Access to finance for Research and Technology Organisations (RTOs) and their academic and industrial partners

Final Report

Prepared for:

European Commission
DG Research and Innovation

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Luxembourg, March 2017

Foreword

Research and Technology Organisations (RTOs) play a pivotal role in the European business landscape. They bring together individuals from across the innovation chain, providing a dynamic and essential connection between research and industry. They help breathe life into the ideas which they steer from laboratory to market. Their role is consequently vital in a context of a wide investment gap in Europe, in particular in innovation, an area which is so critical to our long-term competitiveness and will underpin sustainable growth and job creation.

Access to adequate finance delivered via appropriate channels is an essential condition of success for all companies, and especially for innovative ones. I would therefore like to congratulate the European Association of Research and Technology Organisations (EARTO) for the leadership that it has shown in initiating the InnovFin Advisory mandate which led to this report. In seeking to identify ways of broadening access to finance for its members, EARTO has taken a vital step towards improving the financial environment in which they operate.

This study shows that the European (public) funding landscape for R&D and innovation is changing rapidly. While grants are, and will remain, an important source of financing for RTOs, their uncertain future creates challenges. This may, however, also create new opportunities, as new and optimised business modelling and the enhanced knowledge and expertise of the financial community may help to diversify funding sources, while Open Innovation will help RTOs to become even more relevant for industry and thus generate additional streams of income. An optimised use and effective leveraging of grant funding by RTOs may help attract complementary sources of return-based financing.

The EIB Group and the European Commission Directorate General for Research and Innovation have joined forces to give life to more than EUR 25 billion of investment under the InnovFin programme. Thanks to Horizon 2020 support, this study has been able to benefit from the appropriate resources, attention and skills, and I wish hereby to thank Commissioner Moedas for the excellence collaboration. As a proactive financier of R&D and innovation, the EIB group intends to further support this transformation process. In 2015 alone, we invested EUR 18.7 billion in innovation and skills, of which EUR 4.9 billion was directed to the RDI sector. Tools such as InnovFin and the European Fund for Strategic Investments have significantly boosted our capacity to support innovative ideas and deliver in this sector.

As the EU bank, we understand the challenges that many RTOs face in raising finance. The EIB Group is ideally placed to help RTOs in their quest for new funding models. We are ready to build on our existing range of financial instruments to deliver advice and products which will help RTOs optimise their funding possibilities. I extend a warm invitation to EARTO members to contact the EIB with their project proposals and look forward to developing our engagement as in a joint effort we seek to bring innovative ideas to market.

Werner Hoyer
President of the European Investment Bank

Statement by Commissioner Moedas

I would like to thank EARTO and the European Investment Bank (Innovation Finance Advisory) for carrying out this important new study developed under the InnovFin – EU Finance for Innovators advisory mandate.

The mission of Research and Technology Organisations (RTOs) is to harness science and technology in the service of innovation, to improve quality of life and build economic competitiveness. They are increasingly acting as hubs within the innovation eco-system, bringing together key innovation actors across the innovation cycle from fundamental research to commercialisation. They are generally non-profit organisations; revenues from commercial exploitation are used to fund new innovation cycles and to facilitate a virtuous cycle of investment.

EARTO members are involved in all parts of Horizon 2020, strongly contributing to increasing its impact on innovation. Our figures show that EARTO members by June 2016 had received 7.7% of all the funding granted under Horizon 2020 up to then, while representing only 1% of all the beneficiaries under the programme. RTOs are promoting growth and job creation across the European Union: an EARTO study has established that in 2014 each job in an RTO generated a total of three new jobs elsewhere and that for every public €1 invested in an RTO, governments had a return of €3.8.

I encourage RTOs to actively explore the full range of InnovFin and EFSI products to diversify their funding options. The recent move by RTOs to pursue market driven innovation and support their spinoffs can be financially supported by new InnovFin Equity financial instrument which aims to facilitate technology transfer by financing the transfer of the results of publicly funded and performed research to for-profit entities. The financing covers the pre-seed stage of proof of concept and commercialisation via a spinout or, where appropriate, through licencing. Furthermore, a range of quasi-equity and debt type financial instruments is also available to support the planned investments by the RTO community. It is very encouraging to see that RTOs are pro-actively looking at new ways of funding and see in this period of change great opportunities to capitalise on their specific know-how and skills in ways they had never imagined before.

Carlos Moedas
Commissioner for Research, Science and Innovation

Statement by the President of EARTO

Research and Technology Organizations (RTOs) play a crucial role in Europe's innovation system. They focus on applied research and partner with companies to transform original ideas (TRL 1) into innovations (TRL 9) that benefit society and strengthen the European economy.

RTOs are non-profit organizations which finance their business through base funding from regional and/or national governments as well as through publicly funded research and contract research with industrial partners.

The financing model of the European R&I system is increasingly getting under pressure. Stakeholders are asking the impact question and want to see a higher or faster return on the investment in research. The challenge is to close the gap between the availability of research results and the readiness of the market to turn these results into innovative products or services.

In order to tackle this challenge, EARTO and the EIB have been working together for more than a year and a half on learning from each other's business approach. This effort was triggered by the creation of the new Juncker Plan in 2015 which relaunched also the debate on using loans versus grants for the funding of research.

While loans are no options for the majority of the RTOs, many EARTO members consider some of the EIB financing tools as a possible complement to the funding options at hand.

This report presents an interesting tool set, which invites the EARTO members and EIB to further explore new ways of financing the technology transfer on its way to the market. And we are happy to see that a first group of EARTO members is already looking very seriously into these new options.

Our challenge now will be to follow the various discussions started and to get jointly through the learning curve. In the current economic and political European context, coherence of R&I funding instruments will be key for our future. Such joint efforts are stepping stones in this direction: R&I actors such as RTOs are the ones to create synergy by using the various funding tools which are at their disposal. The role of policy-makers is to propose the proper tools in the most efficient and coherent way possible. Open dialogue and exercises such as this one will be key to ensure comprehension on both sides and to support that R&I actors as well as policy makers work hand in hand together to create a more efficient R&I system in time where resources are getting limited.

Many thanks again to the EIB and the EC for having supported this joint effort! We are looking forward to discussing and working further on the findings in this report.

Frank Treppe
President EARTO

Acknowledgements

We would like to take this opportunity to express our gratitude to those who supported and actively contributed to this study.

In particular we would like to express our sincerest thanks to the European Association of Research and Technology Organisations (EARTO), Muriel Attané (Secretary General) and Talita Soares (Senior Policy Officer) for their active and dedicated support throughout the study. Furthermore, we would like to thank the members of the EARTO Working Group Financial Experts for their constructive feedback and inspiring discussions, and all the individual RTOs that have participated in the survey and bilateral interviews.

At the European Investment Bank Group (EIB Group), we would like to thank the EIB Operational Department, the EIB Project Directorate and the European Investment Fund.

Disclaimer:

European Investment Bank

List of abbreviations

AC	Associated countries
CEBF	Connecting Europe Broadband Facility
CEF	Connecting Europe Facility
CMU	Capital Markets Union
EARTO	European Association of Research and Technology Organisations
EIB	European Investment Bank
EIF	European Investment Fund
EC	European Commission
EFSI	European Fund for Strategic Investments
ERIC	European Research Infrastructure Consortium
ESFRI	European Strategy Forum on Research Infrastructures
FCF	Free cash flow (also referred to as CF in figures and tables): the essence of FCF for analysis is cash flow from operations less capital expenditures needed to maintain its current growth. Rating agencies use adjusted definitions of FCF
FOAK	First-of-a-Kind
FP	Framework Programme
H2020	Horizon 2020 programme, the EU Framework Programme for Research and Innovation
HC	Head count
IIC	Infrastructure for Innovation and Commercialisation
IFA	Innovation Finance Advisory, European Investment Bank, Horizon 2020 programme
IP	Intellectual property
JV	Joint venture
LSI	Large-Scale Infrastructure
MIN./MAX.	Minimum/maximum
MS	European Union Member State
NPI	National Promotional Institution or Bank, acting on a local, regional or national level with financing activities and that has a developmental and/or promotional mandate from the relevant authority
PE	Private equity
RI	Research infrastructure
RDI	Research, development and innovation
R&D	Research and development
RSFF	Risk Sharing Finance Facility
RTO	Research and Technology Organisation
SET	Sustainable Energy Technologies
SME	Small and medium-sized enterprises
SPV	Special purpose vehicle
TBD	To be defined
TRL	Technology Readiness Level
TT	Technology transfer
TTO	Technology transfer organisation

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1. Executive summary

Key messages

RTOs fulfil a crucial role in Europe's R&D and innovation system by bridging industry and academia and by adding value across the entire innovation value chain. In 2014 alone, the nine largest RTOs generated total value added of EUR 14bn.

Grants are, and will remain, a critical and fundamental source of financing in the RTOs' overall funding mix, especially for core activities like competence building and, albeit partially, technology development.

The European (public) funding landscape for R&D and innovation is changing rapidly. The future availability of grants (especially core funding) is becoming increasingly uncertain but at the same time **new opportunities and sources of (repayable) financing are becoming available to the RTO community**. These sources span from debt to quasi-equity and equity financial instruments, and include products such as Venture Capital and Technology Transfer Funds.

These changes provide the option to use grants even "smarter", i.e. even further, for the financing of non-commercially viable activities, and **leverage them even better towards the attraction of complementary sources of return-based financing** (as provided by the EIB Group, for example). This is expected to further strengthen the growth-driven funding models ("1+1=3") of several RTOs.

For some RTOs existing **business model could be further optimised and complemented** in order to reposition part of the current activities and, where possible, introduce a more commercial and market-driven perspective. The evolution of **Open Innovation** may provide opportunities to further strengthen the relations with industry and generate new income streams that could open the door to more commercial types of financing for current and future investments.

Financial knowledge and technological understanding are important and should be further leveraged in the innovation ecosystem. First, not all RTOs may have the necessary knowledge of project and financial structuring. Second, financial players should be supported by bringing technological know-how into the financial and due-diligence process. RTOs could play a role in providing this know-how and as such develop new services and associated streams of income.

RTOs should consider to what extent their **current financing mix can be broadened by smartly mixing grant and repayable sources of financing**. The EIB Group offers a broad range of financial products and advisory services and welcomes the opportunity to further engage with the RTO community in the discussion of concrete investment plans and projects.

Background

Research and Technology Organisations (RTOs) are defined as organisations *"whose predominant activity is to provide research and development, technology and innovation services to enterprises, governments and other clients".*

The core mission of RTOs is to harness science and technology to serve innovation, improve quality of life and build economic competitiveness. RTOs operate across the innovation value chain, from fundamental to technological research, through product and process development, prototyping and demonstration, to applications in the public and private sectors. A recent study[1] on the economic footprint of the nine largest European RTOs (imec, CEA, DTI, VTT, Fraunhofer, TNO, SINTEF, Tecnalia, and SP) showed that, in 2014, these RTOs generated an aggregate of 225,860 jobs in head count (HC), a turnover of EUR 29.3bn and total value added of EUR 14bn[2] (including RTO core activities, bilateral contract research and spin-off activities). On average, for each job in an RTO another three jobs are created elsewhere in the European economy. These numbers clearly indicate the economic importance of RTOs for the European economy.

After approval by the European Parliament, the EU Council adopted the regulation on a European Fund for Strategic Investments (EFSI) on 25 June 2015. EFSI, aiming to mobilise private finance for strategic investment, is one of the three pillars of the Investment Plan for Europe (http://www.eib.org/efsi/). EFSI is a EUR 16bn guarantee from the EU budget, complemented by a EUR 5bn allocation from the EIB's own capital. The EU funding was secured by redeploying grants from the Connecting Europe Facility (transport, energy and digital networks) and the Horizon 2020 programme (research and innovation), as well as unused margins in the EU's annual budget. Particularly relevant to the RTO ecosystem was the EUR 2.2bn reallocation of Horizon 2020 funds. As a result of this budget reallocation, RTOs and their partners needed to further consider how EFSI financing, and by extension other repayable sources of financing, could be accessed in a complementary way alongside grants.

On 27 April 2015, the EIB's Innovation Finance Advisory, in close collaboration with the European Commission, organised a workshop with representatives from the RTO community, the EIB Group, the EC (DG RTD) and the European Association of Research and Technology Organisations (EARTO). The main objective of this workshop was to exchange information on activities, trends and developments relevant to the financial sustainability (such as the rollout of EFSI and the broader Investment Plan for Europe) of RTOs and their partners. The workshop demonstrated that RTOs and their partners face very specific challenges in obtaining the necessary funds for infrastructure development (e.g. test facilities and equipment) and for spin-out/special purpose vehicle (SPV) creation. In view of the difficult budgetary climate on research, development and innovation (RDI) in many Member States, it was concluded that it was essential to actively support the RTO ecosystem in re-engineering and/or complementing existing financial models, where needed, in order to contribute towards better access to finance.

[1] IDEA Consult (2015), Economic footprint of 9 European RTOs, Brussels
http://www.earto.eu/fileadmin/content/02_Events/EARTO_Economic_Footprint_Study/EARTO_Economic_Footprint_Report_-_final.pdf
[2] Values correspond to the aggregated economic effect of the nine RTOs from their core activities, contract research and spin-offs.

In the conclusion of the workshop, EARTO's President asked the European Commission and the EIB Group representatives to consider a dedicated Innovation Finance Advisory (IFA)[3] assignment to assess the existing funding situation and develop new funding models for RTOs. EARTO and its members would fully support the implementation of the study. Subsequently, in June 2015, IFA developed a dedicated study in close collaboration with the European Commission and EARTO[4].

Study objectives

The specific objectives of the study were the following:

1. Review the current business models of RTOs
2. Assess the funding needs of the wider RTO community
3. Propose potential funding mechanisms that could channel EIB Group funding (incl. EFSI, potentially the NPBs, and InnovFin) to RTOs
4. Test these solutions in concrete cases with interested RTOs and their partners (possibly through Light Project Advisory)

The study shows that the RTO ecosystem is highly granular and diverse. RTOs differ significantly in view of their legal form, geographical reach, size and scale, business model, sector of activity, funding strategy, capital structure and project development strategy. **As a result, not all the conclusions and recommendations provided throughout the report are equally relevant and applicable to all RTOs.** Nevertheless, the insights obtained reflect the experiences of a sizeable group of European RTOs active in a variety of European countries and technological domains (including energy and climate, life sciences, ICT and microelectronics, space and aeronautics, food and agriculture, etc.).

The key conclusions and recommendations will be presented below.

Key conclusions

1. Grants are, and will remain, a critical and fundamental source of financing but the (public) funding landscape is rapidly changing and new opportunities are arising for RTOs to sustainably diversify their funding mix in support of their future growth ambitions.

Grants, provided by public authorities, are and will remain a critical and fundamental source of financing in RTOs' overall funding mix, especially for core activities like competence building and, albeit partially, technology development. However, uncertainties regarding the continuity of national and pan-European programmes and the associated availability of grants for RDI (mainly grants for core funding but not necessarily for competitively bid project funding), in combination with the overall risk retrenching and risk appetite of the financial sector challenge the traditional funding and business models of RTOs. RTOs indicate that it is becoming increasingly difficult to

[3] http://www.eib.org/products/advising/innovfin-advisory/index.htm

[4] The study (part of the work programme of IFA) focused on the broader (financial) ecosystem in which RTOs operate, reflecting the open innovation collaboration model of RTOs and their partners, and was implemented in three phases (preparation, data collection and analysis, integration and final reporting) in close collaboration with EARTO and a working group of RTOs (CEA, France; CSEM, Switzerland; Fraunhofer, Germany; Imec, Belgium; SP and RISE, Sweden; Tecnalia, Spain; TNO, The Netherlands; TWI, United Kingdom; VTT, Finland). The approach included a targeted survey, which was launched and followed-up by EARTO, and a series of in-depth bilateral discussions. Finally, the study was implemented in close collaboration with the EIB Operational Directorate.

obtain the necessary funds for capital intensive and risky infrastructure, facilities and equipment, spin-outs/SPV creation and the financing of technology development/transfer projects at Technology Readiness Levels (TRL) 7-8. Grants will remain an important budget line in RTOs' financial models but the question is how they can be complemented and further leveraged with other sources of financing in order to move to a stronger funding mix (while safeguarding the grant based core activities of RTOs, which is the development of new knowledge). The EIB Group, in cooperation with the EC, offers a wide range of financial products and advisory services (see below and Chapter 6) that can help RTOs and their partners to broaden their funding mix, especially for the financing of commercially viable investment proposals. This allows RTOs to use grants even smarter, primarily for activities with a strong public benefit and that cannot become commercially viable or bankable.

2. RTOs are aware that further diversification of funding sources, where possible and feasible, is not only a nice-to-have, but is also becoming a necessity.

The results of the market consultation (survey and bilateral discussions) show that RTOs in general rely heavily on grant funding for their operations (central of which is the development of new knowledge) and investments. Grants, and in particular core funding, are often unsustainable sources of financing in terms of duration (often short-term), volume and policy/political priority. The short-term nature of grants can be expected to result in structural asset-liability mismatches in RTOs' balance sheets, leading to an undesired level of refinancing risk. This would particularly be the case with financing of infrastructure and technology transfer projects with extended periods to commercialisation and long-term returns. The RTOs surveyed indicated that they intend to finance future investments mainly from own funds (capital and reserves, the latter being a form of equity), along with public support/grants. During the discussions with RTOs it became clear that they are aware of the need to further diversify their funding sources in order to sustain and even strengthen current levels of investment. Diversification of funding sources is expected to be a difficult process that needs to be well-coordinated with all stakeholders involved (RTOs, industry, academia, the financial community and policy makers at regional, national and European levels). Further optimisation, and perhaps innovation, in the current business models of some RTOs will play a pivotal role in this diversification process.

3. For some RTOs, business model optimisation, and possibly innovation, following an open innovation model will be instrumental in further diversifying funding sources beyond grants (i.e. debt, equity, equity-like financing).

Despite the fact that on average the RTO community as a whole is successful in attracting private sources of income the distribution seems to be rather skewed. Some of the RTOs surveyed have financial and business models that lean strongly on public core funding (grants) as their key funding source while others indeed show high levels of private income generation. The generation of sufficient private income and customer revenues as part of overall (free) cash flow generation is one of the preconditions for so-called "bankability" and associated repayment capacity of projects and investments, but there are others as indicated under point 4.

Following an open innovation approach whereby collaboration and knowledge sharing takes place beyond the boundaries of individual actors may lead to new commercialisation trajectories and the generation of new sources of income. As industrial partners may increasingly outsource (parts of) their R&D to RTOs on the basis of long-term contractual agreements[5], this could generate additional substantial and continuous revenues. In order for this to succeed, openness and co-creation among the different partners in the RTO ecosystem are essential. Commercially viable business models and a better understanding of the risk profile of specific projects are essential to better match the risk profile of the investment community and as such broaden the available sources of finance.

4. There is a bi-directional knowledge gap between the RTO and the investor community that needs to be addressed. In addressing this gap, RTOs could provide technological know-how to investors and as such develop new services and associated income streams.

The knowledge gap between the "deep tech"/RTO community and investors[6] goes in two directions. RTOs often lack the necessary credit risk structuring knowledge at the project inception stage and are perhaps less aware of the risk sensitivities of the investment community or are uncertain about how to address these, which may negatively impact the bankability prospects of otherwise technologically sound projects. Financial investors also often lack the specific industry/technology knowledge needed to fully assess an RTO-project proposition. Investors will perform a balancing act of due diligence effort and project risk versus expected return. Non-specialised investors (such as venture capitalists) have limited capacity to develop internal expertise in the vast spectrum of outstanding and to-come technologies, fields of application and commercialisation. Limitations to in-house due diligence combined with lack of in-depth understanding of a technology, of its development risks and of its commercialisation potential feed significant uncertainty into the project. This lack of knowledge will often lead to a high risk allocation to the project concerned, which may impede investment (i.e. investors' internal risk limits) and/or may divert investors to alternative (less risky/better understood) investment options. RTOs could provide the necessary technological know-how to investors and their due diligence process and develop a new business activity or service, which could generate a new stream of income.

5. As a consequence of the above-mentioned factors, debt currently plays a minor role on RTOs' balance sheets.

As some of the existing RTO business models seem not to be fit-for-purpose to attract commercial financing, it is not surprising to acknowledge that debt plays a minor role in the "on balance sheet" capital structure of most RTOs surveyed (over 80%). The debt-to-equity ratio shows that on average, over the period 2012-2014, the RTOs surveyed had a level of indebtedness below 10%. The debt-to-total-assets ratio shows, as expected, a somewhat lower

[5] The evidence on increasing levels of R&D outsourcing by companies is rather fragmented and sector specific. The R&D outsourcing trend in the entire life sciences sectors is quite compelling just as it is for other high-tech industries like ICT. Systematic data on the subject are not available but EARTO has strongly reflected on the topic in the past (click here); an academic view on R&D outsourcing can be found here: http://www-management.wharton.upenn.edu/guillen/PDF-Documents/RD_Outsourcing_JIM-2012.pdf

[6] A similar conclusion was drawn in the recently published IFA report on access to finance for KETs companies: http://www.eib.org/infocentre/publications/all/access-to-finance-conditions-for-kets-companies.htm

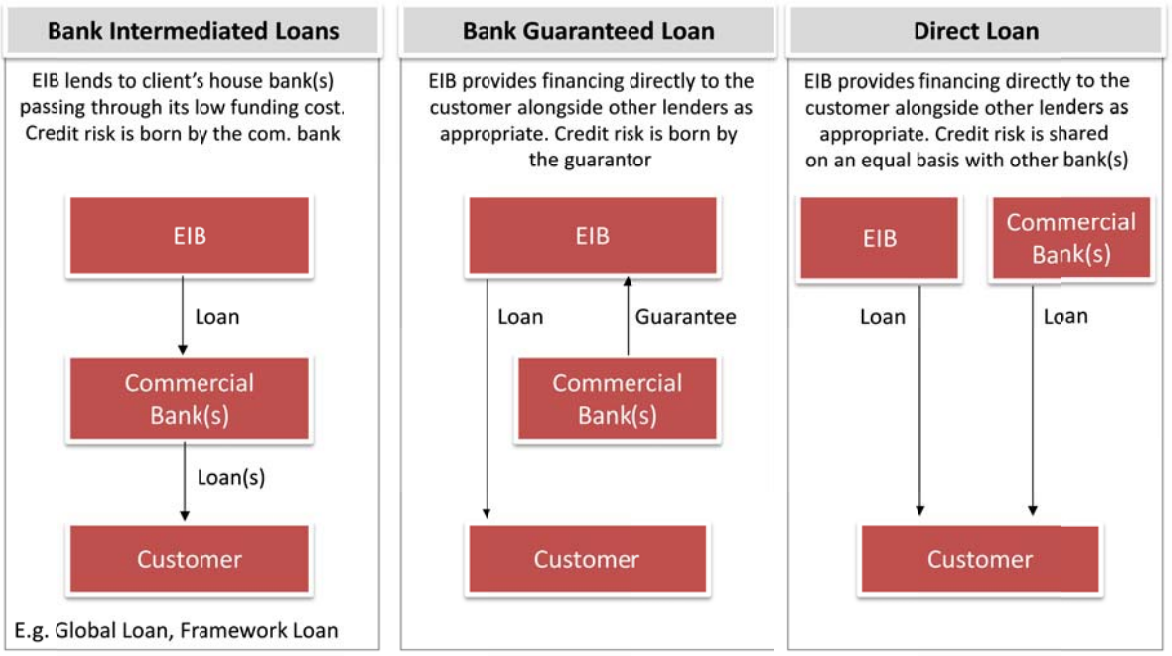
ratio, suggesting that RTOs are currently not that leveraged. However, for some RTOs this may be the result of a limited capability to generate sufficient (free) cash flows and/or to mitigate associated investment risks, rather than an indication of existing unused debt capacity. Some privately owned RTOs (like TWI in the UK) show higher levels of debt financing compared to public and mixed ownership RTOs[7]. Most RTOs surveyed do not face any formal/legal restrictions to raising debt (see Chapter 4 for more details) but there RTOs that do.

Over the period 2012-2014, the RTOs surveyed indicated that they invested in RDI infrastructure, such as in pilot plants, research facilities and laboratories. Investment needs were also attributed to equipment requirements, such as research and ICT equipment, yet to a lesser extent. These investments were mainly (53%) financed from own funds (capital and reserves, the latter being a form of equity), followed by public funding/grants (38%).

6. The EIB Group, in collaboration with the European Commission, already offers a well-balanced set of financial instruments and advisory services for the RTO ecosystem.

The EIB Group has a long-standing track record of providing financing to support research, development and innovation (RDI) through a set of financial instruments under different programmes and mechanisms. The classic EIB loan types are illustrated in Figure 1.

Figure 1: EIB loan types[8]



The EIB Group has a well-established track record of (co-)financing of research infrastructures such as CERN, the European Space Observatory and the European Synchrotron Radiation Facility, and to a lesser extent the direct financing of infrastructure for innovation and commercialisation projects (see Section 7.3). Regarding technology transfer projects, the EIB Group is making progress in covering the funding gap of sound RDI projects with instruments such as the InnovFin

[7] Results could vary depending on whether spin-off financing has been accounted for and if so, if in full.
[8] com.: Commercial

Energy Demo Projects Facility, Infectious Diseases Finance Facility and the MidCap Growth Facility, which will be further strengthened under EFSI, the Investment Plan for Europe (see Annex 2 for an overview of relevant EIB/EC financial instruments).

There are already a number of financing schemes that would be relevant/of interest to RTOs, such as:

- The InnovFin Energy Demo Projects Facility provides thematic finance from EUR 7.5m to EUR 75m for RDI first-of-a-kind (FOAK) projects in the field of renewable energy and hydrogen/fuel cells. In the context of Innovation Finance Advisory's work – e.g. on circular economy or bioeconomy – it has been recommended to broaden the scope of this facility to other technology areas, making it even more relevant for RTOs and their partners.
- The Infectious Diseases Finance Facility aims to stimulate investments in the development of innovative vaccines, drugs, medical and diagnostic devices, and novel research infrastructure for infectious diseases. The loans provided vary between EUR 7.5m and EUR 75m. Final recipients are project developers that have successfully completed the pre-clinical stage and now need clinical validation or to be ready for later stage clinical trials. This financial instrument is relevant for RTOs, and their partners, active in the healthcare sector.
- The European Fund for Strategic Investments (EFSI) mobilises additional investments in areas including infrastructure, education, research, innovation, renewable energy and energy efficiency. It also focuses on SMEs and midcaps (companies with between 250 and 3,000 employees). Under EFSI, RTOs are eligible to receive financing for projects that pass the EIB's standard due diligence practices.
- Under the EFSI Investment Platform instrument, the EC and the EIB are in the process of setting up a commercial fund of EUR 500m to address the investment challenge for broadband projects in less dense areas. The Connecting Europe Facility (CEBF) is designed to ensure that smaller companies and projects get a fair shot at financing. The scarcity of financing solutions is particularly pronounced for smaller projects; therefore the focus of the CEBF is on transactions lower than EUR 30m. The funds from the Connecting Europe Facility (CEF), EFSI and the EIB, together with capital from NPIs and the private sector, will be invested in economically viable broadband projects. Although the thematic scope of the CEBF may only be relevant to a selected group of RTOs, the possibility of setting up sectorial/thematic Investment Platforms may be relevant to the broader RTO community.
- EIF is already a large investor in the space of technology transfer and commercialisation[9], and the role of EIF is increasing in importance and scope. As of July 2016, 34 equity investments have been made into technology transfer (TT) & intellectual property funds, totalling EUR 596m. Of these investments, 21 were made since 2013 (EUR 435m). EIF's investments are supported by e.g. EFSI, InnovFin and EIB Group resources, and NPIs investing in the sector through investment programmes in the context of the EIF-NPI Equity Platform. EIF provides equity financing on commercial terms to private equity investment funds, managed by independent fund managers. Target beneficiaries of these funds are

[9] For detail, see Annex 2 and http://www.eif.org/what_we_do/equity/technology_transfer/index.htm

early stage projects (including RTO projects), SMEs and midcaps. As a cornerstone investor and often key negotiator of the relevant agreement(s) and (governance) structure of the fund, EIF's participation in a fund has a strong catalytic effect in attracting other investors. RTOs can participate in EIF's equity financing activities of technology transfer, commercialisation or early stage venture capital funds by investing in these projects alongside EIF. Additionally, RTOs can participate in and benefit from EIF investment programmes as partner institutions of fund managers supported by EIF (see Annex 2 for more information on investment process).

RTOs can also benefit from a wide range of existing advisory services that can help them to improve the design and the bankability prospects of RTO projects. During this study Innovation Finance Advisory (EIB) signed advisory services agreements with two RTO-driven consortia. The first concerns the development of an R&D infrastructure project in energy, the second concerns the commercialisation of a new generation of display manufacturing technology. Requests for assistance could, among others, be received through the European Investment Advisory Hub (http://www.eib.org/eiah/index.htm).

Key recommendations

Finance-related recommendations

1. In order to diversify their funding sources, RTOs should consider further optimising and complementing their business model and finance strategy in order to grasp the new financing possibilities offered to them.

There is a need to optimise and complement RTOs' traditional business model and funding strategies with new additional business models and funding strategies to allow them to successfully navigate through a changing funding landscape and make full use of existing business opportunities. The optimisation of existing models and the addition of new commercially viable business models, together with a better understanding of the risk profile of specific projects in order to better align its risks with the investment community need to be addressed at two levels:

1. The addition of repayable instruments to grant-based funding schemes requires a business model that generates sufficient cash flows to service debt raised by the RTO directly, and as such to support and/or guarantee financial obligations at the investment project level.
2. Moreover, RTOs could develop knowledge and expertise on project risk assessment and potential mitigating factors to ensure that the overall risk profile fits with the risk appetite of the investment community as far as possible. This is expected to improve overall "bankability" prospects and in the end lead to easier access to finance (see Chapter 6 for more background).

The above requires knowledge of specific technologies and markets, but also knowledge of the financial sector, risk structuring, credit risk drivers and risk assessment methodologies and of the investors' decision-making processes. While some RTOs are more advanced than others, the need to build internally their finance-related knowledge alongside R&D, technology and sector knowledge has to be fully recognised.

Subsequently, all stakeholders involved have a role to play in supporting the RTOs to do so. EARTO could play a role in providing a platform for knowledge exchange and guiding of RTOs to financial market specialists and advisors. European, national and/or regional policy makers should also support the RTOs by putting in place the right incentives and by creating the right framework conditions. Depending on the maturity level of the underlying project Innovation Finance Advisory can be one of the actors playing a role here as well, as it already does in a number of ongoing advisory trajectories with individual RTOs (as mentioned above).

Intensified cooperation (and co-investment) within the entire RTO ecosystem could also be central to a new business model. Open innovation, whereby industry increasingly outsources (parts of) its R&D activities[10] to RTOs may provide new business opportunities and streams of income. Furthermore, fostering improved connectivity across technology developers, supply chains (in particular in the case of First Of A Kind - FOAK) and thus also among RTOs themselves (in view of the pivotal and connecting role) is important in order to be able to compete on a global level and ensure a supportive and cohesive financing ecosystem.

2. Grants should be used as smart as possible to mainly finance activities that are not bankable (such as competence building and technology development) and to pull in public and private sources of repayable finance.

As access to grants becomes more uncertain (especially grants for core funding), RTOs are already focusing on generating more income from private sources. This often brings along a more short term perspective than is perhaps adequate for long-term strategic R&D programming. Some RTOs can do more to further optimise and innovate in their business model (e.g. by making it more entrepreneurial) in order to expand their finance mix with repayable sources. Furthermore, the limited availability of grants requires optimisation in their use by for example a good alignment between the (future) R&D project portfolio and the finance portfolio. Competence building, knowledge development (core functions), lower TRL levels and/or special projects (see Section 3.2 and Chapter 5) are prone to grant (non-refundable) financing due to their non-cash generating nature. RTOs should endeavour to finance projects at higher TRL stages with alternative and repayable sources of funding. Alternative and longer-term sources of repayable financing would also address the potential refinancing risk that short-term grants (due to their volatility) may introduce to a project.

3. Policy-makers should support RTOs to optimise the use of existing EIB Group/EC financial instruments through better knowledge of the available financial instruments and their eligibility criteria.

RTOs' activities involve innovations across sectors sharing common funding challenges and in some cases featuring unique risk and investment barriers. The InnovFin thematic instruments[11] aim to cover these sector-specific and unique funding gaps. The EIB already has a solid track record of providing long and ultra-long debt financing for technology development projects, research infrastructure projects, and to a lesser extent infrastructure for innovation projects. Information about existing financial instruments should be even better disseminated to RTOs. To

[10] Cf. footnote 5
[11] http://www.eib.org/products/blending/innovfin/

achieve this, EARTO, the EIB Group (through the Innovation Finance Advisory mandate) and European, national and regional policy makers all have a role to play. For example, when it comes to information dissemination about repayable financial instruments and their eligibility criteria, EIB National Contact hubs could also play a key role either by providing the information themselves or by referring to third parties that can provide this information.

The RTO community is a highly granular universe, with different objectives, scope, legal forms, size, etc., and so are its projects. Consequently, a one-size-fits-all solution or address is not applicable. The findings suggest that a concentration of efforts through EARTO in coordination with Innovation Finance Advisory may provide an adequate framework to further investigate and define the potential necessary areas of improvement in the existing instruments, which is critical to fostering RTOs' access to financial instruments.

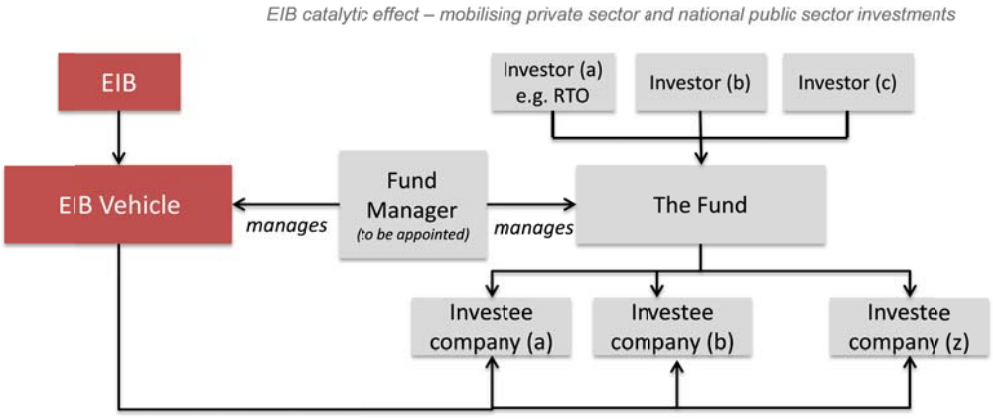
In Section 7.4 we summarise the preliminary proposals for ways forward in connection with the assessment of the fitness of the (selected) financial instruments and of the assessment of the value added of developing tailor-made RTO Co-investment Funds and an Investment Platform scheme.

