitment to ILL may not be viable in the future. A more flexible model for access and/or funding needs to be developed. The trans-national access (TA) schemes in integrated infrastructure initiatives provide a mechanism for financing non-national use of national facilities, which could be adapted to small, non-member use of a European facility like the ILL. This would have to be established with the European Commission and the ILL's stakeholders so as not to undermine their investment in ILL.

Scientific fields and the corresponding collaborations which transcend national frontiers may provide a more

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natural basis for funding facility access in the future and again this needs to be explored with European and national agencies which fund research projects, as well as the ILL's stakeholders. In this challenging task, we will actively seek interaction with the European Commission, national research agencies, the national neutron facilities and ILL's stakeholders.

Task 4.4: New international cooperation

In order to reinforce existing and develop new international cooperation, ILL will collaborate and organise a benchmarking exercise with other neutron centres world-wide. The outcome will allow distilling of best practices for engaging with new users and funding agencies. ILL will then be able to engage in new opportunities for growth and capacity building in neutron science with academia and industry.

Work package number	5	**Start and End Date**	M1 – M48
Work package title	New service packages for academia and Industry - Centre of excellence		
Participant number	1		
Short name of participant	ILL		
Person/months per participant	180,0		

Objectives

This work package has three main objectives corresponding to the three main user profiles:

- For academic usage, we will provide enhanced support to users (especially also to novice users) in order to ensure the best possible use of the facility and address all the ILL-experimentation related issues and difficulties which a visiting scientist might encounter from defining the scientific idea to the final communication of a result. This is further referred to as "Centre of Excellence".
- Improving direct Industry usage is already at the core of the ongoing H2020 SINE2020 collaborative project led by ILL. Specifically SINE2020's WP4 focusses on "*enhancing knowledge in industry about neutron scattering solutions*", "*training and educating industrial researchers*", "*improving consultation*" and propose a "*harmonized access strategy*". Therefore, the objective in this FILL 2030 WP5 is to improve the local support at ILL at least up to the level required by novice users and to build case studies for the most frequent needs of companies particularly as companies are focussed much more on practical results, illustrated by case studies, rather than the instruments and techniques themselves.
- Industry usage via academia. About one quarter of academic experiments performed at ILL are linked to industry. These research groups provide an important interface between industrial users' research facilities like ILL. In order to better cater to the specific needs within that relationship, ILL needs to better understand the service provided by academia. This way, ILL will be able to introduce dedicated and tailor-made services to academia to facilitate their collaboration.
- The 4th user profile is that of industry via industry, where specialised commercial intermediates perform research on behalf of their industry clients. As for industry via academia (above), the potential of this service to industry needs to be better understood in order to be able as ILL to deliver targeted services and support to these intermediates. At this moment, this 4th profile is marginal at ILL. This profile will be studied as part of WP5.3.

Potential difficulties to overcome for a novice user

In order to understand the rationale for the "centre of excellence" we need to briefly describe the potential difficulties that a new user has to overcome. The ILL is a scientific service institute which gives access to its infrastructure via a proposal system based on scientific excellence. It is notoriously difficult for a novice scientist to write a proposal getting positive attention of the review committees, to select the right technique and describe a feasible experiment plot, to identify an in-house expert that could answer open questions and help improving

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