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## Deliverable 3.2

# Methodologies for accessing RTOs, including cross sectoral business cases

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## 1. Introduction

A significant factor for the innovative capacity of a sustainable and competitive Photonic SME is access to state of the art know how and infrastructures. Such access is instrumental in the development of new products, processes and services, it can enrich their technology and product portfolio and correspondingly increase market penetration and turnover. However for an SME, targeted Research and Development (R&D) activities covering the whole value chain of the products/services developed are costly to maintain and lengthy to develop. Thus, in most cases, companies especially SMEs lack the funds and personnel to support a specialized or fully functional R&D department. This may have severe consequences on product commercialisation and company growth, and impede its ability to adapt to the constantly changing demands of the market and address Europe's major societal challenges.

On the other hand, Europe has a large number of very successful Research and Technology Organizations (RTOs) that effectively focus their research on Key Enabling Technologies including Photonics. However in most cases these research efforts are tailored for academic access and a wide gap exists between those RTOs and SMEs needing relevant technological support. In most cases, RTOs lack the needed tools in terms of personnel and business plan to adapt and offer their high impact knowhow to SMEs so to assist them in reaching the market in a smoother and low risk path.

Therefore a pairing between these two entities (RTOs and SMEs) upon a common agenda of know-how transfer from the first to the second would obviously be extremely beneficial for both parties involved. In specific regions or for certain RTOs this had been successfully demonstrated with many emerging benefits. However overall and across all Europe the access of SMEs to RTOs needs to be further enabled and reinforced. It is the aim of this report to examine further what obstacles exist in the access of Photonics SMEs to RTOs and provide possible suggestions in overcoming these difficulties.

## 2. Methodology approach

The two main players in the SME –RTO collaboration are the SME in the role of the “facility seeker” and the RTO in the role of the “facility provider”. The two sides, in many cases, can have a quite different view of the characteristics of their collaboration, communication protocols, the desired outcome, the obstacles that impede it and finally the possible solutions to overcome them. In order to extent and strength the collaboration, the views of both parties must be recorded first to determine the current conditions, identify liaison points and most importantly good practices. In this content the actions adopted in developing the methodology presented here have involved the following steps (figure 1):

- Qualitative and quantitative insight into the views, experiences and needs of SMEs and RTOs
- identification of gaps and obstacles in SME-RTO collaboration
- suggestion of actions for improving SME access to RTOs

The approach and adopted actions are described in more detail in the following paragraphs.



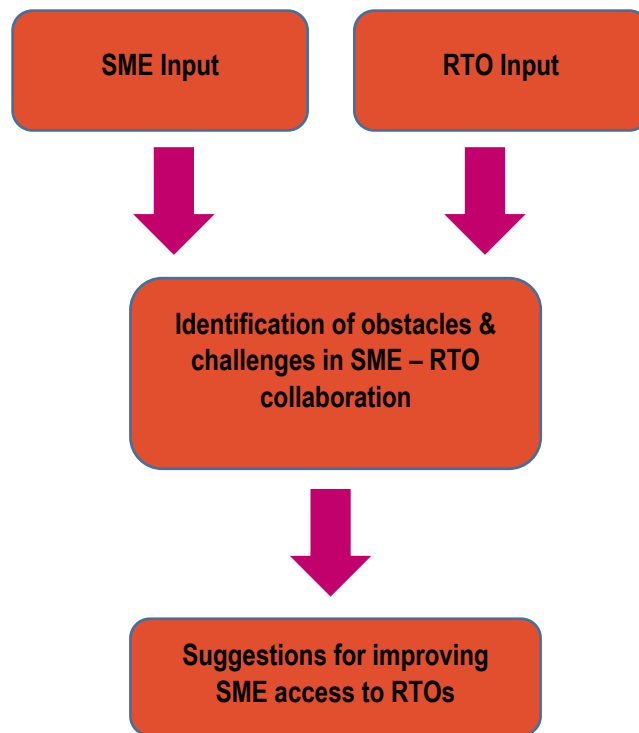


Figure 1. Methodology development actions

### SME input

The first step in developing the methodology is to record the position/vision, experiences and needs of SMEs on the matter of their access to RTOs. During the innovation audits, foreseen under a different task of the project, the consortium contacted 27 SMEs across Europe and carried out interviews regarding SME access to RTOs.

A specifically compiled questionnaire was used that aimed to gather information on the company's previous collaboration with RTOs and potential future requirements. The questionnaire is divided into three sections. Section 1 with 6 generic questions aims to determine if the company needs assistance (and of what type) for the development of new products/services along a specified value chain.

For companies that have already accessed the facilities or expertise of an RTO to support the development of new products/services and accordingly bridging gaps into their value chains, the interview sheet continues to Section 2 with 10 questions on "Assessment of prior involvement". This section aims to gain insight on what need prompted the engagement of the SME with the RTO, the funding scheme followed, the specific RTO selection criteria and whether the RTO was in Photonics (and which domain) or in a different sector. Furthermore, the success of the access to the RTO and the chances of repeating the exercise is assessed.

The final section with 7 questions focuses on potential future involvement of the SME with RTOs. Similarly to the previous section, here the questions concentrate on issues such as the funding scheme preferred, the selection criteria posed and the scientific sector of the RTO potentially targeted. Questions in both sections 2 and 3 enquire on the involvement of the company with RTOs not just in Photonics but in one of the 3 sectors targeted in Work Package 2 (Energy/ Environment, Transport Manufacturing). Identifying cases of this type of collaboration between a photonics SME and a non-photonics RTO is keyrole in the elaboration of an expanded methodology covering cross-sectorial

cases, wherein an SME seeks access to RTOs of inter-disciplinary expertise, covering hard filled gaps into its value chain with cross-sectorial technological and market character. The responses of the SME that were interviewed are summarized (anonymously) in Annex I and discussed in more detail in section 3.

### **RTO input**

As a second step, the consortium carried out interviews with leading European Photonic RTOs to enquire on the availability of their facilities and expertise to SMEs. A list of questions were addressed to RTO director/ senior personnel on issues such as specific policies and funding schemes to facilitate SME access, major benefits and encumbrances emerging from the collaboration.. Furthermore the handling of sensitive issues such as IP Rights management, technology disclosure agreements and conflict of interest were discussed.

The aim of the interview was also to identify good practices in how specific RTOs are succeeding in being “welcoming” to SMEs and investigate if these characteristics can be adopted by other RTOs. Furthermore in cases where the RTO contacted had a good track record of collaboration with the industry, but SME’s were not the prime target, the goal of the interview was to collect information on the RTOs perspective and then examine whether it could be expanded/alterd to include/target SMEs. The responses of 10 RTOs that were interviewed are given in Annex II and discussed in more detail in section 4

### **Identification of obstacles and challenges in SME-RTO collaboration**

Following actions 1 and 2 described above, FORTH as task leader, collected all inputs from partners and proceeded in the interpretation of the results aiming to produce a list of the obstacles and challenges suggested by SMEs and RTOs that act as barriers in their collaboration. These are listed and commented upon in section 5

### **Measures to assist SME access to RTOs**

Based on the interviews carried out with SMEs and RTOs and the identified areas that need improvement, possible solutions to overcome the obstacles were investigated. RTOs that reported on a good track record of collaboration with SMEs were treated as a good practice cases and their methodology and practice was examined closer to act as a guide. A list of possible actions to improve access of SMEs to RTOs is appended in section 6.

## **3. Overview of SME interviews**

Interviews were carried out with SMEs across Europe and a total of 27 companies gave input (Annex I). In most cases the person interviewed was the company’s CEO or other senior manager. The following paragraphs provide an overview of the main observations based on the responses collected.

### **Effect of RTO access to SME’s competitiveness**

Along the lines of this investigation SMEs at high percentage (85 %) stated that access to RTOs is highly beneficial to their short-term competitiveness (Fig. 2), by means of fulfilling specific technological needs emerging from the product/service development process. Accordingly, the needs of the SME recorded, are diverse in nature and in a top-5 live list include (in order of importance)



- Know-how transfer: assistance in overcoming specific technological challenges during the new product development along different TRL stages
- Certification: validation of new products reaching, or upgrading their position into the market
- Intellectual property: technological support/ new entrepreneurial ideas that could be developed in new products; consulting on technological approaches to a specific problem at various TRLs
- contractors: external human resources to assist in specific technological support in the development of a new product
- Access to large scale/specialised Infrastructures: access to clean rooms, characterization facilities, foundries, special competences laboratories

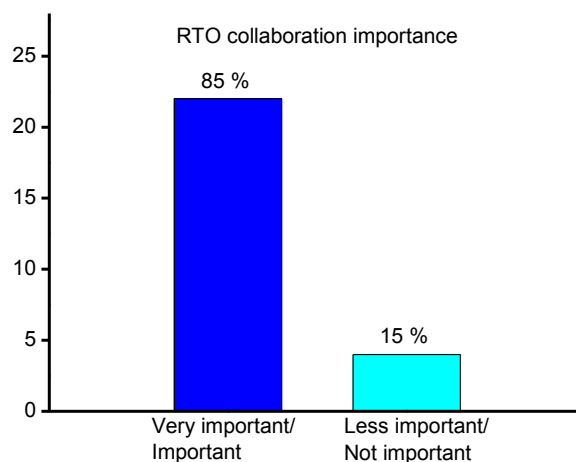


Figure 2. Q1.2: How important is for an SME the collaboration with an RTO?

### Track on previous collaborations

Most of the SMEs (89%) questioned, have collaborated/accessed in the past an RTO within the frame of new product development (Fig 3). This value is considered to be quite high, since it includes a wide range of interactions such as short access, long term collaboration, contracted services etc. For each of these cases the contribution of the RTO and the significance of the access nature/outcome in the overall product development process can be quite diverse. In many of the reported access cases the SME had a brief interaction with the RTO in the form of consulting or short time equipment use. Small /medium scale projects are also common with a time frame of up to a few months while large scale R&D projects are also possible in most cases with some type of external funding (National /EU project).

