

How to Exploit the Untapped Potential of RTOs’ Deep-Tech Start-Ups in Europe

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Executive Summary

Europe has clearly realised the need to support the few European start-ups able to survive beyond the critical phase of 2-3 years, and the even fewer ones growing into large firms. As stated in the [EU Communication](#) on the Start-up and Scale-up Initiative, [Eurostat](#) “estimated that there could be up to 1 million new jobs created and up to €2000 billion added to GDP in the EU over the next 20 years if the share of scale-ups would match that of the US. Due to the positive link between firm size and productivity, this would improve Europe’s productivity growth”.

As also noted by the EU Council, “The EU as a whole, and all individual Member States, continue lagging behind the USA in the amount of available venture capital (VC), an important precondition for innovative companies to grow and scale-up. While the persistent lack of financing for innovation in the EU may be a result of a combination of both supply (i.e. a lack of available funding) and demand (i.e. a lack of robust innovation projects deemed worthwhile to obtain funding), it seems that the crisis has also deteriorated the overall situation.”¹

Deep-tech start-ups are key to Europe’s competitiveness and industrial renewal, delivering high socio-economic impact contributing to strengthen the European Research Area. Contrary to US-type digital companies, or unicorns like Uber or Airbnb, EU-type deep-tech start-ups have great life expectancy and low rate of failure. However, in order to deliver such good results, the support they need early-on to make innovation investment-ready are much higher, even though they tend to balance out at a later development stage.

With their open-innovation business model, one of the core missions of Research and Technology Organisations (RTOs) is to transfer research and technology to the market with high impact for society. RTOs thus play a crucial role in the creation of these deep-tech start-ups by developing highly innovative technologies with the objective to transfer them to the market, either by collaborating with existing companies and supporting them to access technology, or by creating successful deep-tech start-ups themselves. The creation of these start-ups requires four key actors with aligned incentives: a strong and smart team combining Minds (technology experts) and Management (entrepreneurs), developing a promising technology with strong IP towards the Market (industrial partners), with Money (smart investors/capital) fuelling the whole process.

When developing new, sometimes game-changing technologies, RTOs adopt a market-oriented approach early on, with the objective to develop strong IP and to transfer their technology to the market. However, it is not in RTOs’ core business to sustain a pool of entrepreneurs or to have a commercial strategy. We believe public authorities could play a role to support this type of activity which help to make innovations investment-ready.

It is critical for Europe to refocus on strengthening the European Research Area and on developing a strong industrial base, where SMEs and midcap companies, often “the hidden champions” with sustainable company management and strong corporate social responsibility, play a key role. Some support schemes like the SME Instrument, the European Fund for Strategic Investment (EFSI), the EU Start-up and Scale-up initiative including the pan-European Venture Capital Fund-of-Funds, and the Capital Market Union (CMU) already exist at EU level. However, they do not target the specific needs of RTOs’ deep-tech start-ups which essentially lie prior to the actual foundation of the spin-offs.

To support the creation of deep-tech start-ups with high life expectancy in Europe and capable to grow in the market, the European Innovation Council and the EC’s Start-up and Scale-up Initiative could complement each other. This support should be provided prior to the actual foundation of the start-up and focus on aligning the four above-mentioned dimensions required to create successful deep-tech start-ups able to drive industrial renewal in Europe. This support could include:

- Supporting the Minds: creating a pan-European investment mechanism for RTOs’ technological infrastructures.
- Linking the Minds: creating a network of RTOs’ deep-tech start-ups accelerator units.
- Connecting Minds & Money: pre-seed funding grant to make innovation investment-ready.
- Connecting Minds & Management to build smart teams.
- Connecting Management & Money: access to liquidity after the start-up creation.

¹ Maximising opportunities for Research, Development and Innovation (RDI) under the European Fund for Strategic Investments (EFSI), Non-paper to Ministers for 1 December 2015 Competitiveness Council

1. RTOs' Deep Tech Start-Ups

1.1 Specificities of RTOs' Deep-Tech Start-Ups

With their open-innovation business model, one of the core missions of RTOs is to transfer research and technology to the market with high impact for society. RTOs have many ways of doing so, one of which being the incubation, creation and development of spin-off companies: deep-tech start-ups. RTOs are venture builders, they accelerate the incubation of business opportunities converting innovative technological assets into investment-ready deals capable of generating value for society.

The deep-tech start-ups created by RTOs have several specificities:

- They are based on deep-technology: unique, differentiated, often protected with strong IP or hard to reproduce, technological or scientific advances made within RTOs.
- They are based on very diverse technologies, including Key Enabling Technologies (KETs), in all sectors, for instance high-tech, semicon, cleantech, energy, medtech, automotive, etc.
- They have a strong industry focus and sell their products to other businesses (B2B).
- They focus on two major types of technological innovation increasing productivity with high societal value:
 1. Breakthrough innovation creating new markets, based on intensive development of disruptive technologies deriving from research laboratories and typically associated with industrial challenges,
 2. Innovation through use, resolving large profit & loss problems (decreasing costs or increasing revenues) based on the combination of mature technologies for the development of new uses and/or economic models, present in the digital economy.
- The socio-economic impact that these deep-tech start-ups generate is thus very balanced between job creation, increase in turnover and capitalisation across the value-chain.
- They tend to have 7/10 employees at the time of their creation, and more than 50 employees after 2nd round of financing. They then tend to either scale-up by gaining more industrial clients and accessing new markets, or to integrate an existing company.