Herein we distinguish two tracks:

Track 1: Further assessment of the added value and feasibility of setting up new instruments based on the existing ones to overcome certain potential barriers facing RTOs/RTOs' projects. The following deserves further exploration in particular (See Section 7.4 and Table 7 for instrument-specific ways forward):

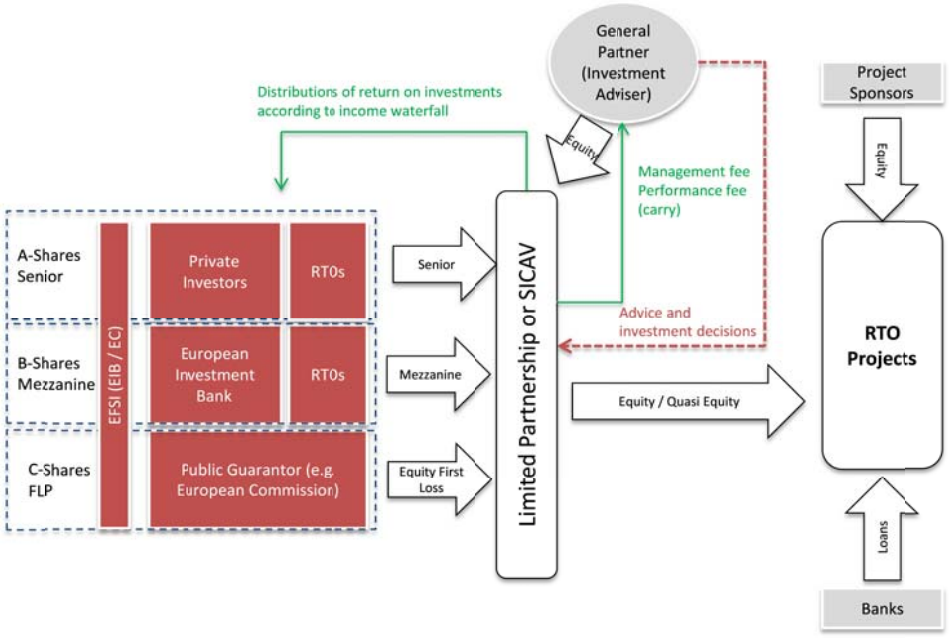
- Potential setup of a joint RTO and EIB Co-lending Fund, dedicated to the financing of RTO projects. Figure 2 shows an illustrative layout of the potential solution based on the SPI co-lending facility currently in place and discussed in detail in Chapter 7.

Figure 2: Illustrative layout - Co-lending Fund



- Potential setup of a thematic Investment Platform following the broadband fund concept. Figure 3 shows an illustrative layout of the potential solution based on the CEBF co-lending facility currently in place and discussed in detail in Chapter 7.

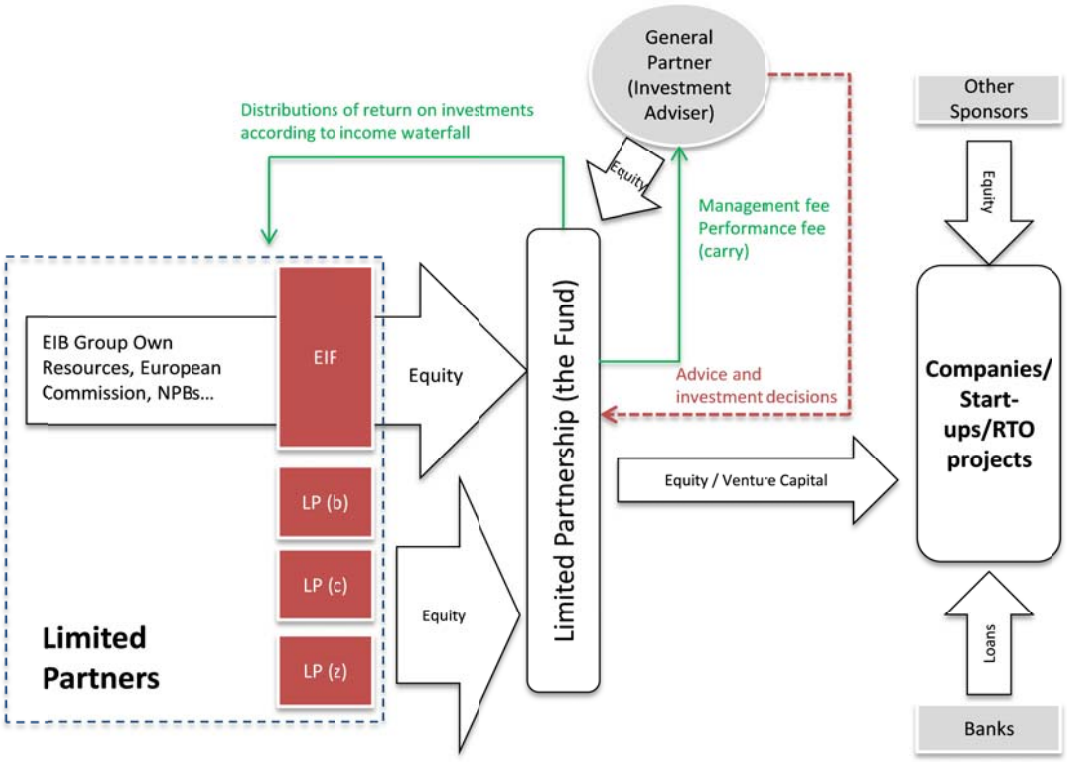
Figure 3: Illustrative layout – thematic Investment Platform



- Assess the degree of convergence of existing thematic risk finance instruments with RTOs' project pipeline characteristics, potentially leading to further fine-tuning and/or amendment.
- Participation of RTOs in EIF's individual investments or investment programmes, as investors or partners – depending on the capacity of the specific RTO – to stimulate the financing and/or sourcing of potential investment opportunities. EIF is already active in equity financing of technology transfer (TT) and commercialisation, by investing in e.g. independently managed technology transfer funds, which in turn provide equity financing to RTO projects, proof of concept stage[12] or other early stage projects or companies. EIF's investments are supported by e.g. EFSI, InnovFin and EIB Group resources, and NPIs investing in the sector through investment programmes in the context of the EIF-NPI Equity Platform. See Annex 2 for more detail on EIF's investment activities targeting technology transfer.

[12] Including products/technologies with Technology Readiness Level maturity between TRL 3 to TRL 6 or the equivalent Innovation Readiness Level maturity between IRL 1 and IRL 2.

Figure 4: EIF fund investments – typical structure (illustrative)



Track 2: Further assessment of the need to adjust (improve) the terms of existing instruments in order to better reflect RTOs'/RTOs' projects' needs and fundamentals. Among these could be potential barriers related to investment (and payback) periods and project size and, in the case of specific investment funds and platforms, eligible counterparts and sectors (see Section 6.4 for more details).

4. New business opportunities could provide RTOs with new streams of income and ways to further increase their socio-economic impact.

4.1. Explore the setup of a joint investment advisory board in order to catalyse knowledge and finance for economic impact.

EARTO, in collaboration with other relevant stakeholders, could further explore the viability of setting up a joint investment advisory board bringing together technology expertise (of RTOs and other actors), industrial expertise (corporate partners) and investment expertise (financial investors) as a mechanism to bridge the technology-commercial-risk-finance gap. Such an advisory board could connect actors and assess or pre-assess the investment readiness/potential of RTO projects and could provide technological know-how to investors and their due diligence process. EARTO could explore if such a role/mandate is compatible with the strict confidentiality dominating RTO ventures. Moreover, EARTO thereby supported by a.o. regional, national and European policy makers (see also recommendation 1), could also explore how RTOs themselves could develop stronger knowledge on project preparation and presentation, including risk assessment and mitigation, in order to better connect with the financial community.

4.2. *Investors should be supported to develop deeper scientific and "tech" knowledge and/or get better access to technological expertise. It should be explored how RTOs can support investors and potentially develop new services and associated streams of income.*

Policy makers and their agencies should support investors to develop deeper scientific and "tech" knowledge or get better access to technological expertise. Several cooperation models between RTOs and financial institutions could be explored, based on new services provided by RTOs, but also on shared investment instruments. RTOs could act as financing catalysts, potentially through the provision of education/training of financial market participants about the potential of specific technologies and as such add credibility to projects/technologies/start-ups. Technological know-how could be provided by RTOs to investors and their due diligence process (the study *Access-to-finance conditions for KET companies*, carried out by Innovation Finance Advisory in 2016, referred to this as "knowledge asymmetry"[13]). This would not only generate new streams of income for RTOs but would also further unlock public and private investments in technology-intensive sectors of the economy. In this context, Innovation Finance Advisory recently also launched a new study on how to better assess the technology/market potential of KETs technologies in the context of a due diligence process.

4.3. *Assess the viability of setting up an independent financing mechanism for "pooled" IP valorisation.*

Further assessing the feasibility of establishing a joint and independent financing mechanism for IP valorisation and associated early-stage investments could be used as a mechanism to provide liquidity to the IPs. A point of reference is the European Angels Fund[14] special investment vehicle. Such an initiative would involve venture capital firms and industrial partners in addition to RTOs and the EIB Group, and would also include national sub-funds in order to take into account local specifications in the technology transfer business (e.g. IP ownership rights). It should be noted that the consideration of an IP upfront monetisation fund is not further discussed as the EIB Group is already in discussions with an RTO on assessing potential ways forward in this regard.

[13] KETs (key enabling technologies) companies encounter a largely risk-averse financial sector with difficulties understanding the potential of KET innovations. KET companies' main drivers for their financing needs, technology and innovation, are often complex and previously untested on the markets on a larger scale. While KET companies often approach lending institutions for financing cutting-edge, proprietary products and processes, they usually understand such innovations far better than their respective lenders. Many KET companies report difficulties in making lenders understand product innovations. Simultaneously, banks report difficulties evaluating the technology investments proposed by KET companies in terms of financial returns. Such a "knowledge asymmetry" between borrowers and lenders is thus likely to make their financial transactions more complex and the associated risks harder to assess than in more established markets. As KETs are in many cases developed and commercialised by RTOs, the problem of "knowledge asymmetry" also applies to the RTO community vis-à-vis their investors.

[14] The European Angels Fund is an initiative advised by the EIF which provides equity to business angels and other non-institutional investors for the financing of innovative companies in the form of co-investments.

Other recommendations

5. RTOs could further join forces and collaborate in order to enhance a project's added value, e.g. through technology blending.

The ability to integrate technologies across RTOs, to ensure deployment along the necessary supply chains, transferability and scalability, are key drivers of credit quality and ultimately of investors' appetite. Ensuring that RTOs can maximise their impact in the changing funding and technological landscape and to be able to ensure that their projects are competitive at global level from a technology and value added standpoint requires a multi-level approach.

6. In view of its importance for commercialisation, the European Commission could consider developing an explicit policy for innovation infrastructure (IIC) (pilot, demonstration facilities etc.) by analogy with the existing policy framework on research infrastructure (RI), in particular ESFRI and ERIC.

The public sector is frequently a strategic, if not necessary, shareholder in RTOs' projects, including investments in innovation infrastructures that are necessary to allow for demonstration, upscaling and market introduction (higher TRL stages). A more explicit policy towards the development of innovation infrastructures in the regions and Member States, including topics such as strategic prioritisation of infrastructure and financing issues, could further strengthen Europe's innovation performance.

2. Introduction

2.1. Background

Research and Technology Organisations (RTOs) are defined[15] as organisations *"whose predominant activity is to provide research and development, technology and innovation services to enterprises, governments and other clients".* This definition distinguishes RTOs from universities, the predominant activity of which is education, and from enterprises, the predominant activity of which is the production and sale of goods and services.

The core mission of RTOs is to harness science and technology in the service of innovation, to improve quality of life and build economic competitiveness. RTOs occupy nodal positions within innovation ecosystems, bringing together key players across the whole innovation chain, from fundamental to technological research, from product and process development to prototyping and demonstration, and on to full-scale implementation in the public and private sectors.

Many European RTOs are represented by EARTO, the European Association of Research and Technology Organisations. EARTO is a non-profit international association established in Brussels, representing the interests of about 350 RTOs from across the European Union and "FP-associated[16]" countries (90 direct members, some of which are associations regrouping several RTOs). One of the main aims of EARTO is to contribute to a competitive European economy and high quality of life through beneficial cooperation with all stakeholders, and by promoting and defending the interests of RTOs in Europe (towards policy makers and EU programmes, and towards their members through mutual learning and information provisions).

On 25 June 2015, after approval by the European Parliament, the EU Council adopted the regulation on a European Fund for Strategic Investments (EFSI). EFSI, aiming to mobilise private finance for strategic investment, is one of the three pillars of the Investment Plan for Europe (http://www.eib.org/efsi/). EFSI is a EUR 16bn guarantee from the EU budget, complemented by a EUR 5bn allocation of the EIB's own capital. The EU funding was taken from redeploying grants from the Connecting Europe Facility (transport, energy and digital networks) and the Horizon 2020 programme (research and innovation), as well as unused margins in the EU's annual budget. Particularly relevant to RTOs was the EUR 2.2bn reallocation of Horizon 2020 funds. The funding levels for the European Research Council, the Marie Sklodowska Curie Actions and the specific "spreading excellence and widening participation" objective remained, while all the other Horizon 2020 sub-programmes saw a reduction in proportion to their original budgets. As a result of this budget reallocation, RTOs and their partners needed to further consider how EFSI financing could be accessed in a complementary way alongside grants.

[15] Op. Cit., EURAB (2005), Research and Technology Organisations (RTOs) and ERA, Final Report by the European Research Advisory Board.
[16] Countries associated with the EU Framework Programme for Research, Development and Innovation.

On 27 April 2015, EIB's Innovation Finance Advisory (IFA), in close collaboration with the European Commission[17], initiated a workshop between different EIB Group Services and EARTO[18]. The main objective of this workshop was to exchange information on activities, trends and developments relevant to the financial sustainability (such as the rollout of EFSI and the broader Investment Plan for Europe) of RTOs and their partners. The workshop demonstrated that RTOs and their partners face very specific challenges in obtaining the necessary funds for infrastructure development (e.g. RDI test facilities and equipment) and for spin-out/SPV (special purpose vehicle) creation. In view, inter alia, of the difficult budgetary climate with respect to research, development and innovation in many Member States, it was concluded that it was essential to actively support the RTO ecosystem in re-engineering and/or complementing existing financial models, where needed, in order to contribute towards better access to finance.

In the conclusion of the workshop, EARTO's President (at the time Ms Maria Khorsand) asked the European Commission and the EIB Group representatives to consider a dedicated Innovation Finance Advisory assignment to address the access to finance challenges of RTOs in a more systematic way with the support of the EARTO secretariat and its members. Subsequently, in June 2015, IFA developed a dedicated access-to-finance study (a Horizontal Activity[19]) in close collaboration with the European Commission and EARTO.

2.2. Objectives and key activities

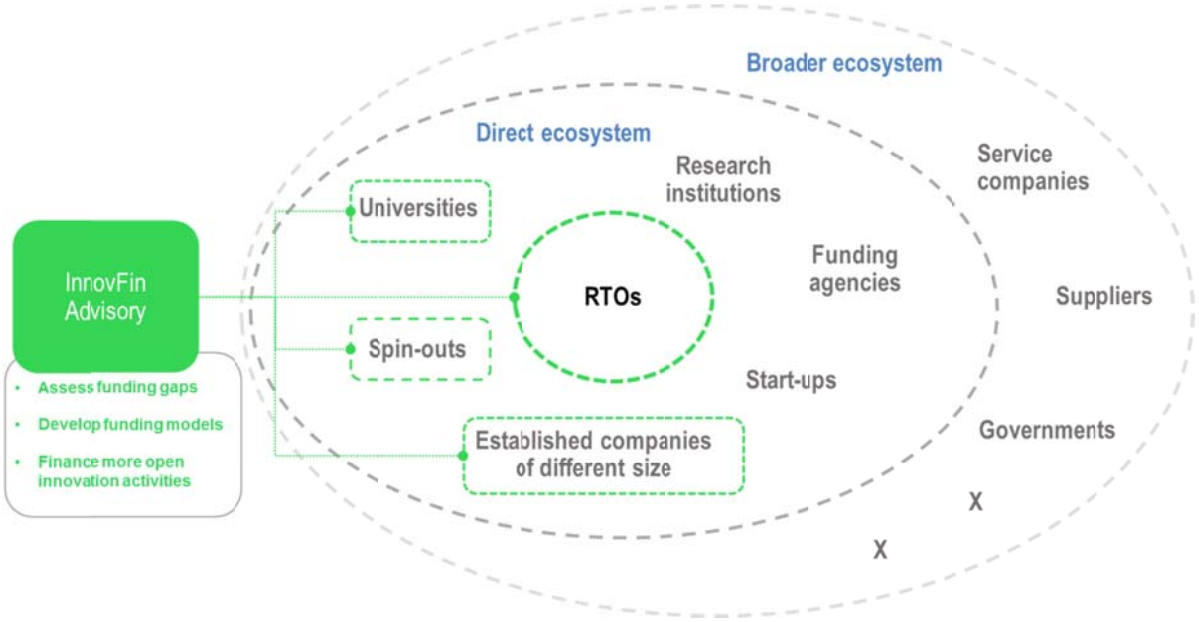
The objectives of the IFA assignment were to:

1. Review the current business models of RTOs
2. Assess the funding needs of the wider RTO community
3. Propose potential funding mechanisms that could channel EIB Group funding (incl. EFSI, potentially the NPBs, and InnovFin) to RTOs
4. Test those solutions in concrete cases with interested RTOs and their partners (possibly through Project Advisory)

Major attention was paid to the relevance of financial instruments (like those provided by the EIB) as a complementary source of funding to grants for RTOs. The study focused on the broader (financial) ecosystem in which RTOs operate (see the figure below). This provides a good reflection of the open innovation strategy underlying the collaboration model of RTOs with their partners. Open innovation reflects the paradigm whereby the actors in the ecosystem use external as well as internal ideas – and internal and external paths to the market – as they look to advance their technologies and innovate.

[17] Organised back-to-back with EARTO's annual conference in Luxembourg, 28-29 April 2015.
[18] At the EIB premises, Luxembourg.
[19] Horizontal activities aim to improve framework conditions for access to finance, involving preparing studies to improve the effectiveness of H2020 to address specific sectors/RDI projects' needs, identify funding gaps and in those cases where it is deemed necessary to develop a business case for new financing mechanisms to support specific RDI policy objectives by covering the funding gap.

Figure 5: Open innovation and ecosystem approach



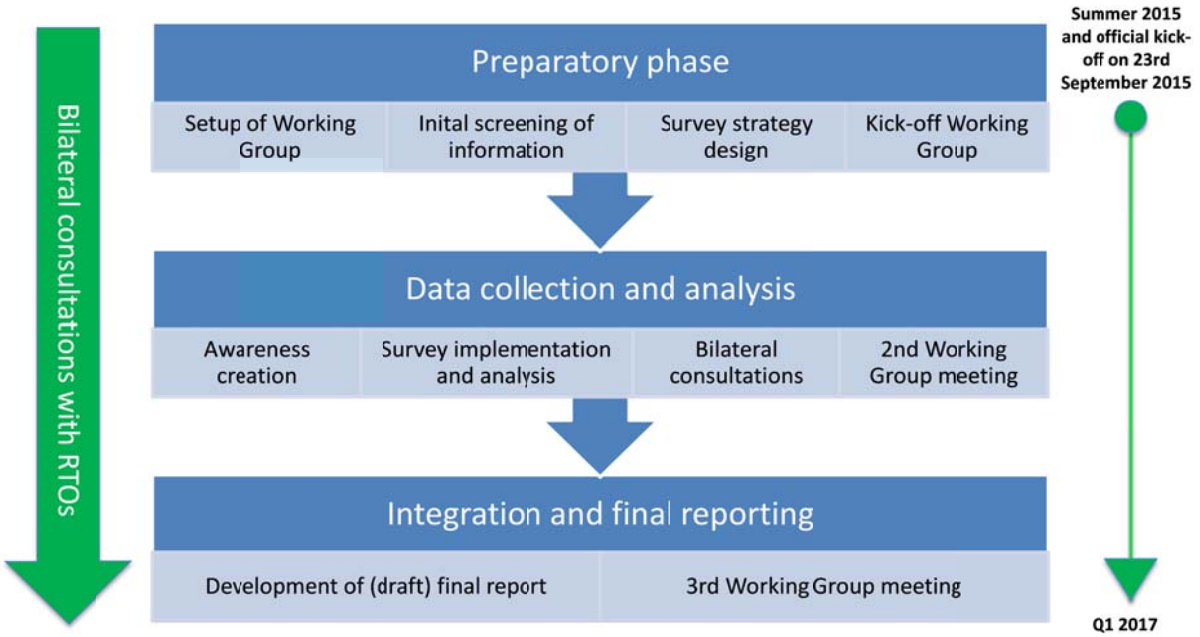
The figure illustrates that the focus of the study was not only on RTOs but also on (potential) partners in the ecosystem. RTOs are catalysts of collective RDI actions and programmes in which industrial, academic and governmental partners intensively collaborate and co-create. The combination of knowledge beyond the boundaries of individual actors in the ecosystem is powerful and at the same time necessary for disruptive innovations, which may ultimately lead to the creation of new companies (spin-outs). For open innovation to flourish, the underlying (relevant) ecosystem needs to be financially sustainable.

The actors in the RTO ecosystem can generate additional income through the development and implementation of longer-term joint RDI programmes in which the offtake of certain services and/or facilities rendered by the RTO is guaranteed. Although at the beginning of the study implementation interaction with universities (another key actor in the open innovation ecosystem) was not excluded, underlying work mainly focused on RTOs and their industrial partners, and on technology transfer/IP valorisation (through, for example, licensing, start-up and spin-out activities). On the technology transfer side, IFA closely collaborated with the European Investment Fund (EIF) which already offers different early stage investment equity products that focus on the conversion of research to products for the market.

2.3. Approach and methodology

The previously described objectives were further operationalised into three broad phases with specific underlying activities (as illustrated in the figure below). EARTO, the European Association of Research and Technology Organisations, strongly supported and facilitated the implementation of the study.

Figure 6: Overview of different phases and activities



Phase 1: Preparatory phase

✓ *Setup of working group*

As part of the preparation phase, a working group consisting of major European RTOs was set up in collaboration with EARTO. The role of this working group was one of a "sounding board", meaning that the group was actively involved in providing input and reflections during the different implementation steps. The working group was formed on the basis of an open invitation to all RTOs (sent by EARTO) and was composed of the following members:

- CEA, France (Commissariat à l'énergie atomique et aux énergies alternatives)
- CSEM, Switzerland (CSEM SA)
- Fraunhofer, Germany (Fraunhofer Gesellschaft)
- Imec, Belgium
- SP and RISE, Sweden
- Tecnalia, Spain (Tecnalia Corporación Tecnológica)
- TNO, The Netherlands
- TWI, United Kingdom (The Welding Institute Group)
- VTT, Finland (Teknologian tutkimuskeskus VTT Oy)

✓ *Initial screening of existing information*

Also under this preparatory phase, IFA carried out an initial screening of existing information and background material (EC studies, EARTO studies and position papers, specific RTO material, etc.). Attention was paid to RTO operations, their partners, investment and associated financing needs, and the potential financing challenges they face (the key findings and references to specific sources will be presented in Chapter 4).

✓ *Survey strategy design*

Subsequently, IFA developed a survey strategy and underlying survey questionnaire which was first discussed with and validated by EARTO, the working group and the European Commission. The objectives of the survey were:

1. To identify the investments and associated funding needs (investment plans) of RTOs and their partners;
2. To identify and describe the existing funding instruments (both private and public) used by RTOs;
3. To assess the access-to-finance conditions of RTOs and their partners, in particular regarding their funding challenges and key risks.

The survey questionnaire was structured into the following four sections:

- Section A: Information of the RTO and their partners
- Section B: Business Model and Strategy
- Section C: Investment Needs and Funding Sources of the RTO
- Section D: Investment Needs and Funding Sources of industrial and academic partners of RTOs

The questionnaire was piloted prior to the kick-off meeting with the RTO working group in Brussels where the test results were discussed and the questionnaire was further refined and approved. During the preparation of the survey questionnaire, IFA identified a similar ongoing consultation/survey (research project funded under H2020, named BOOST – EU Great!) directed towards the financing of large-scale RDI initiatives (LSI). That survey targeted so-called consortia which combined different players from the public and private sector, including RTOs. The IFA survey, on the contrary, focused on the financial and investment strategies of individual RTOs and had a more detailed questionnaire.

✓ *Kick-off meeting working group*

The kick-off meeting with the working group took place in Brussels (EARTO premises) on 23 September 2015. The stage was set by a general IFA presentation of an overview of the objectives and planned activities of the study. Specific attention was devoted to the survey and the draft questionnaire, followed by a more general discussion on the challenges faced by RTOs when wanting to raise financing for investments. It became clear that the current and future investment levels of RTOs may become unsustainable in view of the (political) pressure and uncertainty related to public funding (national public appropriations for RDI, Horizon 2020 reallocations to EFSI, etc.).

RTOs indicated that they are facing the difficulty of presenting a business case to justify loans, while they are supposed to focus on addressing global societal challenges. Finally, it was highlighted that for specific sectors it was difficult to mobilise partners for investing and building demonstrations, particularly when the industry is scattered and mainly composed of SMEs.

Phase 2: Data collection and analysis

✓ *Awareness creation*

As part of the data collection and validation phase, and in order to inform and mobilise the RTO community to come forward and discuss potential investment plans with the EIB and other investors, IFA presented its preliminary findings at several workshops and conferences bringing together the RTO ecosystem. The overview of these events is provided below:

- EARTO CEOs Meeting, San Sebastian, Spain, November 2015
- EARTO Economic Footprint Event, Brussels, Belgium, January 2016
- EARTO Annual Members Meeting, The Hague, The Netherlands, April 2016
- EARTO Annual Conference, The Hague, The Netherlands, April 2016
- 9th Plenary Meeting of the European TTO Circle, San Sebastian, Spain, May 2016

IFA also raised awareness inside the EIB with, among other things, a Briefing Note to the EIB Management Committee about the importance of RTOs for the European economy and the potential for the EIB Group to intensify future support for RTOs.

✓ *Survey implementation and analysis*

The survey was launched by the EARTO Secretariat in close cooperation with IFA, and targeted three groups of RTOs: 1) RTOs that were members of the working group; 2) RTOs, EARTO members and non-members large enough (approximate annual income of EUR 100m or above) to suggest substantial investment plans (and amounts) and the possibility to take debt financing on board; 3) a wider group of smaller RTOs. Groups 1 and 2 were actively followed-up by the EARTO Secretariat and IFA through email, telephone, and announcements during workshops and conferences (more details are provided in Chapter 4).

✓ *Bilateral consultations*

In parallel to the survey implementation, IFA carried out in-depth bilateral consultations (on a confidential basis) involving the respective EIB loan officers from the geographical teams. Bilateral discussions took place with the following RTOs: Fraunhofer (Germany), TNO (Netherlands), CEA (France), CSEM (Switzerland), imec (Belgium), TWI (United Kingdom) and VTT (Finland). The Swedish SP was also consulted as part of an existing project advisory agreement signed between IFA and SP concerning the development of a winter car testing facility. The aim of these bilateral discussions was to review existing financial strategies and business models, to discuss possible investment opportunities and link these opportunities to potential EIB advisory mandates and EIB Group transactions (including under EFSI). The results are further discussed in Chapter 4.

As a result of these bilateral consultations, IFA developed two Project Advisory trajectories. The first (ongoing) deals with a planned investment related to the expansion of existing innovation infrastructure (for development and demonstration purposes) in the area of sustainable energy and intelligent energy systems (including smart grids, advanced district heating and cooling). The second trajectory (exploration stage) concerns the commercialisation (spin-out/SPV through a potential joint venture) of a new generation of manufacturing technology. For confidentiality reasons, the names of the RTOs and partners involved cannot be revealed. Besides these concrete cases, several discussions with other RTOs are (at the time of publication of this report) ongoing.

✓ *Second working group meeting*

The second meeting with the working group was organised in Brussels (EARTO premises) on 16 December 2015. During that workshop, representatives from the EIF presented the technology transfer support schemes and associated financing products, and some of the key steps of the EIF due-diligence process. Subsequently, IFA explained the status and preliminary insights of the ongoing access-to-finance study. The remainder of the workshop focused on the presentation and discussion of several investment cases by RTOs (thereby sharing experiences on barriers, enablers, etc.). This discussion pointed out that debt financing plays little to no role in the capital structure and that the main funding sources of investments were equity (own resources) and grants.

Phase 3: Integration and final reporting

✓ *Development of (draft) final report*

Under this activity the different results and insights were further integrated and analysed. This led to the development of the (draft) final report which was further discussed with all relevant stakeholders (EIB, European Commission and the RTO community – see below).

✓ *Third working group meeting*

The third working group meeting took place on 22 September 2016 (EARTO premises, Brussels). During this meeting IFA presented and discussed the key results with the RTO working group. Relevant comments and suggestions were taken on board for the finalisation of the report.

2.4. Guide for the reader

This report presents the key findings, conclusions and recommendations of IFA's advisory work on access to finance for RTOs. Chapter 3 presents further background on RTOs, their key processes, activities and impact. Chapter 4 presents the key results of the RTO market consultation, including the bilateral discussions. As the financing of infrastructure for innovation is a key challenge for RTOs, Chapter 5 provides a review of risks and potential mitigating factors related to these. Chapter 6 reflects on the particularities of the RTO business models versus the ability to attract financing. The chapter presents the two key funding gaps and how these can be mitigated. Chapter 7 provides an informative overview and discussion of the different EIB financial instruments and how these may serve the financing needs of RTOs.

This chapter also includes a discussion on how the European Investment Fund can support the valorisation of IP (in relation to addressing technology transfer challenges) stemming from RTOs. Finally, Chapter 8 provides key conclusions and recommendations.

3. Role and importance of RTOs[20]

3.1. About Research and Technology Organisations (RTOs)

According to EARTO, the European association that represents about 350 RTOs, Research and Technology Organisations (RTOs) are:

> *"Organisations whose predominant activity is to provide research and development, technology and innovation services to enterprises, governments and other clients…"*

This definition distinguishes RTOs from universities for which the primary activity is education, but also from companies for which the predominant activity is the production and sale of goods and services. According to the definition, RTOs could be considered as a separate RDI and innovation actor that can be positioned between the academia and industry. The core mission of RTOs, according to EARTO, is to harness science and technology to serve innovation, improve quality of life and build economic competitiveness.

RTOs operate across the value chain of innovation, from fundamental to technological research, through product and process development, prototyping and demonstration, to applications in the public and private sectors. By developing and helping implement new technology platforms and by clustering both new and existing knowledge, they enable companies and other producers to go beyond the limits of their internal (RDI) technological capabilities. Hence, RTOs occupy a hybrid position between the public and private actors, or as Carlos Moedas, Commissioner for Research, Science and Innovation, put it:

> *"In our increasingly interconnected and competitive world, RTOs provide researchers and businesses with the right conditions for innovation and they do so while mitigating the risks of innovation… The kind of solutions we need, if we want to transform research results into meaningful societal impacts."*

The RTO ecosystem includes a variety of actors such as SMEs and large companies, universities, vocational and educational institutes, authorities and agencies (from municipal and regional to national and pan-European). By housing complex large scale research and technological infrastructure/facilities needed by many stakeholders of the ecosystem, which are too resource-intensive for any single industry investment, RTOs are promoting the maturity of technologies for the long-term benefit of European society. RTOs usually partner with either single industry players or together with a consortium of several industrial actors in an attempt to address different RDI activities according to the time frame of challenges they intend to tackle.

[20] In this section, when referring to revenues and income, it should be noted that RTOs may have used a broader definition of revenues, including as such other flows in addition to the amount of cash generated by the sale of products or services associated with the RTO's primary operations.

According to EARTO (2015)[21], RTOs' operations and services can be clustered into three main types of research, development and innovation activities:

1. RDI activities addressing the "immediate"

RTOs provide immediate added value to their industrial partners and foster knowledge dissemination with access to validation, testing and certification. The clients involved in these close-to-market activities are typically from industry (large, medium and small companies both in the RTO's country of origin and abroad), but collaboration with national regulators, for example, also occurs.

2. RDI activities addressing the "pre-competitive"

These activities concern cooperative projects and applied research programmes under regional, national or European competitive calls. Here RTOs liaise with industry players and collaborate in the early-stage development of products. Any other relevant stakeholders may be involved to maximise the RDI impact and dissemination of research results.

3. RDI activities bringing the "future"

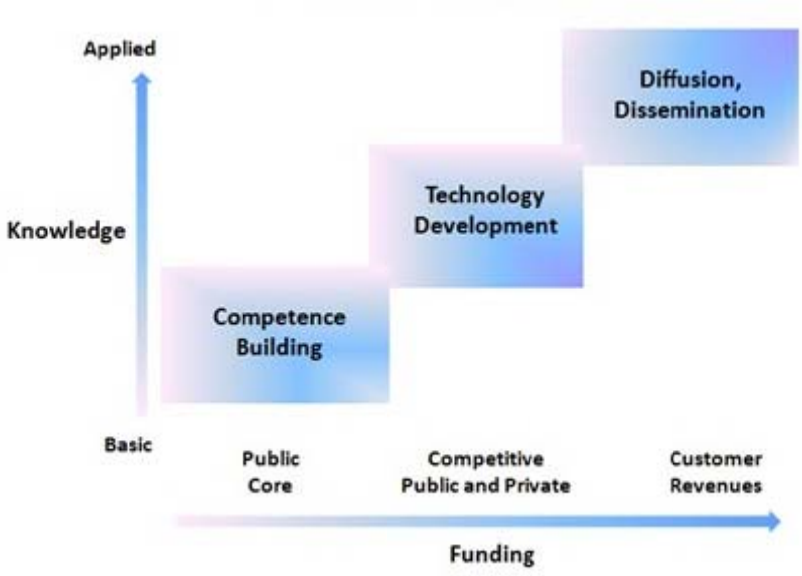
RTOs have strong links with national and regional governments in defining strategic innovation plans and collaborate closely with universities to harvest ideas from their basic research and bring them to higher technology readiness levels as a result of applied research. They collaborate with universities on long-term forward looking RDI activities through staff sharing (e.g. joint professors, guest researchers), hosting PhD students, joint educational programmes, joint research activities, joint facilities, etc.

In terms of financial profile, RTOs are generally non-profit organisations and their revenues from dissemination and deployment are re-employed to fund new innovation cycles (see also Chapter 4). They generally operate according to a three-stage innovation dynamic, which broadly correlates with a three-part funding model (see also figure below):

- Public core funding to support exploration of needs and competence-building
- Competitive public and private income for technology development
- Customer revenues from dissemination and deployment

[21] http://www.earto.eu/fileadmin/content/Website/EARTO_Paper_-_Data_on_European_RTOs_-_Final_01.pdf

Figure 7: RTOs' three-stage innovation dynamic and funding model



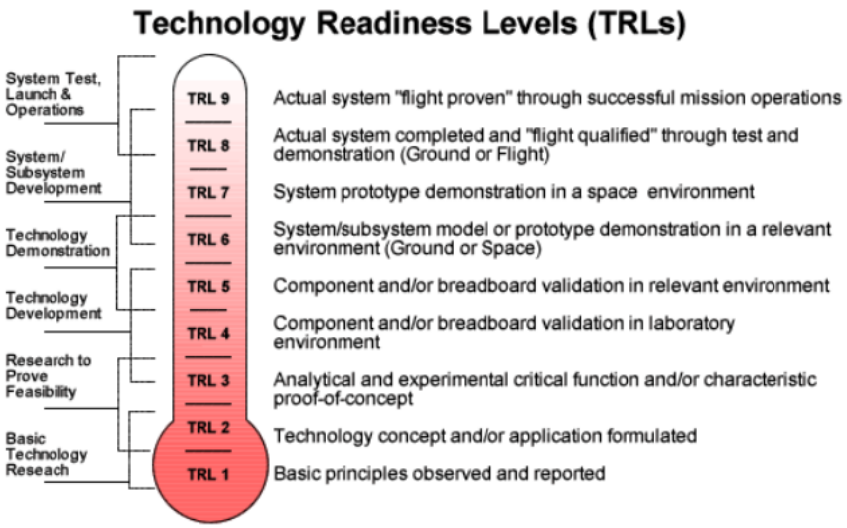
Source: EARTO

As illustrated in Chapter 4, most RTOs have financial and business models that rely heavily on public core funding (grants) as their key funding source, while only a few have developed business models that rely heavily on the attraction of private sources of income. **The generation of sufficient customer revenues, as part of the overall cash flow generation, is often a precondition for the so-called "bankability", and associated repayment capacity, of investments.** Existing business models of RTOs (see also Chapter 6) are often insufficiently equipped to generate these necessary cash flows (this is furthermore reflected in RTOs' capital structure and the challenges they face in attracting debt financing). The findings presented throughout this report should hence be considered from this perspective.

