DELIVERABLE REPORT

Ref. Ares(2020)3758825 - 16/07/2020

WP11 NA – Innovation and networking activities

D11.20

NFFA-EUROPE position paper on sustainable business models

Expected date

M54

NFFA-Europe has received funding from the EU's H2020 framework programme for research and innovation under grant agreement n. 654360

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PROJECT DETAILS

PROJECT ACRONYM
NFFA-Europe

PROJECT TITLE
NANOSCIENCE FOUNDRIES AND FINE ANALYSIS - EUROPE

GRANT AGREEMENT NO:
654360

FUNDING SCHEME
RIA - Research and Innovation action

START DATE
01/09/2015

WP DETAILS

WORK PACKAGE ID
WP11

WORK PACKAGE TITLE
NA – Innovation and networking activities

WORK PACKAGE LEADER
Ennio Capria (ESRF)

DELIVERABLE DETAILS

DELIVERABLE ID
D11.20

DELIVERABLE TITLE
NFFA-EUROPE position paper on sustainable business models

DELIVERABLE DESCRIPTION
NFFA-EUROPE position paper on sustainable business models

EXPECTED DATE
M54 29/02/2020

ESTIMATED INDICATIVE PERSONMONTHS
MM

AUTHOR(S)

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Ennio Capria (ESRF)

NATURE
R - Report

DISSEMINATION LEVEL

☒ P - Public
☐ PP - Restricted to other programme participants & EC:
☐ RE - Restricted to a group
☐ CO - Confidential, only for members of the consortium

REPORT DETAILS

ACTUAL SUBMISSION DATE	NUMBER OF PAGES
15/07/2020	24

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Version	Date	Author(s)	Description / Reason for modification	Status
0	28/06/2020	Ennio Capria		Final
				Choose an item.
				Choose an item.
				Choose an item.
				Choose an item.
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Executive Summary

This position paper is addressed to both localised and distributed Research Infrastructures (RIs) in physical science and engineering with a representative volume of activity on nanoscience and nanotechnology. A set of original recommendation on how to better engage with industry are provided. The conclusions take in consideration the previous literature on the topic and the recommendation matured from relevant public stakeholders, policy makers and similar initiative. In particular, this paper presents the return of experience and the lessons learned from the NFFA-Europe consortium and synthesises some of the main conclusions emerged in the context of relevant selected workshops organised with partner institutions focused on this topic.

1. Introduction

1.1 The context

1.1.1. Definition of a Research Infrastructure

The Directorate-General for Research of the European Commission defines Research Infrastructures as “facilities, resources and related services that are used by the scientific community to conduct top-level research in their respective fields and covers major scientific equipment or sets of instruments; knowledge-based resources such as collections, archives or structures for scientific information; enabling Information and Communications Technology-based infrastructures such as Grid, computing, software and communication, or any other entity of a unique nature essential to achieve excellence in research. Such infrastructures may be “single-sited” or “distributed” (an organised network of resources)”.

1.1.2. What is NFFA Europe

NFFA Europe (Nanoscience Foundries and Fine Analysis) is a distributed research infrastructure offering free peer-reviewed transnational access to academic and industrial users, in the field of nanoscience and nanotechnology. NFFA has been financed in the context of INFRAIA-1-2014-2015 – “Integrating and opening existing national and regional research infrastructures of European interest”.

1.1.3. Aims of the position paper

The present position paper has been drafted as a deliverable of Subtask 11.5.5: Future business models.
European research infrastructure and research institutes are evolving, as are industry needs for access to data and support by the European academic community. This paper will look at industrial needs in these directions and how they can be matched by the academic community with sustainable business models.
The term “business model” generally indicates the systematic and synthetic representation of the origin of the “added value” of an organisation with respect to a set of identified stakeholders, on a certain period and for a certain domain of activity. With respect to the contents of this paper, the “added value” is not intended only in terms of cash income, but as a tangible return for the actors of the European innovation ecosystem enabled by the actions of a Research Infrastructure (RI). On the other hand, this paper will not address added value production mechanism which could be relevant for other target community than the industrial one. In particular, the mechanism of production of knowledge by academic institutions only, that even contributing to innovation, are taking place out of any public-private partnership are not within the scope of this paper. Furthermore, this paper is focused to RIs (localised or distributed) operating in the field of physical science and engineering with a substantial volume of activity in the domain of the nanoscience and nanotechnology.

In this respect, this paper would focus on the identification of better ways to engage with industry (partnership) by RIs in the nano-domain. The engagement with industry will be considered in the broader sense, where not only direct industry-RIs relationship will be considered, but also indirect relationships where industry subcontract its research activities to academic institutions. The actions suggested will have indeed a positive socio-economic impact and contribute to nanosafety of eventual marketable products or developments.

1.2 Objectives

This position paper would contain a series of evaluations on the best strategies to put in place at RIs to better contribute to innovation in nanotechnology. The recommendations expressed in the position paper are at the foundation of all actions proposed to promote innovation in a proposal that the NFFA Consortium presented for a Pilot call in INFRAIA-3-2020. In particular, this proposal would contain specific actions addressing nanosafety that have never been specifically addressed so far.

1.3 Methodology

This paper has been written taking into consideration the main conclusions coming from existing studies and upon the European Strategy Forum on Research Infrastructures (ESFRI) Innovation Working Group. Furthermore, this paper will take into account the conclusions coming from exchanges and working groups in which NFFA, participated in connection with other similar and complementary initiatives, like the Horizon 2020 (H2020) funded initiatives Calipso+, SINE2020 respectively on synchrotrons and neutrons. Also the contribution from institutional partners like the European Material Characterisation Council (EMCC) or the TTCircle (TT: Technology Transfer) or EIROFORUM (EIRO: European Intergovernmental Research Organisation) has been considered. With respect to NFFA, this proposal would take into consideration the feedback from the SIAP (Scientific Industrial Advisory Board). Moreover, this report will synthetise the conclusions from two workshops organised by NFFA in collaboration with other partners respectively in Heraklion (10-11 April 2019) and in Lund (9-10 January 2020). The first workshop was an open discussion among Industrial Contact Officers (ICOs) at research infrastructures organised in collaboration with Calipso+ and SINE2020, while the second one was dedicated to the coming challenges in nanosafety, with a particular attention to industrial matters.

2. State of play: Research Infrastructures and innovation in nanotechnology

2.1 Why Bridging industry with Academia is important.

Innovation is the ensemble of actions and processes capable to transform an idea or device into a product or service and providing a tangible return on the investment. In the modern technological societies, where the creation of wealth and richness is associated to the benefit obtained with the production of goods, a high rate of innovation is a clear multiplier to guarantee growth and improvement in the quality of life, for the general interest of the population.

Academia and publicly funded organisations are the undiscussed leaders in the production of knowledge. They are curiosity driven and operate under the guidance of the scientific method, motivated by discovery and new knowledge production, often delivered to the society in the form of publications. On the other side, private companies have the role to produce goods and services to contribute satisfying people needs and in this way improving their quality of life. Their objectives and methodologies refer to their business plan, which, if successful, can allow the company to make a profit leveraging the response to their customer needs. If the main reward of an academic contributor is materialised in the act of the “discovery”, the one from a company is centred on the “invention”. Considerable as “applied discovery”, an invention derives from the happy conjunction between a knowledge and a human need with the aim to elaborate an economically viable solution to a meaningful problem.