In addition, those deep-tech start-ups nurtured by RTOs have generally a better life expectancy after 5 years than average start-ups. They also have much greater chances of scaling-up in the deep-tech area, creating new industrial champions in Europe.

1.2 Deep-Tech Start-Ups Are Europe Distinctive Strength

Europe's deep-tech start-ups created by RTOs are very different from US-type digital unicorns, often taken as examples to follow in political speeches in Europe. US-type digital unicorns like Uber, Airbnb or Snapchat, are purely based on new business-models with no technology of their own, rather using commonly available technology, disrupting value-chains and bringing value to their shareholders with an unbalanced growth model concentrated on capitalisation. The table below is a general simplified characterisation highlighting the differences between US-type digital start-ups and Europe-type deep-tech start-ups (RTOs' spin-offs).

	US-type Digital Start-ups (incl. US-Unicorns)	EU-type Deep-Tech Start-ups (RTOs' Spin-offs)
Technology Use/R&I Intensity	Used-tech (often no own technology, use commonly available technologies)	Deep-tech (unique, differentiated, often protected or hard to reproduce technology)
Clients	Business to Customers (B2C)	Business to Business (B2B)
Challenge Solved	Business-model challenge	Technology & Market challenge
Business Case	Service-based	Technology-based
Influence on Value-Chains	Disrupt value-chains	Connect value-chains, building on to existing industry
Value	Shareholder value	Stakeholder value (productivity growth)
Resources' Needs Before Foundation	Low	Resource-intensive
Time to market	Immediate	3 to 5 years for proof of concept & Minimum Viable Product (maturation, incubation)
Resources' Needs for Scaling-up	Exponential growth (fast & resource-intensive) to achieve market leadership "winner-takes-it-all" (global marketing)	Linear/controlled growth directly linked to revenues & acquisition of industrial customers' (targeted approach)
Life expectancy after 5 years	Low: <25% success rate ²	High: >80% success rate (see 2.3)

² 9 out of 10 Silicon Valley start-up fails - [Forbes](#) 2014 ; 3 out of 4 start-ups fail - [Wall Street Journal](#) 2012 based on Shikhar Ghosh research, Senior Lecturer at Harvard Business School

Growth Model	Capitalisation growth	Balanced growth: jobs, turnover & capitalisation
Societal Impact	Short to medium-term societal impact accompanied by important disruption	Long-term societal impact sustaining industry
Sectors	Everyday life services exploiting the new potential of ICT	All technology sectors: including high-tech, semicon, cleantech, digitalisation, energy, medtech, automotive, etc.

To start-up, these two types of companies have very different needs. Indeed, in order to ensure a high life expectancy after 5 years, the resources needed to create EU-type deep-tech start-ups and make innovations investment-ready are much higher, therefore requiring very different support compared to US-type digital companies/unicorns. Therefore, Europe should not aim at creating another ICT-focussed Silicon Valley ecosystem but rather focus on its distinctive strength: deep-tech start-ups closely linked to a strong European industrial base. This includes developing a more tailormade approach to creating new businesses and making them grow.

1.3 Socio-Economic Impact of RTOs' Deep-Tech Start-Ups

Many RTOs transfer technology by creating and nurturing a certain number of deep-tech start-ups every year. An EARTO survey circulated among EARTO members revealed that the 50 RTOs who responded had more than 550 spin-offs still active in 2014.

Looking at the impact of RTOs' deep-tech start-ups on growth and job creation, the EARTO Economic Footprint Study³ showed that the 257 spin-offs created by 7 of the largest EU RTOs and active in 2014 represent:

- 13.800 jobs in 2014
- €1.8bn turnover in 2014
- €855M value-added in 2014
- €350M fiscal and parafiscal return to governments in 2014

Additional studies at national level have also looked at the impact of RTOs' deep-tech start-ups and especially at their success and growth potential. For instance, the [study by Grufman Reije](#) in Sweden shows that the 17 spin-offs from EARTO member RISE ICT created between 2000-2005 had a total turnover of 130M€ by 2010. It can be compared, for example, to the total turnover of 125M€ that 122 companies from incubators at major Swedish universities show in the same period. In 2014, the turnover of spin-off companies with roots in the RISE ICT institutes even reached 200M€.

It is also important to highlight that the human capital moving from the founding RTO to the spin-off contributes to the availability and dispersion of highly qualified knowledge and skills to the local economy and related industries. Furthermore, the positive impact in terms of culture evolution due to the contact (direct or indirect) of young citizens and students with these start-ups in their local ecosystem is also worth mentioning.

These good results are mainly due to the intensive in-house operational and financial support that RTOs offer to their start-ups. Thanks to this strong support, RTOs' deep-tech start-ups are able to continuously create high value for an established or new market. Looking at these impact figures, EARTO believes that RTOs' deep-tech start-ups are a great untapped potential in Europe, worth further supporting at EU level.

1.4 Four Key Dimensions to Create Deep-Tech Start-Ups

To create deep-tech start-ups in a successful way and ensure a long-term life expectancy, three key dimensions need to be connected from the beginning of the creation process:

1. **Minds:** technology experts with access to excellent **technological infrastructure** developing a promising market-oriented RTO technology into a product with **strong IP**, often creating a new market or resolving a large Profit & Loss problem in a B2B context.
2. **Management:** strong, smart and versatile team built around a motivated entrepreneur/intrapreneur with good market vision, willing to convert disruptive technologies into ready-to-invest business opportunities.
3. **Market:** strategy with interested and committed industrial partners/clients.