3.2. RTOs and the Technology Readiness Levels (TRL)

The Technology Readiness Level (TRL) scale was first developed during the 1970-80s by the National Aeronautics and Space Administration (NASA) (see figure below) and further refined in the 1990s to a nine-level scale that gained widespread acceptance across industry and government. The TRL scale was developed to enable the assessment of the maturity of a particular technology and the consistent comparison of maturity between different types of technologies, both from the perspective of commercialisation potential.

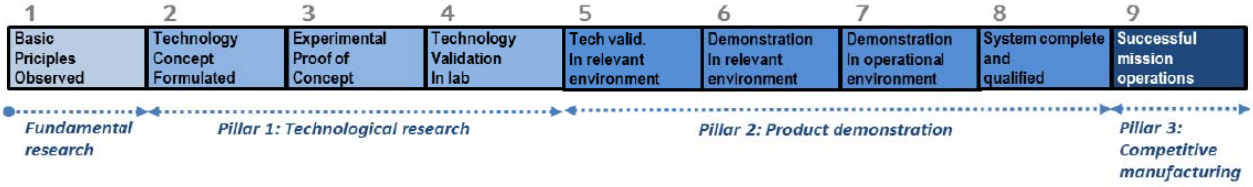
Figure 8: Original TRL levels as developed by NASA



Source: Op cit., EARTO (2014), The TRL scale as a Research & Innovation Policy Tool, EARTO recommendations

Today the TRL scale is used as a tool for decision-making on RDI investments at EU level. In 2011 the European Commission adopted the proposition of the High Level Group (HLG) on key enabling technologies (KETs) to use the TRL scale as a "tool for assessing the results and expectation of the projects" and so to align its RDI activities and balance technological research, product development and demonstration activities within their RDI portfolio (the figure below illustrates the KETs HLG adaptation of the TRL scale).

Figure 9: TRL scale adapted by the KETs HLG

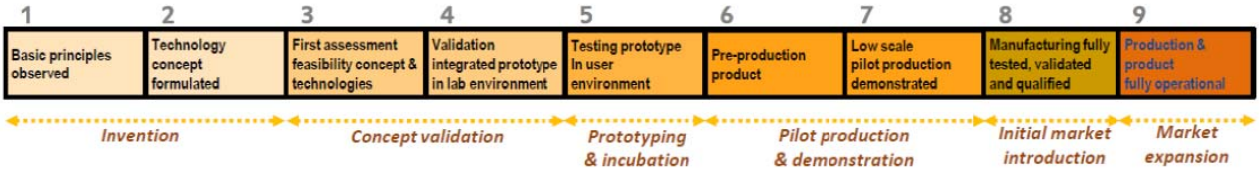


Source: Op cit., EARTO (2014), The TRL scale as a Research & Innovation Policy Tool, EARTO recommendations

The TRL scale is used differently by individual organisations in different policy contexts (for example, the OECD, ERFD and the EIB all use different, often combined and aggregated scales, of the TRLs). RTOs are active throughout the scale and lead projects in all TRL areas in collaboration (based on experience and infrastructure that RTOs have) with the industry at higher TRLs and academia at lower TRLs[22]. According to EARTO the TRL scale can be used to assess the eligibility of innovation projects based on their maturity, assuming the scales are adapted to the specific context in which they are used. The figure below presents the EARTO[23] reading of the TRL scales, including manufacturability and non-technological aspects.

[22] EARTO, The TRL scale as a Research & Innovation Policy Tool, EARTO recommendations.
[23] Ibid, p. 7.

Figure 10: EARTO reading of the TRL scales



Source: EARTO (2014), The TRL scale as a Research & Innovation Policy Tool, EARTO recommendations

Using this approach it becomes clear that "Invention" is part of fundamental research, with "Concept validation" being its natural extension enabling early participation from industrial partners. "Prototyping & incubation" can be seen as an integral step towards industrial research and "Pilot production & demonstration" aspects of experimental development. Finally "Full market introduction" and "Market expansion" are fully commercial activities and normally part of the commercial risks companies take[24].

In the remainder of this report, the TRL scale will be frequently referred to in connection with the maturity and bankability of projects in the RTO ecosystem.

3.3. The size of the European RTO market

The distribution of the RTO sector follows a so-called Pareto distribution, whereby approximately 20% of RTOs roughly account for about 80% of aggregated size and impact (in terms of income and staff). In 2002, the EUROLABS inventory of research institutes underlined the large number of European RTOs as well as the concentration of employment in some large organisations. More specifically, the study showed that around 50% of total employment is concentrated in the 28 largest organisations[25]. COWI, a Denmark-based international consulting group, underlined in an unpublished survey in 2008 that 151 of the largest RTOs in Europe generated approximately EUR 31bn and employed around 293,000 people[26].

In 2010, Technopolis Group conducted a study on the impact of European RTOs[27] and included a set of 275 organisations under their wider definition, of which 61% (168) are EARTO members. Further to this, the study estimated the size of the sector at between 697 and 849 institutes, as many RTO organisations include several institutes within one association. In terms of turnover, the study estimated that the European RTO sector generated between EUR 18.5bn and EUR 23bn in revenues (depending on the definition used[28]). Additionally, the study findings also highlighted the economic impact of RTOs reaching up to EUR 40bn annually (EUR 100bn in the long term) and supporting some 100,000 companies annually, especially SMEs.

[24] EARTO, op. cit.
[25] Op cit., Technopolis Group (2010), Impacts of European RTOs, a Study of Social and Economic Impacts of Research and Technology Organisations, report delivered to EARTO.
[26] COWI, Co-ordination and co-operation – non-university Research Performing Organisations, Lyngby: COWI, 2008.
[27] Ibid 4
[28] Technopolis Group's narrow definition of an RTO only covers organisations which receive public-sector subsidies and carry out contract research, and excludes private-sector organisations and bodies which primarily function as government laboratories.

In 2015, Belgium-based IDEA Consult conducted a study on the economic footprint of the nine largest European RTOs (imec, CEA, DTI, VTT, Fraunhofer, TNO, SINTEF, Tecnalia, and SP[29]), which represent about a third of EARTO members in terms of employees and turnover. A total of 225 860 jobs in head count (HC) result from the aggregated economic impact of these nine RTOs, in turn corresponding to a EUR 29.3bn turnover and total value added of EUR 14bn[30].

The study further underlined the direct, indirect and induced economic footprint of the nine largest European RTOs. In terms of direct economic impact, measured at the level of the RTOs, the nine RTOs generated around 55,800 HC employees in 2014, which in turn created a direct turnover of EUR 4.5bn per year and a total direct value added of EUR 4bn in 2014[31]. The indirect economic effect, defined as employment created at the suppliers as a result of purchases of RTOs, led to the creation of over 53,000 jobs (HC) in 2014, in turn creating an indirect turnover of EUR 6bn and indirect value added creation of approximately EUR 2.8bn in the same year. The induced effect, a third economic footprint defined as the spending of the additional income generated by RTOs in the economy, created around 10,100 (HC) jobs in 2014, and turnover creation of over EUR 1.1bn in turn leading to induced value creation of over EUR 0.5bn in the same period. These numbers clearly indicate the economic importance of the activities of RTOs for Europe and the importance of sustaining their activities.

[29] Please note that except for DTI and SINTEF, all other RTOs were members of the working group that was set up for this study.
[30] Values correspond to the aggregated economic effect of the nine RTOs from their core activities, contract research and spin-offs.
[31] This estimation applies an extrapolation of the value added per FTE as it is observed in the six RTOs where value added is known. The overall amount takes into account operational grants (i.e. about EUR 3.5bn).

4. Market consultation results[32]

4.1. Size, income and debt characteristics

The launch and follow-up of the survey were implemented in close cooperation with the EARTO Secretariat which invited and encouraged its members to share their views by filling out the survey (survey design is discussed in Section 2.2.). In total, 14 European and one Taiwanese RTO responded on a confidential basis to the survey[33] with varying degrees of detail.

Size

The 14 European RTOs that cooperated are relatively large in terms of employees and revenues (on average about 1 000 employees with approximately EUR 150m[34] in revenues[35]). Although due to the sample size the insights obtained may not be representative of the RTO sector as a whole, they nevertheless capture those active in a wide range of countries and technological domains/sectors such as energy and climate, life sciences, ICT and microelectronics, space and aeronautics, food and agriculture, etc.

Ownership structure

Looking at the ownership structure, six RTOs have a public, six a private, and two a mixed public/private ownership structure. Their size, in terms of revenues and total assets, varies significantly and represents different ranges of the market. Annual average revenues vary among the different groups of RTOs, ranging from EUR 6m to EUR 454m. As further illustration of the diversity among the RTOs surveyed, we see that public RTOs generate total average annual revenue of EUR 916m, as compared to EUR 757m and EUR 89m for private and mixed RTOs respectively[36]. Likewise, the total asset size of RTOs also varies significantly and ranges from EUR 17m to EUR 400m, with private RTOs reporting average yearly assets of EUR 840m compared to EUR 540m for public RTOs and EUR 512m for mixed ownership RTOs. Publicly owned RTOs also represented a higher number of employees as compared to private and mixed RTOs. Whilst debt played no role in the on balance sheet capital structure of most RTOs surveyed (over 80%), private RTOs show higher levels of debt financing compared to public and mixed ownership RTOs (results could vary depending on whether spin-off financing has been accounted for and if so, if in full).

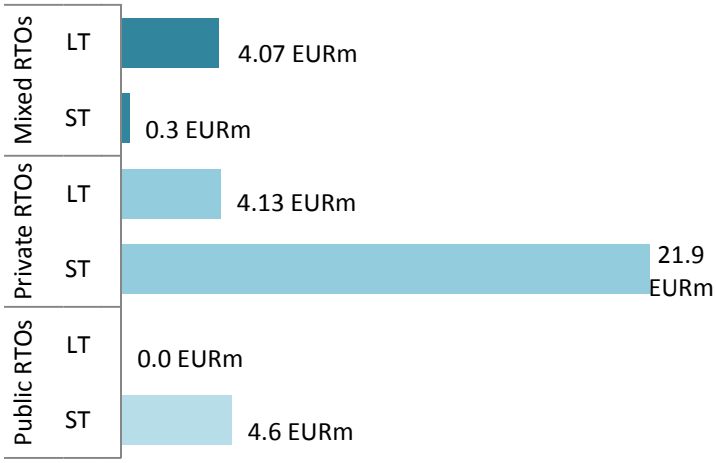
Levels of debt financing

Among privately owned RTOs, short-term debt financing (potentially for working capital and/or broader liquidity planning) is seemingly dominant, as per the figure below. However, as a result of lack of detail disclosure/break-down of RTOs' balance sheets, the refinancing risk that RTOs seem to

[32] In this section, when referring to revenues and income, it should be noted that RTOs may have used a broader definition of revenues, including as such other flows in addition to the amount of cash generated by the sale of products or services associated with the RTOs' primary operations.
[33] This RTO has not been included in the main analysis but is referred to in comparison when relevant.
[34] Corrected for one very large RTO (an "outlier" in terms of size), the Helmholtz Association.
[35] Assuming that RTOs interpreted revenues as the total amount of cash generated by the sale of products or services associated with their primary operations.
[36] Calculations based on the average yearly revenues of RTOs surveyed between 2012 and 2014.

bear (short-term to long-term debt volumes) could be distorted[37]. In addition, differences in business and financial models between RTOs (e.g. SPV versus on balance sheet projects) could limit the reliability of cross-RTO comparisons. Lastly, debt financing seems to play a minor role in the capital structure of public RTOs, with only two instances of (short-term) debt financing among the RTOs surveyed.

Figure 11: Average annual short-term (ST) and long-term (LT) financial debt reported by RTOs surveyed in EUR m (2012-2014)[38]



Debt ratios[39] can be used to gain a general idea of the financial leverage of a company/organisation. A low ratio means that the company/organisation is less dependent on debt, i.e. money borrowed from and/or owed to others. However, it should be noted that a low ratio is not necessary indicative of a financially robust entity. Although lower leverage means that the company/organisation has a strong equity position, it does not necessarily imply that it bears low (financial) risk. For example, ceteris paribus, an organisation with low debt levels combined with poor and highly volatile cash flow generation capacity would feature a higher credit risk profile than a more leveraged company with fairly robust and predictable (net) cash flows.

In principle, with the caveat above, the higher the ratio, the more credit risk that company is considered to have taken on. **We looked at two ratios used: debt-to-equity and debt-to-total assets as comparability of income or cash flow based ratios offered limited reliability.** Furthermore, for balance sheet ratios, it is not clear whether RTOs include debt only or have also included other liabilities in their reported data, meaning that we have to be careful with the interpretation of the outcomes. The debt-to-equity ratio shows that on average over the period 2012-2014, the RTOs surveyed have a level of indebtedness below 10%. The debt-to-total assets ratio shows, as expected, a somewhat lower ratio. In view of the lack of detailed data and of the limited size of the sample, these ratios can only be considered as indicative, pointing out that in general the RTOs surveyed are currently not that leveraged.

[37] For example, the outstanding guarantees of RTOs to SPVs, their nature (short-term/long-term) and if they are being consolidated for debt calculation purposes are not disclosed.
[38] Short-term (ST) debt based on eight responses (six responses missing); long-term (LT) debt based on nine responses (five responses missing).
[39] Such as debt-to-equity or debt-to-assets measures, debt-to-cash flow measures or debt-to-income measures (e.g. EBITDA).

It remains to be explored if the seemingly low on balance sheet leverage is an indication of unused debt capacity or rather the result of a weak business model in terms of cash flow generation, and therefore lack of headroom for additional debt. This could also fit into the broader discussion on which activities should be financed through grants (leveraged by) and which should be financed through, for example, debt financing.

With regards to revenue sources, all RTOs surveyed have both private and public sources more or less in a balanced proportion. The data suggests that public funding from a competitive source (e.g. H2020) tends to increase for most of RTOs, whilst private funding remains constant overall. Interestingly enough, this evolution is also visible at the Taiwan-based RTO (the only non-EU RTO that participated in the survey).

4.2. Past and future investments: needs and funding sources

Finding 1: Most RTOs principally finance their investments[40] through own funds and public funding/grants

KEY TAKEAWAYS

- ✓ Public and private RTOs principally sourced and expect to source their investments mainly from their own funds (capital and reserves, a form of equity), thereby complemented by public funding/grants.
- ✓ Only the private RTOs (not the public or mixed ownership RTOs) have financed part of their past investments through debt financing.
- ✓ Low debt levels are in some cases due to business model(s) that do not generate sufficient cash flows (and profitability) to service debt.

Note: the above does not necessarily apply to debt indirectly raised by RTOs through financing at SPV level.

Over the period 2012-2014, most of the RTOs surveyed indicated that they mainly made investments in research and development infrastructure, such as in pilot plants, research facilities and laboratories. Investment needs were also attributed to equipment requirements, such as research and ICT equipment, yet to a lesser extent. These investments represented an annual average investment expenditure in the range of EUR 0-10m (n=6) and EUR 10-20m between 2012-2014[41] (n=6), although privately owned RTOs (n=6) underlined a stronger average investment expenditure of around EUR 92m per year on average, more than double the indicated investment size of around EUR 41m[42] of the publicly owned RTOs.

[40] In the last three years (2012-2014).
[41] Two responses not available.
[42] Mixed ownership RTOs recorded an average annual investment size of EUR 11m.

RTOs (53%) principally sourced their investment funding from their own funds (capital and reserves, the latter being a form of equity), followed by public funding/grants (38%), additional contributions by external private investors (4%) and to some extent private/public debt (6% of RTOs surveyed)[43]. It is clear that own funds and public support/grants were the key funding sources for RTO investments over the period 2012-2014. Private RTOs did use debt funding to a large extent, averaging at around 14% of their annual investments.

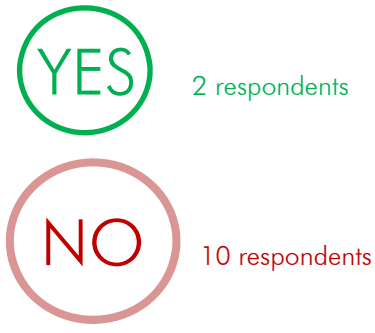
All RTOs indicated that they had well-articulated investment plans/needs for 2016 and 2017, with publicly owned RTOs showcasing stronger investment needs relative to private and mixed ownership RTOs respectively. For 2016 and 2017, the RTOs surveyed expect to invest approximately EUR 140m annually (the annual investments of the entire RTO landscape are expected to be a multiple of this amount). The RTOs expect to finance these investments primarily from own funds, as well as from public support/grants. Debt financing plays only a minor role in the expected capital structure for funding future investments[44], with this only applying to two RTOs.

Finding 2: Most RTOs do not see restrictions to them raising debt, but debt is also not preferred

Despite debt financing not being a component in RTOs' past financing strategy, most RTOs stated there were no restrictions to them raising debt. A few RTOs indicated that debt financing is less desirable as it could conflict with the public/societal goals RTOs aim for. Only two publicly owned RTOs stated explicit restrictions to raising debt funding, attributed to provisions in their statutes forbidding them to seek this type of financing.

Figure 12: RTO restrictions to raise debt[45]

Are there any [formal] restrictions to your RTO raising debt?



Related Quotes

There are no restrictions to raising debt, but it is an undesirable financing source.
CEO of an RTO

We cannot use debt financing, as payback with interest is not possible with RTO cash flows and cost/revenue structures.
CFO of an RTO

There is a statutory provision which explicitly forbids us to take out loans
CTO of an RTO

[43] None of the RTOs interviewed received funding from hybrid/mezzanine, leasing/factoring or any other type of source.
[44] One public RTO and one private RTO.
[45] Based on 12 responses; two responses missing.

A specific RTO highlighted that its non-profit status underlines its public role which is not compatible with the generation of a solid return on investment (ROI). Consequently, this does not provide the option to receive financing either from retained profits (as genuine profit is not made) or from commercial loans (as the level of cash flow generation is insufficient to service the debt).

Finding 3: RTOs face clear challenges in securing funding for investments

KEY TAKEAWAYS

- ✓ Securing contributions from public shareholders for future investments (in view of general public RDI budget cuts) is challenging.
- ✓ Securing contributions from partners/clients is challenging, as they also have their own funding problems.
- ✓ Financial market participants show increased credit requirements and high interest rates.

Figure 13: Challenges faced by RTOs related to securing funding from public shareholders[46]

Has your RTO faced (or does it expect to face) any challenges related to securing funding from public shareholders?

12 respondents

1 respondent

Related Quotes

Public research budgets are facing general cuts, following the restructuring of government budgets. Governments are showing risk aversion towards lower TRL level investments.
Financial Director of an RTO

Limited public funding (budget constraints and more demanding conditions), which increases dependence on private funding.
CEO of an RTO

There is much stronger competition on H2020 calls, combined with worse financial conditions for H2020.
R&D Director of an RTO

Research budget constraints as well as the level of available co-financing is decreasing. There is also increased competition for limited resources.
Financial Director of an RTO

A second key challenge (see figure and associated quotes below) faced by RTOs to secure funding for future investments is related to contributions by partners/clients (in the RTO ecosystem), as they have their own funding problems and/or diverging interests. As an RTO executive indicated, industry is not interested in joint and/or long-term investments.

[46] Based on 13 responses; one response missing.

Figure 14: Challenges faced by RTOs related to contributions by partners/clients[47]

Has your RTO faced (or does it expect to face) any challenges related to contributions by partners/clients?

10 respondents

3 respondents

Related Quotes

Partners can fund investments and be in full-cooperation with other partners, or can fund investments just for themselves which is contrary to the RTO's public task.
Head of Grants of an RTO

There is a risk of financial problems due to the size or the activity sector of some of the partners/clients.
CEO of an RTO

Long-term investments are not attractive. The industry only reimburses research and testing services, and is not interested in jointly investing.
C-level executive of an RTO

Finding 4: RTOs face specific risks in securing funding from private financial market participants

KEY TAKEAWAYS

Key business and financial risks in obtaining funding from private financial market participants are related to:

- ✓ Unpredictability and uncertainty regarding future public shareholder involvement and contributions.
- ✓ Uncertainties regarding demand-driven (public) research requests.
- ✓ Uncertainty regarding (future) contracts from private companies.

Several RTOs highlighted uncertainties regarding (future) public shareholder contributions (and behaviour) as a key influencer of private financial markets' financial involvement (e.g. potential budget cuts, insufficient usage of RTO facilities and equipment, etc.) with RTOs underlining the issues in limited R&D public funding, reduced government grants (in particular for core funding) and the "*lack of a legally enforceable claim of a lender against public shareholders*". In response, the related RTOs proposed potential mitigating factors to these types of risks, including establishing long-term public R&D strategies and dedicated funding, and seeking alternative legacy income in the long term.

Related Quotes

There is limited public funding for R&D, in particular national funding, and there is a risk of loss of research excellence.
CEO of an RTO

The reduced government grant funding limits the development of the organisations.
Director of an RTO

[47] Based on 13 responses; one response missing.

Policy and/or regulatory risk: another key risk in securing private investment is related to uncertainties regarding demand-driven public research requests, due to budget cuts, changes in legislation/regulations, etc. Several RTOs underlined that changes in R&D legislation and regulations can impact the financial involvement of the private financial sector, as can budget cuts and the absence of long-term financing policies implemented by the government. The RTOs surveyed underlined that increased government stability (and commitment) with regards to R&D policies, as well as increased public R&D initiatives, could be potential mitigating factors to these types of risk.

Revenue risk: a third risk underlined by RTOs is related to the uncertainty of contracts from private companies (industry). RTOs generally underlined that this type of risk is attributed to the loss of research/technological leadership, the loss of key research personnel, and the establishment of other competing players (RTOs) providing similar services with higher levels of public funding. With the goal of mitigating these types of risk, high standards of technical competence and delivery of projects can be established, as well as increased public funding for R&D initiatives.

Related Quote

There is competition from new R&D organisations with higher levels of public funding, which in turn can provide competition for industrial project partners.
Director of an RTO

Liquidity risk: a fourth risk was highlighted relating to liquidity risk, such as a lack of back-up lines and poor cash reserves in securing funding from private financial market participants. Some RTOs emphasised that a lack of cash reserves, poor payment collection, risk of default and potential payment delays (public and private) are factors that could negatively impact the financial involvement of private financial market participants.

Finally, a few RTOs referred to a number of other challenges that make it difficult to obtain funding from banks. They specially refer to increasing credit requirements such as high interest rates and short repayment periods, complex and stringent due diligence frameworks and guarantees, and general risk aversion often due to a lack of understanding of the technology/market potential.

Related Quotes

There are several restrictions to credit in the private financial sector, including increased requirements and high interest rates.
CEO of an RTO

Bank lenders have recently introduced more stringent due diligence frameworks and guarantees.
Director of an RTO

Financial market participants show risk aversion towards investments in lower TRL level projects.
Financial Executive of an RTO

Finding 5: Public financial instruments are not able to fill the funding gap if RTOs fail to secure funding from private sources

Under the scenario that the RTO fails to secure funding from private sources, several RTOs (n=5) stated that public financial instruments, such as debt from a public institution, would not be able to fill the financing gap. A few RTOs (n=3) responded that in an emergency they can resort to national public instruments for debt offered by a public institution. However, current business models (see also Chapter 6) and associated repayment potential would make such loans difficult and very likely only available with unfavourable conditions.

Figure 15: Public financial instruments' ability to fill a (investment) funding gap[48]

3 respondents

Related Quotes

There is a long-term loan by a [national institution], but we can only obtain these funds if our RTO were to declare bankruptcy (i.e. one week away). The loan is however a one-time scenario, and it is not likely that such an intervention would happen again.
Head of Business Development of an RTO

Our RTO has access to a government venture fund, which allows us to secure funds for start-ups.
Managing Director of an RTO

5 respondents

There are no public financial instruments available to fill the shortfalls in private funding. It is our responsibility to find alternate sources of private funding, or to fund from our reserves, which in turn leads to a prudent approach to partly funded public projects.
Director of an RTO

We do not foresee any contributions from public sources, leaving us with internal turn-around, lay-offs and an increased focus on internal productivity.
CEO of an RTO

Several RTOs underline potential solutions to mitigate the absence of public funding, such as the availability of contingent loans where repayment is dependent on the success of the project, which in turn would also acknowledge that R&D projects/investments have an element of risk. Additionally, other potential solutions (as indicated by the RTOs) included a reduction of term debt and an increase in equity.

[48] Based on eight responses; five responses n/a.

5. RTOs' project and access to finance challenges

Based on the RTO consultation and the assessment of industry and investment trends, Chapter 5 introduces and discusses the particularities of RTO projects and the challenges faced in accessing third party financing and overall financing close. The results suggest that through the opportunity offered by the market for **business model innovation**, RTOs have leeway to mitigate operating challenges, underpin their stability and reinforce the impact of their societal mission. Chapter 6 will discuss in more detail the impact that business model innovation can have on RTOs' financial strength, access to finance options and the opportunity provided to strengthen and optimise their societal impact.

5.1. Project-level challenges

RTOs' investment proposals typically involve sizeable technology and project risk, and require significant non-refundable, equity or in-kind contributions.

Technology transfer – first-of-a-kind (FOAK) projects

In technology transfer projects, the complex nature of the technologies concerned and their market potential, in particular for first-of-a-kind (FOAK) projects, combined with potentially long development-to-commercialisation periods, a lack of project track record (e.g. FOAK) and the complexity and uncertainty of the technology developed, may escalate project execution risk (delays, growing costs, etc.) and pose a natural barrier to accessing traditional repayable funding instruments.

Among the risks of these types of project are:

- Significant operating costs (development-to-commercialisation phase) coupled with lack of cash flows at project level.
- Project (technology) complexity coupled with intrinsic cost/budget uncertainty due to lack of track record, raising risk of project redefinition, cost escalations and overruns.
- Commercialisation uncertainty[49], therefore of the ability of the project to repay committed debt types of financing.

Regulatory requirements (e.g. Basel III regulations) on banks and insurance companies have further reduced their willingness to take risk, impacting investment activities which might have otherwise been considered. When it comes to unproven technology, banks and general investors tend to restrict themselves to opportunities involving projects at the stages of initial market introduction and market expansion (**beyond TRL 9**) (see Section 3.2 for further background on TRL levels), hence where manufacturing is fully tested and validated and production is fully operational. This is because in traditional debt financing the repayment obligation (interest and principal) of the debt instrument, in the case of projects that still have significantly high levels of inherent cash flow uncertainty, builds high insolvency or bankruptcy risks in the funding vehicle. Stand-alone third party equity investment proves problematic in particular for FOAK projects.

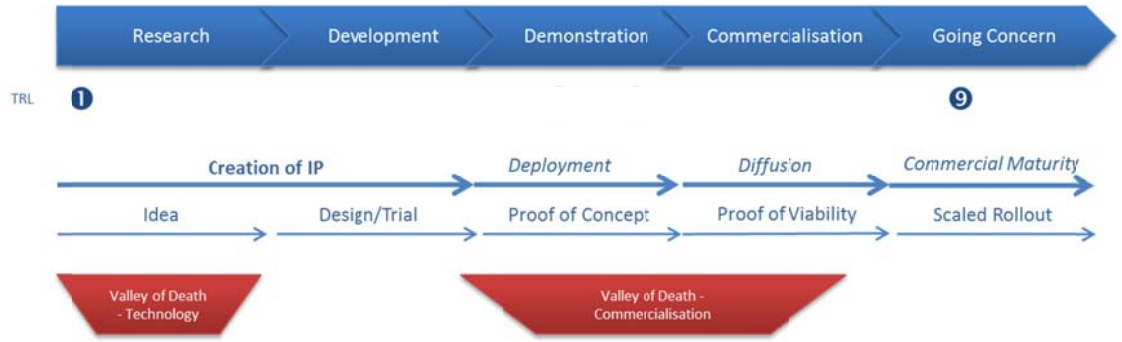
[49] Commercialisation uncertainty takes into account direct and indirect risks to cash-flow generation. A project may have relatively solidly locked off take agreements and therefore low direct commercialisation risk (e.g. traditionally the case of feed-in tariffs for technologies connected to renewable energy) but still carry a significant indirect commercialisation risk (e.g. regulatory approval uncertainty in the case of med/health technologies).

Explanations for this retrenchment include the competing attraction of opportunities present in other sectors, especially the more "capital-light" deals.

In summary, as it stands, equity-based financing and risk-sharing facilities are more focused on TRL 8-9 projects (manufacturing proven and production operational), as projects and project holders are often able to generate revenues from more proven technologies, less risky research which feeds existing operations and/or cash flow from project commercialisation is certain/has a sufficient degree of certainty with traditional debt lenders and general investors stepping in at TRL 9 or later.

Integrated investment solutions are certainly needed for innovations that relate to projects at the stage of demonstration in an operational environment (TRL 7) and system completion/lower scale piloting and demonstration, and the stage of qualification/manufacturing testing (TRL 8). Figure 16 below illustrates this commercialisation/second valley of death in the context of the TRL spectrum and a project's maturity phases.

Figure 16: Project TRL versus sources of finance – commercialisation funding gap



Previous IFA studies across different innovation sectors such as bio-economy, circular economy[50] and SET (sustainable energy technologies) further show that debt funding is not widely available for FOAK projects and have advised developing new instruments and/or adjusting existing ones to address the identified funding gap. This is for example the case in the Infectious Diseases Financing Facility (IDFF). It should also be noted that, as will be discussed in detail in Chapter 7, the EIB's financial instruments such as the Energy Demonstration Projects Facility (EDP) and the above-mentioned Infectious Diseases Financing Facility (IDFF), as well as contingent tailor-made facilities under InnovFin and EFSI, are devised to address this commercialisation valley of death.

For lower TRLs (research, invention, prototyping and incubation) it is seed, venture capital and grant funding – not debt – that is best suited to financing a project. Standard debt project finance is ill-suited before projects are piloted and matured to a certain level. Although not within the scope of this study, Figure 16 maps the lower TRL levels to the project's stages and indicatively positions the lower TRL levels valley of death – the technology/first valley of death.

[50] For additional information on financing the circular economy see the IFA report available at: http://www.eib.org/infocentre/events/all/financing-the-circular-economy.htm

Additionally, technology-driven projects are found to face intrinsic limitations in access to finance arising from the lack of tangible collateral, proof of concept and of size/scale:

- Technology projects, in contrast to research and innovation infrastructure, are to varying degrees based on intellectual property (IP) with limited or no tangible collateral. In contrast with projects with tangible collateral (e.g. research and innovation infrastructure) lenders tend to grant no or at best very limited value to IP as collateral. In essence, the lack of monetisation prospects for IP (whether completed or in progress) hinders the value of the IP as collateral as it does not contribute to enhancing the recovery rate for the lenders.

- As RTOs do support new technology projects, (lack of) proof of concept (hence technology risk) adds an additional layer of risk to successful project execution and the financing thereof.

- Finally, lack of size and scale (technology and commercialisation) may be detrimental for creditworthiness. The appeal to external investors tends to be lower when size and scale are limited because of the comparably high transaction costs. Investors will perform a balancing act of due diligence effort and project risk versus expected return.

Infrastructure projects

Together with research infrastructure[51] (RI), infrastructure for innovation and commercialisation (IIC) and technology transfer projects (TT) are an integral part of the European innovation ecosystem. IIC often concerns investments in technological infrastructure (e.g. e-infrastructure) and the development of pilot lines[52], which are needed to test and scale-up the production of innovative products and services (higher TRL levels). IIC plays a critical role for technology commercialisation and market introduction and is hence important to fulfilling the role of RTOs. IICs are usually composed of a multi-disciplinary network of different public and private sector actors, including RTOs, universities, SMEs and industry. They contribute to transforming research across the different technology readiness levels (TRLs), supporting technology transfer and applications of existing technologies in their respective sectors, start-ups, SMEs, and industries (especially when in-house industrial RDI capabilities are not available or limited).

The results of the RTO market consultation have pointed out that there are different challenges that need to be overcome in order to ensure the sustainability of RTO operations and associated investments in, for example, IICs. Some of these key challenges are uncertainties regarding future shareholder contributions (including from public shareholders), uncertainties with respect to private sector co-investments and demand for RTO services, and general liquidity risks. Scarcity and the lack of integration of different funding sources (venture capital, bank financing and grants) add another layer of complexity and difficulty to accessing available finance.

[51] Infrastructure for scientific research refers to facilities, resources and related services used by the scientific community to conduct cutting-edge research in their respective disciplines, ranging from social sciences to astronomy, genomics to nanotechnologies.
[52] KETs Final Report (2015) Assessing support of pilot production in multi-KETs activities: D7 final report of the multi-KETs Pilot project, including the tentative policy roadmap. 28 August, 2015, page 28.

Additionally, IIC projects lack a solid track-record for up-front assessment due to their innovative nature and are more likely to experience unforeseen complexities, both of which contribute to cost escalations in the operating budget. In light of these uncertainties, solid oversight and due diligence is required on both the technical and funding side in order to mitigate as many of the foreseen risks as possible through adequate contingency safeguards.

5.2. *The role of financial flexibility and optimisation in supporting RTOs' mission*

To sustain and even maximise societal impact, reliable and sustainable sources of funding (funding mix) and optimal allocation (and associated choices) of such funding is important. Indeed, grants have the benefit of not being repayable and requiring lower scrutiny than private funds, and in particular debt and debt-like instruments. However, as the market consultation also emphasised, grants (especially for core funding) are an unstable source of financing, uncertain in duration, volume and grant policies, and subject to political changes and risk. Repayable and private financing is in contrast stable and long term. The constraints faced by RTOs in financing their projects need to be addressed in the first instance by the RTO business model and associated financing strategy.

In terms of business model, there are clear opportunities provided through open innovation. Companies are increasingly shifting from so-called closed innovation processes towards a more open way of innovating. As Chesbrough[53] has pointed out, large amounts of knowledge exist outside the research laboratories of large companies. The availability of venture capital has made it possible for good and promising ideas and technologies to be further developed outside the firm, for instance in the form of entrepreneurial firms. Moreover, the possibilities of further developing ideas and technologies outside the firm, for instance in the form of spin-offs or through licensing agreements, are also growing. In general, RTOs already play an important role in making open innovation possible through the provision of technology and IP, R&D and innovation services, highly trained human capital, etc. As companies increasingly search for new technologies and knowledge outside of the boundaries of the firm, RTOs can position themselves even more strongly as open innovation partners. However, in order to fully appropriate the benefits and generate new streams of income, RTOs (clearly not a similar extent) should also innovate in their own business model by rethinking their value proposition and associated compensation mechanisms.

Hence, in order to secure funding for the associated future essential investments, action needs to be taken at different and connected stages:

Stage 1: Optimisation of existing business model

In general, RTOs have the opportunity to optimise and complement their business model by further taking advantage of the opportunities and challenges offered by the operating environment such as those discussed in the previous section.

