VR utlysning: Bidrag för tillgängliggörande av infrastruktur

MAXESS Industry Arena

Purpose and aims

Large Scale Research Infrastructures (LSRIs) are unique centres, characterised by extraordinary levels of multi- and cross-disciplinary scientific and technical activities that involve multiple actors. LSRIs bring together and enable interactions amongst highly skilled scientists, engineers, technicians and managers as well as with funding agencies, public authorities, policy decision-makers and industry, including small and medium enterprises.

Assessments such as the national ESS-strategy and the report from the SWEbeams-project, report that LSRIs can, if set in the right environment and with the right governance, provide novel, innovative settings where fundamental and applied research meets innovation and industry. This can actualise in the form of new industrial applications, technologies and business.

During their construction and continuous upgrades (*up-stream*), LSRIs act as major drivers of industrial innovation in design and engineering. Such innovations are often enabled via pre-commercial procurement practices for new high-tech components, instruments and related services. During their operation phase (*down-stream*), the facilities generate new knowledge that enables further innovations, removes technological barriers as well as forms knowledge transfer amongst actors.

There is, however, a clear scope to enhance the rate of innovation when using LSRIs. Even so, there are a number of practical and communication challenges that need to be overcome in order for increased innovation by industry to succeed. These challenges are the key drivers for this project, which are as follows.

1) Limited industry awareness of possibilities and procedures

The techniques at LSRIs are complex, and many companies have a limited understanding of the development possibilities opened up by using LSRIs. Their competence and capacity to both choose and use the relevant tools that are available at MAX IV, ESS and SMS are currently insufficient. Cutting-edge LSRIs are not only underutilised in industry but also in academia and institutes. Enhancing the competences and capacity of academic and institutes is also crucial to the industry since industry often gains competences by recruiting from academia and institutes. Although industry only leads in 3-5% of the available beamtime projects in LSRIs, up to 20-40% of the open beamtime is used by projects that can be defined as industrial-academic and industrial-institute collaborations.

2) Shortcomings in experimental capabilities that are key to ease-of-use and industry

The LSRIs are equipped with instruments and techniques that serve advanced users in well-established LSRI communities. The driver for developing new LSRI capabilities is often perceived as too science dominated. Nonetheless, there are some good examples of industry involvement in instrument development from the pharmaceutical and forest industries. Such input from both industrial and applied research communities has led to LSRI experimental environments that also consider practical needs. Examples of such practical needs are i) automation that supports high-throughput analysis; and, ii) more sophisticated sample environments that support *in-situ* and *in-operando* studies of processes and materials that are relevant for industrial development.

3) Immature service sector, scattered competences and limited holistic processes

A major bottleneck to industrial use is the limited capacity that LSRIs can offer in terms of data collection, data processing and probably most importantly, data analysis. Scientists at LSRIs are technical experts and have limited competences in user applications that require detailed knowledge of complex material systems and industrial production processes. Therefore, many companies and even academic groups are alone in facing the challenge of i) using the facilities optimally – and ii) effectively analysing data to get new knowledge.

Accordingly, there is a clear need for academia, institutes, industry and the facilities to join forces to better meet complex applied academic, and industry research needs as well as enable a more seamless use of different facilities by users.

Sweden has already established ***Big Science Sweden*** as the up-stream link between industry and the big science facilities. This ***MAXESS Industry Arena*** *initiative will address some of the down-stream industrial key challenges defined for ESS, MAX IV and SMS as well as other relevant research infrastructures.*

This project will establish a national arena for industrial engagement towards Sweden's large-scale research infrastructures, namely MAX IV and the international facility ESS in Sweden and the Swedish Material Science beamline (SMS) at PETRA III, DESY.

The way of working in the MAXESS Industry Arena will be to Increase collaboration and communication between existing LSRI initiatives and organisations to realise synergies, enhance the use and achieve impact.