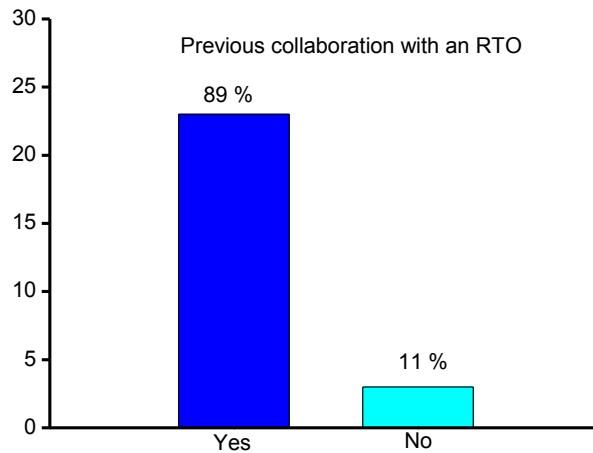


Figure 3. Q 1.5: Have you already accessed the facilities or expertise of an RTO to support the development of some new products?

### Type of service requested by SMEs from RTOs

For the case of previous collaborations with an RTO the SME in most cases needed to acquire know how that SME personnel lacked and was essential for the development of a new product or service process at certain TRL level (Fig. 4). Quite common was also the access to an RTO for the use of their characterization facilities. In most cases SMEs cannot afford to maintain in house permanently expensive characterization or processing equipment especially when these are needed at the early stages of the development process far from commercialization point, where the actual risk for the company is still very high. Third in the list of services provided by RTOs was certification of a new or existing product. Certification services were sought necessary for either introducing a new product into a competitive, regulated market, or, for pushing an existing product into a new market with different performance/operational needs.

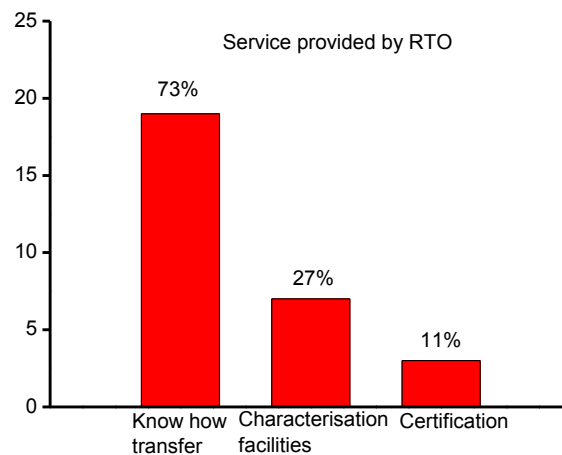


Figure 4. Q2.1: Which was the main reason for the access to the RTO (for previous collaborations)?

### Access to RTOs in different application sectors



An additional end goal of the questionnaire was to investigate the experience and future prospects regarding access of Photonics SMEs to RTOs in different sectors. Specifically alliances with RTOs in the sectors of Energy /Environment, Transport and Manufacturing were enquired as these sectors are identified by RespiceSME as potentially prosperous areas for Photonics SME value chain expansion. Responses by SMEs highlighted that these occurrences are not very common. Only 20% of the reported prior access cases were to a non-Photonics RTO. On the contrary expression of interests for future access opportunities for the three aforementioned sectors was much higher closer to 35% indicating the potential for such type of collaborations.

### Collaboration funding

A critical parameter in the SME-RTO collaboration is funding cost (Fig 5). For cases of single access or small scale projects the RTO may not charge an access fee to the SME in which case minor cost e.g for consumables are covered by the SME from its own resources or through regional funds. Larger scale projects with higher cost in most cases require external funding (national or EU) with contribution from both the SME and RTO in cash or kind.

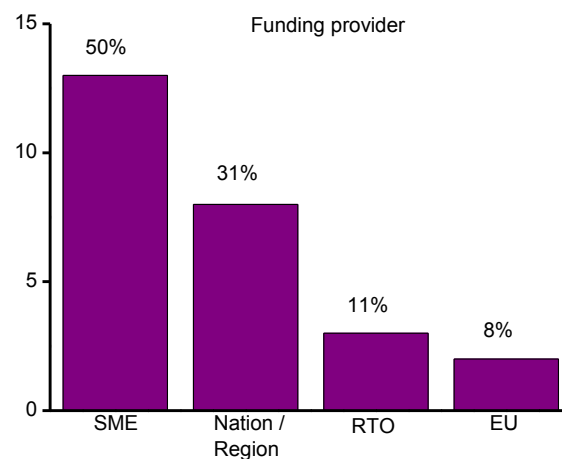


Figure 5. Q 2.2: Who funded the RTO access?

### RTO selection criteria

One of the most profound outcomes of the small scale survey was that the collaboration of an SME with a RTOs is in most cases restricted to the geographical region of the SME (Fig 6). The first criterion in the selection of an RTO for collaboration is location proximity. This is understandable since in most cases these collaboration are triggered by personal contacts between RTO-SME personnel and also proximity lowers costs and assists interaction. An equally important criterion is an already established collaboration (in most cases with a regional RTO) with the advantage of familiarity and proven trust between the two parties.



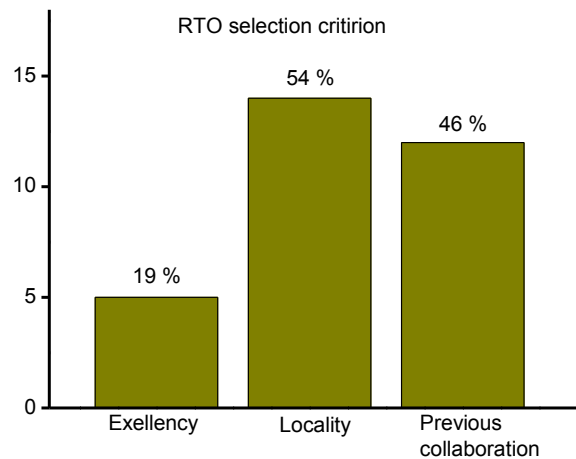


Figure 6. Q 2.3: Which criteria defined the selection of the specific RTO?

### Success rate of collaboration

Regarding the outcome of the collaboration the failure percentage is very low (11%) and in most cases represents collaborations that were abandoned at an early stage due to failure to agree on IP ownership issues. In all other considered cases the aim of the collaboration was partially or totally achieved (Fig 7).

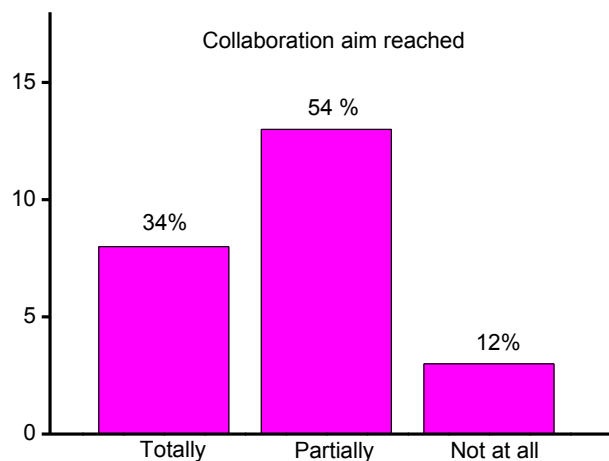


Figure 7. Q 2.5 Was the aim of the RTO access reached?

### Non-Disclosure Agreement (NDA)

The first step in establishing a productive, long term collaboration is trust between the two partners. For both parties, trust in each other's capabilities and confidentiality is a prerequisite and a high percentage (79%) of previous collaborations have necessitated the signing of a non-disclosure agreement (Fig 8).

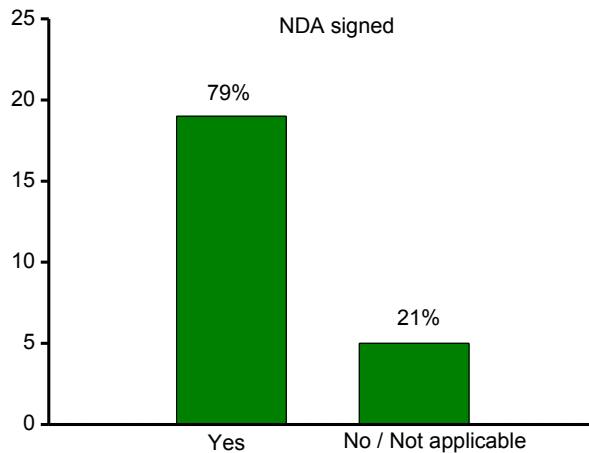


Fig 8. Q2.7: Did your company conclude a NDA with the RTO?

### Intellectual Property management agreement

Intellectual Property handling is a crucial issue in SME- RTO collaboration. The survey showed that in some cases it can be the determining factor in the failure of the partnership. There are no standard rules in drafting the agreement and each case is decided upon individually. The type of the service provided and the funding scheme determine in a large extend the ownership of IP generated during the access (Fig 9).

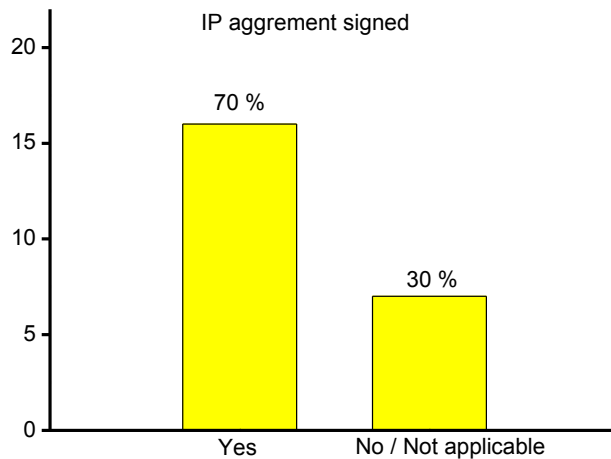


Fig 9 Q2.6: Did your company conclude an agreement on IP management with the RTO?

Some interesting highlights of comments provided:

*“...The (public) RTOs and the SMEs have different rhythms: the RTOs are very slow and rigid, while an SME needs agility and flexibility. Furthermore, the researchers lack real knowledge about the SME’s environment and its constraints, they also believe it has important amount of resources.”*

*“... RTO have more fundamental perspectives compared with the urgent timescale over which this company operates...”*

*“ ...many good research groups available in the region but the problem is mainly the lack of a list with available competences ” .*

*“...Company would seek complementary and also compatible competencies, nevertheless it does not have enough financial resources for the moment to engage new R&D collaborations.”*

## **4. Overview of RTO interviews**

The consortium carried out interviews with 10 European Photonics RTOs using a predetermined list of questions specifically formulated to target the issue of SME access to RTOs. The responses registered are appended in Annex II and briefly discussed below.