- Firstly, **review RTOs' traditional business models (and funding strategy)** in order to adjust to and take advantage of the new investment, competitive and market landscapes, and the opportunities provided by the open innovation model. A business model that better

[53] Chesbrough, H. (2003), "Open Innovation: The New Imperative for Creating and Profiting from Technology", Harvard Business School Press.

monetises the value of RTOs to industry will enable management and reduction of the effects of the uncertainty surrounding grant availability (in particular core funding) and will enhance the leveraging factor of grants in scenarios when no other alternative sources of finance are available.

- Secondly, a reinforced focus on **understanding what the investors' show-stoppers are and accordingly, on structuring, managing and adjusting project risks** early enough in the project cycle to match, as far as possible, the risk appetite of the investment community and thereby broaden the funding mix (Chapter 6 is devoted to this subject).

In summary, the greater the extent to which the RTO (or any other project holder) is able to generate sizeable and stable revenues from its portfolio of projects and activities, the stronger the credit support it can provide to the project. This de-risking paves the way for improved financeability and broadens access to financial instruments. Of equal importance is the fact that a reinforcement of RTOs' business model can be expected to add financial flexibility and a balance sheet buffer, instrumental for RTOs to become more active investors.

Stage 2: Diversification of financing sources

Insofar as the optimisation of the business model is achieved, alternative sources of finance can be made available for project financing. These should further complement grants as they allow for:

- The deployment of these grants for activities that are the most necessary (e.g. lower TRL projects), and coincide mainly with "competence building" in RTOs' three-stage innovation dynamic and funding model (see Figure 7).
- Improved ability of the project holder to support the project in case of execution difficulties arising (e.g. delays), the latter because the RTO will still have the grant buffer to support the project if necessary (in view of an overall risk-improved business model).

In summary, on the basis of an individual RTO's portfolio of RDI activities (see Section 6.3) a funding mix should be developed that combines repayable sources and grants in a complementary and mutually reinforcing way.

6. RTOs business model versus ability to attract financing

As laid out in Chapter 5, RTOs should consider optimising their existing business models and adding new models where applicable (while safeguarding the often grant based core activity, new knowledge development), thereby paying sufficient attention to project concept and design and investment limitations. To ensure that viable innovation projects with real added value (real impact) are not stranded due to a lack of (timely) finance, consideration by both RTOs, in maximising the financeability of the project, and by finance institutions such as the EIB, in improving access to finance conditions for RTOs via specific financial solutions, are important.

This chapter examines the impact of business model optimisation on the RTO funding gap. For this purpose the study has analysed the qualitative structure of the RTO funding gap, the results of which are presented in the first part of this chapter. As detailed therein, findings show a funding gap with a split origin – endogenous and exogenous – each requiring a different type of address. The chapter goes on by analysing in detail the opportunities that an enhancement of the business model (discussed in Chapter 5) offers to RTOs to tackle the endogenous funding gap and to, ultimately, increase the impact of their mission. The exogenous component of the funding gap identified by the study requires a different address, in the form of support of adequate financial instruments, and accordingly is discussed separately in Chapter 7.

Lastly, as the purpose of the proposed business model optimisation discussed herein is aimed at enhancing both (i) the credit profile of RTOs (hence their ability to financially support their projects) and (ii) the credit profile of the projects to optimise its fit with investors' needs, the chapter closes with an overview and analysis of typical credit drivers of investors' decisions.

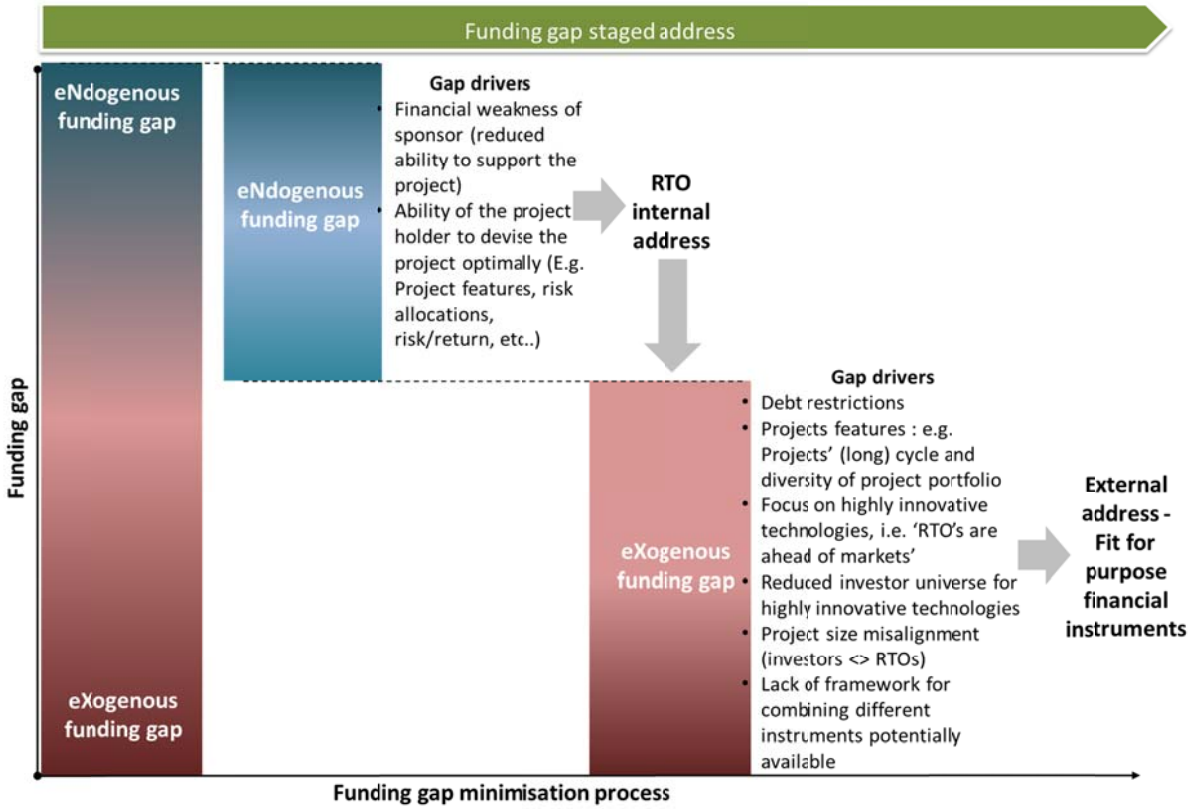
6.1. Mapping RTO access to finance barriers – a two-level split funding gap

In general, RTOs have the opportunity to improve the financeability of projects via business model innovation in two ways. Firstly, by improving their financial flexibility, expanding their access to finance via business model innovation and secondly, by addressing as far as possible private investors' "show-stoppers" when devising projects (for further discussion and details see Section 5.1). Yet, the study shows RTOs face an inherent funding gap in addition to the one that could be addressed through this business model innovation. This exogenous funding gap is in essence driven by RTOs' being ahead of markets due to their focus on highly innovative technologies, certain intrinsic features of their projects and for some RTOs, their legal limitations in raising debt finance.

Figure 17 illustrates this split (endogenous/exogenous) funding gap and its key drivers. As depicted therein, to the extent that financing instruments to address investment barriers are available, the ability to attract the necessary external investment is fundamentally driven by the soundness of the project and the strength of the sponsor. Hence, in a basic scenario, a sufficiently solid free cash flow generation capacity of the project sponsor and its ability to structure investor-sound projects will minimise this funding gap. Insofar as RTOs have the opportunity to narrow or eliminate this funding gap via business mode information, the study has considered this gap as endogenous, i.e. demanding

an internal address by the RTOs. Yet, independently of the degree of business model innovation/financial strength, RTOs do have a residual, exogenous financing gap as illustrated in Figure 17.

Figure 17: Identified RTOs split funding gap



Note: Sizes of boxes are illustrative and are not in any way indicative of relative size/proportion.

Endogenous funding gap

In many cases the financing barriers faced by RTO projects to access return-based financing are project-specific and in essence similar to those faced by non-RTO-promoted projects of the same kind. For instance, technology and commercialisation risks are at the root of the funding gap faced by RTOs' technology transfer projects whilst project execution, completion and commercialisation are among the risks faced by RTOs' RDI infrastructure projects. As laid out in Section 7.2, the EIB has financial instruments in place aimed at bridging the gap between investors' risk/asset-class appetite and projects' financing needs. A case study discussed in detail in Section 7.2, in technology transfer, concerns the AW-Energy (FOAK project in the area of blue energy) supported by the EIB's Energy Demonstration Project Facility (EDP) to bridge the valley of death between demonstration and commercialisation (see also Figure 16).

Lack of ability by the project promoter to support the project and weak structuring of the project are typically among the barriers for project financeability faced by project promoters in high risk profile projects such as those introduced above. The current operating environment offers RTOs the opportunity to tackle these obstacles – hence the endogenous funding gap – via enhancement/innovation of the business model that brings in financial flexibility and access to broader (return-based) sources of finance. Additionally, improving awareness and knowledge of the EIB Group instruments available coupled with a more widespread consideration of EIB Group instruments by RTOs when devising projects will be beneficial.

Exogenous funding gap

The exogenous funding gap stems from the intrinsic nature and activities of RTOs. Regardless of the soundness of their cash flow generation capacity and project structuring, RTOs have fundamental differences with corporates, such as the decoupling of high innovative technology and markets, project features of these innovative technologies and certain regulatory limitations to debt financing. Furthermore, in contrast with, for example, a traditional corporate, RTOs' activities cover an extensive range of RDI projects across multiple technologies and with unique features. Table 1 summarises the main drivers of the exogenous funding gap observed.

Table 1: Key drivers of RTOs' exogenous funding gap observed

	Gap driver	Description
❶	**Debt restriction**	• Legal limitations of some RTOs to accessing debt financing
❷	**Project features**	• E.g. Projects' (long) cycle
❸	**Project diversity**	• The granularity of the project universe (see Section 7.1 for further details)
❹	**Focus on highly innovative technologies**	• Due to the nature of their activities, RTOs tend to be ahead of markets, including investment trends, solutions and appetite
❺	**Investor appetite for highly innovative technologies**	• E.g. Lack of the required technological expertise, opportunity costs, etc.
❻	**Project size misalignment (investors <> RTOs)**	• The small (for the market) or excessively large (for RTOs) size of projects
❼	**Blending**	• RTOs' projects span a broad risk spectrum, meaning that they need to be financed by different forms of capital, involving not only bank finance but also equity and grants

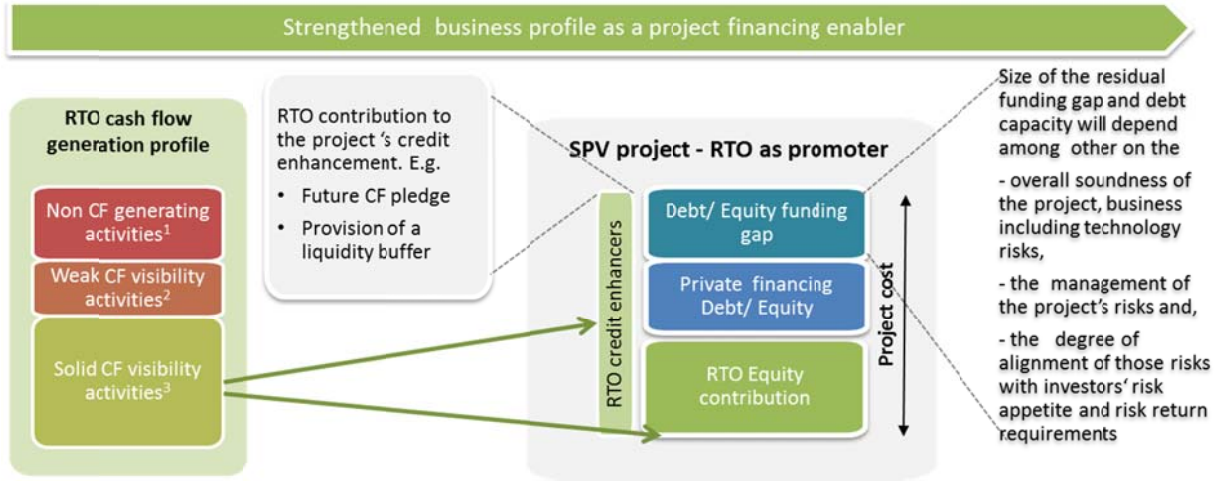
6.2. *Funding gap implications of business model innovation*

Introduction. The effect of business models on narrowing the (endogenous) funding gap

Taking as an example the case of IIC projects, the funding commitments by shareholders have to cover all funding needs during the RI project cycle phases: (i) pre-implementation: normally characterised by lower financing needs; (ii) implementation/construction requiring the largest amounts of financing; (iii) operational phase: lower amounts, but may stretch over extended periods; and (iv) phase-out: lower amounts, but again may require a prolonged commitment. There might be differences in the timing of cash payments between totally new projects (greenfield), where larger amounts are likely needed in the first few years of construction in the case of IIC, and ongoing projects (brownfield), where payments are presumably more evenly distributed.

The above-described funding challenges illustrate some of the multiple financing risks that RTO projects are exposed to and that are discussed in detail in Chapter 5. Regardless of whether the project is on balance sheet or off balance sheet, its financeability will be subject to, among other things, the ability of the project sponsor to mitigate the financial (and business) risks via a sufficiently robust business profile. Figure 18 illustrates (through an off balance sheet example) the implications of robust cash flow generation capacity on the part of the promoter and sound structuring of project risks in achieving project bankability and minimising the funding gap.

Figure 18: Impact of the business model and project structuring in projects' funding gap



A robust business profile improves the ability of the project sponsor to provide the project with the financing support needed to attract investors. Adequate structuring of project risks further supports the financeability of the project, and also reduces the project's funding gap. For further discussion and details on RTOs' cash flow generation/business model see Section 6.3.

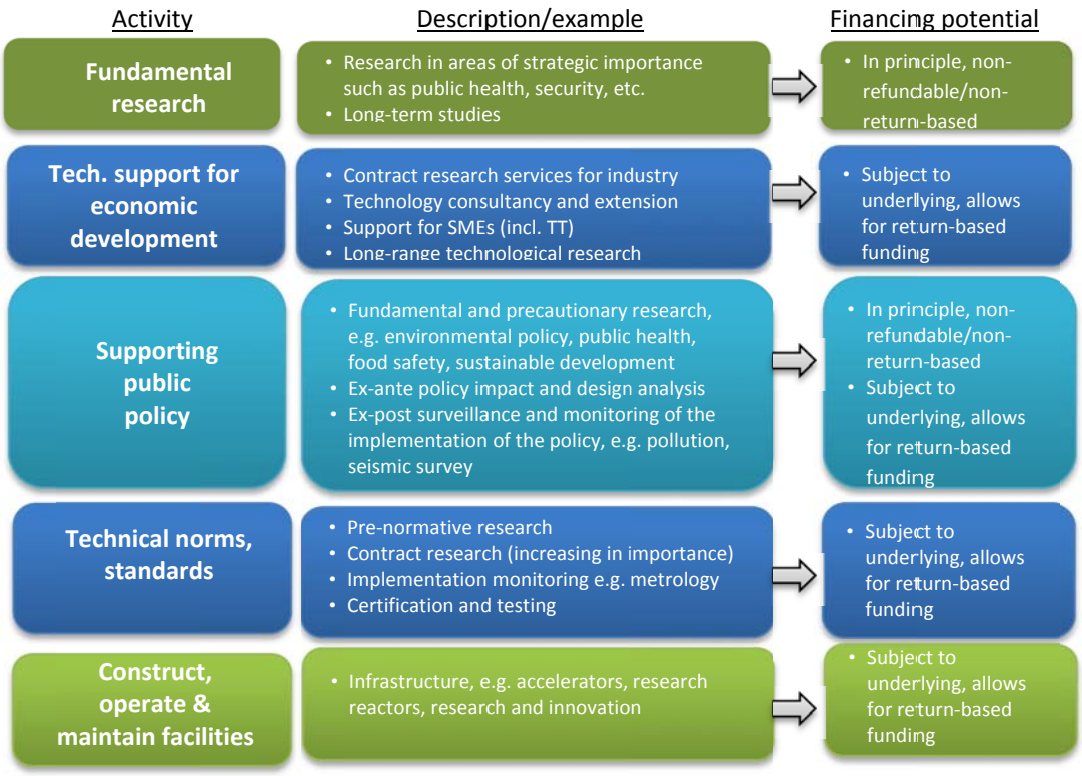
6.3. RTOs' business model, financial flexibility and project financing implications

Differences in the operating context[54] of RTOs, their mission, scope and particularities[55] of their activities makes RTOs, and their projects, a highly granular community (see also Chapter 4). RTO research activities embrace features of both basic and applied research. Basic research allows RTOs to develop the knowledge and technologies needed to complete their service offering (and thus their mission) while their applied research activity allows for prompt/short-term[56] or longer-term[57] horizon cash flow generation. Figure 19 offers an indicative layout of the aforementioned RTOs' activities, their content and which of them could potentially (subject to the underlying features of the activity) be fit for return-based (commercial) financing. **The heterogeneity of RTOs' activities and of how these activities are performed explains why even in a case of RTOs with similar form, mission, scale and environment, their financial stance can differ significantly.**

[54] The operating context in its broader sense includes aspects such as the RDI stance of their related governments up to the economic environment within which they operate and the particularities of the regions in which they are active.
[55] The particularities of RTOs' activities are broad, expanding from geographical reach to matters such as the structure of the offtake agreements they may engage in.
[56] E.g. prompt/instant contract research.
[57] E.g. technology transfer: R&D with the objective of developing a new technology with the aim of being transferred/commercialised at some point in several years' time.

The more the RTO, or any other project holder, is able to generate sizeable and stable revenues from its portfolio of projects and activities, the stronger the credit support it can provide to the project. De-risking paves the way for improved bankability and broadens access to financial instruments. Furthermore, a reinforcement of RTOs' business model can be expected to add financial flexibility and a balance sheet buffer, instrumental for RTOs becoming more active investors. Figure 19 illustrates the indicative access to finance potential that RTOs have based on free cash flow generation potential.

Figure 19: Indicative layout of RTO activities and positioning vis-à-vis potential return-based financing



Source/based on: Research and Technology Organisations (RTOs) and ERA, European Research Advisory Board, December 2005; EIB

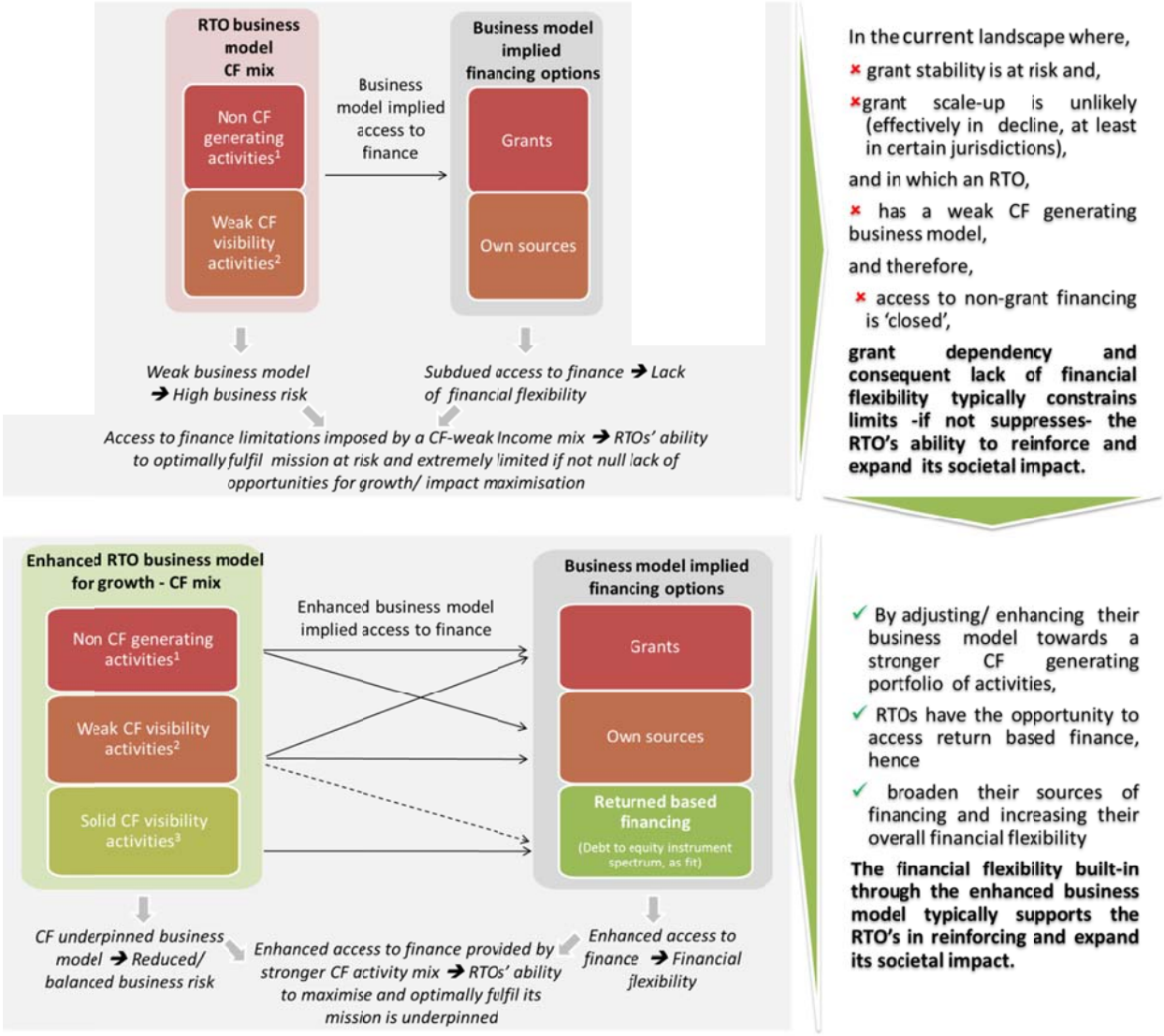
The way activities are performed and the combination of those activities (i.e. the broader business model) lays the foundations for RTOs' financial flexibility. For example, innovation infrastructure services and IP ownership may be a source of cash flow but subject, among other things, to the soundness of the engagements (e.g. duration, counterparty, granularity) and, in the case of IP, the degree of monetisation of the IP and how this monetisation will be achieved (e.g. royalties versus TT).

The structure of RTOs' activity portfolios poses substantial management challenges. The way the portfolio is structured and combined will be a key element in defining the financial flexibility that the RTO has/may be able to achieve within a given funding landscape.

The business model and therefore the quality of the income streams should have sufficient financial flexibility to adapt not only to changing funding landscapes, but also research opportunities and operating environments. Figure 20 illustrates the impact of business model cash flow robustness in an entity's financing flexibility.

Figure 20: Business model implied access to finance. Illustrative examples

Weak free cash flow generation business model versus an enhanced free cash flow generation business model
Financing options



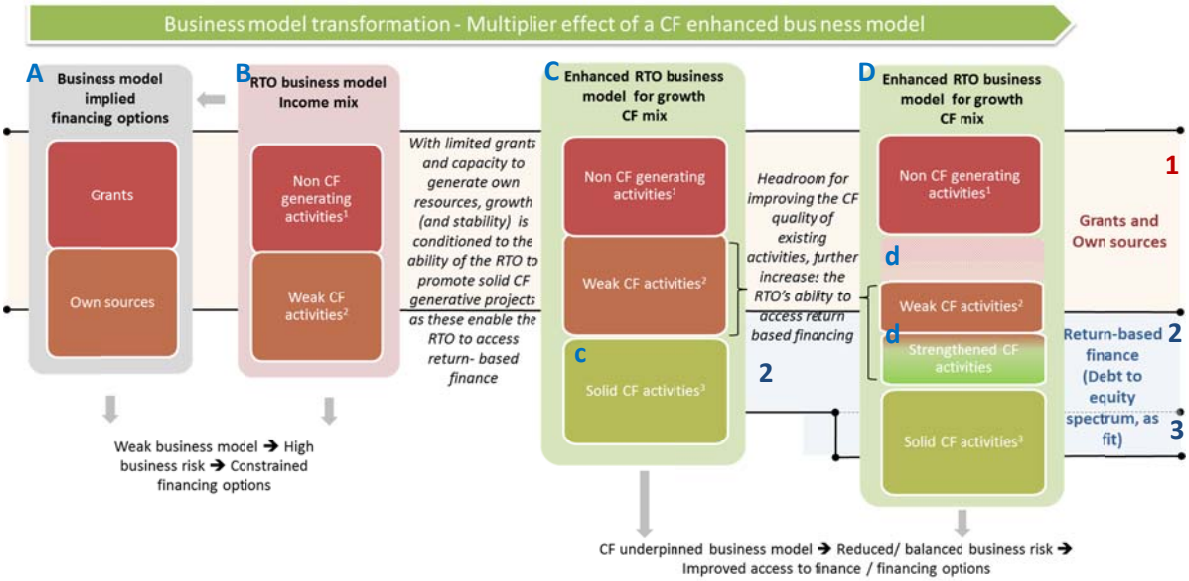
Notes: Sizes of boxes are illustrative and are not in any way indicative of the relative size/proportion of the different sources of CF and/or financing instruments; CF: free cash flow; own sources ≅ cash available; 1) Non CF generating activities. E.g. fundamental research; non-monetised IP; 2) Weak CF visibility activities. E.g. weak IP royalties' arrangements/weak contractual arrangements for contract research services/sub-optimally commercially devised infrastructure projects; 3) Solid CF visibility activities. E.g. long-term sizeable IP royalties' arrangements/long-term solid margin contractual arrangements for contract research services/solidly commercially devised infrastructure projects, with solid investment/return features; 4) A sufficiently robust CF component in the portfolio of activities could potentially make it possible to finance certain weaker CF activities via return-based financing.

In turn, the financing strategy and therefore the financing instruments of an RTO should aim to balance both the short and long-term perspectives and the reliability and durability of its income streams. An improved cash flow generation capacity combined with a manageable refinancing risk should enable RTOs to strengthen their income bottom line and thus their ability to support both internal and off balance sheet/spin-off projects.

Furthermore, as illustrated in Figure 21, **the improved financial flexibility achievable through a cash flow enhanced business model can be expected to have a multiplier effect on RTOs' mission reach**. As the enhanced cash flow generating activities enable the RTO to access return-based finance, the RTO can focus the deployment of grant funding on the portion of their activities that, by their nature, are non-cash generative, such as fundamental research.

In Figure 21, the left side of (A) shows the typical financing options (grants and potentially a certain volume of internally generated resources) available to the case's example RTO with a portfolio of activities shaped in a way that generates weak (volume, stability) cash flow to the RTO (B). Access to finance (grants and own sources) is illustrated as a red band (1). As shown in (C), a growth model for this RTO in which the newly initiated activities (C) provide stronger monetisation/return for the RTO results in an overall strengthening of the RTO's financial profile, paving the way for accessing broader (return-based) sources of finance (1)+(2). An enhancement of the monetisation of existing weak cash flow generative activities (d) further amplifies access to finance (1)+(2)+(3).

Figure 21: The multiplier effect of a strengthened business model for growth. Illustration



Notes: Sizes of boxes are illustrative and are not in any way indicative of the relative size/proportion of the different sources of CF and/or financing instruments; CF: free cash flow; own sources, cash available; 1) Non CF generating activities. E.g. fundamental research; non-monetised IP; 2) Weak CF visibility activities. E.g. weak IP royalties' arrangements/weak contractual arrangements for contract research services/sub-optimally commercially devised infrastructure projects; 3) Solid CF visibility activities. E.g. long-term sizeable IP royalties arrangements/long-term solid margin contractual arrangements for contract research services/solidly commercially devised infrastructure projects, solid investment/return features.

The impact of an RTO's business model on its financial flexibility and therefore ultimately on its ability to serve its mission can be easily identified when looking into some of the features and dynamics of its activities. For instance, in mission-oriented research in the context of critical mass and, in innovation infrastructure, in matters such as competitiveness, duplicity as well as critical mass:

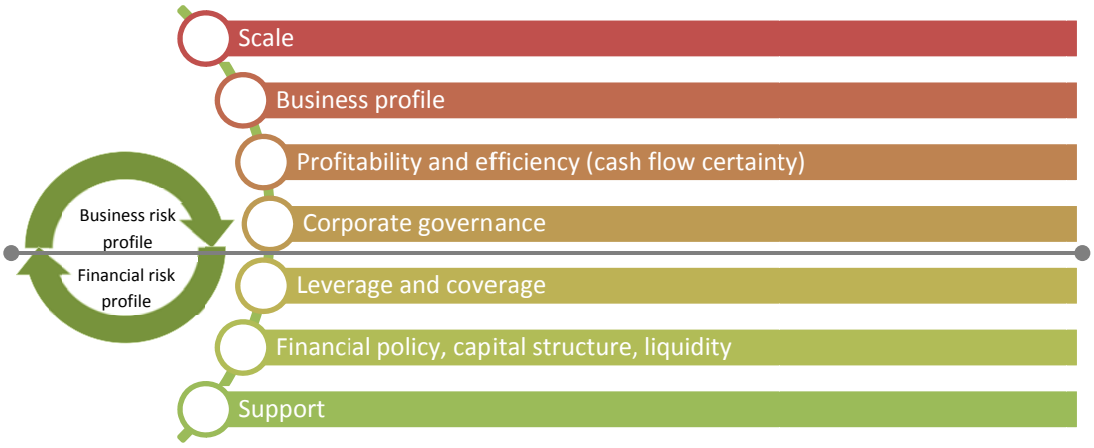
- In **mission-oriented research**, the rising complexity of the technologies and markets, the changing operational conditions and research opportunities, the costs of equipment and infrastructure and the different degrees of R&D support at national level pose a sizeable challenge. Trans-border cooperation/pooling between RTOs with a similar scope/mission could be a way forward to maximise the results of the activity whilst providing additional financial flexibility through lower costs, synergies and elimination of duplicities generated by the pooling.
- Development of **innovation infrastructure**, following regional and national policy objectives may result in trans-regional/national duplicities, lack of critical mass and overall a lack of the necessary scale to compete globally which, in turn, ultimately leads to non-financially sustainable projects. Opening up innovation culture among RTOs and relevant stakeholders and having sufficient operational independency from their governments/public sponsors play a relevant role in nourishing the needed cooperation between RTOs in order to maximise the value added of innovation infrastructure.

6.4. Considerations for third party debt capital raising. Credit risk

As already discussed, RTOs with a business model that is able to generate a solid and stable cash flow stream are more likely to be able to successfully adjust and benefit from the new financing landscape and financing reality. They are therefore also likely to be in an improved position to support their RDI projects, which typically feature high technology, execution and commercialisation risks.

This section is intended to provide RTOs with general guidance, awareness and understanding on how qualitative and quantitative risk characteristics typically affect the creditworthiness and therefore the financeability of their technology ventures throughout the project life cycle. Figure 22 introduces the key drivers of an entity's overall strength. In principle, ceteris paribus, the stronger the business profile is (in essence, solid and stable cash flow generation capacity) the higher the financial risk that entity can take on. Access to a broader source of financing instruments (such as the spectrum of return-based financing), investor base and financing terms are among the typical benefits of such increased financial flexibility.

Figure 22: Standard credit risk drivers – Entity level



Note: The risk factors considered here are entity-specific. Other risks such as country, industry, and project execution have to be considered as well to perform a creditworthiness assessment.

The *business model credit drivers* presented in Figure 22 are briefly discussed below:

- ***Size and scale***

Scale is an indicator of the strength of the entity and therefore of its resilience ability to overcome project – including technology – execution challenges as well as to commercialise and influence the value chain (customers, suppliers). The resulting diversification of a broader commercial application of a technology (e.g. product, industry, geography) leads to more stable and predictable revenues and profit once the technology reaches commercialisation (reduced commercialisation risk). For any project credit worthiness, the higher its business risk is the lower the financial risk the project will be able to take on. Small and mid-market projects tend to be intrinsically more vulnerable to volatility due to the uncertainty of future margins, scalability and penetration. The combination of a high technology risk and overall project execution risk at development phase and high profitably risk at commercialisation phase typically results in a non-financeable project. Insofar as this commercialisation risk can be modelled and/or reduced at project conception stage, the bankability of an intrinsically high risk technology and/or development project will improve.

- ***Business profile and profitability***

Operating efficiency typically indicates high cash conversion cycles. Ceteris paribus, a project with higher operating efficiency can absorb higher revenue volatility. Operating efficiency comes in many forms – such as working capital and flexibility in cost structures – and should be taken into account at project inception to maximise the bankability of a project. A competitive advantage is to demonstrate more stable operating margins and therefore, ceteris paribus, improved bankability. Furthermore, the uniqueness and transferability of the project's technology, technology integration and cross-market (sector, jurisdiction) solutions lay the foundations for operating cash flow stability and should be taken into account to maximise the bankability of a project.

- ***Governance***

For a project to be declared as bankable, the lender has to be able to assess the financial and governance structure. The overall governance structure of the project has to be determined, relating to the scope of activities, targeted research goals, shareholder structure, legal framework, and management and administrative arrangements. Additionally, the project holder should address upstream risks and safeguard against any premature end or potential cancellation of commitments by including a risk mitigation strategy integrating adequate contingencies, e.g. in case of cost overruns.

7. Potential EIB Group financing solutions

The RTO community is a highly granular universe – with different objectives, scope, legal forms, size, etc. – and so are its projects. Consequently, a one-size-fits-all solution is not applicable. When assessing the fitness of financing instruments the study has aimed to take into account as many RTO-specific aspects as possible in order to draw conclusions on whether tailor-made financing solutions are needed.

To address RTOs' exogenous funding gap, this chapter first streamlines and rationalises the RTO project environment by grouping the projects (presented to the EIB) into clusters. The second part of this chapter analyses the track record of access to finance and fitness of the most relevant EIB instruments, including examples. In the next part, the study assesses how fit these instruments are to address project-specific features and the exogenous funding gap (discussed in detail in Chapter 6). Based on the above analysis and results, the last part of this chapter sets out the way forward in terms of financial instruments that could significantly improve capacity to support RTOs' projects. Finally, Table 7 and Table 8 in Annex I present a detailed description of the instruments and of their fitness for RTOs.

7.1. RTO projects - Identification of access to finance clusters

The range of project types supported by RTOs is extremely wide. In addition, among similar types of project, each project is likely to have differentiating/unique features which in turn influence/may influence financeability. This fragmentation at project level stems partially from the granularity of the RTO community discussed in Chapter 3 and from the diverse nature of the technological solutions/underlying to be financed (for further details see Section 5.1). These singularities can be grouped into three differentiated layers according to their reach (see also Figure 23):

- **Layer 1 – Heterogeneity of RTOs**: granularity is the result, among other things, of differences in business models and financial flexibility, geographical scope, size, scale, reach, competitive position, legal form, technology and project and financial structuring knowledge.
- **Layer 2 – Granularity in types of project**: granularity is, among other things, the result of differences in project scope and objectives such as whether the project is a technology transfer, IP development, development infrastructure, if it is a spin-off or is on balance sheet, the sector or sectors involved and the stage of development.
- **Layer 3 – Project-intrinsic features**: at project-specific level, granularity stems from differences in the project business and financial risks and return. These differences are interlocked with Layer 1 and Layer 2 above yielding a complex and extensive set of possible permutations of shapes and types of project.