In such an economic system, it is clear that the rate of creation of wealth in the society is proportional to its aptitude to innovate, which is directly correlated to its capability to transfer the knowledge from academia to industry.

The strategy of the European Commission for the next years will focus on the ability of the European Union (EU) to create millions of new jobs to replace the ones lost during the recent COVID-19 economic crisis, and on the consideration, that our future living standard will depend on the ability of the economic environment to stimulate innovation in products, services and business models. One of the instruments that the Commission uses to stimulate the creation of knowledge is Horizon 2020, a programme of funding dedicated to scientific research. In this context, the Commission finances scientific activities, but under the explicit condition that the beneficiaries of these grants would put in place an implementation plan adapted to operate the transfer to industry of the results obtained via the scientific programmes in the most efficient way, and consequently increasing the overall impact of the investment for society.

Indeed, one of the key factor of success for this transfer to occur, it is the creation of fertile environments (or ecosystems) where industry and academia are partners and have a good level of exchange and reciprocal awareness. This paper will provide some key indications for the institution of a successful partnership between industry and RIs.

2.2 How does research infrastructure engage with industry?

Engagement between industry and RIs is a complex mechanism, which needs tailored approaches to overcome a persistent translational barrier. Industrial approaches tends to privilege an objective driven mentality, more than a curiosity driven one, which is more characteristic of academia. For this reason, to guarantee a proper participation and engagement of the industrial community, RIs need to put in place tailored operating methodologies. A special dedicated effort of intermediation is often needed. Moreover, potential industrial users needs to be reached through specific channels that are not always the same than for academics. Industry would be more interested to study real systems than model ones, because their objective is to finalise a product, more than defining a proof of principle. The exceptionality of the industrial achievement are more often identified with a tangible socio-economic impact than with scientific excellence. Consequently, to properly estimate the value of an industrial research achievement, the two criteria cannot be dissociated.

An extensive literature review has been carried out completed with respect to the status of the engagement of RIs with industry, in the field of physical science and engineering and in particular in the domain of nanotechnology. The main bottlenecks identified are listed below, with some suggestions to overcome them.

2.2.1. The translational challenge

It is well known that when industry is in quest of expertise, has the tendency to prefer a pragmatic solution driven approach than a punctual request focused on a particular technique. This naïve and holistic approach can be misaligned with respect to the more expert based approach that is the common rationale with academic users. This different perspective is somehow perceived as a lack of competence by the academic scientists with respect to their industrial counterparts, but this is not true. From experience reported by academic scientists, it does not take long to understand that the difference is purely on the level of the objectives, missions and perspectives. The priority of industrial scientists is not to deeply understand a topic in order to be capable to defend a theory in a peer-review communication. They are expected by their management to meet a technological objective in the most straightforward way. For them an instrument is a tool, and there is no need to become an expert on a tool if the expertise can be available elsewhere. The investment of an industrial partner for knowledge development and competence will be functional to the achievement of a technological objective. Industrial scientists are driven by the result and not by the knowledge. For this reason, industrial users tend, in general, to demand more established and repeatable measurement than exotic cutting-edge experiment, difficult, less reliable and with a poor standardisation. Off-course many shades are available of this very sharp picture depending on the size of the company, the department, and the expected time to market.
This translational challenge is for sure obvious when it is about describing the perceptions of RIs by the industrial community. If RIs branding is mainly focused to communicate about the uniqueness, state-of–the art and fantastic science that they produce, they may miss a great deal of industrial users expectations. They will consider RIs difficult to use, risky, just adapted for fundamental science and not for industry and in some cases expensive. This aspect has to be considered when designing any outreach campaign targeting industry.

2.2.2. The needs of specific resources to work with industry

The need for a tailored approach to address the industrial demand would likely need extra resources, both material and human.

An extra workforce is necessary to maintain the industrial relationships at the facilities, with a consequent need for specific trained staff capable to understand the industrial perspective. The possibility to put in place a customer management relationship centred on a key account manager is often appreciated. After the most coherent and recent suggestion by the European Commission (EC), these special people can be called Industrial Contact Officers (ICOs). They are in charge to understand and interpret the industrial needs, to suggest an appropriate methodology to address it and to provide the necessary hand-holding all along the industrial access. ICOs are expected to have a very broad technical background to be able to understand the industrial demand and indicate the best solution to be proposed. Often, ICOs are part of a team organised by sector of competence. Nonetheless, a broad generic approach is always needed. This last aspect is not trivial since, at present, no specific ICO training exists and all the needed skills are based on experiences acquired by the staff all along their specific career path. In this context, the support supplied by professional intermediaries can become particularly important. Intermediaries are privately own SMEs that are gradually appearing in various countries, supporting industry when they access the RIs. They offer a professional and unambiguous B2B customer approach and play a crucial role in particular when the data analysis can be a barrier to the exploitation of the results. This is often the case when the industrial users are not looking for raw data but for a report.

On the material side, it seems beneficial to give the possibility to new comers from industry to obtain access for selected pre-emptive feasibility studies to provide a proof of concept and reduce the risks associated to a too unconventional approach.

2.2.3. Need of building awareness and provide training and education

The adoption by industry of techniques provided by the RIs needs a capillary, committed and devoted activity of outreach in order to build the awareness of the potential industrial users and give the appropriate visibility on the potential opportunity of the offer provided. This results in the design of a proper promotional campaign, which would use the most current marketing tools and channels. The production of good quality supporting materials (both physical and virtual, e.g. flyers, posters and videos) is needed to support off-line and on-line actions. In particular, an appropriate presence on social networks and social media in general, is offering a unique opportunity to reach a large audience in a targeted manner. Finally, the institution of dedicated trainings designed for the industrial community can be a good tool to increase the industrial engagement.

2.2.4 Statutes and working practices designed for academics

RIs access modes are today designed for academics. Most of the access provided is based in peer-reviewed proposals. Some facilities can offer confidential fee-based commercial access, but very often this has lower priority with respect to the public programme and it is consequently slow.

Furthermore, the selection of the scientific staff and their career path are designed around the need to produce high quality papers. In this context, the work carried out for industry can be considered off-topic and out of core business and staff motivation may consequently drop dramatically. This barrier could be probably lowered introducing new recruitment procedure and criteria, and inserting industry right at the core of the scientific mission of staff, and opening the way to the definition of novel career paths.

On another side, on the more operational side, apart from the human resources concern, the administrative procedures needs to be reduced at the minimum. This can be difficult, since may demand a major change in management efforts.

2.2.5 The need for industry tailored equipment, standards and certification

The possibility to access instruments especially tailored for industry would also be beneficial. These instruments are often routine high throughput facilities that can provide standard reliable results in service mode. Ideally, these services are co-designed with industrial users. The possibility to certify some instruments where industrial access is particularly important can be considered. Nonetheless, at present, an ISO type certification does not seems to represent the highest priority for industry for scenarios other than production. In general, industry is already satisfied if the instruments that they access are well characterised and an appropriate set of standard operating procedures is in place, to guarantee the reliability and reproducibility of the results.