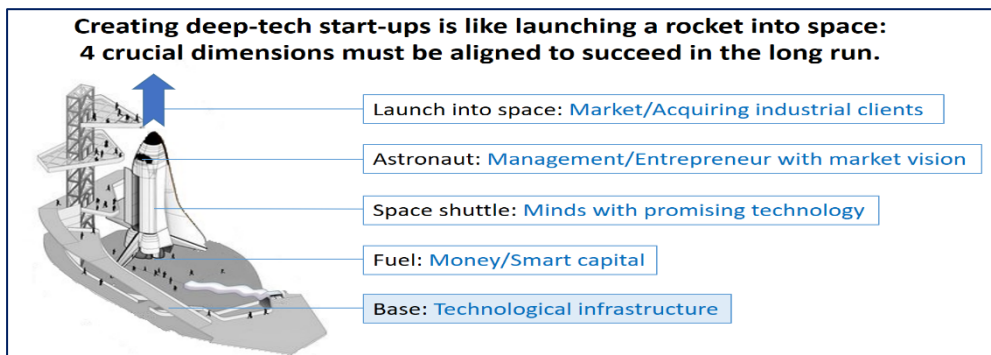
It is essential to connect these three dimensions as early as possible in the process, in order to best align the technology maturation and the market development.

³ Economic Footprint Study: Impact of 9 European RTOs in 2014 - 14 January 2016 - [full report](#) & [summary brochure](#)

A fourth dimension then becomes crucial:

4. **Money:** Smart capital from investors seeking to transform technology based investment opportunities into business value and growth.

Incentives must be aligned between these four dimensions to ensure compatibility and success. Most of the time, a strong and smart team of Minds & Management developing a promising technology with a smart Market strategy including several committed industrial clients will make it much easier to attract and secure smart Money.

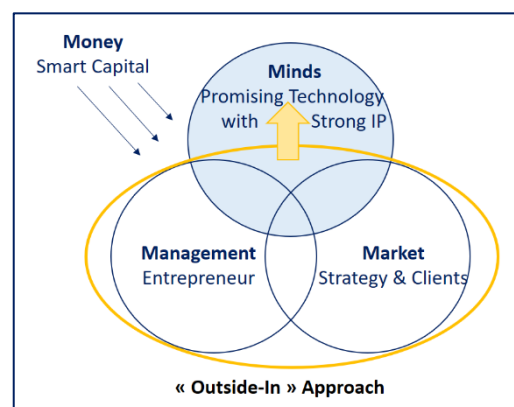


1.5 Two Models of Deep-Tech Start-Ups

Based on these four dimensions, RTOs use two main models to transfer technology via start-ups: either helping existing start-ups in low-medium TRL to access technology, or by creating new deep-tech start-ups themselves. In both case, the objective is to integrate the three first dimensions (Minds, Management and Market) as fast as possible to best align market and technology and develop them together. The fourth dimension, money, acts as a fuel throughout the process.

1.5.1 Outside-In Approach

Most of RTOs' technology transfer activities today are done under an "outside-in" approach. In the specific case of start-ups, this consists in entrepreneurs/ early stage start-ups still in low-medium TRLs, with good vision of a market and potential clients, looking for a diversified and state-of-the-art technology portfolio to support their idea. They contact RTOs to develop a promising technology portfolio for the new business. RTOs then collaborate with these entrepreneurs, helping them create the needed technology or apply an existing RTO technology to their needs. This collaboration includes the access to the RTO's innovation hubs and a wide range of services and support. Subsequently to the collaborative project with the start-up, especially if the start-up wants to license the technology developed, the RTO can take the opportunity to invest in it (see Mofitto and TinkerList examples).



Several mechanisms support such means of technology transfer, including for instance Fast-Track to Innovation or the SME Instrument. RTOs need support to further develop this technology transfer activity in a way that especially targets early stage start-ups looking to access technology (see Robo TT-Net project). Providing start-ups access to RTOs' untapped technology reservoir/potential and business development expertise would indeed deliver high value for society.

Examples:

- [Mifitto](#), deep-tech start-up from Fraunhofer in Germany, is a supplier of innovative solutions for shoe and apparel retailers in distance and store-based retailing, enabling individual and custom-fit size recommendations. Mifitto contacted Fraunhofer and carried out a research project in which they developed Fraunhofer technology further to fit Mifitto's purpose. Subsequently, Mifitto wanted to license the technology and Fraunhofer took the opportunity to invest in Mifitto.
- [TinkerList](#), deep-tech start-up from imec (previously iMinds) in Belgium, has developed a content management system that streamlines the production workflow of television making. The founders of the company, active in the media world, contacted imec and a collaboration has been set-up. The company created one environment, in which all participants of the editorial team (editors, copywriters, graphic designers,...) and the production crew (director, producer, technical operators,...) can collaboratively create and adapt content during all stages of the television production process.