This multi-layered granularity of the RTO universe makes a one-size-fits-all solution for assessing and enhancing the access to finance of RTOs ill-conceived. When assessing the fitness of financing instruments, a balance has to be struck between this singularity and the aim of ensuring that the financing solutions in place sufficiently embrace and respond to the acute and proven funding gaps.

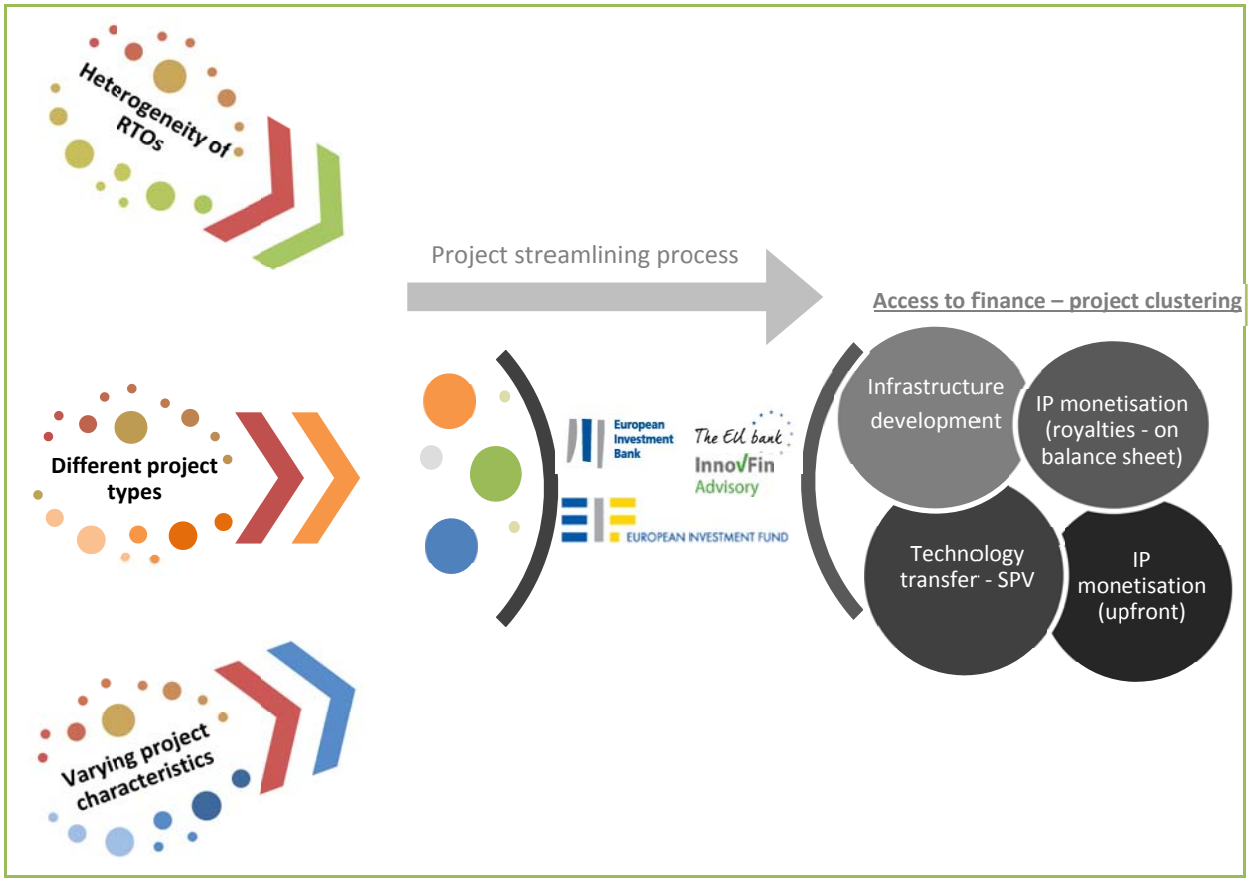
Projects presented to Innovation Finance Advisory (whether or not they achieved financial close) and those projects already financed by the EIB and the EIF are an effective point of reference to assess the needs but also the adequacy of existing instruments. Hence, by utilising this EIB Group pool of projects as the starting point to review the funding conditions of RTO projects, the assessment takes into account a sufficiently broad view of the access to finance environment. On this basis, the following types of projects have been distinguished (the "project clusters").

1) Innovation infrastructure
2) Technology transfer via SPV
3) IP monetisation: a) upfront (off balance sheet) and b) royalty-based (on balance sheet)

Figure 23 illustrates this process of streamlining and rationalising the otherwise complex scenario for assessing the financing conditions for RTO projects. Although not all of the projects referred to above were sourced by RTOs, their form and content are similar to those of RTOs. Indeed, the different nature of (one of) the sponsor(s) when an RTO is present feeds some particularities into the projects[58]. These particularities need to be taken into account when assessing the access to finance, but do not hinder the approach to and outcome of the above project clustering.

[58] These particularities are driven by i) potential formal restrictions imposed on some RTOs to debt fund themselves and ii) the fact that due to its genesis the RTOs' profile is to be fundamentally different from that of other sponsors (regardless of the soundness of their business and financial model).

Figure 23: Streamlining and rationalising the assessment of access to funding conditions - clusters



These project clusters share common features in terms of business and financial risks, such as cash flow uncertainty, project, technology and commercialisation risks and the relatively long time needed for projects to be significantly cash generative. However, there will also be material differences between them from a financing risk perspective, requiring a different financing approach. For instance:

a) An innovation infrastructure project cash flow generation risk could be mitigated if the sponsor is able to close a granular, long-term contract pool and/or engage with a number of counterparties with a sound credit risk profile.
b) In contrast, in principle, IP development without clear/short-term commercialisation prospects will provide absolutely no certainty of cash flow generation and therefore of the ability to generate the risk/return needed by investors.
c) Similarly, a project comprising the development of the IP (or technology) and at the same time its commercialisation will have a lower cash flow generation risk than an IP development (solo) project, as the latter (unless supported by a mechanism that provides sufficient certainty that the IP will be commercialised (e.g. royalties)) offers no prospects of commercialisation and therefore of investment return.
d) Regarding collateral, for the reasons above, the IP can be expected to have a relatively higher value as collateral in the case of IP development and commercialisation than in IP development. In the case of innovation infrastructure, as the project progresses collateral

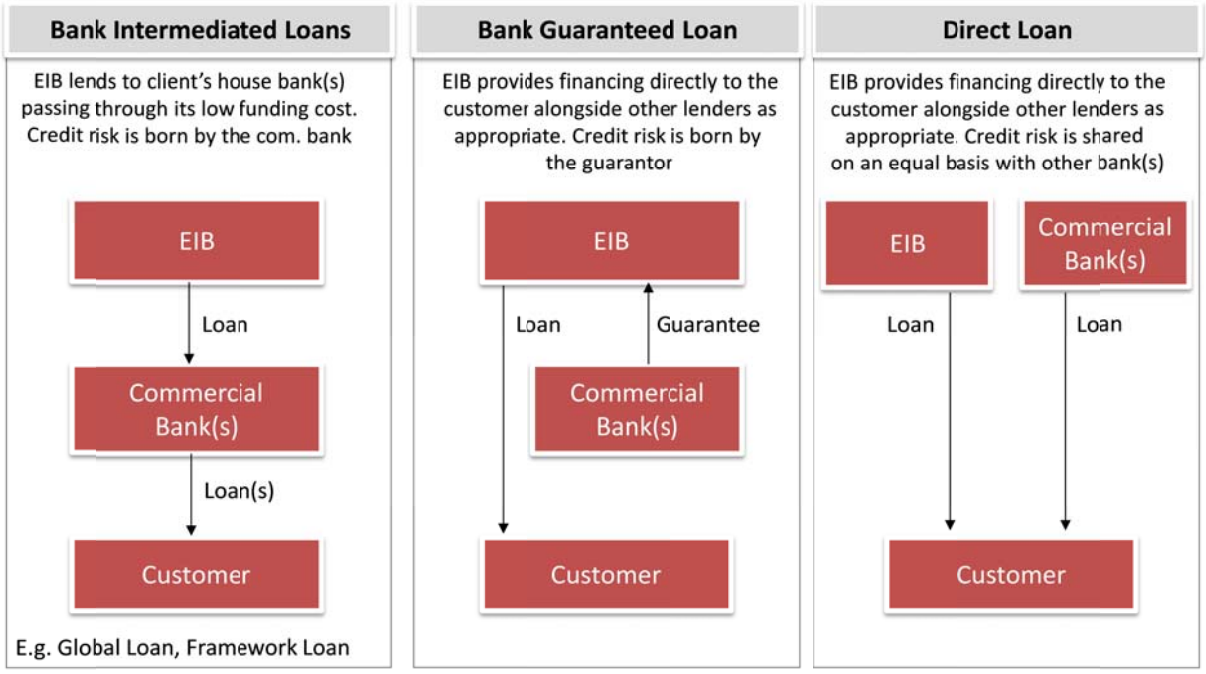
value is developed as the infrastructure progresses. In terms of technology uncertainty, a FOAK technology transfer at TRL 6-8 could in principle offer higher technology and execution risk than the development of innovation infrastructure. Furthermore, with innovation infrastructure, cash flow risk may vary substantially depending on the TRL level and nature of the counterparties involved (e.g. SMEs, universities, investment grade corporates, etc.).

The resulting clustering of projects and related considerations discussed herein lays the foundations for assessing the fitness of the existing financing instruments in Section 7.2.

7.2. Financing track record and fitness of selected existing financial instruments

The EIB has long-standing track record of providing financing to support research, development and innovation (RDI) through a set of financial instruments under different programmes and mechanisms. The classic EIB loan types are illustrated in Figure 24.

Figure 24: EIB loan types[59]



In the context of the EIB Group and the EC strategic joint initiatives under Horizon 2020 and the Investment Plan Europe (and similar previous initiatives such as the RSFF) aiming, among other things, to mobilise investment and foster research and innovation, the EIB Group has developed and continues to develop products to address both market investment gaps and financial instrument gaps[60].

[59] com.: Commercial
[60] Instrument gap refers to the lack in certain instances of fit for purpose financial instruments.

The EIB's track record of financing RDI projects sponsored/similar to those sponsored by RTOs covers the full equity-debt spectrum and clinches the different stages of technology development and nature of the projects.

European Fund for Strategic Investments (EFSI) and RDI infrastructure

Through the **European Fund for Strategic Investments** (EFSI)[61], part of the EIB Group's special activities[62], the EIB is able to accept higher risk projects and by facilitating their financing through offering instruments or accepting security structures which are not commonly available or accepted on the market, makes such projects feasible. The objectives of the EFSI programme and the instrument offering conceived address RTO/RTO-like projects.

The EIB has long track record of financing **RDI infrastructure**. In addition to financing through the EIB's standard lending operations, this infrastructure can be financed under EFSI, which enables access to finance for those projects with higher risk profiles. The following examples illustrate the EIB's investment impact in RDI infrastructure finance:

Technopolis Science Parks III

In November 2014, the EIB closed EUR 40m in long-dated financing supporting the knowledge-based economy in Finland, Lithuania and Estonia. The project totalling EUR 88m concerns the design and construction of premises for innovative companies, start-up incubators and research organisations in existing and new technology parks in Finland, Estonia and Lithuania. The promoter, Technopolis OYJ, is a Finish midcap public limited company operating in the science park segment and listed on the Midcap OMX Nordic Exchange Helsinki.

European Synchrotron Research Infrastructure

Under the InnovFin Large Projects product, the EIB provided EUR 65m in risk finance for the ESRF-Extremely Brilliant Source (ESRF-EBS) project promoted by the European Synchrotron Facility in Grenoble. The investment is a large-scale financing operation that will help to mobilise the resources required to implement the ESRF-EBS. This innovative project, involving the 21 ESRF partner countries and representing a total investment of EUR 150m over the period 2015-2022, covers the creation, within existing infrastructure, of a first-of-a-kind storage ring with unrivalled properties which will expand the frontiers of X-ray science and the exploration of matter and materials. ESRF will provide European and international researchers and industrialists with a facility of excellence for basic and applied research. The project also comprises an ambitious instrumentation programme and an intensified "big data" strategy, designed to exploit the properties of this new extremely brilliant synchrotron light source. The financing was closed in December 2015.

Additionally, the EIB indirectly finances RDI infrastructure through its infrastructure lending to, among others, hospitals and universities, through both direct and indirect mechanisms. Through its cooperation with NPIs, a continuation from the earlier call of the European Council in June 2013, the EIB continues to strengthen the alignment of its operations with MS policies. The cooperation arrangements between the EIB and EIF and NPIs in the form of **platforms** and **direct lending/co-lending** are among the mechanisms that are instrumental for RTOs for financing their RDI projects.

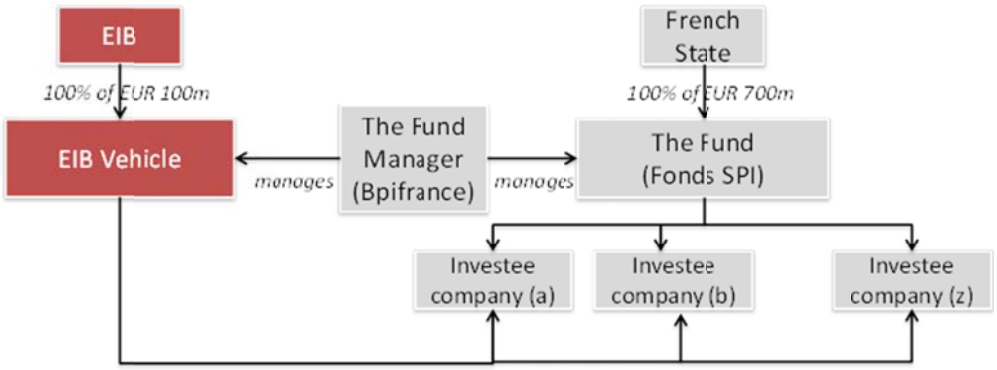
[61] Details on the EFSI programme and its instruments can be found in the Annex and at www.eib.org.
[62] Overall special activities include (i) loan, guarantee or equity operations where the higher risk is entirely borne by the EIB as well as (ii) operations where the risk is shared with third parties (risk sharing), notably the EU budget under agreements with the EC.

Case study: EIB NPI co-funding

Fonds SPI - Sociétés De Projets Industriels

The EIB set up a EUR 100m co-investment facility (the "EIB Vehicle") to invest alongside a EUR 700m public sector fund (SPI) backed by the French government and managed by BPI France (the "Main Vehicle"). The EIB, through its parallel fund vehicle also managed by BPI France, is offered the same opportunities as the Main Fund with an excuse right. Each co-investment by the EIB Vehicle is made under the same terms and conditions as the Main Vehicle and is proportional to the EIB's outstanding commitments in the fund. The EIB co-investment allows the Main Vehicle to increase the impact and scale of its investments and provides a signalling effect in attracting private capital.

Figure 25: Fonds SPI



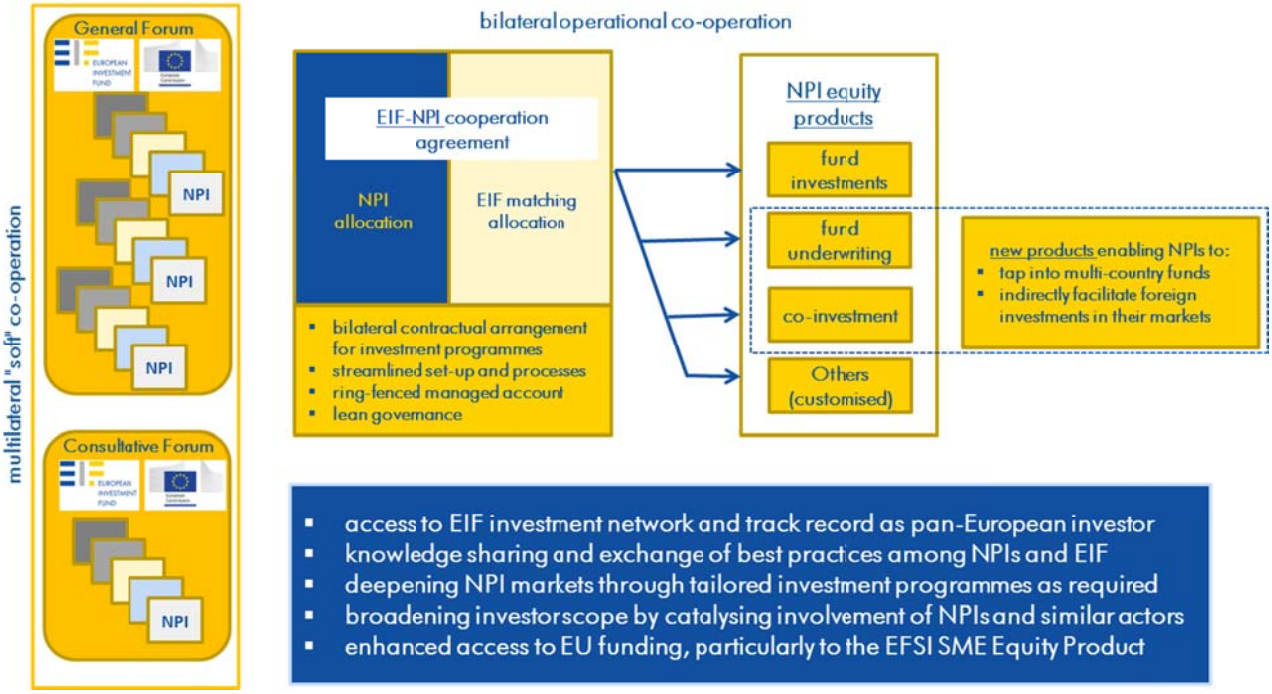
EIF and EFSI funding for supporting SMEs and RTO project stage initiatives

Within EIB Group, EIF has been entrusted to manage the portion of EFSI targeting SMEs and early stage VC and innovations financing (including RTO project stage), both in the guarantee and equity space. In this context, EIF is collaborating with relevant MS agencies and national/regional development financing bodies, such as National Promotional Institutions or Banks (NPIs/NPBs).

The EIF-NPI Equity Platform is a new collaborative initiative launched by the EIF in 2016 that promotes knowledge sharing and best practices between EIF and national promotional institutions (NPIs) or banks (NPBs) across EU Member States. Its ultimate goal is to enhance access to funding for SMEs and Midcaps, support defragmentation of equity markets, and match national, EU and private sources of funding.

This initiative is established on the occasion of the Investment Plan for Europe, and as a response to priorities set by EU stakeholders and NPIs. It will guide EIF and NPIs in implementing equity investments, including EFSI-related activities across the EU with a view to supporting a well-functioning European Venture Capital and Private Equity market for the ultimate benefit of European SMEs and Midcaps.

Figure 26: EIF-NPI Equity Platform



Source: European Investment Fund

InnovFin

Through **InnovFin**[63], an initiative under the Multiannual Financial Framework (MFF) 2014-2020, successor to RSFF and implemented under Horizon 2020, the EIB offers specific products aimed at closing the midcap gap as well as an advisory component through Innovation Finance Advisory, providing support to improve the investment readiness of large projects and to keep the conditions necessary for access to risk finance for RDI.

The InnovFin programme covers the entire value chain of RDI supporting investments from the smallest to the largest enterprise across all eligible sectors under Horizon 2020, hence fitting into the broad spectrum of RTO/RTO project sizes, scope and features. Details on the InnovFin instruments, including those managed by the EIF, relevant for RTOs can be found in Annex 2.

[63] In partnership with the EC. For additional information see http://www.eib.org/products/blending/innovfin/index.htm

Certain projects financed under this programme are similar to those sponsored by RTOs and face similar challenges such as the absence of a cash flow track record (start-up/early stage) and lack of standard collateral. Several case studies can be found below:

Case studies: Contingent loans

Jennewein Biotechnologie

Jennewein Biotechnologie (development of new processes): under InnovFin MidCap Growth finance, the EIB provided finance via a quasi-equity tailor-made contingent loan instrument to a project for the development of a commercial-scale production plant for innovative complex sugars and ongoing R&D investments.

UCB Pharmaceutical

UCB Pharmaceutical (early product development stage): under InnovFin Large Projects, the EIB provided finance via a tailor-made financial instrument for the R&D programme of a group of drug projects at different stages of development. The borrower and the EIB share the risks and rewards, with UCB Pharmaceutical putting its own money in to match the EIB's support. The EIB receives milestone payments when and if projects advance in development, but UCB Pharmaceutical will not owe any money to the Bank if projects fail.

Case studies: Special risk sharing facilities – thematic InnovFin financing

Mobidiag

Mobidiag (early product development stage): under the Infectious Diseases Financing Facility (IDFF), the EIB provided tailor-made long-term financing for the finalisation and scale-up of the "Novodiag"[64] products manufacturing, assay validation and commercialisation.

Transgene

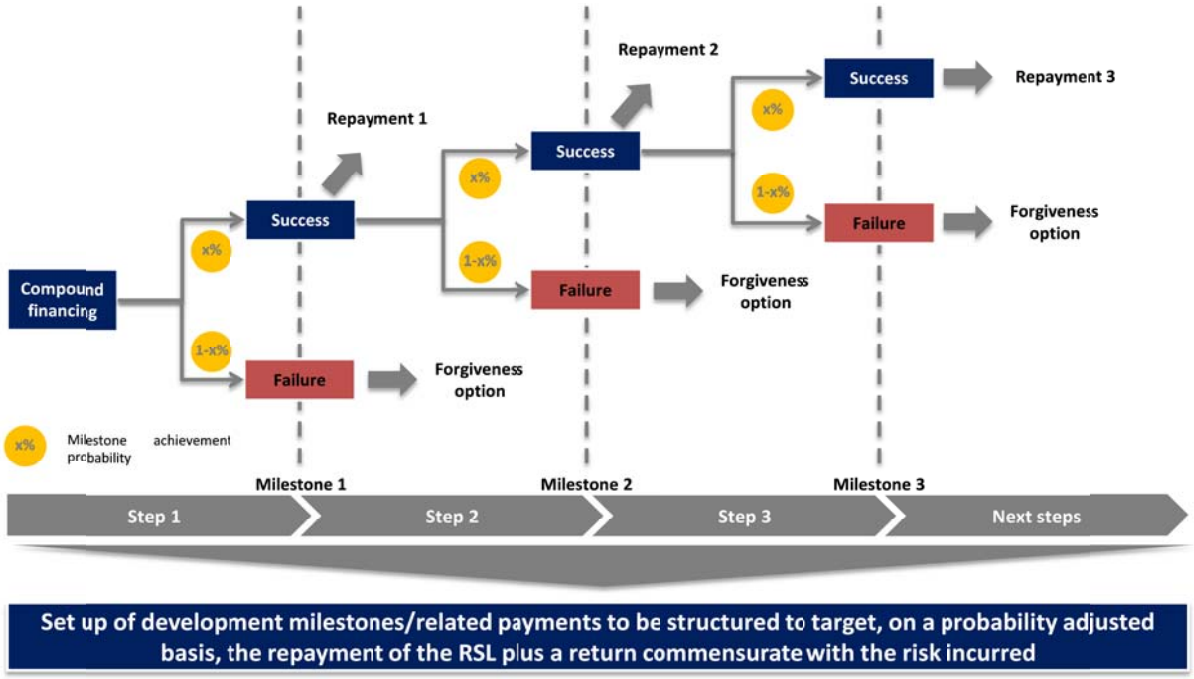
Transgene (early product development stage): under the Infectious Diseases Financing Facility (IDFF), the EIB provided tailor-made five-year unsecured finance for financing clinical trials of products targeting infectious diseases. The interest on the facility accrued for the first three years is deferred and payable starting in 2019.

AW-Energy

AW-Energy (pioneering start-up company, first-of-a-kind demonstration phase project converting wave energy into electrical power): under the Energy Demo Projects Facility (EDP), the EIB provided a tailor-made financing solution to support bridging the valley of death from demonstration to commercialisation. The financing, closed in July 2016, enables AW-Energy to build a full-scale demonstration unit of their WaveRoller® concept, helping to keep the company firmly on track for the commercialisation of the WaveRoller®. The company has successfully demonstrated the WaveRoller® technology with a three-unit demonstration installation in Portugal, utilising a fully commercial grid-connection license and already providing power for the local population in 2012. AW-Energy has identified commercial leads in six countries and has the potential objective of selling more than 50 units in the next four years (the project will also be financed by Tekes, the Finnish Funding Agency for Innovation).

[64] Novodiag is a Mobidiag proprietary 'sample-in, result-out' diagnostic solution.

Figure 27: EIB risk sharing mechanism (illustrative)



Key features of transactions are provided in Table 2.

Table 2: Illustration of selected InnovFin RDI transactions – IP collateralised/contingent/participant facilities[65]

	Jennewein Biotechnologie	Mobidiag	Transgene	UCB Pharmaceutical (UCB)
Loan purpose	Development of commercial-scale production plant for innovative complex sugars and ongoing R&D investments in product development	Finalisation and scale-up of the "Novodiag"[66] products' manufacturing, assay validation and commercialisation over the next three years	Clinical trials of products targeting infectious diseases, including chronic hepatitis B, virus-induced cancers such as HPV (human papilloma virus) and tuberculosis	R&D programme of six new compounds at different stages of development
Borrower profile	Established in 2005, focused on the development of new processes for the large-scale production of monosaccharides and oligosaccharides	Established in 2000, focused on the development of innovative solutions to advance the diagnosis of infectious diseases (early-stage product development) and on the European clinical diagnostics market	Established, publicly listed company, focused on discovering and developing (early product development stage, preclinical and clinical stages) targeted immunotherapies for the treatment of cancer and infectious diseases	Established, publicly listed company with over 85 years of trading with focus on discovering and developing (early product development stage) new therapies for neurological and immunological diseases
Signed (date)	December 2015	July 2016	December 2015	June 2014
EIB mandate	InnovFin MidCap Growth Finance (InnovFin MGF)	InnovFin Infectious Diseases Financing Facility (InnovFin IDFF)	InnovFin Infectious Diseases Financing Facility (InnovFin IDFF)	InnovFin Large Projects
Amount	EUR 10m	EUR 15m	EUR 20m	EUR 75m
Pricing	Market level	Market level	Market level	Market level
Special terms			• Disbursement in two tranches of EUR 10m each with the disbursement of the second tranche subject to fundraising milestones • The interest accrued for the first three years is payable starting in 2019	• At-risk co-development funding. The EIB acquires and co-owns (with UCB) part of the IP that would be jointly developed under the specified programmes and time frame • UCB will ultimately re-acquire all the co-owned IP at the end of the partnership agreement • Milestone payments due when and if projects advance in development • The projects have been selected from across UCB's pipeline to represent drugs in different development stages, and balance the overall risk

[65] For further information please refer to EIB's website: http://www.eib.org

[66] Novdiag is a Mobidiag proprietary "sample-in, result-out" diagnostic solution.

a) Through other mechanisms such as the **Connecting Europe Facility**[67] (CEF), also an initiative under the Multiannual Financial Framework (MFF) 2014-2020, the EIB Group offers an alternative to traditional grant funding by offering competitive financial products for priority investments in transport, energy and telecommunications. Through the EFSI Investment Platform instrument[68], funds coming from the Connecting Europe Facility (CEF), EFSI and the EIB will be deployed alongside capital from NPIs and the private sector to set up the Connecting Europe Broadband Fund (CEBF).

   The thematic scope of the CEBF may be of residual relevance for RTOs, however. The EFSI Investment Platform – the CEBF's umbrella – is a mechanism in principle fit to address the funding challenges faced by RTOs' sound projects. This is primarily because it makes it possible to address market failures effectively and efficiently:

   - It is a high risk bearing instrument with a sizeable capital commitment from the EC.
   - It has a multi-level private sector and NPI crowding-in effect by providing:
     - more efficient risk allocation between investors, attracting private financing that otherwise would remain on the side-lines (the EIB's subordinated position in the EFSI Investment Platform allows private investors to contribute at lower risk levels than otherwise);
     - project aggregation and bigger investment ticket size, attracting investors that otherwise would not invest in the project directly due to the (small) project size and transaction and information costs;
     - a diversified investment risk (project granularity, fund strategy).
   - It is designed to address sector/theme key access to finance issues.
     - In the case of broadband they stem, among other things, from the size and risk profile of projects. As such, in the CEBF case study, the fund improves access to finance conditions by, among other things, reducing the investment risk for private investors and by targeting smaller scale projects (investments will be of a size between EUR 1m and EUR 30m, for projects representing total costs of EUR 150m or less).
   - Facilitates projects' access to finance as through an EFSI Investment Platform a promoter accesses several investors including the EIB in one single fundraising exercise.
   - Eliminates investment barriers related to the high opportunity cost and assessment risk faced by investors that consider investing in more granular, complex and specialised innovative technology projects.

[67] Details can be found at http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/project-funding/cef_en.htm
[68] The Investment Platforms are co-investment arrangements structured with a view to catalysing investments in a portfolio of projects (as opposed to individual projects) with a thematic or geographic focus. Investment Platforms are a means to aggregate investment projects, reduce transaction and information costs and provide for more efficient risk allocation between various investors; Regulation (EU) 2015/1017 ("EFSI Regulation").

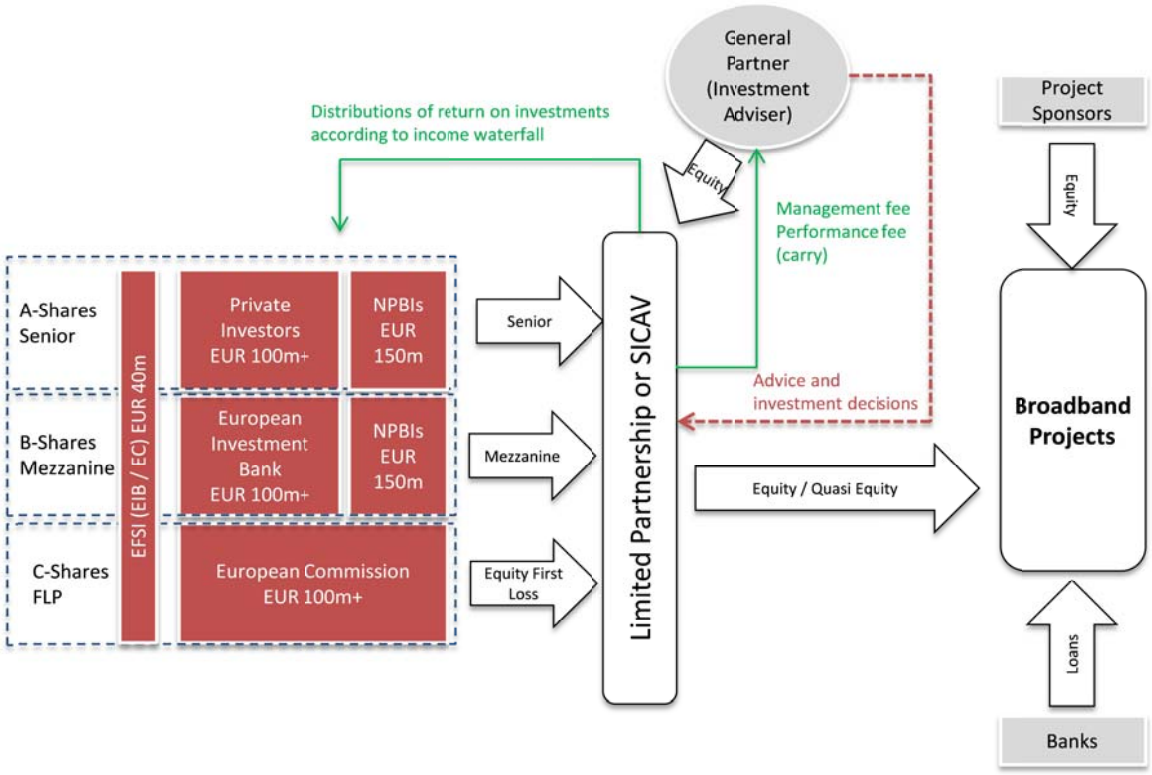
Furthermore, its multi-layer features and conception minimise the risk of disrupting or unduly distorting markets or crowding-out private finance, including new entrants. The details of this instrument can be found in Table 7.

Case study: EIB investment platforms

Connecting Europe Broadband Fund (CEBF)

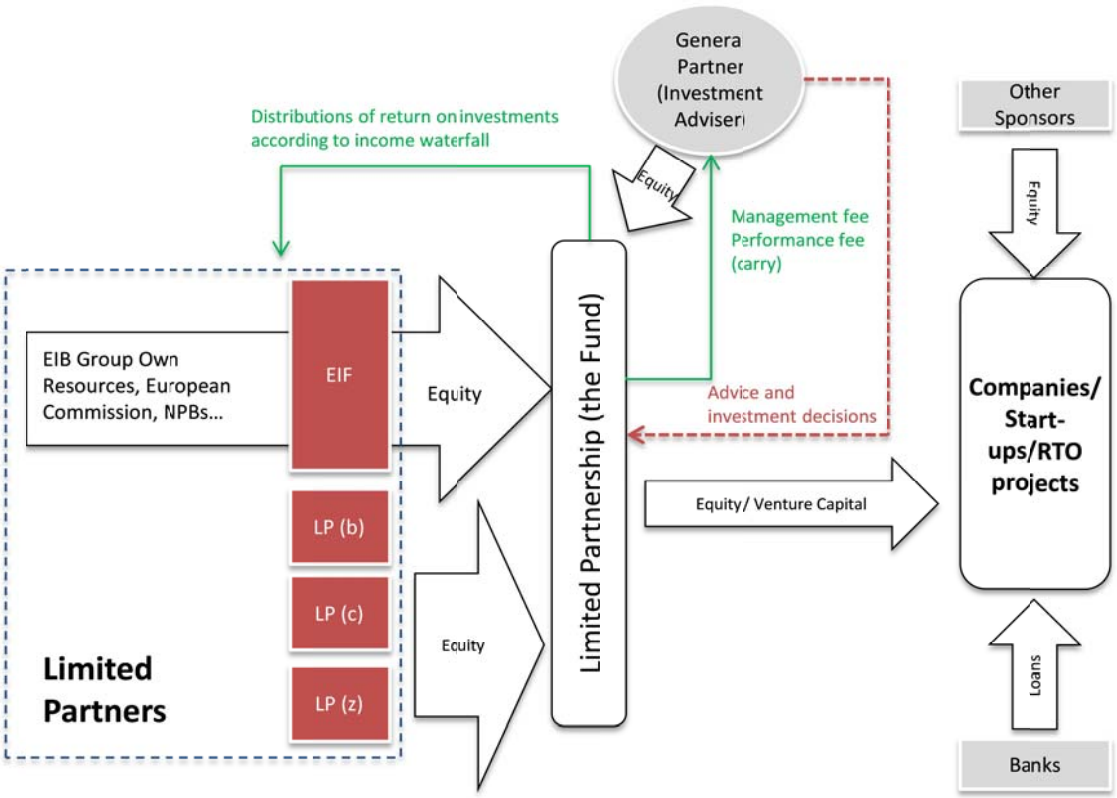
Connecting Europe Broadband Fund (CEBF): under the EFSI Investment Platform instrument, the EC and the EIB are in the process of setting up a commercial fund of EUR 500m to address the investment challenge for broadband projects in less dense areas. The CEBF is to ensure that smaller companies and projects get a fair shot at financing. The scarcity of financing solutions is particularly pronounced for smaller projects; therefore the focus of the CEBF is on transactions lower than EUR 30m. The funds coming from the Connecting Europe Facility (CEF), EFSI and the EIB, together with capital from NPIs and the private sector, will be invested in economically viable broadband projects. EFSI contribution to the fund is as subordinated investor and/or the private sector to contribute on a lower risk level.