For sake of completeness, we would like to mention that one of the best way from an RI to have one of its techniques adopted by an industrial user community is to see these techniques integrated in a norm which become the reference for validation and qualification of industrial components. This process can be long and complex, and would definitely need an important normative effort. Some initial cases are on their way, for example on the use of 3D synchrotron and neutron based imaging for inspection of metallic parts fabricated via additive manufacturing. Some further case may arise from the proposals evaluated in the context of the recent H2020 call: *NMBP-35-2020: Towards harmonised characterisation protocols in NMBP (RIA)*.

2.2.6. The need for a tailored approach, based on the industrial context

Whatever approach is defined with the aim to provoke the interest of an industrial partner, it is important to adapt it to the individual specific case. Although a lot of generalisation and analysis can be drawn, in the mind of an ICO, it does not exist such a thing as what we call: “industry”. For the ICO, the industrial partners are all distinct profiles, each one with its peculiarity and particular needs, depending from various factors. We summarised below those factors that are mostly related to the structure of the company:

- LEVEL OF MATURITY, UNDERSTANDING AND ADOPTION OF THE RI TECHNICAL SOLUTION. SOME COMPANIES MAY HAVE ALREADY IN HOUSE THE RIGHT COMPETENCE TO CAPTURE THE VALUE OF THE TECHNIQUE OFFERED BY THE RIS. IN THOSE CASES, THE COMPANY COULD BE MORE INTERESTED TO THE BEST WAYS TO FACILITATE THE ACCESS TO THE FACILITY THAN ANYTHING ELSE.
- SIZE OF THE COMPANY. THIS CAN BE A CRUCIAL FACTOR TO UNDERSTAND DIFFERENT PATHS IN THE DECISION MAKING OR IN THE BUDGET AVAILABILITY. IN AVERAGE, THE LARGE COMPANIES TENDS TO HAVE LARGER BUDGETS STRICTLY PLANNED ON A YEARLY BASE, WHILE SME MAY HAVE MORE DIFFICULTY IN CASH FLOW. INSTEAD, ON THE SIDE OF THE

DECISION MAKING PROCESS, THE ACCESS TO DECISION MAKERS CAN BE FASTER IN SME THAN LARGE COMPANIES. HOWEVER, THIS MAY NOT THE RULE IN SMES PARTICIPATED BY INVESTMENT BODY, WHICH CAN EXCERT A CONTROL ON THE VALIDATION OF THE BUDGET.

- R&D INTENSITY WITHIN THE COMPANY. THE COMPANIES WITH A BIGGER R&D SPENDITURE TENDS TO HAVE MORE AVALIABILITY IN EXPERTISE AND BUDGET. THIS SHOULD BE TAKEN INTO CONSIDERATION WHILE CHOOSING THE TARGET OF AN OUTREACH CAMPAIGN. NATIONAL TRENDS ALSO EXISTS. FOR EXAMPLE, IN EUROPE, THE PERCENTAGE OF GDP SPENT FOR R&D IN GERMANY, UK AND FRANCE TENDS TO BE HIGHER THAN IN OTHER COUNTRY. THIS WOULD FOR SURE GIVE AN INDICATION OF THE AMOUNT OF RESOURCES AVAILABLE FOR R&D ACTIVITIES IN THOSE COUNTRIES.
- LEVEL OF EQUIPMENT. IN THE PERCEPTION OF A COMPANY, WHATEVER ACTIVITY IS CARRIED OUT AT RIS ADDS A LEVEL OF COMPLEXITY AND A COST. FOR THIS REASON, COMPANIES WILL ALWAYS TRY AS MUCH AS THEY CAN TO USE IN HOUSE EQUIPMENT THAN TO EXPLOIT EXTERNAL INSTRUMENTATION. THE PERCEIVED ADDED VALUE NEEDS TO BE CONSIDERABLE TO CONVINCE AN INDUSTRIAL SCIENTIST TO LOOK OUTSIDE THE OWN LABORATORY. THIS MEANS THAT THE BIGGEST IS THE INVESTMENT THAT A COMPANY DOES IN PROPRIETARY INSTRUMENTATION, THE BIGGEST COULD BE THE RESISTANCE TO ADOPT OTHER METHODOLOGY. ON THE POINT OF VIEW OF THE ICOS, THIS CAN BE SOMEHOW PROBLEMATIC, BECAUSE THESE COMPANIES ARE ALSO AMONG THE ONES WITH THE LARGEST TECHNICAL EXPERTISE AND WELL TRAINED STAFF, WHICH ARE EXPECTED TO APPRECIATE THE MOST THE OPPORTUNITY OFFERED BY RIS.
- SECTORS. HIGH TECH SECTORS TENDS TO BE MORE ACTIVE IN R&D, AND MORE FAMILIAR WITH THE CHALLENGES ADDRESSED BY RIS. NONETHELESS, THIS TRAIT IS NOT GENERAL, IN PARTICUALR WHEN SOME MORE ROUTINE TECHNIQUES ARE DISCUSSED.

2.3 The NFFA Europe Experience

Innovation has been at the core of the perspectives of NFFA since its first begin with the design study in 2011. Already in this study, NFFA considered the possibility to offer proprietary confidential research, with a particular attention to the respect of IP rights. The institution of an ICOs network was also suggested. Of course, the importance of an appropriate marketing activity and outreach campaign was highlighted. Finally, the importance to set up quality standard for the management of customer commitments (ISO 9000-9001 standard) was mentioned.

The industrial relations in NFFA Europe have been built on the basics of those guidelines defined in 2011. An ambitious programme of outreach and engaging of industrial partners and users have been operated, steered on the basic of a marketing campaign executed right at the beginning of the project. In order to facilitate the industrial engagement, an incentivised knowledge transfer access has been proposed.

Out of the experience of NFFA, the success of the industrial activity was proven by the fact that the number of industrial users constantly grew during the proposal and that the amount of submitted proposal that were connected with industry reached the 10%. This number is in line, or even higher to the quota that is normally declared by scientific RIs much more mature than NFFA.