### **RTO policies /mechanisms to encourage collaboration with industry / SME**

The responses collected indicate that the majority of the contacted RTOs do not have predefined policies/ mechanisms to attract industrial collaborations or SME partnerships in particular. All RTOs expressed strong commitment in providing access and support to industry and identified this task as part of their core business. Contacts can be initiated by both RTO and the SME per case. From the RTO side, personnel usually advertise the available competences in fairs/ exhibitions while in some cases specifically dedicated events e.g Annual Technology Days at Fraunhofer IOSB can provide companies with valuable insight to RTO expertise. Some RTOs have enquiry forms in their internet site and welcome SME input while regional and national databases can provide SME with details about the available R&D services.

### **Benefits/ encumbrances arising from SME access**

All RTOs that participated in the survey indicated that industrial collaborations are highly beneficial for their organization. Overall, interaction with industry (including SMEs) prompts RTO personnel to remain well informed and up to date with the current technological needs of the market. Furthermore industrial projects can act as an assessment of the RTO in terms of its R&D and innovation capacity. Additionally, since some RTOs are Universities or have strong contacts with Universities being in close collaboration with industry can be very beneficial for the students in terms of securing future jobs.

On the other hand, collaboration specifically with SMEs, as opposed to larger companies, can in some cases limit projects to the small scale (with a proportionally large administration) due to lack of funding. Furthermore SMEs are more vulnerable in financial terms and thus in more risk to suffer management changes/ financial difficulties during a collaboration that can affect or even cancel the project.

### **Type of service provided**

For the majority of RTOs, collaboration with SMEs is in a frame of joint research projects (at lower TRLs). Also feasibility studies are very common and act as an important, first, lower risk step in the potential adoption of a new technology that can lead to the development of a new product. Providing services at higher TRLs is more demanding and may necessitate the collaboration of RTOs from different sectors to ensure that the technology infrastructures are capable of supporting a full supply-chain from design to demonstration.

### **Collaboration assessment/ outcome**

In most cases providing an SME access to an RTO can lead to the establishment of long term collaboration. Services are of course available to newcomers but partnering with returning SMEs is more straightforward based on already established trust relations. Furthermore the success probability of a project (and thus the profitability) rises when the two parties have previous experience in working together. Additionally, some RTO stated that they consider repeated enquires and subsequent collaboration with the same SME as a validation of the high level of the service they provide.

RTOs confirmed that SME access to RTO services can have a high impact on issues such as patenting, new product development and growth. In some cases (RISE Acreo, Sweden) it was commented that each year the RTO outsources an analysis of the outcome of the collaboration with companies which is highly beneficial in planning future steps and adapting internal policies.

### **Funding issues**

Securing the necessary funds is one of the main issues in the SME –RTO collaboration. Input from RTOs suggests that the majority of the available funding options are open to all enterprises and do not favor neither exclude SMEs. In most cases the funds are provided through regional, national and European research projects. Innovation checks/vouchers are available in some countries designed to encourage companies to co-operate with research institutes. In some cases the SME can partially or totally finance the access while for projects with a clear market prospective the RTO can also invest through its own budget. Combination of multiple funding sources (public and private) seems to be a good option provided that the rights on the resulting IP is clearly agreed by all parties

Some interesting highlights of comments provided:

*“...SME’s often cannot afford to pay larger research projects (even if they are funded)..... funding rates (and also amounts) should become a bit larger for SMEs that recently have been founded and/or do not have a product on the market yet.”*

*“.....Not knowing about the availability of specific infrastructure is the main problem. Conventional databases are of limited help as they usually need to be searched with technology-oriented keywords that someone just looking for a solution to a problem might not know yet.”*

*“.....(SMEs) do not have the same means as larger groups and it may limit the scope of projects.”*

*“...profitability rises with returning SMEs. Initiating collaboration with SMEs usually starts with limited resources”*

*“ ....(RTOs’) own spin-off companies are in fact the best customers.”*

## **5. Summary of obstacles in SME access to RTOs**

The main obstacles in the SME–RTO collaboration that were identified through the interviews with SMEs and RTOs as described in previous sections are summarized below.

### **Lack of detailed, accurate information on RTO competences**

In many cases SMEs face a problem in some stage of their new product development process but they are unable to determine which RTO could help them to overcome it. The problem is twofold in the sense that SMEs don’t know if a specific technology could be suitable for their case and then which RTO can provide it. Access to detailed information on what a RTOs can offer is a key issue in fostering SME – RTO collaboration. Furthermore although RTOs have personnel with very high level knowledge on

specific scientific domains, they lack dedicated personnel with over all knowledge of the RTO competences that can act as a contact point between the RTO and SMEs. Currently most of the SME – RTO collaboration are based on personal connections and rely on individual recommendations when trying to establish as new partnership.

### **Difficulty to engage with an RTO from a different sector.**

One of the aims of the short scale survey that was undertaken for the development of the analysis reported here was to pin point collaborations between Photonic SMEs and RTOs from different sectors manly focusing but not restricted to Energy /Environment, Transport, Manufacturing. Findings suggest that this interaction is rather limited and possible reasons could be that, as indicated above, SMEs usually depend on personal contacts that can be more easily available in the same sector (Photonics) but more scarce for RTOs in different application areas.

### **Collaboration mostly with RTOs located in SME's region/ country, waste of valuable expertise available in pan European level**

SMEs' input suggests that when choosing an RTO for collaboration the predominant selection criterion is the location of the RTO. RTOs located in the same region as the SME are preferred with those in the same country coming second. Collaboration with RTOs in different countries in most cases is only possible through EU funded projects. The rationale behind these preferences is obvious since access to RTOs in the same region/ country offers the advantage of geographical proximity, availability of regional /national funds and eliminates any barriers in communication and cultural attitudes.

### **Lack of common rhythm/ mentality**

SMEs very often stated that RTOs have a different perspective in the execution of a task compared to an SME and different priorities. Companies tend to be more focused to the end goal which is commercialization while RTOs lack the business mentality and tend to adopt a less “to the point” approach. Collaboration examples between RTOs and spin off SMEs or with SMEs with personnel with academic background are proving more successful because the two parties can interact more effortlessly.

### **RTOs can favour collaboration with large scale companies**

SMEs indicated that the road to RTOs access can sometimes be blocked by large scale companies. These companies are in some cases preferred by RTOs for collaboration since they are considered as a safer investment in terms of time and effort and more equipped in handling administrative issues and providing funds.

### **IP handling issues**

Agreement on IP ownership is one of the most common reasons that collaborations between SMEs and RTOs are avoided or abandoned at an early stage of negotiation. This can be attributed to the lack of trust between the two parties but also to the absence of a standard guideline/policy as a starting point that can be further modified/adapted for each case individually. Furthermore independent subsidised advisors that can act as mediators could provide valuable input and assist negotiations.

### **Lack of funding**

The most important limiting parameter in the SME RTO collaboration, suggested by both RTOs and SMEs, is the lack of funding. Some countries (e.g. Austria Germany) have introduce innovation



vouchers/checks that have proven to be very successful in facilitating SME access to RTOs. Furthermore regional/national funds are available across Europe but at pan European level funds are rather limited. A very successful funding option for SME access to RTOs at European level is the one-stop-shop projects (e.g. ACTPHAST) funded under H2020 that are however limited to specific technological areas.

### Collaboration mainly for low TRLs far from commercialization

For many regions /countries RTOs are active at lower TRL so SMEs are missing valuable, much needed, expertise at higher TRLs. Furthermore funds for collaboration at lower TRLs is usually more easily available through EU /National research projects. When an SME requires assistance at a higher TRL closer to commercialization funds from external sources are scarce due to the competitive stage of product development. SMEs may be required to fund the RTO access in which case their expectation and demands towards the RTO are higher.

The above issues can be grouped under three main areas that require further optimization in order to boost SME RTO collaboration

Lack of information	<ul style="list-style-type: none"> <li>• Lack of detailed, accurate information on RTO competences</li> <li>• Difficulty to engage with an RTO from a different sector.</li> </ul>
Communication barriers	<ul style="list-style-type: none"> <li>• Collaboration mostly with RTOs located in SME's region</li> <li>• Lack of common rhythm/ mentality</li> <li>• RTOs can favour collaboration with large scale companies</li> </ul>
Limited availability of tools	<ul style="list-style-type: none"> <li>• IP handling issues</li> <li>• Lack of funding</li> <li>• Collaboration mainly for low TRLs</li> </ul>

Table I. Obstacles in SME-RTO collaboration

## 6. Proposed measures to assist SME access to RTOs

Based on the obstacles identified in the previous section (table I) the road map to improve SME access to RTOs involves three main actions (figure 10). Firstly, to increase visibility of RTOs and **spread relevant information** in a manner tailored to SME needs and business approach. At the moment there is no facilitating instrument to provide knowledge, at a European level, of the expertise, services and facilities offered by RTOs. Mapping of what RTOs can offer is an important first step but faces only a part of the problem. In order to have successful collaborations it's the people that must interact and form synergies based on trust. It is therefore a necessity to cultivate interaction between SME and RTO personnel and **assist communication**. In many cases the two parties are seen as "speaking a different language" which can prevent partnering when in fact RTOs and SME have the same final aim but may pursue it in a dissimilar way. Establishing trust is the main prerequisite in forming meaningful, long-term productive collaborations. Finally, following successful handling of the above topics, at the end of the day, the determining factor in turning a first contact situation to an alliance is **providing** the necessary **tools** in terms of mainly funding but also administration handling and problem solving to ease the path of bringing innovation from the research environment to the market.