Figure 28: Connecting Europe Broadband Fund



b) Through the EIF's activities focused on the provision of risk financing for entrepreneurship and innovation, which include the financial support of sustainable technology transfer structures[69] or funds. EIF is already a large investor in the space of technology transfer and commercialisation and the role of EIF is increasing in importance and scope. As of July 2016, 34 equity investments have been made into technology transfer (TT) & intellectual property funds, totalling EUR 596m. Of these investments, 21 were made since 2013 (EUR 435m). The EIF catalyses the commercialisation of intellectual property through the creation of long-term, sustainable investment vehicles that work alongside research organisations and their technology transfer offices (TTOs). These vehicles have the ability to invest in projects or start-up companies at proof of concept, pre-seed, seed, post-seed and A & B rounds. The EIF's collaboration with TTOs allows management teams to maintain their independence, as the EIF does not seek to become involved in management decisions. The typical minimum fund size of such vehicles is in the range of EUR 30m, whereby the EIF can provide up to 50% of the resources.

Figure 29: EIF fund investments – typical structure (illustrative)



As a cornerstone investor and often key negotiator of the relevant agreement(s) and (governance) structure of the fund, EIF's participation in a fund has a strong catalytic effect in attracting other investors. RTOs can participate in EIF's equity financing activities of technology transfer, commercialisation or early stage venture capital funds by investing in these projects alongside EIF. RTO's can participate in EIF's equity financing activities of technology transfer, commercialisation or early stage venture capital funds by investing alongside or together with EIF, and participating National Promotional Institutions or Banks (NPIs or NPBs) in investment

[69] For further information see http://www.eif.europa.eu/what_we_do/equity/technology_transfer/index.htm

programmes targeting e.g. RTO projects. Additionally, RTOs can participate in and benefit from EIF investment programmes as partner institutions of fund managers supported by EIF (see Annex 2 for more information on investment process).

The following examples illustrate the EIF's investment impact in the technology transfer space.

Case studies: Indirect technology transfer financing – EIF technology transfer organisation equity funds

PEP-Therapy (Quadrivium 1)

Quadrivium 1 is a French academic spin-outs fund launched in December 2013 and managed by Seventure Partners. The EIF invested EUR 20m (36% of the total fund size) in the fund alongside other investors including Bpifrance. The EIF's investment was backed by the EU's Investment Plan for Europe. The fund has so far invested in eight companies (with a total target of 20), each of which started out at one of 12 research institutions that are involved with Quadrivium, including, for example, the Sorbonne and Institut Curie.

PEP-Therapy is a small company founded by Angelita Rebollo, a Spanish scientist, as a result of her research into cell-penetrating and interfering peptides which started 17 years ago in Madrid. These molecules have the potential to kill cancer cells without the side-effects of traditional chemotherapy, which destroys not only cancer but also many healthy cells. PEP-Therapy was founded in January 2014 with EUR 1m in backing from Quadrivium 1. The investment is helping PEP-Therapy in the development stages of the drug. It will be up to eight years before the molecules are fully licenced and sold as medicine. Quadrivium 1 already expects to contribute to the funding of the next stage of development, which sends very positive signals to the market, helping the company attract finance from additional investors.

CFEED (SINTEF Venture IV)

The EIF invested EUR 12m (45% of total fund size) in SINTEF Venture IV in 2013. SINTEF Venture IV (SV IV) is a NOK 209m seed investment fund that enables the development of new and viable technology-driven SMEs. SV IV was launched by SINTEF, a Norwegian applied research, technology and innovation centre. The fund was established with support from SINTEF, the EIF and SpareBank1 SMN. The EIF's investment was made possible by resources from the European Commission's Competitiveness and Innovation Programme.

SV IV invested in CFEED AS in 2014. CFEED AS is a first-of-a-kind commercial producer of copepods, a tiny crustacean species which serve as "baby food" for newly-born marine fish. Copepods have a naturally high nutritional content and are found in the sea and in almost every freshwater habitat. They are used as a replacement for traditional live feed such as artemia and rotifiers. Use of copepods not only reduces the rate of deformities and malpigmentation in fish larvae, but also improves their growth, survival and stress tolerance. This results in increased production quality and output, meaning lower per-unit costs and increased sales. CFEED's production methods and technology are based on 25 years of research and development at SINTEF Fisheries and Aquaculture. CFEED is an example of a company created through an opportunity presented in its local system. Norway has an established marine industry and therefore this investment is aligned with the needs of the market.

c) Through the EIF´s role as a (leading) provider of **venture capital** (VC) equity[70] to young innovative European high-tech start-ups, with an estimated 41% share of the European VC market in 2014. Through its Venture Capital Financing programme, the EIF addresses the segment´s market gaps and crowds-in private capital by investing through venture capital funds. The instrument objectives and the profile of the target beneficiaries is a good fit for a wide range of RTO projects within the clusters identified in Section 7.1.

Venture capital financing

Luxembourg Future Fund (LFF)

LFF is a EUR 150m fund which aims to stimulate the diversification and sustainable development of the Luxembourgish economy. The LFF combines EUR 30m in investment from the EIF with a EUR 120m contribution from Société Nationale de Crédit et d'Investissement (SNCI), to be deployed over a five-year period. LFF invests and co-invests in early and growth innovative European technology SMEs as well as in venture capital funds.

Baltic Innovation Fund (BIF)

BIF is a fund of funds initiative launched by the EIF in 2012 in close co-operation with the governments of Lithuania, Latvia and Estonia to boost equity investments made into Baltic small and medium-sized enterprises with high growth potential. The BIF combines EUR 52m in investment from the EIF with a EUR 26m contribution from each Baltic government committed through their respective national agencies (INVEGA in Lithuania, KredEx in Estonia and Altum in Latvia (previously LGA)). BIF is to invest EUR 130m into private equity and venture capital funds focusing on the Baltic States by 2016 through a fund of funds process, in order to attract additional private finance and implement the best market standards for equity investing in businesses. This trans-national process provides a real opportunity to further develop the Baltic private equity and venture capital market and to stimulate employment and competitiveness in the region.

[70] For additional information see http://www.eif.org/what_we_do/equity/venture/index.htm

7.3. Addressing RTOs' structuring funding gap via EIB instruments

As detailed in Section 6.1, RTOs residual exogenous funding gap stems from the inherent nature of RTOs. Regardless of the soundness of their cash flow generation capacity and project structuring, RTOs have fundamental differences with corporates centred on their social mission, ownership structure and legal limitations. Furthermore, in contrast with corporates, RTO activities cover an extensive range of RDI projects, across multiple technologies and which tend to have unique features. Table 3 summarises the main drivers of RTOs' exogenous funding gap.

Table 3: Key drivers of RTOs' exogenous funding gap

	Gap driver	Description
❶	**Debt restriction**	• Legal limitations of some RTOs' access to debt financing
❷	**Project features**	• E.g. projects' (long) cycle
❸	**Project diversity**	• The granularity of the project universe (see Section 7.1 for further details)
❹	**Focus on highly innovative technologies**	• Due to the nature of their activities, RTOs tend to be ahead of markets, including investment trends, solutions and appetite
❺	**Investor appetite for highly innovative technologies**	• E.g. Lack of the needed technological expertise, opportunity costs, etc.
❻	**Project size misalignment (investors <> RTOs)**	• The small (for the market) or excessively large (for RTOs) size of projects
❼	**Blending**	• RTOs' projects span a broad risk spectrum, meaning that they need to be financed by different forms of capital, involving not only bank finance but also equity and grants

This study has conducted a preliminary assessment of the fitness of the available EIB and EIF instruments to address RTOs' exogenous funding gap. The assessment shows that, as summarised below, certain EIB and EIF instruments, namely

- EIB-NPI Co-investment Funds;
- the EIB Investment Platform; and
- EIF Technology Transfer Funds and EIF-NPI Platform Investment Programmes

are in principle well-suited for addressing this gap. Furthermore, these instruments offer the benefit of it being possible to devise them to optimally address RTOs' exogenous funding gap. The provision by RTOs of a pipeline of sound projects would enable the EIB to take steps to evaluate the viability of the new/adjusted instrument and of the features that need to be considered in order to optimise its impact.

Having regard to the strong focus of the EIB, the EC and the NPI on addressing Europe's funding gap and delivering a positive impact on the European economy, the alignment of interests with NPBs/NPIs is self-evident. Furthermore, as a consequence of EFSI and other initiatives, the EIB's cooperation with NPBs has developed significantly. The EIB Co-investment Fund instrument and the EIF NPI Equity Platform Investment Programmes (see Table 7) are examples of this collaboration.

The natural degree of convergence of the objectives of RTOs and their regional NPI makes these collaboration instruments of particular value for RTOs. As these EIB Group NPI co-investment instruments are set at MS level, they are a good fit for addressing potential differences in R&D policy objectives and regional particularities and challenges among RTOs. Accordingly, Co-investment Funds with certain NPIs under an RTO theme and reflecting EIB-NPI-RTOs' local shared priorities are a mechanism to enhance RTOs' impact, to address the policy/mission/reach-driven limitations of some RTOs and to have a catalytic effect of its own.

This study has developed a preliminary assessment of the fitness of the instrument to cover the exogenous funding gap. The findings summarised in Table 4 show that in principle the Co-investment Fund is fit to serve this purpose.

Table 4: EIB Co-investment Funds: fitness of the instrument to address RTOs' exogenous funding gap

	Gap driver	Fitness of the financial instrument to cover RTOs' exogenous gaps
❶	**Debt restriction**	✓ (equity investment)
❷	**Project features**	✓ Long-term investment
❸	**Project features**	✓ Risk capital, long-term investment. An RTO-based fund of this type could be devised to encapsulate a diverse range of projects
❹	**Focus on highly innovative technologies**	✓ Signalling effect of the EIB to attract private investment
❺	**Investor appetite for highly innovative technologies**	✓ Co-investment of EIB and NPI increases impact and scale of investments
❻	**Project size misalignment (investors <> RTOs)**	✓ The size of the single investment can be adjusted to address the specific size gap issue within the fund theme. E.g. for F-SPI, EUR 10-160m project size (See Table 7)
❼	**Blending**	≅ Blends NPI and EIB financing and has crowding-in effect for private investors. However there is no systemic view to catalyse other resources such as grants, MS state and potentially compatible EIB-EIF instruments, private investment

The provision by RTOs of a project pipeline and outlook for projects would be necessary for the EIB to measure the effective size of the funding gap (hence if the fund is justified) and the specific features that the potential Co-investment Fund set for this purpose would need to have.

EIB Investment Platform Funds

As shown in Table 5, the EIB Investment Platform is well aligned to address RTOs' exogenous funding gap. Among the benefits are the investment platform's layered (equity) structure, the crowding-in effect, blending, the possibility of defining an RTO thematic fund and of adjusting the investment objectives to optimally address RTOs' funding gap. Furthermore, the platform catalytic effect could be fostered by an RTO joint investment in the fund.

Table 5: EIB Investment Platform: fitness of the instrument to address RTOs' exogenous funding gap

	Gap driver	Fitness of the financial instrument to cover RTOs' exogenous gaps
❶	**Debt restriction**	✓ (equity investment)
❷	**Project features**	✓ Long-term investment
❸	**Project diversity**	✓ Risk capital, long-term investment. An RTO-based fund of this type could be devised to encapsulate a diverse range of projects
❹	**Focus on highly innovative technologies**	✓ Risk buffer provided by the EIB-EC-NPI contribution (layered fund) enabling private investors to invest in projects that they would otherwise not enter into due to risk and capabilities
❺	**Investor appetite for highly innovative technologies**	✓ Signalling effect of the EIB to attract private investment
❻	**Project size misalignment (investors <> RTOs)**	✓ The size of the single investment can be adjusted to address the specific size gap issue within the fund theme. E.g. for the CEBF, EUR 1-20m project size (See Table 7)
❼	**Blending**	✓≅ Blends NPI, EIB and private investor financing; facilitates an RTO joint investment. However there is no systemic view to catalyse other resources such as grants, MS state and potentially compatible EIB-EIF instruments

EIF equity financing for Technology Transfer investment funds and TTOs

EIF supports technology transfer through instruments such as equity financing of investment funds targeting technology transfer and/or early stage VC. In collaboration with interested regional NPIs, EIF is also establishing investment programmes in the context of the EIF-NPI Equity Platform which inter alia target to support this segment of the equity financing market (see Table 6). As such, EIF's instruments address RTOs gap drivers, as they channel public sources of funding, on commercial and sustainable terms to the market – which helps catalyse private sector financing and participation. The provision by the RTOs of a pipeline of projects would enable to assess if certain features of the existing instruments need to be adjusted to maximise their impact.

EIF is already a large investor in the space of technology transfer and commercialisation[71], and the role of EIF is increasing in importance and scope. As of July 2016, 34 equity investments have been made into technology transfer (TT) & intellectual property funds, totalling EUR 596m. Of these investments, 21 were made since 2013 (EUR 435m). EIF's investments are supported by e.g. EFSI, InnovFin and EIB Group resources, and NPIs investing in the sector through investment programmes in the context of the EIF-NPI Equity Platform. EIF provides equity financing on commercial terms to private equity investment funds, managed by independent fund managers. Target beneficiaries of

[71] For detail, see Annex 2 and http://www.eif.org/what_we_do/equity/technology_transfer/index.htm

these funds are early stage projects (including RTO projects), SMEs and midcaps. As a cornerstone investor and often key negotiator of the relevant agreement(s) and (governance) structure of the fund, EIF's participation in a fund has a strong catalytic effect in attracting other investors. RTOs can participate in EIF's equity financing activities of technology transfer, commercialisation or early stage venture capital funds by investing in these projects alongside EIF. Additionally, RTOs can participate in and benefit from EIF investment programmes as partner institutions of fund managers supported by EIF (see Annex 2 for more information on investment process).

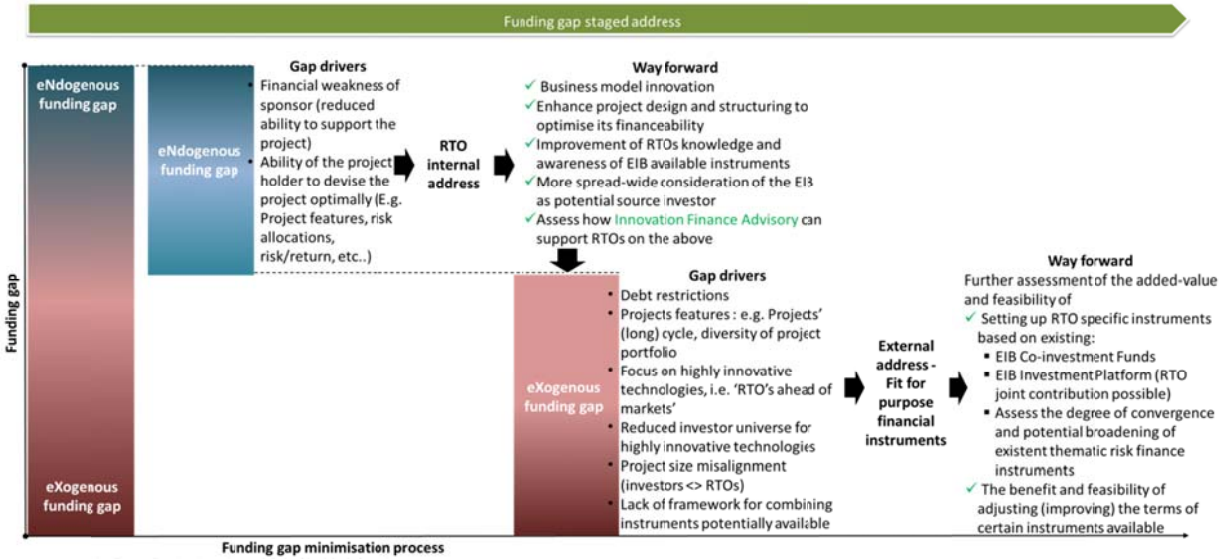
Table 6: EIF equity financing for Technology Transfer investment funds and TTOs: fitness of the instrument to address RTOs' exogenous funding gap

	Gap driver	Fitness of the financial instrument(s) to cover RTOs' Exogenous gaps	
		Investment in equity funds for Technology Transfer	Investment programmes under the EIF-NPI Equity Platform
❶	**Debt restriction**	✓ (equity, or equity type investment)	
❷	**Project features**	✓ Long term investment	
❸	**Project diversity**	✓ Risk capital, long term investment. An RTO based fund of this type could be devised to encapsulate a diverse type of projects	
❹	**Focus on highly innovative technologies**	✓ Signalling effect of the EIF to attract private investment	
❺	**Investor appetite for highly innovative technologies**	✓ Co-financing of EIF and NPI increases impact and scale of investment, with EIF typically representing the NPI as LP	
❻	**Project size misalignment (investors <> RTOs)**	✓ The size of the single investment can be adjusted to address the specific size gap issue within the Fund theme. Contribution from EIF up to EUR 60m, but maximum 50% of total fund size. Minimum/maximum investments available to individual projects/companies are at the discretion of the fund manager (See Table 7)	
❼	**Blending**	✓Blends EIF, NPI, and private investor financing; facilitates an RTO joint investment or partnership with the fund manager	

7.4. Way forward. A multi-level exercise to address the split funding gap

As discussed in Section 6.1, the study identifies two different categories of funding gap faced by RTOs. Section 6.2 analyses the opportunity that business model innovation provides to RTOs to address the endogenous component of the funding gap whereas a tailor-made financial solution as discussed in Chapter 7 may be required to address the exogenous funding gap. Figure 30 below summarises RTOs' split funding gap and the ways forward discussed in this section.

Figure 30: RTOs' split funding gap and way forward



Notes: Sizes of boxes are illustrative and are not in any way indicative of relative size/proportion

The track record of financing RTO/RTO-like projects through the selected (based on the project clustering in Section 6.2) financial instruments and mechanisms (see Section 6.3) and the results of analysing and mapping the RTO and RTO project features to those financial instruments shows that the palate of products available through the EIB Group via its standard operations and through the EC-EIB Group joint initiatives provides a reasonable overlap with RTO-type projects. Increasing RTOs' demand for these instruments requires a multi-level exercise taking into account the funding gap split they face:

Way forward to address RTOs' endogenous funding gap

First. ✓ RTOs have an opportunity to enhance their impact by strengthening their business and financial models.

Second. ✓ RTOs have the opportunity to enhance their access to finance via further intensifying the focus on sound structuring of projects to ensure projects respond as far as possible to investors and market requirements.

Third. ✓ RTOs have the opportunity to optimise use of existing EIB Group/EC financial instruments through better knowledge of the financial instruments available and how to access them.

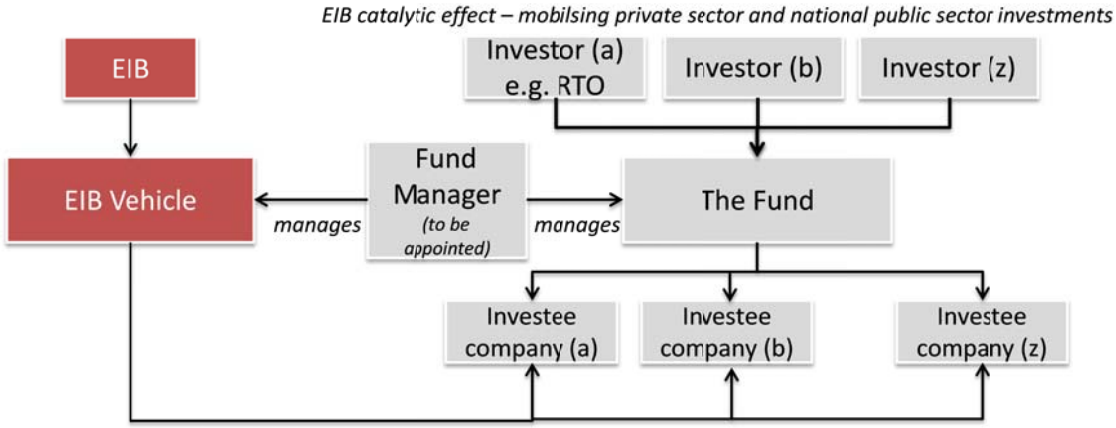
Fourth. ✓ More widespread consideration among RTOs of EIB Group instruments when devising their projects.

Fifth. ✓ Assess if and how Innovation Finance Advisory can support EARTO/RTOs in connection with points 1 to 4 above.

Sixth. ✓ Further assessment of the added value and feasibility of setting up new instruments based on existing ones to overcome RTOs' exogenous barriers to finance. In particular:

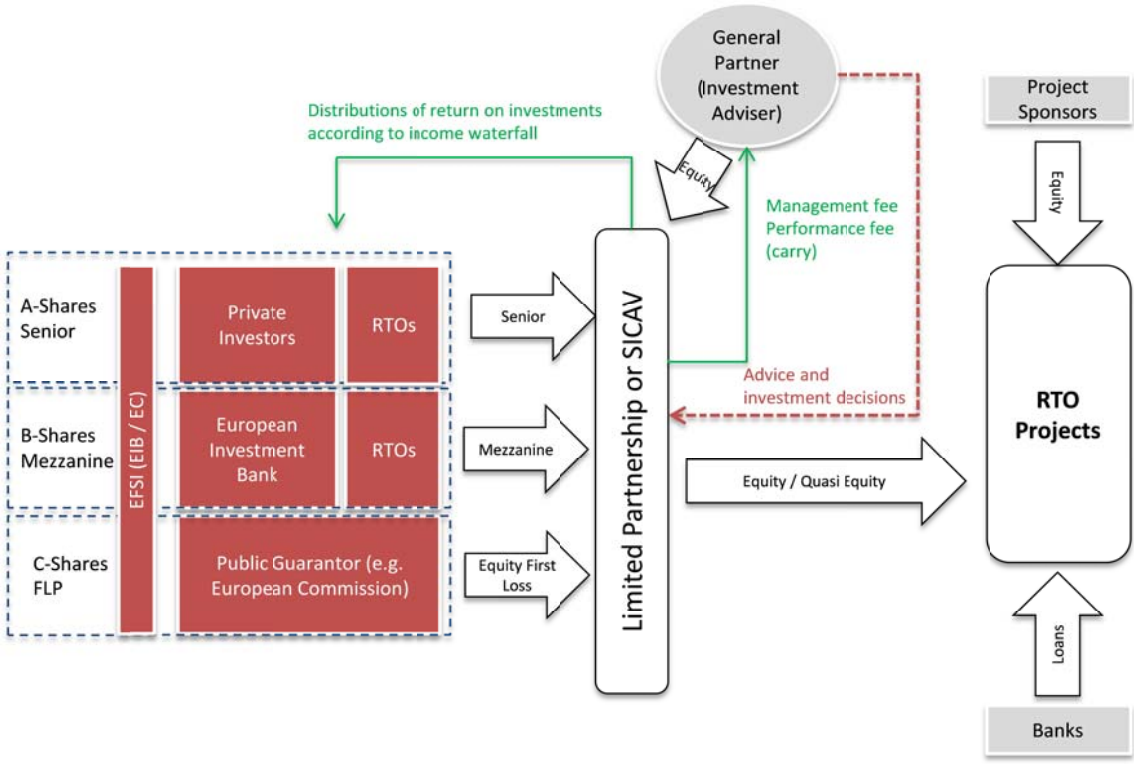
- Establishment of tailor-made EIB-NPI Co-lending Funds (for details on this instrument see Table 7). Figure 31 shows an illustrative layout of the potential solution based on the SFI co-lending facility currently in place and discussed in detail in Chapter 7.

Figure 31: Illustrative layout - Co-lending Fund



- Establishment of an EIB Investment Platform similar to the broadband fund presented herein with consideration for a joint RTO investment in the fund (for details on this instrument see Table 7). Figure 32 shows an illustrative layout of the potential solution based on the Broadband fund currently in place and discussed in detail in Chapter 7.

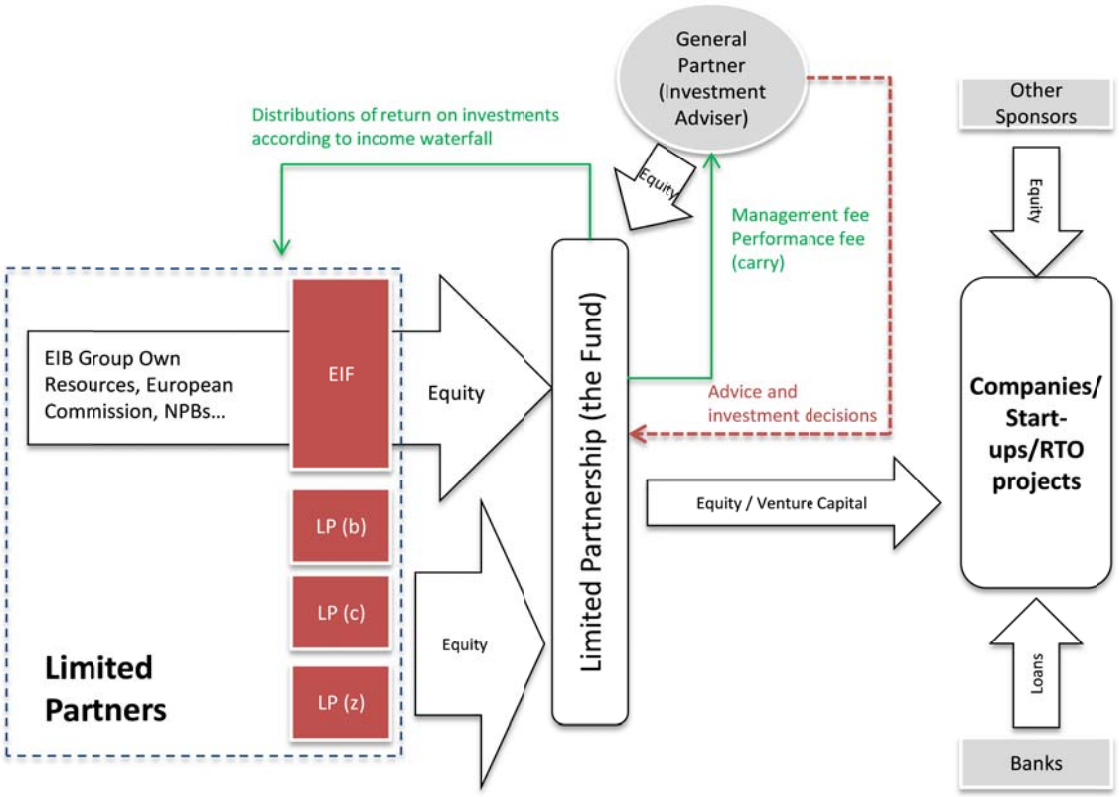
Figure 32: Illustrative layout – thematic Investment Platform



- Participation of RTOs in EIF's individual investments or investment programmes, as investors or partners – depending on the capacity of the specific RTO – to stimulate the financing and/or sourcing of potential investment opportunities. EIF is already active in equity financing of technology transfer (TT) and commercialisation, by investing in e.g. independently managed technology transfer funds, which in turn provide equity financing to RTO projects, proof of concept stage[72] or other early stage projects or companies (see Figure 33). EIF's investments are supported by e.g. EFSI, InnovFin and EIB Group resources, and NPIs investing in the sector through investment programmes in the context of the EIF-NPI Equity Platform. See Annex 2 for more detail on EIF's investment activities targeting technology transfer.

[72] Including products/technologies with Technology Readiness Level maturity between TRL 3 to TRL 6 or the equivalent Innovation Readiness Level maturity between IRL 1 and IRL 2.

Figure 33: EIF fund investments – typical structure (illustrative)



Assess the degree of convergence and potential broadening of existing thematic risk finance instruments with RTOs' project pipeline themes.

- ✓ In parallel to the above, assessment of the benefit and feasibility of adjusting (improving) the terms of certain instruments available to better reflect RTOs/ RTOs' projects' needs and fundamentals. Among these are potential barriers related to investment (and payback) periods and size and, in the case of specific funds and platforms, potential beneficiaries and sectors should be also assessed.

The success of this assessment will depend on the RTOs' level of preparedness for developing concrete investment projects, where needed with the support of Innovation Finance Advisory, and submitting them to the EIB. Only a concrete pipeline of projects will ensure an accurate and reliable assessment of the limitations and the provision of optimal solutions to the access to finance issues identified.

As already mentioned, it should be noted that the ways forward presented exclude the consideration of an IP upfront monetisation fund as the EIB Group is already in discussions with an RTO on assessing potential ways forward.

8. Conclusions and recommendations

The study shows that the RTO ecosystem is highly granular and diverse. RTOs differ significantly in view of their legal form, geographical reach, size and scale, business model, sector of activity, funding strategy, capital structure and project development strategy. As a result, not all the conclusions and recommendations are equally relevant and applicable to all RTOs. Nevertheless, the insights obtained reflect the experiences of a sizeable group of European RTOs active in a variety of European countries and technological domains (including energy and climate, life sciences, ICT and microelectronics, space and aeronautics, food and agriculture, etc.).

The key conclusions and recommendations will be presented below.

Key conclusions

1. Grants are, and will remain, a critical and fundamental source of financing but the (public) funding landscape is rapidly changing and new opportunities are arising for RTOs to sustainably diversify their funding mix in support of their future growth ambitions.

Grants, provided by public authorities, are and will remain a critical and fundamental source of financing in RTOs' overall funding mix, especially for core activities like competence building and, albeit partially, technology development. However, uncertainties regarding the continuity of national and pan-European programmes and the associated availability of grants for RDI (mainly grants for core funding but not necessarily for competitively bid project funding), in combination with the overall risk retrenching and risk appetite of the financial sector challenge the traditional funding and business models of RTOs. RTOs indicate that it is becoming increasingly difficult to obtain the necessary funds for capital intensive and risky infrastructure, facilities and equipment, spin-outs/SPV creation and the financing of technology development/transfer projects at Technology Readiness Levels (TRL) 7-8. Grants will remain an important budget line in RTOs' financial models but the question is how they can be complemented and further leveraged with other sources of financing in order to move to a stronger funding mix (while safeguarding the grant based core activities of RTOs, which is the development of new knowledge). The EIB Group, in cooperation with the EC, offers a wide range of financial products and advisory services (see below and Chapter 6) that can help RTOs and their partners to broaden their funding mix, especially for the financing of commercially viable investment proposals. This allows RTOs to use grants even smarter, primarily for activities with a strong public benefit and that cannot become commercially viable or bankable.

2. RTOs are aware that further diversification of funding sources, where possible and feasible, is not only a nice-to-have, but is also becoming a necessity.

The results of the market consultation (survey and bilateral discussions) show that RTOs in general rely heavily on grant funding for their operations (central of which is the development of new knowledge) and investments. Grants, and in particular core funding, are often unsustainable sources of financing in terms of duration (often short-term), volume and policy/political priority.

The short-term nature of grants can be expected to result in structural asset-liability mismatches in RTOs' balance sheets, leading to an undesired level of refinancing risk. This would particularly be the case with financing of infrastructure and technology transfer projects with extended periods to commercialisation and long-term returns. The RTOs surveyed indicated that they intend to finance future investments mainly from own funds (capital and reserves, the latter being a form of equity), along with public support/grants. During the discussions with RTOs it became clear that they are aware of the need to further diversify their funding sources in order to sustain and even strengthen current levels of investment. Diversification of funding sources is expected to be a difficult process that needs to be well-coordinated with all stakeholders involved (RTOs, industry, academia, the financial community and policy makers at regional, national and European levels). Further optimisation, and perhaps innovation, in the current business models of some RTOs will play a pivotal role in this diversification process.

3. For some RTOs, business model optimisation, and perhaps innovation, following an open innovation model will be instrumental in further diversifying funding sources beyond grants (i.e. debt, equity, equity-like financing).

Despite the fact that on average the RTO community as a whole is successful in attracting private sources of income the distribution seems to be rather skewed. Some of the RTOs surveyed have financial and business models that lean strongly on public core funding (grants) as their key funding source while others indeed show high levels of private income generation. The generation of sufficient private income and customer revenues as part of overall (free) cash flow generation is one of the preconditions for so-called "bankability" and associated repayment capacity of projects and investments, but there are others as indicated under point 4.

Following an open innovation approach whereby collaboration and knowledge sharing takes place beyond the boundaries of individual actors may lead to new commercialisation trajectories and the generation of new sources of income. As industrial partners may increasingly outsource (parts of) their R&D to RTOs on the basis of long-term contractual agreements[73], this could generate additional substantial and continuous revenues. In order for this to succeed, openness and co-creation among the different partners in the RTO ecosystem are essential. Commercially viable business models and a better understanding of the risk profile of specific projects are

[73] The evidence on increasing levels of R&D outsourcing by companies is rather fragmented and sector specific. The R&D outsourcing trend in the entire life sciences sectors is quite compelling just as it is for other high-tech industries like ICT. Systematic data on the subject are not available but EARTO has strongly reflected on the topic in the past (click here); an academic view on R&D outsourcing can be found here: http://www-management.wharton.upenn.edu/guillen/PDF-Documents/RD_Outsourcing_JIM-2012.pdf

essential to better match the risk profile of the investment community and as such broaden the available sources of finance.

4. There is a bi-directional knowledge gap between the RTO and the investor community that needs to be addressed. In addressing this gap, RTOs could provide technological know-how to investors and as such develop new services and associated income streams.

The knowledge gap between the "deep tech"/RTO community and investors[74] goes in two directions. RTOs often lack the necessary credit risk structuring knowledge at the project inception stage and are perhaps less aware of the risk sensitivities of the investment community or are uncertain about how to address these, which may negatively impact the bankability prospects of otherwise technologically sound projects. Financial investors also often lack the specific industry/technology knowledge needed to fully assess an RTO-project proposition. Investors will perform a balancing act of due diligence effort and project risk versus expected return. Non-specialised investors (such as venture capitalists) have limited capacity to develop internal expertise in the vast spectrum of outstanding and to-come technologies, fields of application and commercialisation. Limitations to in-house due diligence combined with lack of in-depth understanding of a technology, of its development risks and of its commercialisation potential feed significant uncertainty into the project. This lack of knowledge will often lead to a high risk allocation to the project concerned, which may impede investment (i.e. investors' internal risk limits) and/or may divert investors to alternative (less risky/better understood) investment options. RTOs could provide the necessary technological know-how to investors and their due diligence process and develop a new business activity or service, which could generate a new stream of income.

5. As a consequence of the above-mentioned factors, debt currently plays a minor role on RTOs' balance sheets.

As some of the existing RTO business models seem not to be fit-for-purpose to attract commercial financing, it is not surprising to acknowledge that debt plays a minor role in the "on balance sheet" capital structure of most RTOs surveyed (over 80%). The debt-to-equity ratio shows that on average, over the period 2012-2014, the RTOs surveyed had a level of indebtedness below 10%. The debt-to-total-assets ratio shows, as expected, a somewhat lower ratio, suggesting that RTOs are currently not that leveraged. However, for some RTOs this may be the result of a limited capability to generate sufficient (free) cash flows and/or to mitigate associated investment risks, rather than an indication of existing unused debt capacity. Some privately owned RTOs (like TWI in the UK) show higher levels of debt financing compared to public and mixed ownership RTOs[75]. Most RTOs surveyed do not face any formal/legal restrictions to raising debt (see Chapter 4 for more details) but there RTOs that do.