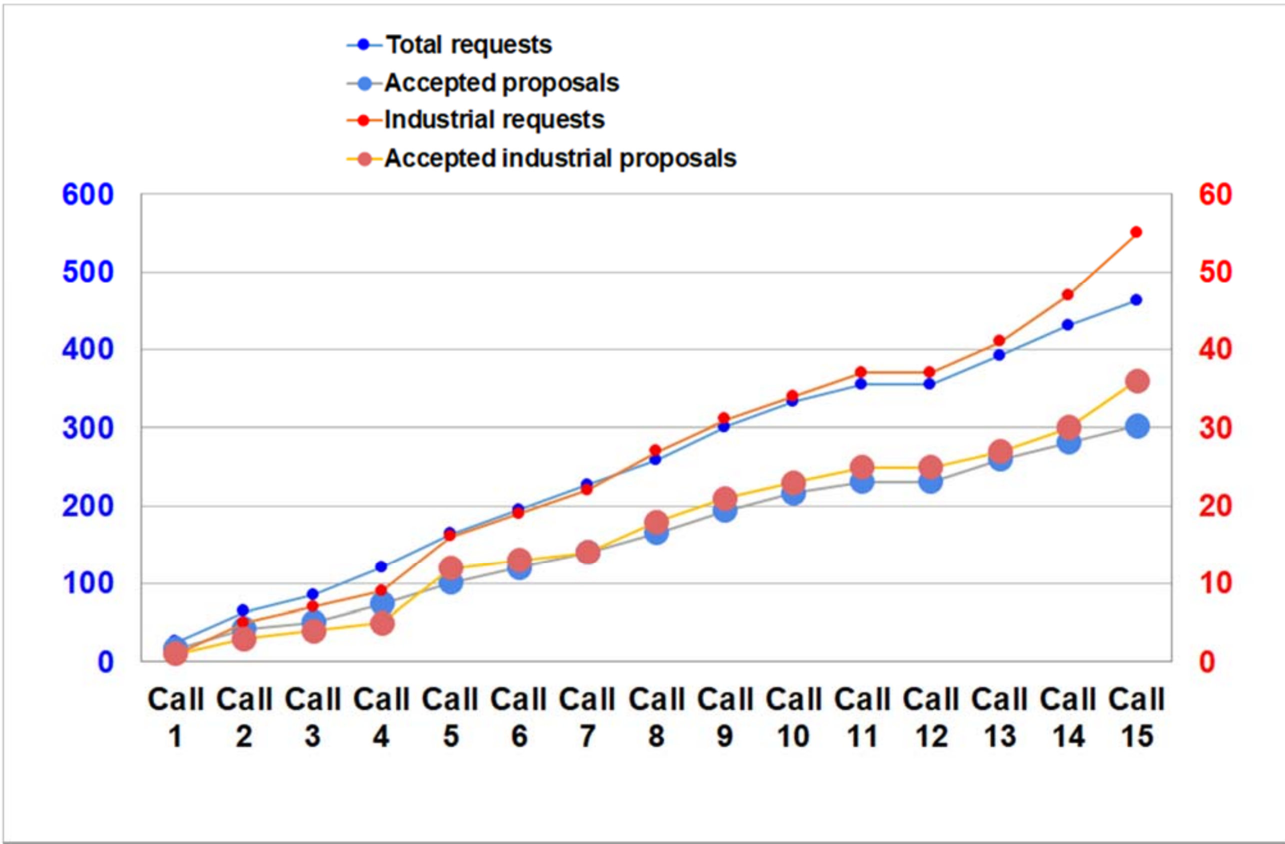


Figure 1: Trend of industrial proposals vs total proposals for NFFA

The networking and involvement among the various facility ICOs was not very successful, probably due to the absence of commercial access. Most of the work was carried out by the task coordinator.

With respect to the valorisation and the exploitation of the IP generated within the NFFA actions some success stories can be listed. Some IP have been developed in collaboration with private partners and, in some cases, the IP generated contributed to the issuing of patents. Although some good results have been obtained, a more structured action for monitoring, assessing, managing and valorising the IP generated within the project was lacking. Many partners were reluctant to discuss about IP generation, because they had some difficulty to place the boundaries between the IP generated by the consortium and the one already present in the partner laboratory. Furthermore, in some case, the generation of IP was even difficult to detect and identify.

NFFA offered to companies the possibility to have feasibility access, the so-called Incentivised Knowledge Transfer Access (IKTA). This opportunity was given when a certain risk was associated with a TA or consultation on a proprietary access in order to mitigate it and allow the partner to decide how to proceed. A very low use of IKTA was registered, essentially by big companies sensible to confidentiality issues and thus aspiring for a proprietary research access to NFFA-Europe. This is probably a consequence of the success of the TA programme more than a proof of a lack of attractiveness of the feasibility access.

3. Conclusions / Perspectives

As already discussed in the previous chapter, the NFFA experience can be considered as a relevant case study in the context of an extensive literature already existing on the topic of bridging industry with academia. All across the life of the project, the NFFA team participated to relevant working groups and dedicated workshop that allowed the possibility to write the conclusions presented in this chapter. These conclusions have to be considered as complementary to the general ones already described in 2.2 and can be generalised to the whole community of the RIs, in particular in the context of innovation in the nano-domain. Furthermore, it is worth mentioning that the recommendations presented below have been taken into account for the proposal presented by the NFFA Consortium to the INFRAIA-3-2020 call for Pilots.

3.1 Effectiveness of the TA access to support industrial activity in pre-competitive phase

As introduced in 2.2.2, RIs are facilities mainly designed to serve the academic community, and this, in some cases, can create tensions with the industrial programme. This was not the case for the NFFA experience. The exploitation of the opportunities offered by the Transnational Access (TA) demonstrated the possibility to create direct synergies and engagement between industry and the NFFA members. This resulted in a beneficial cross-contamination and a wider sharing of information, knowledge and technologies between academia and industry (SMEs in particular). Industry demonstrated the capability to produce excellent science, in particular during the pre-competitive phase of development of new products, which is normally happening at very low TRL levels (below 3).

As described in 2.3, in NFFA an overall amount of around 10% of the total access has been provided for industry related access. This is in line with the result of the most active RIs in the domain of physical science and engineering. The fact that there is such a linear natural correlation between the academic access and the industrial access can suggest that some useful synergies may exist there. More specifically, a successful academic programme is for sure beneficial for a successful industrial programme and maybe the opposite can be true. Sometimes, in some RIs the academic and the industrial programme are considered in competition with each other. This value can definitely demonstrate that this vision is wrong and that one of the best asset, for a RI, in order to be successful in engaging with industry, it is having a successful academic programme.

It has been reported that in the case of more mature infrastructures, the possibility to provide confidential fee-based access can be useful. In this respect, it would be recommended that RIs would establish a methodology ready to be adopted for when some technical demands would be promoted from the pre-competitive to the proprietary access. The possibility of executing some feasibility access to promote the fee-based access can be useful when techniques are mature enough to be offered on a commercial basis, but it demonstrated of minor interest when the industrial users are in the pre-competitive phase, when they would prefer to apply directly for TA.

3.2 Interaction of RI with Open innovation initiatives and technology infrastructures

Based on the definition given by EC, Technology Infrastructures (TIs) are “facilities, equipment, capabilities and support services where industrial players can find support to commercialise new products, processes and services, in full compliance with EU regulations”. Some examples are already there and some more are being considered. RIs and Tis are not mutually exclusive. In the context of the NMBP actions, a set of very interesting tools have been launched to address industrial challenges, the Open Innovation Test Beds (OITB) and Environments (OIE). These platforms (in which some of the NFFA partners are also members), do not offer Transnational Access and are designed to serve activities with TRL between 4 and 6. It is then plausible to imagine a process where the industrial programme run by the RIs would support the early stage of R&D activities and would allow the OITB and OIE to take the relay for higher TRLs. This could end-up having, in Europe, a set of facilities perfectly synchronised to mature interesting opportunities all across the TRL range, between 2 and 6, and then give the possibility to private companies to take in charge the competitive and proprietary phase of their development. This would definitely contribute to create a virtuous European innovation ecosystem and would help the generation of new market opportunities which could support and boost the European economic system, reduce the time to market for new products and strengthen competitiveness and growth of companies.