The aims of this MAXESS Industry Arena are to:

1. Provide a more systematic approach to communications with industry in order to facilitate industry realising the benefits and taking the first steps to start to use LSRIs
2. Facilitate the further develop of existing thematic initiatives and launch new thematic initiatives that can better support industry engagement as well as LSRI adaptation e.g.new experimental capabilities that match the needs of industry requirements - while maintaining scientific excellence
3. Create more effective industrial use via enhanced academic-institute-industrial collaborations as well as the establishment of a mediator business sector

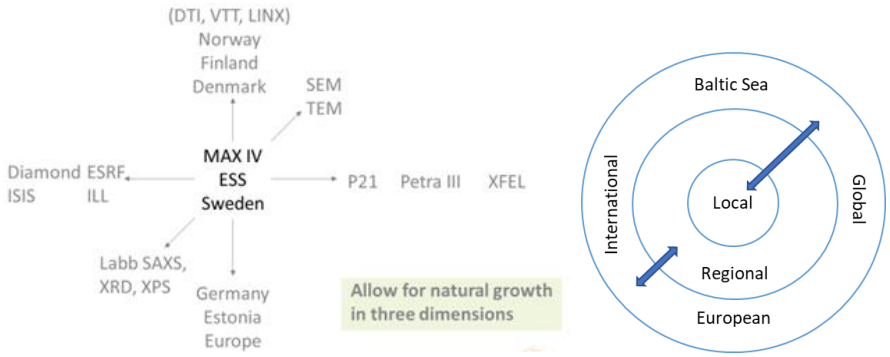

Figure 1: The arena will start by focusing on MAX IV, ESS and SMS and then grow naturally in several dimensions.

Preliminary and previous results

The SWEbeams project brought together actors interested in the use of MAX and ESS. Its activities inspired the need for MAXESS, an arena for industry engaged in using MAX or ESS – namely the MAXESS Industry Arena. In addition to industry, the SWEbeams project recommended the Industry Arena concept should be anchored within the research

communities that are highly relevant for industry. Since Q4 2018, meetings have therefore been held with key actors at LU, MAU, Chalmers, KTH, LTU, RISE and Swerim to build a community of committed actors that can back up and further develop industrial access to MAX IV, ESS and SMS. The emerging consensus within the Swedish LSRI research community is that the next step for enhancing industry access is the pre-competitive space. Accordingly, our Industry Arena concept is based on that.

The project received 0.5 MSEK in funding from Region Skåne in early 2020 to start building the first version of a digital platform for the arena. The platform will be a crucial access point to the arena via the web. The current implementation is available at http://maxess.se and comprises a searchable database of the leading actors and assets in the eco-system. The website will be developed further during 2020.

Project description

MAXESS Industry Arena will be an industrial entry point and an excellent starting point for any industrial researcher interested in how synchrotron and neutron-based techniques can support their research and development. The ambition is to further develop the arena into an open platform for any relevant organisation or individual who wants to be part of connecting industry with synchrotron and neutron-based techniques through collaborations or provision of services can join. The arena will be flexible to accommodate the diverse needs of different industries and companies. It will provide information and resources on different levels of sophistication ***to match the needs that range from new to advanced users***.