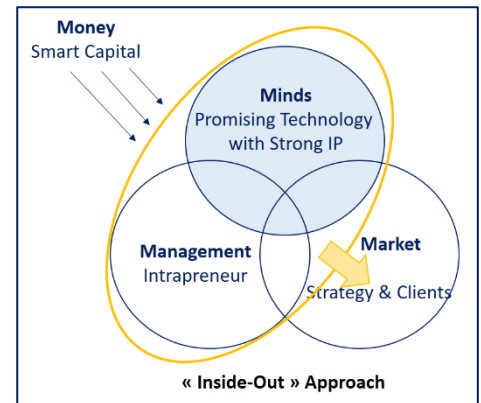
- [Robo TT-Net project](#), a EC-financed “technological voucher” helping to build relationships between RTOs (Danish Technical Institute, Fraunhofer, Manufacturing Technology Centre and Tecnia with Tecnia Venture as third party) and early stage start-ups that are still in low-medium TRLs. Anyone with a concrete idea, challenge or development project related to industrial robotics can apply to the program. The selected projects receive a ROBOTT-NET voucher, entitling them to free consulting with RTOs’ experts to develop a plan of the innovation needed and the business case for product maturation. ROBOTT-NET also holds Open Lab events with developers, end-users, investors to help network development. A few projects are then selected for even further development assistance up to the pilot phase.



1.5.2 Inside-Out Approach

In the case of a strategically important often game-changing or market-creating RTO’s technology, or of a technology that cannot be transferred to existing companies, RTOs tend to create their own deep-tech start-ups with an “inside-out approach”. There are usually three steps:

1. An RTO’s deep-tech start-ups usually starts with a promising technology at a close-to-market level of development, with potential applications in different markets.
2. Leadership dilemma: the RTO needs to find a motivated intrapreneur who will act as a driving force to develop the market. Minds and Management together form the Smart Team.
3. Market Development: The second step is the smart team then needs to develop the market and the technology hand in hand and to identify the industrial clients interested in the technology/ market perspectives. The higher the number of industrial partners the start-up acquires, the lower the risks are.



Being based on a very different approach, this model requires different types of support than the outside-in approach. Indeed, when developing new, sometimes game-changing technologies, RTOs adopt a market-oriented approach early on, with the objective to develop strong IP and to transfer the technology to the market. However, it is not in RTOs’ core business to sustain a pool of entrepreneurs or to have a commercial strategy and find industrial clients. RTOs’ therefore need support to align the different necessary dimensions of deep-tech start-up creation, for high economic and societal impact.

A few public instruments supporting this model of deep-tech start-up creation already exist, based on market analysis and business plans’ support, but it could be improved. Indeed, these instruments are often not adapted to the specific needs of RTOs’ deep-tech start-ups creation since most of the support they cover is already provided by RTOs themselves (for instance SME Instrument Phase 1).

Examples:

- [Dispelix](#), spin-off from VTT Technical Research Centre of Finland, is one of [Bloomberg’s 50 most promising startups](#) from around the world 2016. Based on R&I in optics and display manufacturing technology since 2011, Dispelix makes see-through lenses for Augmented Reality. Dispelix Technology can be embedded into applications from smart helmets to regular eyeglasses, and has simple optical interfaces making it easy to embed in partners’ products. In April 2016, Dispelix had raised €1.7M smart capital.
- [Aledia](#), spin-off from CEA in France, has won an [EARTO Innovation Awards in 2016](#) with its wireLED technology: a new generation of 3D LED with drastically reduced production costs. Aledia received exclusive worldwide rights to all CEA patents on the 3D LED technology applied to lighting. In 2015, Aledia totalled €28.4M investment. In 2017, Aledia should commercialise 3D LEDs at 50% below average selling price.
- [Neos Surgery](#), spin-off from Eurecat and Tecnia in Spain, is specialised in innovative design and manufacturing of implantable surgical devices, based on the use of unique biomaterials. The spin-off won different awards like the International Technology Forum [Excellence Entrepreneurship Award](#) and benefited from the H2020 SME Instrument phase 2. The company has raised more than 8M€ of private and public capital.