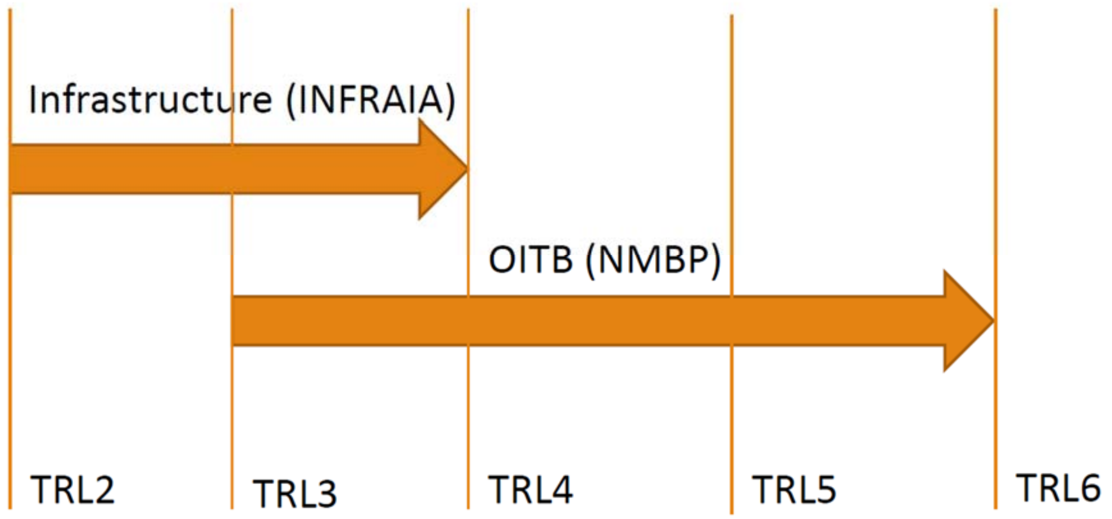


Figure 2: TRL range of activity of different H2020 financed actions

In this respect, in recent years the EMCC is doing a remarkable work to define a roadmap for characterisation which would predict and identify the challenges for the coming years related to characterisation for industry. In this exercise, the next edition of the roadmap is likely to contain some characterisation opportunity which needs to be proven, matured and developed, because they are in the early stage of their development. It is reasonable that some pioneering companies would be interested to try some pioneering and preliminary experiment to mature these new techniques. This work would be in TRL 2 and the access needed could be obtained via the public program available at RIs. These activities would ideally be coordinated by a company, which would have the double role of being member of the RI providing access and an industrial member of EMCC.

3.3 The translational barrier and the importance of intermediaries

As already discussed in 2.2.2, apart the very technical, expert focus support offered by the instrument scientists, a further level of interface is needed to guarantee the necessary hand-holding and maximise the industrial user experience and the perceived value. In this perspective, the support offered by the ICOs is essential. Furthermore, to overcome the translational barrier, the RIs can team up with existing intermediaries. Intermediaries can be publicly funded or professional private companies (mainly SMEs) which could support the technical staff at RIs to provide a service adequate to the industrial user expectations.

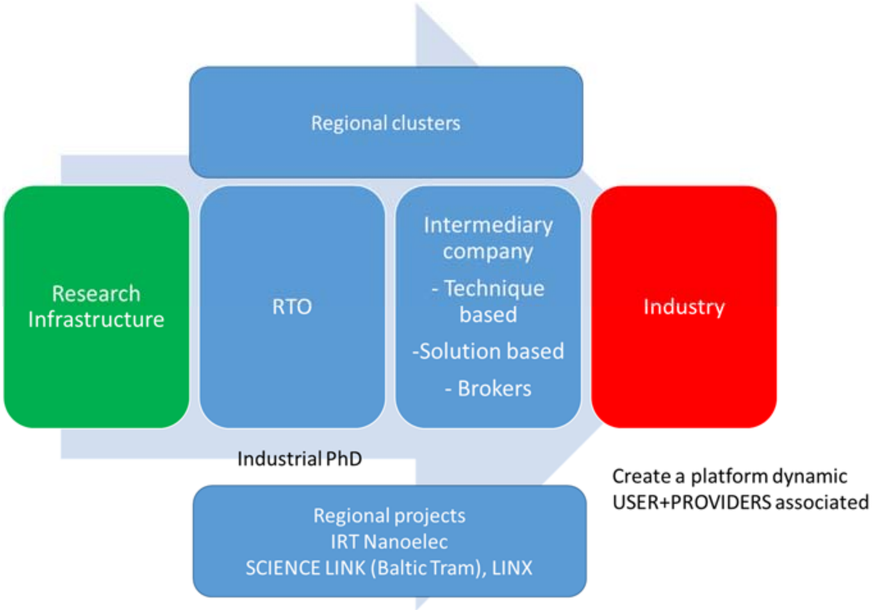


Figure 3: Bridging industry with academia: the intermediaries.

A meaningful collaboration between the RIs and intermediaries can be in particular obtained creating a platform dynamic where the RIs would become the catalyser for a hub. These structures can act as competence centres, where industry can address questions and where in return can get solutions. This offer of expertise, even before than access to the instrument, is a crucial factor to allow the development of the needed trust that is a premise for the development of any sort of industrial engagement. In this respect, the ICOs and the intermediary working together can be in charge for:

- THE OUTREACH AND THE PROMOTION OF THE SERVICES OFFERED BY THE RI TOWARD THE INDUSTRIAL COMMUNITY
- THE PROBLEM ASSESSMENT AND THE ADDRESSING OF THE NEED WITH MOST APPROPRIATE TECHNIQUE
- GUARANTEE THAT THE ACCESS ADMINISTRATION IS SMOOTH AND EFFECTIVE
- THE DATA ANALYSYS IN COLLABORATION WITH THE EXPERT AND THE ELABORATION OF A TECHNICAL REPORT

The support of intermediaries can in particular be important to overcome the lack of motivation from scientists at the facilities and the assumption of any liability from RIs connected with the results provided in the context of industrial accesses.

With respect to the role of intermediary, particular attention should be paid to the work currently done in the context of the CAROT (Commercial Analytical Research Organisations Transnational Strategy) project, financed by the Interreg programme of the Baltic Sea region. With respect to the

ICOs, instead, major attention should be paid to the outcomes of the project ENRIITC (The European Network of Research Infrastructures and Industry for Collaboration), financed in the context of H2020.

3.4 Adapted branding and new ways to increase awareness

As already discussed in 2.2.1 and 2.2.3 the branding of RIs needs to be adjusted in order to encourage the right perception in the industrial community and inspire confidence. Moreover, outreach is necessary to raise awareness, which is an essential preliminary step for engagement. On-line and off-line actions can be considered, with a particular focus on the use of social media. To what already said we can add that any promotional action need to be established in the framework of a proper marketing strategy matured as a consequence of a careful market analysis. Furthermore, all the communication activities needs to be coordinated and conducted within the context of an editorial plan.

In the groups of discussion established in recent years, further ways to engage with industry has been suggested, all leveraging on the solution driven approach by industry. The first suggestion is the one of the “calls for problem” and “hackatons”. Different formats can be experimented, but the main aim is the same: encourage industry to communicate on a specific need and stimulate an appropriate answer from the expert scientific community that address this need. The call for problem can be structured as an open call to industry or as an open call for scientists focused on a set of selected industrial problems identified beforehand. Furthermore, the format can be completely virtual and remote or materialised in a physical venue with the presence of representatives from the two communities.

Furthermore, there is the possibility to put in place some spaces of co-creation where industry and scientists can brainstorm around specific topics. The possibility to have some inspirational space designed ad-hoc around the opportunities offered by the RIs can stimulate new ideas and creative thinking. Various experiences have been already successfully launched in this respect, like, just to give an example, the French Ideas Laboratories.