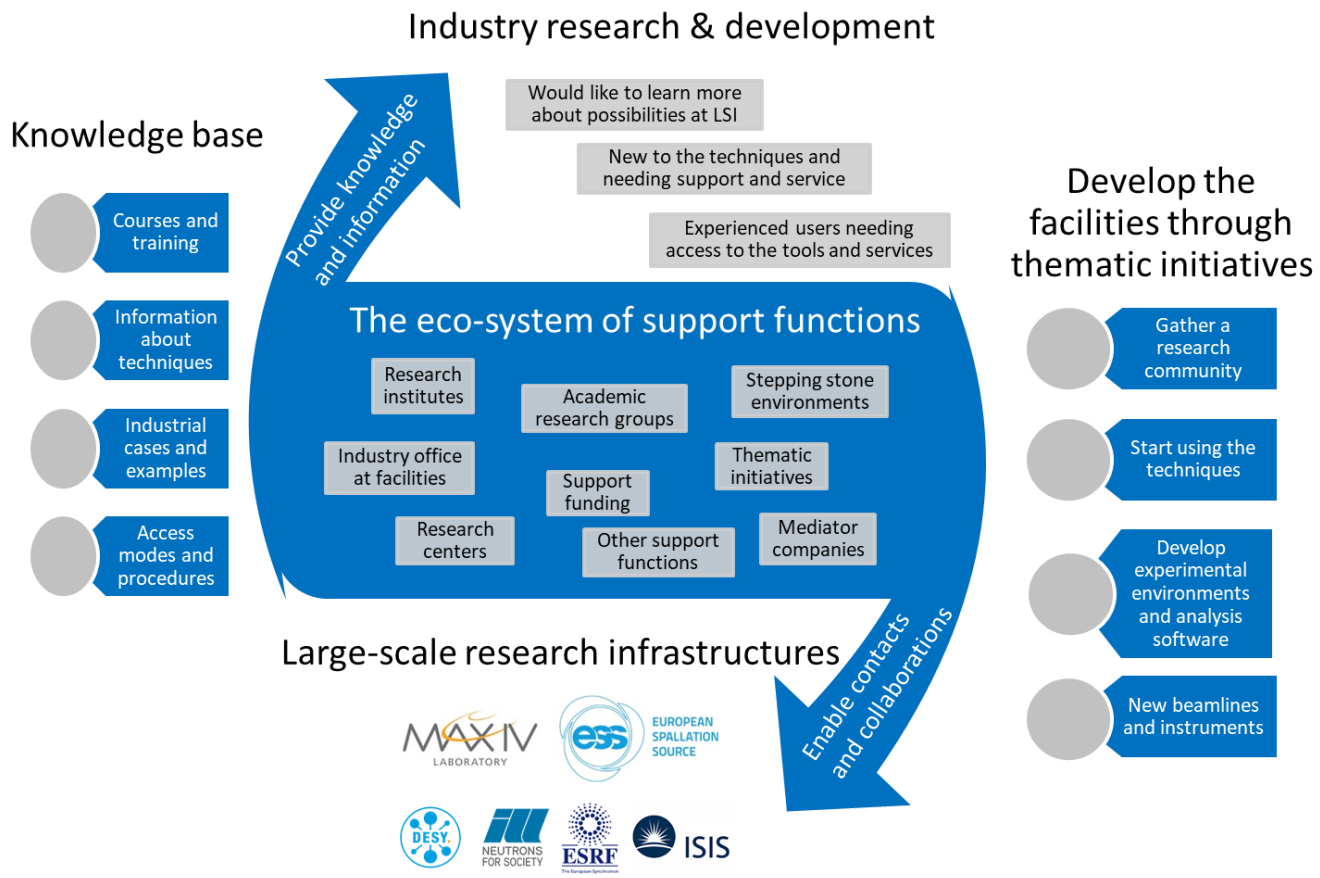

Figure 2: Illustration of MAXESS Industry Arena – The eco-system of support functions and service providers linking the different needs of industry with the Swedish synchrotron and neutron based LSRI investments seen in the middle. The arena provides knowledge and

know-how through information and training sessions tailored to the industrial user needs (left). The arena facilities the process of developing the LSRI through different types of thematic initiatives to meet the industry needs (right).

The project has three central components that are divided into three work packages:

1. Establishing a common entry point for Swedish industry to MAX IV, ESS, SMS and other relevant LSRIs
2. Supporting neutral platforms for pre-competitive research (Thematic Initiatives) as enablers for engaging new industry participants in LSRIs
3. Forming road-maps for arena development

WP 1. Establish a common entry point for Swedish industry to MAX IV, ESS, SMS and other relevant LSRIs

The aim of this work package is for The MAXESS Industry Arena to be an enabler for industry to gain access to LSRIs and LSRI competences in Sweden and internationally. We will work to achieve this aim in close collaboration with a multitude of actors in the eco-system, including researchers, institutes, mediator companies and LSRI user offices. This aim will be achieved via three objectives.