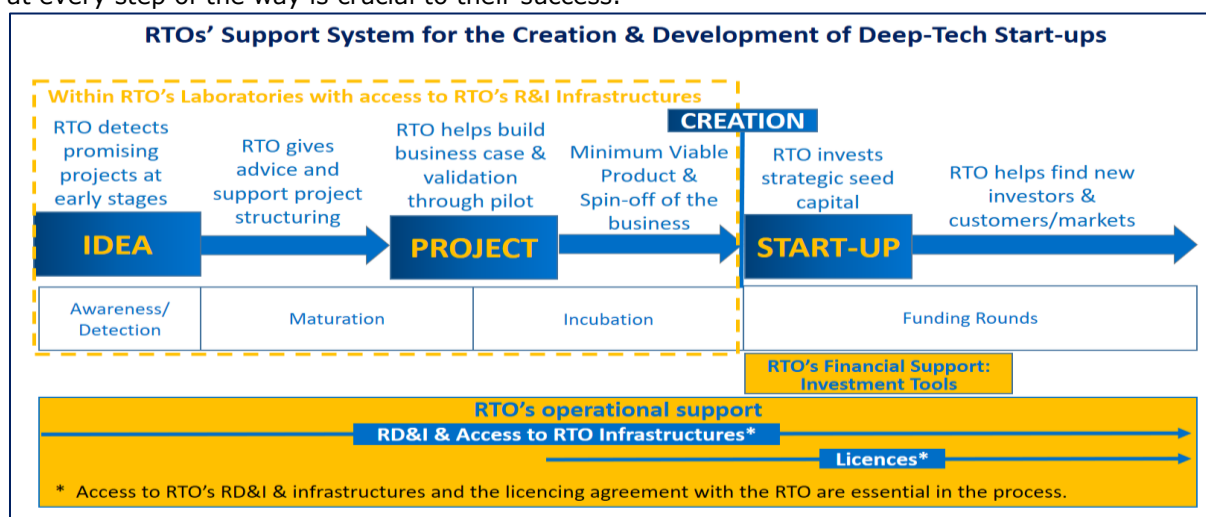


- [Silex Microsystems](#), spin-off from RISE Acreo in Sweden, is based on leading Micro-Electro-Mechanical Systems (MEMS) and was created to manufacture specific MEMS structures. The business grew in volume and broadened its product offering to become a contractual MEMS component manufacturer. In 2015 it had €30m in revenue and 135 people employed. During 2016 the business was sold to an industrial company.
- [Blue Foot Membranes](#), spin-off from VITO in Belgium, was founded in 2017 with 2.5M€ seed capital. Based on 10 years of R&I, the worldwide-patented IPC™ membranes are a key component in wastewater treatment and water reuse, helping reduce the world water footprint.
- [AD Biocomposites](#), spin-off from ITENE in Spain, is powered by a team of experts in the development of high advanced materials for packaging applications. Their technology improves the required properties of the major bioplastic material used nowadays.



2. RTOs' In-House Support for the Creation of Deep-Tech Start-Ups

To ensure the success of their deep-tech start-ups, many RTOs have developed in-house capacity to share the high risk that these deep-tech start-ups represent and dedicated business development teams supporting their creation. The multifaceted support they provide to their deep-tech start-ups at every step of the way is crucial to their success.



2.1 Making Innovations Investment-Ready: RTOs' Operational Support for Deep-Tech Start-Ups

RTOs' operational support for the creation of deep-tech start-ups includes:

- Detection of promising projects at early stages,
- Advice and support for project structuring,
- Support to build the business case and launch & implement the business plan,
- Support for the validation phase through pilots and prototypes,
- Access to in-house technological research infrastructures, essential to the validation/pilot phase, and allowing the company to grow and create value with a low capital need,
- Transfer of strong Intellectual Property Rights, often being a condition to attract external sources of financing and acting as due diligence process & formal right of protection against the commercialisation of the innovation by other firms,
- Support to build smart teams and find committed and motivated high-level entrepreneurs/intrapreneurs,
- Financial support, advice on (preparing) funding rounds, help to find investors and seed money: RTOs' label as due diligence process,
- Legal support, IP issues assessment,
- Staff detachment,
- Connecting to industry and finding customers,
- Advice on internationalisation,
- Coaching on how to reinforce the technological basis of the venture.

2.2 Bringing Science into Finance: RTOs' Financial Support for Deep-Tech Start-Ups

RTOs also support financially their deep-tech start-ups by transferring their technology, granting licencing agreements and/or taking shares as investor in the spin-off. Specific RTOs in-house services, often called "tech start-up accelerators", are sometimes also managing investment funds. These accelerators are often RTOs' subsidiaries or "daughter companies". They leverage the inherent risk of these operations and are oriented at producing investable opportunities for "smart capital" (Corporate Funds; Companies; Family Offices; VCs; BAs) to invest in. With their deep technological knowledge and expertise and the high life expectancy of their deep-tech start-ups, RTOs bring science into finance and act as due diligence for investors, helping them assess the combined value of what technology can do in the targeted application field.

2.3 Some Figures on RTOs' Support to Deep-Tech Start-Ups

More details about RTOs' in-house start-up accelerator units and figures about the spin-offs created are given in the table below.

RTO's accelerator unit	Number of spin-offs created every year & total so far	Number, turnover and jobs of spin-offs still active in 2016	Spin-offs' life expectancy 5 years after creation	RTOs' investment funds & other programmes
CEA Investment (France)	<ul style="list-style-type: none"> 6-7 spin-offs /year 198 spin-offs created - not all received financing through CEA Investment 	<ul style="list-style-type: none"> 50+ spin-offs active (financed through CEA Investment) 620M€/year turnover 3800 jobs 	80% success rate after 5 years	<ul style="list-style-type: none"> New investment fund created in March 2017: Supernova for Capital Growth Internal CEATech "Innovation Challenge" to encourage spin-off creation
Fraunhofer Venture (Germany)	<ul style="list-style-type: none"> 20+ spin-offs /year 189 spin-offs created since 2006 	<ul style="list-style-type: none"> 172 spin-offs still active 200M€/year turnover 1500 jobs 	97% success rate after 3 years	<ul style="list-style-type: none"> Internal Programmes: Pre-qualification program (Business ideation), Fraunhofer Days, Fraunhofer Fosters Entrepreneurs, Fraunhofer Fosters Management, Fraunhofer Innovator
Imec istory (Belgium) merged with <i>iMinds</i> in 2016	<ul style="list-style-type: none"> 22 spin-offs created in 2016 			<ul style="list-style-type: none"> Imec.xpand invests in innovative, early-stage ideas & projects, from inside & outside imec Imec istory is recognised as one of the world's best incubation programme by UBI
Itene (Spain)	<ul style="list-style-type: none"> 2 spin-offs/year 	4 spin-offs active		
RISE (Sweden)	<ul style="list-style-type: none"> 2-3 spin-offs /year 49 spin-offs created since 1997 	<ul style="list-style-type: none"> 43 spin-offs active 260M€/year turnover 1200 jobs (26 spin-offs in which RISE owns equity) 		<ul style="list-style-type: none"> RISE SICS Startup Accelerator RISE ICT Spin-off Companies RISE Interactive Spin-off Companies
SINTEF TTO (Norway)	<ul style="list-style-type: none"> 4-5 spin-offs /year 80+ spin-offs created 	14 spin-offs in portfolio		<ul style="list-style-type: none"> Seed investment fund SINTEF Venture IV with investment capital of 23m€ from SINTEF, EIF, Sparebank SBN & CIP resources
Tecnalia Ventures (Spain)	<ul style="list-style-type: none"> 5 spin-offs in the pipeline for 2017 9 spin-off created over the past 3 years. 	<ul style="list-style-type: none"> 12 spin-offs in portfolio €30M/year revenues 250 jobs 	No failure since 2012	<ul style="list-style-type: none"> No investment fund raised by Tecnalia (only gets shares in spin-offs in exchange for the technology provided) 25 different investors invested in Tecnalia Ventures' spin-offs over the last 4 years
TNO Companies/First Dutch Innovation (The Netherlands)	5 spin-offs /year	<ul style="list-style-type: none"> 24 spin-offs active, 100M€/year turnover 900+ jobs 	High success rate, only one failure so far	<ul style="list-style-type: none"> Internal tech transfer program for business case development Soon to be established early-stage tech fund jointly with technical universities: Innovation Industries Fund Shareholder in First Dutch Innovations fund
VITO Venturing (Belgium)	2 spin-offs /year	8 spin-offs active		<ul style="list-style-type: none"> Shareholder in QBIC, an investment fund for spin-offs from Belgian Universities & VITO
VTT Ventures (Finland)	3-4 spin-offs per year	20 spin-offs active	High success rate, only one failure so far	<ul style="list-style-type: none"> Captive evergreen fund investing in VTT technologies with VCs, angels & industrial partners. 23 M€ assets under management, ~2M€/year dry powder & in-kind contribution In 2016 €18M raised in seed & scale-up round In 2016 4 Horizon2020 grants total 6M€ & 2 Horizon Ambassador companies