Before to conclude this chapter, it is important nonetheless to report that, on the basics of the statistics collected on industrial access in various RIs, and in particular NFFA, we can prove that a linear correlation exists between the industrial and academic access. As discussed in 3.1, this can be considered as a tangible proof that the industrial and academic missions (and related programmes) at RIs are not in conflict, but reciprocally and synergically supporting each other. For example, the visibility given by the publication records of the academic programme are for sure beneficial to boost the reputation and the credibility of RIs and attract industrial users, while the professionalization and the optimisation of technical equipment instigated by industry can definitely be beneficial to produce high quality science in the public programme. Concluding, for a RI, a successful academic programme is, with the other actions suggested in this chapter, one of the best asset to support a successful industry engagement (obviously with all the other conditions unchanged).

3.5 Training and career design

The main considerations about training for users have been already listed in 2.2.3. As already pointed out, bridging industry with academia is a complex activity that rely on weak equilibria. The need for open-minded people with a hybrid technical and business double faceted profile is needed. The importance of the dialog, understanding someone else point of view and being constantly out of one's comfort zone is primordial. This kind of attitude should be emphasised since the early stage of the education and at least at the University. In this respect, it could be important to motivate business schools and engineering schools to offer to the students the opportunity to have some moments of exchange to learn about the importance of the exchanges and understand about the better way to interact and dialog. Of course, this mechanism is out of the control of the RIs but it is a recommendation of general interest that could have a beneficial return on the activities that are the object of this paper. In this respect, the RIs could definitely be ready to contribute in the animation of possible initiatives and nourish them with case studies and proposals.

A further suggestion that emerged from the discussions with NFFA partners is the possibility to offer "hands-on" experiences for industry. The idea would be to induce and stimulate industry adoption of the RIs techniques by encouraging a fruitful exchange about their issues, and by taking the opportunity to illustrate to them the capabilities of the RIs with the aim to stimulate new ideas, too. Once some common interests are identified some practical experiences to increase the engagement of industrial users can be organised. These experiences can have different durations and can go up to have some real staff exchanges and secondment from industry at the RIs. This could be in particular useful for junior scientist still in the early phases of their career.

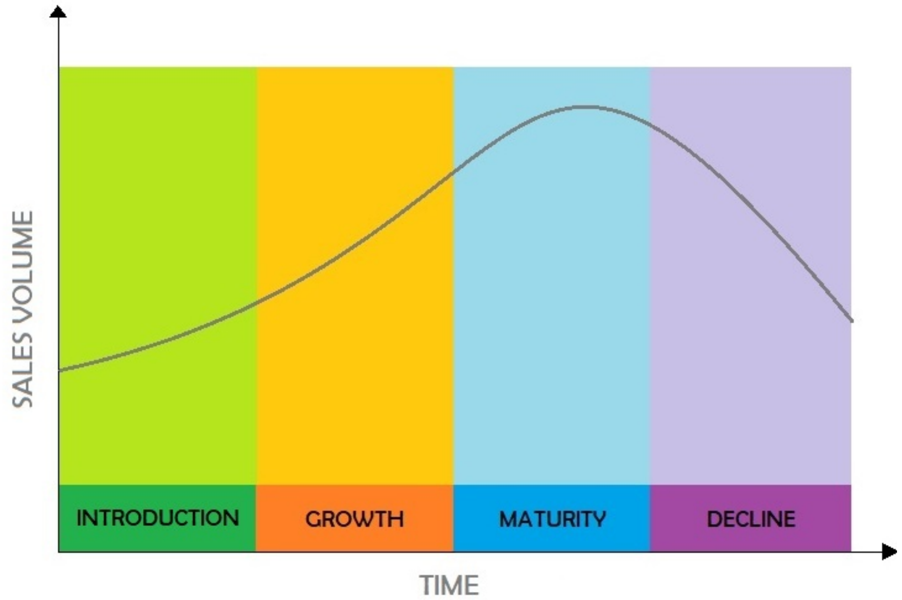
Another set of recommendations, related with training, is based on the observation that industrial staff which had experience, during their early career and education, at RIs, and that decided pursue their career in industry tends to be good ambassadors for RIs. In this respect, RIs should, as much as possible, try to maintain a connection with their alumni and promote initiatives for training staff in the perspective to pursue a scientific career in industry. Various initiatives exist in this direction, like the EC supported Industrial PhD programme, the French government supported CIFRE scholarship or some more specific initiatives, like the H2020 funded InnovaXN in Grenoble. Furthermore, some bilateral agreements for co-financing trainees, PhD, postdocs between RIs and companies should be stimulated. On the same logic, RIs should maximise their effort to be present, as much as possible, in the education programmes at university level. In particular, the students in engineering, which are the more suitable to pursue their careers in industry should be a primary target.

Training, with its long-term perspective and strategic value, can definitely be an important tool to generate industry engagement. For this reason, RIs should try to maximise the involvement of industrial scientists in the organisation of their usual educational activities. The invitation of R&D managers and scientists from industry should be a common practice in the organisation workshops and summer schools.

3.6 Development of novel industry tailored instrumental facilities

As already discussed in 2.2.4. The possibility to implement industry tailored facilities co-designed with industrial users is for sure one of the most successful actions to maximise industry engagement. The experience matured so far demonstrated that the democratisation of cutting-edge analysis techniques offered by RIs can happen.

Innovative techniques of analysis, like any other product, may follow a life cycle as the one described below:



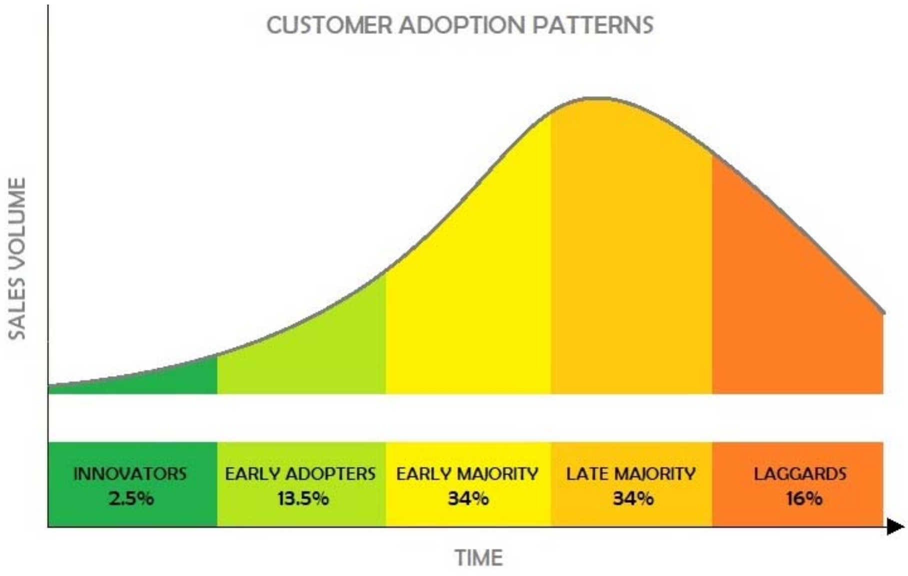


Figure 4: life cycle analysis of a product and customer adoption pattern [https://www.oberlo.com/blog/product-life-cycle

As we can see, after a first phase of introduction, mainly by innovators and early adopters, a growth phase is expected and then a maturity phase occurs where the price would stabilise. This pattern can be definitely identified already in the industrial demand for synchrotron based protein crystallography, which did reach maturity and synchrotron 3D imaging, which seems clearly ongoing the phase of growth.