[74] A similar conclusion was drawn in the recently published IFA report on access to finance for KETs companies: http://www.eib.org/infocentre/publications/all/access-to-finance-conditions-for-kets-companies.htm

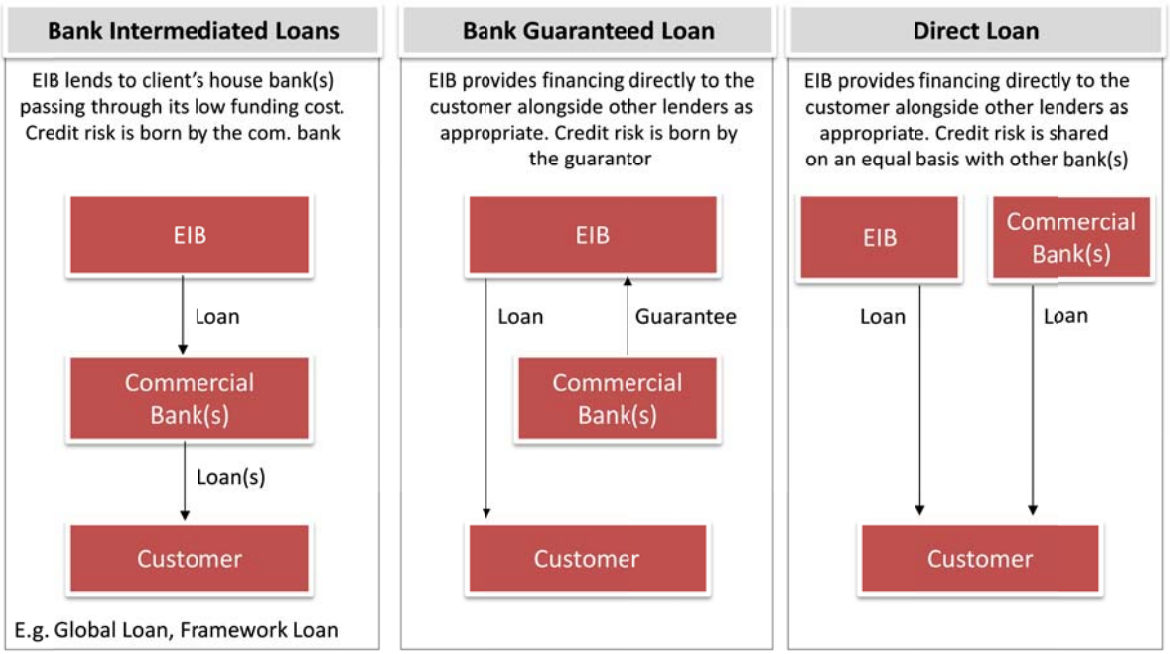
[75] Results could vary depending on whether spin-off financing has been accounted for and if so, if in full.

Over the period 2012-2014, the RTOs surveyed indicated that they invested in RDI infrastructure, such as in pilot plants, research facilities and laboratories. Investment needs were also attributed to equipment requirements, such as research and ICT equipment, yet to a lesser extent. These investments were mainly (53%) financed from own funds (capital and reserves, the latter being a form of equity), followed by public funding/grants (38%).

6. The EIB Group, in collaboration with the European Commission, already offers a well-balanced set of financial instruments and advisory services for the RTO ecosystem.

The EIB Group has a long-standing track record of providing financing to support research, development and innovation (RDI) through a set of financial instruments under different programmes and mechanisms. The classic EIB loan types are illustrated in Figure 34.

Figure 34: EIB loan types[76]



The EIB Group has a well-established track record of (co-)financing of research infrastructures such as CERN, the European Space Observatory and the European Synchrotron Radiation Facility, and to a lesser extent the direct financing of infrastructure for innovation and commercialisation projects (see Section 7.3). Regarding technology transfer projects, the EIB Group is making progress in covering the funding gap of sound RDI projects with instruments such as the InnovFin Energy Demo Projects Facility, Infectious Diseases Finance Facility and the MidCap Growth Facility, which will be further strengthened under EFSI, the Investment Plan for Europe (see Annex 2 for an overview of relevant EIB/EC financial instruments).

There are already a number of financing schemes that would be relevant/of interest to RTOs, such as:

[76] Com.: Commercial

- The InnovFin Energy Demo Projects Facility provides thematic finance from EUR 7.5m to EUR 75m for RDI first-of-a-kind (FOAK) projects in the field of renewable energy and hydrogen/fuel cells. In the context of Innovation Finance Advisory's work – e.g. on circular economy or bioeconomy – it has been recommended to broaden the scope of this facility to other technology areas, making it even more relevant for RTOs and their partners.
- The Infectious Diseases Finance Facility aims to stimulate investments in the development of innovative vaccines, drugs, medical and diagnostic devices, and novel research infrastructure for infectious diseases. The loans provided vary between EUR 7.5m and EUR 75m. Final recipients are project developers that have successfully completed the pre-clinical stage and now need clinical validation or to be ready for later stage clinical trials. This financial instrument is relevant for RTOs, and their partners, active in the healthcare sector.
- The European Fund for Strategic Investments (EFSI) mobilises additional investments in areas including infrastructure, education, research, innovation, renewable energy and energy efficiency. It also focuses on SMEs and midcaps (companies with between 250 and 3,000 employees). Under EFSI, RTOs are eligible to receive financing for projects that pass the EIB's standard due diligence practices.
- Under the EFSI Investment Platform instrument, the EC and the EIB are in the process of setting up a commercial fund of EUR 500m to address the investment challenge for broadband projects in less dense areas. The CEBF is designed to ensure that smaller companies and projects get a fair shot at financing. The scarcity of financing solutions is particularly pronounced for smaller projects; therefore the focus of the CEBF is on transactions lower than EUR 30m. The funds from the Connecting Europe Facility (CEF), EFSI and the EIB, together with capital from NPIs and the private sector, will be invested in economically viable broadband projects. Although the thematic scope of the CEBF may only be relevant to a selected group of RTOs, the possibility of setting up sectorial/thematic Investment Platforms may be relevant to the broader RTO community.
- EIF is already a large investor in the space of technology transfer and commercialisation[77], and the role of EIF is increasing in importance and scope. As of July 2016, 34 equity investments have been made into technology transfer (TT) & intellectual property funds, totalling EUR 596m. Of these investments, 21 were made since 2013 (EUR 435m). EIF's investments are supported by e.g. EFSI, InnovFin and EIB Group resources, and NPIs investing in the sector through investment programmes in the context of the EIF-NPI Equity Platform. EIF provides equity financing on commercial terms to private equity investment funds, managed by independent fund managers. Target beneficiaries of these funds are early stage projects (including RTO projects), SMEs and midcaps. As a cornerstone investor and often key negotiator of the relevant agreement(s) and (governance) structure of the fund, EIF's participation in a fund has a strong catalytic effect in attracting other investors. RTOs can participate in EIF's equity financing activities of technology transfer, commercialisation or early stage venture capital funds by investing in these projects

[77] For detail, see Annex 2 and http://www.eif.org/what_we_do/equity/technology_transfer/index.htm

alongside EIF. Additionally, RTOs can participate in and benefit from EIF investment programmes as partner institutions of fund managers supported by EIF (see Annex 2 for more information on investment process).

RTOs can also benefit from a wide range of existing advisory services that can help them to improve the design and the bankability prospects of RTO projects. During this study Innovation Finance Advisory (EIB) signed advisory services agreements with two RTO-driven consortia. The first concerns the development of an R&D infrastructure project in energy, the second concerns the commercialisation of a new generation of display manufacturing technology. Requests for assistance could, among others, be received through the European Investment Advisory Hub (http://www.eib.org/eiah/index.htm).

Key recommendations

Finance-related recommendations

1. In order to diversify their funding sources, RTOs should consider further optimising and complementing their business model and finance strategy in order to grasp the new financing possibilities offered to them.

There is a need to optimise and complement RTOs' traditional business model and funding strategies with new additional business models and funding strategies to allow them to successfully navigate through a changing funding landscape and make full use of existing business opportunities. The optimisation of existing models and the addition of new commercially viable business models, together with a better understanding of the risk profile of specific projects in order to better align its risks with the investment community need to be addressed at two levels:

3. The addition of repayable instruments to grant-based funding schemes requires a business model that generates sufficient cash flows to service debt raised by the RTO directly, and as such to support and/or guarantee financial obligations at the investment project level.
4. Moreover, RTOs could develop knowledge and expertise on project risk assessment and potential mitigating factors to ensure that the overall risk profile fits with the risk appetite of the investment community as far as possible. This is expected to improve overall "bankability" prospects and in the end lead to easier access to finance (see Chapter 6 for more background).

The above requires knowledge of specific technologies and markets, but also knowledge of the financial sector, risk structuring, credit risk drivers and risk assessment methodologies and of the investors' decision-making processes. While some RTOs are more advanced than others, the need to build internally their finance-related knowledge alongside R&D, technology and sector knowledge has to be fully recognised.

Subsequently, all stakeholders involved have a role to play in supporting the RTOs to do so. EARTO could play a role in providing a platform for knowledge exchange and guiding of RTOs to financial market specialists and advisors. European, national and/or regional policy makers

should also support the RTOs by putting in place the right incentives and by creating the right framework conditions. Depending on the maturity level of the underlying project Innovation Finance Advisory can be one of the actors playing a role here as well, as it already does in a number of ongoing advisory trajectories with individual RTOs (as mentioned above).

Intensified cooperation (and co-investment) within the entire RTO ecosystem could also be central to a new business model. Open innovation, whereby industry increasingly outsources (parts of) its R&D activities to RTOs may provide new business opportunities and streams of income. Furthermore, fostering improved connectivity across technology developers, supply chains (in particular in the case of First Of A Kind - FOAK) and thus also among RTOs themselves (in view of the pivotal and connecting role) is important in order to be able to compete on a global level and ensure a supportive and cohesive financing ecosystem.

2. Grants should be used as smart as possible to mainly finance activities that are not bankable (such as competence building and technology development) and to pull in public and private sources of repayable finance.

As access to grants becomes more uncertain (especially grants for core funding), RTOs are already focusing on generating more income from private sources. This often brings along a more short term perspective than is perhaps adequate for long-term strategic R&D programming. Some RTOs can do more to further optimise and innovate in their business model (e.g. by making it more entrepreneurial) in order to expand their finance mix with repayable sources. Furthermore, the limited availability of grants requires optimisation in their use by for example a good alignment between the (future) R&D project portfolio and the finance portfolio. Competence building, knowledge development (core functions), lower TRL levels and/or special projects (see Section 3.2 and Chapter 5) are prone to grant (non-refundable) financing due to their non-cash generating nature. RTOs should endeavour to finance projects at higher TRL stages with alternative and repayable sources of funding. Alternative and longer-term sources of repayable financing would also address the potential refinancing risk that short-term grants (due to their volatility) may introduce to a project.

3. Policy-makers should support RTOs to optimise the use of existing EIB Group/EC financial instruments through better knowledge of the available financial instruments and their eligibility criteria.

RTOs' activities involve innovations across sectors sharing common funding challenges and in some cases featuring unique risk and investment barriers. The InnovFin thematic instruments[78] aim to cover these sector-specific and unique funding gaps. The EIB already has a solid track record of providing long and ultra-long debt financing for technology development projects, research infrastructure projects, and to a lesser extent infrastructure for innovation projects. Information about existing financial instruments should be even better disseminated to RTOs. To achieve this, EARTO, the EIB Group (through the Innovation Finance Advisory mandate) and European, national and regional policy makers all have a role to play. For example, when it comes to information dissemination about repayable financial instruments and their eligibility

[78] http://www.eib.org/products/blending/innovfin/

criteria, EIB National Contact hubs could also play a key role either by providing the information themselves or by referring to third parties that can provide this information.

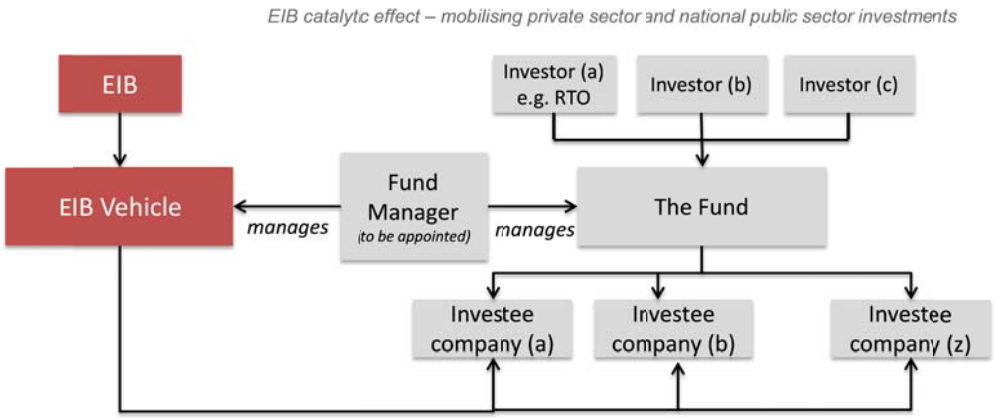
The RTO community is a highly granular universe, with different objectives, scope, legal forms, size, etc., and so are its projects. Consequently, a one-size-fits-all solution or address is not applicable. The findings suggest that a concentration of efforts through EARTO in coordination with Innovation Finance Advisory may provide an adequate framework to further investigate and define the potential necessary areas of improvement in the existing instruments, which is critical to fostering RTOs' access to financial instruments. In Section 7.4 we summarise the preliminary proposals for ways forward in connection with the assessment of the fitness of the (selected) financial instruments and of the assessment of the value added of developing tailor-made RTO Co-investment Funds and an Investment Platform scheme.

Herein we distinguish two tracks:

Track 1: Further assessment of the added value and feasibility of setting up new instruments based on the existing ones to overcome certain potential barriers facing RTOs/RTOs' projects. The following deserves further exploration in particular (See Section 7.4 and Table 7 for instrument-specific ways forward):

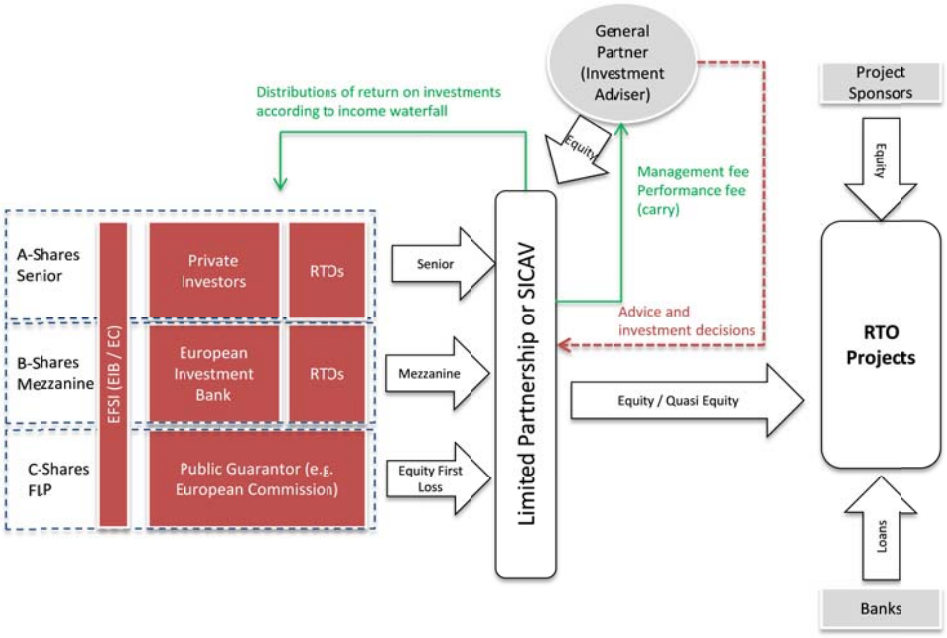
- Potential setup of a joint RTO and EIB Co-lending Fund, dedicated to the financing of RTO projects. Figure 35Figure 2 shows an illustrative layout of the potential solution based on the SPI co-lending facility currently in place and discussed in detail in Chapter 7.

Figure 35: Illustrative layout - Co-lending Fund



- Potential setup of a thematic Investment Platform following the broadband fund concept. Figure 36 shows an illustrative layout of the potential solution based on the CEBF co-lending facility currently in place and discussed in detail in Chapter 7.

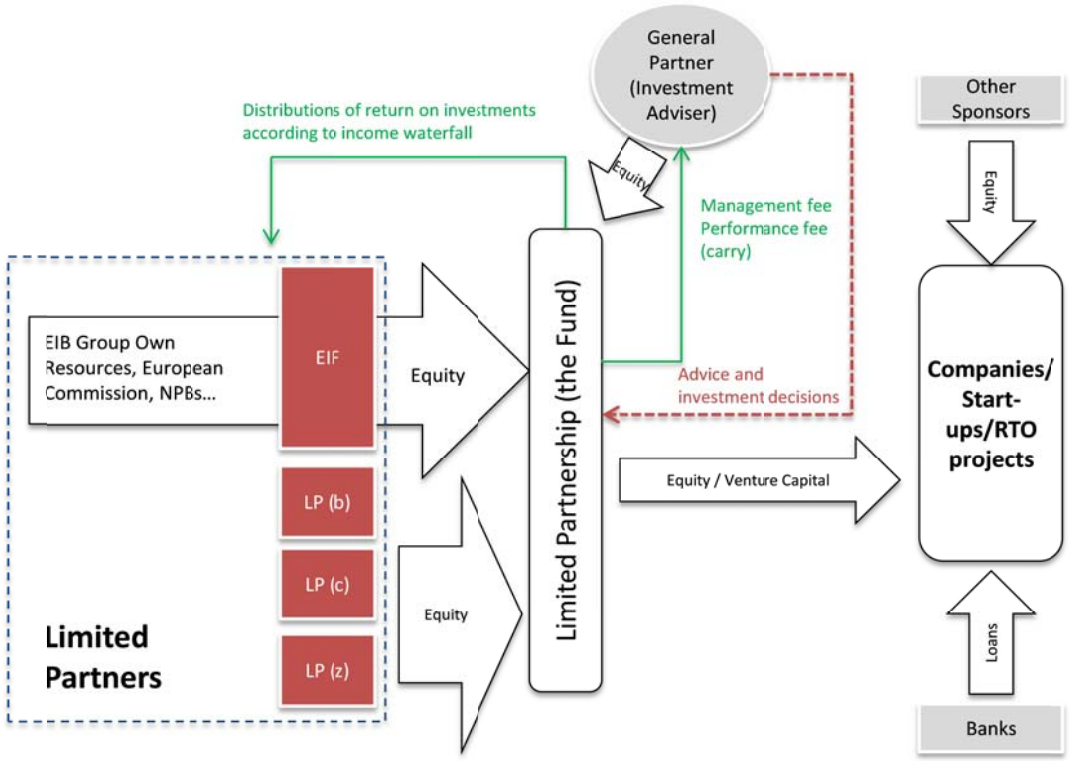
Figure 36: Illustrative layout – thematic Investment Platform



- Assess the degree of convergence of existing thematic risk finance instruments with RTOs' project pipeline characteristics, potentially leading to further fine-tuning and/or amendment.
- Participation of RTOs in EIF's individual investments or investment programmes, as investors or partners – depending on the capacity of the specific RTO – to stimulate the financing and/or sourcing of potential investment opportunities. EIF is already active in equity financing of technology transfer (TT) and commercialisation, by investing in e.g. independently managed technology transfer funds, which in turn provide equity financing to RTO projects, proof of concept stage[79] or other early stage projects or companies. EIF's investments are supported by e.g. EFSI, InnovFin and EIB Group resources, and NPIs investing in the sector through investment programmes in the context of the EIF-NPI Equity Platform. See Annex 2 for more detail on EIF's investment activities targeting technology transfer.

[79] Including products/technologies with Technology Readiness Level maturity between TRL 3 to TRL 6 or the equivalent Innovation Readiness Level maturity between IRL 1 and IRL 2.

Figure 37: EIF fund investments – typical structure (illustrative)



Track 2: Further assessment of the need to adjust (improve) the terms of existing instruments in order to better reflect RTOs'/RTOs' projects' needs and fundamentals. Among these could be potential barriers related to investment (and payback) periods and project size and, in the case of specific investment funds and platforms, eligible counterparts and sectors (see Section 6.4 for more details).

4. New business opportunities could provide RTOs with new streams of income and ways to further increase their socio-economic impact.

4.1. Explore the setup of a joint investment advisory board in order to catalyse knowledge and finance for economic impact.

EARTO, in collaboration with other relevant stakeholders, could further explore the viability of setting up a joint investment advisory board bringing together technology expertise (of RTOs and other actors), industrial expertise (corporate partners) and investment expertise (financial investors) as a mechanism to bridge the technology-commercial-risk-finance gap. Such an advisory board could connect actors and assess or pre-assess the investment readiness/potential of RTO projects and could provide technological know-how to investors and their due diligence process. EARTO could explore if such a role/mandate is compatible with the strict confidentiality dominating RTO ventures. Moreover, EARTO thereby supported by a.o. regional, national and European policy makers (see also recommendation 1), could also explore how RTOs themselves could develop stronger knowledge on project preparation and presentation, including risk assessment and mitigation, in order to better connect with the financial community.

4.2. Investors should be supported to develop deeper scientific and "tech" knowledge and/or get better access to technological expertise. It should be explored how RTOs can support investors and potentially develop new services and associated streams of income.

Policy makers and their agencies should support investors to develop deeper scientific and "tech" knowledge or get better access to technological expertise. Several cooperation models between RTOs and financial institutions could be explored, based on new services provided by RTOs, but also on shared investment instruments. RTOs could act as financing catalysts, potentially through the provision of education/training of financial market participants about the potential of specific technologies and as such add credibility to projects/technologies/start-ups. Technological know-how could be provided by RTOs to investors and their due diligence process (the study *Access-to-finance conditions for KET companies*, carried out by Innovation Finance Advisory in 2016, referred to this as "knowledge asymmetry"[80]). This would not only generate new streams of income for RTOs but would also further unlock public and private investments in technology-intensive sectors of the economy. In this context, Innovation Finance Advisory recently also launched a new study on how to better assess the technology/market potential of KETs technologies in the context of a due diligence process.

4.3. Assess the viability of setting up an independent financing mechanism for "pooled" IP valorisation.

Further assessing the feasibility of establishing a joint and independent financing mechanism for IP valorisation and associated early-stage investments could be used as a mechanism to provide liquidity to the IPs. A point of reference is the European Angels Fund[81] special investment vehicle. Such an initiative would involve venture capital firms and industrial partners in addition to RTOs and the EIB Group, and would also include national sub-funds in order to take into account local specifications in the technology transfer business (e.g. IP ownership rights). It should be noted that the consideration of an IP upfront monetisation fund is not further discussed as the EIB Group is already in discussions with an RTO on assessing potential ways forward in this regard.

[80] KETs (key enabling technologies) companies encounter a largely risk-averse financial sector with difficulties understanding the potential of KET innovations. KET companies' main drivers for their financing needs, technology and innovation, are often complex and previously untested on the markets on a larger scale. While KET companies often approach lending institutions for financing cutting-edge, proprietary products and processes, they usually understand such innovations far better than their respective lenders. Many KET companies report difficulties in making lenders understand product innovations. Simultaneously, banks report difficulties evaluating the technology investments proposed by KET companies in terms of financial returns. Such a "knowledge asymmetry" between borrowers and lenders is thus likely to make their financial transactions more complex and the associated risks harder to assess than in more established markets. As KETs are in many cases developed and commercialised by RTOs, the problem of "knowledge asymmetry" also applies to the RTO community vis-à-vis their investors.

[81] The European Angels Fund is an initiative advised by the EIF which provides equity to business angels and other non-institutional investors for the financing of innovative companies in the form of co-investments.

Other recommendations

5. RTOs could further join forces and collaborate in order to enhance a project's added value, e.g. through technology blending.

The ability to integrate technologies across RTOs, to ensure deployment along the necessary supply chains, transferability and scalability, are key drivers of credit quality and ultimately of investors' appetite. Ensuring that RTOs can maximise their impact in the changing funding and technological landscape and to be able to ensure that their projects are competitive at global level from a technology and value added standpoint requires a multi-level approach.

6. In view of its importance for commercialisation, the European Commission could consider developing an explicit policy for innovation infrastructure (IIC) (pilot, demonstration facilities etc.) by analogy with the existing policy framework on research infrastructure (RI), in particular ESFRI and ERIC.

The public sector is frequently a strategic, if not necessary, shareholder in RTOs' projects, including investments in innovation infrastructures that are necessary to allow for demonstration, upscaling and market introduction (higher TRL stages). A more explicit policy towards the development of innovation infrastructures in the regions and Member States, including topics such as strategic prioritisation of infrastructure and financing issues, could further strengthen Europe's innovation performance.

Annex 1 – EIB instruments applied/potentially applicable to RTO projects and way forward - tables

Table 7: EIB instruments applied or potentially applicable to RTO projects and way forward - partnership instruments

	EIB Co-investment Fund	EIB Investment Platforms	EIF NPI Equity Platform Investment Programmes (with NPIs[82] or other)		EIF fund investments: for technology transfer organisations and venture capital	
			Fund investing programmes	Co-investment scheme[83]		
OVERVIEW						
Programme/mandate	EFSI	EFSI	Case-specific (EFSI, EIB/EIF resources, other EC mandates, and matching funding provided by NPIs/other investors)		Case-specific (most appropriate mandate selected for each investment, including institutional and regional/thematic mandates)	
Provider	EIB	EIB	EIF	EIF	EIF	EIF
Objective	• EIB parallel fund vehicle (EIB Vehicle) co-investing alongside a NPI and other pre-approved parties (Main Vehicle) • EIB Vehicle offers the same investment opportunities and similar investment policy as the Main Vehicle, subject to EIB rules • Increases impact and scale of investments • Signalling effect of the EIB's presence in attracting private capital	• Specialised investment fund combining EIB, EC, NPI and private funding to maximise scale • Risk buffer provided by EC-backed first loss piece (FLP) serves as catalyst to private investment • Addresses the funding gap through both direct and intermediated funding	• Enables NPIs to support target sectors, as per own preferences and pre-defined eligibility criteria • Allows NPIs to leverage on the EIF's fund investing activities in NPI's own and/or other markets, and to increase funding to market together with EIF resources (e.g. EFSI) • Increases and speeds up the market's access to equity financing from NPIs and other investors with targeted interests	• Enables NPIs to support targeted companies in co-investment rounds • Leverages on EIF's portfolio of approved fund managers ("eligible GPs") to further support the market by enabling the EIF to provide funding for such co-investments • Facilitates fast access to co-investments from limited partners (LPs) (e.g. EIF, NPI) for eligible general partners (GPs) • Maximising scale and impact through facilitated direct equity investments	• The key objective of the EIF's investments in equity funds is to (indirectly) provide capital to SMEs and midcaps, supporting entrepreneurship and innovation in Europe • A number of institutional (i.e. EIB, EC) and thematic mandates are available to finance the investments (e.g. Technology Transfer Accelerator Turkey, Baltic Innovation Fund, Dutch Venture Initiative, Luxembourg Future Fund, etc.)[84]	
Product case/selected EIB finance example	Example: Fonds SPI - Sociétés De Projets Industriels (F-SPI, managed by BPI France): EIB co-investment facility alongside SPI[85]	Connecting Europe Broadband Fund (CEBF)[86]	Multiple examples, ranging from generalist to targeted programmes with market development intentions (e.g. Technology Transfer Accelerator Turkey)	n/a (new; comparable to already existing growth VC and mezzanine co-investment programmes by the EIF)	Multiple examples, e.g. SINTEF[87], Quadrivium[88]	Multiple examples, e.g. Rocket, Advent[89]
MAIN FEATURES	***Example of Fonds SPI***	***Example of CEBF[90]***				
Fund/programme size (as applicable)	Up to EUR 100m (EIB Vehicle), alongside EUR 700m (BPI France; Main Vehicle)	Target size of EUR 500m[91]	Variable, depending on deal-flow and NPI resources	Variable, depending on deal-flow and NPI resources	Variable, a sum of mandates/annual budget (e.g. EUR 2.1bn total equity in 2015)	
Investment structure	• Managed by same fund manager as Main Fund (BPI-France) • Following the same investment policy as the Main Fund, with excuse right for EIB co-investment vehicle (investments must follow EIB eligibility rules and standards)	• Asymmetric. Different layers of risk tranches bearing different risk/return profiles • Sizeable tranche of capital committed by the EC from the Connecting Europe Facility budget • Preliminary structure: Private investors – A Shares (preferred equity) NPI and EIB – B Shares EC – C Shares (junior equity)	• NPI commits to a fund investment programme and defines investment objectives and eligible beneficiaries and GPs ex-ante. No deal-by-deal assessment by NPI • The EIF acts as manager for the programme/fund-of-funds, which invests on commercial and pari-passu terms in funds (e.g. TT, VC and other PE), where EIF acts as LP (typically also on behalf of the NPI) and takes and Advisory Board seat • The EIF and NPI may collaborate on activities and information sharing	• NPI commits to a co-investment programme and defines eligibility criteria ex-ante. The EIF checks eligibility for each proposal ahead of committing resources. No deal-by-deal assessment by NPI • Eligible GPs approach the EIF with co-investment opportunities. The EIF assesses only GP performance and eligibility criteria of deal – no company level diligence	• EIF acting as fund-of-funds (i.e. investor in technology transfer/venture capital funds) • Typically general partner (GP)/limited partner (LP) structure, the EIF acting as LP and taking Advisory Board seat	
Participants	Open to private investors alongside the EIB co-investment with BPI (F-SPI)	Open to private investors alongside the EIB, EC and NPIs	The EIF, NPIs and other investors as limited partners (LPs; pari-passu) for the programme(s). For funds supported by the programme, the EIF commits pari-passu with private/institutional investors (private capital required in fund)	The EIF, NPIs and other investors as LPs (pari-passu) Eligible GPs must be managers of the EIF's portfolio funds	The EIF commits pari-passu with private/institutional investors (private capital required in fund)	
Type of investment	Risk capital, in the form of equity	Risk capital, in the form of equity and quasi-equity	Equity (including hybrid and quasi-equity)	Equity (including hybrid and quasi-equity)	Equity (including hybrid and quasi-equity)	Equity (including hybrid and quasi-equity)
Geographical scope	MS	MS and EEA countries participating in CEF Telecom[92]	MS, potential candidate countries, H2020 participating countries	MS, potential candidate countries, H2020 participating countries	MS, potential candidate countries, H2020 participating countries	
Sector/theme	Sector-thematic MS by MS (as per bilateral agreements)	Sector-thematic	Generalist or sector-thematic/geography approach; mandate-dependent		Generalist sector/geography approach; mandate-dependent	
Eligible beneficiaries	Co-investment specific. In the case study, F-SPI takes minority positions in JV with private sector entities, mostly SMEs and midcaps in the manufacturing sectors, enabling them to industrialise new technologies, processes and products	Platform specific. In the case study, CEBF, criteria include: significant contribution to the digital agenda of Europe, state-of-the-art technology, economically viable, high potential for replication, innovative business model[93]	As per Programme / mandate (early stage/RTO projects, SMEs and Midcaps)		As per programme/mandate (project stage, SMEs and Midcaps)	

[82] National promotional institution or bank, acting on a local, regional or national level with financing activities and with a developmental and/or promotional mandate from relevant authority.
[83] Expected to become operational in Q4-2016. Features could vary.
[84] For the full list / overview of programmes please refer to the EIF's website: http://www.eif.org/what_we_do/resources/index.htm
[85] Public Sector Fund (SPI) backed by the French government via the "Programme d'Investissement d'Avenir".
[86] Launch expected by end of 2016.
[87] For the full list of equity signatures please refer to the EIF's website: http://www.eif.org/what_we_do/equity/eif-equity-portfolio.pdf
[88] For detail on the fund Quadrivium, see case study 4, Annex 2.
[89] For the full list of equity signatures please refer to the EIF's website: http://www.eif.org/what_we_do/equity/eif-equity-portfolio.pdf
[90] For additional information please refer to the EC website: http://enrd.ec.europa.eu/sites/enrd/files/w6_efsi2_broadband_blanchard_brunac.pdf
[91] EUR 100m from the Connecting Europe Facility budget expected to be committed in the junior equity tranche from the EC at first close.
[92] EEA: European Economic Area.
[93] CEF Regulation (EU) 1316/2013 and CEF Telcom guidelines (EU) 28372014 apply.

	EIB Co-investment Fund	EIB Investment Platforms	EIF NPI Equity Platform Investment Programmes (with NPIs[82] or other)		EIF fund investments: for technology transfer organisations and venture capital
			Fund investing programmes	Co-investment scheme[83]	
Max. participation in single project	49.9% of project qualifying funding need	50% of the aggregate amount invested in the project	Case-by-case: depending on programme/mandate and type of fund (typically <= 50% of the total fund size)	Case-by-case: depending on programme/mandate and type of fund (The co-investment may be committed in full by the EIF)	50% of the total fund size
Min./max. size of single investment	For F-SPI EUR 10-160m combined investment, with the EIB investing proportionally alongside SPI	EUR 1-30m, indicative average of EUR 10m	Case-by-case: depending on programme/mandate and type of fund	Case-by-case: depending on programme/mandate and type of fund	Mandate-dependent (typically up to EUR 60m)
FITNESS FOR RTOs PROJECTS					
Fit for RTOs with legal debt limits	✓✓	✓✓	✓✓		✓✓
Relevance for RTOs	✓✓	✓✓ For projects in the platform's thematic area ➔**Way forward: explore the consideration of an RTO thematic platform**[94]			
Sector/theme eligible beneficiaries	✓ Broad	✓ Platforms set up based on identified funding gaps to achieve EU objectives ?: Instrument is sector/theme specific ➔ **Way forward: assess with RTOs thematic/sector needs in the context of their short and mid-term project pipeline**	✓✓		✓✓
Term	➔ **Way forward: assess with RTOs the need of specific investment terms in light of RTOs' project pipeline and sector dynamics**	?➔ **Way forward: assess with RTOs the need of specific investment terms in light of RTOs' project pipeline and sector dynamics**	➔ **Way forward: assess the fitness of the instruments with RTOs based on effective project experience and pipeline**		
Min./max. size of single investment	✓✖ Min. project size leaves out sound smaller projects ➔ **Way forward: assess with RTOs the most adequate size concept in light of RTOs' project pipeline and sector dynamics**	✓✓ **The CEBF case study covers the lower size/scale of RTOs' project spectrum** ➔ **Way forward: assess with RTOs the most adequate size concept in light of RTOs' project pipeline and sector dynamics**	➔ **Way forward: assess the fitness of the maximum investment size with RTOs based on effective project experience and pipeline** ➔ **Way forward: assess the value-added of setting a framework for supporting RTOs' projects with the aim of optimising the combination of the EIB and EIF instrument pool**		
Geographical scope	✓✖ Access subject to each MS-NPI policy objective ✖ Potentially, differences between MS co-funds scope and features	✓✓	✓✓		✓✓
Purpose – fits with RTO project needs	✓✓ SPV financing ✖ Not fit for general RTO purposes/non-ring fenced project financing	✓✓ SPV financing ✖ Not fit for general RTO purposes/non-ring fenced project financing	✓✓ SPV financing		✓✓ SPV financing

[94] Access to finance would be fostered in two ways: 1) by investing through the platform rather than in the project, RTOs are able to better manage their return risk (lower risk); 2) a potential RTO-contributed fund would scale up its investment capacity/impact whilst being able to better manage its investment risk/certainty of returns.