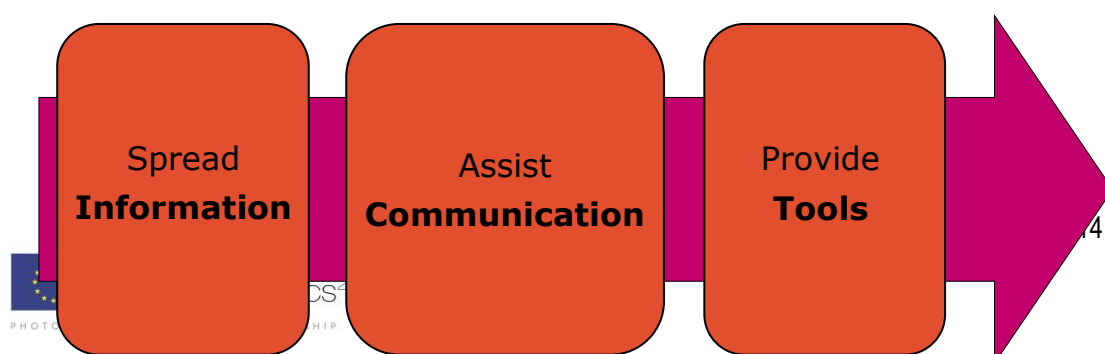


Figure 10. Methodology to facilitate SME access to RTOs

## 6.1 Spread Information

### **RTO competence database**

A web based, user friendly database of competences available in European RTOs is required. The database should be oriented to the SME audience and include short and to the point information on the expertise, facilities and services a RTO can provide. The information must be updated regularly by the RTOs while additional information such as contact persons and funding options must also be appended. Under Deliverable 3.1 of RespiceSME the consortium collected information on the RTOs available in partners' countries producing a list of more than 450 RTOs in Photonics but also in Energy /Environment, Transport, Manufacturing. For each RTO the specific Photonics domains available are listed along with a short description of offered competences. This list can be considered as a seed for a more elaborated database with up to date information provided directly by RTOs.

### **RTOs services dissemination and SME access point**

RTOs must actively disseminate their expertise, facilities and services through all available information disseminating channels including newsletters, social media and industry participating events (exhibitions, fairs etc). Furthermore each RTO must have an SME access point that can act as a first contact, efficiently handle SME enquires and forward service seekers to the corresponding expert in its personnel pool for further discussions. Additionally the access point will be responsible for keeping in touch with SME clients and execute a well-defined feedback process to identify good practices but also problems within previous collaborations.

### **Awareness raising events (open days for industry) at a pan-European level**

A very successful initiative at a pan European level is Researchers night that is organized at the same date each year in research institutions across Europe. The aim is to motivate and inspire the youth to enjoy, understand and pursue science and technology by connecting them with outstanding scientists and innovations. A similar event organized by RTOs with the SME/industrial personnel as target audience and different content could be proven equally successful. An open day for industry in institutions all around Europe at a predetermined date can become a yearly tradition and allow fruitful discussions and exchange of ideas between RTO and SME personnel.

## 6.2 Assist Communication

### **Personnel exchange/ training**

Intense interaction between RTO and SME personnel can help synchronize their activities and build trust in each other. This can be achieved via study visits where RTO and SME personnel will have the opportunity to present their expertise and requirements. Furthermore, training of personnel within the premises of the opposite party can educate RTO personnel in business aspects and provide SME personnel with new skills required to deploy innovative technologies. Overall, personnel exchange can deepen cooperative relations and provide individuals with valuable experience.



## **Regional Photonics RTO team as emissary to European /other sector RTOs**

It is clearly documented that a regional focus exists in the SME-RTO collaboration that in many cases has resulted in the establishment of long term partnerships where the two parties understand and trust each other. In order to facilitate SME access to RTOs across Europe or RTOs in different sectors the regional RTO team can act as an emissary to these organizations on behalf of the SME. The regional RTO team has a good knowledge of the specific SME and at the same time has the knowhow, contacts and communication channels to initiate discussion with other photonics/ non photonics RTOs in trying to solve a particular problem faced by the SME. The effort could be much more productive rather than the SME trying to establish collaborations on its own. An added benefit in establishing such a practise would be a boost in collaboration among different RTOs especially from different sectors which is in many cases a prerequisite especially for projects at higher TRLs.

### **6.3 Provide Tools**

#### **Independent advisory services to SMEs**

In many cases, SMEs acknowledge the need for external assistance in their product/service development process however they can be reluctant to proceed due to unfamiliarity with the requirements of such a process and in fear of the risk involved. An independent advisory service they can trust can assist SMEs in executing a tested and accepted business model for collaboration. The advisor team could provide valuable assistance in issues such as assessment of new technologies, identifying the best suited RTO, evaluate the investment budget and potential risk, advice on IP handling and moderate initial meetings to facilitate a smooth evolution of the collaboration.

#### **Funding tools**

The access of SMEs to RTOs strongly relies on access to finance. A number of SME specific European funding calls have been proven very successful, however additional targeted actions are required specifically aiming at SME RTO collaboration. A very well received option is the One-stop-shop projects (e.g. ACTPAHST, Smarter-SI, NFFA Europe, ePIXfab) funded under H2020 and previous EU Research and Innovation programmes. These types of projects address many of the challenges in the SME-RTO collaboration and have demonstrated many success stories of such a partnership. The endorsement of similar additional actions covering a wide range of application fields even including RTOs from different sectors could be instrumental in the promotion of SME RTO collaboration. Furthermore, funding tools aiming to facilitate collaboration between an SME in a less developed region with a RTO in more developed region and vice versa can contribute in eliminating region specific discrepancies. Finally the endorsement at European level of a scheme similar to the innovation voucher available in some countries can facilitate access of SMEs to top level services and infrastructures regardless of their geographic location.

#### **Promote and reward good practices in RTO-SME collaboration**

Access of SMEs to RTOs has been in many cases extremely beneficial for both parties involved. The identification and advertizing of such collaborations can greatly encourage other SME/RTOs to overcome any initial hesitation and peruse partnerships. It can also act as a guide on the required steps and attitude in fostering such an alliance and handing any obstacles that exist. Such publicity would also be advantageous for the SME and RTO involved while the establishment of a reward/prize can act as an incentive towards further actions.





## 7. Conclusions

SMEs hold a strategic position in the European industry and dominate its size portfolio. This is particularly prominent in the photonics sector where over 90% companies are SMEs employing around 200000 people. SMEs are considered as key drivers for innovation, economic growth and new jobs creation across Europe and are ideally suited to respond to the rapid technological evolution due to their flexibility and dynamic character.

The conversion of knowledge generated by RTOs into marketable products and services can greatly assist SMEs to fulfil their vital role in the European economy so it's thus crucial to boost SME – RTO collaborations. Access to RTOs can provide innovative photonics SMEs with valuable technological expertise, services and infrastructure to support their R&D activities and facilitate the introduction of novel photonics or photonics enabled products and services to the European market.

The present report is contributing to this task first by identifying obstacles that prevent SME access to RTOs and then by providing a methodology on how to minimize/remove these roadblocks. The list of suggested actions evolves around there main pillars:

- increase awareness and exchange of mutually beneficial information between SMEs and RTOs
- assist SMEs and RTOs to learn to “speak the same language”
- provide necessary initiatives and tools to ease and facilitate collaborations.



## ANNEX I: SME questionnaires





**1. GENERIC DATA**

**1.1 Do you need access to contractors, intellectual property, infrastructures or certification in order to develop a new product?**

		<b>Contractors</b>	<b>Intellectual property</b>	<b>Know-how transfer</b>	<b>Infrastructures</b>	<b>Certification</b>	<b>Other</b>
<b>AUSTRIA</b>	<b>SME1</b>	YES	YES	YES	YES		
	<b>SME2</b>	YES	YES	YES	YES	YES	
	<b>SME3</b>	YES		YES	YES		
<b>FRANCE</b>	<b>SME1</b>		YES		YES		
	<b>SME2</b>	YES	YES	YES	YES	YES	YES
	<b>SME3</b>	YES	YES	YES			
<b>GERMANY</b>	<b>SME1</b>						
	<b>SME2</b>	YES	YES	YES	YES	YES	
	<b>SME3</b>				YES	YES	
<b>GREECE</b>	<b>SME1</b>	YES	YES	YES	YES	YES	
	<b>SME2</b>			YES	YES		
	<b>SME3</b>			YES		YES	
<b>IRELAND</b>	<b>SME1</b>	YES	YES	YES	YES	YES	
	<b>SME2</b>	YES				YES	
	<b>SME3</b>				YES	YES	
<b>LITHUANIA</b>	<b>SME1</b>		YES	YES	YES		
	<b>SME2</b>			YES	YES		
	<b>SME3</b>		YES			YES	
<b>SPAIN</b>	<b>SME1</b>	YES	YES	YES		YES	
	<b>SME2</b>			YES	YES	YES	
	<b>SME3</b>	YES	YES	YES		YES	
<b>SWEDEN</b>	<b>SME1</b>	YES	YES				
	<b>SME2</b>			YES			YES
	<b>SME3</b>	YES	YES			YES	
<b>UK</b>	<b>SME1</b>	YES	YES	YES		YES	
	<b>SME2</b>	YES		YES		YES	
	<b>SME3</b>	YES	YES	YES	YES	YES	



1. GENERIC DATA

		Q1.2 How important is a collaboration with RTOs for your short-term competitiveness? (5 very important, 0 not at all important)	Q 1.3 What research and development tasks your company might potentially need an RTO to perform to support your product development efforts?	Q 1.4 Do you require access to an RTO with specific competences?	Q 1.5 Have you already accessed the facilities or expertise of an RTO to support the development of some new products?	1.6 Why your company did not get involved with an RTO?
AUSTRIA	SME1	5	Publication	YES	YES	
	SME2	4	Optical, thermal Simulation Certification Funded, interdisciplinary projects	YES	YES	
	SME3	4		YES	YES	
FRANCE	SME1	3	R&D biochemical analysis	BIOCHEMICAL ANALYSIS	YES	
	SME2	0		SURFACE LASER TREATMENT	YES	
	SME3	5	SENSORS, IMAGE PROSSEING ALGORITHMS	YES	YES	
GERMANY	SME1	5	CONFIDENTIAL	NO	YES	
	SME2	3	PRODUCT IMPROVEMENT	YES	YES	
	SME3	4	USE OF EQUIPMENT	YES	YES	
GREECE	SME1	4		YES	YES	
	SME2	4	NON PHOTONIC	YES/NO	NO	NOT NEEDED
	SME3	5	PRESENTLY UNKNOWN	YES	YES	
IRELAND	SME1	4	DIODE PACKGING	YES	YES	
	SME2	3	PRODUC DEVELOPMENT	YES/NO	NO	UNKNOWN PROCEDURE
	SME3	4	SYSTEM DEVELOPMENT	YES	YES	
LITHUANIA	SME1	3	Process testing	YES	YES	
	SME2	4	Component validation in laboratory environment	YES	YES	
	SME3	3	Design of thin film with specific parameters	YES	YES	
SPAIN	SME1	5	INERGRATED OPTICS FOR MINIATURIZATION OF LASER SOURCE	YES	YES	
	SME2	4	R&D SUPPORT LASER DEVELOPMENT TARGETING CHEMICAL APPLICATION	YES	YES	
	SME3	5		YES	YES	
SWEDEN	SME1	2	PHYSICAL MODELING	YES	YES	
	SME2	2		YES	YES	
	SME3	3	COMPONENT DEVELOPMENT	YES	YES	
UK	SME1	3	New applications and facilites for upscaling	YES	YES	
	SME2	2	Collaboration sought in applications of lasers to advanced manufacturing	YES	NO	HVM Catapult in the UK failed to respond to request for meeting
	SME3	5	Collaboration sought in applications of lasers to advanced manufacturing	YES	YES	





2 Assessment of prior involvement

Q2.1 Which was the main reason for the access to the RTO?