On the technical point of view these dynamic of adoption may translate in the evolutions described in the image below.

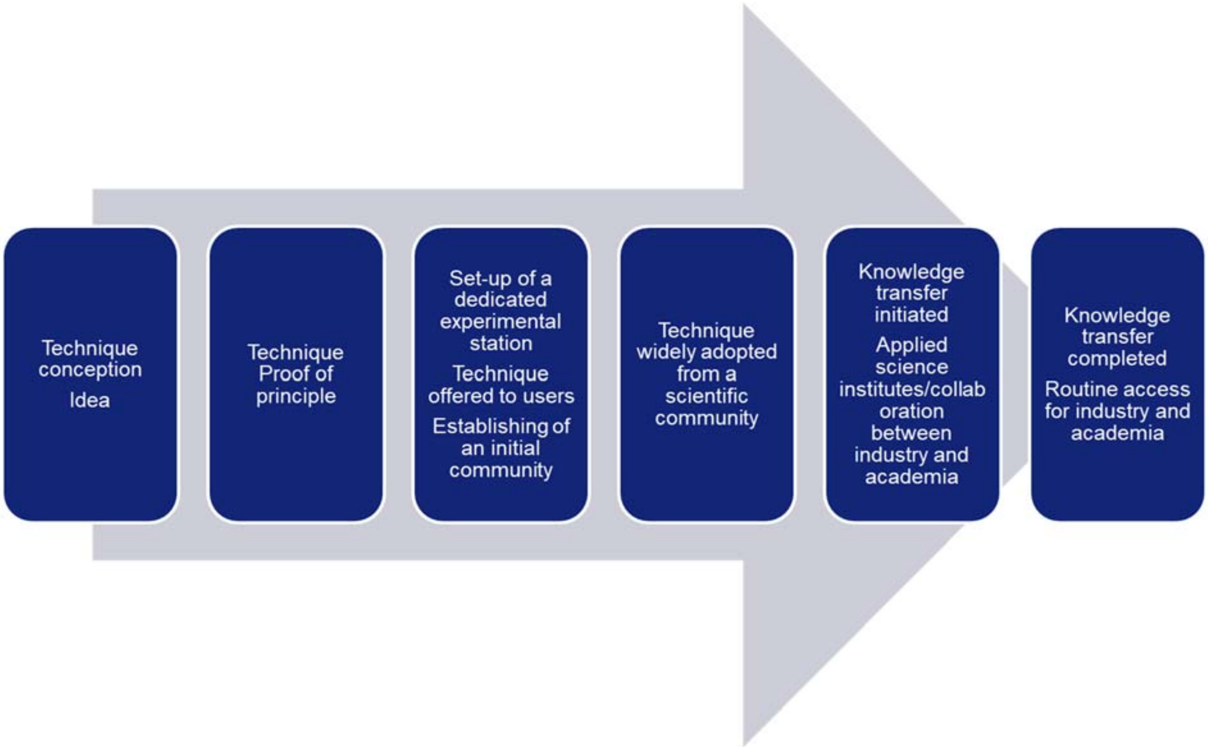


Figure 5: process of adoption and maturing of a cutting-edge technique

In these cases, the scope for a high-throughput routine instrumentation could be there. A technique that was originally designed for unique high performance measurement will be optimised and professionalised for a recurrent access. The technique can be standardised and offered as an integrated service by implementing the pipeline described below:

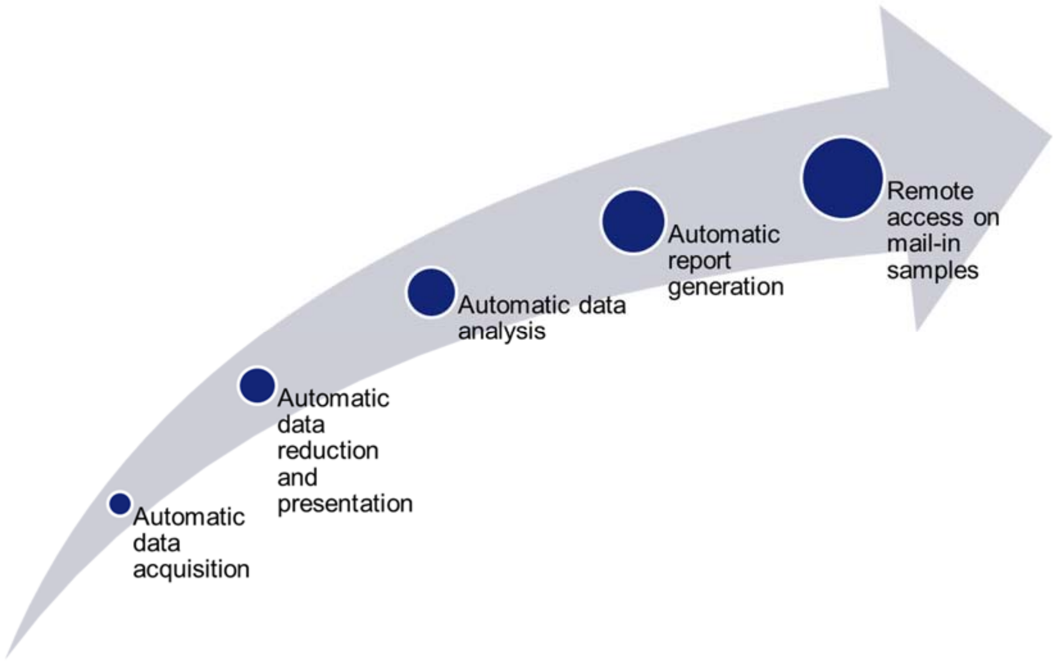


Figure 6: progression of a data automation support for a high throughput optimised cutting-edge technique.

This action generate a virtuous process that is beneficial for both the academic and the industrial community. The increase of capacity on the upgraded instrument can, in fact, reduce the tension between industrial and academic programme, and the possibility to have automation can liberate some scientist time that could be used to develop novel cutting-edges techniques. Furthermore, the possibility to have a standardised and reliable instrument will support the academic user community as well, opening to the possibility to have measurements with an increased statistical value. Finally, the possibility to have remote access would be within reach. It is obvious the advantage that this could bring in this period of COVID-19 pandemic, but also on the long-term, by reducing the operational costs and environmental impact related to travelling.