Table 8: EIB instruments applied or potentially applicable to RTO projects and way forward - single instruments

	Innovation infrastructure finance	Lending against IP collateral under development	Contingent loans (other than lending against IP collateral)	Thematic RDI risk finance (IDFF, EDP)	MidCap Growth Facility
OVERVIEW					
Programme/mandate	EIB/EFSI/InnovFin	EFSI/InnovFin	EFSI/InnovFin	InnovFin	InnovFin
Provider	EIB	EIB	EIB	EIB	EIB
Objective	Project-specific in accordance with programme objectives	Project-specific in accordance with programme objectives	Project-specific, in accordance with programme objectives	Project/theme-specific, in accordance with programme objectives	Support innovative business growth and investments in RDI
Product case / Selected EIB finance examples[95]	Direct: innovation infrastructure (see Page 64)[96] Indirect: infrastructure embedding innovation. Case study: Royal Liverpool Hospital[97]	Case study: Mobidiag[98] (See)[99]	The EIB has a track record of providing contingent loan financing including for RDI projects. Case studies: UCB Pharmaceutical (see also)[100]	Infectious Diseases Financing Facility (IDFF), Energy Demonstration Projects Facility (EDP), Case studies: Mobidiag, Transgene, WaveRoller (see also)[101]	Case study: Jennewein Biotechnologie (see also)[102]
MAIN FEATURES					
Fund/programme Size (as applicable)	EUR 24bn in total available under InnovFin. EUR 21m in total available under EFSI (additional EUR 12.5bn proposed)[103]				
Investment structure	Case-by-case lending agreement	Case-by-case lending agreement	Case-by-case lending agreement, repayment linked to contingent event	Case-by-case	Case-by-case
Participants	EIB	EIB	EIB	EIB	EIB
Type of investment	Case-by-case with debt format	Case-by-case spectrum, from debt to quasi-equity	Case-by-case spectrum, from debt to quasi-equity	Case-by-case spectrum, from debt to quasi-equity	Case-by-case spectrum, from debt to quasi-equity
Geographical scope	MS (EFSI) and H2020 associated countries[75]	MS (EFSI) and H2020 associated countries[75]	MS (EFSI) and H2020 associated countries[75]	MS and H2020 associated countries[75]	MS and H2020 associated countries[75]
Sector/theme eligible beneficiaries	Innovation infrastructure	As per programme/mandate	As per programme/mandate	As per programme/mandate	As per programme/mandate
Term	Case-by-case long/ultra-long	Case-by-case	Case-by-case	Case-by-case	Case-by-case
Min. / Max. size of single investment	Up to 50% of the aggregate amount invested in the project/of total RDI project costs	Up to 50% of the aggregate amount invested in the project/of total RDI project costs	Up to 50% of the aggregate amount invested in the project/of total RDI project costs	Up to 50% of the aggregate amount invested in the project/of total RDI project costs	Up to 50% of the aggregate amount invested in the project /of total RDI project costs
FITNESS FOR RTOs PROJECTS					
Relevance for RTOs	✓✓	✓✓	✓✓	✓✓	✓✓
Risk bearing capacity	✓✓ Under EFSI/InnovFIn	✓✓	✓✓	✓✓	✓✓
Geographical scope	✓✓	✓✓	✓✓	✓✓	✓✓
Sector / Theme eligible beneficiaries	✓✓	✓✓	✓✓	➔ **Way forward: assess the degree of convergence of existent thematic risk finance instruments with the RTOs' project pipeline themes**	✓✓
Max. term	➔ **Way forward: assess with EARTO the fitness of the investment period based on RTOs' project track record and pipeline**				
Min. / Max. size of single investment	✓✓ For innovation infrastructure	➔ **Way forward: Assess the fitness of the minimum size threshold based RTOs project track record and pipeline**			
Purpose – Fit with RTO	➔ **Way forward: assess the fitness of existing programmes/mandates in the context of RTOs' pipeline of RDI Infrastructure projects**	✓✓ ➔ **Way forward: assess the fitness of existing IP financing in the context of RTOs' pipeline of IP development and commercialisation projects**	✓✓	➔ **Way forward: assess the degree of convergence of existing (thematic) risk finance instruments with RTOs' project pipeline risk features**	✓✓

[95] For further information please refer to the EIB's website: http://www.eib.org
[96] For further information please refer to the EIB's website: http://www.eib.org
[97] The (new) Royal Liverpool Hospital project comprises a large clinical research facility (in addition to 18 theatres, 23 wards, 646 single bedrooms, a large clinical research facility and a 40-bed critical care unit). EIB-financed amount: GBP 90m (total project cost of around GBP 330m). For further information please refer to the EIB's website http://www.eib.org and the EC's website http://www.eib.org/infocentre/stories/all/2015-may-01/healthcare-a-community-matter-in-liverpool.htm
[98] For further information please refer to the EIB's website: http://www.eib.org
[99] For further information please refer to the EIB's website: http://www.eib.org
[100] For further information please refer to the EIB's website: http://www.eib.org
[101] For further information please refer to the EIB's website: http://www.eib.org
[102] For further information please refer to the EIB's website: http://www.eib.org
[103] See the European Commission's press release: http://europa.eu/rapid/press-release_MEMO-16-2983_en.htm

Annex 2 – Presentation of the EIF's technology transfer support schemes

The European Investment Fund (EIF) provides risk financing for entrepreneurship and innovation. The EIF's principal activities include the provision of financial guarantees and equity in European Union Member States as well as in EFTA and accession countries. The EIF manages resources on behalf of its stakeholders, which include the European Investment Bank, the European Commission as well as national and regional funds and entities. The EIF's portfolio includes 498 equity funds as of 31/03/2016[104]. Out of these, 34 equity investments have been made into technology transfer (TT) and intellectual property funds, totalling EUR 596m as of July 2016. 21 of these investments have been made since 2013 (EUR 435m). The EIF's equity investment activities span a wide spectrum of company development stages, including business angel financing, technology transfer, venture capital, up to lower mid-market private equity, mezzanine and private debt funding. Technology transfer plays a particular role in bridging the gap between research generated in Europe's research organisations and the market, by catalysing the transformation of research results into new commercial products and services.

Technology transfer

Technology transfer (TT) can take place through a number of means, in particular through collaboration between research organisations and industry, the licensing of intellectual property rights and the creation of start-up businesses or university spin-out companies. As academic research is often considered too risky to receive financing from traditional investors, new discoveries and technologies may fail to realise their potential unless they become attractive to industry or downstream investors. The EIF catalyses the commercialisation of intellectual property through the creation of long-term, sustainable investment vehicles working alongside research organisations and their technology transfer offices (TTOs). These vehicles have the ability to invest in projects or start-up companies at proof of concept, pre-seed, seed, post-seed and A & B rounds.

The EIF's collaboration with TTOs allows management teams to maintain their independence, as the EIF does not seek to become involved in management decisions. The typical minimum fund size of such vehicles is in the range of EUR 30m, whereby the EIF can provide up to 50% of the resources. Examples of EIF TT investments include K. U. Leuven (Belgium), IP Group (UK) and Karolinska Development (Sweden).

Investment process

The EIF's technology transfer investment process consists of four phases. At the first screening stage, investment professionals evaluate the proposed concept based on preliminary questionnaires and concept notes submitted by the team. The second screening stage entails a physical meeting as an opportunity to articulate the investment opportunity more fully. These two phases may be iterative, with the EIF seeking to align the interests of both parties appropriately. The process may then move

[104] http://www.eif.org/what_we_do/equity/eif-equity-portfolio.pdf

into the due diligence phase, during which the EIF team conducts on-site visits and validates assumptions. Following a submission and approval of the investment proposal by the EIF Board of Directors, legal documents are agreed. An overview of the screening criteria used by the EIF is provided below.

Case studies

The following case studies exemplify the EIF's investment impact in the technology transfer space.

Case study 1: CFEED (SINTEF Venture IV)

Roles of the EIF and SINTEF

The EIF invested EUR 12m (45% of the total fund size) in SINTEF Venture IV in 2013. SINTEF Venture IV (SV IV) is a NOK 209m seed investment fund that enables the development of new and viable technology-driven SMEs. SV IV was launched by SINTEF, a Norwegian applied research, technology and innovation centre. The fund was established with support from SINTEF, the EIF and SpareBank1 SMN. The EIF's investment was made possible by resources from the European Commission's Competitiveness and Innovation Programme.

CFEED AS

SV IV invested in CFEED AS in 2014. CFEED AS is a first-of-a-kind commercial producer of copepods, a tiny crustacean species which serve as "baby food" for newly-born marine fish. Copepods have a naturally high nutritional content and are found in the sea and in almost every freshwater habitat. They are used as a replacement for traditional live feed such as artemia and rotifiers. Use of copepods not only reduces the rate of deformities and malpigmentation of fish larvae, but also improves their growth, survival and stress tolerance. This results in increased production quality and output, meaning lower per-unit costs and increased sales. CFEED's production methods and technology are based on 25 years of research and development at SINTEF Fisheries and Aquaculture. CFEED is an example of a company created through an opportunity presented in its local system. Norway has an established marine industry and therefore this investment is aligned with the needs of the market.

Case study 2: Discovery and development of dengue anti-viral drugs (Centre for Drug Design and Discovery)

Roles of the EIF and CD3

The Centre for Drug Design and Discovery (CD3) is a partnership which fosters the **discovery and development of innovative medicines** for a wide range of diseases. It was set up in 2006 by KU Leuven Research & Development (LRD) and the EIF with starting capital of EUR 8m (50% of the equity was provided by each investor). This was followed by a top-up of EUR 16m equally split between the EIF and LRD in 2010. CD3 has developed over 20 projects seeking to develop potential medicines for various diseases, such as AIDS, hepatitis C, cancer, arthritis, asthma, dengue virus infections, epilepsy and Alzheimer's disease.

Dengue anti-viral drugs

Dengue haemorrhagic fever (DHF) is the second-most prevalent mosquito-borne infection after malaria. About 40% of the world's population are now at risk and up to 390 million dengue infections occur annually worldwide. An estimated 500,000 people with DHF require hospitalisation every year, and about 2.5% of those diagnosed with DHF die.

In 2013, researchers at KU Leuven collaborated with Janssen Pharmaceuticals Inc. and the Wellcome Trust to develop the first anti-viral drugs for the treatment and prevention of dengue infections. This collaboration builds on the previous three-year drug discovery programme at the Rega Institute of KU Leuven, supported by the Wellcome Trust Seeding Drug Discovery Award (WTSDDA). The aforementioned previous research successfully identified a series of chemical compounds which are highly potent inhibitors of dengue virus replication. Through an alliance with the Janssen Infectious Diseases & Vaccines team and the WTSDDA, the team will progress the compounds towards a first-class candidate drug for the prevention and treatment of infections with dengue virus. At the end of the collaboration period, Janssen can further develop the candidate drug towards regulatory approval, with the goal of global commercialisation within six to ten years.

Case study 3: KEMWATT (GO CAPITAL)

Roles of the EIF and GO Capital

GO Capital is a French private equity firm founded in 2003 and based in Rennes. GO Capital manages four private equity funds with a total of EUR 140m in assets under management. The EIF invested EUR 15m in GO Capital Amorcage in 2013. The funds primarily invest in start-ups and companies across north-western France, whereby investment sizes range from EUR 200 000 to EUR 4m. The sector focus covers digital, greentech, biotech and healthcare. To date, GO Capital has completed around 60 investments.

KEMWATT

One of GO Capital's investees is KEMWATT, a company founded in 2014 following research at the Institute of Chemical Sciences in Rennes that led to the development of the innovative redox flow battery technology. Redox flow batteries are a type of rechargeable battery that store electricity in liquids (electrolytes). Redox batteries allow for large capacities; instead of multiplying the number of batteries, one merely increases the volume of the electrolyte. Redox batteries have several technical advantages over conventional rechargeables, including potentially separable liquid tanks and near unlimited longevity. Existing implementations are less powerful and require more sophisticated electronics. KEMWATT will create a 20 kW battery prototype by the end of 2016.

Case study 4: PEP-Therapy (Quadrivium 1)

Roles of the EIF and Quadrivium 1

Quadrivium 1 is a French academic spin-out fund launched in December 2013 and managed by Seventure Partners. The EIF invested EUR 20m (36% of the total fund size) in the fund alongside other investors including Bpifrance. The EIF's investment was backed by the EU's Investment Plan for Europe. The fund has so far invested in eight companies (with a total target of 20), each of which started out at one of 12 research institutions that are involved with Quadrivium, including, for example, the Sorbonne and Institut Curie.

PEP-Therapy

PEP-Therapy is a small company founded by Angelita Rebollo, a Spanish scientist, as a result of her research into cell-penetrating and interfering peptides which started 17 years ago in Madrid. These molecules have the potential to kill cancer cells without the side effects of traditional chemotherapy, which destroys not only cancer but also many healthy cells. PEP-Therapy was founded in January 2014 with EUR 1m in backing from Quadrivium 1. The investment is helping PEP-Therapy in the development stages of the drug. It will be up to eight years before the molecules are fully licenced and sold as medicine. Quadrivium 1 already expects to contribute to the funding of the next stage of development, which sends very positive signals to the market, helping the company attract finance from additional investors.

Link to EIB press release: *http://blog.eib.org/academic-spinouts-france/*

List of EIF technology transfer investments

Year	Investment	Country	EIF commitment
Technology transfer and intellectual property funds			***EUR m***
2001	T-Source	France	4.3
2003	Louvain Vives I	Belgium	4.5
2006	Leuven CD3 (Centre for Drug design and Discovery)	Belgium	4
2006	IP Venture Fund	UK	18
2008	Chalmers Innovation Seed Fund	Sweden	9
2008	Manchester UMIP Premier Fund	UK	11
2009	Karolinska Development	Sweden	27
2010	Leuven CD3 II (Centre for Drug design and Discovery)	Belgium	8
2011	Louvain Vives II	Belgium	15
2011	Telecom Technologies Transfert (3T)	France	10
2012	Demeter Cleantech seed fund	France	20
2012	Elaia Alpha fund	France	15
2012	Cancer Research Tech (CRT) Pioneer Fund (a)	UK	15
2013	Epidarex (formerly Rock Spring)	UK	10
2013	INRIA IT Translation	France	10
2013	IP Venture Fund II	UK	24
2013	Grand Ouest d'Amorcage Sante	France	15
2013	Auriga Bioseeds IV	France	12
2013	SINTEF Venture IV	Norway	12
2014	Cancer Research Tech (CRT) Pioneer Fund (b)	UK	15
2014	Armilar Ventures (not closed, fund-raising)	Portugal	15
2014	Diffusion Capital	Turkey	26
2014	Kurma Diagnostics	France	15
2015	ACT TTA Fund	Turkey	18
2015	Abingworth Pharma Co-development Fund	UK	54
2015	P-101	Italy	20
2015	V-Bio Ventures	Belgium	30
2015	Thuja	Netherlands	15
2015	Quadrivium	France	20
2015	BeAble	Spain	15
2016	UCL Technology Fund	UK	34
2016	Carduso	Netherlands	15
2016	CD3 III	Belgium	30
2016	University Bridge Fund	Ireland	30

For the complete list of EIF investments as of 31 March 2016 please refer to the link below:
http://www.eif.org/what_we_do/equity/eif-equity-portfolio.pdf

EIF investment criteria

The main criteria the EIF considers when evaluating investments in TT funds are as follows:

Partner Institutions

Metrics: research budget, peer group comparisons, invention disclosures, IP filed, IP awarded, growth rates, commercialisation income, encumbrances, 3rd party agreements

Structure: organigramme of TTO, roles, ownership of TTO

Policies: IP policy, rules, regulations, ownership rights

Activities: industry co-operations, advisory services, contract research, etc.

Financials: for TTO, revenues, royalty income, grants, licenses, cost of sales, gross profit, operating costs, gift aid, dividends

Dealflow and pipeline

Origination: source of projects, networks (formal and informal), privileged / preferential access, rights of first refusal, option rights

Fees: payments in lieu of access to pipeline

Historical analysis: e.g. 3-5 yrs evolution of dealflow by source, sector, etc.

Selectivity ratio: historical examples / experience

Pipeline: of current and future opportunities

Investment strategy

Licensing / spin-outs: proposed route for commercialisation

Strategy: geographical focus, stage focus, sectors, investment sizes, follow-on and reserve policy, holding periods, role in financing rounds

Fund size: justification for size through bottom-up analysis, min / target / max size, modification to strategy according to size scenarios

Target profiles: criteria for investment targets (company profiles)

Co-investors: envisaged co-investors at different stages of investments

Exits: strategies based, for example on previous examples

Market / competitors

Trends: in targeted sectors, challenges faced, evolution in previous years

Competitors: for financing, other sources of finance, private / public

Demand side economics: analysis and evidence of demand for targeted projects

Potential investors

Sponsors: main investors , anchor investors , special rights (e.g. fees, carry, information, co-investment, etc.)

Names / profiles: like-minded, long-term investors with soft and hard commitments

Team investment: investment to fund, e.g. 1%, 2%, 5%, absolute amount, split between team members (see also remun. / incentives)

Fundraising strategy: list of other potential / targeted investors, status of contacts, potential commitments, % Market Oriented Investors

Investment process

Process: origination, screening, project / deal review, due diligence, deal approval, deal structuring, negotiation, deal completion, contracting third parties

Decision-making bodies: which bodies, or individuals take final decisions at each stage, delegations foreseen

Team

Composition: envisaged team responsible for managing fund, key individuals from TTO / other, secondees, new recruits (profiles)

Profiles / CVs: Full CVs of team members and key individuals, specific dates, positions held, achievements

Experience: collective team experience in IP management, licensing, creation of companies, investing,, strategy, consulting, etc.

Team collaboration: yrs worked together, prior collective working relationships

Workload: time commitment to fund vs. other activities, activity allocation, other board seats

Board members: CVs

Track Record

Previous funds: metrics, vintage, total size, fund cash flows, net and gross IRR, LPs, amounts

Companies: for previous / current funds, dates of investment, investment at cost, FMV (EVCA), gross multiples, forecast exit dates, exit scenarios

Individuals: Track record of individuals, other investment / relevant activity (e.g. licensing deals)

Partner institutions: licensing and spin-out company creation, notable success stories (e.g. nobel prizes), products developed

Governance

Structure: e.g. UK-LP, SCR, FCR, NV, SPRL, SICAR, KB, etc.

Relationships: Overall structure and relationships between governing and decision-making bodies. Role and function of each of the bodies. Specific individuals involved and respective voting powers and rights

CoI: Conflict of interest management, for example with (other) investors in fund, any investor (LP) involvement in decision-making

Advisory board: composition, largest investors, etc.

Management co.

History: evolution, founders, key dates and events in development, significant changes in organisation, strategy, ownership

Legal status: capital structure, ownership

Regulation: how management company shall be regulated, adherence to AML/KYC

Economics

Budget: detailed forecast budget for management company over lifetime of fund, under different scenarios, e.g. min / target / max size

Management fee: justification for level of management fee, use of fees, fee offsets

Remun. / incentives

Alignment of interests: team investment to fund aligns with investors, long-term time horizon, team stability / instability

Remuneration: detailed breakdown of remuneration for all team members including base salaries, bonuses

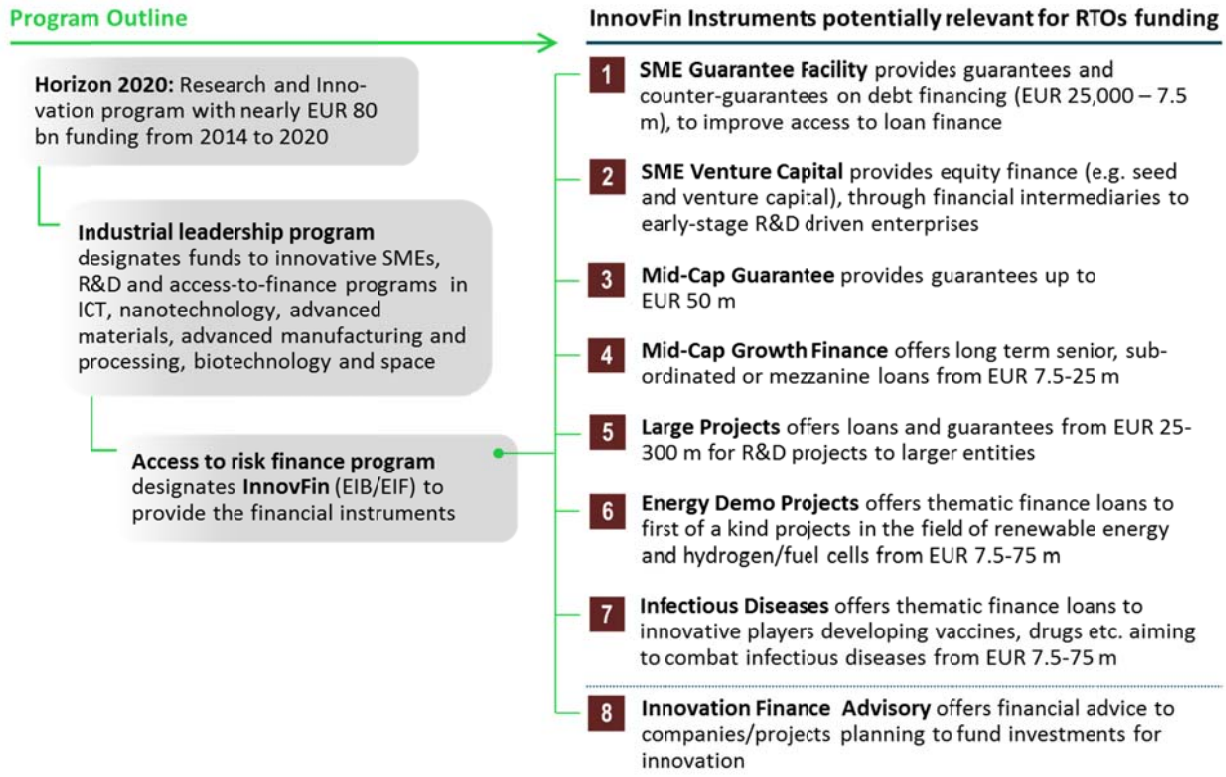
Evolution: historical evolution of remuneration for individual team members in previous years

Incentives via carry: repartition of carry to individuals, unallocated carry if applicable, carry to partner institution(s)

Annex 3 – Relevant EIB Group/EC financial instruments

For the period 2007 to 2013, the 7th Framework Programme for Research and Technological Development (FP7), with a budget of over EUR 50bn, invested in various research and innovation-related activities. The budget had increased by 63% compared to its predecessor FP6. FP7's centrepiece for innovation finance was the so-called Risk Sharing Finance Facility (RSFF), featuring various financial instruments applicable to RTO financing. Up to the end of 2013, the RSFF provided over EUR 11bn to 114 research, development and innovation (RDI) projects worth over EUR 30bn. Meanwhile, Horizon 2020 replaced FP7 as an umbrella programme for RDI support, with a budget of nearly EUR 80bn (see the figure below). Also, the InnovFin programme has replaced the RSFF as the innovation finance tool relevant for RTOs. Compared to its predecessor RSFF, the budget for InnovFin has more than doubled, with EUR 24bn in available funds. In addition, the EC has established the European Fund for Strategic Investments (EFSI), a financial scheme intended to attract EUR 315bn in investment for Europe's strategic infrastructure, including various RDI activities and SMEs. As a result, unprecedented amounts of European-level funds and various financial instruments for the promotion of innovative technologies are currently available.

Figure 38: Instruments relevant to RTOs and their partners (in the ecosystem)



InnovFin: under Horizon 2020, the EU research programme for 2014-20, the EC and the EIB Group launched a new generation of financial instruments and advisory services to help innovative firms access finance more easily. Until 2020, InnovFin – EU Finance for Innovators will offer a range of tailored financial products for RDI by smaller, medium-sized and larger companies and promoters of research and innovation infrastructure. InnovFin further includes a number of thematic products addressing the specific financing needs of certain innovative sectors. InnovFin financial products are backed by funds set aside by the EU (under Horizon 2020) and by the EIB Group (from its own resources).

InnovFin consists of a series of financing tools and advisory services offered by the EIB Group, covering the entire value chain of RDI in order to support investments from the smallest to the largest enterprise. InnovFin is available across all eligible sectors under Horizon 2020, in EU Member States and associated countries. By 2020, InnovFin is expected to make over EUR 24bn in debt and equity financing available to innovative companies to support EUR 48bn in final RDI investments.

- **InnovFin SME Guarantee** provides guarantees and counter-guarantees on debt financing between EUR 25 000 and EUR 7.5m, in order to improve access to loan finance for innovative smaller and medium-sized enterprises and smaller midcaps (up to 499 employees). This facility is being rolled out through financial intermediaries. Under InnovFin SME Guarantee, financial intermediaries are guaranteed or counter-guaranteed against a portion of their potential losses by the European Investment Fund (EIF).

- **InnovFin SME Venture Capital** will primarily invest in venture capital funds and other vehicles investing or cooperating with business angels. The programme targets enterprises which may not yet have started generating revenues from the sale of their product(s) or service(s). This includes companies in their pre-seed, seed, and start-up phases. The investment focus will be with innovative sectors, including life sciences, clean energy and high-tech.

- **InnovFin MidCap Guarantee** provides guarantees and counter-guarantees on debt financing of up to EUR 50m, in order to improve access to finance for innovative midcaps (up to 3 000 employees) which are not eligible under the InnovFin SME Guarantee. This is being rolled out through financial intermediaries such as banks and other financial institutions. Under InnovFin MidCap Guarantee, financial intermediaries are guaranteed against a portion of their potential losses by the EIB.

- **InnovFin MidCap Growth Finance** offers long-term senior, subordinated or mezzanine loans from EUR 7.5m to EUR 25m for innovative larger midcaps (up to 3 000 employees), but also SMEs and smaller midcaps.

- **InnovFin Large Projects** delivers loans and guarantees from EUR 25m to EUR 300m for RDI projects emanating from larger firms, universities and public research organisations, for RDI infrastructure (including innovation-enabling infrastructure), for public-private partnerships, and for special purpose vehicles. Under this financing tool, the EIB has financed several large-scale pieces of RDI infrastructure and facilities (see examples below).

Example 1 - Cooperation in science and technology

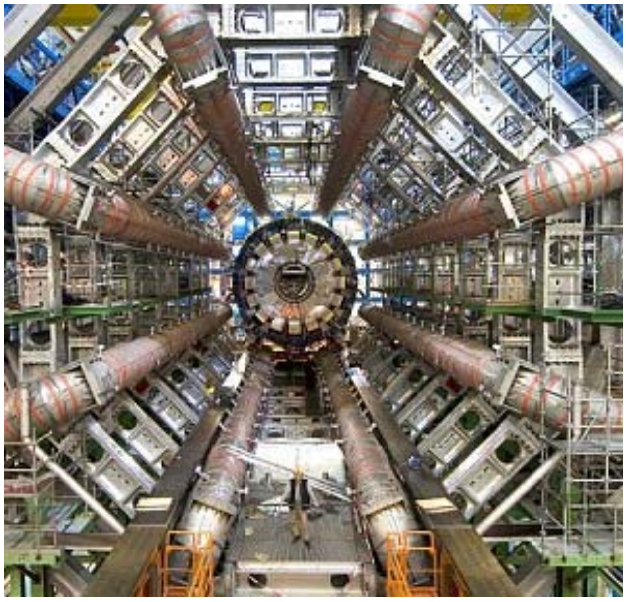
The objective of COST is to finance trans-national networks of nationally funded research activities to enable European researchers to jointly develop their own ideas and new initiatives across all scientific disciplines. The networking tools include meetings, short-term scientific missions, training schools, workshops and conferences.

Terms of loan:

- Financed under the RSFF-European research infrastructure and InnovFin
- EIB loan for EUR 100m, signed in 2014, to partly finance the 2014-2020 budget of COST
- EIB funding sourced prior to the start of construction, specific terms and conditions linked to project implementation: bullet loan of up to five years
- Security/guarantee: inside EU own risk
- Start of work 01/01/2014 – End of work 30/06/2021

Example 2 - Extreme Light Infrastructure

The loan to Extreme Light research Infrastructure (ELI) is to finance the design, construction and outfitting of a state-of-the-art laser research facility in Szeged (Hungary), in what is a brownfield development of a former Soviet military camp. This facility is part of the pan-European ELI network, with complementary research centres located in the Czech Republic and Romania. The EIB loan will not only facilitate ground-breaking scientific research in a number of areas (ranging from material science and nanotechnology to medicine), but also contribute to close pan-European cooperation and exchange between RDI institutions and scientists.



Terms of loan:

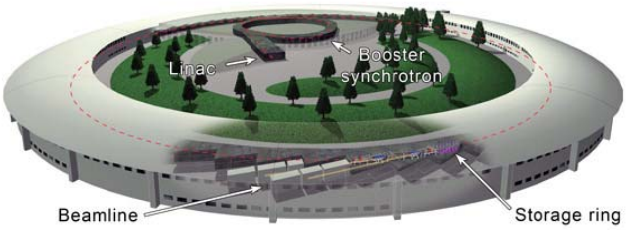
- Financed under the RSFF-European research infrastructure compartment
- EIB loan for EUR 33.62m, signed in 2014, to serve for the construction of a high-capacity laser research facility and installation of advanced laser technology equipment therein
- EIB funding sourced prior to the start of construction
- Specific terms and conditions linked to project implementation: amortising loan of up to 20 years with up to three years' grace; or bullet loan of up to 11 years
- Security/guarantee: inside EU own risk

Example 3 - European Synchrotron Radiation Facility (ESRF)

The European Synchrotron Radiation Facility (ESRF) was founded on 16 December 1988 pursuant to an international convention between 13 sovereign states. ESRF has been entrusted to a not-for-profit French société civile regulated by the French Civil Code, whose shareholders are public entities (or similar entities) from the sovereign states who concluded the ESRF convention. ESRF is part of the high-technology department of the European Photon & Neutron (EPN) science campus in Grenoble, which also hosts the Institute Laue Langevin-neutron source and the European Molecular Biology Laboratory (EMBL), both being other pieces of European research infrastructure. This campus itself is part of the GIANT (Grenoble Innovation for Advanced New Technologies) campus, which offers 6,000 research jobs (generating 5,000 publication and 500 patent filings per year), 5,000 students and 5,000 industrial jobs in 40 companies in nano-sciences, cryogenics, material sciences and life science. The ESRF is accredited for its scientific excellence, producing more than 1 800 scientific articles per year, of which nearly 300 are qualified as "high impact articles".

Terms of loan:

- Financed as an InnovFin Large Project under Horizon 2020 financial instruments
- EIB loan for EUR 65m, signed in 2015, to upgrade the European Synchrotron Radiation Facility (ESRF) facilities in Grenoble
- EIB funding sourced prior to the start of construction
- Specific terms and conditions linked to project implementation: amortising loan of up to 20 years with up to six years' grace; or bullet loan of up to 13 years
- Implementation time for the project: 2015 to 2022
- Security/guarantee: inside EU own risk



- **InnovFin Energy Demo Projects** provides thematic finance from EUR 7.5m to EUR 75m for RDI first-of-a-kind (FOAK) projects in the field of renewable energy and hydrogen/fuel cells. Energy Demo Projects is a risk-sharing finance facility where the first loss piece risk (95%) is guaranteed

by the European Commission during the pre-commercial phase of the projects, making the riskier funding of yet unproven/new technologies possible (see example below).

Example 4 – EUR 10m to harness ocean wave energy

A first-of-a-kind demonstration project that converts wave energy into electrical power, which could be a major step forward in the quest to find new sources of sustainable energy, will be built thanks to an EU loan of EUR 10m from the new InnovFin **Energy Demo Project** Facility. The deal will enable the Finnish company AW-Energy to build a full-scale demonstration unit of their WaveRoller concept in Portugal. The loan, provided by the European Investment Bank (EIB) and backed by the EU's research and innovation funding programme Horizon 2020, is the first under the InnovFin Energy Demo Project, an innovative, sectoral debt facility which aims to support projects that are commercially promising, but are deemed technologically risky.

Example 5 – EUR 150m to produce energy from sewage sludge

In 2015 the EIB signed a EUR 150m loan to finance the Energy Optimisation Sludge Treatment (EOS) project. The objective of this project is to ensure the energy self-sufficiency of Vienna's wastewater treatment plant by using sewage sludge as an energy resource for in-house energy needs. With this project, 20 million m³ of methane-rich biogas is expected to be extracted annually from sewage sludge and converted into electricity and heat. This will allow Vienna's wastewater treatment plant to cover 100% of its own electricity needs by 2020 and to reduce its energy costs at the same time.

- **InnovFin Infectious Diseases** provides thematic finance from EUR 7.5m to EUR 75m to innovative players active in developing vaccines, drugs, medical and diagnostic devices, and research infrastructure for combating infectious diseases. Financing is aimed at projects that have passed the pre-clinical stage and for which clinical validation is needed for further development.

- **Innovation Finance Advisory** aims to improve the bankability and investment-readiness of large projects and companies that need substantial, long-term investments. It will also provide advice to improve the conditions for access to finance for RDI through horizontal activities such as sector studies, criteria reports and better information tools. The main clients foreseen are promoters of large RDI projects and companies (both private and public) that meet Horizon 2020's societal challenges. It builds on a successful pilot operated under the RSFF in FP7.

The Investment Plan for Europe: since the global economic and financial crisis, the EU has been suffering from low levels of investment. Compared to a 2007 peak, investments have dropped by around 15% in the EU. In the short term, weak investment slows economic recovery. In the longer term, the lack of investment hurts growth and competitiveness. Weak investment in the euro area has a considerable impact on the capital stock, which in turn holds back Europe's growth potential, productivity, employment levels and job creation. Collective and coordinated efforts at European level are needed to reverse this downward trend and put Europe firmly on the path of economic recovery, which is the top priority of the so-called "Juncker Plan" under the President of the European Commission Jean-Claude Juncker. Therefore, the EC has introduced the so-called Investment Plan for Europe.

The Investment Plan for Europe has three objectives: removing obstacles to investment by deepening the single market, providing visibility and technical assistance to investment projects and making smarter use of new and existing financial resources. According to EC estimates, the Investment Plan for Europe has the potential to add EUR 330bn to EUR 410bn to the EU's GDP and

create between 1 million and 1.3 million new jobs in the coming years. There is sufficient liquidity in the EU, but private investors are not investing at the levels needed due to a lack of confidence and uncertainty, among other factors, so the Investment Plan for Europe aims to address this.

The European Fund for Strategic Investments (EFSI) is at the heart of the Investment Plan for Europe. EFSI's challenge is to break the vicious circle of under-confidence and under-investment and to make use of liquidity held by financial institutions, corporations and individuals at a time when public resources are scarce. The EFSI is being set up within the EIB Group. It will mobilise additional investments in the real economy in areas including infrastructure, education, research, innovation, renewable energy and energy efficiency. It will also focus on SMEs and midcaps (companies with between 250 and 3,000 employees). EFSI will target projects that will, among other objectives, promote job creation, long-term growth and competitiveness.

To establish EFSI, a guarantee of EUR 16bn has been provided by the EC. The EC guarantee will be backed by a guarantee fund of EUR 8bn (half the amount) from the EU budget. The EIB Group has committed an additional EUR 5bn, giving EFSI a risk absorbing capacity of EUR 21bn. Thanks to this EUR 21bn in capital/guarantees, the EIB/EIF are expected to provide EUR 61bn in debt and equity investments. EIB Group and EC experience indicates that such debt and equity investments provided by the EIB/EIF catalyse approximately five times as much additional investment from the private sector. Therefore, the EUR 21bn in capital/guarantees provided by the EC/EIB Group is expected, via an aggregated 15x multiplier effect, to catalyse EUR 315bn in total investment from the public and private sector. This means that EUR 1 in protection by the EC/EIB Group would generate EUR 15 in private/public investment in the real economy that would not have happened otherwise.