		Know how not available	External funding	Characterization facility	Certification	Value chain gap	Other
AUSTRIA	SME1	YES					
	SME2	YES					
	SME3					YES	
FRANCE	SME1	YES		YES			
	SME2	YES	YES	YES			YES
	SME3						YES
GERMANY	SME1	YES					YES
	SME2	YES	YES	YES			
	SME3						YES
GREECE	SME1	YES					
	SME2						
	SME3	YES					YES
IRELAND	SME1	YES					YES
	SME2					YES	YES
	SME3	YES		YES			
LITHUANIA	SME1	YES					
	SME2		YES				
	SME3	YES					
SPAIN	SME1	YES		YES	YES		
	SME2	YES			YES		
	SME3	YES		YES	YES		
SWEDEN	SME1	YES					
	SME2		YES				
	SME3	YES					
UK	SME1	YES		YES		YES	YES
	SME2						
	SME3	PHOTONICS <sup>21</sup> YES				YES	YES

2 Assessment of prior involvement

		Q 2.2. Who funded the access?	Q 2.3 Which criteria defined the selection of the specific RTO?	Q2.4 RTO sector	Q 2.5 Was the aim of the access reached?	Q2.6 Did your company conclude an agreement on IP management with the RTO?	2.7 Did your company conclude a NDA with the RTO?	2.8 On a scale of 5 (positive) to 0 (negative) rate the overall experience	2.9 On a scale of 5 (very likely) to 0 (not likely) what are the chances that you will seek access to an RTO again in the future?
AUSTRIA	SME1	SME Regional -national	Excellency	Security Metrology & Sensors	Totally	YES	YES	5	5
	SME2	SME Regional -national	Previous collaboration Locality Funding /cost		Partially	NO	YES	4	4
	SME3	SME	Previous collaboration Excellency	Advanced Manufacturing	Partially	YES	YES	4	5
FRANCE	SME1	SME	Previous collaboration Locality	NON PHOTONIC /Energy Enviroment	Partially	YES	YES	4	5
	SME2	CANCELELD due to technology transfer and IP issues.	Only one with expertise Locality	Advanced Manufacturing	Not at all	Not applicable	Not applicable	2	4
	SME3	National research transfer support organism	Previous collaboration Other	Life Sciences and Health	Partially	PI completely belongs to the company, but it would agree to share it with an RTO in some cases.	Not applicable	4 /3	5
GERMANY	SME1	RTO	Only one with expertise Locality	Life Sciences and Health	Totally	YES	YES	4	5
	SME2	SME Regional -national	Previous collaboration Locality Excellency	Security Metrology & Sensors NON PHOTONIC /manufacturing	Partially	YES	YES	4	5
	SME3	SME Regional -national	Previous collaboration Locality	Security Metrology & Sensors Visualization & Displays	Partially	NO	YES	4	5
GREECE	SME1	SME Regional -national	Previous collaboration Excellency	Security Metrology & Sensors NON PHOTONIC /manufacturing	Partially	YES	YES	3	5
	SME2								
	SME3	SME	Previous collaboration Locality	Information and communication	Totally	NO	NO	5	4



(Continued)

IRELAND	SME1	SME	Only one with expertise Funding/cost	Advanced Manufacturing	Partially	Not applicable	YES	3	5
	SME2	Regional -national	Previous collaboration Locality	Advanced Manufacturing Information and communication	Partially	YES	YES	4	3
	SME3	Regional -national	Previous collaboration Locality		Partially	YES	YES	4	5
LITHUANIA	SME1	SME	Locality Availability	Advanced Manufacturing	Partially	YES	YES	3	5
	SME2	SME	Locality	Advanced Manufacturing	Totally	YES	NO	5	5
	SME3	EU	Locality Excellency	Security Metrology & Sensors	Partially	YES	YES	4	5
SPAIN	SME1	SME Regional -national	Locality	Information and communication	Not at all	YES	YES	4	5
	SME2	SME	Locality	Life Sciences and Health	Partially	YES	YES	4	5
	SME3	RTO SME	Previous collaboration Locality	Advanced Manufacturing Automotive & Aerospace Security Metrology & Sensors	Totally	YES	YES	5	5
SWEDEN	SME1		Previous collaboration		Totally	Not applicable	YES	4	5
	SME2	RTO	Previous collaboration	Security Metrology & Sensors	Totally	NO	NO	4	3
	SME3	SME EU	Only one with expertise Excellency	Advanced Manufacturing	Totally	YES	YES	4	5
UK		OTHER/ FUNDING APPLICATION	Only one with expertise	NON PHOTONIC	Not at all	YES	YES	4	4
	SME1								
	SME3	RTO	Only one with expertise	NON PHOTONIC /Manufacturing	Partially	YES	YES	4	4



**3 Future involvement with RTOs**

**Q3.1 Which would be the main reason to seek access to an RTO?**

		Know how not available	External funding	Characterization facility	Certification	Value chain gap	Other
AUSTRIA	SME1	YES					
	SME2	YES	YES				
	SME3					YES	
FRANCE	SME1	YES	YES	YES	YES	YES	
	SME2			YES			
	SME3	YES					YES
GERMANY	SME1						
	SME2	YES	YES				
	SME3	YES					YES
GREECE	SME1			YES	YES		
	SME2						
	SME3	YES	YES				
IRELAND	SME1	YES	YES				
	SME2		YES			YES	
	SME3	YES				YES	
LITHUANIA	SME1	YES		YES			
	SME2		YES	YES			
	SME3	YES	YES				
SPAIN	SME1	YES		YES	YES	YES	
	SME2	YES		YES		YES	
	SME3	YES		YES	YES	YES	
SWEDEN	SME1	YES		YES			
	SME2	YES	YES				
	SME3	YES	YES				
UK	SME1	YES	YES	YES		YES	
	SME2	YES	YES	YES		YES	
	SME3	YES	YES	YES		YES	



**3 Future involvement with RTOs**

		<b>Q 3.2 Which funding option would be preferable to support your access to a RTO?</b>	<b>Q 3.3 Which criteria would determine the selection of a specific RTO?</b>	<b>Q3.4-3.5 RTO sector</b>	<b>Q 3.5 What type of technology provider would you consider to support the development of your product or service?</b>
<b>AUSTRIA</b>	<b>SME1</b>	RTO EU Regional /National	Excellency	Security Metrology & Sensors	
	<b>SME2</b>		Previous collaboration Locality	Emerging & Advanced Lighting Security Metrology & Sensors Information & Communication Life Sciences & Health	
	<b>SME3</b>	SME	Previous collaboration Excellency	Advance Manufacturing	Other company
<b>FRANCE</b>	<b>SME1</b>	RTO EU Regional /National	Only one with expertise Excellency Funding/cost	Advance Manufacturing Automotive &Aerospace Energy &Environment Life Sciences & Health Security Metrology & Sensors NON PHOTONIC/ Energy -Environment NON PHOTONIC / Manufacturing	Individual research lab Other company
	<b>SME2</b>	RTO EU Regional /National	Only one with expertise Funding/cost	Advance Manufacturing NON PHOTONIC / Manufacturing	Other company
	<b>SME3</b>	RTO EU Regional /National		Advance Manufacturing Automotive &Aerospace Energy &Environment Life Sciences & Health Security Metrology & Sensors	Individual research lab Other company

(Continued)

<b>GERMANY</b>	<b>SME1</b>	Regional /National	Only one with expertise Previous collaboration Locality	Security Metrology & Sensors Visualization & Displays NON PHOTONIC / Manufacturing	Individual research lab Private technology transfer organization
	<b>SME2</b>	SME Regional /National	Previous collaboration Locality	Security Metrology & Sensors Visualization & Displays	Individual research lab Private technology transfer organization
	<b>SME3</b>				
<b>GREECE</b>	<b>SME1</b>	EU Regional/ National SME	Previous collaboration Excellency	Advance Manufacturing Energy &Environment Information & Communication NON PHOTONIC / Energy -Environment	Individual research lab Other company
	<b>SME2</b>				
	<b>SME3</b>	ALL (per case)	Excellency Funding/cost	Information & Communication	
<b>IRELAND</b>	<b>SME1</b>	RTO EU Regional /National	Excellency Funding/cost	Advance Manufacturing Emerging & Advanced Lighting Security Metrology & Sensors NON PHOTONIC / Manufacturing	Private technology transfer organization Other company
	<b>SME2</b>	SME Regional /National	Only one with expertise Locality	NON PHOTONIC / Manufacturing	Individual research lab
	<b>SME3</b>	EU	Previous collaboration Locality	NON PHOTONIC / Manufacturing	Individual research lab
<b>LITHUANIA</b>	<b>SME1</b>	Regional /National	Previous collaboration Funding /cost	Advance Manufacturing NON PHOTONIC / Manufacturing	Private technology transfer organization Other company
	<b>SME2</b>	RTO EU	Only one with expertise Locality	Advance Manufacturing NON PHOTONIC/ Energy -Environment	Individual research lab Private technology transfer organization
	<b>SME3</b>	EU Regional /National	Only one with expertise Funding /cost	Energy &Environment Life Sciences & Health NON PHOTONIC / Manufacturing	Individual research lab Other company