3.7 Improving the structure of the industrial user community

With the aim to describe the dynamics governing the relationship between industry and academia, a lot of authors have extensively reported about the metaphor of the bridge that needs to connect the academic knowhow production with the industrial valorisation in order to cross the "Valley of Death" and complete the process of knowledge transfer, which is the main enabler of any successful process of innovation. If we remain with the metaphor of the bridge, we can consider that the two pillars on each sides of the bridge represent the main intermediaries respectively at the academic institution and at the corporate partner. With the aim to maximise the TT opportunities, a lot of effort has been spent by public institutions and policy makers to better structure and optimise the academic pillar of the bridge, and guarantee a proper opening to the world of academic institutions, including RIs. The academic side of the bridge presents today a certain structure, with the institution of the ICOs at various facilities, the presence of the private intermediaries and the institution of publicly funded RTOs (e.g. just to cite some CEA in France, Fraunhofer in Germany, IIT in Italy) to whom industry tends to subcontract its more risky R&D projects. On the other side of the bridge, the industrial pillar is the one supposed to provide a strategic approach in the formulation of the demand, with clear perspectives and projections. It is crucial to transform a substantial technology push approach into a market pull approach. On the industrial pillar, normally would sit the open innovation managers (which could have different denominations, depending from the company). Often belonging to the R&D departments, they are in charge for the scouting of new opportunities and for finding solutions to unmet challenges by the companies. Apart from selected sectors with peculiar market structures (like the semiconductor industry), today, the industrial pillar lacks structure. This is partially due to the difficulty of companies to work together to define common roadmaps, but this is also due to the fact that a clear driver is missing. A lack of steering and leadership in the industrial community is evident and consequently no action is in place to better structure the demand. As a result, the action of the ICOs is less efficient that it could be. It is difficult to understand which actor should be in charge for this, among the ones existing on the innovation landscape:

- THE TECHNOLOGICAL CLUSTERS (E.G. POLES DE COMPETITIVITE IN FRANCE OR DISTRETTI TECHNOLOGICI IN ITALY): ARE MULTIPLYING ACROSS VARIOUS COUNTRIES. THEY HAVE THE MISSION OF FACILITATING THE CONNECTION BETWEEN THE INDUSTRIAL DEMAND AND THE R&D OFFER. UNFORTUNATELY, THESE STRUCTURES TENDS TO ACT MORE AS HUBS TO CATALYSE THE DEMAND AND THE OFFER, THAN TO ACT AS A STRUCTURING ELEMENT OF THE INDUSTRIAL LANDSCAPE IN A GIVEN SECTOR.
- LARGE COMPANIES CAN PLAY A KEY ROLE IN STRUCTURING AND ORGANISING THE DEMAND AND EXPECTATIONS FROM A CERTAIN SECTOR. THEY HAVE THE APPROPRIATE RESOURCES, COMPETENCES AND VISION. FURTHERMORE, THEY HAVE A VERY COMPREHENSIVE VIEW ON THE MARKET AND ON THE DYNAMOCS WITHIN THEIR REFERENCE SECTORS. NONETHELESS, THEIR LACK OF NEUTRALITY AND THEIR DIFFICULTY TO COLLABORATE WITH COMPETITORS COULD BE A LIMITING FACTOR.
- EMCC LAUNCHED A PUBLIC SURVEY TO DEFINE A ROADMAP ON THE NEED OF INDUSTRY FOR CHARACTERISATION IN THE COMING YEARS. THIS REPRESENTS AN IMPORTANT OPPORTUNITY, BUT IT WOULD BE SUCCESSFUL ONLY IF EMCC WOULD MANAGE TO EXTENSIVELY IMPLICATE PRIVATE CORPORATES IN THE ROADMAPPING EXERCISE.

3.8 Networking and teaming up between RIs

The connection, interaction and collaboration of RIs with industry is often an activity perceived as important and strategic, but a bit off-core business for the RIs. The budget invested by each RI is relatively modest and, apart from particular cases of very mature techniques, like the one of protein crystallography at synchrotrons, the approach is clearly pioneering. The opportunities available are much larger than what can be unveiled by the outreach action of each facility alone. This scenario is more adapted for a mutualisation effort than a very competitive approach. At this stage, the RIs have much more to gain from a collaborative approach learning from each other, sharing their best practices and teaming up for joint outreach opportunities than from a competitive one. We are in a clear context of “coopetition”, where an important effort is needed to unveil a potential opportunity before being ready to seize it. In this respect, it is not rare to see collaborative efforts in place among RIs that share some sort of similarity, e.g. synchrotrons together, or neutrons, EIROs, etc. A concrete stimulus to such a collaborative approach is given by the European Commission via its instruments for financing infrastructures, i.e. INFRAIA and INFRADEV. In most of such cases, the consortia bring together selected RIs and a portion of the grant (roughly 2.5-5%) is devoted to industrial outreach. In particular, we would like to mention the European Analytical Research Infrastructure (EARIV) initiative. This action brings together a set of European and Regional publicly financed initiatives that contains among their members some neutrons or synchrotron/photons sources with the objective to mutualise some actions of outreach about these techniques toward the industrial community. EARIV represents 41 RIs and it is an instrument to optimise the funding received from public grants.

3.9 Conflicts of interest in the case of distributed RIs

Out of the experience matured in the context of distributed RIs we would like to point out the necessity to operate a common, efficient and transparent approach about the way to address industry. If a joint outreach activity is carried out, it is important that each facility would feel properly represented and would recognise within the associated branding. Moreover, it is important that if any opportunity would arise from the common outreach initiative a univocal method of assessing the demand and addressing the industrial request is defined, in a way perceived as fair by everybody.

In order to “exploit the innovation potential of RIs”, one of the recommendations adopted by the EU Commission (and based on the outcome of the ESFRI innovation WG) is to encourage the “integration of RIs into local, regional and global innovation system”. In the particular case of distributed RIs, this suggestion would make even more sense as the impact of the local/regional components can be even higher. A distributed RI is, in fact, intrinsically local and international. Nonetheless, we would like to point out that, in the particular (but important case) where the engagement with industry goes through the TA access, the impact from the local component is minimal. In fact, if the local RI antenna would collect engagement from local industry, but then the industry has the obligation to access a facility elsewhere this process would simply not work. In one side the RI would not be motivated to spend its relational capital without having the opportunity to get the expected return, and on the other side, the company trust (funded on the relation of proximity) could be compromised. This means that, in this respect a local outreach action would only be effective for non-TA access, as the commercial one, for example.

3.10 Need for a strategic vision and a far sighted “industrial programme”

One of the clearest message arisen from recent experiences is that engagement with industry is a complex topic. It relies heavily on people’s trust and awareness, and in this respect is related to human and relational capital. It is also related to how some objective administrative and access barriers are avoided. It is definitely related to the perceived values of RIs from industry.

In this respect, engagement with industry cannot just be obtained putting in place a well designed marketing campaign, or by offering wonderful instrumentation. Industry engagement means before everything establishing a partnership and understanding each other. It means listening the counterpart and working together. It is anticipating the future needs and build together the facilities needed for the future. It is optimising existing instruments and validate novel methodologies, produce relevant case studies that can be inspirational for the industrial users, and provide the incontrovertible proof of the quality of the solution provided. It is convincing the industrial partner that the RI can provide a tangible benefit, a competitive advantage, and that the pioneering effort will be recompensed with the first mover advantage. It is managing the change, innovate together, taking risks to end-up with the adoption of novel methodologies. Novel techniques and novel way of working. This would correspond to a long term, visionary strategic, programme and not just to a patchy short-term minded approach. The time needed from a first approach to an unconditioned adoption of a technique and its deployment for competitive work, by an industrial partner, can take from 2 up to 5 years if the application is already mature. This time can increase to 10 years if the collaboration is originated in the pre-competitive phase and on a very preliminary exploratory topic. Of course, the time can be reduced proportionally to the level of prior awareness of the industrial partner. This means that to have a successful engagement with industry, it is necessary to have an adequate planning, budget and support from the top management, i.e. to carry out a real concrete “industrial programme”.