3. How to Support RTOs' Creation of Deep-Tech Start-Ups for High Societal Impact?

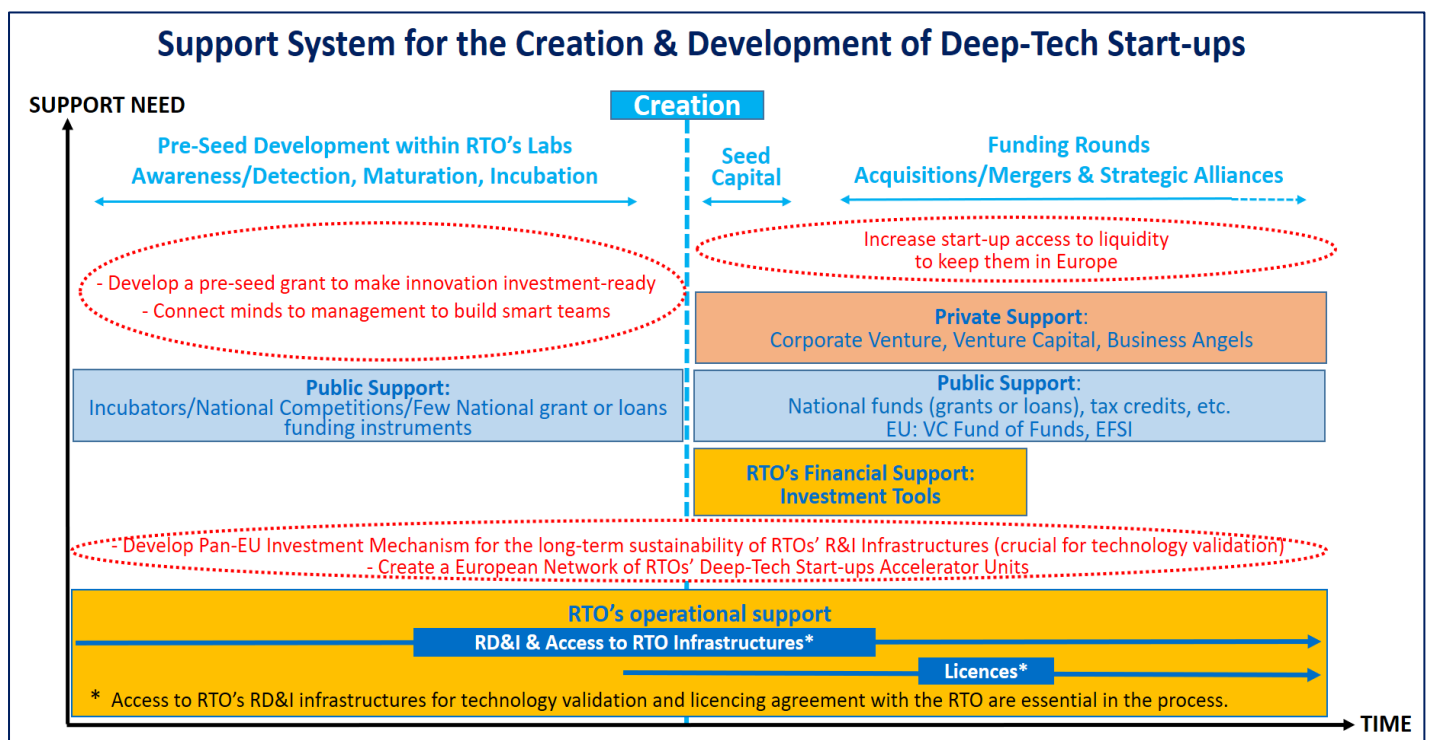
Deep-tech start-ups are key to Europe's competitiveness and industrial renewal, delivering high socio-economic impact, jobs and resilience for society. Contrary to US-type digital companies/unicorns, they have great life expectancy and low rate of failure. However, in order to deliver such good results, the resources they need to make innovation investment-ready are much higher.