(Continued)

<b>SPAIN</b>	<b>SME1</b>	RTO EU Regional /National	Only one with expertise Previous collaboration Excellency Funding /cost	Advance Manufacturing Energy &Environment Life Sciences & Health NON PHOTONIC/ Energy -Environment	Individual research lab Private technology transfer organization
	<b>SME2</b>	RTO EU Regional /National	Previous collaboration Locality Excellency	Energy &Environment Life Sciences & Health NON PHOTONIC/ Energy -Environment	Individual research lab Private technology transfer organization
	<b>SME3</b>	RTO EU Regional /National	Previous collaboration	Advance Manufacturing Automotive &Aerospace NON PHOTONIC/ Energy -Environment	Individual research lab
<b>SWEDEN</b>	<b>SME1</b>	SME	Only one with expertise Funding/cost		Individual research lab
	<b>SME2</b>	Regional /National		NON PHOTONIC / Manufacturing	Individual research lab Other company
	<b>SME3</b>	ALL (per case)	Previous collaboration Excellency	Advance Manufacturing Automotive &Aerospace Security Metrology & Sensors NON PHOTONIC / Manufacturing	Individual research lab





(Continued)

<b>UK</b>	<b>SME1</b>	RTO EU Regional /National	Previous collaboration Locality Funding/cost	Advance Manufacturing Information & Communication Visualization & Displays Security Metrology & Sensors NON PHOTONIC/ Energy -Environment NON PHOTONIC / Manufacturing	Individual research lab Private technology transfer organization
	<b>SME2</b>	RTO EU Regional /National	Only one with expertise Previous collaboration Locality Exellency Funding/cost	Advance Manufacturing Automotive &Aerospace Energy &Environment Life Sciences & Health NON PHOTONIC/ Energy -Environment NON PHOTONIC / Transport NON PHOTONIC / Manufacturing	Individual research lab Private technology transfer organization
	<b>SME3</b>	RTO EU Regional /National	Only one with expertise Previous collaboration Exellency	Advance Manufacturing Energy &Environment Visualization & Displays Security Metrology & Sensors NON PHOTONIC/ Energy -Environment NON PHOTONIC / Transport NON PHOTONIC / Manufacturing	Individual research lab Private technology transfer organization





## ANNEX II: RTO Interviews

The list of questions are provided in table II followed by tables with the corresponding answers provided by each of the RTO interviewed.

1. Joanneum Research, Austria
2. Karl Franzens University Graz, Austria
3. PIMM-ENSAM Processes and engineering in mechanics and materials, France
4. Fraunhofer IOF, Institute for Applied Optics and Precision Engineering, Germany
5. Fraunhofer IOSB Institute for Optronics, Systems Engineering & Image Analysis, Germany
6. Foundation for Research and Technology –Hellas (FORTH), Greece
7. Curam, Center for research in medical devices, Ireland
8. Center for Physical Sciences and Technology, Lithuania
9. RISE Acreo, Sweden
10. The Welding Institute, UK

Table II. List of Questions

No	Question
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1	Does your organisation's mission foresee facility access for photonic industrial users? If so, are there predefined policies encouraging collaboration with industry? Please mention any specific policies or mechanisms within your organisation encouraging this goal, while being specifically focused on the access of Photonics SMEs.
2	When establishing a collaboration with Photonics SMEs, which of the two parties is most likely responsible for the first contact? Does your organisation facilitate specific enquiry channels or promotion protocols to foster such interactions?
3	Please name up to three major benefits for your organization arising from providing access to Photonics SME's. Describe, accordingly, incurring encumbrances that emerge from this type of access facilitation.
4	Photonics SMEs seek access to an RTO mainly for one of the following reasons: contractors, acquiring Intellectual Property, know how transfer, infrastructure access, training and certification. Please indicate which of the above services are provided by your organisation and comment on whether a specific type of access is considered more beneficial and productive for your organisation and /or the SME.
5	Please provide an indicative ratio figure of collaboration with returning SME users versus access for first time users. Do you establish long term collaborations with SMEs that have accessed your facilities?
6	Please offer a statistical estimation of the successful outcome of SME-RTO collaboration. Can you comment on and if possible quantify the impact of SME-RTO collaboration on the SME's performance on issues such as patenting, new product development and growth?
7	How does your organisation handle sensitive issues that may occur within such a type of interaction, e.g. IP Rights management (forward and backward know-how definition), technology disclosure agreements and conflict of interest?
8	What are the main funding schemes that enable access of Photonics SMEs to your RTO? From your experience please describe the impact of facility fees in the access of industrial users in your organisation. Do you adopt alternative funding policies for easing the access of SME's to your facility premises?
9	Can you describe in brief, major hurdles that may impede the access of SME's to RTO's? Please provide any general comments/ thoughts on how to further assist SME's access to RTOs.

**RTO: Joanneum Research Forschungsgesellschaft mbH, Institute of Surface Technologies and Photonics, Austria**

**Interview with: Dr. Christian Sommer, Researcher, Light and Optical Technologies**

No	Answer
1	Yes, as a non-university research organisation facility access for (photonic) industrial users is



	one core field of business. In particular for our group the photonic industry is the most relevant one. Despite longer running research projects, there are also several possibilities regarding access for smaller research projects: a) the individual devices of our facility can be operated by employees of our institute and the results are reported to the company, b) employees of the company can be present in the lab during the time the measurements are performed, c) for some devices that are less difficult and less risky to be operated there is also the possibility to operate the devices by employees of the company. In addition, companies have also the possibility to rent e.g., a specific room like a clean room temporarily for their work.
2	Both, on the one hand there are several companies that contact our institution in case of a specific problem (since we are known that we provide research activities for companies), on the other hand employees of our institution take part in a lot of workshops (scientific conferences) and so on to promote our work and the possibilities our institution provides for research co-operations with companies.
3	Being technologically up-to-date when working on problems of companies, possibility to provide suggestions for co-operative research projects to the companies once their problems are better known, networking
4	Despite explicit training, to some extent all these services are provided. All of them may have their advantages and disadvantages, which has to be evaluated in each individual case.
5	About 5 to 1. There are some companies with which long term collaborations have been established.
6	The outcomes can be estimated to be successful to more than 90%. In particular SMEs often have more defined research questions with a shorter run-time since they are primarily interested to bring products into the market as soon as possible, therefore the research often contains less risk. Generally, the results of the research may support patent activities of SMEs and also product development. Growth is mostly determined how successfully the new product can be implemented in the market
7	For these issues research and co-operation contracts are set-up together with the company in which it is defined how these issues will be handled.
8	In Austria, there are some specific instruments of funding especially for SMEs, like the Innovationscheck or the Feasibility Study, which allows a quite high funding rate for the SME for initial research activities. Still, SME's also take part in larger national or international research projects, for which SMEs get a larger funding rate.
9	For sure, one problem is the money. SME's often cannot afford to pay larger research projects (even if they are funded) since in some cases they do not have a product on the market yet with which they can earn money. So, maybe, funding rates (and also amounts) should become a bit larger for SMEs that recently have been founded and/or do not have a product on the market yet.

**RTO: Karl Franzens University Graz, Institute of Physics, Austria**

**Interview with: Ao.Univ.-Prof. Dr. Joachim Krenn, Group leader Nano-Optics**

No	Answer
1	Yes. No specific policy. Via entries in the BMWFV ministry research infrastructure database, <a href="https://forschungsinfrastruktur.bmwf.vg.at/en">https://forschungsinfrastruktur.bmwf.vg.at/en</a> .
2	The SME. No, as inquiries come too infrequent.
3	(My org = university) 1) establishing contacts for future jobs of nowadays students, 2) mutual access to SME's infrastructure; no evident encumbrances



4	Access to our infrastructure is too infrequent to infer meaningful data on this.
5	About 1:5. Yes.
6	Unknown.
7	On a case-to-case basis.
8	Various, no main scheme; thus no explicit alternative option.
9	Not knowing about the availability of specific infrastructure is the main problem. Conventional databases are of limited help as they usually need to be searched with technology-oriented keywords that someone just looking for a solution to a problem might not know yet.

**RTO: PIMM-ENSAM Processes and engineering in mechanics and materials, France**

**Interview with: Laurent Berthe, Research Director**

No	Answer
1	The RTO seeks collaborations with industrial users, both SME and large groups. Currently, the RTO doesn't have a clearly defined goal, the collaborations are rather done opportunistically. The management (higher level) team at the institute level defines the strategies and the policies for industrial collaborations.
2	Mostly the SMEs, in some cases, mainly R&D collaborative projects the partners meet through networks. Even though the research team organises events that attract industrial users and generate collaborations, the main purpose of those events is rather scientific. The management team at the institute level has dedicated channels to collaborate with the industrials, they are the entry point for these channels.





3	SMEs are very reactive and flexible, good results have been obtained in several collaborative projects. On the other hand they do not have the same means as larger groups and it may limit the scope of the projects.
4	The SMEs mainly seek access for know-how and infrastructure access, in most of the cases it is done within collaborative projects.
5	Most of the collaborations are done with returning SME, long term collaborations are established through collaborative R&D projects and "industrial PhDs".
6	We consider most of R&D collaborations during collaborative projects successful, but we don't have statistics. SMEs exploit the know-how they acquire during the project, in some cases they develop new products.
7	Potential problems are managed from the beginning through NDAs, IP management is also established by specialists through negotiations at the beginning of the projects
8	It is mostly public funding, French government funding and currently there are 2 ongoing EU project. In one case the work was completely financed by the SME, but public funding facilitates these collaborations.
9	Most of the regional SME do not know the know-how and the work done by the RTO, it's one of the biggest roadblocks; they also do not know how easy it is to access the RTOs facilities. More involvement from the regional officials to stimulate collaborations between RTOs and SMEs and to actively promote photonics would certainly help ; interfaces to create the connexions are also lacking.