Objective 1.1 - Deliver a Web portal entry point

This web portal will be a common entry point for Swedish industry users interested in MAX IV, ESS, SMS and other relevant LSRIs. It will provide an arena where a diverse range of research organisations and service providers can profile themselves and offer services. The web portal will also be a vital source of knowledge and information for the industry. Tasks to achieve this objective are to:

1. Develop further the online-tool, maxess.se, engaging more research groups and service providers to provide content as well as refining the tool throughout this project (O1.1.1), including shaping relevant search methods
2. Provide overviews of courses, training sessions, webinars and workshops that are already held in the fields of synchrotron and neutron techniques in Sweden and our neighbouring countries (D1.1.2).
3. Shape information about the facilities and the many techniques (D1.1.3) in a way that is more tailored to fit the information needs of industrial users
4. Produce inspiring, explanatory industrial cases (D1.1.4) and presentations on maxess.se
5. Offer a phone/chat/mail support function (O1.1.5) that can guide industry users to the types of further support, collaborations, and events that they need.
6. Make funding schemes, available for industrial connection to LSRIs, visible through the maxess website. (The project will also identify other such funding opportunities (D1.1.6))

Objective 1.2 - Identify stepping-stone environments for initial access

Once industrial users find their way into the portal, this work package aims to lower the threshold for industrial to then start to get access to LSRIs. We will do this via the objective of identifying and connecting so-called *stepping-stone environments* to MAXESS Industry Arena. Stepping-stone environments are local hubs of research experts in various application fields, who are experts in applying neutron and synchrotron techniques, with lab facilities and often also with LSRIs. This objective will be achieved via the tasks:

1. Being transparent and communicating with the Swedish community about the need for stepping stones and how the community can support this
2. Identifying actual and potential stepping-stone environments and connecting them to MAXESS Industry Arena through the web site
3. Encouraging such Stepping Stone Environments to develop offerings, e.g. access to labs, training, preparation and initial characterisation of samples

Objective 1.3 - Develop a flexible Science Village meeting facility for joint use by eco-system actors

As new facilities are constructed, commissioned and become into operation, there is a growing number of national Swedish LSRI-actors emerging on the strategic and operational level on all parts of the value chain, both up- and downstream. There is therefore, an increasing need for active co-presence in Lund/Science Village to facilitate effective coordination and joint activities – as well as to better support and meet industry actors. Our objective 1.3 is, therefore, to provide a shared office and meeting space for the MAXESS eco-system to support such activities more effectively. The tasks are to:

1. Identify shared office and meeting space, firstly at a temporary site and then in the Loop building at Science Village.
2. Provide flexible workstations for partners and attractive meeting facilities for meetings/workshops that can be integrated with Science Village

Additionally, with regards to all activities in this arena, we will also:

3. Collect web statistics and conduct industry and eco-system surveys concerning maxess.se delivery and use.

WP 2. Support neutral platforms for pre-competitive research as enablers for engaging new industry participants in LSRIs

Competing companies in Swedish industries have a strong tradition of collaborating in pre-competitive projects. In LSRIs, companies have formed Thematic Initiatives with eco-system partners to give industry a voice regarding the development of LSRIs, e.g. where the Swedish forest materials industry and its R&D eco-system have supported the construction of the ForMAX beamline. Such Thematic Initiatives have either focused on a specific industry sector or spanned across several industry sectors by focusing on a common theme or concepts. This work package, therefore, has the objectives to:

1. Support existing Thematic Initiatives to take their next step in engaging more of their industry personnel in LSRI - by facilitating the development of experimental environments that are more appropriate for industrial applications
2. Support industries that are new to LSRIs to develop their own Thematic Initiatives.

Objective *2.1 - Facilitate the initiation of new thematic initiatives*.

Tasks to achieve this objective are to:

1. Document the processes, past experiences and lessons learned from the formation of existing Thematic Initiatives – and develop guidelines for new initiatives
2. Identify companies/networks that have an interest in developing their industry network's capabilities in LSRIs and contact them
3. Support such companies/networks establish contacts with a wide range of actors in the MAXESS eco-system

4. Facilitate these actors to trigger the initiation of a Thematic Initiative and support such initiatives gain momentum - and, thereby, engage more industry actors

Objective 2.2 - Make visible industrial needs in the development of beamlines and their experimental environments at LSRIs.

The tasks within this objective are:

1. To survey a Thematic Initiative about their measurement needs, e.g. the Swedish material science community about the types of in-situ / in-operando stress-strain measurements they ought to undertake, as well as the range of data analysis parameters that they need
2. To shape an experimental environment design concept for automated beamline measurements and data analysis, where the automation of data analysis will use existing scripts from LSRI facilities
3. To make a plan, e.g. prepare a project proposal and consortium that can implement such a holistic design for experimental environment and data analysis processes, which is transparent across LSRIs
4. To communicate the lessons learned in building industrial relevance into experimental designs to actors in the eco-system, so that other thematic areas, beamlines as well as actors in the Big Science community can also build-in industrial user relevance into their beamline/experimental environment upgrades.