RTOs play a crucial role in the creation of these deep-tech start-ups. When developing highly innovative and game-changing technologies, RTOs adopt a market-oriented approach early on, with the mission and objective to develop strong IP and transfer them to the market, either by collaborating with existing companies and supporting them to access technology, or by creating deep-tech start-ups themselves. developing new technologies. However, it is not in RTOs' core business to sustain a pool of entrepreneurs or to have a commercial strategy. We believe public authorities could play a role to support this type of activity which help to make innovations investment-ready.

It is critical for Europe to refocus on strengthening the European Research Area and on developing a strong industrial base, where SMEs and midcap companies, often "the hidden champions" with sustainable company management and strong corporate social responsibility, play a key role. Some support schemes like the SME Instrument, the European Fund for Strategic Investment (EFSI), the EU Start-up and Scale-up initiative including the pan-European Venture Capital Fund-of-Funds, and the Capital Market Union (CMU) already exist at EU level. However, they do not target the specific needs of RTOs' deep-tech start-ups which essentially lie prior to the actual foundation of the spin-offs.

To support the creation of deep-tech start-ups with high life expectancy in Europe and capable to grow in the market, the European Innovation Council and the EC's Start-up and Scale-up Initiative could complement each other. This support should be provided prior to the actual creation of the start-up and focus on aligning the 4 key dimensions (Minds, Management, Market and Money) to create successful deep-tech start-ups able to drive industrial renewal in Europe. This support could include:

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- Linking the Minds: creating a network of RTOs' deep-tech start-ups accelerator units.
- Connecting Minds & Money: pre-seed funding grant to make innovation investment-ready.
- Connecting Minds & Management to build smart teams.
- Connecting Management & Money: access to liquidity after the start-up creation.



3.1 Creating a Pan-European Investment Mechanism for RTOs' Technological Infrastructures

Taking an idea from the drawing board through demonstrations, pilots, and practical development hurdles to commercial success requires expertise and infrastructures that RTOs possess and that can be accessed by deep-tech start-ups. Indeed, RTOs have the role of supporting value chains by managing complex large scale research and technological infrastructures/facilities including multi-use research (prototype) and low-rate manufacturing (test & validation) facilities supporting piloting and pilot-production. These are essential to the creation of deep-tech start-ups but they are too expensive for any single industry investment. Access to RTO in-house infrastructure allows a company to grow and create value with a low capital need. A single research infrastructure can be used to investigate completely new technology piloting and spin-off incubation, to test changes in existing products, and to validate emerging concepts.

However, large scale infrastructures require major investments and highly competent technological staff to be sustainable in the long run. The creation of a pan-European investment mechanism for RTOs' technological infrastructure would therefore be essential to boost the creation of European deep-tech start-ups with high life expectancy after 5 years. Additionally, linking up RTOs' technological infrastructure throughout Europe in a network of accessible facilities for RTOs' spin-off development would be of added-value, facilitating access to relevant equipment and facilities to speed up the prototype development at lower cost possible.

3.2 Creating a Network of RTOs' Deep-Tech Start-Ups Accelerator Units

Connecting RTOs' tech start-ups and business accelerator units would also be very beneficial in terms of efficiency gain. This would also contribute greatly to a stronger European Research Area. Such network could for instance be set-up through a Horizon 2020 CSA project in the Work Programme 2018-2020, with the objective for instance to:

- Create opportunities for RTOs' deep-tech start-ups to collaborate by cross-linking the web sites describing the spin-offs and their patents or sharing information and experience on public instruments.
- Create a network of RTOs' technology infrastructures that can be used for validation and piloting by other RTOs' deep-tech start-ups.
- Share information on RTOs' patent portfolio to look at complementarities and create incentives for RTOs to commercialise another RTO's IP.
- Increase collaboration between RTOs towards IPR brokers by sharing experience, but also creating a map of IPR brokers known, selecting joint IP portfolio/pool for brokers in a selected sector, etc.
- Launch common web-based services for networking/ matchmaking managers with RTOs' business opportunities.
- Increase collaboration between RTOs towards investors by sharing information on opportunities for investment/investment-ready technologies, building cross-links and a joint access (web site) for investors to access the whole range of opportunities/ deal flow of RTOs, and creating a bi-yearly show-casing of top 15 European investment opportunities in deep-tech with proven potential for Global VC to invest in.
- Developing common programmes or "innovation challenge" to encourage RTOs' technology experts to create deep-tech start-ups.

3.3 Developing a Pre-Seed Funding Grant to Make Innovation Investment-Ready

With the overall decrease in RD&I public & private investment in Europe, RTOs' own resources also tend to decrease, making it increasingly difficult for them to transfer high potential innovation through the creation of deep-tech start-ups. Indeed, such means of technology transfer require continuity and high operational and financial investments from RTOs, at a time when their financial constraints require them to focus more on more on short-term contract research.

RTOs need support in the form of grant-financing schemes focussing on the maturation and incubation phase (pre-seed funding), with the aim to make innovation investment-ready, increasing both the technological and commercial readiness-level. Indeed, private investors cannot invest at that stage, as they lack the expertise to assess the combined value of what technology can do in the targeted application field.