### RTO: Fraunhofer IOF, Institute for Applied Optics and Precision Engineering, Germany

Interview with: Dr. Kevin Füchsel, Head of Strategy / Marketing / Coordination

No	Answer
1	<ul style="list-style-type: none"> <li>▪ Collaboration between RTO and SME is a crucial part of our mission, especially in to reinforce the competitive strength of the region and Germany</li> <li>▪ Fraunhofer established "Verbünde" (Light and Surface) and Center of Excellence (Leistungszentrum Photonic) for a more focused research</li> <li>▪ Definition of strategic roadmaps, establish in a ppp model</li> <li>▪ Research projects focussing on innovation management and innovation processes in SME's (<a href="http://www.innofo3d.de">www.innofo3d.de</a>)</li> <li>▪ Strategic collaboration projects in ppp-model (THEFA, fo+ Freeform Optics Plus <a href="http://www.fo-plus.de/en/home/">www.fo-plus.de/en/home/</a>, 3Dsensation <a href="http://www.3d-sensation.de/en.html">www.3d-sensation.de/en.html</a>)</li> </ul>
2	<ul style="list-style-type: none"> <li>▪ Case 1, direct contacts: first contact by industry</li> <li>▪ Case 2, public funded projects: first contact initiated by Fraunhofer IOF</li> </ul>



	<ul style="list-style-type: none"> <li>▪ Channels: exhibition (Photonics West, Optatec, Laser, Hannover Messe International), conferences, publications in peer-review journals, Fraunhofer IOF PR, in-house workshops and lectures (MIPS conference <a href="http://www.microoptics.org/">www.microoptics.org/</a>, UP workshop <a href="http://www.optonet-jena.de/veranstaltungen/workshop-ultra-precision-manufacturing/">www.optonet-jena.de/veranstaltungen/workshop-ultra-precision-manufacturing/</a> ), Networking events (Optikgespräche – Talks about Optics)</li> </ul>
3	<ul style="list-style-type: none"> <li>▪ Industry-oriented research activities</li> <li>▪ Market insights, defining research problems</li> </ul>
4	<ul style="list-style-type: none"> <li>▪ Contractors: beneficial and productive for organisation and the SME</li> <li>▪ IP: beneficial and productive for organisation and the SME</li> <li>▪ Know-how: more beneficial for SME</li> <li>▪ Infrastructure access: more beneficial for SME</li> <li>▪ Training: more beneficial for organization</li> </ul>
5	<ul style="list-style-type: none"> <li>• We target long term collaboration (profitability rises with returning SMEs)</li> <li>• Initiating collaboration with SMEs usually starts with limited resources</li> <li>• Success rate &gt; 80 percent</li> </ul>
6	High success rate (SME-RTO collaboration enhance SMEs resources that are needed for their product development)
7	<ul style="list-style-type: none"> <li>▪ NDAs and agreements (regarding backward and forward IP)</li> <li>▪ Consortium Agreements in case of complex joint projects (3Dsensation, fo+)</li> </ul>
8	<ul style="list-style-type: none"> <li>▪ Research request</li> <li>▪ We use European programs in H2020</li> <li>▪ On national and local level we are active in strategic programs and innovation strategies like RIS3 in Thuringia</li> <li>▪ Of special interest are complex programs like “Regional Growth Cores” where consortia are formed with 10 or more partners and possible subsidy amounts of a few Million Euro</li> <li>▪ Participation is a new approach that we consider to take in place to deal with limited financial resources of the SMEs</li> </ul>
9	At our knowledge there are no hurdle that we know of concerning the access

**RTO: Fraunhofer IOSB Institute for Optronics, Systems Engineering & Image Analysis, Germany**

**Interview with: Dr. Ebert Division Manager Photonics and Optronic Systems**

No	Answer
1	The Fraunhofer funding model is composed as follows: 1/3 basic financing, 1/3 public funding (national & EU) and 1/3 industrial contracts. Considering this, we need a clear strategy on how to work with the industry and achieve the goal of building our budget of by 1/3 of industrial commissions. We have a set goals (broken down for each department) how much should ideally be achieved in a year. Therefore, it is necessary that the units, which are divided into 5 different working areas, are permanently maintaining contact with the industry so that they can reach that 1/3 of the budget.
2	We get in touch with the industry in 3 ways: 1. we present ourselves: We always use the opportunity at the Hannover Fair and other exhibitions to show our competence and products if we have some at that time. After that we usually get plenty of queries. 2. Furthermore, we have the "Annual Technology Days" to which companies are invited. 3. We also receive many direct enquiries from companies searching for solutions to their problems via our Internet portal where we introduce our business divisions and departments. We are mainly the ones being contacted. Of course, we also approach companies with ideas if we believe that they are the right partners for us. Fraunhofer is well known with its guiding concept to bring innovations in the medium-sized industrial sector. Those industrial companies that cannot afford their own research enter into a partnership with us. We overtake then the research aspects and implement them into the company's product. A good example is the sorting of bulk goods: we develop the sensor system for identifying and sorting the materials and the companies implement it in their sorting machines. The marketing of the machines and the next stages of the value chain are then taken over by the company. We seal then a licence agreement with the company. For each sold machine we become a share for the usage of the sensor system for the special case. This is our commitment to cooperation: we make good use of the money that we make and use it to support further research activities, to develop our own projects and innovations, to generate new methods for different issues, etc. Our wish and goal is being a reliable research partner for the industry sector. We are mainly focusing on research activities up to TRL level of 3-4. Then, we search for an industry partner who can translate the technology into a product. Medium-sized enterprises are therefore suitable because they rarely work at a TRL level of 1-4.
3	Because we want to keep our status of being a research institute, it is important for us to have reliable industrial partners. And if we have an innovation that leads to a completely new product, we look for an industrial partner who can take over the marketing and sales. If we do not find a dedicated industrial partner for this product, we build start-ups that focus on the marketable aspects while we further focus on Research. <i>Additional question: In this case, how do you get your income from this new product?</i> There are different business models. We would ideally long-term economic advantages of our project results. 1. Patents and licensing of the technologies make this possible. 2. It may also happen that a company wants to have the exclusive rights of the product. We sell then the product with the know-how. But what we cannot afford is to be restricted by a partnership with a company who expects an exclusive cooperation (we are not allow to work with other companies). Obviously, when there is competition between two companies a legally binding non-disclosure agreement (NDA) is always mandatory. The most important for us is to have always several cooperation opportunities. It may also be that a big company requests us to carry out a feasibility study (the study belongs thus to the company) who then buys our research activities. This happens e.g. with companies that work on a TRL level of 1-4 and do not have defined a clear product yet, they want to launch a scientific clarification process. In that case, we carry out an expertise and some modelling relevant for the product.

	Some encumbrances might appear with smaller companies who come to us with a concrete problem to be solved. But when it comes to discussing the questions of methodology, actions and weaknesses of a particular product, some fear of contact arises because they have to share sensitive information with us and accept therefore their weaknesses. It is thus part of our strategy to develop long term and trustful partnerships.
4	It depends on the business field, e.g. safety of the production: we have built a security laboratory where we are providing trainings for the middle-sized industry. We also have a test bench for optronic devices – the company’s technicians can come and use our measuring system. We are charging them then per device. We do not have any ISO-certification, but we develop standards which are commonly accepted by the community. However, our major are research and feasibility studies.
5	We have plenty of partnerships with SMEs running since more than 10 years. Of course, we are also always open for new collaborations. It is very difficult to give a ratio since most of our collaborations are long term.
6	The most important success for us is when a company comes back to us with a new contract. This is a sign that it was an economic success for the company and that they are happy with our work.
7	This is of course always an area of tension. In case we receive 2 requests from 2 competitive companies who want to solve the same problem, we inform the company we know and work longer with and ask them if they agree to work with another company in the same field. At this stage, we always use a NDA. If needed, two separate research groups are built and each group works separately under strict anonymity. We always take all risks into consideration.
8	There are different situations: 1. The SME has own money to finance our research activities.2. The SME applies for an EU- or a national project. These are both main sources of money. Yes, it is possible that we discover a new market area through the SME. We make then the decision to make further investments and researches, if we estimate that it is worth it.
9	First of all, all Fraunhofer institutes are strategically located in strong industrial areas with a quite high level of industries (large + SMEs). In the case of working with a SME, we are often facing the case that the company is not capable of exactly expressing their problems, because they have difficulties to admit that they have weaknesses. We play therefore here the role of a kind of mentor and help them to define and express the problem they are facing. This is a typical hurdle that can be only solved through a trustful relationship. We start the discussion with the SME by explaining our rules and insisting on the importance of a long-term partnership. We name some referential industrial partners we are working with for a long time. We give the company the feeling that everything what is discussed will be kept confidential. We have collaborators who are trained for acquisition activities with the industry; they are regularly trained to deal with industrial partners and build the trustful relationship between Fraunhofer and the company. Those training units take place in-house and we regularly analyse the best and worst cases experienced.