WP 3. Road-maps for arena development

This project aims to engage more industry users and Thematic Initiatives in the use and development of LSRIs. However, LSRIs and the eco-system around them are not static. They are ever-changing, with a multitude of governments, international organisations, eco-system actors, beamline investments etc. all developing plans and activities. It would, therefore, make sense to support the MAXESS eco-system actors to be aware of the general road-maps of the international LSRI community. The intent is to support Swedish industry initiatives stimulated by this project time their developments so that they are in tune with what is going on in Sweden as well as internationally.

Objective 3.1 Develop a 5-year road-map that integrates the known national and international initiatives, including the National Science Park.

Tasks to achieve this objective are:

1. Monitor the trends in the LSRI field via surveys and participation in relevant fora
2. Follow the development plans of LSRIs, beamlines and experimental environments relevant to Sweden
3. Establish a broad industrial reference group (D3.1.1) with key stakeholders to guide the arena development and to secure industrial relevance and benefit
4. Engage in a dialogue with all key stakeholders, through various fora, and by establishing and our communication channels (O3.1.1)
5. Map these trends and plans to develop the five-year road-map (D3.1.2)
6. Review and update the road-map throughout the project – communicating our overview, e.g. on maxess.se

Objective 3.2 Raise awareness of financing needs and opportunities

The road-map should cover funding needs, e.g. work package two will identify needs for new investments to upgrade LSRIs in a way that is also relevant for industrial use. The road-map will, therefore, include output from the following tasks:

1. Analyse investment needs identified within different initiatives
2. Flag these investments needs and any issues via an open dialogue with Swedish and international funding organisations

Time plan and implementation

Table 1: Outputs and deliverables listed with a time plan in relation to their work packages outlined above.

Outputs/ Deliverables	Description of outputs and deliverables	2021	2022	2023	2024
O 1.1.1	Upgrades to the web portal maxess.se		Q4		
O 1.1.2	Implement calendar function at maxess.se with workshops, courses, and training sessions (min 10/y)	Q4			
O 1.1.3	Develop industry use explanations about the ten most common techniques at LSRIs		Q2		
O 1.1.4	Industry case database at maxess.se with all Vinnova pilot project cases described		Q2		
O 1.1.5	Implement a phone, chat or email support system connected to the arena		Q4		
O 1.1.6	Make relevant funding opportunities visible through the maxess.se website	Q2			
D 1.2.1	Road-map on connecting relevant stepping-stone environments to MAXESS	Q2		Q2	
O 1.3.1	Provide information on available meeting space facilities and how to book them		Q4		Q4
D 1.3.1	Report on industry experience on services, eco-system experience of services and meeting points	Q4	Q4	Q4	Q4
O 2.1.1	Further develop the guidelines for initiating and running thematic initiatives	Q4		Q1	
O 2.1.2	Connect five new research centres and research projects to MAXESS Industry Arena		Q4		
O 2.1.3	Facilitate the initiation of two new thematic initiatives and connect them to MAXESS Industry Arena		Q1		Q1
D 2.2.1	Identify instrument development needs from industry	Q3		Q3	
D 2.2.2	Shape an instrument design proposal together with an industrial consortium		Q2		Q2
D 2.2.3	Provide case studies on lessons learned from instrument development to other actors in the eco-system		Q4		Q4
O3.1.1	Establish an industrial reference group and run annual meetings	Q3	Q3	Q3	Q3
O 3.1.1	Organise annual forum meetings with involved stakeholders and partners		Q1	Q1	Q1
D 3.1.2	Develop and update a road-map for the project including investment analysis	Q4	Q4	Q4	Q4

Project organisation

This project organisation comprises actors who today hold key roles and responsibilities in the Swedish LSRI eco-system.