This pre-seed development therefore needs to be supported through public instruments, with the objective to make the innovation ready for private investment. This type of activity requires grant-

funding schemes, equity being too risky at that stage. In addition, this extra support would make it possible to increase the length of the maturation/incubation phase, helping to secure the market of the future deep-tech start-up, ensuring that there are at least 2 or 3 customers for the new product, therefore improving even more the chances of success of the spin-off.

In some European countries, national grant-funding instruments for the maturation/incubation stage can support RTOs in making their market-creating innovations investment-ready. For instance:

- In Finland, Tekes has a limited but well working pre-seed grant funding instrument supporting this commercialisation/maturation/incubation phase at national level with €20M/year pre-seed funding grant with the main target to transfer technology to the market through the creation of deep-tech start-ups. Project financing includes 60% Tekes grant and 40% RTOs' funding, and content encompasses proof of concept, technology improvement/maturation for a better business case.
- In Germany, the EXIST Transfer of Research Program is another good example of technology transfer grant-funding to develop an MVP (phase 1), to build business case (phase 2), and to attract capital (phase 3).

However, such national instruments are limited and not available in all countries. They are mostly focussed on low to medium scale investments and cannot fund the large, high potential, high risk, deep-tech investment, which are the ones that have the highest potential impact. The EU could therefore develop a pre-seed funding grant scheme with a bottom-up approach targeting a few game-changing and market-creating deep-tech innovations with scale-up potential, which could have high benefits, supporting jobs, growth and competitiveness in Europe.

3.4 Connecting Technological Experts to Entrepreneurs to Build Smart Teams

Building strong, smart and versatile teams around a motivated entrepreneur/ intrapreneur willing to convert disruptive technologies into ready-to-invest business opportunities is an essential success factor in deep-tech start-up creation. A smart team drives the innovation towards the market, helping to attract industrial clients and investors.

However, while the Chief Technology Officer of the new deep-tech start-up usually comes from the RTO's staff, this is most of the time not the case for the CEO. RTOs need to find motivated and experienced entrepreneurs /intrapreneurs with good knowledge of the market to lead the team. However, it is hard to find strong commitment with that level of risk at early stage. To solve this issue, some RTOs developed support mechanisms to find the right entrepreneur/intrapreneur for their deep-tech start-ups, including:

- advertising RTOs as places to start new ventures,
- headhunting,
- creating links with business schools throughout Europe,
- making deals with partners (retainer/success fee on company),
- launching new web-based services for networking/ matchmaking managers with business opportunities.

As finding entrepreneurs is not the core-business of RTOs, this effort should be supported at EU level to better connect technological experts to entrepreneurs with strong market insights. This could be done by creating a pool of entrepreneurs/intrapreneurs with market insights looking for high potential business opportunities, and connecting it to a pool of untapped RTOs' technological potential. This could be complemented by using a pool of seasoned "entrepreneurs" as mentors to support less experienced ones.

3.5 Access to Liquidity after the Start-Up Foundation to Keep Them in Europe

After the start-up creation, once they reach a certain stage in their scaling-up process, many of the deep-tech start-ups that were nurtured in the EU tend to move out of Europe to places where funding is more easily accessible, with less regulatory constraints. This has been the case for several RTOs' deep-tech start-ups, and often RTOs do not have the means on their own to provide the liquidity that these companies require, thus preventing them from moving overseas.

Although not part of RTOs current core-business, they try to help fill this gap by extending the financial support they can give to deep-tech start-ups after the seed-funding round. However, RTOs have limited funding to dedicate to this activity. There is therefore a strong need for an increased public and private support to provide liquidity to those start-ups at a later stage after their creation. Only then would the high investment they require be worthwhile and potentially leading to creating

jobs and growth in Europe. This should be understood as a strategic opportunity for Europe, an opportunity that creates continuity and true added value.

The European Fund for Strategic Investment (EFSI), the EU Start-up and Scale-up initiative including the pan-European Fund-of-Funds, and the Capital Market Union (CMU) are already trying to bridge this gap and overcome capital shortage by increasing the availability of liquidity and venture capital funding in Europe. Indeed, stimulating seed and early round investors to work beyond the national or regional level on a more European scale would help prevent the lack of investors within the small countries or regions. This could be complemented by improving the regulatory framework in Europe to attract foreign investors from overseas. Show-casing the top European investment opportunities with proven potential in deep-tech twice a year could for instance help attract foreign investment.

EARTO hopes this short analysis will bring forward some further thinking on how to better exploit the untapped potential of European innovative deep-tech start-ups to boost jobs and growth in Europe.

RTOs - Research and Technology Organisations

From the lab to your everyday life. RTOs innovate to improve your health and well-being, your safety and security, your mobility and connectivity. RTOs' technologies cover all scientific fields. Their work range from basic research to new products and services development. RTOs are non-profit organisations with public missions to support society. To do so, they closely cooperate with industries, large and small, as well as a wide array of public actors.

EARTO - European Association of Research and Technology Organisations

Founded in 1999, EARTO promotes RTOs and represents their interest in Europe. EARTO network counts over 350 RTOs in more than 20 countries. EARTO members represent 150.000 highly-skilled researchers and engineers managing a wide range of innovation infrastructures.

EARTO Contact: Muriel Attané, Secretary General, attane@earto.eu, Tel: +32 2 502 86 98