**RTO: Foundation for Research and Technology –Hellas (FORTH), Institute of Electronic Structure and Laser (IESL) Greece,**

**Interview with: Dr Panagiotis Loukakos, Principal Researcher, UV Laser Facility Technical Manager**

No	Answer
1	Access to industry including SMEs is foreseen in R&D terms. There is an encouragement to activity coordinators to establish links with industrial collaborators at national and European level. There is a dedicated position within the institute for a person to deal with know-how transfer and exploitation of results. Additionally, IESL, closely collaborates with the Help-Forward network <a href="http://help-forward.gr/">http://help-forward.gr/</a> in order to facilitate such actions.
2	Collaboration can be initiated by both IESL-FORTH and industrial partners. At national level, enquires are in many cases based on personal connections or recommendations due to the relative small scale of the photonics community in Greece. IESL-FORTH is a member in Horizon 2020 access projects (ACTPHAST <a href="http://www.actphast.eu/">http://www.actphast.eu/</a> , NFFA Europe, <a href="http://www.nffa.eu/">http://www.nffa.eu/</a> ) that facilitate interaction with industrial partners through central contact points. Furthermore IESL FORTH operates the IESL UV Laser Facility as part of the LaserLab Europe scheme <a href="https://www.laserlab-europe.eu/">https://www.laserlab-europe.eu/</a> that provides access to academic and industrial research teams from Europe and beyond.
3	A major benefit arising from SME access in our institute is increasing the prospect for direct exploitation of research results. Furthermore interaction with industrial partners allows first-



	hand knowledge of industrial trends that are critical in co-formulating the research agenda of the institute. Finally establishing links for common participation in EU funding proposals is an additional advantage. However in order to provide top rate services to the industry, the institute must further develop and maintain competing and inter-disciplinary facilities and support dedicated technical staff which imposes additional requirements in terms of finances.
4	All types of listed services are provided while certification services also available from specific laboratories. For IESL FORTH Know how transfer and contractor services are considered more beneficial and productive.
5	N/A. Long term collaboration is preferred and facilitated
6	N/A
7	IESL FORTH operates a legal department with high specialization on IP management. Upon case NDAs can be signed or other relevant legal action can be undertaken to protect IP of visiting SME and IESL-FORTH
8	Funds are available mainly through EU projects e.g. Research Infrastructures Program or other EU projects (ACTPHAST) while there are also cases where SMEs undertake costs for R&D activities. There is a standard predefined fee for facilities use, applicable upon user, type of facility and period of access. Additionally, alternative routes are also available to cover occurring fees in terms of providing non cash payment (returns in equipment, or IP rights).
9	Main obstacles involve difficulties in outreach and the establishment of mutual trust. Covering of fees can also pose a barrier in the access of industrial partners. Specifically organised events to encourage interaction between RTO and SME personnel could assist in outreach efforts, facilitate exchange of ideas and building of trust.



**RTO: Curam, Center for research in medical devices, Ireland**

**Interview with: Neil Ferguson, Industry Programme Manager**

No	Answer
1	<ul style="list-style-type: none"> <li>▪ Photonics – Not so Much</li> <li>▪ High tech</li> <li>▪ Promote to SMEs in Med Tech Sector</li> <li>▪ Access- Co-fund research &amp; provide access to a SME afterwards</li> <li>▪ Equipment they don't have i.p. skills</li> </ul>
2	<ul style="list-style-type: none"> <li>▪ High Level Outreach (conferences) then they come back about</li> <li>▪ About 70% them coming</li> <li>▪ Already have relationships with person in curam</li> <li>▪ Relationship &amp; trust driven</li> <li>▪ Aim to target specific persons/companies</li> <li>▪ Have an industrial liaison to manage inbound queries</li> </ul>
3	<ul style="list-style-type: none"> <li>▪ Promotion/creating jobs for region</li> <li>▪ Working on innovative tech</li> <li>▪ Access to their market knowledge &amp; unmet clinical needs</li> </ul>
4	<ul style="list-style-type: none"> <li>▪ Infrastructure access</li> <li>▪ Know how transfer</li> <li>▪ Access to future recruits</li> <li>▪ I.P.</li> <li>▪ Training and certification</li> </ul>
5	100% return but center is only 2years old
6	Probably ~ 80% success but it is subjective
7	<ul style="list-style-type: none"> <li>▪ Start with NDA, discuss scope &amp; get agreement, then get a collaboration agreement listing details.</li> <li>▪ Regular project meeting with project</li> <li>▪ Engaging feedback</li> </ul>
8	<ul style="list-style-type: none"> <li>▪ SFI spokes project</li> <li>▪ Have a budget to co-fund project from industry</li> <li>▪ SME 1: 1.5 RTO</li> </ul>
9	Major Hurdles: finance, 3-5 year minimum, capacity to take project to market, timeline is a problem with RTO

**RTO: Center for Physical Sciences and Technology, Lithuania**

**Interview with: Gintaras Valušis, Director**



No	Answer
1	Our organisation foresees the R&D facility access for photonic industrial users. To encourage this goal the Centre for Physical Sciences and Technology already established several open access centres, include ones for processing technologies BALTFAB and depositing chemical coatings. The implementation of the open access policies is supported through public funding schemes which provide the matching funding for certain type of activities.
2	In most cases the photonic SMEs are the initiators of the first contact with the institute. To foster the initial contact the Centre for Physical Sciences and Technology has an online application form <a href="http://www.baltfab.com/">http://www.baltfab.com/</a> and provides further details about the available R&D services via the public information repositories created by the government such as <a href="https://www.e-mokslovertai.lt/welcome">https://www.e-mokslovertai.lt/welcome</a> .
3	The major benefits are: 1) the possibility of gaining the additional funding for the Centre, 2) the possibility of getting updated with the knowledge and information about the current industry needs, and 3) the possibility to assessment the potential of the Centre in terms of R&D and innovation capacity. The identified encumbrances are mainly related to the lack of innovative industry in the region that would be able to participate in creating innovative technologies and new knowledge together with scientists.
4	The main services provided include the open access to infrastructure, laboratory services, calibration and metrology services, contract research, technology transfer.
5	It is difficult to assess. Since the photonics industry in Lithuania is still rather small, most of the SMEs are long-term partners of the Centre which develops and maintains relationships over years if not decades: often because the companies were founded by the former scientists or their academic alumni.
6	The most valuable key performance indicator would be a number of the established successful joint spin-offs with the participation or efforts of the Centre and SMEs. Such an indicator would help to assess and even measure the complexity and the scale of the collaboration between academia and industry.
7	IPR management and related procedures are defined in the internal regulations of the organisation, and are fully compatible with the legal status of the Centre as a public research institution funded from the national budget.
8	The main public support schemes that enable a wider access of Photonics SMEs to our RTO are: 1) Innovation vouchers 2) R&D cooperation projects from the EU Structural funds. These schemes help the companies to lower their costs since full costs for SMEs would be unbearable. The access to the infrastructure funded by the EU Structural funds is offered on the basis of reduced prices.
9	The major hurdles are: 1) The lack of adequate funding for RTO services 2) The lack of innovative industry which would require specialized RTO services

### RTO: RISE Acreo, Sweden

Interview with: Peter Björklund, VD Swedish ICT Acreo AB and Teresita Qvarnström SME Development

No	Answer
1	Yes, but no limited to photonics. Acreo has special programmes in order to collaborate with SMEs and bigger industry. There is no real policies to encourage this goal, but we have a long





	<p>tradition. There are many facilities within RISE accessible to SMEs (Photonics and others) and there is a big focus to promote the use of these facilities. For what regards Photonics, this is mainly the Electrum laboratory and the Fiberlab. Electrum is part of the MyFab collaboration (with Uppsala Ångström lab and Chalmers in Gothenburg and Lund University).</p> <p>Acreeo is active around the companies attracted to Max IV in Lund. Acreeo is also involved in Pronano in Lund: <a href="http://luopen.lu.se/project/pronano/">http://luopen.lu.se/project/pronano/</a></p>
2	<p>In most cases the initiative comes from Acreeo. It can happen that an “unknown” company contacts Acreeo. Mostly from direct contacts between the technology departments and the companies. The participation in networks, both Swedish and European, is also an important channel.</p> <p>Thematic workshops to gather SMEs is a good tool to establish collaboration. Acreeo reaches out to SMEs via SMED (a dedicated department to work with industry) this department also coaches SMEs in business development. Acreeo contacts SMEs for collaboration in EU projects. The SMEs contact Acreeo if they have a special problem to solve, application to write, etc. Spin offs and start-ups contact Acreeo on their own initiative. SMED will most likely increase the number of SMEs using the facilities and competences of Acreeo.</p>
3	<ul style="list-style-type: none"> <li>▪ <i>Use of the facilities. If the degree of use is high, maintenance and drift costs are proportionally lower...</i></li> <li>▪ <i>Note: own spin-off companies are in fact the best customers.</i></li> <li>▪ <i>Awareness about the companies' and market's needs is increased.</i></li> <li>▪ <i>It enables complementary offers for future.</i></li> </ul> <p><i>Drawbacks:</i></p> <ul style="list-style-type: none"> <li>▪ <i>Difficult to get long-term projects.</i></li> <li>▪ <i>Usually small projects with a proportionally large administration.</i></li> <li>▪ <i>Some of these companies are unstable in the Valley of Death (can be bought up or go bankrupt or changes might easily occur).</i></li> </ul>
4	1) Infrastructure access, 2) know how transfer, 3) contractors,
5	Long term collaboration in the framework of EU projects. <i>Features can be found in the annual report.</i>
6	<i>ICT Division is contracting someone every year to analyse the outcome of the collaboration with companies.</i>
7	<i>All types of agreements do exist at Acreeo.</i>
8	<i>EU, Tillväxtverket, Vinnova</i> <i>SMEs and industry from abroad approach Acreeo and bring in own money to collaborate and let Acreeo work on a dedicated challenge.</i>
9	<i>Mostly funding issues.</i>

## RTO: The Welding Institute, UK

### Interview with: Dr Rob Scudamore

No	Answer
1	We are an RTO that gives access to laser processing to our Members. A proportion of the Members are SME's (30%). We have 'policies' encouraging collaboration with industry as it is at the heart of our vision. We exist to support our Members and industry as a whole.
2	Either and we have engagement through many channels such as digital media and events.
3	We get work and experience, and they get the industrial solution. Often it is difficult for an SME to take on new technology because of the investment and expertise barrier. It is risky.
4	All of the above and they are all important. I would say that immediate problem solving, particularly regarding production, would be where we see the most pull from SME's.

5	30/70? We try to.
6	We mainly do this through Technology Transfer Programmes. We have data on this. It could be circa £15Mn pa if you count everything.
7	With care. We have an IP team.
8	We win Technology transfer Programmes that provide funding for SME (and other) access to TWI facilities. These are often in Objective 1 style regions that are in need of support. We also do H2020 European and Innovate UK (plus other UK) projects that directly and indirectly help SME's. We do try to accommodate SME's but it is difficult to be able to offer more affordability unless we are subsidised through Tech Transfer, because of our overheads.
9	Major issues are cost and time. SME's also need to adopt new technology and hence they need R and D support, access to finance, productionisation assistance, IP support etc. Solution would be to have government sponsored Technology Transfer Programmes using organisations that provide specific technical benefits to industry, preferably with a track record of success. RTO's, as intermediary organisations, are often more useful than Universities in this space.