Magnus Larsson, Head of Industrial Relations at MAX IV Laboratory, will lead the project in a core operational team together with the two new employees, who will both work fulltime in this project. Magnus has for the last five years been heading the Industrial Relations Office at MAX IV, following eight years in the industry. He has extensive experience in industrial-academic partnership and working together with the eco-system of actors surrounding the industrial use of MAX IV. Magnus will work 40% of his time on this project. Selma Maric (Industrial relations Officer) will also contribute 10% of her time on this project. MAX IV will also be responsible for WP1.

The Center for X-Rays in Swedish Material Science (CeXS) is the academic host of the Swedish Material Science beamline at PETRA III and is located at KTH. CeXS is represented by its manager, who has 20 years of innovation project experiences in academia, industry and EU projects. Denise who will work 15% of her time, including taking responsibility for Objective 2.1.

European Spallation Source (ESS) is represented by Pia Kinhult (Head of Host States Relations) with responsibilities to coordinate ESS collaboration with its host countries of Sweden and Denmark. Pia's extensive experience includes being the First Governor of Region Skåne. Pia will work 15% on this project.

RISE Research Institutes of Sweden is represented by Tomas Lundqvist (Senior Coordinator for LSRIs). Tomas will work 40% in this project. He has almost 20 years of infrastructure and LSRI experiences, working in various management roles in pharmaceutical industries and MAX IV before taking his current position at RISE. Tomas will lead WP2.

Science Village Scandinavia AB will be represented by Fredrik Melander (Head of R&D relations) and Ludvig Duregård (Communications), who each will work on the project 10% of their time. Science Village will lead WP3.

The team will design a lightweight and inclusive organisational structure based on the WP-responsibilities and build on the consortium's already existing roles and responsibilities. The project activities have been specified to be clear on the structure of responsibilities for daily operations, support and guidance as well as strategic development and long-term planning. MAX IV will be the project host organisation. The project steering group will be composed of members of the management from the five participating project organisations.

This project will be supported by a reference group (see WP3), which will act as a sounding board, enable access to industry and international support networks as well as provide input to project activities. Three trade associations representing key industry segments are providing letters of support for this project.

Equipment

Not applicable

Need for research infrastructure

Not applicable

International and national collaboration

MAX IV is a Swedish LSRI with a large international user community and a broad national and international network of collaborations; ESS is a European LSRI that is jointly hosted by Sweden and Denmark and has a large international user community and network; SMS is an RÅC investment in the PETRA III LSRI in Hamburg, with CeXS acting at the Swedish host; RISE is a Swedish research institute with a vast network of nodes and projects covering all areas of Sweden and has a clear international ambition; SVS is a regional organisation with an aspiration to create an internationally renowned area in connection to MAX IV and ESS. All project core partners have a robust national anchor and international ambition, and the project is by its by nature collaborative in the sense that it aims to provide links between industries and a national and international network of research partners, service providers and other functions. The project aims to build continuously on these growing national and international networks.

Other applications or grants

MAX IV, ESS and SciLifeLab are applying for VR funding for the project InfraLife - "Life Science Infrastructure Hub for the national large-scale infrastructures SciLifeLab, MAX IV and ESS". The project aims to strengthen the link between the three large scale research infrastructures specifically within the field of life science, and through this collaboration platform, launch new thematic initiatives towards life science. MAXESS Industry Arena will be a support function and a broadcasting platform for the new InfraLife initiatives. This includes workshops, courses and other projects that will be made visible through the events calendar at MAXESS Industry Arena. The InfraLife project will also have a permanent place in the arena with information, contacts and links to the InfraLife webpage and partners.

ESS has been granted funding for the BrightnEss 2 project in Horizon, with one goal to form an industry and innovation office at ESS. This project is already collaborating closely with MAXESS Industry Arena. ESS has also been granted funds from the Swedish national ERUF program to find ways for Swedish universities to get involved in the on-going instrument program at ESS. This can be aligned with thematic initiatives when relevant.

RISE upholds government/VR funding to support activities connected to the use of MAX IV (Project to increase accessibility and use of MAX IV and P21@Petra III by industry and public sector; dnr: 2018-06378). This funding is also matched with additional internal resources. In addition to this application, RISE supports several other applications within the call that has a clear link to the objectives behind the arena and our funding.